Certificate of Originality

This is to certify that I am responsible for the work submitted in this thesis, that the original work is my own except as specified in the acknowledgements or in footnotes, and that neither the thesis nor the original work contained therein has been submitted to this or any other institution for a higher degree.

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A comprehensive evaluation of outcomes from patient handling interventions

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A Doctoral Thesis submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy of Loughborough University

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Abstract.

Assisting less able people to move in a healthcare setting is a very common occurrence but carries risks to staff and patients. The scientific study of patient handling activities and interventions to help reduce musculoskeletal disorders in the workplace is a relatively new but growing area. Recent literature reviews have identified two key factors, the lack of high quality studies and the lack of strong links between patient handling interventions and reduced musculoskeletal injury.

This study has systematically reviewed the available literature and investigated the potential outcome measures used to show benefits of improved patient handling. A wide range of outcomes has been identified concentrated on the benefits to staff, patients and organisations. No methods were identified to compare different benefits, outcomes or intervention strategies.

This study used mixed methods to develop a tool to compare the results of all types of interventions:

a. Focus group studies in four EU countries recorded a priority list of the 12 most important outcomes from patient handling interventions
b. The most suitable method for examining the 12 outcomes was identified
c. The Intervention Evaluation Tool (IET) was developed as a single measurement tool
d. The IET was translated and used in four EU countries to evaluate its usability and its usefulness to patient handling practitioners

The EU trials and subsequent expert review have given favourable feedback for the IET. The IET creates 12 outcome evaluations with detail and differentiation, and an overall performance score to assist an organisation to target its future interventions. The method can be used to compare interventions, and the performance between organisations and countries across the EU. Though the IET needs more field trials and validity testing it is hoped that a wider application may be to create a benchmarking method that can assist in the improvement of patient handling systems across Europe.

Acknowledgements.

The completion of a part-time, non-funded PhD programme is enough to deter many willing students. Without the personal requirement to move into a research position and the valued support from specific individuals this project would have remained in the to do pile.

Financially I must thank Arjo-Huntleigh ab for the sponsorship of the project. The funds for travel, translations and conference presentations have allowed much EU information to be included. It has made this PhD a very different and unique study.

I have received a huge amount of support from my supervisor and mentor Sue Hignett. The author of ‘Evidence Based Patient Handling’ upon so many of my ideas have been developed she has been a constant driver, assistant, sounding board and colleague through the process. Her focus on delivering high quality research is a great inspiration.

This project was intended to bring together the EPPHE group but I would especially like to thank Leena, Teresa, Olga, Natale and Daniela for their assistance in organising and completing the EU focus groups. It has been a pleasure to work with you all. In addition anyone who attended a group, completed a form, gave me suggestions, translated some words or supported a conference presentation, thank you for your help.

Five years is a long time to have something like this in your life and many things change over that time. I would like to thank my wife and soul-mate Nicky for having the courage to agree to the process and for always believing that it was the right thing to do. I thank Cardi for always understanding when I needed to sit with someone early in the morning when my brain was doing a million miles an hour. I thank Misty for not hitting the delete button when she walked across the keyboard.

My final thought is for those not here to see the end result. I thank my godmother, Sylvia whose bequest paid for my 5 years fees and prompted the start of this journey. But mostly, to my parents, my Dad for the scientific gene and a thirst for knowledge, and my Mother for showing me drive and determination in the face of extreme adversity. I leave this award to you as a lasting tribute.

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Glossary

Manual handling
: To move, support or apply force to a discrete load by hand or bodily force

Patient handling
: A specific application of manual handling in a care setting. To assist a person with reduced ability to move, reposition or improve the delivery of a care task. Patient handling can be completed by hand, with aids or by mechanical alternatives.

Patient handling transfers
: The movement by patient handling, or by the patient’s independent actions, of a patient from one position to another. The range of transfers in this study is limited to single location transfers bed to chair, toileting, in and out of bath, movement in bed. Movement of a person from location to location will be described as patient transport.

Patient handling techniques
: A specific series of movements, actions and use of equipment to move a person from one position to another.

Patient Handling Advisor
: A named individual providing patient handling advice to a defined location. In different countries and within countries the job title, job role and areas of responsibility can differ significantly.

Risk Assessment
: A process defined by ISO, HSE and the EC directive to identify hazards evaluate the present risks and to implement control measures to minimise the risks. Risk assessment is a process that is widely applied to all forms of risk in manual handling and beyond.

Generic Patient Handling Assessment
: The application of manual handling risk assessment processes to the identified hazards in a given area or organisation.

Patient Handling Risk Assessment
: The application of risk assessment methods to the patient handling practice of one individual patient to consider their movement and care needs

Patient Handling Plan
: A patient specific document outlining the control measures and movement plans for a single individual patient

Patient Handling Intervention
: The implementation of a change in the organisational systems, environment, equipment or methods to complete patient handling tasks in a specified area.

Outcomes

A quality or quantity that is seen as a result of an intervention

Outcome Measure (OM)

An outcome measure is a recorded quantity, quality or value (single or series) that can be identified to compare the before and after intervention state. e.g. equipment provided for a workplace.

Outcome Measurement Tool (OMT)

An outcome measurement tool uses the outcome measure or several outcome measures for internal assessment against a known and traceable set of criteria. The OMT should give rational level data in its final score system. OMTs should measure outcomes and not describe interventions, but an OMT could describe the magnitude of an intervention when there is clearly stated evidence of the links between the intervention and the outcome improvement.

The following glossary terms define research terminology in the context of the Intervention Evaluation Tool (IET) created in this study:

Validity

The validity of any measurement device is the level that the measurements recorded and analysed truly reflect the qualities found in that situation. Many experimentation and data collection errors can reduce the validity of any study. In this study the validity refers to how the IET scores represent the management performance of the ward in managing the risks of patient handling to its staff and patients.

Reliability

In research studies the term reliability reflects the consistency of data collection. In this study the reliability of the IET should show consistent results when a single data collector collects repeated measures at different times (inter-rater reliability) and that if different data collectors collected the IET in the same ward at the same time then they would also collected the same information (intra-rater reliability).

Sensitivity

The sensitivity of the IET is the level by which changes in the data collected are reflected in the calculated scores. Too much sensitivity and small changes in the data would equate to large changes in the scores and too little sensitivity and real changes in the data would not be reflected in the final calculation. Appropriate levels of sensitivity will reflect in the validity of the IET.

List of Acronyms/Abbreviations

Terminology

MH	Manual handling
PH	Patient handling
PHA	Patient handling advisor
PHRA	Patient handling risk assessment
PHP	Patient handling plan
OH	Occupational health
H&S	Health and safety
HASAW	Health and Safety at Work etc. Act 1974
MHASAW	Management of Health and Safety at Work Regulations 1992
PUWER	Provision and Use of Work Equipment Regulations 1998
MHOR	Manual Handling Operations Regulations 1992
MSD	Musculoskeletal Disorders
MSI	Musculoskeletal Injuries

Organisations

EU	European Union
EC	European Council
NBE	National Back Exchange
NHS	National Health Service (UK)
NPSA	National Patient Safety Agency (UK)
HSE	Health and Safety Executive (UK)
EPPHE	European Panel for Patient Handling Ergonomics
NIOSH	North American Institute for Occupational Safety and Health
OSHA	Occupational Safety and Heath Administration (US)

CHAPTER 1

Introduction

1.1 A personal perspective

Since 1997 I have been the course tutor for the Postgraduate Programme in Back-Care Management at Loughborough University. This programme educates post-qualification and post experience learners in the scientific background and the implementation processes for managing the risks of patient handling in the full range of health, social care and educational organisations. The model for the role of a Patient Handling Advisor (PHA), either internal or external to care organisations, is better defined and educationally supported in the UK than anywhere else in the world, and the programmes offered in the UK can educate the PHA to Masters degree level. The academic and evidence bases for some areas of the patient handling development are not well defined and the reduced level of information has been paramount in myself taking up the challenge of this research study.

Within this report are a number of personal aims alongside the academic aims of the PhD process based on my many years of teaching, training, research, employment and consultancy in the role of Patient Handling Advisor. As someone who firmly believes in the scientific background to evidence based practice, the development of qualifications to assist the improvement of practice, and data collection to prove the value of any intervention, certain questions have struck a chord through the years. It is some of these professional areas that lack clarity, which I have tried to address in this study.

The two main topics of personal interest are:

- Even when very experienced people in the field of patient handling have been implementing safe systems over a period of years there is a paucity of data to prove that the interventions have been of benefit to the organisation. It has been my experience that people do not fully understand the relationships between interventions and outcomes and how to measure them appropriately.
- The subsequent question, which I want the Patient Handling Advisor to be able to answer, is: How do you know whether your organisation is effectively managing the patient handling risks?

I hope that this investigation not only adds to the body of knowledge in the field, but in providing a clear outline of the relationships between intervention and outcome, and a useable tool, can improve practice in patient handling risk management.

1.2 The scope of the problem

The literature review (Chapter 2) will report the volume of research that has identified the known risks for musculoskeletal injury in the delivery of health and social care. To reduce these potential problems the field of patient handling has developed rapidly since the adoption of European legislation in 1992. The area has seen some research to measure the improvements in the quality of management strategies to improve the delivery of patient handling tasks. A wide range of intervention strategies has been developed, mostly covering the physical engineering solutions, people based interventions of training, instructions and supervision, and organisational solutions of systems and process (Hignett et al., 2003). It is difficult to compare the benefits of these different types of interventions, as any measurable outcome will be structured on the type of intervention.

The problem to be investigated in this project is three fold:

a) Given that there is some evidence that many patient handling interventions have no significant effect on reducing the prevalence of musculoskeletal disorders (Martimo et al., 2008, Amick et al., 2006), with what other values can the outcomes of patient handling interventions be measured?
b) If the outcomes from patient handling interventions can be measured with other values, then how are they to be compared when the wide range of intervention types is considered?
c) Can a combination of outcome measures be developed into a single tool that quantifies the risk management performance for patient handling risks in a given area?

The EC directive (90/269/EEC) is applied to all EU countries, but the systems for implementation are recognised as different across the countries, care settings, areas of special interest, and personal differences of the leaders in the field. This project not only aims to answer the questions above but also to include the views, actions and interests of all countries across the EU. The inclusion of EU factors, and opinions, has been provided by the European Panel of Patient Handling Ergonomics.

1.3 Conceptual framework

The scientific basis for this study is based firmly in the field of the applied scientific approach that is common in healthcare situations. Modern thinking for the improvement of health and social care practice is supported by ‘Evidence Based Practice’. This study is set within the same boundaries and can be defined as an evaluation of ‘current best practice’.

The scientific approach for this investigation is a clear use of mixed methodologies, incorporating both qualitative exploratory methods, and quantitative evaluation and scoring processes. This dual approach also can be described by the inductive and deductive approaches (Bryman, 2008). The literature analysis (Chapter 2) and the selection of tools for the content of the assessment tool (Chapter 4) has exploited deductive theory, exploring the peer-reviewed literature and working towards future observations, but the collection of the focus group data (Chapter 3) to identify the important outcomes was based on the inductive approach.

The application of the study to the environments of health and social care, the involvement of practitioners and experts in data collection, and peer-review more appropriately define the process as realistic research (Pawson and Tilley, 1997), as the project aims to provide a specific evaluation method based upon practitioners’ views to be used in a clearly defined set of circumstances.

1.4 The research aim

The overall research aims are to investigate the relationships between outcomes, outcome measures and the measurements of success for patient handling interventions. This investigation is applied to the practitioner field, and is aimed at delivering useable solutions and a method to create a positive change in both the practitioner and research fields. The second aim of the study is to develop a single tool that measures the important outcomes in a single measure to quantify the benefits between pre- and post-intervention performance.

1.5 Scope and limitations of the project

The EC Directive (90/269/EEC) applies to all manual handling activities across all industries. The very specific application of manual handling investigated in this project was the use of manual actions, with or without the use of aids and equipment for the purpose of patient handling. A growing body of research and practical evidence has been developing since the implementation of the Directive, which shows that most of the tasks and development of safer practice are recorded in health or social care situations. These two fields will constitute the area of investigation in this study, though it is recognised that many other areas will be exposed to patient handling risks.

The Directive on Manual Handling applies to all of the full members of the European Union, and the application of this project is to incorporate a wide representation of all the countries affected. It was not possible to consider accessing all 27 member states and the 3 accession states (www.europa.eu, 2009), so for data collection an appropriate demographic and geographical range was designed.

The area of investigation for this study is to understand the relationship between interventions, outcomes, outcome measures and the measurement of success. A European sample of practitioners was used to define the content of the

Intervention Evaluation Tool. Analysing the available literature and selecting the most suitable methods created the structure and format of the tool. The time and funding limitations of the project did not allow the development and implementation of an intervention trial to evaluate the tool, and that will form the basis for future investigations and projects.

The programme of data collection (Figure 1.1), investigation and analysis has been concurrently completed in four European states for the field trials, but has had the peer-review of many other countries' to make it a truly international study. Though there has been such involvement, the analysis and interpretation had to be in English. The tool and process that have been developed have had some evaluation and peer-review but in the context of this study the process for full user evaluation and validation will be discussed in the latter stages of the report.

1.6 Thesis outline

The structure of this thesis outlines the full research project in a step-wise logic. This project was completed with the financial assistance of an external sponsor (Arjo-Huntleigh ab) and the clear brief agreed at the outset was to design a tool to measure the success of patient handling interventions in the EU. This tool was to be used by practitioners in the field and if possible as a research tool in future intervention studies. Each stage of the design of the tool is contained within the different chapters of this report. The process for the requirements, design, development and evaluation of the Intervention Evaluation Tool (IET) is shown in Figure 1.1.

Chapter 2a reviews the background literature to identify the position and developments in patient handling since the adoption of EC legislation. To give clarity to the range of interventions, outcomes and the different measurement methods Chapter 2b describes a systematic literature analysis, which allowed the research question to be defined and clear objectives to be included.

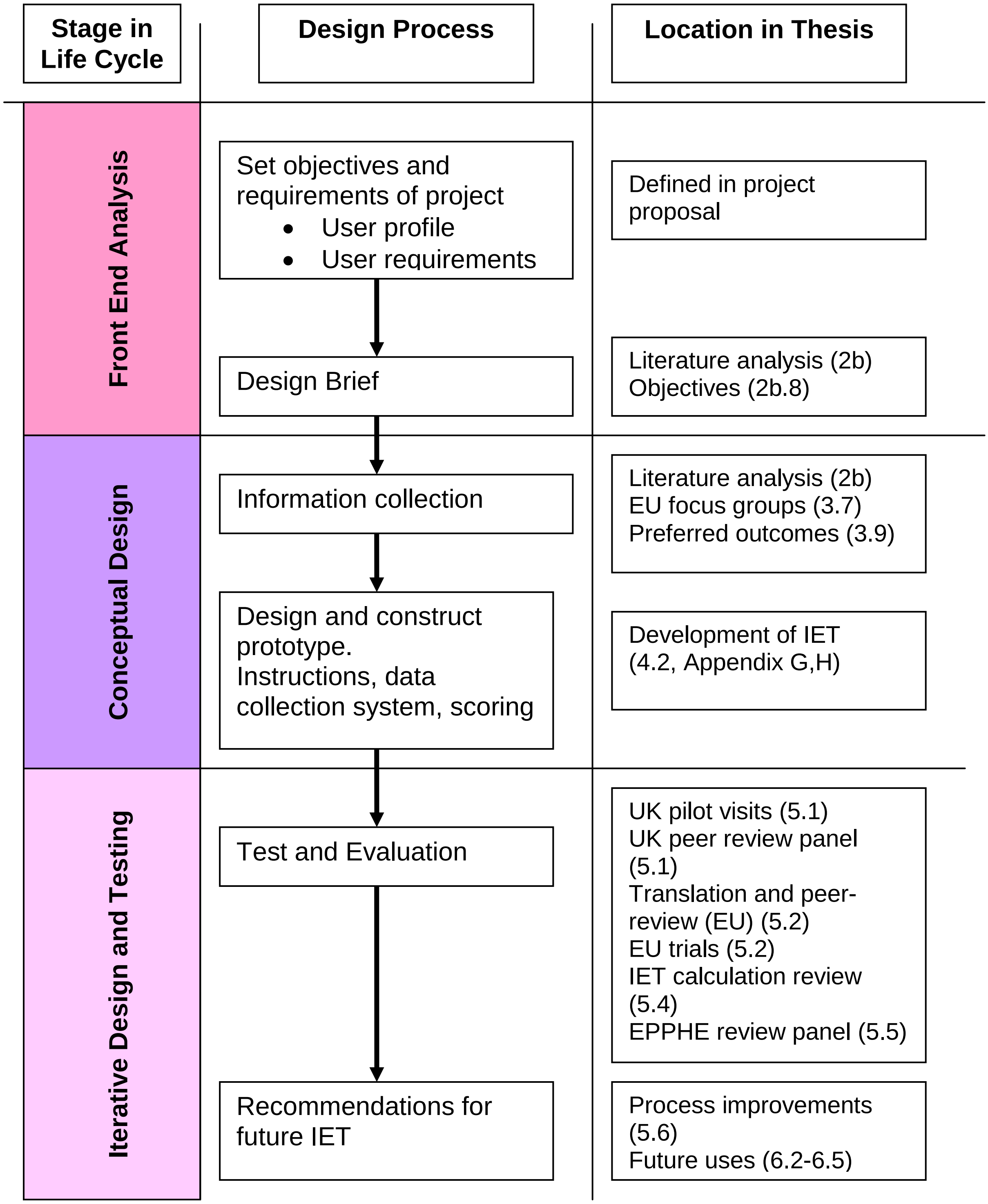

Figure 1.1. Design process for the Intervention Evaluation Tool (based on Wilson and Morrisroe, 2005)

The conceptual design of the tool was created from the literature analysis (Chapter 2b) which defined what, and how, outcomes could be measured, and the EU focus group study in Chapter 3 which provided a prioritised list of outcomes that defined the boundaries of the measurements in the IET. The data collection, results and analysis of the EU focus group study is described in Chapter 3. The design of the prototype tool is described (Chapter 4) and the selection of the most suitable measurements for the 12 included outcomes is explained. The IET experienced several stages of evaluation. Chapter 5 showed the methods used for testing and evaluation for the Intervention Evaluation Tool and discussed the various trials and evaluations across the EU.

This project delivered the Intervention Evaluation Tool as an evaluated prototype and recommendations for the design, documentation and process of use of the tool are described in Section 5.6 and through Chapter 6. Chapter 6 also considered the wider aspects of this project, discussed the findings and their context, and made a variety of recommendations for the future development of this work. Specific direction for the improvement of validity and reliability is outlined in Section 6.4. A brief conclusion completes the report in Chapter 7.

CHAPTER 2

Background And Context

Chapter 2a
Literature Review

2a.1 General Introduction

The overall aim of this research project is to develop a clearer understanding of the relationship between interventions and the measurement of outcomes for patient handling interventions in EU healthcare. To place this research into context, this background chapter explores the available literature in both general and systematic approaches. The initial sections discuss the wider body of literature to cover the contextual setting of interventions, outcomes and outcome measures in the reduction of musculoskeletal risks. The evidence of MSD in nursing and the associated healthcare professions is covered in section 2a.2. The contextual and historical differences between EU countries are discussed in 2a.3 before the relationships of interventions, outcomes and outcome measures in a wider context are described in section 2a.4. Closer focus on patient handling interventions and the measurement of outcomes is described in 2a.5 onwards.

Section 2a describes literature sources from a wider context. The literature for this general review was collected using the search strategies described in section 2b.1 but many of the papers included in this section failed to meet the specific inclusion criteria for the systematic review. Additional material was located by expanding reference lists from included studies and further manual keyword searches in the specific data bases that cover the areas of ergonomics, occupational health and safety, and nursing (i.e. Medline, Science Direct, Scopus, Ergonomics Abstracts, Ovid and Proquest).

To gain a detailed understanding of the relationships between interventions, outcomes and outcome measures for patient handling studies, section 2b includes a systematic literature analysis of all published patient handling interventions. This analysis describes the range of interventions, outcomes and outcome measures recorded by patient handling studies. This in-depth discussion allowed the philosophical issues of patient handling research and the application of evidence in the field to be discussed, and clear research aims and objectives to be described (2b.9).

2a.2 MSD in health and social care workers

The presence of musculoskeletal injury and illness in the health and social care workforce has been reported in many epidemiological studies. The information relating to prevalence of musculoskeletal disorders (MSD) is not just related to front line care workers, but there is also concern relating to ancillary professions: Battevi et al., (2000), Hignett (1996a), Fanello et al., (2002), Hildebrandt (1995), Estryn-Bahar et al., (1990), Baldasseroni et al., (2000), Ore (2003), Smedley et al., (1995), Smith and Secombe (1996) all indicate high prevalence rates among nursing and related personnel. Lu and Yeh (2006) identified musculoskeletal prevalence in care centres, while Menzel (2004) and Menzel et al. (2004) reported factors and rates of musculoskeletal discomfort in nursing personnel. In other health related areas Glover et al. (2005) and Rugelj (2003) showed the raised level of problem in physiotherapists. The extremely high levels of injury seen from the repetitive postures and actions of sonography have been reported in Russo et al. (2002) and Crawford et al. (2002), physical issues in dentistry by Turner et al. (2002), podiatry by Al Nasseeri et al. (2002), and X-ray technologists by Kumar et al. (2004).

The range of studies indicates that MSD in this occupational sector remains a major issue. The perceived high rates of prevalence and the corresponding losses in terms of finance and manpower created the need for action to manage the potential risks not only across the European Union (EU) but worldwide. Studies based on the epidemiological data have identified a range of risk factors in these occupational groups. These risk identification studies identify different factors for different occupational groups. The key series of factors identified is relative to the physical requirements of the work tasks, for example the weights of people being moved, frequency of lifting tasks, hazardous postures and methods (Garg et al., 1991, Owen and Garg, 1991, Owen et al., 2001, Smedley et al., 1995 Stobbe et al., 1988, Winkelmolen et al., 1994, Knibbe and Friele, 1999, Edlich et al., 2001, Hyytiainen and Saarel, 1990, Engkvist, 2004 and 2008, Fisher et al., 2006, Gagnon et al., 2006, Capiello et al., 2005, Garg et al., 2003, and Menzel et al., 2004). Work organisation factors and shift patterns were identified by Toupin (2006). Psychosocial factors were also identified as potential risk factors for illness and during the return to work following injury (Baird et al., 2006, Wiitavaara et al., 2007, Daraiseh et al., 2003, and Eriksen et al., 2004). Hazards have also been identified for other areas of the health professions: nursery nursing (Coole and Haselgrave, 2000), hazards in midwifery (Hignett,1996, Thompson, 2000, and Steele and Stubbs, 2002), X-ray technologists (Kumar et al., 2004), dentistry (Thornton et al., 2004), and hospital cleaning (Carravick et al., 2005).

The growing number of studies that describe the possible interventions to assist MSD reduction have further shown the potential hazards and risks of patient handling methods (Hignett et al., 2003, Nelson, 2006, Amick et al., 2006). The range of these intervention studies will be discussed later in this review.

2a.3 European Picture

The epidemiological information, in the previous section, showed that the prevalence of musculoskeletal problems was widespread both geographically and across occupations within health and social care. This knowledge initiated the European Union to create a European Council (EC) directive to help reduce the effects of many health and safety risks to the workers of the EU. The framework directive (89/391/EEC) covers all areas of health and safety in the workplace. This was followed more specifically by the manual handling directive (90/269/EEC), which indicated the participating countries should manage risks related to the manual handling of loads, specifically where there was risk of injury to workers. The manual handling directive was completed on the 29th May 1990 and implementation of country specific regulations was targeted for 1992. EC directives are however general guidance for governments to follow and each country developed different responses in time and detail (Hignett et al., 2007).

The historical development of manual handling practices, systems and intervention strategies in EU countries has for the most part been in isolation from their geographical neighbours. Though some cross boundary discussion forums have been in operation (e.g. OSHA, The Djuro Group and ISSA Health and Safety Forums) there is still limited transfer of information and sharing of methods or solutions. In 2004 the European Panel of Patient Handling Ergonomics (EPPHE) was formed as a combination of interested parties from two Technical Groups of the International Ergonomics Association (IEA) (T9 and T13). The two aims of the EPPHE group were to improve the dissemination of scientific evidence between the participating countries and to develop and collect more pan-European information from collaborative studies. The initial studies and collaborations from the EPPHE group identified that there were likely to be differences in the structures of health care delivery and questions surrounding the validity of comparison.

Hignett et al. (2007) compared specific measures relating to the provision of healthcare and implementation of the EU directives in countries with EPPHE representation. The study showed that healthcare is primarily delivered by government systems in all these countries, but there were differences in the number of beds per 100 000 in the population, and in the number of registered nurses and healthcare staff employed. The table also shows some differences in the timing for the implementation of regulations to support the directive, and specifically a scarcity of published guidance to assist with patient handling. Only Finland, Sweden and the UK had published patient handling guidance.

Table 2a.1. Comparison of EU Countries (Hignett et al., 2007)

Country	**Pop^n (Million)**	**Hospital beds per 100 000 population**	**Total healthcare staff (000's)**	**Implem^n of EU directive**	**Guidance**
Finland	5.2	723.9	346	1994	1998
France	60.6	777.6	546	1993	No official guidance
Germany	82.5	874.4	2 200	1996	No official guidance
Greece	11.1	487.0	90	1994	No official guidance
Ireland	4.1	1006.7	98	1993	No official guidance
Italy	58.5	445.4	1 201	1994	No official guidance
Portugal	10.5	365.1	120	1993	No official guidance
Sweden	9.0	358.5	260	1993 2000	2002
UK	60.0	396.9	1 300	1993	1981

There are recent studies still identifying problems with musculoskeletal health of workers in healthcare occupations, over ten years after the implementation of the manual handling directive. Simon et al. (2008) reported the most recent information from the ‘Nurses early exit study’ (NEXT). The NEXT study shows that high levels of musculoskeletal and psychosocial factors are still prevalent in healthcare workers. Interestingly this study of seven countries, using 21 516 responses, showed that staff in hospitals reported the lowest availability of lifting equipment compared to nursing homes and home care. There was still a good correlation between the amount of physical lifting and bending and the prevalence of back and neck pain in this group, but psychosocial factors showed a stronger link with disability from MSD. In conclusion the paper agrees with Hignett (2003b), Nelson et al. (2006) and suggests that multi-factorial interventions are key to removing risks, and should also take account of psychosocial factors.

2a.4 Interventions studies in a wider context

The application of intervention strategies to the health and safety of workers and service users is widespread. Many publications and methodologies have been described to measure and quantify the intervention type and indeed the outcomes achieved. The use of interventions is also related to the development and the implementation of ergonomics as an industrial science. Both as a methodological science and a philosophy it has user outcomes as its focus. Recent reviews and philosophical papers have considered the effectiveness of intervention strategies and the possible process barriers.

Robson et al. (2007) define an occupational health and safety management system (OHSMS) as ‘A set of interrelated or interacting elements to establish OSH policy and objectives, and to achieve those objectives’, with the qualifying statement that there are difficulties with interpreting the definition as to what elements are activities, management and or systems. Redinger and Levine (1998) suggested that the primary elements of an OHSMS are:

- Management commitment and resources

- Employee participation
- Occupational health and safety policy
- Goals and objectives
- Performance measures
- System planning and development
- OHSMS manual and procedures
- Training system
- Hazard control system (risk assessment and control)
- Preventative and corrective action system
- Procurement and contracting
- Communication system
- Evaluation systems for continual improvement
- Integration
- Management review

These key elements describe a sound overview for all safety related interventions, though defining each observed strategy within each title is difficult as most interventions include a mix and match approach, depending on the needs analysis and the organisational structure.

Robson et al. (2007) conducted a systematic review of OHS management interventions to identify the key factors based on the quality of the research data. In some similarities to patient handling reviews, the volume of the high quality data was low with only one study being judged to be of high methodological quality. Interestingly in the description of the review the study concept identified a clear approach to interventions and possible outcome measures. The intervention may itself create implementation measures that relate to an organisation's response to the suggestion. There are then physical or organisational measures soon after the intervention has been created that may result in the final outcomes towards which the intervention was aimed Figure 2a.1 below. This replicates the framework for patient handling interventions. A proposal for change is made which, dependent on management buy-in (intervention), leads to the implementation of training, equipment or a change in process (implementation). This leads to intermediate outcomes in the way a task is performed, the uptake of the intervention, or postural/biomechanical effects of the new method. Ultimately the long term goals are related to the individual or organisational outcomes of reduced accident reports or sickness absence from MSD. These could directly or indirectly lead to the financial evaluation. In comparison with the patient handling reviews in section 2b.5.1, the intermediate outcomes identify the changes in causal exposure, and the final outcomes represent the final effect of the intervention at the desired level.

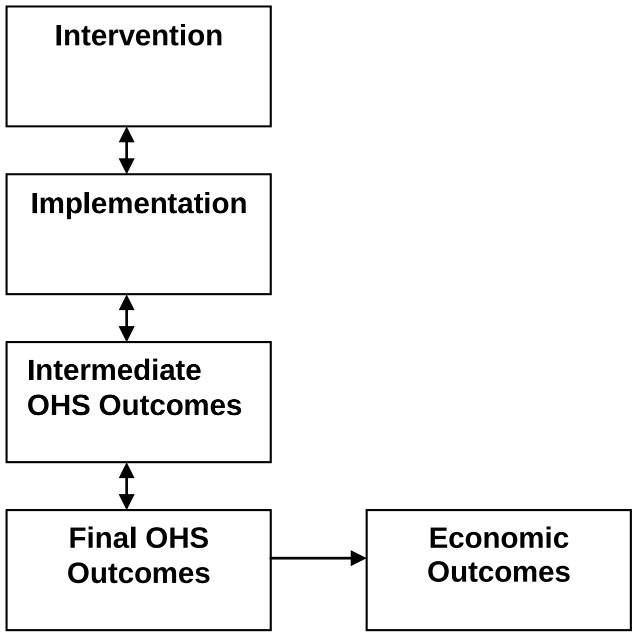

Figure 2a.1 Conceptual framework for OHSMS review (Robson et al., 2007)

Vredenburgh (2002) evaluated proactive and reactive strategies in hospital safety, and found that hospitals that used proactive strategies, e.g. training and selection filters, in addition to re-active repair strategies had an improved safety score. This agreed with the philosophy of Zink (2005) that identified the link between industrial safety and corporate health management, based on the theories of Total Quality Management (TQM). Taveira et al. (2003) and Lee (2005) also discuss the relationship between the implementation of ergonomics and TQM in large organisations. One review that noted positive outcomes considered participatory ergonomics interventions (Rivils et al. 2008), and showed that participatory ergonomics interventions across a wide range of settings and methods showed positive effects on MSD. This review did include a number of healthcare related and or back pain related studies (e.g. Carravick et al., 2001, Evanoff et al., 1999).

In addition to the examination of OHS interventions there is also the consideration of ergonomics interventions in general when considering the outcomes of MSD and their severity. The definition and scope of ergonomics interventions are wide and in the most part published studies consider a narrow area of application to prove validity. Some papers have considered the wider field of MSD implementation. Whysall et al. (2004) identified the process for consultant ergonomists. Haslam (2002) considered the role and philosophy of health promotion. The justification and effectiveness of ergonomics interventions were examined by MacLoed (2003), Koningsveld et al. (2005) and Kerr et al. (2008). The over-riding finding of these papers is that as a science ergonomics does not collect enough outcome detail to be able to convince others of its importance. This is particularly relevant to the area of cost benefit analysis. The concentration on justifying a financial or MSD quantifiable outcome has proven to be problematic, and in health and social care the cost evaluation is similarly difficult, due to the complexity of the care and the difficulties of costing clinical benefit.

Though this study is concentrating on the process of intervention studies relating to patient handling in health and social care, it is important to appreciate that the wider fields of healthcare risk and the more general approaches of health and safety also overlap in this area. Initially the context of the provision of healthcare and the range of demands on care practitioners may be a useful context. Freisdorf and Marsolek (2005) considered the provision of care tasks as a simple socio-technical system. Figure 2a.2 shows the relationship between the carer, the patient and any mechanical or physical device that is being used for the task that can describe the criteria of a patient handling task operation. Some tasks will involve just the relationship between carer and patient, but some will also involve mechanical equipment of varying complexities.

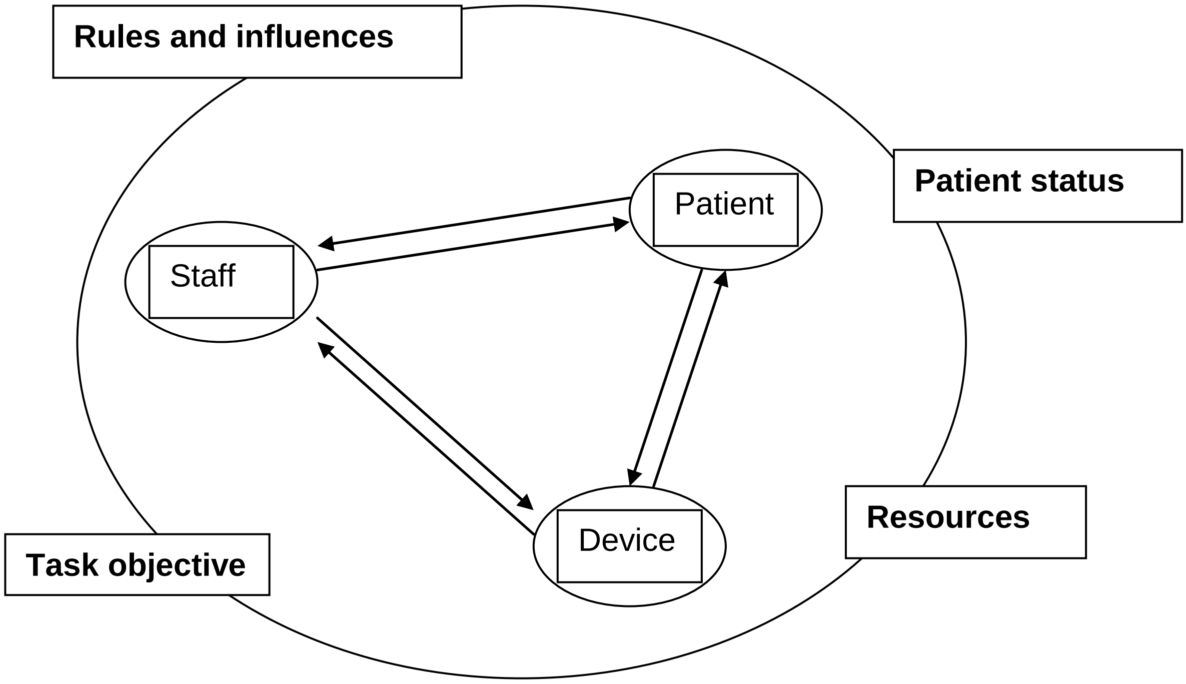

Figure 2a.2 Simple work system

For the patient handling scenario this model has many factors that may influence the completion of a specific movement or task. The reference above suggests that for a medical task four factors: patient status, rules and influences, task objectives and available resources add complexity to the actions. The difference for the patient handling task is that it is usually not the primary objective of the care task, and mostly is seen as an action that assists the caregiver to achieve the objective.

The role of ergonomics in the development and evaluation of patient handling tasks is clear, as the model forms a complex man machine interface with a number of organisational and systems overlays. Catino et al. (2005) suggest that this model not only consists of factors within the workplace, but actions and possible errors are considered at individual, organisational and inter-organisational level. Nurse and carer behaviour is certainly affected by peer group information, locally, and national guidance for health, health and safety information and professional standards or guidance, externally.

The completion of patient handling tasks also depends upon standard health and safety rules, regulations and guidance. The UK perspective is clearly defined within the plethora of information disseminated from the Health and Safety Executive (HSE), which covers all areas of workplace settings. The care services are also well advised by different bodies from The Department of Health (DH), Health Services Advisory Council (HSAC), Royal College of Nursing (RCN), other professional bodies and unions such as Unison. There are also other sources of patient handling guidance from specific bodies and documents in Table 2a.2.

Table 2a.2 Patient Handling Guidance Documents

Description	Source
Organisational systems	Manual Handling Management Standards, NBE (2005) Manual Handling in the Health Services (2nd Edition). HSE/HSC (1998) DIAG (1999) Essential Back-Up (Revised 2002) NBE (2002)
General Books	Charney and Hudson (2004). Smith (Ed) (2005) Nelson (Ed) (2006)
Specific practical patient handling guidance	DIAG (1999) Smith (Ed) (2005) Collins et al., (2006), Oregon Nurses Association (2004), Guidance for Midwifery. Royal College for Midwives (1999) OSHA Guidance 2009 ACC Worksafe (2003)

This set of recommendations is widely added to by the frequently published best practice advice that appears in journals and professional magazines in the from of professional opinion studies or reviews (Stetler et al., 2003, Strong, 1999, Nelson et al., 2003, Hignett, 2003a, Nelson and Baptiste, 2004, etc.)

All of this direction and information adds to the complexity of the process of completing the handling task in the care setting. In particular, some of the methods and techniques under scrutiny appear contradictory. This leads the investigation to evaluate how evidence is compiled to evaluate the different handling systems from the different perspectives.

2a.5 Interventions and outcomes

Patient handling in the care setting is known to have health effects on the staff involved in these potentially hazardous processes. The reduction of the effects of known hazards and risks is the responsibility of the employer (EC Directive and HSAW etc Act 1974). The process of risk identification, assessment and control is well established in many industries. The HSE (HSE 2006) identifies the 5 steps to risk assessment as

1. Identify the hazards
2. Decide who might be harmed and how
3. Evaluate the risks and decide on precautions
4. Record your findings and implement them
5. Review your assessment and update if necessary

The healthcare industry has embraced this responsibility and accountability and has focused on the safe movement of patients. Advisors in patient handling have, for a number of years, been developing systems that identify the level of musculoskeletal risk for a given patient handling scenario.

This clearly defined process of risk assessment has a number of different contextual considerations in the field of patient handling. Many different approaches and measures have been used to identify the levels of risk, and the residual risks to staff, before and after an intervention has taken place.

This section discusses the variations in the range of risk assessment methods that have been developed. Hignett et al., (2003) indicated from a systematic literature review that the process of implementing risk assessments has a powerful effect on reducing risk to health staff, fourteen studies gave positive evidence to show that interventions were successful when based on risk assessment or risk management methods. Nelson (2006) concurred that the implementation of the risk assessment process at various levels was an important action to help improve staff and patient safety.

The context of risk assessment as part of the ergonomics process is important. The simple concentric rings model of ergonomics (Singleton, 1974) would show the patient as the centre of the care delivery function (Figure 2a.3). Any potential intervention strategies could include all levels of the work process from the patient, staff, environment and organisation, with the aim of improvements in the work task at all levels.

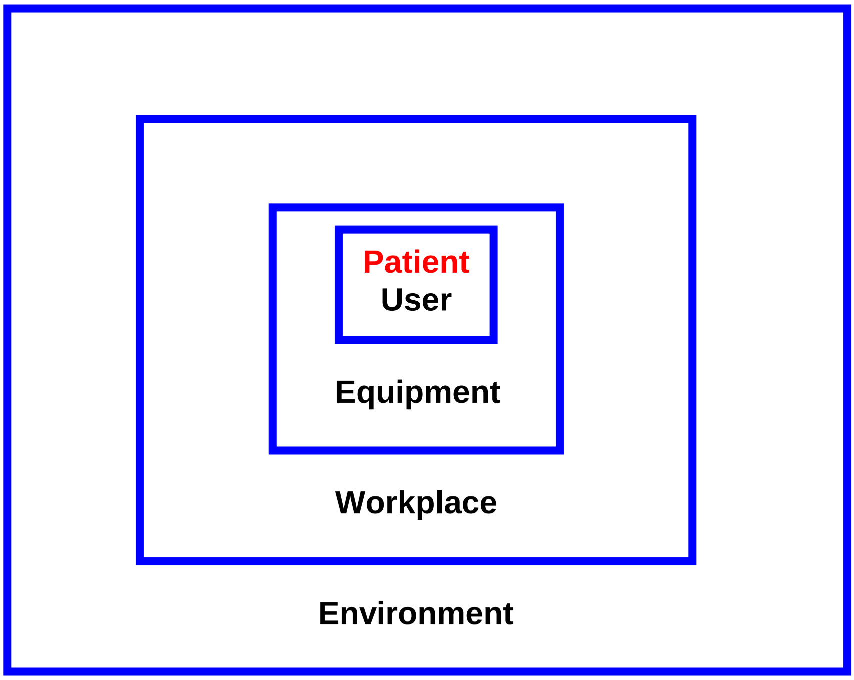

Figure 2a.3 Singleton's Ergonomics Concentric Rings Model (1974)

Table 2a.3 shows the wide range of applications and strategies used for patient handling interventions. It is important to be able to evaluate the range of interventions. The selection of appropriate outcome measures is crucial when evaluating an intervention. The next section describes the different outcome tools and risk assessment methods that have been published and applied to intervention studies for patient handling.

Table 2a.3 Intervention strategies used for patient handling

Level	Intervention Type
Organisation	Management systems Policies and procedures Occupational Health, Human Resources interventions Fitness for work Risk Assessment systems Health and Safety management National regulation / guidance Peer-leaders / workplace supervision
Workplace	Buildings and facilities Equipment provision Equipment maintenance Workplace layout Lifting teams Staffing levels Health surveillance
Staff	Preparation Phase • Training for increased skills • Equipment selection • Method selection Performance Phase • Training for increased skills • Supervision to increase compliance
Task	Change environment Change routine/protocol/technique/method Change intended outcome Avoidance of high risk tasks Equipment use
Patient	Increased involvement Participation strategies Behavioural change

(Developed from Hignett ,2003a, Amick et al., 2006 and Charney and Hudson (eds), 2004)

2a.6 Outcome measures

Ergonomics is centred around quantifying and qualifying the demands of work on individuals and understanding their impact on tasks and organisations. There have been tools developed for these purposes. Many ergonomics textbooks are available to describe the numerous processes for quantifying and qualifying work processes, (Wilson and Corlett, 2005, Stanton et al., 2006, Karwowski, 2006, etc.). These tools measure a range of physical, psychological and sometimes organisational outcomes. In addition there are studies that apply working knowledge to the measurement and the improvement of methods and techniques of human performance measurement. Dempsey et al. (2005) surveyed practising ergonomists to show the breadth of tools used in practice.

The following section briefly shows the range of tools that is available for the measuring workplace activities that are appropriate to the field of patient handling.

1. Safety Culture

The nature and measurement of safety culture is explored by Choudhry et al., (2007). Though not suggesting the definitive method of measurement, there is good clarification regarding the importance of positive safety culture and the component parts; organisational and individual behaviours, management commitment, employee involvement, promotional strategies and campaigns and training. Further development of the systems ergonomics approach is described in Flin (2008). The measurement of safety culture in Danish healthcare was explored by Madsen and Anderson (2005). A safety climate questionnaire was evaluated in UK healthcare by Hutchinson et al. (2006) while Julien et al. (2005) used logic trees to examine corporate behaviour.

2. Financial evaluations

The financial evaluation of ergonomics or OHS interventions has been recorded in a series of evaluation papers (Smedley et al., 2005; Siddarthan et al., 2005;

Hendrick 2003; Beevis and Slade 2003; Beevis 2003; Stanton and Baber, 2003; Landstat et al., 2002 and Biddle et al., 2005).

3. Patient Outcomes

The domain of patient outcomes is not well researched outside the clinical outcomes literature, which is beyond the remit of this review. Hogston (1995) considers a series of studies that suggest patient outcomes are identified by nursing staff as the measure of quality of nursing care. Patient satisfaction is an inherent part of that judgement. Aydin et al., (2004) produced a more rigorous review of a state-wide quality evaluation, but failed to describe specific scoring patterns for patient outcomes.

4. Psychological load

The wider field of MSD has embraced the issues of psychosocial factors in many occupational settings. Manual handling tasks however have received little attention in terms of this measure. Bartys et al. (2002), Pretorius and Cilliers (2007) and Bourbonnais et al. (2006) all describe methods that could be applicable to handling occupations.

5. Physical hazards of manual materials handling

The recording and analysis of the physical hazards of lifting are well reported. The development of the NIOSH model is central to this research area. Dempsey (2002), Dempsey et al. (2002), Pinder (2002) and Waters et al. (2007) have all added to the robustness of the original model (Waters et al., 1993)

- Other tools have been compared to the NIOSH model (Russell et al., 2007; Dempsey and Mathiassen, 2006; Dolan and Adams, 2000 and Mastrominico et al., 2005).
- The calculation of compressive forces relative to different lifting postures and tasks have been reviewed (Agruss et al., 2004; Fischer et al., 2007; Kumar and Narayan, 2006; Gagnon, 2003 and 2005).
- The use of new technology for assessment of posture and hazard has been explored (Sutherland et al., 2008; Williams and Medland, 2002; Plamondon et al., 2007; Sutherland et al., 2007; Lamkull et al., 2007; Littlewood and May, 2007 and Lavender, 2000).

- EMG measures to quantify peak and cumulative workload are described by Village et al. (2005) and briefly by Albayrak et al. (2006).
- The relationship between subjective evaluation of handling and physical measures has been compared (Johnson and Hall, 2005; Nastasia et al., 2007; Tak et al., 2007 and Ryan and Haslegrave, 2007).
- Self reported exposure tools have been reported and evaluated (Yeung et al 2002; d'Errico et al., 2007 and Noyes and Bruneau, 2007).
- Physiological measures for dynamic load carriage tasks (Abe et al., 2008 and Wickel and Reiser, 2008).
- Push-pull evaluation methods (Okunribido and Haslegrave, 2008; Lemerle et al., 2008; Marras et al., 2009 and Rice et al., 2009).

In addition to the above methods relating to the recording of back posture and lifting hazards, some additional tools cover other task types and methods (PLIBEL, Klemmert, 1995). The Quick Exposure Checklist (QEC) is a whole body exposure tool for MSD (Brown and Li, 2003 and David et al., 2008). Upper limb assessment tools have been noted (Bao et al., 2007; Occhipinti and Columbini, 2007 and Roman-Liu, 2007). Chung, Lee and Kee (2005) related the measure of postural load to perceived discomfort for other physical exposures. The Manual Handling Assessment Chart (MAC) developed by the HSE has also been reported as a simple risk identifier (Monnington et al., 2003; Tapley and Buckle, 2003; Pinder, 2003 and Mawle, 2005).

6. Methods for quantifying hazards in nursing

The physical and psycho-social hazards of the nursing role are well recognised and several models not specifically related to patient handling have been reported. Ramsay et al. (2006) consider an approach to job hazard analysis based on the OSHA hazard list. The overall physical workload was observed and quantified by Janowitz et al. (2006), the psychosocial work environment for hospital workers was evaluated by Aust et al. (2007), and nurse performance measures were suggested by Gurses and Carayon (2006). Specific models that concentrated on the measurement of trunk loading, lifting hazards or exposure to risk included studies by Ciavarro et al. (2006), Engkvist et al. (1995) and Skotte (2001).

2a.7 Methods used for patient handling studies

Studies concentrating on patient handling identify many different aspects of performance, risk and outcome. The following discussion explores the many methods used both for the analysis of the risks of patient handling and as outcome measures for intervention studies. The tools reviewed in this discussion have different formats and measure different criteria. They are divided into the following categories:

a) Individual Patient Handling Risk Assessments and Plans
b) Physical Environment Risk Assessments
    i. Criteria Based Assessments
    ii. Residual Risk Scores/Evaluations
c) Individual observational tools for specific handling tasks
    i. Postural Analysis Tools
    ii. Biomechanical Assessment Tools
    iii. Exposure Measures
    iv. Subjective Appraisal Measures
    v. Methodological Observation Tools
d) Organisational/Management Structure Audit Tools
e) Financial Models of Assessment

Each different tool type is described in the following sections.

2a.7.1 Individual Patient Handling Risk Assessments and Plans

For a practitioner, the risk assessment process is an evaluation of the identified hazards, and the development of a safe system of work, to allow patient transfers to be repeatedly completed with controlled risks to the carer. The risk factors for a transfer are mostly based on i) the transfer type and location, and ii) the presenting physical, psychological and behavioural condition of the patient to be assisted. Identified hazards can be recorded as either a list of factors (Fray et al., 1999; RCN, 2001; Smith (Ed), 2005 and ACC Worksafe, 2003) or developed as a score matrix. Radovanovic and Alexandre (2004) scored 8 patient characteristics: weight, height, level of consciousness, mobility in bed, transfer ability, walking, catheters and equipment and special risks. Each characteristic was scored 1-3 giving an overall risk level, low, medium or high, ranging from 8-24.

The development of a safe system of work has not been included in all risk assessment tools. In particular, the scoring systems have had a tendency to stop at the quantification of risk, using these values as a measure of the exposure to risk for a staff cohort, in a given area, based on patient need. This is similar to the nursing model of calculating workload by adding patient dependency scores for a patient cohort.

The development of a safe system of work (SSOW) for completing the transfer has also been subject to much work at practitioner level within healthcare providers in the UK (Fray et al., 1999; Smith (ed), 2005 and Nelson (ed), 2006). In line with the TILEO structure (HMSO, 2004), the instructions given as a result of the hazard identification and evaluation may involve combinations of the following:

- Task - Changes to the way the actions are to be completed.
- Individual Differences – Managing the skill and physical abilities of the staff to ensure safety
- Load – Reducing the manual effort of the task by the supply of aids, equipment or increasing the assistance of the patient being assisted.
- Environment – Changes to the location, equipment, buildings design to reduce risks.
- Other factors

As practical work-based documents, assuming a healthy and skilled workforce, the consensus for most SSOW's designed for the completion of each task include as essential information: the transfer type, the number of staff required to complete the transfer, the equipment and environmental changes, and a method statement as to how the task is completed.

2a.7.2 Physical Environment Risk Assessments

In addition to risk assessments for the handling risks associated with an individual patient or handling task, some tools have been designed to assess the potential hazards for an environment or location.

i. Criteria Based Assessments

This type of assessment looks at the needs for a specific situation, task or location. The individual assessments can be collated to give a risk summary for a building or facility. The criteria can be set as a specific need, a piece of equipment or other issue. The risk evaluation process in these tools is to accept or reject the chosen task based on the environmental situation. Scoring mechanisms vary from simple yes/no compliance statements (Fray et al., 1999, p46) to more complex environmental assessments giving a more complex score and summary total. E.g. the Lite Workplace Profile (ACC Worksafe, 2003 p195-200)

Two other tools are used to assess the equipment need for a given care environment. The Hoist Identification Tool developed by Smith et al. (2005) assesses the lifting need in any given environment, based on the Functional Independence Measure (Granger et al., 1993) and the number of staff teams available. It summarises the number of passive and active hoists required. Quick Scan (Arjo Ab, a) is a similar tool to assess the hoisting and bathing equipment required.

ii. Residual Risk Scores/Evaluations

A more complex risk scoring system can be found in two tools looking at the needs of an organisation and comparing these with the level of controls in place to give a residual risk score. Both the MAPO tool (Battevi et al., 2000) and the Care Thermometer (Arjo Ab, b) use measures of the patient group, the tasks completed, the equipment and environment. The Care Thermometer is a derivation of a Dutch model that has been used in a central government implementation and evaluation process (Knibbe and Knibbe, 2005).

2a.7.3 Individual observational tools for specific handling tasks

A review of outcome measures from patient handling interventions found that many different methods were used to identify the risks to the care giver carrying out the handling task (Fray and Hignett, 2007a). These include measures of physical position, force and repetition or exposure (Putz Anderson, 1988).

i. Postural analysis tools

The effect of body mechanics and shape on the risk level can be measured by certain tools. Some studies have looked at the specific joint angle or physical measures but most measured the risk scores with established posture analysis tools. Two common tools were REBA (Hignett and McAtamney, 2000) and OWAS (Karhu et al., 1977). These consider a range of body part positions and movements and compare them with known MSD risks to develop an ordinal risk level score ranging from high to low risk.

Raine (2001) developed the ‘People Environment Risk’ tool (PER) specifically for patient handling tasks. This used a similar methodology to REBA and OWAS but added several points of reference relating to the neuro-muscular approach to efficient movement (Vasey and Crozier, 1982; Crozier and Cozens, 1998).

ii. Biomechanical assessment tools

Biomechanical load has long been associated with musculoskeletal risk and many studies use these measures to evaluate the outcome of interventions. The risks were primarily related to the calculation of load, torque or compressive forces in the joints of the lower back e.g. NIOSH (Waters et al., 1993). The calculation methods, the level of detail, and the accuracy all showed differences. The observation methods varied from video taping with freeze frame analysis, photographic methods, simple distance measures for turning moments to high technology methods using electronic goniometry (Skotte, 2001) or the Lumbar Motion Monitor (Marras et al., 1999). A comparison of five such tools can be found in Russell et al. (2007).

iii. Exposure measures

Measures of exposure are not very common. Simple scores of time and total number of repetitions are used as measures of risk exposure. Knibbe and Friele (1999) examined the use of self completing logs to identify levels of risk as a fieldwork tool. This was in some ways similar to the self reported exposure methods described by Yeung et al. (2002). Another tool was developed and evaluated by Janowitz et al. (2006) to measure the physical demands of the hospital environment, but this was not specific to patient handling scenarios. Dempsey and Mathiassen (2006) suggest that the methods of quantifying risk based on a single load or task approach has lost its relevance in modern ergonomics, and cumulative day/shift models of exposure might be an improved method. For this review it is felt that the overall load on the workforce relative to the work demands of each individual care area may be a useful tool to measure the success of any patient handling intervention. The level of MSD in a high dependency care ward should be different to an area where patients are more self caring and mobile.

iv. Subjective appraisal measures

Subjective feedback has been used as a source of information to support interventions. No specific tools were found to measure the intervention effects on the patients but subjective measures of comfort, security and dignity were recorded. In addition there were many subjective assessments of the staff response to the task: the Borg scales for the rate of perceived exertion (Borg, 1998), likert scales for comfort (Nelson et al., 2006), and ease of use for equipment (Connelly et al., 2001).

v. Methodological observation tools

Observational tools have been the subject of much research in the patient handling field. These tools are developed to assess the safety or competency of an individual operator in completing the observed task. All of the tools evaluated in this study developed a checklist score sheet with a list of predefined questions and attainable qualities. Simple checklist criteria were suggested by Alovosius and Sulzer Azarof (1985), Feldstein et al. (1990), Kjellberg (2000 and 1998), St Vincent et al. (1989) and Engels et al. (1997). In part Raine's PER (2001) also fits these criteria. These question sets have seen some development to give a more detailed analysis; Pate (Kjellberg, 2000); DiNO (Johnsson et al., 2004); and a video analysis tool (Warming et al., 2004). The tools evaluate each observed transfer based on scores for: the preparation for the transfer, the performance of the transfer, and the result of the transfer. Most differ in the tasks that are to be observed, the physical movement criteria under pinning the model, and the success criteria.

Using a different assessment criterion Crumpton and Johnson (2005) highlighted the Benner Scale (Benner, 1984) as a method for measuring the skill level needed to comply with a transfer method. This method has been more clearly defined by the Finnish development of the SOPMAS tool (Tamminen-Peter, 2004) looking at the competency and learning levels required for task completion. The SOPMAS tool has been specifically developed for patient handling and includes reference to body movement and facilitation of the patient.

2a.7.4 Organisational/Management Structure Audit Tools

Health and safety management systems have been widely developed to assess compliance with the management regulations in the UK (MHASAW 1998). The Patient Handling Observation Question Set (PHOQS) tool, developed by Hignett and Crumpton (2005), and based on the RCN competencies (RCN, 2003), was the only audit tool found in the public domain specific to the organisational and management factors involved to managing the MSD risks of patient handling. The question set included compliance statements and cumulative scores for: policies and procedures, risk management, patient handling assessment, and organisational culture.

Other audit processes have been located within other patient handling guidance documents. The Derbyshire Inter-Agency Group Guidelines (Fray et al., 1999), the All Wales NHS Manual Handling Training Passport and Information Scheme (NHS Wales, 2003) and the Policy Mirror (Arjo Ab c), all identify organisational requirements that can be evaluated as a measure of performance.

2a.7.5 Financial Models

The need for an intervention to be economically viable is important in all areas of musculoskeletal injury prevention. Many studies consider the costing process and the comparison of cost versus benefit, but few have been specifically constructed as tools for patient handling interventions. A general outline was created by Siddarthan et al. (2005) using three scores for measuring the profitability based on US models of accounting:

- Payback Period. How long the project will take to reimburse the investment.
- Net Present Value (NPV). Comparing the initial investment over a period of time and including a discount measure to weaken the future returns as future returns are less valuable than present returns due to inflation.
- Internal Rate of Return (IRR). Defined as the time when the returns meet the present level of investment (NPV=0), calculated as a percentage of the life of the project.

The MARCH tool (Smedley et al., 2005) examined investment in patient handling controls via resource allocation and is similar to the PHOQS tool (section 2.4). Twelve questions were scored 0-2 against pre-set criteria and an overall score (x/24) was calculated.

CHAPTER 2

Background And Context

Chapter 2b
Systematic Literature Analysis

The literature review (Section 2a) has shown that the knowledge level, and level of application in MSD interventions is high but varied. Intervention strategies can approach organisational, physical or personal changes in the workplace, and the outcomes can be recorded via a wide range of risk exposure, physical observation or organisational measures. In order to relate the breadth of tools that have been noted as potential outcome measures for patient handling interventions a formal analysis of the literature has been completed. The aims of this analysis of the available literature were to:

1. Record the intervention strategies that are used in the literature
2. Record the beneficiaries from patient handling interventions
3. Record the outcomes and outcome measures used to evaluate patient handling interventions
4. Investigate what success measures are recorded in the published literature

2b.1 Methodology for Literature Analysis

The same sampling and inclusion/exclusion criteria defined by Hignett et al. (2003) were used in this project. The papers were (a) selected using inclusion/exclusion criteria based on quality and content; (b) appraised using a validated critical appraisal checklist to assess the quality of the research; and (c) assessed by multiple assessors to ensure inter-rater reliability (Downs and Black, 1998). The inclusion exclusion/criteria are defined below and a paper would be:

1. included if it described a named task, piece of equipment or intervention relating directly to patient handling;
2. included as a professional opinion if it met criterion 1 and had:
    a. included references,
    b. critically appraised the literature,
    c. provided a new interpretation of the literature;
3. excluded if it was related to epidemiology of musculoskeletal disorders(usually low back pain) and did not meet 1;

4. excluded if it was not the primary source of a study. The primary source was sought and included;
5. excluded if it was a legal case law report.

In comparison to previous academic systemmatic reviews (Van Poppel et al, 2004; Bos et al., 2006; Amick et al., 2006; and Martimo et al., 2008) this process is designed to be inclusive. The assessment criteria allow all types of study to be accepted. It is particularly relevant to discuss the format of what constitutes an intervention study as all valid information relating to the performance of patient handling tasks is to be accessed.

- Intervention studies- The classic before and after models of interventions are accepted with or without control groups e.g. RCT, Non-RCT and quasi experimental.
- Comparison studies- Data sets that identify and evaluate multiple methods, techniques or situational differences are accepted e.g. cohort studies, case control or cross sectional studies.
- Case studies- Case studies that evaluate a patient handling task or method with known tools, and compare them against accepted criteria are accepted e.g. descriptive cross sectional studies, case series studies.
- Qualitative evaluations of handling tasks and scenarios and the views and opinions of the patients and staff using them.

One significant difference for this evaluation was the secondary filtering of the studies to identify workplace intervention studies as a subset of the full collection. These studies have specific interest for PHAs as they measure real world changes in behaviour following the intervention. The selection of these papers was based on the following inclusion/exclusion criteria:

1. Include only papers that involve a workplace application of a patient handling intervention
2. Include studies based in the workplace that feature pre to post comparisons, treatment versus control comparisons, or multiple treatment comparisons.

3. Exclusion of professional opinion papers because they inherently will not identify an outcome measure, as no new data are collected and analysed.

2b.1.1 Data collection

The search strategy was based on Hignett et al. (2003 p9). The previous search was completed from 1960-2001 which was extended to December 2008. The original strategy had identified that the most successful sources were Medline, Embase and CINAHL databases. The Proquest access portal was used in addition to support these major sources. It was not possible to follow the complex search strategy reported in Appendix 1 (Hignett et al., 2003) due to time constraints. Every effort was taken to use the same language and search strategies to complete the extension of the search.

The inclusion criteria resulted in a total of 777 papers being identified for scoring, all from the original publication. The dates of included publications ranged from 1975-2008. The oldest, by Dehlin and Lindberg (1975), was from a Scandinavian journal and was one of only a few publications that predated 1980. The number of included papers increased towards the latter years of the sample. The final date of collection was Dec 2008, to allow for analysis.

The research aim of this systemmatic literature analysis was to explore the published material and report the evidence contained. The data extraction sheets devised for Hignett et al. (2003) were used for the new additions to the sample. Each selected paper was scored twice by independent assessors, and any descrepency was scored by a third independent assessor.

Table 2b.1 Summary of included studies

Description	N$^{o.}$
Papers included from Hignett et al 2003	207
Total papers found for scoring (2000-2008)	777
Papers excluded by scoring	656
Papers included (2000-2008)	121
Total papers included in analysis	328

2b.1.2 Scoring and recording systems

Appendix A contains the collected information for the 328 studies. For convenience in this section the papers will be referred to in Vancouver style relative to its inclusion number, a full list of the references and numbers is in Appendix A.

The following information was scored and recorded for each of the included papers:

- Beneficiary
- Number of outcomes included in the study
- Outcome recorded
- Outcome measure
- The details of the statistical analysis reported in the paper for each outcome/outcome measure
- The details of the intervention that was used in the study
- The QR score for academic quality. (Downs and Black, 1998)
- Practitioner rating score (Hignett et al., 2003)

As many different assessment criteria have been used for the measurement of outcomes, it is important at this stage to compare the methods. The question of cause and effect is raised about whether the measurement is describing the intervention or an outcome of the intervention. This may be seen in the equipment provision models. In order to clarify future discussions the following definitions will be used.

- **Beneficiary:** The intended target for the resultant improvement of an intervention or comparison trial.

- **Outcome:** An outcome is a quality or conceptual value that describes the intention of an intervention. It can be described by both the target of the improvement, the beneficiary, e.g. staff, patient, and the quality described, i.e. reduction of injuries or reduction of costs.

- **Outcome Measure** (OM): An outcome measure is a recorded quantity, quality or value (single or series) that can be identified to compare the before and after intervention state or compare different methods, e.g. equipment provided for a workplace

- **Outcome Measurement Tool** (OMT): An outcome measurement tool uses the outcome measure, or several outcome measures, for internal assessment against a known and traceable set of criteria. The OMT should give rational level data in its final score system. OMTs should measure outcomes and not describe interventions, but an OMT could describe the magnitude of an intervention when there is clearly stated evidence of the links between the intervention and the outcome improvement.

In addition to the Downs and Black (1998) scoring system for the academic quality of each paper, the following assessment tools were included in the academic analysis.

<u>Robson's Outcome Measure Score</u>

Based on the relative order of intervention to full effect in the end users, Robson et al. (2007) suggests that there is a ranked order of importance.

1. Outcomes that measure quantities and qualities of the intervention
    a. Provision of equipment, training numbers etc
2. Outcomes that represent a reduction in exposure to known risk factors
    a. Changes in force, postures and method, physiological performance
    b. Measures of skill, compliance, and competence
    c. Subjective measures in patients and staff
3. Outcomes that measure a real effect in the target population in a real situation
    a. Reduction in sickness absence, number of injuries, number of accidents in patients and staff

    b. Financial measures or losses

Ranked list of preferred outcomes

The EU study described in Chapter 3 created a ranked list of preferences for the outcomes from a practitioner view. Each included study was compared against the list below and the outcome was recorded against 1-13.

1. Safety Culture
2. MSD Measures
    1. LBP, pain
    2. Injuries
    3. Clearly defined discomfort (BPDS)
3. Competence and compliance
4. Absence or staff health
    1. Lost days
    2. Measures of ability to work WAI
    3. Adaptations in work or reduced capacity
5. Quality of care
6. Accident numbers
7. Psychological well being
8. Patient condition
9. Patient perception
10. MSD exposure measures
    1. Included subjective evaluation of effort
    2. Comfort, safety
    3. Risk perception
11. Patient injuries
12. Financial
13. Other, e.g.
    1. Time taken
    2. Equipment evaluation scores
    3. No of staff to complete task
    4. Training numbers

Hignett Convincing Scale (Hignett et al. 2003)

The Hignett Convincing Scale was developed to improve the evaluation of usefulness of the data included in the various papers include in Hignett et al. (2003). A five point scale is used to allow the assessor to indicate how important the findings of a study would be to their practice as a PHA. The tables included in Appendix A and B refer to this scale as the Practitioner Rating (PR) for convenience, and to match with previous analysis. The question set is included in the list below. The numerical score is in brackets:

How convinced are you, as a practitioner, by the relevant findings or recommendations from this paper?

- Very convinced, will definitely use this in my practice/teaching (5)
- Fairly convinced, might use this in my practice/teaching (4)
- Borderline, there might be something in this but I need to know more (3)
- Not convinced. But I don't think its complete rubbish (2)
- Complete rubbish (1)

Summary

The analysis details included in Appendix A identify which studies had the highest academic quality, the most valid outcome measure, and the highest level of support from the practitioners and experts in the field of patient handling.

The reasoning behind the different items is as follows:

- The QR gives an academic score for the quality of the study but gives no consideration for the quantity described.
- The Robson Value gives a rating of the power of the quantity described
- The Preferred Outcome Rating is the level of importance of the outcome from the EU study
- The Practitioner Rating (Hignett Convincing Scale), (Hignett et al., 2003) gives a level of judgement from multiple reviewers of the usefulness of the information included in the study

The comparison of the cumulative score will be worthy of investigation in the future.

Table 2b.2 Summary of analysis included

Description	Range	Source
Downs and Black QR	0-100%	Double scored using trained readers. Conflict goes to 3rd reader
Robson Outcome Value	1-3	MF scored outcomes based on included criteria
Preferred outcome rating	1-13	Based on focus group analysis (Chap 3)
Practitioner rating	1-5	Multiple scored using trained readers. Average score included

The methodology created a selection containing 328 studies for all included papers. The included studies reported 598 specific outcome measures to quantify the change in practice. Some studies (35) recorded no outcome measures, as they were descriptive or developmental studies that had no intervention or changes in the workplace. The highest number of outcomes recorded in any study was eight (Garg and Owen, 1994) who conducted a multi-factorial study in a laboratory and then as a field study with four outcomes for each.

A subset of the data was created which included only workplace interventions that recorded a change in observed practice (101). For these studies at least one outcome was required. The range 1-7 saw Nelson et al. (2006) with the highest number of outcomes. The average number of outcomes was higher for the intervention studies (2.33).

Table 2b.3 Overview of included studies

Included studies	No.	
Studies included in full review	328	
Number of outcomes recorded		598
Range		0-8
Average per study		1.9
Number of intervention studies included	101	
Number of outcomes recorded		235
Range		1-7
Average per study		2.33

The following sections explore the 328 studies for content and quality.

2b.2 Beneficiaries

Stakeholders involved in the intervention process were identified as beneficiaries. Their level in the organisation was shown to evaluate whether immediate benefits, such as changes in posture and force, were measured rather than longer term organisational or health related benefits. The benficiaries were categorised as follows:

1. patient
2. relative,
3. staff (caregiver),
4. organisation (at any level),
5. society,
6. equipment
7. task.

It was observed that some outcome tools could cross categories, so more than one beneficiary could be identified from the same intervention and measured by the same outcome measure. In this analysis it was decided not to allow the double scoring of an outcome. An example of this would be reduced musculoskeletal injury rates that could be scored as both an individual staff outcome and an organisational outcome.

Example 1. Reduced risks of injury, and recorded injury rates to the staff involved in the study were recorded as a staff outcome. Lost time caused by sickness absence, compensation claims or reduced legislative costs were recorded as organisational outcomes.

Example 2. The time taken to complete a task was categorised as a task outcome. But it could be argued that making a task quicker is an organisational benefit. In some physical studies the time taken to complete a task was actually a physical measure of the exposure to risk.

2b.2.1 Descriptions of the Beneficiary Categories

The following definitions have been developed for this analysis:

1. The **patient** category was for the measurement of a succesful patient handling task, or any form of physical or subjective feedback that was created by the patient being moved in the trial. This category included clinical outcomes. If the handling method improved the clinical outcome of the treatment programme it is suggested that would be a high level outcome. Though this was defined as a patient outcome there are likely to be longer term links to both organisational and society outcomes.
2. The **relative** category was added when one study identified an observer feedback measure for a specific manual handling application (Waldenstrom and Gotvall,1991). The outcomes in this paper were subjective feedback from observers, but there may be surveys and studies in the future that include family carers or advocates. In particular this could be expected in the field of social care and home care applications.
3. The **staff** category was expected to be the most frequent. In the main, patient handling interventions have focussed on preventing musculoskeletal injury in employed groups, reducing the musculoskeletal risks for the people completing the task.

4. **Organisation** outcomes were data measures specifically related to the wider collective, rather than the individual at risk from the task being completed. These included the costs of accidents or injuries, or legal actions against the hospital or body involved.
5. Many epidemiology studies relating to the area of back care identify higher level outcomes than the individual organisation involved. It was decided to classify **society** benefits as full profession data or measures relating to society as a whole eg health or social care costs.
6. The **equipment** category was used for interventions where the sole purpose was to design a product or device and the outcomes benefitted from that process.
7. The **task** category was identified as outcomes relating to the functional benefits e.g. the time taken to complete a task or a quality measure of the task. These again in the longer term could be organisational benefits as they could be measures of productivity.

Table 2b.4 Results of the beneficiary data.

Beneficiary	No.
Staff	439
Organisation	76
Patient	43
Task	28
Relative	1
Training	2
Equipment	9
	598

The beneficiaries were recorded for each defined outcome as per the criteria above. Table 2b.4 shows the number recorded in each category. As expected the prevention of injury to the staff is represented more frequently than all other categories combined. Organisational outcomes represented 12.7% of the total and were mostly comprised of sickness absence and financial outcomes. Patient outcomes in a care centred industry were recorded in only 7.2% of entries. Smaller representations were recorded for task performance, relatives, training and equipment outcomes. These smaller groups were likely to play little part in future analysis.

The beneficiary of any study is an important denominator as it defines the intention of the study, especially during the workplace intervention studies that contribute strongly to the body of PH evidence. The focus of PH on the reduction of health and safety effects of hazardous actions is evident in this information. The historical creation of new and improved practice to assist patients to move has been driven by the EC Manual Handling Directive (1990), and has created this focus in the research and practice. The number of patient directed outcomes is low and has in part hindered the development of best practice, as the priority of hospital management is in improvements in patient care and the cost efficiency of services. The relationships between the target of the intervention and the type of intervention will be described in the next section.

2b.3 Intervention strategies

A secondary analysis (Section 2b.1) seperated studies that describe a true intervention and not a descriptive or developmental study or a laboratory comparison.   101 intervention studies (Appendix B) were identified and are the basis for the analysis in this section.

Interventions have been the focus of much of the research and development of PH methods and risk management. It is the transfer of theoretical and laboratory based studies that should carry most influence in the practitioner field, as they define the actions that the PHA uses to change the behaviours and effects of PH in the organisation concerned. It is an assumption of all research based scientists that the publication of research and the findings of interventions studies have a carry over to real world application. It would be seen in the UK that more easily available general professional literature may have a stronger effect on current practice (e.g. Smith (ed) 2005). It was not possible due to the constraints of this study to question the level of use of research evidence in the health and social care across the EU.

Publications such as Nelson (ed) (2006), Smith (ed) (2005) and Charney and Hudson (ed)(2006) indicate that the more positive results of PH interventions are found with multi-factorial interventions. To review this statement and practice the body of literature was analysed to examine the range of intervention methods recorded. Previous systematic reviews (Hignett et al., 2003; Amick et al., 2006) also noted intervention strategies and evaluated the quality of each of the studies for comparison. Similar analysis is completed in this review. This allows the evaluation of how successful the study was at demonstrating the effects in a workplace intervention. Hignett (2003a) recorded 22 different intervention strategies in varying patterns. The extension of the sample has raised the number of intervention strategies to 25 and these are listed below:

1. Risk Assessment
2. Equipment provision and or purchase (including training on new equipment)
3. Equipment design/evaluation
4. Equipment maintenance
5. Education and training
6. Work environment redesign, space constraints addressed
7. Work organisation / practices changed
8. Feedback
9. Group problem solving / Team building
10. Review and change of policies and procedures/ safe systems of work
11. Discussion of goals with clients (patient)
12. Injury monitoring, treatment e.g. Return to work
13. Change / introduce patient risk assessment system
14. Introduction of hazard register
15. Audit of working practices/risk assessments
16. Review staffing levels, Increase staffing levels
17. Introduction of lifting team programme
18. Physical fitness training
19. Stress management
20. Medical examination and lifting skill assessment
21. Task analysis, job design analysis
22. Change in uniforms
23. Peer leader, BCA, Ergo coach, local risk assessment facilitator or patient handling supervisor
24. Management systems, change management, organisational structures
25. National regulation

Figure 2b.1 Intervention Strategies (Based on Hignett, 2003.)

Many intervention reviews consider intervention strategies to belong to a small number of categories. The most frequently seen categories consist of organisational, physical/engineering or personal change strategies. The list of 25 strategies identified in these PH intervention studies also aligns with these categories:

Category	Intervention strategy
Organisational	• Risk Assessment (1) • Work organisation / practices changed (7) • Feedback (8) • Group problem solving / Team building (9) • Review and change of policies and procedures/ safe systems of work (10) • Discussion of goals with clients (patient) (11) • Change / introduce patient risk assessment system (13) • Introduction of hazard register (14) • Audit of working practices/risk assessments (15) • Peer leader, BCA, Ergo coach, local risk assessment facilitator or patient handling supervisor (23) • Management systems, change management, organisational structures (24) • National regulation (25)
Physical or engineering	• Equipment provision and or purchase (including training on new equipment) (2) • Equipment design/evaluation (3) • Equipment maintenance (4) • Work environment redesign, space constraints addressed (6) • Review staffing levels, Increase staffing levels (16) • Introduction of lifting team programme (17) • Task analysis, job design analysis (21) • Change in uniforms (22)
Personal	• Education and training (5) • Injury monitoring, treatment e.g. Return to work (12) • Physical fitness training (18) • Stress management(19) • Medical examination and lifting skill assessment (20)

Figure 2b.2 Categories of interventions

Most strategies are considered to be at the organisational level and many are associated with the process of risk assessment and the delivery of appropriate PH solutions. National guidance (25) appeared in two large studies funded and supported by a government body (Australia [303], Netherlands [241]). The structures and authors of other studies suggested that government guidance was being evaluated by the study, but the National Guidance was not described in the details (US [296], Germany [293], Canada [254, 263, 265]).

Equipment and engineering solutions also appeared to be well recorded in the range of included intervention studies. The range of physical interventions included the provision and upkeep of equipment in the workplace, even though there is still a need for a standard approach for how much and which type of equipment is the essential provision in any given area. Physical space was evaluated in six studies but only as a part of more complex intervention strategies [30, 82, 94, 123, 172, 176]. Physical solutions in some studies described the provision of suitable staff numbers and skills for the completion of PH activities. The provision of suitable numbers for care are constantly in debate in the EU as the financial constraints of national health services tighten. The numbers for PH are primarily based upon the knowledge that has been developed from PH practice and research that shows for certain patient dependencies and the use of certain equipment there is a minimum acceptable number over a 24 hour period. One specific solution that is reported in a number of studies is the provision of lifting teams. Only studies from the US cover this approach [6, 70, 87, 198, 199, 324] and most show very positive effects on costs and MSD.

Change stategies on a personal level comprise two approaches, firstly the very common approach of training (see table 2b.5) and the less frequently included occupational health services (12, 18, 19, 20). There are very few interventions published that only treat or manage injuries from PH, as most services offer management for all MSD.

This overview of intervention types describes an ‘ideal’ PH management system where:

- Organisational inputs include a suitable risk assessment system, policies and procedures to create positive safety culture, a participatory approach to implementation of solutions, and suitable personnel to implement and control the PH risks
- Engineering inputs should provide both equipment and environmental solutions for space and movement of patients, and suitable numbers of staff must be available
- Personal behaviours should be assisted by training and any injury or health deficit should be assessed and treated by a suitable occupational health system

The evidence from the different intervention situations is now covered in more detail.

2b.3.1 Single intervention studies

41/101 studies included a single intervention strategy with the other studies having various levels of complexity, Engkvist 2006 [82] had the most complex intervention with nine individual methods described. The studies that included only one strategy are tabulated below in Table 2b.5.

Table 2b.5 Single strategy intervention studies

Intervention	Included studies	Range	Mean
2. Equipment provision and or purchase (including training on new equipment) (9)	5, 130, 212, 217, 228, 240, 267, 281, 289	11-83	44.3
5. Education and training (25)	4, 9, 14, 43, 48, 55, 56, 57, 63, 64, 66, 99, 116, 117, 134, 136, 137, 138, 162, 165, 219, 247, 255, 294, 328	31-86	55.8
10. Review and change of policies and procedures/ safe systems of work (2)	251, 259	30-67	48.5
17. Introduction of lifting team programme (5)	6, 70, 87, 198, 199	35-72	54.8
	41	**11-86**	**52.8**

The breakdown of the single strategy interventions show only four types used. The most frequent was education and training, which also had the highest average academic score (QR=55.8). This academic score strengthens the evidence that training interventions in isolation are of little benefit (Hignett et al., 2003, Amick et al., 2006, Haslam et al., 2007) as the quality of the studies is comparable with other intervention types. Similarly high academic scores were found in five studies that introduced lifting teams. The provision of lifting teams has been recognised as successful, but culturally the practice remains confined to small sections of the PH population. In the EU, Spain and France have some evidence of lift teams, but the practice is rare in other countries. The extent to which PHAs adopt research evidence is questionable from this evidence, as training shows little benefit from good quality studies, and lift teams shows good benefits in costs and MSD from high quality studies.

In addition the equipment provision and organisational strategies had reduced academic quality scores, but are also seen as essential parts of the risk management process by the PHA.

2b.3.2 Multiple intervention studies

60 studies had more complex intervention strategies. These studies were analysed to create groups of 2,3 and 4+ intervention strategies to investigate any patterns in the design of interventions.

Table 2b.6 Multi-faceted design of interventions in PH studies

No	2 Interventions	QR	No	3 Interventions	QR	No	4+ Interventions	QR
6	5, 22	37	19	5, 8, 10	44	1	5, 10, 13, 15, 20	37
13	2, 5	33	83	2, 5, 10	20	20	1, 2, 5, 10, 13	31
40	5, 18	31	86	1, 2, 5	63	30	1, 2, 6, 11, 13, 16	50
42	2, 5	81	151	1, 5, 10	50	52	1, 5, 12, 13, 14	52
50	2, 5	50	172	2, 6, 7	65	81	2, 5, 18, 19	76
54	2, 5	100	176	2, 6, 7	27	82	1, 3, 4, 6, 7, 9, 10	58
62	5, 10	29.5	180	5, 18, 19	58	90	2, 5, 10, 13, 22	35
69	5, 18	68	254	2, 5, 10	67	94	3, 6, 10, 13	50
78	2, 5	54	263	2, 5, 10	91	123	1, 3, 5, 6, 7, 9, 10	81
79	2, 13	44	265	2, 5, 10	59	140	1, 2, 3, 7, 9, 10, 11	58
163	5,8	56	280	2, 5, 13	41	149	1, 2, 4, 5	65
207	5, 8	39	284	5, 15, 23	22	153	1, 2, 5, 8	63
213	1, 2	63	324	2, 5, 17	37	179	1, 2, 3, 5	28
226	2, 3	56	(13)			187	1, 5, 8, 10, 13	22
241	10, 25	74				188	1, 2, 5, 7	63
245	10, 12	42				208	Hosp,2,5,9,12,18,20,21 NH, 1,3,5,13	44
259	2, 7	52				210	1, 2, 10, 13, 23	70
308	5, 8	26				211	2, 7, 10, 23	70
311	5, 18	89				225	1, 2, 7, 17	44
(19)						232	1, 5, 10, 12, 15, 24	30
						246	1, 2, 5, 10, 23	44
						248	2, 5, 10, 12, 24	52
						256	1,2,5,9,10,13,15,23,24	73
						268	1, 4, 5, 12, 24	44
						293	2, 5, 7, 8, 23	48
						296	2, 4, 5, 10, 12	59
						299	1, 2, 5, 8, 10, 15	46
						303	2, 10, 23, 24, 25	33
						(28)		

The 2 and 3 intervention groups were dominated by interventions 2,5,8. The combinations 2, 5 (5) and 5, 8 (3) were most common in the 2 intervention group, and only studies [241] and [245] contained none of those types. In the 3 intervention group, types 2,5, or 8 appeared in every study included. The combination of 2,5 appeared in seven studies. The most frequent combination was 2, 5, 10 which appeared four times, and was represented by a series of similar studies from British Columbia [254, 263, 265]. Interestingly the academic quality of the group of papers varied from 67-91, depending upon the theme of the study.

There was a varied list of combinations seen in the more complex intervention strategies (4+). But as in the simpler studies, certain intervention styles appeared more frequntly than others. The role of risk assessment (1) in organisations was seen in 19/28 studies, The equipment interventions that included either equipment provision or development/evaluation occured in 20 and six studies respectively giving 23 studies in all. Education and training interventions (5) were represented in 21 of the included studies and organisational changes (10) such as policy, procedures or management strucures were recorded in 15 studies. In the same way as 2, 5 and 8 commanded the small selection studies, all studies in this complex section contained at least one of the group 1, 2 or 3, 5 or 10.

Table 2b.7 Academic quality for the multifaceted studies

Number	Range	Average QR Score
2 Interventions	26-100	53.9
3 Interventions	20-91	49.5
4+ Interventions	22-81	50.9

The academic score for each of the sub-groups showed little difference across any numbers (Table 2b.7).

Table 2b.8 Higher quality MSD and cost intervention studies

Criteria	MSD measures for staff		Staff absence as organisational measure	Financial measures from staff absence/claims
Outcome Included	52		35	18
QR of 50% and over	30		19	6
Statistical significance reported	12		5	2
Studies meeting all criteria ([No] year)	[66] 1997 [69] 1993 [163] 1987 [210] 2006 [211] 2003 [213] 2005	[251] 2003 [254] 2001 [256] 2006 [263] 2005 [265] 2005 [311] 2008	[82] 1999 [163] 1987 [213] 2005 [293] 2004 x2	[251] 2003 [293] 2004

The key outcomes from PH interventions studies have been those relating to musculoskeletal disorders and the resulting losses of staff time and costs. Table 2b.8 shows the studies that were included for records of staff MSDs, organisational measures for sickness absence, and the financial costs to the organisation. The intervention sub-group included in this part of the study comprised 101 studies and recorded 234 outcomes. 105 (45%) of those outcomes were related to these three types. The quality of many of the studies included is weak, so studies with a QR of 50% or over were filtered. In addition the method for showing a successful intervention in all academic studies is to report statistical significance. Those reporting significance were also filtered. No quality judgements were placed over the reporting of statistical analysis as in Martimo et al. (2008). Some studies reported no significance but many studies reported no statistical analysis.

This filter identified 19 outcomes from the 101 studies. Four studies appeared more than once in the filtered list [163, 213, 251, 293], Collins et al. (2004) [293] recorded three high level outcome measures in a powerful study that investigated implementation of PH practices in nursing homes in the US. Twelve measures were linked to the physical measures of sickness absence. Most measured injury rates but occasionally pain, discomfort or function were measured. Organisational measures investigated sickness absence primarily, but the financial evaluations showed differences in the level of analysis. Some simply recorded the financial value of days lost, where other studies entered the process of cost benefit analysis. The larger numbers of studies recording changes in MSD signs,symptoms and recorded injuries are not reproduced in the data for sickness absence and financial gain. This interaction between MSD and losses to the organisation is best explained with the two following studies:

- Passfield et al. (2003) [251] showed statistical reductions for MSD reporting and the costs of absence for an organisational intervention
- Yassi et al., (2001) [254] recorded statistical reduction in pain and discomfort, but failed to show significant reductions in costs following a mixed intervention using equipment, training and organisational changes.

This relationship between subjective and workplace based instant reporting of pain, discomfort and injury has frequently shown more differences than the long term and more medically serious injuries that require absence from work. Further analysis on this small group of studies may be of interest to PHA.

In summary, the analysis of the intervention types included in this sub-group showed that a wide variety of intervention types were recorded. The academic level varied across the different types of interventions and outcomes. There was only a small number of high quality studies that could be further analysed to identify specific success in reducing the musculoskeletal effects of PH injuries. 14 out of the 19 included higher quality studies were published from 2001 onwards, which indicates that the levels of intervention studies are improving, and a growing body of evidence may be indicated.

2b.4 Outcomes and outcome measures

The 328 studies were analysed for the outcomes and outcome measures that were used to compare the different conditions reported. The included studies created 598 outcomes and outcome measures, and 39 studies recorded no specific outcomes or measures. Studies that had no outcomes recorded were primarily professional opinion papers, case studies that reported a single intervention without measures, or papers that investigated a PH scenario and made clear recommendations for the future.

Table 2b.9 Outcomes Per Study

Outcomes	No.
0	39
1	128
2	76
3	45
4	26
5	11
6	1
7	1
8	1
No studies	**328**

Table 2b.9 shows the tendency for many of the studies to have only a small range of outcomes in each study. 38.7% (127) of the studies recorded only a single outcome measure in this sample, while 74.2% of the studies had either 0,1 or 2 outcomes, which shows only 24% of the sample could have delivered a wide range of data sources to create a robust argument for the intervention using the triangulation of data approach.

Where some papers gave a single perspective some chose to give width in the measures used. Engel's paper (1998) [65] was one that specifically identified a range of outcome measures to enable triangulation of the data. Staff postures were evaluated using OWAS scores, a level of compliance with taught methods was evaluated with a checklist and the subjective opinions of the staff were recorded using a form of Borg's RPE scale (Borg, 1998). Triangulation of data is an important consideration when investigating the level of detail and the strength of various studies. In addition there were a number of papers that used data from at least three different sources to give validity to the outcomes and their future recommendations (e.g. [31, 55, 73, 86, 241, 254, 260, 293] etc.).

The use of multiple outcomes has a bearing on how influential the data from the study could be. During this analysis a scoring system to allow comparison between studies has been under consideration. The QR score values the academic quality of the paper and as a direct comparison is used to compare the value of each study. An addition logic will create stronger contributions for studies with high numbers of outcomes measured e.g. Nelson et al. (2006) [210], with seven outcomes and a number of data sources with a QR of 70%, against Engkvist et al. (2001) [54] who conducted a detailed analysis on a single outcome and gained a QR of 100%. Using the Hignett Convincing Scale (Hignett et al., 2003) in addition to the QR score could add to the quantification of the importance of each study.

2b.4.1 Recorded outcomes

The outcomes for each study were recorded and are summarised in Table 2b.10. The outcomes are presented grouped by their intended beneficiary. The groupings show that staff outcomes are the focus of more studies than other groups. In particular, physical workload, perceptions of work and number of staff injuries were the highest recorded.

The range of outcomes intended by the included studies is wide. All the beneficiaries described in the previous section were represented, but equipment studies and relative perception were infrequent. The largest section reported was the intended changes for staff. Measures for the physical workload, the perception of the staff and records of injuries made up the largest contribution. Other outcomes in this section related to the competence measures of the staff, twenty five competence outcomes were recorded that measured performance of PH tasks and activities, three studies measured competence from an organisational perspective and were representations of safety culture. Measures of the staff knowledge and skill were assessments of information retention and learning but not practical assessment of movement skills, and could be added to the competence scores.

Table 2b.10 Recorded outcomes in all included studies

Beneficiary	Outcome	No
Staff (429)	Staff competence	25
	Staff competence (Org)	3
	Staff injuries	81
	Staff knowledge skill	12
	Staff perception	127
	Staff use of equipment	14
	Physical workload	153
	Psychological well-being	5
	Modified Work	2
	Number of staff	5
	Carer perception	2
Patient (44)	Patient perception	38
	Patient result	6
Organisation (83)	Financial	28
	Incident/Accident	8
	Quality of care	1
	Risk assessment	6
	Staff absence	32
	Training numbers	7
	Audit performance	1
Task (32)	PH techniques	10
	Time for task	22
Equipment	Equipment	8
Relative	Relative perception	2
	Total	598

Perception outcomes appear strongly in both staff and patient sections. PH tasks involve the actions, attitudes and the physical effects on the individuals concerned. In many situations where technology would interfere with the completion of the patient transfers, a subjective assessment is the viable option for data collection. The perception of the use of equipment was recorded under several outcomes because of the different intentions. Some studies that were designed to formally evaluate equipment were categorised under equipment as their target was clear. Other studies that were designed more for reduction of MSD interventions also recorded as part of the study the participants responses to using the equipment, and in some situations the use of equipment in-terms of numbers was also recorded as an effect of the changed work routines.

Patient outcomes were recorded in 43 studies but only six studies recorded anything other than perception of the handling tasks or equipment. These six studies all measured a different characteristic: patient position post transfer [34], development of functional skills [51], infection control [118], resident agitation [188], obstetric [108] and clinical outcomes [258] were all recorded once. Clinical or functional outcomes are powerful in a health care forum, but the lack of these studies shows the low position of patient handling skills and structures in the clinical environment. Many PHA anecdotally suggest that high levels of skill and control in PH activities create a positive health environment and reduce length of stay and improve function, patient satisfaction, improve independence and patient control. But there is little published evidence to support these suggestions.

The task outcomes were less frequent (32), and 22 studies measured the time taken to complete tasks. Further analysis showed that most of these studies that used equipment interventions reported increased time for safe practice. The other outcome recorded with task as a benefit related to changes or improvements in PH technique. Most of the day-to-day interventions of PHA are aimed at developing the most suitable PH techniques, and some of the papers included described that process. There is a clear link between these PH technique papers and the staff competence, staff knowledge and skill outcomes. It may be proven in future years that these PH technique studies disappear as the consensus creates a battery of acceptable PH techniques, and the controversial and hazardous methods are removed from practice. The outcomes will then need to focus on competence and compliance.

Organisational outcomes concentrated on the sickness absence and financial losses from the same. Other organisational outcomes recorded changes or improvements to the management systems. The benefits of risk assessment, training and audit were all recorded in some studies. ‘Quality of care’ drives many healthcare management systems, but could only be identified in a single study [242], again pointing to the lack of perspective from the PHA, and the context of PH in the delivery of care tasks.

The intended outcomes recorded for the studies included show a focus on staff and organisational measures. The next section records the detail of the outcome measures used against all of the recorded outcomes. Table 2b.11 identifies all the individual papers, using each outcome measure for each category.

2b.4.2 Recorded outcome measures

Table 2b.11 records all 328 studies against their outcome and outcome measures. The recorded content of patient handling studies is widely variable. Studies covered many different formats and deliver improvements for different beneficiaries, and used a wide range of outcome measures to prove the differences between conditions. The complexity of the outcome measures showed variation, depending on the area of study and the level of investigation. It was decided that in order to analyse the outcomes, fine detail studies that recorded multiple scores for identical qualities would be scored singly. A example of this was regularly seen in the complex biomechanical studies. A group of subjects would be measured for three dimensional models, with many different physical quantities being included in the analysis (e.g. Schibye and Skotte, 2000; Marras et al, 1999; and Garg et al, 1992). This was recorded as one outcome as the benefit to the staff was recognised as that of reduced biomechanical risk. In a similar way a study that asked a complex battery of questions to ascertain the subjective appraisal of a task also scored a single outcome. Examples of these would be: the use of interviews for staff feedback (Griffiths and McArthur, 1999), questionnaires for staff perceptions (Scott, 1995 and Gingher et al., 1996), observational checklists for environments (Bertolazzi and Saia, 1999), managers knowledge and attitudes (McGuire et al., 1997). In order to avoid inconsistency subjective appraisals that were difficult to separate were also scored as a single outcome measure. An example of this was the views of a patient on security and comfort (Conneely, 1992), where clarity in the question sets did allow for patient comfort and patient security to be scored separately in many studies (Zhuang et al., 2000, and Garg and Owen, 1994).

The improvement of working conditions for the staff comprised the largest number of records (430). Three outcome groups recorded large numbers of measures, staff injuries, staff perception and physical workload. The recording of staff injuries was a common outcome measure, 52 studies recorded the number of injuries resulting in MSD problems. A further 22 studies recorded pain or discomfort in the workforce. The most common data collection tool reported was the Nordic pain questionnaire (Kuorinka et al., 1987) (e.g. [308]), but many studies used simple workplace reporting systems as evidence. The relevance of the two measures is key, as there is a noteable difference between official reporting systems and the compilation of sickness absence due to work related injuries and the reporting of pain and discomfort in operators still at work. Very few studies used other specific occupational health measures e.g. Workability Index [140] (Toumi et al., 1998) or SF36 (Ware et al., 1993) [226]. There was a noted lack of occupational health interventions and measures across the sample as a whole. MS injuries are reported in many studies but no studies has separated PH injuries or effects as a specific group for investigation.

Given the large number of perception studies, the range of methods for data collection were not so diverse and the use of qualitative methodologies was seldom seen. In most of the studies there was a tendency to quantify the recording of emotion, feeling, etc., with rating scales or ranking assessments, and Likert scales were predominant. 39 studies measured perceived exertion. Significant numbers of these used the RPE (Borg, 1998) and its well used derivitives. A further 31 studies recorded the staff perception of the risks of patient handling tasks and the risks of nursing care in general. Questionnaire studies comprised the largest number of data collection methods in this section. More detailed qualitative studies investigated attitudes [20,43,149,155] or used formal or informal interviews. One study also used verbal protocol analysis [230] to investigate decision making.

The recording of physical workload measures incorporated many outcome measures that have been developed for wider applications than just PH studies. The four most commonly recorded outcome measures in this section were posture analysis (28), forces applied (25), measures of muscle activity with electromyography (EMG) (18) and biomechanical measures (51).

- Postural analysis studies recorded OWAS (Karhu et al., 1977) [234] and REBA [230, 236, 289] (Hignett and MacAtamney, 2000) as preferred choices, but a small number of studies recorded higher level of detail using electronic goniometry or reported actual joint positions and ranges of movement. The contrast in these studies is the inclusion of risk level in the developed tools against implied risk of the studies reporting actual measures.
- Force has long been recognised as a risk identifier in load movement studies and was recorded in 25 studies. The measurement of force indicated a laboratory type study, as the inclusion of the measurement device is contraindicated in usual care activities. Any workplace based studies were required to report RPE (above) as a subjective appraisal. It was surprising that more studies had not measured load over time, which was only recorded for three studies [18, 39, 42]. One high quality study [42] recorded both peak force and cumulative force over time.
- EMG was recorded in 18 studies as a measure of muscle activity, and all required attachments to the participants and laboratory studies were recorded. Most of these studies used EMG as a comparison against other physical measures posture, force, etc., and many reported that EMG is not significantly affected over long shift patterns, due to the short duration of PH tasks.
- Biomechanical measures (51) were also well represented, and required either video anlysis or highly technical data collection systems (e.g. Lumbar Motion Monitor [47, 128, 129, 231, 253], etc.). Many studies reported biomechanical load on the individual (e.g. [25, 33, 42, 53, 237, 252, 257, 264, 266, 310] etc) either as applied force or as low back load. An interesting addition to this section is that the inclusion of recommendations for safe limits allows for the definition of safe against unsafe, which is rarely seen in other forms of study (E.g. NIOSH Recommended Weight Limit (RWL) values [31, 43]).

Table 2b.11 Outcome measures recorded in literature analysis

Beneficiary	Outcome	Outcome Measure	Included Studies
Staff (430)	Staff competence	Observed checklist for performance	19, 32, 40, 55, 56, 63, 214, 219, 227, 247, 304, 307
		Compliance with taught methods	42, 162, 165, 180, 207, 211, 218, 255, 293, 324
		Hazardous lifts observed/Errors	100, 328
		Self reported compliance	210, 222
	Staff competence (Org)	Safety culture measure	230
		Compliance with policy mirror	241
		Organisational support	325
	Staff injuries	Staff injury numbers	6, 11, 17, 21, 43, 52, 55, 65, 68, 70, 71, 73, 78, 79, 81, 86, 98, 103, 116, 149, 163, 174, 179, 190, 198, 199, 208, 210, 211, 212, 213, 217, 223, 224, 225, 228, 229, 239, 246, 248, 251, 254, 256, 260, 263, 268, 276, 280, 289, 308, 311, 324
		Pain reporting inc LBP	9, 66, 69, 103, 132, 144, 148, 165, 174, 175, 180, 196, 201, 226, 241, 245, 254, 256, 293, 294, 301, 311
		Self reported injuries	48, 191
		Health surveillance	50
		MSD risk factors	82
		Compliance with WRBME	134
		Workability Index	140
		Low back disorder model	152
	Staff knowledge skill	Staff knowledge	4, 20, 68, 96, 116, 222, 230, 277, 309
		Self reported knowledge skill	55
		Perception of learning	304
	Staff perception	Effect on staff / workload	2, 141, 142, 165, 174, 254, 269, 278, 293, 295, 327
		Perception of risks	3, 14, 30(2), 67, 73, 76, 92, 99, 103, 116, 117, 123, 125, 126, 145, 146, 159, 167, 169, 188, 191, 194, 201, 202, 224, 240, 265, 271, 306, 321
		Rating of perceived exertion (RPE)	5, 19, 39, 49, 57, 72, 73, 86, 88, 93, 105, 107, 109, 113, 114, 132, 172, 181, 183, 184,185, 214, 229, 233, 236, 237, 244, 252, 257, 274, 275, 280(2), 288, 291, 298, 300, 323
		Comfort and or safety	5, 74, 138, 161, 240, 250, 255, 256, 265, 271, 292
		Use of hoists/equipment	10(2), 122, 157, 158, 159(2), 168, 209, 271
		Informal/Formal interview	12, 32, 37, 56
		Staff/managers attitude survey	20, 43, 149, 155

		Interviews to create hierarchical tree	29
		Rating of preference of methods	46, 73, 74, 93, 143, 144, 236
		Ranking of tasks	144, 237
		Staff assessment of programme	81, 207, 210(2), 217, 224, 246, 277
	Staff use of equipment	Staff evaluation of use of equipment	7, 17, 36, 38, 45, 86, 168, 209, 233, 236, 256, 295, 304
	Physical workload	Posture analysis	15, 19, 57, 66, 91, 96, 108, 114, 119, 137, 140, 160, 161, 167, 171, 172, 177, 181, 189, 192, 194, 230, 234, 236, 253, 266, 289, 292
		Forces applied	15, 16, 28, 33, 42, 57, 97, 139, 141, 160, 172(2), 176, 189, 194, 195, 203, 218, 250, 252, 270, 286, 287, 288, 297
		Cumulative load per worker	18, 39, 42
		Muscle activity, EMG	23, 109, 114, 132, 186, 214, 216, 218, 231, 250, 253, 262, 266, 274, 275, 291, 295, 323
		Heart rate	140, 172, 174, 295
		Intra-abdominal pressure	102, 136, 138(2)
		Biomechanical model (inc NIOSH)	25, 31, 46(2), 47(2), 53, 73, 85, 86, 88, 89, 101, 105, 106, 110, 113, 128, 129, 133, 143, 144, 152, 161, 166, 170, 171, 178, 181, 182, 183, 184, 185, 186, 193, 216, 221, 231, 237, 244, 249, 250, 252, 257, 261, 264, 266, 269, 302, 308, 310
		Back fatigue	39
		Risk exposure measure/risk factors	50, 54, 80, 104, 121, 135, 188, 226, 239, 241, 262
		MAPO evaluation	60
		Number of tasks	130, 175, 203(2), 254, 289
		Serum concentrations	312
	Psychological well-being	Staff job satisfaction	4, 210, 324
		Psycho-social stressors	82, 211, 308
	Modified Work	Modified work	1(2)
	Number of staff	Number of staff required	5, 96, 203
		Staff patient ratios	260(2)
	Carer perception	Carer perception	151, 282
Patient (43)	Patient perception	Staff perception of patient effect	2
		Patient comfort	5, 49, 66, 72, 73, 74, 90, 107, 143, 159, 183, 184, 185, 227, 255, 280, 292, 298
		Questionnaire for patient control	23
		Patient security	49, 72, 73, 107, 159, 183, 184, 185, 217, 271, 280
		Occupier appraisal	141
		Patient attitude to equipment	156, 158, 168, 200

		Patient satisfaction Patient rating/ranking of preference	214, 233, 324 237, 289
	Patient result	Sitting position Time to develop bridging Obstetric outcomes Transfer micro-organisms Resident agitation Clinical benefit	34 51 108 118 188 258
Organisation (83)	Financial	Financial values Financial evaluation Compensation costs	6, 179, 225, 232, 240, 248, 251, 263, 265, 267, 268, 281, 296, 313, 324 27, 31, 198, 199, 210, 285, 296, 303 82, 87, 296, 299, 303
	Incident/Accident	Staff incidents/accidents Factors in accidents	26, 75, 153(2), 188, 235, 284 169
	Quality of care	Quality of care tool	242
	Risk assessment	Observational checklist Number assessments completed Documentation review Accuracy of risk assessments Risk assessment process	18 20 56 116 117, 305
	Staff absence	Lost time / Sickness absence Self reported absence (Ques/Interv)	1(2), 11, 13, 50, 66, 75, 82, 83, 87, 90, 145, 149, 163, 179, 187, 210, 212, 213, 217, 225, 241, 243, 245, 248, 256, 259, 260(2), 268, 276, 293 48
	Training numbers	Training attendance numbers Training evaluation Efficiency of training	20, 180, 305, 309 219 325
	Audit performance	Compliance with audit	79
Task (31)	PH technique	Positioning after hip surgery Consultation with surgeons Changes in work practice Self reported changes in practice Model for handling capacity Importance of task	8 24 55, 62, 94, 203, 238 64 67 203
	Time for task	Speed of transfer (Time taken)	2, 5, 31, 73(2), 74, 86, 93, 113, 114, 143, 176, 192, 205(2), 230, 233, 236, 237, 257, 271, 298

Equipment	Equipment	Criteria scores for equipment Physical evaluation Accessibility of equipment Equipment provided	45, 148, 158, 173, 205 168, 205 229 305
Relative	Relative perception	Mother/Father perception	108

Organisational outcome measures were concentrated on lost time injuries, or measures of lost time (32) for an organisation and the resulting financial evaluation. Sickness absence was usually reported by simple number scores, but some studies particularly US based, used standardised measures per numbers of the workforce. The recording of financial effects was seen to include three types of data:

- Some studies recorded simple data showing the costs of injuries for a given set of circumstances (15)
- Where possible some studies also reported compensation costs (5) and represented government system information, usually from the US, Canada and Australia.
- Eight studies completed a form of cost benefit analysis to compare costs against losses from the interventions

From the patient, task, equipment and relative outcome groups, a further three groups recorded significant numbers of entries, patient comfort (18) and patient security (11) accounted for most of the patient data input into the analysis, and the time taken to complete the task was reported in 22 studies though many reported increased time when using equipment.

If the inclusion of high numbers of studies using particular outcomes indicates the level of importance of the outcome measures to the PHA population, then any complex measurement tool designed to measure the success of PH interventions could include the topics in Table 2b.12.

Table 2b.12 Most frequent outcome measures

Outcome	Outcome Measure	Outcome	Outcome Measure
Staff injuries	Staff injury numbers Pain reporting	Task	Speed of task
Staff perception	Perception of risks Rating of perceived exertion	Patient	Patient comfort
Physical workload	Posture analysis Forces applied Muscle activity (EMG) Biomechanical models	Organisation	Lost time figures/Sickness absence Financial values

These most recorded 12 outcome measures create a very physical review of PH tasks in healthcare workplaces, and perhaps give an indication of a historical review of the research process surrounding this area. It may be necessary to consider if these outcomes and outcome measures are still the priority of the PHA population in the present.

2b.5 Measures of success

The literature analysis above (2b.3 and 2b.4) has shown the range of outcomes that have been the intentions of the different included studies. In a developing area of clinical practice an important criterion is to identify the level of success, or the level of acceptable performance, in the chosen field. The academic nature of the publications sought in this analysis indicates that the chosen level of success is the recording of statistical difference between the conditions. The power of statistical significance between conditions is most effective when recorded in the workplace applied intervention studies (Appendix 2).

The analysis of intervention trials included 101 studies. The level of statistical analysis was recorded for each study. Success for the intervention was described as achieving statistical significance. No higher analysis was made to examine the sample size, test validity, etc. Table 2b.13 states the number of studies that had different levels of statistical analysis. Approximately one third of the outcome measures (89/235) included in this filtered sample showed positive significance in the data, while 25 showed no significance from the testing, and 51% (121/235) reported no statistical testing in the study.

Table 2b.13 Statistical testing in the intervention studies

Description	Numbers		
Outcome measures show: Statistical significance No significance Not statistically tested	 89 25 121 235		
Included studies	No.	Outcome Measure	QR
Staff Outcomes for MSD	66	Back pain	70
	69	Back pain	68
	163	Injuries	56
	165	Back pain	41
	210	Injury rate	70
	211	Low back pain	70
	213	MSD rate	63
	251	Injury rate	67
	254	Pain\discomfort	67
	256	Injury rate	73
	263	MS injury rate	91
	265	Comfort	59
	311	Severity of back pain	89
Organisational Outcomes for MSD	82	Lost time injuries	58
	82	Compensation costs	58
	212	Lost time	26
	213	Days Lost	63
	251	Costs	67
	256	Time lost	73
	263	Costs	91
	265	Injury costs	59
	296	Workers compensation costs	59
	296	Lost work days	59

The most frequently used measure for success is the reduction of MSD in the sample population. Table 2b.13 reports the studies that included statistical significance for staff related MSD data, and organisational related MSD sickness absence data, and the costs of such but does not include studies that completed a cost benefit analysis. Thirteen studies showed significant differences in the measures of staff related MSD rate or MSD related evidence, while [265] reported comfort, [254] reported pain/discomfort and [165,163 and 66] all reported back pain records. The academic scores of this group were high. Only one of the sample showed less than 50 % as a QR score, and the average was 68% (range 41%-91%).

The organisational effects of MSD were reported as sickness absence data, costs of absence, or compensation costs where government data allowed. Again in this small sample the academic score was a high average 61.3% (range 26%-91%) with only one scoring below 50%[212]. This analysis shows that there are some PH intervention studies that show statistically significant positive outcomes against a number of key outcome measures (16). The QR scores of those included studies showed a good level of academic quality for those that recorded staff MSD and the organisational effects of MSD. However, even with this very targeted set of papers there is little in common between the studies in terms of intervention, outcome or outcome measures.

In comparison to the information found in this analysis, and in addition to epidemiological evidence, there has been a growing body of evidence relating to the development of PH intervention strategies for the reduction of the risks of exposure to patient handling tasks. Recently, several reviews of interventions have been published identifying similar but not identical findings from the literature. The range of review papers in general shows a poor success rate for a range of manual handling interventions across a number of areas of application. The findings and methods for these reviews have been compared below and presented in date order. Table 2b.14 shows the methodological processes for each review. PH training has been a focus for many organisations as a PH intervention strategy, even though the potential success has long been questioned. All the studies accepted training interventions, but Bos et al. (2006), Dawson et al. (2007), and Martimo et al. (2008) specifically included those interventions and excluded some other interventions. Haslam et al. (2007) also conducted a large systematic review of manual handling training but included all occupational groups and training applications, so was not included in this analysis.

2b.5.1 Comparison of PH literature reviews

The five reviews of patient handling literature reviews included in Table 2b.14 have many similarities. The strength in academic studies has always been identified with the control of variables and creating a clear link between cause and effect. This directs all academic reviews to be exclusive of many data sets that do not fall into high academic quality e.g. RCT, CCT. This links very specifically with the guidance produced by NIOSH, which shows how to create an intervention study, collect data and create sound scientific proof that the intervention had been effective (NIOSH, 2001). Hignett et al. (2003) showed many patient handling studies to be outside the RCT, or high academic structures, and that the quality of those studies can also be evaluated to aid comparison.

Secondly the perceived holy grail of occupational health and safety interventions is their effect upon rates of musculoskeletal injury, LBP and sickness absence or disability. None of the exclusive reviews (Bos et al., 2006; Dawson et al., 2007; Amick et al., 2006; Martimo et al., 2008) found any evidence of impact upon patient outcomes or clinical benefits. Fray and Hignett (2007a) in a study of patient handling interventions reported that many patient handling studies include other forms of feedback or outcome measures. The analysis of the included interventions in 2b.5 showed that of the 89 outcome measures that showed statistical significance 67 (75%) described measures that were not MSD related. It is a very limiting strategy to only focus on the single set of MSD outcome measures. The literature included in Hignett et al. (2003) and some of the studies identified in Bos et al. (2006), Dawson et al. (2007), Amick et al. (2006), and Martimo et al. (2008), also recorded other important outcome criteria relating to staff health, musculoskeletal risk factors, subjective or qualitative data (Wiitavaara et al., 2007), performance criteria, patient outcomes etc. To not include studies recording these outcomes appears to be weakening the argument for interventions of any kind.

Table 2b.14 Inclusion exclusion for PH Intervention Reviews

Paper	Inclusion Exclusion Criteria	Study types	Analysis	Studies included
Hignett et al 2003	Inclusion: 1960-2001 All health and social care worker studies Any study depicting PH, interventions, tasks or equipment	All types	The Quality Ratio (QR) Downs and Black (1998). Level of evidence Bernard (1997), Faculty of Occupational Medicine (2000)	225
	Exclusion: Purely epidemiology. Not primary source. Legal case report			
Bos et al 2006	Inclusion: 1985-2005 Only health-care workers. Aim to reduce MSD Explicitly described education /training Outcomes MS symptoms, sickness absence, physical load	RCT, CCT, CT	Criterion checklist without clinical assessments (Van Tulder et al 1997). Taxonomy for responsiveness (Beaton et al., 2001)	RCT 3 Control group 8 No control group 2
	Exclusion: Only used exercise or equipment. Focussed on people not in work/absent. Focused on individual employees			
Dawson et al 2007	Inclusion: Up to 2004 Target group nurses only including aides and students Aim to prevent LBP and back injury Explicitly described education /training LBP and/or back pain and/or back injury	RCT, N-RCT	Methodological quality (Cochrane Review Guidance, Van Tulder et al. 1997) (Table 1 p644) Internal validity and descriptive quality were recorded, papers scored high quality or low quality.	RCT 8 NCT 8
	Exclusion: Laboratory tests of techniques or equipment Mixed care groups no separation of nurse sub group.			
Amick et al 2006	Inclusion: Up to 2005 Health care setting and workers. Peer-reviewed publication MS symptoms, disorders, injury	RCT, N-RCT	Comprehensive 3 part inclusion and quality review. Based on Cochrane 2005, Slavin 1995 and Cote et al 2001.	40 (16 full, 24 part)
	Exclusion: No control group			
Martimo et al 2008	Inclusion: Up to 2005 Occupations involving lifting. Aim to reduce MS symptoms Must include training and lifting equipment Outcomes LBP, sickness absence, subsequent disability	RCT, CCT	Cochrane scoring system for RCT (Van Tulder et al., 2003) For the cohort studies (Slin et al., 2003). No details of the scoring system included.	11 (8 included PH)
	Exclusion: Only using exercise or equipment Focussed on people not in work due to sick leave Focused on individual employees			

It is important to discuss the explanation of cause and effect when examining these findings. The higher academic quality reviews are investigating MSD as an effect of the intervention, but many studies also measure the reduction in causal workplace risk factors. The academic argument states that there will always be confounding of the data, unless there is quantification of the reduction in the effect rather than exposure to cause. There is always the question of whether it is sufficient to accept a reduced exposure to known risk factors, or whether the end effect should always reported. An interesting philosophical question for the reviewers of the literature is to evaluate why, after 20 years of striving to develop patient handling interventions and systems, is there not a much larger body of evidence of higher academic quality? There are good scientific reasons why the body of evidence has not developed to the extent of medical studies. These are:

- The development of high quality RCT type studies relies on the availability of a control group. Workplace studies especially in the complex working environment of the NHS in the UK would be difficult to isolate (Straker et al., 2004).
- It would be difficult to find health care workers that have not had some manual handling training or exposure to manual handling equipment, to use as a controlled cohort.
- It is difficult to avoid confounding of the result by the bias of other workplace factors, such as psycho-social issues and workplace pressures that are constantly changing in these complex environments.
- Healthcare in the UK is now subject to much higher controls in terms of ethics and research governance, again making access to studies more difficult.
- The final point of course is one of ethical research in health and safety matters. Here the issue is that if we consider that an intervention is of benefit then it is difficult to justify not giving the intervention to all, and evaluating the outcomes on a whole population.

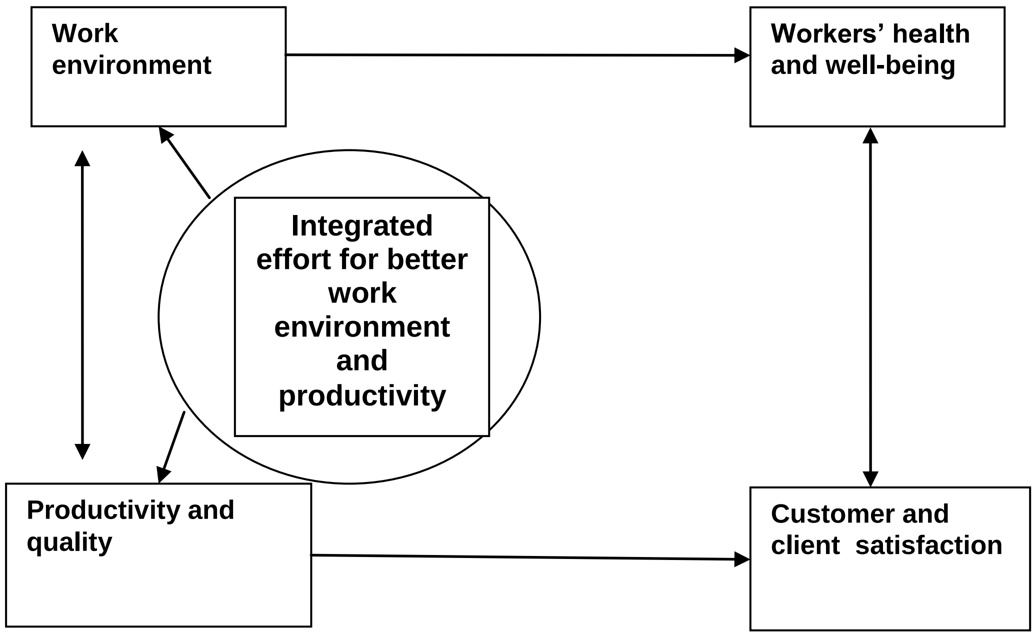

Figure 2b.3 Sirdal Model

The "Sirdal Model" (Figure 2b.3) (Kristensen et al., 2005) goes further in this evaluation to remind researchers that 'workplaces are not arenas for intervention research; and that their objectives are to produce goods and services. This indicates that it is important that the workplace and all involved in it become beneficiaries of the intervention. This cannot always be said for patient handling interventions.

The summary table 2b.15 below shows the conclusions drawn from the five review papers included in this discussion. It is apparent from this series of reviews that there is no strong evidence to show that patient handling interventions have any effect on MSD and its measures. There is reported in many of the reviews the growing body of evidence that there might be proven benefits if there was a better supply of studies.

One question still remains in whether the other values that can be measured in patient handling interventions are more valid as proof that high quality patient handling interventions are a benefit to the delivery of health care.

Table 2b.15 Findings from PH intervention Reviews

Paper	Findings and conclusion
Hignett et al 2003	Training interventions in isolation have little benefit. Multi-factorial interventions are likely to show the most benefit over a range of outcome measures. There is positive evidence of moderate value to show that a range of equipment reduces exposure to patient handling risks.
Bos et al 2006	Branch specific occupational interventions for the reduction of musculoskeletal symptoms may be effective, especially when training and education are combined with other interventions.
Dawson et al 2007	No strong evidence to support any firm conclusions. Moderate evidence that training in isolation is not successful and multi-dimensional interventions are effective
Amick et al 2006	A moderate level of evidence for the effect of OHS interventions on MSK in healthcare settings. This relates to most of the high and medium high quality studies showing positive effects. There were no negative effects from any intervention. There was moderate level of evidence for multi-component patient handling interventions and physical exercise interventions. Due to the low number of included studies, there was insufficient evidence to identify any individual intervention successes: Patient handling training, Back school, Cognitive behavioural interventions, Exercise and patient handling and stress management, Injury prevention programs, Participatory ergonomics, Equipment and training combinations, Health management programmes.
Martimo et al 2008	'No evidence that training with or without lifting equipment is effective in the prevention of back pain or consequent disability. Either the advocated techniques did not reduce the risk of back injury or training did not lead to adequate change in lifting and handling technique'. The cause and effect relationship and the efficacy of RCT in real working environments is identified as a limitation in this area of research.

In comparing the content of the analysis in this study with the published literature reviews, there is some evidence that PH interventions have positive effects on MSD and the related costs, but also there is an important part to play in considering the other forms of outcome measures. In this format of investigation the scientific approach leads the direction and function of the enquiry. Patient handling in health care settings is an applied workplace science, and as such the opinions and judgments of practitioners should be taken into account when investigating outcomes from PH interventions.

This analysis has identified one further weakness with the science of PH intervention studies as an applied science, and that is the lack of success measures outside the statistical analysis of difference between conditions. Some postural analysis tools and biomechanical models have developed safe levels of performance, but there seems to be a reluctance to report studies with a realistic measure of safety in the analysis. This is surprising as there have been a number of tools developed over the recent past that attempt to develop a risk exposure approach to patient handling, and indicate the level of success based on a number of different approaches.

A final consideration of this analysis is that when examining the collective knowledge regarding PH interventions and other types of PH studies the range of measures considered makes it extremely difficult to compare interventions. Five high quality academic reviews showed differing interpretations of the same body of literature when considering the single target of MSD reduction. This analysis shows that three quarters of the significant outcome measures are excluded by the focus on MSD. The question remains as to whether the reduction of MSD is the only valued outcome or improvement, or whether the practitioner in the role of PHA would prefer other measures, or whether a combination of measures may give a better evaluation of intervention strategies.

2b.6 Outcome measurement tools (OMT)

Given the range of outcomes and outcome measures recorded in the assessment of patient handling interventions, success criteria have rarely been reported. Recent studies have developed models that record the exposure to risk or performance measures for the management of PH risks. These tools are defined below as Patient Handling Outcome Measurement Tools. This section outlines the different OMT reported, and both describes the use of, and compares the methods of the different formats.

- **Outcome Measurement Tool** (OMT): An outcome measurement tool uses the outcome measure or several outcome measures for internal assessment against a known and traceable set of criteria. The OMT should give rational level data in its final score system. OMTs should measure outcomes and not describe interventions. An OMT could describe the magnitude of an intervention when there is clearly stated evidence of the links between the intervention and the outcome improvement.

2b.6.1 Inclusion criteria

Only validated OMTs specifically designed to compare the outcomes of patient handling interventions against a known set of criteria will be further discussed. The question of cause and effect is raised about whether OMTs describe an intervention or an outcome of the intervention. This was seen in the equipment provision models reported below.

A review of OMs (Fray and Hignett 2007a) found that the four key beneficiaries for outcomes for patient handling interventions are:

- Organisational measures (2b.6.2)
- Staff outcomes (2b6.3)
- Task performance measures (2b6.4)
- Patient outcomes (2b6.5)

This breakdown was repeated in the extended analysis in section 2b.2. This review considered how OMTs analyse patient handling intervention outcomes, and how they measure success around the given criteria. Importantly this review compares the different OMT and examines if they could be used to develop a more definitive tool to evaluate the overall strength of an intervention, or to allow comparison between types of intervention strategies and outcomes (Fray and Hignett 2007b).

2b.6.2 Organisational Outcomes

The measurement of organisational commitment to the prevention of MSD from patient handling actions seems to be well defined in OMTs in two groups.

1) Organisational performance

PHOQS (Hignett and Crumpton, 2005) and MARCH (Smedley et al., 2005) both evaluated the organisational performance in terms of policy, accountability, risk assessment, supervision and communication. MARCH also included financial commitment in their criteria.

2) Equipment Provision

MAPO (Battevi et al, 2006), HIT (Smith et al., 2005), Quick Scan (Arjo ab a), Care Thermometer (Arjo ab b and Knibbe and Knibbe, 2005) all assess the need for equipment and information in the workplace. Some of the OMs used by the two groups are overlapping.

2b.6.2.1 Organisational performance

The first comparison looks at PHOQS and MARCH. From an initial analysis the level of questions appear superficially similar. The two lists of questions are displayed in Table 2b.16

Table 2b.16 Comparison of PHOQS and MARCH

MARCH (Total Score 24)	**PHOQS** (Total Score 30)
i. Defined management responsibility for manual handling issues at board level (2) ii. Written, trust wide policy for manual handling (2) iii. Score on H&S section of risk management audit on Controls Assurance baseline assessment 2000 (2) iv. Routine collection of data on sickness absence and ill-health retirement (2) v. Data on manual handling incidents collected routinely and presented to study team on request. (2) vi. Salary allocation for manual handling specialists per 1000 staff	i. Have you had an internal manual handling audit in the last 2 years (1) ii. Was your last internal audit: a service provision audit, an equipment or training audit, local monitoring or supervision (2) iii. Do you have a general manual handling risk assessment system? Is it: organisation wide, local level, task specific, No risk assessment system (2) iv. Are completed risk assessments held: centrally, locally, both, none at all (2) v. Are manual handling risk assessments reviewed at least annually (1)

(2) vii. Time per 1000 staff of manual handling specialists allocated to advising about risks and controls (2) viii. Guidelines on referral to occupational health department for nurses with back problems (2) ix. Rapid access to physiotherapy for nurses with back problems (2) x. Level of manual handling training (2) xi. Records of attendance for manual handling training and a proportion of nurses with attendance last year (2) xii. Proportion of clinical wards with accessible lifting equipment. (2)	vi. Is the review system: formal, informal.(1) vii. Are patient mobility assessments held in: care plans, separate forms, both.(1) viii. Are patient mobility plans held: with the patient, elsewhere(2) ix. If elsewhere is there a reason (1) x. Do you have appointed manual handling supervisors: for all wards and departments, some wards and departments.(2) xi. How is contact maintained with the manual handling supervisors and their competence ensured: formal traing sessions, formal staff meetings, informal meetings initiated by the BCA, informal meetings initiated by the supervisor, ad-hoc meetings(5) xii. How do the manual handling supervisors maintain their contact with the staff and ensure their competence: training records, assessing the quality of the patient mobility assessments, entries in patient records and notes, ward meetings/handover, personal development plans, problem solving sessions, case conference/mdt meetings, Other format training, informal documentation, others (10)

These two tools have different aims. The MARCH tool evaluates the organisational commitment to the processes of managing MSD in the organisation. It recognises the processes of managing illness in the workplace with measures of sickness absence, access to occupational health and rapid access physiotherapy. The initial investigation (Section 2a.7) and considered the MARCH tool as a financial investment model. When compared with PHOQS this is confirmed as the assessment uses organisational systems that require funding as outcome criteria. It is important to note that the MARCH tool evaluates the commitment to the intervention and not necessarily the outcome itself.

The PHOQS tool was developed as an audit tool for HSE inspectors and examines management in an organisation. The use of the Controls Assurance baseline (CNST, 2009) measure in the MARCH tool does lead the tool towards a measure of safety culture, but is not specifically a measure of patient handling safety culture, compared to the PHOQS tool. Work by Knibbe and Knibbe (2006b), Knibbe et al. (2007) and Nelson (ed) (2006) suggests that time and responsibility allocation to someone in the organisation can play a key role in implementing and improving the compliance with good patient handling practice. A follow up study for the HSE, evaluating the PHOQS tool (Hignett and Crumpton, 2004, and Hignett and Crumpton, 2007), found that the organisations with a high PHOQS score for safety culture showed more positive levels of compliance and higher levels of knowledge and decision making in several clinical tasks.

A method to evaluate the organisational commitment and safety culture would be valuable for comparing organisations. It is important to link these values with the more important process of financial evaluation of the impact on sickness absence, and the longer-term effects for managing MSD in the organisations. This should be able to identify the commitment in terms of expert staff time, equipment provision, risk management systems that are in place, and equate these costs with the potential losses of MSD (See Table 2b.10).

2b.6.2.2 Environment and Equipment Outcomes

The second group of tools looking at organisational commitment to the process of managing MSD in the workplace measures the provision of equipment and safe working environments. Hignett (2003a) found that the provision of a wide range of equipment in a patient handling environment produced a positive effect on potential problems. The range of equipment included hoists, bed provision, and transport devices as well as a number of small aids. Not all of the tools listed seek to quantify the range of equipment and suitable environmental changes.

<u>a) Quick Scan</u>.

The first tool is a simple descriptor of hoists, bathing equipment and slide sheets. The Quick Scan (Arjo ab a) is developed as an assessment tool for a given location e.g. a ward, and bases the calculation of required equipment on the following:

- One slide sheet per person requiring help

- One active hoist can provide 30 transfers per day
- One passive hoist can provide 25 transfers per day

The evidence or rationale that was given for these data is unclear. The report generated by a Quick Scan assessment calculates the number of care tasks needed for the patient dependencies observed. The calculation of equipment needed is based on the ergonomics standards outlined in the Dutch Government convenents (Knibbe and Knibbe, 2005), the resident gallery for patient dependencies (Arjo ab d) and records the number of staff, available aids and equipment. The calculation of equipment need is based on the number of transfers required for 24 hour care.

b) Hoist identification tool (HIT).

The Hoist Identification Tool (Smith et al., 2005) analyses only the hoist requirement for a given area. The process has some interesting methods for quantifying the equipment by comparing the dependency scores (FIM), the number of available teams, and the number of beds to calculate hoisting needs. As with the Quick Scan it was not indicated how the calculation was derived. The number of hoists was calculated using a ‘Key Number’, which was equal to the number of beds / number of teams available at the busiest period. This was then compared to the typical number of patients with FIM scores of 1 or 2 for passive hoists, i.e. the highest dependencies, and 3, 4, 5 for active hoists. This gives a ratio value which equates to the number of hoists required. Table 2b.17 indicates the number of hoists required.

Table 2b.17 Calculation of hoist numbers using HIT process.

Calculation	**Ratio Value**	**Number of hoists required**
$\frac{\text{Typical number of patients in FIM category}}{\text{Key number}}$		
If key number > 3		2 minimum
	0-1	1 or 2
	1-2	2
	2-3	3
	3-4	4

If patient may need barrier nursing		Add 1 hoist
If patient may be very heavy		Add one high capacity hoist

The anomaly for the HIT calculation is that the number of hoists for a given area is derived not only from the number of patients requiring assistance, but the number of nursing teams that are available to use them. So if a poorly funded centre decided to reduce the staff teams available, then they could reduce their equipment needs according to the tool. There is no inclusion in the tool to define maximum transfers per day per team, etc., as with MAPO (Section 3.2.1.2.3). It would be interesting to compare the use of the HIT tool in high dependency nursing homes with the acute healthcare setting, where the availability of staff may be different.

Both tools, Quick Scan and HIT, have limited use as a measure of improved patient handling performance, due to the limited evidence described and the lack of measure for an organisational system supporting the use of equipment. Both show the commitment to provision via the financial outlay.

Two tools that have had a process of much greater development and evaluation are MAPO and the Care Thermometer.

c) MAPO

MAPO was originally created as an assessment tool to get an understanding of whether care delivery institutions were managing the risks associated with patient handling (Battevi et al., 2000). The development and evaluation of the tool has been well documented and has some testing for internal validity and reliability (Battevi et al., 2006). The evidence base for the development of the tool examines the NIOSH guidelines for lifting (Waters et al., 1993), epidemiology data collected in development, identified risk factors for MSD in health care workers, and the guidance from EN 9130 list to outline how many activities can be completed with specific pieces of equipment.

Subsequent studies in Italy have used the MAPO tool as a measurement device to assess the progress of the implementation of the EU directive; including

Fortuna and Ricci (1999), Battevi and Menoni (2006a and 2006b) Battevi et al. (2000). In addition it has been translated and evaluated for use in two other EU countries described by Fray et al. (2006) and Cotrim et al. (2006).

The calculation of the MAPO Index involves the development of four factor scores (Menoni et al., 2004). The system is based on residual risk scoring i.e. each noted deficiency adds to the end MAPO Index score. Higher MAPO Index scores equate to higher levels of residual risk. The MAPO score has four risk levels <1.5, 1.5-5.0, 5.01-10.00, and >10.00.

Table 2b.18 Information required for the MAPO Index calculation

Factor	Values Measured	Coding
Lifting Factor	N° non co-operative patients N° partially co-operative patients Total N° staff over 24hr period N° of hoists available N° of small lifting aids available	NC PC OP LF AF
Wheelchair Factor (WF)	Type and N° wheelchairs and potential failures in stock. Equates to numerical sufficiency	MSWh
Environmental factor (EF)	Type and N° bathroom/showers and potential limitations in design. Equates to numerical sufficiency of average score per ward Type and N° toilets/WC and potential limitations in design limitations. Equates to numerical sufficiency of average score per ward Type and N° wards and potential limitations in space and design. Equates to numerical sufficiency of average score per ward Mean score for environment calculated from MSB + MSWC + MSW against known values to create MSE and EF	MSB MSWC MSW MSE
Training Factor (TF)	Simple values for adequate training, information only or no training	

Table 2b.18 shows all the information and calculated scores derived in the MAPO process. The MAPO calculation takes these factors into account in the following formula:

MAPO INDEX score = [(NC/OP) x LF + (PC/OP) x AF)] x WF x EF x TF

The values for residual risk remain low for areas with adequate staffing and a good variation of equipment and accommodation. In the evaluation of the tool in a UK acute hospital (Fray et al, 2006) all areas scored low, as did an unpublished study by Coman (2007) of Australian elderly care facilities. The Portuguese evaluation (Cotrim et al, 2006) however showed higher levels of risk, and was reported as a reasonable evaluation for their healthcare system. A further study by Barroso (2007) has also suggested the usefulness of the tool in Portugal.

<u>d) Care Thermometer (CT)</u>

The Care Thermometer (Arjo ab b) is derived from the Lift Thermometer produced and evaluated in the Netherlands (Knibbe and Knibbe, 2005). This tool was originally defined to be used as part of a suite of tools recommended by the authors. This suite of tools includes the evaluation of organisational and managerial commitment, the provision of equipment for a given environment and aspects of training and competency of the caregivers.

The process of defining the model is based on the ergonomics guidelines for the safe care environment that have been adopted by the Dutch authorities as working standards (Knibbe and Knibbe, 2005). The guidelines give very specific guidance for the environmental and equipment requirements for the management of six specific patient handling tasks.

- Patient movement within a bed
- Lateral transfers of a patient between two flat surfaces
- Sitting to sitting transfers
- Postures that increase static loading in bathing
- Care activities on the bed including anti-embolus stocking application

- Load lifting, pushing and pulling

These guidelines were based on evidence from research studies (Brinkhoff and Knibbe, 2003) and very specifically followed biomechanical force limits for push, pull, lift and finger force applications, and guidance for prolonged periods of static work. They were developed with peer group involvement and adopted for government enforcement in 2002.

The original definitions of the Lift Thermometer examined compliance with the guidelines, based upon a three level patient dependency assessment. This equated to the independent, partially co-operative and non-co-operative levels used in the MAPO tool. The Care Thermometer has a 'Mobility Gallery' that initially identified five levels of dependency but has different patient groups to include special needs e.g. bariatric, elderly, learning disabilities etc (Arjo ab d). The physical assessment criteria for the patient gallery are in Table 2b.19.

Table 2b.19. Grades of Mobility from the Resident Gallery (Arjo ab d)

Class	Dependence	Assistance from carer	Patient activity	Patient stimulation
A	Independent	Not physically demanding for carer	Verbal guidance may be necessary	Stimulating activity is relevant
B	Depending on carer	Assistance is not physically demanding for carer	Patient is active	Stimulating activity is relevant
C	Depending on carer	Assistance is potentially physically demanding for carer	Patient is active	Stimulating activity is relevant
D	Depending on carer	Assistance is potentially physically demanding for carer	Patient is (nearly) completely passive	Stimulating activity is relevant
E	Depending on carer	Assistance is potentially physically demanding for carer	Patient is (nearly) completely passive	Stimulating activity is not relevant, desirable or permitted

The model requires a clear set of data to be input into the calculation spreadsheet. Initial data include the total number of patients in the ward area and total full time equivalents for the staff. These data are defined by each task in the original Dutch government guidelines, and require a decision as to whether the task has been controlled or not by the provision of the correct equipment. All data follows the format below:

- Task completed
- Mobility level of resident
- Number of residents engaged in this activity
- Number of residents for whom the equipment is being used

Any patients not managed in the method stipulated in the guidelines score as a residual risk. The residual risks are then scored and the outstanding risks are displayed in a number of graphical presentations. The web-based tool www.carethermometer.com (Arjo ab b) has an overall risk rating to give a Care Temperature as a percentage. The most recent model of the tool also defines two new factors:

- Quality of care indicators, based upon the access to activity status of a ward or environment i.e. if the equipment or staff are not available then access is restricted.
- Passivity level, the over use of equipment making patients more passive.

e) Comparing MAPO and Care/Lift Thermometer.

The two models described have many similarities, in that they both describe outstanding risk scores, and both have specific methodologies relating to how much equipment should be provided to control the risks. The MAPO tool is very highly dependent on the ratio of available staff to the care needs of the patient group. In the CT the relationship is evident, but is more task specific. The CT concentrates very specifically on the patient handling tasks outlined in the six guidelines, where the MAPO tool also includes more information relating to the physical dimensions of the care environment. A competent observer completes both tools, but the MAPO tool records the physical environment, whereas the CT records how many patient specific handling issues are controlled by the environment, and the level of equipment provided.

Both tools have had involvement with practitioners from different countries, and both tools have needed to consider the processes and criteria to be a truly European measure of intervention success.

2b.6.3 Staff Outcomes

Table 2b.4 shows that 439 out of 598 of the outcomes recorded, relate to staff completing patient handling actions. Further analysis of the outcome measures in Table 2b.11 identified injuries, perception measures and physical workload as the most widely used methods to measure performance. Mostly the physical and subjective risks to the staff are compared, by using the quantities as OM, i.e. as a pre- and post-intervention comparison. The outcomes can be further divided into groups based upon the qualities and quantities measured.

2b.6.3.1 Physical workload

The largest group of OMs are measures of physical factors. Historically, load handling has found a relationship between physical exposure and the risks of MSD (Smedley et al., 1995, Hignett, 1996a, Josephson et al., 1997). Many different ways have been used to measure force, body position etc for a number of work types. Few of the outcome measures were devised specifically for use in healthcare or patient handling. The key exception is REBA, a model of postural risk analysis developed by Hignett and McAtamney (2000). Many of the tools have been validated and meet the definition of OMT, having internal criteria for success based on evidence and, in many cases, also delivering rational level data for reasonable comparison between pre- and post-intervention. As these studies have mostly been developed outside the field they were omitted from this comparison discussion. The worth and values of most of the posture, exposure and force tools have been reported and cross examined in other areas (Russell et al., 2007; and Dempsey and Mathiassen, 2006).

Fray (2006) showed a full review of all the physical tools that have been recorded in patient handling studies. The review of outcome measures section 2b.4 and table 2b.11 record the range of values used for patient handling studies. Most of the recorded OMs in the analysis do not contain internal assessment criteria and as such cannot be utilised as OMTs. Table 2b.20 compares some of the familiar OMs used to measure staff outcomes with the included OMTs.

Table 2b.20 OMs and OMTs used for the evaluation of physical risks

Risk	Outcome Measures (OM)	Outcome Measurement Tools (OMT)
Exposure	Injury records Self completed logs Number of lifts Volume of lifting	
Posture	Joint angles	OWAS REBA
Biomechanical	Force measures Movement Speed or acceleration	Biomechanical models E.g. NIOSH.
Physiological	Heart rate Oxygen uptake EMG Intra-Abdominal Pressure	

2b.6.3.2 Subjective assessment

Staff perception is commonly recorded as an outcome for patient handling interventions via forms of subjective feedback. The qualities used for OMs are based on physiological response e.g. effort, rate of perceived exertion etc, comfort or discomfort and usability of equipment. No specific tools have been developed to try to clarify assessment for these qualities.

2b.6.3.3 Compliance assessment

The third group of staff outcomes is that of compliance monitoring. This area has seen a higher level of application to the patient handling field. Even though much evidence has been gathered to question the effectiveness of training (Hignett et al., 2003), the patient handling risk management processes still use training, and as such need methods to evaluate outcomes. Three observation tools have been devised specifically to measure the ability of a carer to follow the agreed procedure.

The three models; Kjellberg et al. (2000), Johnsson et al. (2004), and Warming et al. (2004), were developed in Sweden and Denmark with much internal comparison between the different approaches. All have been subjected to a high level of analytical rigour for validity and reliability. Each of these models has good supporting evidence and delivers a clear measure of the outcome. It is not so clear if the combined score delivers a satisfactory outcome, but the data allow for a very easy comparison of pre- and post-intervention studies.

The major differences relate to how the tools should be used. Due to the complexity of the models, Kjellberg et al. (2000) and Warming et al. (2004) are described as video analysis tools where DiNO (Johnsson et al., 2004) can be conducted in real time. Only the DiNO tool has measures relating to the success of the transfer (result phase). All tools measure the preparation and the actual performance phase. The final, and most significant difference is the understanding of the movement principles that underpin the movement assessment. Warming uses the work of Schibye et al. (2003), but the Swedish models have developed movement principles as part of the tool.

The approach of Kjellberg et al. (2000), has been used in three further studies by the author group (Johnsson et al., 2002; and Kjellberg et al., 2003 and 2004). DiNO is the only tool that has been used outside its author group. Lomi et al., (2006) translated the model and the movement principles into Greek for a trial and evaluation, and found the transferability of the model to be effective. Wonnacott (2006), Groves (2008) and MacGregor (2009) found the language describing the movement phases difficult and needed extra descriptions to facilitate a robust scoring system.

2b.6.3.4 Competence measures

The final tool is SOPMAS (Hantikeinen and Tamminen-Peter, 2002). It has some similarities with the Benner skill ratings (Benner, 1984) used by Crumpton and Johnson, (2005). SOPMAS is based on a learning taxonomy, with skill and understanding levels in the methods and interactions that a carer has with a patient during a transfer. Where the Benner scale is a simple learning outcome, not specifically applied to patient handling, SOPMAS has clear links with the movement protocols of patient handling. The grid score system has five levels of skill and four components to grade (Table 2b.21), thus an average or total score can be derived. A comparative study of the scoring system was conducted with the DiNO tool (Johnsson et al., 2004) as part of the validation process for DiNO. The SOPMAS tool has subsequently been used in studies by the author but has not had translated evaluations.

Table 2b.21 The scoring grid for SOPMAS

Learning level	Interaction with patient	Patient's movements	Posture and movements of nurse	Environment and assistive devices
Prestructural				
Unistructural				
Multi-structural				
Relational				
Extended abstract				

As the scoring system assesses the learning and skills inherent in an individual, it is difficult to see how the tools of compliance (3.2.3.2) and competence (3.2.3.3) can be used in widespread data collection. All however can be used as measures of comparison of pre- and post-intervention. Though the tools were made to measure training outcomes, there could be a use to assess the provision of equipment and a safe working system, as this may allow the worker to use the recommended transfer technique. The number of studies that use DiNO show it may have the most useful applicability in terms of reliability, translation and speed of use.

2b.6.4 Task Outcomes

Performance or task outcomes are less frequently monitored in intervention studies (Table 2b.11). Task measures that have been used relate to time factors and speed issues, but there are very good measures, in some trials, of the success of a transfer or task, e.g. better sitting positions, etc. No outcome measurement tools were located to investigate task measures.

2b.6.5 Patient Outcomes

Practitioners will always suggest that the patient outcomes are paramount in patient handling tasks, but patient handling outcomes have been seldom recorded. The analysis recorded in this study found only six studies that included patient results as outcome measures. Fray and Hignett (2007a) showed that more recent studies are including patient outcomes, mainly focussing on patient perception e.g. safety, comfort, security, but no OMTs have been found investigating these OMs.

2b.6.6 Summary

Many outcome measures have been used to measure changes in performance in patient handling interventions. These measures have been categorised into two groups, outcome measures and outcome measurement tools. Outcome measurement tools are assessment tools with internal criteria for evaluating the performance against the identified levels. These in turn have a direct scientific and evidence based link to the process of harm or loss.

The outcome measurement tools were compared against the beneficiary categories in section 2b.2. Financial organisational outcomes and patient outcomes and task performance outcomes were not supported in the OMTs recorded. The range of OMTs complemented and duplicated some data sources. The range of tools can be amalgamated to give a value judgement across the whole area of performance, in managing the risks associated with patient handling in a healthcare organisation.

The definition of an outcome measurement tool sets out the key requirements for inclusion in this study. Table 2b.22 lists the criteria for all the tools in this section. Unlike more physical assessment tools e.g. the NIOSH lifting index (Waters et al., 1993), none of these tools identify a clear strategy for pass or fail criteria. The care thermometer and the MAPO index do state clear levels of outstanding risk, which could be interpreted as fail criteria for high levels of risk. This means most of these tools can only be used as OMs to compare pre- and post-intervention levels of risk, and do not indicate a successful intervention.

Table 2b.22 Summary of the tools included in this review.

Tools	Outcomes measured	Clearly identified criteria for comparison.	Score Systems (Final Score Format)	Success level stated
MARCH	Organisational commitment	Controls Assurance Standards (UK)	Yes/No (x/24)	No
PHOQS	Safety culture	RCN Competencies	Yes/No (x/30)	> or = 40% positive answers
MAPO	Equipment, n^o staff, training, environment.	NIOSH Epidemiology EN 9130	MAPO Index (Complex Ratio data)	Red amber green
Care Thermometer	Tasks, n^o staff, equipment.	Dutch Convenent standards	Care Temperature (%)	Red amber green
Quick Scan	Hoisting and slide sheet provision.	Dutch Convenent standards	Equipment needed	No
HIT	Hoisting provision.		Hoists needed	No
Pate	Staff compliance (video)	Safe principles	24 rated scores, 0-1. (x/24)	No
Warming et al	Staff compliance (video)	Safe principles	23 rated scores. (x/202)	No
DiNO	Staff compliance	Safe principles	16 rated scores, 0-1. (x/16)	No
SOPMAS	Staff Competence	Learning taxonomy	5 rated taxonomies (0-5)	Above iii

Table 2b.22 gives a visual and graphical comparison of the range of OMTs to show the areas of duplication and difference. It may be that, as the research programme defines the priority of patient handling outcomes and the key indicators, this range of outcome measurement tools may be included in the process of comparison for intervention studies. The omission of success criteria from most of the models is a concern, and further work is needed if these are to be included in the final process.

Table 2b.23 Matrix of content for included Outcome Measurement Tools.

Key Outcome Identifier	Quality	Tool			
Organisation outcome	Financial evaluation				
	Sickness absence				
	OH management				
	Organisational commitment	MARCH			
	Patient handling safety culture			PHOQS	
Task outcome	Hoisting Equipment	MAPO	Care	Quick scan	HIT
	Other handling aids	MAPO		Quick scan	
	Environment provision	MAPO	Thermometer		
	Training provision	MAPO			
Staff outcome	Physical outcome measures				
	Laboratory observation	Posture / exposure / biomechanics			
	Field observation	Posture / exposure / biomechanics			
	Compliance with safe methods				
	Video observation	Pate, Warming			
	Field observation	DiNO			
	Skill levels and competencies	SOPMAS			
Patient outcome		Only subjective assessment criteria			

2b.7 Discussion of literature sections

It has been shown through this analysis of the body of literature that methods have been developed to measure the success of patient handling interventions. Outcome measurement tools have been developed to calculate a series of scores against known standards. In addition there have been some academic reviews that identify the success of each individual study. NIOSH (2001) identified a range of criteria to enhance the value of measuring intervention studies. Academic quality scoring systems have been devised to compare studies, including epidemiological studies (Genaidy et al., 2007). High quality scientific studies are assessed primarily by Cochrane methodologies (Van Tulder et al., 2003). Wider more inclusive reviews of the literature can also be assessed (Downs and Black, 1998; and Slin et al., 2003).

In addition there are methodologies to collect bodies of evidence to suggest that collective effects also have a rating of their success. These methods are commonly used to create evidence based practice models and set targets for the level of evidence produced in each specific area (Slavin, 1995; Cooper and Hedges, 1994; Franche et al., 2004; Bernard, 1997; and Faculty of Occupational Medicine, 2000).

The examination of the interventions, outcomes and outcome measures in patient handling studies has revealed different interpretations of the evidence, and has raised specific questions to be discussed.

2b.7.1 Reliance on staff outcomes

The historical development of the role of patient handling advisor is, in the UK, surrounded by the legislative process and the need for the NHS and other Statutory Services to defend themselves against prosecution. This coupled with the vigilance and direction of the HSE has created a body of evidence that in the main identifies the potential injuries to the staff as the key outcome measure. Unfortunately the literature reviews discussed in 2b.5.1 show that the evidence collected has not allowed a direct link to be made between the intervention and the longer-term outcomes of musculoskeletal ill health. An example of this is the numerous studies that identified postural changes in the staff carrying out patient handling tasks, but then did not carry out longer-term reviews to identify whether the rate of MSD or injury had been affected. This dichotomy fits into the relationship between cause and effect. The academic reports and reviews have considered the analysis of MSD rate to be paramount, but given the lack of evidence it may be necessary to develop arguments that support the development of patient handling management systems, based on the reduction of exposure to known risks for MSD. The evidence developed from these studies gives a wider body of literature to repeat the review processes, to identify the components of successful patient handling interventions.

The reliance on and the concentration of the studies on staff based outcomes has reduced the links with patient and task outcomes. Only 7.4% of the outcomes recorded in the survey were patient outcomes (Table 2b.10). A further 5.3% gave some outcomes for task performance that measured changes in the time or techniques of patient movement. This lack of data to support patient outcomes has distanced patient handling from the clinical field. Modern healthcare is driven by productivity, and the success of clinical interventions in a timely and error free fashion. So why has there been no patient handling studies that have used clinical outcomes to prove that high quality handling results in better clinical outcomes?

A range of clinical outcomes could be easily identified to move patient handling into the clinical care field.

- The use of single patient use items, i.e. slings and slide sheets, may reduce the spread of infection.
- The use of competent risk assessment and handling techniques may reduce fear, aid support and improve rehabilitation outcomes for patients with mobility issues
- The use of mechanical hoist options may improve sitting positions and patient comfort when transferring from seat to seat
- The use of improved handling skills could reduce hospital stays or improve the quality of rehabilitation for patients

- The utilisation of appropriate risk assessment and equipment provision may increase the perceptions of patient independence and inclusion in the care process

There is a gap in the body of knowledge surrounding the study of patient handling, and further research needs to identify whether patient handling interventions can be measured with clinical outcomes?

2b7.2 Comparison of interventions and outcome measures

The research evidence developed showed little to identify the relative merit of one outcome against another or to place one beneficiary at higher priority. Even the series of outcome measurement tools that have been peer reviewed (2b.6), all measure outcomes of the interventions at different levels against different criteria:

- Organisational level assessment is identified by PHOQS (Hignett and Crumpton, 2005)
- Ward based tools identify equipment and training deficits and ultimately staff risks are identified by MAPO (Menoni et al., 2004), MARCH (Smedley et al., 2005), and the Care Thermometer (Arjo ab b, 2007) HIT (Smith et al., 2005)
- Training and personal compliance with specific methods are examined by DiNO (Johnsson et al., 2004) and SOPMAS (Tamminen-Peter, 2004)

It could be argued that PHOQS, MAPO, MARCH and the Care Thermometer are tools that measure the level of the intervention against an agreed set of criteria. SOPMAS and DiNO measure the end user, so they are truly outcome measures that prove whether the training or advice has made a difference in the task completion. This again fits the dichotomy question of cause and effect. This could be an indication that one method or measure is regarded as a higher level than another, but that priority is developed by the authors of each OMT. It is unclear how the application of the research evidence by the practitioners (PHA) is completed. Cross comparisons of the different OMTs in different countries from their origin have proved unsuccessful in validating their use (Cotrim et al., 2006, Fray et al., 2006, Lomi and Lomi, 2006, and Tamminen-

Peter et al., 2008). It should be expected in the application of evidence to the workplace that a higher priority be given to effect measures. More importantly the reduction of injuries or reduced sickness absence should be ranked higher than the reduction of exposure to musculoskeletal risk. This is likely to identify by default that longer-term longitudinal studies from a poor starting position are more powerful in terms of their outcome measures.

Given the lack of convincing evidence that PH interventions reduce MSD rates, and without any potential comparison between the wide range of outcome measures reported in this analysis, then it is difficult to identify where the investment for future change should targeted.

2b.7.3 Summary of findings

- There is a wide range of evidence from patient handling intervention research.
- Only academic scoring systems seem to be available for ranking the success of the intervention type.
- Outcomes described in PH studies can be qualified by the position in the continuum between intervention and outcome (Robson et al., 2007)
- It is possible to measure the success of a patient handling intervention by following the scientific evaluation processes.
- It is possible to create evidence based best practice using the scoring systems outlined.
- None of the described outcome measures or outcome measurement tools have any comparison of content of the outcomes, or any relative values for the beneficiary of the outcome. The process for evaluating PH interventions is flawed because the intervener selects the outcome measure or outcome measurement tool to justify the intervention.
- Without a convincing comparison between the different outcome measures it is difficult to design and target future intervention strategies with any level of confidence

2b.8 Developing the research process

At present the relative values of patient, staff, organisation or indeed higher society based outcome measures are unknown, and the merits of any intervention can only be judged in terms of the tools by which it is measured. There have been differences observed in the literature analysis in the details of how each study was reported:

- Beficiaries

  The question for investigation is how one study rates of higher importance than another. The first comparison will be relative to who or what benefits from the outcome measure. Should a patient benefit, in particular a clinical benefit, rate higher than a staff measure? Should an organisational measure that relates to the provision for many staff be rated as higher than a single practitioner measure e.g. posture or force? Should population data or society data be rated as the highest due to its area of application being universal to all individuals?

- Cause and effect

  A similar discussion could be made for the cause and effect data explored in the literature discussion. It could be argued that real world findings related to the actual measured effects of an intervention raise its power in any comparison, rather than the reduced exposure to risk factors. Care however needs to be taken not to negate the studies and information that has proved a link between cause and effect.

- Area of applicability

  It may be possible to rate intervention studies on the area of the healthcare field that the data could be applied to. There is a logical progression in the power of a study related to a) the level of statistical significance expressed in the study and b) the sample size included in the study, or c) the population to which the findings can be inferred. A formal statistical analysis would be required to answer this question, which is outside the limits of this study.

- Comparing outcome measures
  Several outcome measurement tools have been developed to compare measures from a workplace against known criteria. It might be possible to rate interventions by comparing these outcome measurement tools. How does a MAPO amber compare to a SOPMAS III, to a PHOQS 24/30?

It is these issues that have created the requirement to develop this research project, and examine in detail the measurement of success for patient handling interventions, and the success criteria by which to evaluate them. The drive to evidence based practice in many areas of healthcare has increased the need to identify comparative ratings between different sources of data. It is the aim of this study to identify a tool that will be able to recognise the comparative value of each study or data set and allow priorities to be set. This research project is to investigate the relationships between outcome measures, and evaluate if there is a consistency of perception across the EU? It is the aim of this long-term study to identify if it is possible to measure what makes for a successful patient handling intervention?

Research Question:

Can a single measurement tool be created to measure the success of patient handling interventions in a healthcare setting?

Aims:

- To define what outcome measures are preferred by patient handling practitioners across the EU
- To evaluate and select the most suitable methods for measuring the identified outcome measures
- To develop a tool that can be used to compare the relative values of different patient handling interventions, studies and trials.

Objectives:

1. Identify the most important outcome measures considered by practitioners involved in the prevention of patient handling injuries
2. Conduct a series of data collections to compare the important outcome measures from a sample of EU countries
3. Analyse the data from the EU countries and create a priority list for the preferred outcome measures
4. Evaluate the best methods for measuring the preferred outcomes
5. Use the data to create a tool to compare all types of patient handling interventions
6. Test the model in a UK pilot study
7. Test the model in the sample of participating EU countries

Benefits of the Research

The programme should result in real benefits for patient handling in many ways.

1. The first is an accepted method for evaluating the success of a back care / manual handling intervention. This will allow the tailoring of resources and solutions to give known benefits with measurable outcomes.
2. The success criteria will be used to identify the skills and educational needs for manual handling advisors across Europe.
3. There will be better across border collaboration for the management of risks for patient handling situations.

Chapter 3

Preferred Outcomes in the EU: A Focus Group Study

Introduction

This chapter describes the methodologies and methods for the data collection in four EU countries, to record which outcomes were preferred by practitioners in the patient handling field when completing patient handling interventions. The focus group study forms a significant part in the data collection and links with the literature analysis (Fig 3.1).

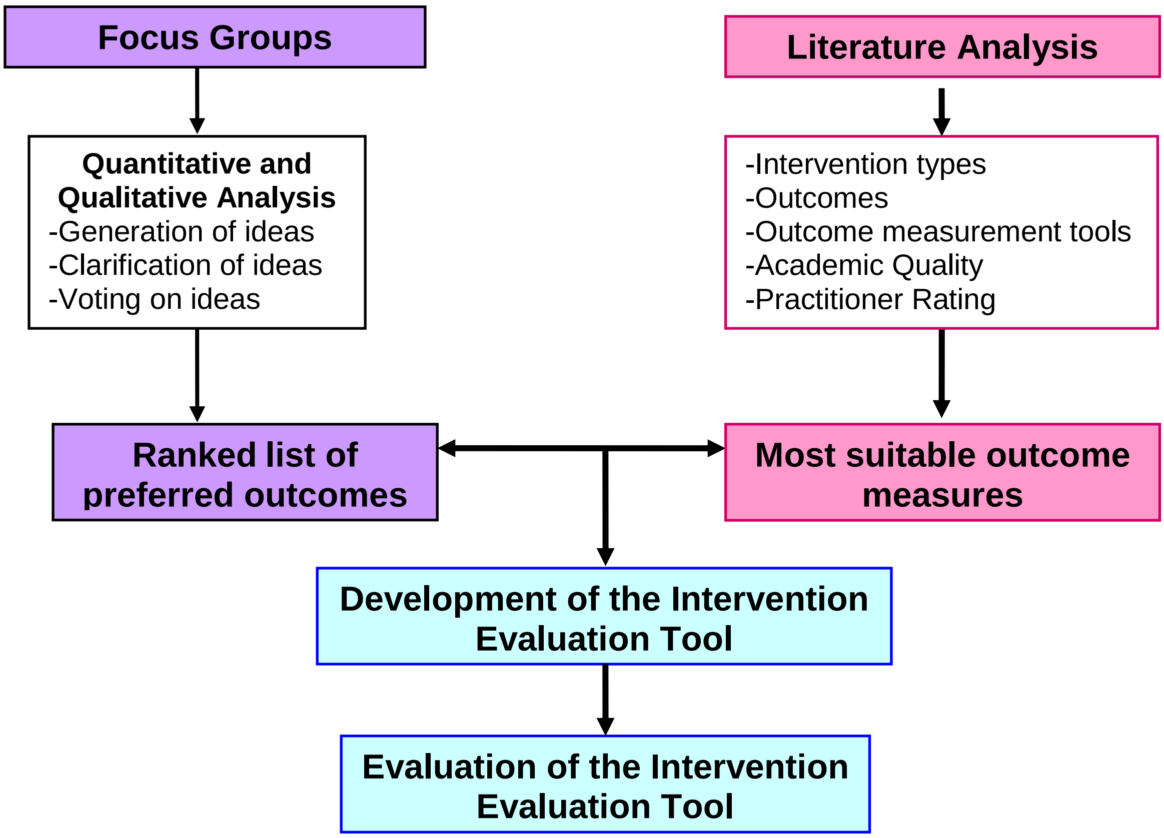

Figure 3.1 Study overview

The opinions and preferences from four EU countries (UK, Finland, Portugal and Italy) were collected and compared to the views of two expert focus groups, that were collected at two separate international academic conferences. Qualitative and quantitative methods were used to analyse the suggestions and definitions created by the groups, to create a list of the most preferred outcomes. The final group represented in 12 outcomes, which were widely represented across all the participating groups, and the voting system allowed them to be ranked as the most influential outcomes to be measured. The highest ranked 12 outcomes were taken forward to be included in the IET (Chapter 4). For consistency the EU groups will be referred to as the UK, Finland, Portugal and Italy groups rather than the British, Finnish, Portuguese or Italian though this is not grammatically correct.

3.1 Study design

The range of outcomes and outcome measures (described in Chapter 2) show a complex picture. They can be described by the recipient of the benefit, for example staff issues, but organisational outcomes and patient benefits are then also noted. They can also be recorded by where in the process of intervention to resultant effect the value is observed (Robson et al., 2007). This data set does not create a comparison, or prioritise the different outcome measures. This initial phase produced a list of the most important outcomes by clarifying their definitions and recording the exact outcomes that are required by people in the patient handling field.

3.1.1 Focus group methodology

As the aim for this phase of the study is to record the opinions of the PHA across the EU, rather than the definition of physical qualities or dimensions, the approach will use qualitative methodology. This phase will record and prioritise which outcomes are most important to PHAs. There are many methods for ascertaining personal information and attitudes or feelings: direct observation, interviews, questionnaires, attitude scales or standardised tests (Robson, 2002).

Due to the range of roles of PHA it is unclear how much the collective group understands about outcomes, and the process of ranking or prioritising the importance. King (1994) states that a qualitative research interview is a suitable method when:

- The study focuses on the meaning of a particular phenomenon to the participants
- Individual perceptions of a process are studied

- Individual historical accounts are to be recorded
- Exploratory work is required before a quantitative study can be completed
- A quantitative study has been carried out and a comparison or further explanation is required.

All of the above stipulations apply in this study where:

- The focus of the study is the perception of outcomes, outcome measures and outcome measurement tools for patient handling interventions
- The individual's opinion is sought
- Each PHA will have different experience and knowledge
- There will be different health systems across the EU
- The priorities and relative value of each outcome, or type of outcome, needs to be sought before the model can be developed
- Some quantitative analysis has already been completed in the systematic analysis of the outcome types in the peer reviewed and quality scored literature

The literature review identified the key themes of the outcomes, so focus groups should identify individual differences or similarities between the PHAs across the different EU groups, and give specific examples of each. The use of interviews also allows for interaction between the interviewer and the respondent, e.g. probing and prompting are known and accepted techniques for the interviewer (Robson 2002). Given that the level of understanding regarding the chosen or priority outcomes might be unclear in the respondent, the face-to-face data collection methods would be the best option (Mason, 2002; and Krueger and Casey, 2000).

The time constraints and the international nature of this EU comparison study added further complexity. The process was repeated and translated in four European countries. Time constraints suggested that the group interview format could improve the efficiency of the data collection. The boundary between a 'focus group' and a 'group interview' is unclear and the terminology has become interchangeable in recent years (Robson, 2002). With either model the benefits of the group structure should prove suitable due to the reasons below:

- The nature of the group interview improves the amount and range of data by collecting from several people at the same time.
- Natural quality controls on data and opinion exist as the group dynamic will restrict extreme views.
- The group dynamic helps maintain the focus on the important topics and it is fairly easy to identify the similarities and differences in the group.
- Participants tend to enjoy focus groups.
- The methods are relatively inexpensive and can be quickly set up.
- Participants can be empowered to comment and provide information that they may be reluctant to offer in other environments.

(Robson, 2002)

In support of the methods Kamberelis and Dimitriadis (2005) note, in a critical summary of focus groups in research practice, ‘On a practical level focus groups are efficient in the sense that they generate large quantities of data from relatively large numbers of people in a relatively short time. In addition because of their synergistic potentials, focus groups often produce data that are seldom produced through individual interviews.’ In further discussion they suggest that the effects are better observed in homogenous groups of people, as in this study.

3.1.2 Focus group design

Robson (2002) identified limitations for the focus group interview. The key issue in time limited studies is the focus of the group. Powney and Watts (1987) describe two types of group interview; a respondent interview where the interviewer remains in control of the process and informant interviews, where the direction is lead by the group’s emotions and information. As the focus of this study is the outcome measures for patient handling interventions, rather than personal emotion or attitude, it was decided that a more directed study was appropriate.

Higgins (1994) describes the ‘Nominal Group Technique’ as a method that allows a focus group to individually record their own thoughts based on a set scenario, before a group discussion on the exploration of ideas and preferences. This approach was used with Langford and McDonagh’s (2003) four stages, as follows:

1. Generation of ideas

   A patient handling scenario created the ideas and prompted the participants to create discussion (Appendix C)

2. Recording of ideas

   Data collection sheets allowed recording by the individual. The tape recording and transcription allowed for further analysis after the event. (Appendix C)

3. Clarification of ideas

   The recording and observation allowed for clarity and discussion of the key issues. To allow a better generation of discussion, and explanation, of the individual outcome measures, it was decided to allow the facilitator to collate all the documented outcomes during a short recess in the programme. The outcomes were then discussed by the group systematically. An opportunity was allowed for the group to add further outcome measures to the list as the discussion developed.

4. Voting on ideas.

   The final data collection sheet allowed an order to be selected by the participants (Appendix C). Each participant was requested to list their highest priority outcomes in order of importance.

The outputs from the four focus groups were (Fig 3.2):

a) Initial recordings of preferred outcomes for the scenario (Generation of ideas).
b) Transcriptions of the discussions of the compiled list (Recorded ideas).
c) Transcriptions of group discussion(Clarification of ideas)
d) Ranked lists of the five highest priority outcomes (Voting).

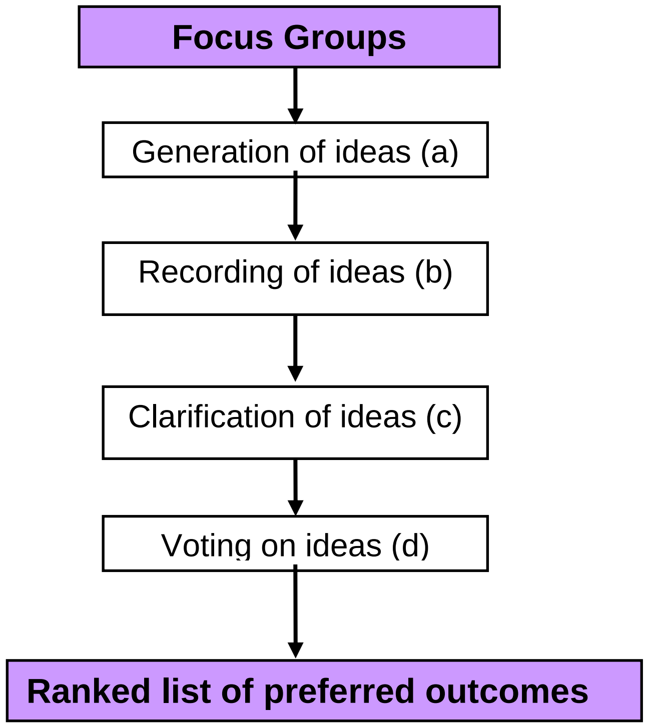

Figure 3.2 Focus group flow and outputs

3.1.3. Partner countries

This project utilised existing links with the EPPHE group. Hignett et al. (2007) described some of the national differences between health and social care provision and in the different approaches taken to meet the EC Manual Handling Directive (90/269/EEC). The countries recruited to participate in the study gave a good range of different service levels, country population, and the systems created to manage patient handling issues. Focus groups were completed in each country using the defined procedure. Up to 12 participants could be accepted in each group. The facilitators, and their affiliations, of the EU groups are listed in Table 3.1.

Table 3.1 Facilitators for the EU focus groups (Hignett et al., 2007)

Country	Pop (mill)	Locn.	Patient handling systems	Liaison and centre
UK	60.0	NW	Well defined job roles and documentation	Mike Fray Loughborough University
Italy	58.5	SE	Primarily in Occupational Health	Natale Battevi EPM, University of Milan
Finland	5.2	NE	Physiotherapy managed process	Leena Tamminen-Peter Finnish Institute of Occupational Health
Portugal	10.3	SW	Weaknesses in access to ergonomics support	Teresa Cotrim University of Lisbon

3.1.4 Participants

There are many stakeholders in the process of patient handling interventions. This project aimed to be inclusive and to gain the representation of all those involved in the design and implementation of patient handling interventions, for example: patient handling advisors, nursing managers, hospital risk managers, H&S advisors, occupational health nurses or managers, staff involved in transfers, and patients (past or present). Silverman (2001) suggests that the position and role of people involved in qualitative studies is an important factor in the validity of the results. It is clear that a senior manager whose focus is on financial results and robustness in a challenging market place would be different in outlook from a nurse supervisor focussed on patient care and the physical demands of a care task. This study recruited a range of people who fulfilled the role of the Patient Handling Advisor (PHA). The validation of models measuring the performance relative to patient handling management systems is further discussed in Chapter 4.

Healthcare and social care across the EU have different delivery systems, individuals and roles for the management of patient handling systems (Hignett et al., 2007). The role of Patient Handling Advisor (PHA) can be taken by a range of professions and levels of staff (Table 3.2). The EPPHE has considered the different roles within their forum and the process and description of how to best fulfil this position is being written in an ISO Technical Report presently (CEN/TC 122/WG 4 and ISO/TC 159/SC3/WG4). The following professional groups are noted in Europe as being represented in the role of PHA.

Table 3.2 Different roles and professions in the PHA position

Role	Profession
Injury prevention and management	Occupational health medics or nurses. Ergonomists Occupational safety professionals Work based physiotherapists
Professional advisors	Higher skilled individuals within the healthcare professions (Nurse, physiotherapist etc)
Training design and delivery	Professional trainers from any discipline or an educational background
Workplace supervisors	Usually from the care professions
Higher management	Risk or safety managers or senior healthcare managers with a role for patient handling in the organisation

3.1.5 Selection of participants.

The aim of the sample strategy is to obtain a 'homogenous' group rather than 'heterogenous', as the facility of conversational development is improved in homogenous groups (Kamberelis and Dimitriadis, 2005). For this study purposive sampling (Stake, 1994) was used to allow for a homogenous group to be developed based on each participant having similar skills, backgrounds and experience. A structure of the requirements to be a participant was developed and circulated to all facilitators. These included: experience in offering advice and management of patient handling issues in health or social services, either in hospital or the community setting; and some responsibility for patient handling advice within their organisation. Beyond the initial requirements each facilitator used their own established networks and recruited from their own geographical area from the individuals that were known to be practicing as PHAs.

3.2 Data collection

The following section describes the process for completing the focus groups, and collecting and analysing the data.

3.2.1 Procedure for focus groups

The process was developed using guidance on the completion of focus groups (Mason, 2002; Krueger and Casey, 2000; Robson, 2002; and Denzin and Lincoln, 2005). It was important to make the process as clear as possible as the translation to the three other EU languages meant that the primary researcher (MF) was not able to directly facilitate the groups. An information sheet (Appendix C) was developed for the facilitator (MF and EU facilitators) to outline the process and timings.

The systematic literature review (Table 2b.11) resulted in four distinct categories of outcome measures.

i. Organisational,
ii. Staff,
iii. Patient
iv. Performance of the task.

The data collection sheets were designed using with these categories to allow comparison. Figure 3.3 describes the outline of the structure of the data collection, summarises the flow of the focus group study, and shows how the different phases interact, to create the prioritised list of outcomes that will be used in the development of the IET (Section 4).

Phase	**Focus groups**	**Analysis**
Pilot Studies	UK Acute health UK Long term care Expert Panel Athens Expert Panel Boston	• Compare outcomes from two samples • Compare outcomes with practitioner data
EU Studies	UK Finland Italy Portugal	Recording • Sheet 1 analysis to define outcomes • Transcript coding to define outcomes • Sheet 3 analysis to define outcomes Clarification • Compare 3 sets of outcome definitions • Agree final definitions • Re-coding of transcripts using definitions Voting • Sheet 3 scoring to rank outcomes
Output		Ranked list of outcomes

Figure 3.3 Summary of the data collection and analysis for the focus groups

1. Generation of ideas

After an initial introduction the participants were given the scenario (Appendix C). Specific information was given to direct the participants to consider the measurement of outcomes rather than intervention style.

2. Recording

Data sheet 1 (Appendix C) was given at the onset, and the participants completed all sections without discussion with the other group members. When all participants had completed their own list, Data sheet 1 and the coloured pens were collected. The facilitator of the session compiled a discussion list of all the outcomes and measures that were listed in the different categories. This list formed the first data set to be analysed (See Focus Group Results Section 3.7) and the structure of the discussion. There was no requirement to follow the list exactly but it was a useful checklist to create, assist and direct discussion, to allow the comparison and detail of the selections to be clarified.

3. Clarification

Sheet 1 was returned to the participants as an aide-memoir for the discussion. A second data sheet (2) was circulated with a different coloured pen. Participants were informed that any additional points should be added to sheet (2) if they considered that outcome or outcome measure to be important.

The responsibility of the facilitator was to ensure that the key areas of organisational, staff, patient and performance were all covered and that any unusual points identified in the initial data sheets were clarified. Time management was a role for the facilitator, as approximately one hour was allowed for the discussion. When the discussion was complete data sheet (3) was circulated for completion.

4. Voting

Sheet (3) asked the participants to rank the preferred top five ranked outcomes that they would like to be measured in their organisations.

All data collection documents for the EU groups were professionally translated by a third party and distributed to the EU facilitators for checking. Any corrections were made before the groups were convened (Appendix C).

Figure 3.4 outlines the steps for data collection during the focus group.

Stage	Procedures
Pre-meeting preparation	The focus group conducted in the host language The facilitators made familiar with the focus group process with detailed instructions and attendance at an expert panel Formal statements for the introductions given to the EU group facilitators Formal set of information regarding the completion of the sheets A clear series of questions for the facilitator for the discussion Invitation to participate
Focus group preparation	Introduction to focus group Information Sheet Consent forms Job titles, qualifications and experience of all participants is collected Descriptions of the categories discussed with the participants for clarity before data collection begins
i)Generation of ideas	Detailed patient handling scenario Participants complete Sheet 1
ii) Recording of ideas	Facilitator collects individual outcomes recorded on Sheet 1 Facilitators to create discussion point list from Sheet 1
iii) Clarification	Discussion group based on issues collated (Whispering interpreter and discussion tape recorded) Discussion closed Participants complete Sheet 2
iv) Voting	Participants rank 5 most important outcomes from all discussions (Sheet 3) Collect all data sheets and close discussion. Debrief

Figure 3.4 Focus group procedure (Sheets 1,2,3 in Appendix C)

3.2.2 Group Management

The management of the discussion group was dependent upon the EU facilitator. Every effort was made to standardise the process and reduce possible variation between the different EU participants and facilitators (Barbour, 2007; Langford and McDonagh, 2003; and Robson, 2002). To manage this constructively and increase the level of control in the data collection:

a. A clear procedure was developed for all facilitators to follow as they lead the discussion.
b. The lead researcher (MF) attended all focus groups to observe and guide the data collection and support the facilitators.
c. Whispering translation was provided for the lead researcher (MF) to allow the discussion to be followed.
d. The lead researcher assisted in the development of the list of discussion points from the collated Sheet 1.
e. If points of clarity were required the lead researcher had an opportunity to seek further discussion through the facilitator.

3.2.3 Translation

A systematic review of studies using a translator (Wallin and Ahlstrom, 2006) showed that the role of the translator has not been closely scrutinised in many studies. But the role of the translator in the research and their background level of understanding should be noted. The open flow of discussion directed by the facilitator was recorded throughout. The whispering translation delivered by the interpreter was also recorded. This allowed the possibility of dual translation, and an extra level of scrutiny, as the EU language tape was sent to a third party for transcription and then for translation separately.

The dual translation also allowed for the different processes of facilitation to be observed, e.g. examination of terminology and different understandings placed on language by the discussion leader. The translation issues are likely to be raised on two levels in the EU groups, as both the facilitator and the translator will be open to personal interpretation. Several levels of control were introduced to limit the variations.

- The facilitators were invited to attend a focus group run by the researcher to familiarise them with the process (Portugal and Finland facilitators attended the Boston Panel, Italy and Finland facilitators attended the Athens Panel).
- The translators were recruited through the departments assisting with the project, to ensure some knowledge of terminology and language

- Specific guidance and information for the EU comparison group facilitators was defined to allow for consistency
- The primary researcher (MF) was present for focus groups to maintain close observation on the process.
- For the UK groups and the Athens Expert group a secondary observer was used to keep field notes and to note any unusual occurrences during the process (Appendix D).

The recording and translation process was as follows:

- Whispering real time translation was provided for the researcher (MF) and was audiotape recorded
- The discussion group was audiotape recorded
- Professional transcription was performed in the host language
- The transcription was professionally translated into English
- The whispering translation was transcribed separately
- The whispering transcript and the EU language translation were compared and compiled to make a single script for analysis
- The facilitators met with the researcher (MF) to check validity of both transcription and translation.

This dual translation format meant that the regular checking process of back translation from English to the source language was not required, as two independent translations had already been provided.

3.2.4 Ethics

Ethical approval was granted appropriate to each site and in accordance with Loughborough University procedures

3.3 Pilot studies

In addition to the main data collection from the four EU focus groups two pilot studies were also completed.

3.3.1 Pilot study 1. Health and social care

The delivery of care in acute health and the longer-term settings of community health, social care and educational systems varies greatly. The role of the PHA covers all care settings and is subject to the varieties of care delivery. To examine if there were differences in the outcome preferences, the UK data collection consisted of two distinct groups. One containing PHA from acute health organisations and one from community health settings, or longer term social and children's services. There agreement in the range of outcomes recorded and the rankings of preferred outcomes between the two groups. There was no need to separate the two groups in future studies (Fray and Hignett, 2007b). The two UK groups were amalgamated for further analysis and single combined groups were completed in the three other EU countries. (A summary of the findings can be found in Appendix E.)

3.3.2 Pilot study 2: Expert focus groups

Two focus groups were conducted in two conference settings (Athens, 2007 and Boston, 2007) to explore the potential differences between the role of the academic and the practitioner for the following reasons:

- An opportunity for all EU facilitators to attend an expert panel to experience the format before leading their own sessions.
- Inclusion of interested academics, some from outside the EU for comparison with the practitioner data
- Recruited from delegates attending the conference with an active participation in patient handling research.

(A summary of the findings can be found in 3.6.)

3.4 Analysis of focus group data

Perakyla (2005) outlines that in qualitative research of the spoken word, there are two main types of data that might be investigated and analysed: interviews and naturally occurring conversation. In a similar way, there are two areas of interest for analysis and those are the linguistic interactions of the conversation and the themes or contents that are discussed. In this study it is clear that the analysis of the transcribed focus group interviews are to be analysed for thematic content. The purpose of the analysis is to identify the relative importance of the outcomes considered for each individual, and within each of the homogenous groups.

Three data sets were collected and the content was analysed as described below:

a) The lists of possible outcomes from Sheet 1(Recording)
b) The transcriptions of the discussions (Clarification)
c) The ranked lists of the preferred outcomes (Voting)

a) The initial recordings of the possible outcomes were analysed for content recorded (Sheet 1). Each outcome recorded within each of the sections was grouped in the classification of organisation, staff, patient and performance of task. Complete lists were produced for comparison between the different EU groups. All documented outcomes were included in this initial review and were scored for frequency of inclusion.

b) The discussion sections were recorded. The transcription of the whispering interpreter, and the translation of the EU discussion, were combined to make a single document for analysis. The NVivo 7 package (QSR International) was used to identify the content of discussion completed during this phase. The original text collection from Sheet 1(a) was coded using categories from the literature review. This analysis gave an opportunity to evaluate the original key themes against those suggested within the group. Tesch (1990) identifies this form of analysis as content analysis in terms of the language and recorded text, and secondly as thematic analysis when incorporating the comprehension or the meaning of the discussion. Krueger and Casey (2000) suggest that all focus group interviews are derivations of the 'long table' approach. As all comments and discussions need to be understood in real time, the importance and comparison of the outcomes were analysed as found. There were several factors that needed to be interpreted in the focus group data to examine the importance of the issues discussed. Frequency of mentions, the specificity of the description, the emotion of the speaker and the extensiveness of the description all create levels of importance within the transcript (Krueger and Casey, 2000). The emotional input of the participant was not possible to analyse due to the effects of translation and transcription. The analysis allowed each outcome and discussion theme to be grouped. This thematic and content process will be presented as a flow of analysis, and importantly as a set of complex definitions for the key themes.

c) The final data collected were the priority lists created by the participants at the close of the focus group interview. These were scored and ranked on a 5-point scale. The rankings were accumulated over the full EU sample and resulted in a priority list (Section 3.7).

d) Defined themed groups were recorded from the discussion transcriptions (b) and from the ranked data sets (c). As a secondary comparison the thematic analysis was repeated using the 12 most important themes to ensure stability in the identified themes.

e) Statistical analysis was completed on the ranked lists using Kendall's Concordance (Seigal and Castellan, 1988) to explore similarities between the EU groups and the expert groups.

3.4.1 Reliability and validity

There has been much written surrounding the questions of evaluating the quality of focus group work and qualitative research. The two issues of note are reliability (Bryman, 1988:p77) and validity (Hammersley, 1990:p57).

Issues of reliability are primarily managed by the organisation of the data collection (Bryman, 1988); the collection of field notes as an active observation, the collection of secondary observer field notes, discussion of the field notes and transcription as soon as possible after the event, and journals of the coding formats (Bryman, 1988; Hammersley, 1992; Spradley, 1979; and Kirk and Millar, 1986).

Hammersley (1990) describes validity as a true record of what was spoken and intended, and truth as ‘the extent to which an account accurately represents the social phenomena to which it refers’. The validity of this study is enhanced by:

a. Analysis of the UK pilot studies to compare health and social care
b. Comparison of four different EU sources
c. Comparison of two expert focus groups against practitioner data
d. Flexibility to allow the participants to create an individual set of preferred outcomes on Sheet 1 (Generation of ideas)
e. Secondary selection of documented outcomes on the repeated Sheet 2
f. Inclusion of all written outcomes in the discussion forum allowed all opinions and options to be analysed (Recording of ideas)
g. Comparison of the discussion group transcripts and the ranked outcomes from Sheet 3 (Clarification against voting)
h. Expert review of findings (EPPHE panel, Nov 2009, Chapter 5)

Silverman (2001:p233) would suggest that by addressing the areas of analytic induction, constant comparison and comprehensive data treatment this study design allows a high level of strength, and the derived set of definitions for the required outcomes should be ‘generalizable’ to the wider field of patient handling advisors. Table 3.3 shows how the procedures in this study meet the different validation methods.

Table 3.3 Methods to improve ‘generalizability’. (From Silverman 2001)

Method	Study response
Analytic induction	d, e
Constant comparison	c, f, g, h
Comprehensive data treatment	a, b

3.5 Summary

The methods described use the opinion and considerations of PHA's from four EU countries to develop a prioritised list of outcomes from patient handling interventions. All focus group discussions were completed in the host language, with translated documentation and a local facilitator. The discussions were interpreted in real time for the primary researcher, and the audiotape of the discussion was translated independently. The data collection has taken guidance from many publications to enhance the reliability and validity of the data that is collected. The results of the focus groups are presented in Sections 3.6 and 3.7.

3.6 Focus group results. Pilot studies

The results from the different focus groups will be reported in this section. The two sets of pilot studies will be briefly discussed to show the reliability and validity in the data collection methods and the four EU groups will be discussed in detail in the later sections. The pilot study review will cover only the documented responses to Sheets 1 and 3. The full analysis of the transcript will be included in the EU study (Section 3.7). The analysis will indicate that repeated comparisons of the data were completed to improve the validity of the findings.

3.6.1 Pilot focus group 1. Health and social care

Two UK pilot focus group interviews were completed as described in 3.3.1, containing participants from acute healthcare and long-term health or social care separately. The aim of this initial pilot was to compare the data from the two groups of participants (Figure 3.3).

3.6.1.1 Participants

The participants all completed the appropriate consent agreements before the interview. The selection criteria, for the group were based on a convenience sample of people who volunteered through a geographical special interest group. One focus group recruited eight PHAs from acute healthcare hospitals.

The eight participants represented six different organisations from Sheffield, Chesterfield, Birmingham, Derby, Mansfield and Leicester. All were employed in their organisations as PHAs at various levels and with varied experience. The second focus group recruited 6 participants from the long-term care sector. The six participants represented three organisations, one from NHS primary care, three from social services care and two from educational services. Geographically they represented Derbyshire and Nottinghamshire. One of the social services representatives was less experienced than the general group but was employed part time as a PHA. This participants notes lacked detail compared to the other members of the group.

Data were collected from all participants for all three stages. In addition notes were collected by an independent observer for both groups, to analyse the process and content of the group (Appendix D). Each of the focus groups was completed in a timely fashion and the allotted time of 2 hours was sufficient. All data sheets were numbered with the participant table position, and no personal details were recorded on the data sheets. The researcher recorded the table position and individual to facilitate the transcription. As the researcher knew the group, a personal occupational and educational history was collected retrospectively to complete the data set.

3.6.1.2 Idea Generation (Sheet 1)

Sheet 1 was structured by the beneficiary status recorded from the literature review i.e. organisational, staff, patient and task performance. The results from Sheet 1 were reviewed during the focus group to create the discussion point list, and after the focus group session to ensure inclusion of all outcomes. The recorded outcomes are shown below in Tables 3.4 to 3.7, being grouped by the beneficiaries. Each of the tables compares findings from the acute health group relative to the long term care group.

Table 3.4 UK Pilot: Organisational Outcomes

Theme	Acute Health Care	Long Term Health or Social Care
Staff accidents or absence	Sickness absence Accident reports Replacement staff costs – Retention	Financial costs of staff Loss of experience Staff turnover Absence Return to work data
Costs of litigation	Decreased Litigation	Insurance costs Compensation costs Decrease litigation
Others	Compliance Bed Blocking No of risk assessments Patient complaints	Improved environment to deliver care Staff morale Improved communication

Outcomes related to the frequency and costs of accidents and sickness absence were important in both groups (Table 3.4). The language used by the groups varied a little, with the long-term care group being more financially oriented in the wording. For example, social care is self-insured under local council schemes that may account for a different focus. Patient complaints and the function of delayed discharge were core to the acute health group.

Table 3.5 UK Pilot: Staff Outcomes

Theme	Acute Health Care	Long Term Health or Social Care
Staff accidents or absence	Incidents and accident figures Injuries Treatment services and outcomes	Decreased Injury and absence Occupational health data Health
Equipment provision	Equipment provision	Equipment provision
Staff perception	Staff feel valued Fatigue Job satisfaction	Decreased effort RPE Confidence in methods Discomfort
Training outcomes / behaviour	Training figures Knowledge and training records	Level of supervision Comply with training Quality and style of

	Working practices	movement
Others	Culture of handling in the organisation	Policy Improved communication

Table 3.5 shows the staff outcomes. The overlapping of the outcomes is shown in this section. Sickness absence as a staff measure featured strongly from both groups. This shows that there is both an organisational measure and a staff measure for sickness absence. The perception of workload was well represented in both groups, and in part indicates an awareness of psychological factors (e.g. job satisfaction), being valued and physical factors. Some outcomes would fit the description of intervention descriptions, e.g. training numbers/records, in addition to observation values for how the task was completed (See Robson measures section 2b.1.2).

Table 3.6 UK Pilot: Patient Outcomes

Theme	Acute Health Care	Long Term Health or Social Care
Damage to patient	Injury Shear/friction damage Infection control measures	Injury Unsafe
Patient perception	Comfort Perceived confidence Satisfaction	Comfort Attitude
Patient condition	Improved patient independence	Improvement in condition Improved independence Decreased recovery time
Others	Decreased complaints Standardisation of methods	Consistency Quality of care Hospital admissions Audit/feedback

Patient outcomes (Table 3.6) showed considerable similarity across the three areas of damage to the patient, patient perception and the possibility of improving or worsening a patient condition. The introduction of the term ‘quality of care' could link with many other outcomes linked with patient perception of patient handling tasks.

Table 3.7 UK Pilot: Performance Outcomes

Theme	Acute Health Care	Long Term Health or Social Care
Productivity	Speed	Efficiency of time Efficiency of effort
Safety and competence	Appropriate use of equipment Competence-Skills Safety	Competency Compliance with methods Decreased incidents
Documentation	Documentation	Plans and documents
Others	Use of ergonomics tools	Equipment available

The performance outcomes (Table 3.7) showed reduced variation with outcomes for productivity measures, safety and competence, and the documentation of risk assessments or handling plans.

It was found that, throughout the four categories, there was major agreement between the acute healthcare and the longer term health and social care groups, though some specific differences were noted in the definition of the terms. The dual reporting of many outcomes was noted for further consideration (Section 3.7). The identification of different levels of outcome measures (Robson et al., 2007) also was recorded, and what may be perceived as a positive outcome to a PHA may simply be a record of their intervention, rather than an effect of their actions.

3.6.1.3 Voting (Sheet 3)

The scores for the acute and long term groups are recorded in Tables 3.8 and 3.9. At the stage of the pilot focus group analysis all outcomes in Sheet 3 were included, though outcomes that were clearly linked were recorded as the same. For example; patient comfort, dignity, development of independence were all recorded as patient assessed ‘Quality of Care’ measures. Each participant’s ranking scored 5 points, for the most favoured, and 1 for the least favoured. The scores for each row are added to give a cumulative total.

Table 3.8 Preferred outcomes: Acute health care group

	Outcome recorded	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Totals**
1	Reduce staff MSD and sickness absence	5		5		4	5	6	5	**30**
2	Reduce incidents/accidents	4	5	1						**10**
3	Appropriate and sufficient equipment/resources	3						2	4	**9**
4	Quality of care: improve patient comfort, independence dignity	2	2		1		2	4		**11**
5	Decrease patient injury	1		3			4			**8**
6	Increase compliance with safe systems		4		3					**7**
7	Job satisfaction/morale		3			2			2	**7**
8	Decrease claims		1							**1**
9	Patient satisfaction reduced complaints			2						**2**
10	Replacement costs for staff			4		1				**5**
11	Improved risk assessment & documentation				2	5	1		3	**11**
12	Attitude to make M&H part of best practice				5		3			**8**
13	Improved knowledge/Competence				4					**4**
14	Moving and handling as patient safety issue					3				**3**
15	Improved insurance rating							3		**3**
16	Access to training programmes								1	**1**
17	Consistency of care									**0**
18	Efficiency of performance									**0**
19	Preventative research									**0**

Table 3.9 Preferred outcomes: Long-term health group

	Outcome recorded	**1**	**2**	**3**	**4**	**7**	**8**	**Totals**
1	Reduce staff MSD and sickness absence	1	2	2	8		5	**18**
2	Reduce incidents/accidents	3	5		2			**10**
3	Appropriate and sufficient equipment/resources		3	5	4			**12**
4	Quality of care: improve patient comfort, independence, dignity	5		3			4	**12**
5	Decrease patient injury							**0**
6	Increase compliance with safe systems				1			**1**
7	Job satisfaction/morale		4	4			3	**11**
8	Decrease claims							**0**
9	Patient satisfaction reduced complaints							**0**
10	Replacement costs for staff	2	1			2	1	**6**
11	Improved risk assessment & documentation							**0**
12	Attitude to make M&H part of best practice					3		**3**
13	Improved knowledge/Competence	4						**4**
14	Moving and handling as patient safety issue							**0**
15	Improved insurance rating							**0**
16	Access to training programmes					4		**4**
17	Consistency of care			1		5		**6**
18	Efficiency of performance					1		**1**
19	Preventative research						2	**2**

3.6.1.4 Discussion

The format of the focus group interview seemed to be successful, as a large amount of data was collected, and the process allowed the participants to express their own preferred outcomes, both in the discussion forum and in the individual written documentation.

Some general points were identified about the process:

- The completion of Sheets 1 and 2 during the focus group interview gave a good spread of data for discussion.
- There was good agreement between the acute health and long-term social groups.
- Lapses and omissions were corrected in general on Sheet 2.
- Participants with lots of ideas needed two sheets of paper (e.g. Long term group participant 4.)
- Double recording of outcomes was noted across organisation, staff, patient, and performance categories.

The records of the independent observers were scrutinised and the following issues were noted (AH =Acute health group, LT=Long term group):

- The process of creating the list of topics from the collected sheet 1 allowed discussion to flow well (AH).
- There was a clear concern from both groups that measuring the chosen outcomes might be difficult in their organisations (AH, LT).
- Many reasons why the outcomes were not measured were suggested (AH, LT).
- Both observers noted time factors with the additional translation requirements for the EU groups.
- Some participants did not relate to the relationship between interventions and outcomes.

There were some concerns related to the beneficiary categories on Sheet 1 (Generation of ideas). There were discrepancies over the beneficiary category where the outcome was recorded. These differences were also found in the coding of patient handling studies in the literature analysis (Section 2b.4). The clearest example was the recording of accidents and musculoskeletal injuries as both organisational and staff outcomes. This indicated that in the main data collection clear definitions had to be developed. The findings showed very close agreement between the two groups for content and breadth of included outcomes.

In the voting stage (Sheet 3) all participants were asked to score the highest five outcomes. The earlier data found there were similarities across the two groups. This was more evident when examining the highest cumulative scores for the two groups. Table 3.10 shows that four of the five highest ranked outcomes are recorded in both groups. Scores are shown as a total score and a percentage for each group.

Table 3.10 Highest 5 preferred outcomes from cumulative scores

	Acute Health Group (N=8)	**Total** (%)	Long Term Health Group (N=6)	**Total** (%)
1	Reduce staff MSD and sickness absence	**30** (25.0)	Reduce staff MSD and sickness absence	**18** (20.0)
2	Quality of care: improve patient comfort, independence dignity	**11** (9.2)	Appropriate and sufficient equipment/resources	**12** (13.3)
3	Improved risk assessment & documentation	**11** (9.2)	Quality of care: improve patient comfort, independence dignity	**12** (13.3)
4	Reduce incidents/accidents	**10** (8.3)	Job satisfaction/morale	**11** (12.2)
5	Appropriate and sufficient equipment/resources	**9** (7.5)	Reduce incidents/accidents	**10** (11.1)

It was concluded that due to the similarities in Sheet 1 and Sheet 3, the EU groups could accept PHA from acute and long-term health backgrounds. The breadth and conformity of the list of outcomes also indicated that it would be suitable to merge the two UK pilots together, and include them in the full study.

3.6.2 Pilot focus group 2. Expert focus groups

Two expert panel focus groups were completed in Athens, Greece in 2007 and Boston, USA in 2007. The expert panel focus groups were recorded and analysed in the same way as described earlier (Section 3.3.1). Both expert panels were facilitated by the lead researcher (MF).

3.6.2.1 Participants

Information was not collected about the experience and qualifications of the expert panel as the participants were representatives on the EPPHE, or people who were either presenting or attending an international research conference. The Athens expert panel had representation from groups that have developed certain tools and risk indices to measure the outcomes of patient handling. The participants in the two expert panels are in Table 3.11.

Table 3.11 Participants for Expert Groups

Focus Group	No. participants	Countries Represented	Observers
Athens, Greece	5	Italy 3 (EU facilitator) Finland 1 (EU facilitator) Netherlands 1	SH (LU, UK) EW (Arjo NL) LS (Arjo SW)
Boston USA	5	Germany 1 USA 1 Belgium 1 Portugal 1 (EU facilitator) Australia 1	SH (LU, UK) LTP (Finland)

3.6.2.2 Idea Generation (Sheet 1)

As expected, there was a slightly different focus from these more academic individuals. Table 3.12 shows there was still a focus on the sickness absence data, but there was more discussion about how and what would be measured. There was a long discussion regarding the benefits and problems of the MSD prevalence as an outcome leading to the costs, and the financial burden of high accident rates, and high MSD rates as the most frequently recorded outcomes. Participants from Germany and Belgium (Boston Panel) both registered the audit and accreditation process that was specific to their own health care systems. The Athens panel recorded both safety culture and quality of care as organisational intervention measures, which differs from the previous pilot study.

Table 3.12 Expert Pilots: Organisational Outcomes

Theme	Athens Panel	Boston Panel
Staff accidents or absence	Sickness leave Increased worker fitness	Health status Decreased MSD rate Retirement/leaving post
Costs of litigation	Decreased claims Decreased patient claims	
Financial	Cost benefit overtime Productivity	Costs of absence Costs of Training Compensation costs
Organisational values		Image of organisation Accreditation/audit/screening
Others	Quality of care Safety culture Decreased exposure to tasks Policy	

Table 3.13 Expert Pilots: Staff Outcomes

Theme	Athens Panel	Boston Panel
Staff accidents or absence	MSD symptoms Injuries Health measures Decreased back pain	No of accidents/incidents MSD's
Risk indices	MAPO index score Risk index	% control measures implemented
Physical observation	Comfort Postures Subjective response	Discomfort Posture Time stress Weight lifted
Equipment	Use of equipment Compliance Training skills	Acceptance Use of equipment
Others		Workplace surveys Satisfaction Decreased complaints

Table 3.13 shows the outcomes recorded as benefitting the staff. There was a focus on the provision and use of equipment. The research evidence has suggested that equipment provision and use, reduce the effect of biomechanical loading, and in particular the lifting component. This is an interesting concept and one for further discussion in the full evaluation of the priority outcomes (Section 3.8.8). The panel discussed a mix of MSD outcomes versus the physical exposure measures of force and postures. These two outcomes are separated by the Robson classification, as MSD outcomes is a real measure in the target population (level 3), and reduced exposure to physical risk is not (level 2) (Robson et al., 2007).

Table 3.14 Expert Pilots: Patient Outcomes

Theme	Athens Panel	Boston Panel
Patient perception	Safety Perceived satisfaction Well being	Fear/Safety Anxiety Acceptance Understanding
Quality of care	Quality of care	Quality of care
Patient Injury/accident	Injury/damage MSD's Falls accidents	Falls Skin condition / tears/ ulcers
Patient condition		Mobility Night disturbances

Patient outcomes (Table 3.14) showed much similarity across three areas of patient injury, patient perception and the possibility of improving or worsening a patient condition. Further discussion in the focus group again raised concern about how the measures would be calculated, as there was a clear understanding of the complexities of apportioning the cause of patient condition to a single factor. This did not reduce the wish of the groups to have a measure of patient factors as an assessment tool. Table 3.15 showed agreement in outcomes recorded against task performance, where competence and compliance and efficient work practices were important.

Table 3.15 Expert Pilots: Task Performance Outcomes

Theme	Athens Panel	Boston Panel
Method of completing task	Compliance with procedures Use of equipment	Compliance Competence Assessment systems Professionalism Efficiency

3.6.2.3 Voting (Sheet 3)

The expert panel data was combined to give a single set of scores and is presented and discussed in section 3.9.

3.6.2.4 Discussion

There was a small change in the focus of the comments recorded in these expert panels, but many similarities in the topics in the UK pilot focus groups.

The expert panels were different to the UK Pilot focus groups, and some important findings were recorded in the field notes (Appendix D), for example:

- Some participants raised the concern that their responses would be different if they considered the questions as a researcher or as a practitioner. It was the perception of the researcher (MF) that these concepts were the same, as measuring the outcomes from a patient handling intervention do not rely on what intervention takes place. The group discussed the role of the scenario and understood that they were not to design the intervention, but outline methods for measurement of the improvements.
- Two of the participants needed a translator and consequently could not enter the discussion as freely as others.
- One participant had major difficulties with the concepts expected in the focus group. The responses to Sheet 1 spread over four pages and were a mixture of management targets, intervention strategies and very specific outcome measures. For example ‘The money available dictates the type of intervention’ and ‘the type of intervention dictates the type of measures used’. This participant also could not complete the ranked

selection (Sheet 3), and commented that they ‘felt pressured into giving answers that were not correct’ and felt ‘pressed through a channel’.

- The comments from this participant suggested that there were significant differences in some countries in the role of the PHA, which may prove to be confounding. These difficulties caused that participant’s information to be removed from the analysis, and any follow up research would not be completed in that country until the full IET had been developed and proven in other locations.
- The independent observer considered that the scenario was un-necessary for the expert panels, as they had sufficient skills and knowledge to discuss the issues without prompting. This possibly raises concerns over the alignment of expert against practitioner data.

3.6.2.5 Facilitator experience

The Finnish (LTP) and Italian (NB and OM) facilitators attended the Athens panel and the Portugal (TC) facilitator attended the Boston panel. The Finnish facilitator also assisted with the Boston panel. A debriefing session was held for the facilitators after the discussion. All agreed to continue with the project, identified the need to be involved with the translation process for the documentation, and agreed to locate participant groups based on the information provided.

3.6.3 Summary of pilot studies

The use of four pilot focus groups improved the data collection procedure. The comparison between the acute health and long-term health groups in the UK found that the preferred outcomes were similar in the two areas, so future focus groups could combine PHAs from both sectors. As there were no structural changes to the data collection procedure, the two UK pilot groups were compiled and used as the UK data set (3.7). The data from the two expert focus groups were included in the analysis as a comparison with the four EU groups (3.7).

3.7 EU focus groups results

The role of the PHA and the experience and function of the role are different across the EU (Hignett et al., 2007). The qualitative approach used in this study, allowed different countries and levels of PHA to be involved in the definition of the important outcomes. The aim of these focus groups was to record the important outcome measures to the participants, and create a prioritised order from the combined data.

Initially a brief overview of the structure, process and demographics of the participants will be reported. The findings of the focus groups are then presented in the structure from section 3.6.1, i.e. organisation, staff, patient, task and other outcomes of importance.

The outcomes recorded from the focus group participants during the stages of generation and clarification, (Sheet 1 and the transcript analyses) were analysed to develop a fully inclusive list of outcome themes. Secondly, the voting process is described to refine the definitions and rank the selected outcomes, to develop a final list of outcomes for the next stage of the project

3.7.1 Introduction

The EU focus groups were facilitated by members of the EPPHE on a voluntary basis. Each facilitator chose their own venue and provided suitable arrangements for the group. The facilitator made contact with the participants and completed all communication relating to the focus group, using the translated documentation. Table 3.16 shows the facilitators, locations and participants in the groups

Table 3.16 Facilitators and locations for focus groups

Country	Facilitator	Location	Observers	Numbers attending.
UK	Mike Fray	Loughborough University	SH. AJ, AT	14
Finland	Leena Tamminen-Peter	Finnish Institute of Occupational Health, Helsinki	MF, SH	7
Portugal	Teresa Cotrim	University Hospital, Lisbon	MF, SH	7
Italy	Olga Menoni	EPM, University of Milan	MF, NB	8

3.7.2 Participant demographics

The composition of each group was selected by availability to attend and willingness to travel for the meeting, as no financial support could be provided. A short questionnaire recording experience was completed by all participants (Appendix C). The information for the UK group was collected retrospectively via personal communication with the researcher.

Table 3.17 Experience of the participants.

	Classification	UK	Finland	Portugal	Italy
Profession	Nurse	5		3	1
	Physiotherapist	1	1	2	
	Occup. Therapist	1	1		
	Occup. Physiotherapist		5		
	Occup. Physician				4
	Other	7		2	3
Training	Postgraduate course	10	2	1	5
	PH training qualification	8	1	3	5
	Short courses	12	5	2	
	No specialist training			1	2
Experience (Years)	0-2	1	3		1
	3-5	1	2	1	2
	5+	12	4	6	5
Is PH part of your job	No				
	Small part		2	1	
	Major part	4	5	5	8
	All	10		1	

The professions and different qualifications of the participants are recorded in Table 3.17. Most were health care professionals. The Finland group requested that occupational physiotherapist be considered as a different category, because they have a different qualification route to physiotherapists. Two of the Portugal group were not healthcare trained. One was an ergonomist and one was an occupational health and safety (OHS) technician. The Italy group had the largest range of qualifications with one nurse; two safety officers, one work inspector, and four occupational physicians. The UK group had a large number of non-qualified healthcare practitioners (7) mostly within the social care practitioners. These were either professional trainers specialising in patient handling, or social services carers who had developed in the PHA role.

The professional groups recorded in Table 3.17, indicated the kind of training given for patient handling or ergonomics skills. More participants in Italy and UK recorded the completion of postgraduate programmes and PH training qualifications, but almost half of the Finland and Portugal group also confirmed this higher level of training. Differences were identified in the availability of higher-level postgraduate programmes in the UK, and the requirements of occupational physicians to attend postgraduate programmes.

Only five participants from the sample had less than two years experience in their current job role and 75% (27/36) had over 5 years experience. The participants were mostly involved in the management and prevention of patient handling injuries. Only 8% (3/33) reported patient handling as a small part of their usual job role, with 92% reporting this as either a major part or their entire job role.

In summary, the participants in the four EU focus groups fulfilled the requirements of the study, and showed that they were educated to provide advice on patient handling and ergonomics. They were involved in the process of managing patient handling risks, and were experienced in that role.

3.7.3. Focus group procedure

All the data were collected by the procedure outlined in Section 3.3. For clarity, the presentation of information from the focus groups will follow the conventions in Figure 3.5. The findings from all focus groups can be found in Appendix E, where the content of each discussion is related to the outcomes registered in the analysis of the generation of ideas.

	Group Title	Terminology
Focus groups	UK Acute health	UKAH
	UK Long term health	UKLT
	UK Combined	UK
	Expert Athens	ExpA
	Expert Boston	ExpB
	Expert Combined	Exp
	Finland	Fi
	Portugal	Po
	Italy	It
Individuals	Participants	Group name and place number. (E.g. Fi, 7)
Quotes	Comments from transcriptions	Group name and page number from NVivo reports (e.g. It, p27)

Figure 3.5 Terminology for describing focus group data

<u>3.7.3.1 Generation of ideas (Sheet 1)</u>

The first opportunity for the participants to record their preferred outcomes was during the generation of ideas phase on Sheet 1. During the focus group, the EU facilitator and MF reviewed all Sheet 1 data to create the discussion structure. The completed sheet 1s were analysed again for content and theme after the focus group to check for errors or omissions. The information presented in this section compares the included list of outcomes for the four EU groups including the compiled Expert group data. The thematic analysis compares and links the individual comments to create an overview of the outcomes recorded on Sheet 1. During this first analysis no exclusion criteria were used, and all documented comments were considered.

The structure of the focus groups and the development of the scenario assisted the participants to consider the outcome measures in the written documentation and the discussion. The homogeneity of the participants also facilitated discussion, as many of the participants were contemporaries with shared interests, locations and job roles. There was a wide variety of outcomes recorded by all the groups. The UK groups had the lowest number of outcomes per participant (4.29), and the highest were in the Portugal (5.71) and Italy (6.5) groups. Some repetition was recorded in the outcomes from the larger groups. The outcomes from Sheet 1 were analysed for content and themes to give definitions of the outcomes. The data is presented in the four categories defined on the data collection sheets (Table 3.18).

Table 3.18 Outcomes from the focus groups

	UK	Fi	Po	It	Exp
Participants	14	7	7	8	10
Organisation	14	13	12	11	18
Staff	20	9	9	14	17
Patient	12	8	9	13	11
Task performance	8	9	6	13	6
Others	4	3	4	0	4
Total	**58**	**42**	**40**	**51**	**56**

Both the UK and Italy groups recorded more staff outcomes than organisational outcomes. The ratios of patient outcomes were similar across the four groups. The UK group recorded less task performance data than the other three groups. Both Finland and Italy recorded almost 25% of their outcomes in this section. The overview of outcomes recorded in each section shows some of the variations between the countries. The difference in focus may be due to cultural, organisational or individual differences but this was not part of this study.

3.7.3.2 Clarification of ideas: Analysis of Transcribed Focus Groups

Each focus group was analysed under the same conditions to maintain the accuracy of the content. The UK and expert groups were transcribed by professional service and the transcript checked by the researcher twice. The foreign language groups were sent for separate transcription and translation with external professional services. The audiotapes recorded the whispering interpreter alongside the foreign language discussion and did not allow for separate transcription and translation. The transcription services provided a foreign language transcript, and a single translation using both the foreign language version and the whispering interpreter information. The researcher clarified the transcription twice in line with the real time interpreter, to mirror the analysis of the UK tapes.

The clarified transcripts were coded using the NVivo7 (QSR International 2006). The transcripts were coded individually for all aspects of outcomes and interventions. The coding structure used the organisation, staff, patient and task categories. The analysis of the generation (Sheet 1) and clarification (Sheet 2 and discussion) stages was used to define the most important outcome themes for the participants. These important themes were then taken forward to the voting stage (Sheet 3).

3.7.4 Organisational Outcomes (Figure 3.6)

3.7.4.1 Generation of ideas (Sheet 1)

The most frequently recorded and clearly described outcomes were incident/accident figures, and the resulting sickness absence or losses from musculoskeletal health changes. This is not surprising given the focus of the manual handling regulations from the EU directive, as an extension of occupational health and safety regulation. The outcome measures identified for the measurement of MSDs were comprehensive, including staff turnover, recruitment costs, loss of experience and the relocation of staff to other areas. The sickness outcomes were clearly linked to the measures of financial impact on the organisation. Only the UK and Expert groups identified the compensation culture and litigation as possible financial outcomes. There was a lack of detail in the costs section from the Finland, Portugal and Italy groups, which could be due to the role of the participants in their hospital system, e.g. level of management. Reference was made to MSD and accidents in the staff section, but the focus of those definitions was on the personal impact of the accident or injury.

All groups identified the ratio of staff numbers to dependent patients in delivering appropriate care as an outcome. The relationship of staff to numbers of dependent patients was a topic for discussion in Portugal and Italy in particular (See 3.7.4.2).

The management of risks and the delivery of safe systems as an outcome were clearly identified e.g. improvements in risk management and risk assessment systems. There was awareness that organisational behaviour and systems with respect to policies, roles and safety culture were measurable outcomes. Finland included an interesting outcome of ‘management commitment’ by almost all participants in that group. Discussion with the facilitator (LTP) clarified that this relates very closely to organisational behaviour and the showing of a strong level of management commitment to control the PH risks.

Behaviour was also identified at an individual level through the measure of compliance, relating to participants in terms of the provision of training and recording of training outcomes. External reputation of the organisation was also recognised as an outcome in three groups. Finland, Portugal and the Expert group all recorded ‘image’ as an outcome, with Australia and Germany participants recording accreditation as a system that was already in place. The UK and Portugal recorded patient or staff satisfaction as organisational issues, though they occurred again in later sections of the study.

Theme	UK	Finland	Portugal	Italy	Expert
Accidents	*Accident figures*	*Accidents/Incidents/Near miss*	*Incident numbers*	*Numbers of accidents*	
Absence or staff health	**Sickness absence** **Replacement staff costs** • **Turnover** • **Loss of experience** **Return to work** **Recruitment costs**	**Sick Leave** **Increased productivity** • **Decrease sickness** • **Decreased turnover** **Improved well being**	**Review occupational health interventions** • **Return to work** • **Job displacement** • **Alternative work** **Injury numbers** • **Absenteeism** • **Severity** • **Length of illness**	**Turnover of staff** • **Moving or leaving** • **Decreasing hours**	**Sickness leave** **Increased worker fitness** **Health status** **Decreased MSD rate** **Retirement/ Leaving post**
Financial costs	*Financial* *Decreased litigation* • *Insurance* • *Compensation* • *HSE prosecution*	*Costs*	*Costs*	*Costs/expenses*	*Decreased claims/compensation* *Decreased patient claims* *Cost of absence and Training* *Cost benefit over time* *Productivity*
Staff ratios for care delivery	**Improved environment to deliver care**	**Staffing numbers**	**Planning services on patient dependencies** • **Staff numbers**	**Team work** • **Less time** • **Less staff** **Ratio of staff to patients** **Task analysis** • **Amount of work** • **Length of shift** **Shift times**	**Decreased exposure to tasks**
Training skills and compliance	*Compliance*	*Number of people trained* • *Lack of training* • *Quality of training* *Compliance* *Improved co-operation*	*Behaviour* • *Compliance with safe methods*	*Training numbers* *Expert local group (on site)*	
Risk management tools	**Number of risk assessments**	**Risk assessment improved**	**Risk management system** • **Policy** • **Roles and responsibility** **Participation in risk assessment** • **Evaluating risks**		**Safety culture** **Policy**
Provision of equipment			*Provide and maintain appropriate equipment*	*Optimisation of equipment* • *Number of aids MAPO* *Work environment* • *Workspace* • *Furniture*	
Satisfaction and image	**Patient complaints** **Staff morale**	**"Image"**	**Staff satisfaction** **Patient satisfaction** **Image in public**		**Image of organisation** **Accreditation/audit**
Others	Communication Delayed discharge	Commitment	Humanisation of care		Quality of care

Figure 3.6 Matrix of Organisational Outcomes

3.7.4.2 Transcription analysis (Clarification)

The discussions surrounding organisational issues created more recorded points than the other sections. Some differences were noted in the focus of the discussion, in that some groups discussed the difficulties of implementation (It, Fi) where some held closely to the discussion of outcomes (ExpA, ExpB, UKAH and UKLT).

Safety culture and organisational commitment were described as requiring a management structure to support the process. The involvement of management at all levels (It p6, Po p1, 2, 17, ExpB p2, Fi p3, UKAH p14) was an important consideration. This tied in with the 'commitment' term that was specifically included in the Finland group outcomes (Fi p3). The involvement of individuals, management and the financial commitment were all considered as contributions to safety culture. Organisational behaviour was included in the discussion of safety culture and descriptions of compliance with policies and procedures (UKAH p8), and the links with complaints and claims (UKAH p9), were discussed, where individual and organisational behaviour are difficult to separate.

The financial outcomes were universally discussed. In some groups the explanation of each countries sickness benefit structure was a theme explored. There was some understanding that the sickness benefit structures affected the reporting and recording of sickness absence (It p4, Belgium, Germany, Australia, ExpB p2). Costs that were identified as outcomes from MSD in the workplace were; occupational health costs (Fi p6), claims and compensation (ExpB p3, Fi p6), replacement of staff costs (ExpB, Fi p6, UKLT p6, UKAH p4), in addition to regular costs for lost time. The relationship between costs and clinical outcomes was described by delayed discharge or bed-blocking as outcomes of poor PH management (UKAH p6). The use of young inexperienced workers raised concern in Portugal, as evidence was discussed that they leave the profession early (ExpB p4). Both Expert panels made specific judgement on the strength of cost benefit analysis to prove the benefits of PH interventions (ExpA p8, ExpB p3).

Accident numbers and reporting were considered as an organisational outcome. It was valued to allow MSD causation to be investigated (UKAH p3). It was linked with health surveillance as a health outcome (It p4, Po p3), but the precise relationship between incidents and accidents, and the time relationship between cause and effect of injury was thought problematic (Po p5). Direct links were drawn between accidents and the numbers of MSD recorded. Many of the groups discussed MSD rate as an organisational outcome, rather than a staff measure in line with the documented outcomes from Sheet 1. The use of MSD as an outcome measure was considered as of great importance. Many countries reported poor systems of data collection; the UK (UKAH p2, UKLT p2) Belgium, Germany, Portugal (ExpA p2), citing government systems, privacy rules and weak organisational management as causes. Australia and USA (ExpB p2) suggested that government systems related to workers compensation improved the access to MSD numbers and claims. A complication with MSD rate as an outcome measure was the recognised two to four year delay for reductions to appear in the data (ExpA p, Fi p10). It was suggested that a more appropriate measure was the ability to work rather than the inability to work (ExpA p5, Fi p1).

Group ExpA created a definition for the measurement of 'quality of care' (ExpA p9, 10) by measures of incontinence accidents, pressure sore prevalence, immobilisation of patients, timely discharge and patient satisfaction. The measure of 'quality of care' may be different in each type of unit as they have different aims and objectives, and the use of targets for quality of care measures may have a relationship with workload and staff numbers.

The morale of the organisation was discussed as an important outcome, but included many factors and interactions. It was suggested that there is a link between positive communication and feedback (UKLT p10-11); staff reporting feeling cared for (UKAH p5), involvement in and support of training, and in reasonable workload (Fi p1) and the level of morale. Morale as a measure also had suggested links with decreased MSD and job satisfaction (ExpA p7), and recruitment and retention of staff, which in turn has an effect on the external image of the organisation (Fi p1).

3.7.5 Staff Outcomes (Figure 3.7)

3.7.5.1 Generation of ideas (Sheet 1)

The focus in staff outcomes clearly centred on the recording of changes to the health status of care workers, including outcomes of the injury to the individual, severity and how the injury affected the person's ability to work. The role of occupational health provision was well represented, including referrals to physician, treatment services, and physiotherapy. There was less focus on specific measures of musculoskeletal risks than would have been expected, though volume of work, postures, loads and physiological observations were all recorded. The UK recorded few physical exposure measures, perhaps suggesting that the focus of the UK group was more on the measures of effects rather than the reduction of causal exposures.

There were large numbers of outcomes describing the effects of training and individual behaviour. The identification of skills and compliance with safe systems, in addition to the recording of training, covered both the delivery of training and the recording of attendance numbers through the assessment of knowledge, skills, compliance and confidence. The method and frequency of equipment use was recorded in four groups. There is an interesting question here about the use of equipment as an intervention or as an outcome; it raises the question of knowledge levels and use of risk assessment.

Psychological well-being was included in three of the groups but there was little detail to suggest how it would be calculated. The inclusion of well-being as an outcome from a primarily physical intervention also raises interesting questions. For example, how does the level of psychological well-being mirror the physical demands of a job; and is there a link between the time, emotional and physical stressors found in the care environment.

3.7.5.2 Transcription analysis (Clarification)

Three themes comprised the discussions in the staff outcomes section of the focus groups; MSD measures, the psychological assessment of work, and competence and compliance.

The use of measures of MSD prevalence was widely recorded as an aim for the PHA (ExpB p6, It p8, Fi p10). Some suggested that insurance data could be used in this calculation (ExpA p17, Po p7). Only ExpA (p14) suggested the use of the Nordic questionnaire as a suitable data collection tool. Other measures of the effects of MSD were in recording treatment numbers in occupational health or physiotherapy services (UKAH p16, UKLT p15, 19) and the use of the return to work procedures as a record of problems (UKAH p18, Po p20).

Debate against the use of MSD prevalence was suggested by the use of measures of MS health rather than injury, which has similarities to the concerns in section 3.7.4.2 outlined previously (UKLT p13, 15, 18, Po p18). The relationship with an aging workforce (Fi p10) was also indicated as having a confounding effect on the measure, but experience could also be considered. The use of occupational health information may be unsatisfactory, as staff perception of that role differs between countries (UKLT p19). An interesting extension of the role of the PHA and training was the identification that staff unfit to complete the training exercises in patient handling are unfit for work (UKLT p17).

The psychological aspects of work suggested measures for fatigue and subjective evaluations of the work (UKAH p18, UKLT p13, ExpB p8). More consideration was described surrounding the subjective measure of workload, and the concepts that could be included in the calculation; staff numbers (UKAH p19), patient dependencies (UKAH p19), and measures of physical workload (ExpB p9, 11, Fi p12, UKLT p13). The physiotherapist rich group in Finland drew attention to the consideration of the relationship between staff fitness and the effects of workload (Fi p12).

Most groups considered the recording and measurement of staff behaviour in the forms of competence and compliance (UKAH p24, 25, Exp p18, It p8, 14). The descriptions suggested the assessment of performance against levels of skill, knowledge, use of equipment, and in particular against the documented patient handling risk assessment by observation (UKLT p20, Po p6, Fi p13). The ExpA group identified the role of supervision and observation of competence as important to be completed by a local person as part of the management structure (ExpA p18), and to be supported by positive feedback (ExpA p19). Agreement with the local supervisor role was found (UKAH p42). It was noted that the measure of compliance could not be replaced by the provision of equipment, as having equipment does not reliably show changes in behaviour (Fi p15). The understanding across the groups was that there was relationship between safe behaviour, the reduction of MSD prevalence and ‘quality of care’.

Theme	UK	Finland	Portugal	Italy	Expert
Incidents and accidents	*Incidents and accidents*			*Number of accidents*	*No Incidents / Accidents*
MSD measures	**Injuries and absence Discomfort** **Treatment services for staff** **Fatigue** **Occupational health data**	**Stress Index** **Musculoskeletal symptoms** **Personal effect** **Workability Index** **Physical condition**	**Increased physical capacity** **Strength** **Endurance** **Work capacity** **Job rotation** **Health surveillance** **Risk exposure** **Work related ill health**	**Amount of diseases and injuries** **Low back injuries** **Changes in health** **Sick leave** **Referral to Occupational Physician** **Staff not fit for jobs** **Substitution of staff to replace illness**	**MSD Symptoms** **Injuries** **Health measures** **Decreased back pain**
Exposure measures	*Decreased effort Movement*	*Physical strain* *Heart rate,* *EMG* *Postures for working*	*Physical measures* • *Postures* • *Force* • *Loads* *Discomfort*	*Risk index from patient handling (MAPO)* *Amount of manual handling exposure (MAPO)*	*MAPO Index* *Risk Index* *Comfort/Discomfort* *Postures* *Subjective response* *Time stress* *Weight lifted* *% Control measures implemented*
Compliance competence and use of equipment	**Training figures** **Knowledge and skill level** **Handling culture** **Handling methods used** **Improved communication** **Improved confidence** **Supervision** **Comply with training**	**Skills in patient handling** **Safety** **Compliance** • **Are people using safe methods** **Use of equipment**	**Supervision of handling** **Improved handling skills** **Training** **Less risky postures** **Improved skill** **Improved knowledge** **Adequate equipment** **Using equipment**	**Continued training (current)** **Use of aids** **Interviews with staff involved**	**Use of equipment** **Compliance** **Training skills** **Acceptance**
Psychological well-being	*Staff feel valued* *Job satisfaction*	*Psychological stress* • *Well-being*		*Job satisfaction* *Well-being*	*Satisfaction*
Others	Policy Provision of equipment • Lack of equipment		Availability of physiotherapy for staff • Skills mix • Risk assessment • Communicate risks • Training	Interdisciplinary?	Workplace surveys Decreased complaints

Figure 3.7 Matrix for Staff Outcomes

3.7.6 Patient Outcomes (Figure 3.8)

3.7.6.1 Generation of ideas (Sheet 1)

Previous research has shown that interventions in patient handling do not regularly measure patient outcomes (Fray and Hignett, 2006). All these groups strongly identified patient outcomes as being important. The outcomes were presented under four themes: patient injuries, patient perception, patient condition and quality of care.

The first group of outcomes suggested that handling may be responsible for deleterious effects on the patient being moved, for example lacerations, bruising, shear/friction damage to tissues, and the prevalence of pressure sores. The investigation of causes of patient injuries is complex and multi-factorial, but there is some evidence to support the potential for this measure (Haigh, 1993; Waldenstrom and Gottvall, 1991; and Harrison, 2004' and 2009). All groups included the number of falls, which suggests that the management of a patient's mobility is a key area of success, and falls were recorded as a failure of this process.

The perception of the patient was also widely valued. Comfort and patient satisfaction were recorded in all EU groups. These two leading responses were supported with issues relating to fear, anxiety and the reporting of complaints.

Some positive outcomes described the effect on the patient. Outcomes in this theme suggested that if timely, effective, supportive handling was used then improvements could be seen, in terms of decreased length of stay, improved activity and increased independence of the patient.

The challenging theme was related to 'quality of care', which included many factors for its measurement and calculation.

3.7.6.2 Transcription analysis (Clarification)

In a similar way to the documented record, the largest contributor to the data was the problems that poor handling may deliver to the patient. Measures of possible damage to the patient were; injuries and accidents (UKAH p27, It p16, Fi p17), tissue viability or the prevalence of pressure ulcers (UKAH p29, ExpA p13, Exp p12), cross infection (UKAH p29), bruising (UKLT p27), lacerations (UKLT p27), falls (UKLT p27, ExpB p12, It p16, Po p13, Fi p17). In comparison the PHAs perceived that positive patient handling could contribute to the treatment and rehabilitation of patients. Outcomes that measure the improvement in function and changes in the dependency levels were reported (UKAH p29, UKLT p28, ExpB p14, Fi p6).

The perception of the quality of the transfers and the delivery of care in general also were considered by the groups as a method to measure patient outcomes. Organisationally the recording of patient complaints (UKAH p26, Po p13) was suggested, against the more subjective personal assessments of comfort, fear or anxiety (Exp p13). These could also be added to the measure of patient satisfaction that implied a greater understanding of the actions of patient handling (It p16, Po p13). The clearest definition of this was presented in ExpA (p11), where it was suggested the assessment of patient handling performance by the patient might reveal that staff who handle patients poorly manually also deliver poor quality care with equipment.

The interaction across beneficiary sections of the measure of ‘quality of care’ was recognised in discussions in the patient outcomes section. The organisation requires a measure of quality to be judged with and compared against other providers. Nursing and care staff need a measure of care in the same way that the PHA does to show a high level of patient care. The complexity of this multi-factorial concept ultimately lies in the assessment and judgement of the patient and it needs to be clarified how these different factors can be amalgamated to make a realistic measure of patient handling quality of care (Section 3.8.6).

Theme	UK	Finland	Portugal	Italy	Expert
Patient injuries	*Injuries* • *Shear/friction* • *Bruising* • *Laceration* • *Falls* *Infection control*	*Falls* *Safety*	*Falls* *Pressure care* *Safety*	*Pressure sore/ulcer* *Problems caused by inappropriate handling* • *Injuries* • *Statistical data* • *Falls* *Number of manual lifts* • *Reported to unit* • *Patient accidents*	*Injury/damage* • *Skin condition* • *Tears* • *Ulcers* *MSD's* *Falls/accidents*
Patient perception	**Comfort** **Patient satisfaction** **Decreased complaints**	**Comfort** **Patient satisfaction**	**Comfort** • **Decreased pain** **Level of satisfaction** • **Complaints** **Less fear, more trust**	**Comfort** **Privacy** **Patient satisfaction** • **Complaints** **Patient accepts/refuses hoist**	**Safety** **Perceived satisfaction** **Well being** **Fear/safety/anxiety** **Understanding**
Patient condition	*Patient condition* • *Length of stay* • *Discharge* • *Re-admission* • *Recovery time* *Improved independence*	*More activity* • *Increased independence* • *Increased control* *Functional diagnosis tools*	*Level of participation* *Level of dependency* *Time spent in hospital*	*Health plan (Care-plan)* *Measure patients abilities* *Decreased length of stay*	*Mobility* *Night disturbances*
Quality of care	**Standardisation of care** • **Consistency** **Confidence in the care** **Quality of care** **Audit/feedback** **Attitude of staff**	**Meeting patient objectives** **Quality of care**	Quality of care	**Care and actions delivered on time** • **Clinical assessment** **Legal numbers of staff** • **Decreased quality** **Uniformity of actions**	**Quality of care**

Figure 3.8 Matrix for Patient Outcomes

Theme	UK	Finland	Portugal	Italy	Expert
Compliance with safe methods	*Appropriate use of equipment* *Competence/skills Efficiency* • *Time taken* • *Movement quality* *Compliance with methods*	*Agreed method for assisting the patient* *Quality of movement* • *Smooth* • *Co-ordinated* • *Skills* *Use of equipment*	*Use of equipment* • *Small aids* • *Hoists and slings*	*Uniformity of treatment* *Work postures adopted Use of aids* *Manual handling actions* *Training* *Correct methods for manual handling*	*Compliance with procedures* *Use of equipment* *Competence* *Assessment systems* *Professionalism* *Efficiency*
Equipment available	**Equipment available**	**Ergonomie of rooms**	**Adequate furniture** • **Work areas** • **Space**	**Bathroom/WC appropriate** **Space /furniture** • **Architectural obstacles** **Provision of aids** **Number of staff**	
Documentation	*Documentation/Plans*	*Documentation* *Good management system* • *Support in workplace*	*Clear management*	*Care-plans*	
Others	Use of ergonomics tools Safety Speed Staff time on wards • Equipment increases time Supervisory levels Environments Custom and practice	Rehabilitation approach • Length of stay Patient safety Falls and Accidents Professional skills Work motivation Work skills	Decrease time taken Job rotation Better relationship between staff and patients Safety culture • Risk awareness Psychosocial factors • Movement • Avoidance of hazards Accessible equipment • Storage Fitness • Relaxation • Lifestyle	Specific actions • Cleaning • Toilets Psychological well-being of staff Health surveillance	Cost effectiveness Eliminate tasks Space requirements Exposure to tasks

Figure 3.9 Matrix for Task and Other Outcomes

3.7.7 Task and 'Other' Outcomes (Figure 3.9)

3.7.7.1 Generation of ideas (Sheet 1)

The literature review (Table 2b.11) revealed some recorded outcomes that measure qualities or quantities related to the completion of specific patient handling tasks. These were mainly related to time (22 studies) and the number of people required (5 studies). There was a lack of conformity in the outcomes recorded in this section, as some examples measured the intervention rather than an outcome. The importance of the provision of ergonomic environments and suitable equipment, and the need to record and audit clear risk assessment and care-plans were recorded in many sections.

The most popular theme was the relationship between task performance and the concepts of competence and compliance. Many different outcomes were assigned to this theme including assessments of competence, movement quality, use of equipment, and use of correct methods. The measures of time and staff numbers were only mentioned in three cases, time taken and speed (UK) and efficiency (Italy). This suggests that speed is not as important as safety, or the effects recorded on staff, patient etc.

The 'other' category was sparsely used and created a wide spread of unrelated items. Most of the outcomes recorded in this section could be attributed to organisational, staff or patient categories, and some met the criterion of being measures of interventions and not outcomes (Table 3.19).

3.7.7.2 Transcription analysis (Clarification)

Due to the inclusion of the task performance outcomes being at the end of the discussion, the contributions were limited, and the focus groups added little to the documented lists of outcomes. Most of the closing discussions concentrated on the barriers to implementation that each of the locations experience, which was not part of this study. The language surrounding the task section caused difficulties especially in the translated groups, as patient handling tasks were not recognised.

Table 3.19 Re-allocation of ‘other’ outcomes

<table>
<tr><td><u>Organisational</u>
Safety culture
• Risk awareness
Cost effectiveness</td><td rowspan="3"><u>Staff</u>
Use of ergonomics tools
Safety
Professional skills
Work motivation
Work skills
Psychosocial factors
• Movement
• Avoidance of hazards
Fitness
• Relaxation
• Lifestyle
Specific actions
• Cleaning
• Toilets
Psychological well-being of staff
Health surveillance
Exposure to tasks</td></tr>
<tr><td><u>Patient</u>
Rehabilitation approach
• Length of stay
Patient safety
Falls and Accidents</td></tr>
<tr><td><u>Task performance</u>
Speed
Staff time on wards
• Equipment increases time
Decrease time taken</td></tr>
<tr><td><u>Intervention measures</u>
Supervisory levels
Environments
Job rotation
Accessible equipment
• Storage
Eliminate tasks
Space requirements</td><td><u>Remaining others</u>
Custom and practice
Better relationship between staff and patients
Specific actions
• Cleaning
• Toilets</td></tr>
</table>

The inclusion of other issues in the closing discussions closely related to the information in Table 3.19 above.

3.8 Important outcomes

The recording of all the important outcomes from four EU, and two Expert sources, through focus group methodologies has allowed a wide range of outcomes to be considered. The analysis has refined the outcomes recorded and aligned them into a series of themes. The original categories of organisation, staff, patient and task have been maintained through the analysis though a number of outcomes, and themes were found to cross those boundaries. During this process some important issues were identified to assist with the interpretation of the findings.

3.8.1 Interventions and outcomes

It was unclear how well the participants of the focus groups understood the relationship between interventions and outcomes. All the research (Chapter 2) records the clear difference between the provision of behavioural, organisational or engineering interventions in the workplace, and measuring the effect of the intervention via a series of recognised outcome measures. Figures 3.5-3.9 show that there are large areas of overlap between the definitions of who benefits from the outcomes defined in this study. Many outcomes were entered against different beneficiaries. Examples are found in descriptions of safe behaviours that could be recorded as a staff, organisational or task performance outcome under ‘compliance’. Organisational behaviour also meets the double entry category, as some participants describe the documented systems as behaviour, and some describe the actions of the staff as the behaviour to range across many beneficiary areas.

There was much confusion in the recorded list of outcomes between the role of intervention and outcome. Some of the outcomes were recorded incorrectly and described the qualities or quantities of an intervention. Some however lacked any clarity and can be considered as both intervention and outcome measures. For example, the provision of training and attendance numbers is clearly a measure of an intervention, whereas an assessment of competence, skills, knowledge or handling methods would be an outcome of the training given. The provision of equipment, or improvements in the environment are engineering based interventions, but the use of equipment could be perceived as compliance with a safe system and is recognised as an individual behavioural outcome. Much of the confusion surrounding the interpretation is related to the cascade effect (3.8.2), and the inter-relationship between the interventions and outcomes, which in many cases form part of a multi-faceted management intervention that gives multi-faceted outcomes. This is complimented in many EU countries by the experience of the PHA, as their role is primarily that of an internal or external advisor. This suggests that they are requested to visit a ward and conduct an analysis of the identified risks and make recommendations for change. Therefore from their advisor perspective, the purchase of equipment or the completion of a training programme is the result of their intervention, and is measured as an outcome. The development of this measurement tool suggests that all outcomes that are measures of interventions i.e. training details and equipment available, should be removed from Figure 3.4.

3.8.2 Cascade relationships between interventions and outcomes

The cascade relationship is where the change in one outcome can be replicated in another from the same intervention. This inter-relationship of outcomes and interventions was already discussed by Nelson (2006), suggesting that multi-factorial interventions give improved outcomes and that all aspects of the management system need to be fulfilled to get a positive response. The general consensus of the participants in the focus groups agreed that the outcomes were linked and comprehensive multifaceted changes to a system would be appropriate. Areas that had the most potential to cascade to extra outcomes were related to management commitment. There was the perception that high commitment could improve staff behaviour via supervision or increased access to training, and would lead to a better working environment due to better equipment and facilities. This would then lead to better quality of care and better patient perception outcomes. These types of interactions occur repeatedly and need to be accepted as the complexity of the management of patient handling risk.

In some circumstances the relationship between outcomes and interventions is based purely on assumption, and consequently weakens the selection and inclusion of outcomes. An example of this is the provision of training. The reliance on training for patient handling risk management has been well discussed, and for the most part shown to be of little effect (Martimo et al., 2008, Hignett et al., 2003, and Haslam et al., 2007). The use of training numbers as an organisational measure does not measure any difference in performance but there is an assumption that training = skills and knowledge = better compliance = decrease MSD risk and organisational risk. This is also found in some of the higher-level outcome measurement tools, e.g. MAPO.

3.8.3 Organisational behaviour

One outcome theme that covers the area of interventions and outcomes is that describing organisational behaviour. Literature describing the management of health and safety risks including practices in the healthcare environment suggests that key issues should be addressed (HMSO (HSG 65), 1997); Policy, Organisation, Arrangements, Measure performance, Review/Audit. Consequently the provision of policies, procedures, and organisational systems such as supervision, risk assessment and audit are understood to be interventions. But their existence and the commitment of the organisation to follow them, in particular evidence of individuals and departments complying with the system, is an outcome. The theme of organisational behaviour links three different themes that were identified in the Table 3.20. Risk management systems describe the delivery of risk assessment and controls, policies, procedures etc. Management commitment describes the financial and manpower systems in place to ensure compliance with safe systems. Safety culture defines measureable behaviour in an organisation to show that safe behaviour is being adopted. These measures are all indicators of safety culture/climate and should be combined. This combined outcome theme of safety culture is important. The complexity and multi-faceted quality of the definition suggest a complex set of measurements to quantify the theme (see Chapter 4).

3.8.4 Different outcomes in different categories

The structure of the data collection sheets and focus group content was separated into the beneficiary categories, but some outcomes were recorded in more than one section. The numbers of incidents and accidents were recorded in Organisational, Staff and Patient categories. The focus of the outcome is different for each of the inclusions.

- The recording of accidents and incidents in many organisations is a cultural measure and signifies safety performance, and is a positive organisational measure.
- The recording of staff injuries from accidents and injuries was also recorded as an important criterion. When examining the range of

outcomes included the MS health measure and the sickness absence figures will record the staff incidents and injuries.

- Incidents and accidents that involve patients are also a valid outcome measure and have links with the patient injury category.

Given that both the effects of staff and patient injury or damage will be recorded elsewhere, the incident and accident outcome becomes an organisational performance measure.

3.8.5 Musculoskeletal health and absence

There were many outcomes and inclusions for the measurement of injuries and their effects. The differentiation in the range of included outcomes was about the beneficiary category being organisational or staff. In the first instance there were outcomes that signified a loss of a worker, or any part of their productivity to the organisation. Outcomes in this section included lost days, reduced productivity, replacement staff or recruitment of staff as replacements, including the possibility of losing staff to alternative work sites or roles. The staff category included outcomes and measures defining the effect of the injury on the individual, the number of injuries, specific measures of a person's ability to work, and whether the individual had required attention from medical services i.e. occupational health, physicians, or physiotherapy. To define the two similar outcome themes they were named sickness absence for the organisational theme, and musculoskeletal (MS) health measures for the staff theme.

3.8.6 Quality of Care

There were many different outcomes recorded that suggested measurement of care quality and the definition of quality of care is a complex question. Initially there is the beneficiary question of whether the patient or the organisation should quantify this outcome. This analysis provided arguments for both aspects. Outcomes for patient injury or damage e.g. fractures, falls, pressure ulcers, and cross infection all suggest a poor 'quality of care', but patient perception values for satisfaction, anxiety and complaints add to the picture. Organisational measures of timely discharge, patient satisfaction or patient complaints may also be part of the measure.

Prevention or damage as a direct result of patient handling actions has not been clear in the literature and may be difficult to prove. Four of the groups simply recorded ‘quality of care’, indicating an understanding of the requirement but not how to measure it. More measurable outcomes were indicated by consistency/uniformity of care, confidence in the care, meeting patient objectives and timely delivery. One discussion that was raised in the focus group analysis was regarding the definition of the theme, and what could compose the measure. There was one debate that suggested that quality of care could be measured as quality of assistance. This was in agreement with a second point that linked quality of care with quality of assistance, which was measured by knowledge, skills and competence. The issue of quality of care and the general principles of successful management of healthcare are also of interest in this situation.

3.8.7 Compare EU vs. Expert

The final issue for this phase of the discussion surrounded the differences between the EU practitioner groups and the outcomes recorded by the Expert groups. The Expert groups recorded more detail on how the outcomes would be measured, and recorded several indices, scales and methods. There was a higher concentration on the costs of compensation claims in the measures for sickness absence; this was particularly evident in the ExpB that included representatives from Australia and the USA. It was also recorded that the Expert panels reported less intervention definitions in the sample, e.g. training was described by skills, competence and compliance, and equipment use was included rather than equipment provision. The list of outcomes recorded by the Expert groups did not show significant difference with the range of outcomes recorded with the EU groups, and will be carried forward to the voting analysis.

3.8.8 Summary of outcomes before voting

The generation of ideas recorded 210 different outcome identifiers. The content and thematic analysis grouped them into themes. The beneficiary descriptors that were used in the creation of the study have been maintained in most of the analysis, but as with the literature, organisation and staff outcomes have been more common. The combination of the data from Sheet 1 and the transcription analysis has created a list of factors that the group regarded as important (Table 3.20). To assist clarity of the final scoring process, 20 definitions for each of the outcome themes were created from the analysis. The beneficiary has been linked with a list of terms that occurred in each section. The exception to this is the concept of safety culture, which in this discussion covers some aspects of all the beneficiaries.

Table 3.20 Definitions of the most important outcomes

	Theme (Outcome)	Definition
Organisation	Accidents and incidents	The recording of incidents or accidents from patient handling in a central location as a performance measure
	Absence or staff health	Measures that record the time away from work or lost productivity due to MSD
	Financial	The financial impact of MSD in an organisation against the costs of any prevention programme
	Training	Measurements that define the delivery of training, attendance numbers, duration, assessment criteria.
	Risk Management Systems	Specific interventions in the work place to assist with the control of patient handling situations, e.g., policy, risk assessment systems etc
	Satisfaction and image	Measures relating to how the organisation is perceived outside its organisation
	Management Commitment	A measure of the support for the prevention programme, managerially, financially and organisationally
Staff	MSD Health Measures	The measurement of the level of MSD in the working population, injuries, chronic conditions, fitness for work
	Incidents and accidents	Those staff that have been involved in accidents, incidents or near miss situations when patient handling
	MSD Exposure measures	Physical workload factors that place the staff under strain, forces, postures, frequency of tasks, workload
	Compliance, competence	Measures of the staff's individual behaviour to complete patient transfers, skill, compliance with safe methods and equipment use
	Psychological well-being	Measurement of the staff's mental health status, measures of stress, strain, job satisfaction etc
Patients	Patient injuries	Records of accidents or injuries to patients when being assisted to move, bruises, lacerations, tissue damage etc
	Patient perception	The subjective assessment of a patient when being moved in transfers or mobility situations, fear, comfort etc
	Patient condition	Does the patient handling method affect the length of stay, treatment progression, level of independence
	Quality of care	When a patient is being moved are all their requirements for dignity, respect, safety, empathy, being met
Task	Equipment available	Is all of the appropriate equipment being provided for the level of care required
	Safety	Is the method of moving an patient meeting all the requirements for safety, security, suitability
	Speed	Any measurement that identifies the time taken for patient handling, the rate or speed of movement
All	Safety Culture	Measurement of how the organisation behaves and how its management systems can be shown to control risk

In summary, a range of professions fulfils the PHA role across the EU. The fundamental requirements of what should be achieved by interventions have many similarities but significant breadth and depth. In general PHA have a clear focus on some outcomes that they wish to achieve by their interventions, but their knowledge of outcome measures is not so well defined. Patient outcomes were recognised as important to the groups and need to be included in intervention studies and reviews.

3.9 Priority Ordering (Voting)

Each participant completed Sheet 3 by recording their highest five ranked outcomes. The group facilitators and translators translated the written responses during the focus group. Every attempt was made to translate the meanings of the written statements to identify the specific outcomes and outcome measures. When the meaning of the outcome included in the rankings was unclear discussion between MF and the EU facilitator clarified the definition. Appendix F shows all ranked scores and specific outcomes that required clarification. These outcomes were analysed by a second researcher who had an understanding of the outcome measures in Sheet 1 analysis. A consensus was reached between the researchers and the EU facilitator.

The outcomes that were included in the ranked list are shown in Tables 3.21-3.24 against the beneficiaries. These tables show the narrowing of the range of outcomes from the initial included outcomes. In addition it can be seen that some of the outcomes showed preferences across the different groups and others were valued only in single locations. The numerical values of the ranking are now introduced to the analysis to further explore the importance of each of the included outcomes.

3.9.1 Individual participants

All completed Sheet 3 data sets were included in the analysis. Some individual sets of data required secondary analysis to ensure accuracy.

- Finland 2 repeated measures for safety culture for two of the high rankings.
- Finland 3 recorded nurse motor skills as an outcome, which represented a compliance measure as per the use of the SOPMAS tool.
- Portugal 2 used a series of measures that defined interventions and not outcomes.
- Italy 2 and 8 both used MAPO definitions as outcome measures.
- Italy 5 repeated MSD outcomes for several of the high rankings as they were from an occupational health background.

3.9.2 Organisational Outcomes

Table 3.21 shows the strongest outcome theme in the organisational section was sickness absence, which was included by all five focus groups. This theme was supported by secondary measures of illness that included costs of staff replacement, staff turnover, and the need for alternative work placements. Financial costs were registered by three focus groups but not by Italy and Portugal. The costs of patient handling management systems have been discussed in the two earlier results sections and are clarified in the definition section (Table 3.28). All four EU groups recorded the completion of training as an outcome, but the Expert panels did not. The UK, Portugal and Expert groups prioritised a variety of risk management outcomes. These were surrounding the provision of risk assessment systems including responsible persons, policies, procedures and risk assessment systems. The concept of management commitment recorded by the Finland group, could also be related to management systems, as the effectiveness of the system will be weakened without it. However discussion in 3.7.4.2 showed this to be linked with safety culture.

Table 3.21 Organisational Outcomes (Sheet 3)

Theme	Definitions/ measures	UK	Fi	Po	It	Exp
Accidents	Accident figures	■				
Absence or staff health	Sickness absence	■	■	■	■	■
	Replacement staff costs	■				
	Staff turnover	■				
	Alternative work				■	■
	Increased productivity					■
Financial costs	Financial costs	■	■			■
	Insurance / claims	■				
Training skills and compliance	Number of people trained	■	■	■	■	
Risk management tools	Risk assessment improved	■		■		■
	Risk management system	■		■		■
	Evaluating risks			■	■	■
Satisfaction and image	Image in public		■	■		
Others	Commitment (Management)		■			

3.9.3 Staff Outcomes

The staff outcomes recorded in the higher priority sheets show a much clearer picture (Table 3.22). Two single outcomes were reported from all focus groups; the measure of MSD and the skill and competence level of the workforce. The MSD rate values were supported by occupational health numbers, specific low back pain measures rather than MSD, and other human resource values to measure the lack of availability to work. The competence and skill section was also complimented by a range of secondary outcomes, that quantified compliance with safe methods. Compliance, the use of safe methods, the use of equipment and the consistency of assistance all added to the description. There was recording of the psychological factors relating to physical work tasks through the recording of job satisfaction from all four EU groups, and 'well-being' was recorded by Expert and Italy groups. The final inclusion from three EU sources was the measure of accidents as a score of poor patient handling performance. This does have a direct link to the MSD numbers, but has traditionally been recorded as an instant record of error and poor practice in many areas of health and safety.

Table 3.22 Staff Outcomes (Sheet 3)

Theme	Definitions/ measures	UK	Fi	Po	It	Exp
Incidents and accidents	Number of accidents					
MSD measures	Referral to Occupational Physician Occupational health data Amount of MSD and MSI Low back injuries Changes in health Work capacity Substitution of staff to replace					
Exposure measures	Decreased Effort and Workload Physical measures - Posture					
Compliance competence and use of equipment	Knowledge, skill, competence Compliance Are people using safe methods Using equipment Consistency of assistance					
Psychological well-being	Job satisfaction-Morale Well-being					

3.9.4 Patient outcomes

The focus group discussion (3.7.6.2) centralised the patient outcomes into four issues that were replicated in this section (Table 3.23). Quality of care was included in all focus groups, with patient satisfaction and improving a patient's independence being reported by four groups. The quality of care outcome was linked in the previous discussion (3.7.6.2) with terms like quality of assistance, and consistency of care was included in the priority list. This draws the quality of care score further to the patient section for this final analysis, and in the development of a data collection tool will show the requirement that the patient is to participate in the rating of performance.

Table 3.23 Patient Outcomes (Sheet 3)

Theme	Definitions/ measures	UK	Fi	Po	It	Exp
Patient injuries	Injuries Pressure care Infection control	■			■	■
Patient perception	Comfort Patient satisfaction	■		■	■	■
Patient condition	Improved independence	■	■	■	■	
Quality of care	Consistency of care Quality of care	■	■	■	■	■

3.9.5 Task and other outcomes

Table 3.24 shows that the task performance and others section was little used. The only strong theme identified in this section was safety culture, which was included by three of the EU focus groups. In the detail of the scoring sheets, the theme of safety culture drew closer links with the topic of management commitment, and with the provision of management systems relating to policies, procedures, and most importantly the observation of organisational and individual behaviour. Given there was a strong staff outcome for individual behaviour in competence and compliance, safety culture was assigned to the organisational section in future analysis.

Table 3.24 Task and Other Outcomes (Sheet 3)

Theme	Definitions/ measures	UK	Fi	Po	It	Exp
Equipment available	Equipment available 'Ergonomie' of rooms	■	■	■	■	
Others	Safety Speed Safety culture	■ ■	■	■		■

3.9.6 Scoring the preferred outcomes

The previous four tables show that the breadth of the initial list of outcomes was not reproduced by the highest rankings in Sheet 3. Table 3.25 identifies how the numbers of outcomes has reduced through the different sections of the analysis across the beneficiary groups.

Table 3.25 Range of outcomes included in ranking score sheets

	Sheet 1	Sheet 3		
Beneficiary	**No of outcomes recorded on**	**No included in Expert rankings**	**No Included in EU rankings**	**Total outcomes included in rankings**
Organisational	65	7	13	14 (1)
Staff	57	9	14	17 (3)
Patient	40	3	7	8 (1)
Task	30	1	3	4 (1)
Others	18	0	1	1 (0)
Totals	**210**	**20**	**38**	**44 (6)**

It is clear that many of the outcomes (80%) were not considered to be of high importance. The comparison between the Expert and EU groups shows that the proportions of items included in the ranking lists have much similarity. Only 6 of the 44 outcomes included in the ranking tables were in the expert group only. When the included outcomes (n=44, Table 3.25) are associated with the 20 definitions reported in Table 3.20 there is a further focussing of the importance of each of the different outcomes. Table 3.26 shows the scores against the 20 definitions.

The importance of the beneficiary groups in this description also shows differences between the rates of perceived importance. The importance in these scores shows a ratio of Organisational: Staff: Patient: Task as approximately 4:4:2:1. This ratio agrees with the process all through the different data collection phases, that organisational and staff outcomes are valued as of the highest importance.

Table 3.26 also shows that some of the outcomes received low values in the voting phase. The information, definitions and the scoring can now be combined to create the outcome definitions with the clearest description of the highest priority outcomes from this study. A series of transformations was used to focus the data.

Table 3.26 Total Scores From Ranking (Sheet 3).

Beneficiary	Theme	Exp	EU	Totals	Exp	EU	Totals
Organisation	Accidents	0	12	12			
	Absence or staff health	20	55	75			
	Financial	10	12	22			
	Training	0	20	20			
	Risk Management Systems	13	45	58			
	Satisfaction and image	0	5	5			
	Management Commitment	0	14	14	43	163	206
Staff	MS Health Measures	14	71	85			
	Incidents and accidents	0	20	20			
	Exposure measures	10	12	22			
	Compliance, competence, equip use	22	55	77			
	Psychological well-being	3	31	34	49	189	238
Patient	Patient injuries	4	11	15			
	Patient perception	2	14	16			
	Patient condition	0	18	18			
	Quality of care	13	52	65	19	95	114
Task	Equipment available	0	44	44			
	Safety	0	3	3			
	Speed	2	0	2	2	47	49
Other	Safety Culture	0	26	26	0	26	26
				Totals	**113**	**520**	**633**

Outcomes that measured qualities of an intervention were removed:

- Equipment available
- Training numbers

Outcomes with a score less than five were removed:

- Safety
- Speed
- Satisfaction and image

The measures related to safety culture were all combined to a single measure:

- Risk management tools and improved systems,
- Management commitment
- Safety culture.

Outcomes recorded in two beneficiaries were combined:

- Accidents recorded in the organisational group
- Accidents recorded in the staff group.

The MSD measure in the organisational data was not combined with the MS health measure in the staff data, as one relates to absence and the other relates to the physical effects on the staff member.

Two transformations from the list above require further explanation. The separation of the two outcomes for MSD allowed the quantities of sickness absence, and the health effects for the staff, to be allocated to the different beneficiaries. The double inclusion reflects the importance of MSD across the systems for the PHA. The second transformation was the amalgamation of terms for the measure of safety culture. The MARCH (Smedley et al., 2005) and PHOQS (Hignett and Crumpton, 2005) tools have been used to measure 'Safety Culture' relative to patient handling processes. Between the two tools, they measure organisational systems information like policies and procedures, the provision of funding and personnel for specific roles, examine risk assessment, communication systems and collect evidence that the organisation is following the procedures adopted. Given that these tools have been peer reviewed as successful, the combination of the three safety culture outcomes is appropriate.

Table 3.27 shows the total scores for the EU groups and the rankings for each group based on the scores. This analysis aimed to create a single prioritised list of the most important outcomes. The number of participants for each of the focus groups was variable, so rankings for each of the focus group scores was used to remove the group size differences. The summed totals of the ranks, was then ranked to give the priority list in the blue column. In addition the expert group was also ranked as a comparison (Orange column).

Table 3.27 Scores from voting for 12 most preferred outcomes.

	Theme	It	Po	Fi	UK	Rank It	Rank Po	Rank Fi	Rank UK	Rank Sum	Rank rank	Expert	Rank Exp
Organisation	Incidents and accidents	3	12	0	17	8	3	11	6	28	6	0	12
	Absence or staff health	13	4	17	21	3	8	2	4	17	4	20	2
	Financial	0	0	5	7	12	12	7	10	41	12	10	6.5
	Safety culture	20	23	20	22	2	1	1	2	6	1	13	4.5
Staff	MS health measures	25	8	4	34	1	5	8	1	15	2	14	3
	MSD Exposure measures	0	3	9	0	12	9	5	12	38	10	10	6.5
	Compliance, competence	10	18	10	17	4	2	4	6	16	3	22	1
	Psychological well-being	2	6	2	21	10	7	9	4	30	7.5	3	9
Patient	Patient injuries	3	0	0	8	8	12	11	9	40	11	4	8
	Patient perception	3	1	0	10	8	10	11	8	37	9	2	10
	Patient condition	4	6	6	2	6	7	6	11	30	7.5	0	12
	Quality of care	8	10	15	12	5	4	3	7	19	5	13	4.5

3.9.7 Statistical Analysis

The similarity between the four EU focus group rankings was explored. High rankings were seen for safety culture, compliance and MS health measures in all EU groups and the Expert groups. The lower ranked outcomes were finance and patient related measures. Analysis for association rather than difference was appropriate. Given the format of multiple rankings, there was a limited choice of tools.

Kendall's Measure of Concordance (Seigal and Castellan, 1988), which has a proven link with the processes for Friedman's ANOVA calculation, was completed. The calculation was performed using the correction factor for tied ranks, compared with the Chi^2 tables W=0.6287 (N=12, df 11, k=4, Chi^2 =27.6628), and showed significant concordance (P=0.005). This indicates very close agreement between the four European groups. The test was repeated to include the four EU groups and the combined ranks for the Expert groups. The calculation was performed using the correction factor for tied ranks, compared with the Chi^2 tables W=0.9416 (N=12, df 11, k=5, Chi^2 =51.78) and showed greater significance in concordance (P=0.001).

As a cross check the combined ranks of the combined EU groups were compared to the combined ranks for the Expert groups. For this data W=0.7882 (N=12, df 11, k=2, Chi^2 =17.34), and the significance was reduced to P=0.1. Though the inclusion of the Expert data in the statistical analysis improves the overall concordance measure, there are differences between the priorities of the Expert groups and the EU practitioner groups. The decision was made to use only the EU priority list for future work. The tied rank found between the outcomes of psychological well-being and patient condition was re-calculated, by using the total votes cast for the two outcomes in the individual focus groups. This indicated that psychological well-being was preferred. The full ranked list for future inclusion is in Table 3.28.

3.9.8 Conclusion

Seven focus groups were conducted to create information on the outcomes that PHAs preferred, to show values from patient handling interventions in the workplace. Two hundred and ten different outcomes were identified. Thematic and content analysis reduced these outcomes to 20 themes with clear definitions. Priority was scored by all the participants, and accumulated and ranked scores were tabulated (Table 3.27), and showed 12 outcome themes to be of highest priority. There is a good level of agreement between the priority information found in the four EU focus groups, but reduced agreement with the Expert group priorities. A final list of the 12 strongest outcome themes has been identified (Table 3.28), and these will be taken forward for the creation of the assessment tool (Chapter 4).

Table 3.28 The 12 most preferred outcomes in priority order.

	Theme (Outcome)	Definition
1	Safety culture	A measure of organisational behaviour and how its management systems control patient handling risk. This is an audit of procedures rather than behaviours e.g, policy, risk assessment, records of training etc., and should measure the support for the prevention programme both financially and organisationally
2	MS health measures	The measurement of the level of MSD in the working population, injuries, chronic conditions, fitness for work, staff turnover, work capacity etc.
3	Compliance, competence	Measures of the staff's individual behaviour to complete patient transfers, competence, skill, compliance with safe methods and equipment use
4	Absence or staff health	Measures that record the time away from work or lost productivity due to MSD, days/shifts lost, staff on reduced work capacity, staff turnover
5	Quality of care	When a patient is being moved are all their requirements for dignity, respect, safety, empathy, being met
6	Incidents and accidents	The recording of incidents, accidents or near misses from patient handling where staff could have been injured in a central location as a performance measure
7	Psychological well-being	Measurement of the staff's mental health status, measures of psychological stress, strain, job satisfaction etc.
8	Patient condition	Does the patient handling method affect the length of stay, treatment progression, level of independence
9	Patient perception	The subjective assessment of a patient when being moved in transfers or mobility situations, fear, comfort etc
10	MSD exposure measures	Physical workload factors that place the staff under strain, forces, postures, frequency of tasks, workload measures
11	Patient injuries	Records of incidents, accidents or injuries to patients when being assisted to move, bruises, lacerations, tissue damage etc
12	Financial	The financial impact of MSD in an organisation, lost staff time, lost productivity costs, compensation claims, litigation, all direct and indirect costs against the costs of any prevention programme

CHAPTER 4

Development of the Intervention Evaluation Tool (IET)

4.1 Introduction

Chapter 3 of this study created a prioritised list of outcomes that a PHA would like to measure as part of an assessment process to evaluate the benefits of patient outcomes. This Chapter describes the process to examine each of the 12 selected outcomes and develop a measurement tool for each separate outcome, and a combined process for evaluating PH interventions. The purpose of Intervention Evaluation Tool (IET) is to:

- Be an accurate measure of effects of any intervention strategy in terms of the management of patient handling risks, in any given situation.
- A tool for practitioners, to be used to evaluate their own progress in their organisations (Internal assessment).
- Allow comparison of different intervention strategies across different locations (Intra-agency comparison)
- Be robust in data collection and analysis, to allow the data to be used in multi-centre research programmes (EU comparison)

The tool is, in this study, an assessment for a single ward or unit. Future developments could convert the score systems to allow a whole hospital or health service to be covered. The procedure for data collection and analysis for the IET allows an individual PHA or team to collect organisation wide information and observations on the assessed location, e.g. ward or unit, and then an expert user (MF) to calculate the IET scores. Future development will include the development of a computer based scoring system, to improve access to the scoring and report writing functions.

4.2 Methodology

The focus group study provided a prioritised list of 12 outcome themes that were included in the IET structure. The initial consideration was how to measure the outcomes that had been defined by the EU study (Table 3.28), and then to consider how the 12 individual measures could be amalgamated to provide a single IET total score. Each definition for the 12 outcomes was applied specifically to the field of PH and the resulting organisational effects. However, each of the definitions could also have been used in the much wider fields of MSD or occupational health. Due to the limitations of this project it was not possible to evaluate all the possible outcome measures (OM) and outcome measurement tools (OMT) for the wider context. This indicated that the IET would be comprised of OM and OMT that had previously been assigned to evaluating outcomes in peer-reviewed studies for patient handling issues. The search for the OMs and OMTs was completed on the literature database created for the literature analysis (Section 2b). In this analysis the OMTs included in the comparison section 2b.6 were also considered, as they had all been through the peer-review process, though some had not been used in a peer-review study.

The information discussed was developed into a full guidebook for users, and a set of data collection documents that is presented in Appendix H.

4.2.1 Selection criteria

The creation of the different sections of the IET required a practitioner-based view of the project. The selection process needed to create measures for each outcome that were valid and accurate for the types of situations in which it would be applied. The tool also needed to be usable and accessible for practitioners in patient handling, so the selection process considered the complexity of data collection and analysis during the selection process.

Appendix G includes a breakdown of all outcome measures that correspond to each of the 12 selected outcomes. The outcome measures are ordered by the academic QR score (Downs and Black, 1998) that each study received as part of the literature analysis.

The tools for the IET were then selected using the following criteria:

- The level of the QR ratings were considered and only QRs of >50% were accepted for inclusion

- Papers that used measurement tools that had previously been subject to peer reviewed validation studies were included
- In areas where lower quality studies prevailed:
    - The most frequently observed outcome measures were considered
    - Outcome measures that had been used to score a before and after intervention trial were considered
- Selection depended upon the structure of the IET. The data had to be collectable and the analysis needed to be acceptable in the context of the IET in the healthcare setting.
- In situations where appropriate Robson Level 3 (Robson et al., 2007) outcome measures would be preferred

The number of outcome measures included in the over 50% category for each of the 12 selected is in Table 4.1.

Table 4.1 Numbers of outcome measures included for IET

Preferred outcome	No outcomes included
1.Safety Culture	6
2 MS health measures	46
3 Competence and Compliance	25
4 Absence or staff health	20
5 Quality of care	1
6 Accident numbers	2
7 Psychological well being	10
8 Patient condition	1
9 Patient perception	25
10 MSD exposure measures	163
11 Patient injuries	0
12 Financial	10

Certain factors have been identified when analysing the outcomes against the different categories. Robson level 3 outcomes are mostly organisational style outcomes, and Robson level 2 data are mostly staff and patient outcomes.

Level 1 data are measures of the intervention and are not included in this analysis. Table 4.2 shows the highest QR ratings for each of the 12 preferred outcomes. i.e. the highest level academic papers in each section. The academic score does not necessarily relate to the outcome measured, but to the quality with which the study was conducted. It is clear that only some of the included outcomes can deliver level 3 measures. There is no justified methodology to accept these differences into the score system at present.

Table 4.2 Highest QR for each of the 12 preferred outcomes

Preferred outcome	Level 2	Level 3
1.Safety Culture	Knibbe and Knibbe (2006a) 74% Nelson et al. (2006) 70% Hignett and Crumpton (2007) 67%	
2 MSD measures		Chokar et al. (2005) 93% Warming et al. (2008) 89% Cohen et al (2004) 82%
3 Competence Compliance	Kjellberg et al. (2004) 89% Wachs and Parker (1987) 86% Daynard et al. (2001) 81%	
4 Absence or staff health		Chhokar et al., 2005 Cohen et al. (2004) 82% Craib et al. (2007) 81%
5 Quality of care		Nelson et al.(2008) 59%
6 Accident numbers		Engst et al (2004) 63% Menckel et al. (1997) 63%
7 Psychological well being	Kindblom-Rising et al.(2007) 85% Smedley et al. (2003) 70% Nelson et al. (2006) 70%	
8 Patient condition	Waldenstrom and Gottvall (1991) 93%	
9 Patient perception	Conneeley (1992) 92% Kjellberg et al (2004) 89% Garg et al. (1991) 80%	
10 MSD exposure measures	Engkvist et al. (2001) 100% Hignett (1996a) 96% Waldenstrom and Gottvall (1991) 93%	
11 Patient injuries		
12 Financial		Chokar et al (2005)91% Charney (1997) 72% Nelson et al (2006) 70%

4.3 Selected methods for IET

The studies collated in Table 4.1 (Appendix G) were examined for the outcome measure based on the criteria above. Each included outcome was investigated individually for the best method of measurement. As some of the OM and OMT in the available studies measured more than one outcome, the tools selected for each outcome were compared to minimise overlap and simplify the data collection process, particularly relating to the staff, patient and organisational groups of outcomes.

The following 12 sections describe; the selection process for each of the outcomes included, the reasons for inclusion/exclusion, the method of data collection for each outcome, the method for calculating each of the section scores, and the range of scores expected as part of the data collection.

4.3.1 Safety culture

4.3.1.1 Selection

Only six studies were identified in the database as potential measures for safety culture. Smedley et al., (2005) suggested the MARCH tool for evaluating management commitment, and this was also considered. But for the most part MARCH is an organisational assessment and is difficult to apply in small locations. Table 4.3 shows the most suitable measures.

Table 4.3 Safety Culture – Selected outcome measures

No		Paper ID	Outcome Measure	Method
153	1997	Menckel	Number reports completed	Evaluation interviews
155	1997	McGuire	Manager knowledge and attitude	Qualitative interviews. – attitudes about interventions
210	2006	Nelson	Perceived support of organisation (Culture)	Level of support for program
230	2007	Hignett	Safety Culture PHOQS	PHOQS
241	2006	Knibbe	Prevention strategies/Compliance Policy mirror	Policy mirror

Menckel et al.(1997), McGuire et al. (1997) and Nelson et al. (2006) measured only small selections of the overall problem, so were unsuitable. Only the Policy Mirror (Knibbe and Knibbe, 2006a) and the PHOQS tool (Hignett and Crumpton, 2005) gave an overview of the safety culture in an organisation. The Policy Mirror is self-reported, and PHOQS is an interview-based audit including a document check and the presentation of evidence. PHOQS has been published as a development study, and subject to peer review and evaluated in an intervention study (Hignett and Crumpton, 2007). The factor of management commitment was raised as important in the focus group study (Section 3.7.4), and discussed in Nelson et al. (2006) and the MARCH tool (Smedley et al., 2005) is worthy of inclusion as an addition to the chosen question set. Nelson et al. (2006) asked specialists in the area about the level of support for the programme. This has been added to the question set and will be distributed as part of the staff and management data sheets.

4.3.1.2 Data collection

The data for safety culture was collected mostly from an interview with the ward/unit manager, the management commitment was asked of managers, advisors and staff. This tool is based on the Patient Handling Observational Question Set (PHOQS) tool devised and evaluated by Hignett and Crumpton (2005). The scores were only allowed if documentary evidence was seen by the Observer. This was particularly relevant when discussing the communication based questions. An additional question, the subjective appraisal of management commitment (5 point Likert value) was collected from managers, advisors, and staff and incorporated as a multiplier to the PHOQS score.

4.3.1.3 Calculation

The PHOQS score was calculated from 30 points.
The management commitment score was calculated as two scores, the average score from staff, and the average score from management and advisors

Section 1 Score = PHOQS score x Commitment average score

$$= \frac{\text{Modified PHOQS score}}{120} = \text{as\%}$$

The total from 120 was calculated as a percentage and included in the IET total score.

4.3.1.4 Range of scores

The IET section score is a simple percentage from the total score (0-120). The PHOQS score can be maximised if a very comprehensive management system is in place, with day-to-day evidence of following best practice. It is unlikely that a full percentage score for commitment will be achieved across the staff and management. It might be considered in future reviews that the management commitment score be additive rather than used as a multiplier. The full range of scores will be carried into the IET.

4.3.2 Musculoskeletal Health Measures

4.3.2.1 Selection

The quality required for measuring MS health in the workforce required a self-reported assessment of recent MS health status. The outcome measures for the recording of MS health in the included studies revealed a clear picture. Forty-six outcomes were included in this part of the study; 26 studies recorded injury rates, and 18 recorded the prevalence of pain and discomfort for the given populations. The most frequently referenced tools for data collection were derivations of the Nordic questionnaire (Kuorinka et al., 1987).

4.3.2.2 Data collection

To aid the data collection the short version of the Nordic Questionnaire (Dickinson et al., 1991) was used. This records whether the staff reported any MSD problems over the last 12 months. Each reported problem scored as a negative response. The questionnaire is delivered as part of the staff questionnaire.

The aim is to collect completed forms from 50% of the WTE numbers on the unit. The Observer must record the number of staff absent with MSD at the time of the survey, and include numbers in the calculation as a maximum negative.

4.3.2.3 Calculation

The worst score for any body part (line) is recorded as the submission for each participant. The score for MS Health for each participant is 0-6.

Section 2 Score = Average Nordic Questionnaire Score (as %)

4.3.2.4 Range of scores

If a unit recorded all staff as having MS problems during the survey, it would be a very high level of MSD problems and would be difficult to justify. In a similar way the recording of no problems for any staff would also be unexpected. This indicates that extremes of the range can be removed to give better detail in the final score. Therefore the scoring for the section was based on:

Average scores of <1 = 100%= very good management of MS health, and average scores of >5 = 0% = very high levels of MS problems.

The Expert focus groups (Section 3.7.4 and 3.7.5) discussed the difficulties with using MSD figures, and it may be necessary in future developments to include standardisation for age, experience and workload factors.

4.3.3. Competence and Compliance

4.3.3.1 Selection

The outcomes for competence and compliance were numerous, and 25 studies were included. A selection of the more appropriate measures is included in Table 4.4.

Some methodological factors resulted in exclusion from selection. Any methods based on video analysis were removed due to time and equipment needed. All self reported compliance tools were removed due to the potential reduction in reliability. This left the smaller range of observational tools that ranged from compliance checklists, and use of equipment registers to error recording.

Table 4.4 Competence and compliance – Selected outcome measures

		Paper ID	Quality	Measurement
32	1993	Switzer	Observations of practice	Observation evaluation with OWAS
42	2001	Daynard	Compliance with methods taught	PH technique
63	1987	Troup	Task performance by the staff	Video assessment skilled observer
64	1996	Foster	Self reported changes in practice	Self reported errors in questionnaire
68	1995	Garb	Awareness and knowledge of the staff	Yes no compliance
69	1993	Feldstein	Back pain	BIPP transfer evaluation. Oswestry BP questionnaire
162	1987	Wachs	Compliance with standards	Observational checklist – not validated
180	1993	Hellsing	Observed compliance with teaching	Observed test Fransson 1991
209	1988	Owen	Use of equipment for tasks	Questionnaire
210	2006	Nelson	Self reported unsafe acts (compliance)	Self reported unsafe acts
211	2003	Smedley	Number of unassisted transfers(compliance	Observation – use of equipment
230	2007	Hignett	Skill understanding/Verbal protocol	Interviews
247	2006	Hye-Knudson	Compliance / skill (Warming tool	Video analysis checklist
255	2002	Johnsson	Method assessment (Compliance)	Early version of DiNO Later validated and translated
256	2006	Engkvist	Use of Equipment	Checklist – method selection
277	2007	Reid	Survey response	6 self reported questions
328	1997	Engels	Errors	Video analysis vs checklist
227	2004	Kjellberg	Work technique (clear method)	Kjellberg Method video analysis

The most familiar of the observational tools is DiNO (Johnsson et al., 2004) reported in section 2b.6. This method used an observational checklist of work technique to measure physical compliance. DiNO is a validated tool and has been used in Greece (Lomi and Lomi, 2006), the UK (Griffiths, 2009) and Portugal (Barroso et al., 2007). The checklist is however only an assessment of competence, and has no specific assessment of whether the person is completing the recommended activity.

The definition of the outcome (Table 3.20) included a measure of compliance. Two questions were added to the full DiNO score that required the observer to see the patient handling plan, and judge how well the protocol was followed with a graded response. The two additional scores acted as reducing multipliers to the competence score, which is reduced by 50% if a) there was no protocol or b) the protocol was not followed.

4.3.3.2 Data collection

The observed transfers are selected on a convenience basis. Observations are taken for 25% of the patients in the unit over a 24-hour period (32 Patients= 8 observations). A minimum of five transfers must be observed in any assessment. A working knowledge of DiNO must be noted in the observer.

4.3.3.3 Calculation

Section 3 Score = Average Adapted DINO Scores = as%

4.3.3.4 Range of scores

Even with a very poor patient transfer some movement principles or equipment will be used so full compliance scores are unlikely. Greater use of the range of values will be found if the range of positive scoring is reduced to 4-16. This range would score an average competence transfer (DiNO = 8/16) with no handling plan (x50%) as the lowest level in the range (0%) for the section.

4.3.4 Absence or staff health

Given the focus on MSD and absence in the role of PHA, only 20 studies met the selection criteria for the values of staff absence.

4.3.4.1 Selection

The North American countries have clearer absence reporting structures. The US uses the OSHA reporting system (OSHA 2009, BLS 2009). British Columbia also has many studies using its central reporting systems. If only formal, government or organisation, reporting systems were used in this study there would be a large possibility of excluding information from many EU countries where the data is less well controlled.

The staff related MS health figures were self-reported through the Nordic Questionnaire. So as a comparison the absence data needed to be collected from official records for the organisation. Sickness absence data collected in the organisation with a standardised form was utilised. All self-reported systems, and any systems that required further information from the staff were removed. Only the OSHA data collection and scoring system gave work hours standardisation, so the method in Charney (1997), Charney et al. (2006) and Collins et al. (2004) was selected.

Table 4.5 Absence or staff health – Selected outcome measures

		Paper ID	Quality	Measurement
48	1999	Fanello	Semi structured questionaire for absence	Self reported SA Q
66	1997	Best	Sickness absence	Self reported SA Q
82	1999	Evanoff	Lost time injuries	Injury rates
87	1997	Charney	Lost time from injuries,	OSHA 200 log
140	1998	Pohjonen	Work ability index	Work Ability Index
149	1991	Nyran	Lost Time Claims	MSD questionnaire Ontario lost time claims
163	1987	Wood	Lost time	Number wage loss accidents
210	2006	Nelson	Lost days and modified days	Self reported SA log
213	2005	Fujushiro	Days lost	OSHA log per worker hours Reported MSD
241	2006	Knibbe	Sick leave	National S\A data
243	2006	Knibbe	Absence	Sick leave
256	2006	Engkvist	Time lost	Self reported SA Q
265	2005	Engst	Injury Costs	BC injury rates
296	2004	Collins	Lost work days	Injury records Lost days OSHA logs Restricted work days
248	2006	Charney	Time lost	Injuries per 200 000hrs Injuries per 100FTE
263	2005	Chhokar	Time lost injury rate	BC injury rates Lost time
260	2004	Cohen	Lost days.	BC injury rates Lost time
277	2007	Craib	Lost time injuries	BC injury rates Lost time

<u>4.3.4.2 Data collection</u>

Organisationally collected sickness absence figures were required for the calculation. These could be provided via the manager interview or from a different location if required, e.g. human resources, occupational health or pay services. Total staff numbers and hours were also required for the calculation.

4.3.4.3 Calculation

The calculation of incidence rates for US government projects, reports each case of injury and illness. Due to the smaller sample size and the definition ofreported sickness absence the calculation was changed to included lost time in the ward area. This was multiplied by the OSHA factor, which is the possible hours for 100 staff, against the total hours worked in the unit in question (BLS 2009).

Section 4 score = Time lost x OSHA Work Hours Factor

$$= \text{Time lost} \times \frac{\text{Total work for 100 staff}}{\text{Total productive hours}}$$

The OSHA calculation is based on company workforce numbers, so a grading factor was introduced in the range calculation.

4.3.4.4 Range of scores

The OSHA calculation creates large scores for comparison. The IET is for a single ward or unit, so to examine the range of scores in a unit with 30 staff, and 13 full time shifts per day, the following examples have been developed to show the levels of high and low scoring.

Example 1 High absence

30 staff 10 staff absent with MSD, 5 staff on reduced capacity following injury

Lost time per year = 18900hours

Section 4 score = 18900 x 168000/ 27040 = 117426

Example 2 Low absence

30 staff 1 staff absent with MSD, 1 staff on reduced capacity following injury

Lost time per year = 2100 hours

Section 4 score = 2100 x 168000/ 27040 = 13047

The score for the IET can therefore be based on the range of 0-100 000 and converted to a percentage score.

4.3.5 Quality of care

4.3.5.1 Selection

Only the 2008 paper from Nelson et al., met the criteria for quality of care. This paper utilises the Residents Assessment Instrument (RAI) sponsored by Medicare and Medicaid Services in the USA. It develops scores for cognitive, mood and behaviour, physical function, incontinence and health, using a large battery of data collection instruments. The RAI was too complex for this study. Nelson et al. (2008) considered the acquired pressure ulcer score as a key indicator, and in this tool for patient injury was to be included in Section 11 Patient Injuries. Meeting patient's requirements was the quality measured.

4.3.5.2 Data collection

The data and definition created from the focus group study suggested that the questions for inclusion (Section 3.7) would represent security, comfort, communication, consent and dignity. The questions were targeted at the patient's response to patient transfers across their hospital stay, rather than the feedback from a specific task, as in Section 9, Patient Perception.

4.3.5.3 Calculation

The calculation is a simple average score calculated as a percentage.

4.3.5.4 Range of scores

No limits were added to the range of available scores, as it was not known how the responses might occur. Further narrowing of the acceptable range may be required in future development.

4.3.6 Accident numbers

4.3.6.1 Selection

Table 4.6 shows the two studies that were considered under the accidents and incidents category. The methodology from neither gave a suitable method, but the inclusion of verbal/subjective responses from the staff improved the quality of the data recorded, rather than relying singly on official incident reporting.

Table 4.6 Accident numbers – Selected outcome measures

		Paper ID	Quality	Measurement
153	1997	Menckel	Accident reports and feedback	Verbal and documented reporting
188	2004	Engst	PH incidents	Number of resident handling incidents reported

4.3.6.2 Data collection

The inclusion of incident numbers that have patient handling factors is unclear and complex. The scoring system included scores for non-reporting by the unit manager and self-reports of unsafe practice by the staff. The score was low for units with a lot of accidents, and those with poor practice, or poor reporting. There is a check question in the IET Data 4 to detect if too many people report completing an incident form compared to those recorded. In this case the data is erroneous and should be removed from the survey.

4.3.6.3 Calculation

$$\text{Section 6 score} = \frac{\text{Reported PH incidents + Potential PH incidents}}{\text{Number WTE on unit}}$$

The number for the IET total is an inverse value as a percentage.

4.3.6.4 Range of scores

If the ratio value exceeds one report per member of staff, a score of 0% will be recorded.

4.3.7 Psychological well-being

4.3.7.1 Selection

Eighteen studies were accepted from the full selection. Studies were excluded if they included full job satisfaction measures, as they are complex and have benefit as research tools only. Self-reported perception of injury risk measures and measures of comfort were removed, as they are weak without some psychosocial data. Measures of psychological stressors were a more suitable measure and easier to collect. Evanoff et al. (1999) used a three section assessment tool, based on Bigos et al. (1991) and this was the most suitable.

Table 4.7 Psychological well-being – Selected outcome measures

		Paper ID	Quality	Measurement
82	1999	Evanoff	Psycho social stressors	Psychological stressors - job satisfaction scale (Bigos study 1991)
210	2006	Nelson	Job satisfaction	Job satisfaction (Stamps, 1997)
210	2006	Nelson	Perceived effectiveness of intervention	Safety culture measure
211	2003	Smedley	Psychosocial stress	North et al Whitehall study 1993
237	2005	Santaguida	Ranking of preference	Satisfaction of chosen method (Overlap with 3 Compliance)
240	2006	Millar	Comfort	Perception of self risk. Scale 1-10 perceived risk of injury
306	2007	Kindblom-Rising	Perception after training	Nurse interviews (qualitative study)
188	2004	Engst	Perception of MSD risk	Staff aggression

4.3.7.2 Data collection

Data collection was via a single page staff questionnaire. The link between psycho-social factors and the prevalence of MSD is well documented, and one criticism of MSD risk factor studies is the omission of such factors. The scoring system for this section was defined by Bigos et al., (1991), and used questions to give a score for: job satisfaction, worker satisfaction and psycho-social factors. The final section was scored in reverse as a check score in the data sheet. The calculation recovered the polarity.

4.3.7.3 Calculation

The calculation for the Section 7 overall score, scores each of the three sections equally from the original model, and then scores an average for the section total.

a) Job Satisfaction = Total score / 9 / No participants
b) Work Satisfaction = Total score / 21 / No participants
c) Psycho-social factors = (9 – Total score) / 9 / No participants

$$\text{Total inclusion score for IET} = \frac{a) + b) + c)}{3} = \text{as }\%$$

4.3.7.4 Range of scores

With so many of the questions being three part responses, the full range of scores was possible so no limitations were added to the total IET score

4.3.8 Patient condition

Table 2b.11 in the literature analysis identified six studies with patient result outcomes, but only Waldenstrom and Gottvall (1991) scored over 50% on the QR score. This study measured clinical obstetric outcomes, so was not a suitable measure.

4.3.8.1 Selection

The EU study indicated that Patient Handling Specialists considered that high quality patient handling could improve the treatment and effectiveness of a care package. Quantifying that effect has been a challenge. This series of questions aims to identify any negative effects of poor patient handling systems. Each identified case of a negative effect reduces the score in the section. The consideration that the prevalence of pressure sores may also be a deterioration in the patient condition is included in Section 11.

4.3.8.2 Data collection

The possible reduction in the level of care is recovered from a questionnaire given to staff and management, as it was unclear that patients would have enough understanding of what should happen to them in a care situation. Other studies collecting condition change need either expert assessors or expert patients.

4.3.8.3 Calculation

Section 8 score was calculated a simple score presented as a %.

$$= \frac{\text{Total score from survey}}{16 \times \text{No of forms}} = \text{as } \%$$

4.3.8.4 Range of scores

As this section was a newly defined score, no restrictions were placed on the calculation.

4.3.9 Patient perception

4.3.9.1 Selection

Twenty five outcomes met the inclusion criteria, though many studies provided multiple measures; a sample is given in Table 4.8. Studies that measured family considerations, qualitative records from interviews, subjective assessments of the intervention, or equipment assessments were excluded. This indicated that the measure for patient perception was a judgement of the quality of a single transfer that has just been completed.

In most of the remaining studies the measurement was on a 5- or 7-point Likert scale or a 10-point visual analogue scale. The highest scoring study was by Kjellberg et al. (2004) that used a bi-polar score (-4 to +4) for safety and comfort, with descriptors on the scale. This method was selected and compared with a staff measure of quality of transfer, to evaluate if the transfer was unsafe or uncomfortable due to the quality of the act or unsafe due to the method choice.

Table 4.8 Patient perception – Selected outcome measures

		Paper ID	Quality	Measurement
2	1996	Gingher	Impact of resident from staff view	Observed data
49	1999	Owen	Patient comfort, security	Patient comfort 7 pt Likert scale
66	1997	Best	Patient comfort	Patient reaction –fear, 5 pt scale
72	1999	Owen	Patient Perception Security and comfort	Comfort/security, 7 pt Likert scale
73	1994	Garg	Patient Comfort/security	Comfort/security, 7 pt Likert scale
74	1993	Benevolo	Patient comfort/safety perception	VAS scale 10 point
158	1996	McGuire	Patient perception	Questionnaire
159	2000	Zhuang	Patient comfort / security	Likert scale
168	1997	Le Bon	User trial data Patient	5 pt likert agree or disagree
183	1991	Garg	Patient comfort/ security	Patient comfort 7 pt Likert scale
200	1998	Conneeley	Patient perspective	Qualitative interviews7 pt scale, for comfort security (?fear)
236	2005	Ruszala	Subjective performance rating	Interview - opinion
237	2005	Santaguida	Ranking of preference	Ranked dat for preferred equipment
255	2002	Johnsson	Patient comfort	Bipolar safety and comfort
271	2006	Baptiste	Patient safety	1-10 likert scale
227	2004	Kjellberg	Patient perception	(QR 89%) +4 to -4 comfort and security. Staff and patients

4.3.9.2 Data collection

The general views of staff and management, relating to the quality of the services provided, were accounted for in other sections. This section related to the safety and comfort of the patients that were assisted in movement. After the transfer was completed, large font copies of the Likert scales were presented to the patient and the questions asked verbally.

The staff question ascertains whether the choice of transfer was the root cause for any poor perception. This was to be used as a cross check for the section score.

4.3.9.3 Calculation

A simple average score of the collected data is presented.

4.3.9.4 Range of scores

The bi-polar scales presented in this section suggest that any negative score would be an unacceptable outcome. Therefore the range of included scores should be 0-4. Any average scores under zero score zero.

4.3.10 MSD exposure measure

The definition of MSD exposure measure (Section 3.7) is an expression of the volume of patient handling activities as an indicator of the MSD risk.

4.3.10.1 Selection

Table 4.9 shows the range of outcome types included (163) in this section. There were many tools and studies that score for postural risk, biomechanical loading, forces applied and the resultant physiological response and subjective measures of workload. Most of the studies have measured an individual caregiver for an individual task. This form of data collection was not going to be possible in the IET due to time and technological restrictions.

A small number of studies collected workload measures for a group of workers over a period of time. These measurement devices were investigated to identify the factors that needed to be considered for inclusion. The level of physical effort and demand on the workforce was the desired measure. The most suitable measurements were those related to log registrations as a measure of workload, (Knibbe and Friele, 1999; Cohen et al., 2004; and Warming et al., 2008).

It is the author's opinion that the level of work demand in a given work area is dependent of the following factors: number of staff, number of patients, level of dependency of patients, weight of patients, complexity of care packages of patients, number of handling tasks completed each work period, and methods used to complete the tasks (with a safe system or not).

In line with previous research studies conducted in the industrial partners for the project, the method selected for Section 10 was based on one section of the

Care Thermometer (Arjo ab b). The philosophy of this process indicates success when equipment is provided, but this does exclude some increased workload situations, e.g. for heavier person hoist tasks. The question set included was developed from three studies: self reported workload measure (Knibbe and Friele, 1999), patient parameters and workload (Cohen et al., 2004) and the Arjo Resident Gallery (Arjo ab d).

Table 4.9 MSD Exposure measures – Selected outcome measures

Quality
MSD risk factors
Qualitative studies
Postural loading
Biomechanical loading
Forces applied
Physiology response
Self reported workload measures

<u>4.3.10.2 Data collection</u>

24-hour recordings of actual tasks were not possible in the context of this tool, therefore an estimation of patient handling workload was collected based on the measurement of the following factors:

a) The patient condition rated on the Arjo Resident Gallery
b) The weight of the patient
c) The functional activities that require assistance from staff AND are being completed
d) The provision of suitable equipment to manage the risks of transfers
e) Other additional risks perceived by the staff on the unit

The Care Thermometer guidance for safe transfers is as follows:

Repositioning in bed – Hi/lo bed and sliding aids

Lateral transfers – Requires sliding aids

General transfers – Active or passive lifter where appropriate

Hygiene in sitting – Hi/lo hygiene chair

Shower in supine – Hi/lo shower trolley

Bathing – Hi/lo bath

Transfers to bath – Hi/lo seat or hi/lo trolley

Care on bed – Hi/lo bed

Compression stockings – Stocking applicator aid

The final section allowed the staff on the unit to identify further complications for the handling activities based on their experience. Additional risks will be scored for poor equipment, poor environment and lack of compliance of patient.

4.3.10.3 Calculation

The measurement is calculated as two separate ratios that can be used as comparisons between units. The first is to measure the average handling workload per patient, and the second for inclusion in the IET is the average handling workload per WTE staff member.

4.3.10.4 Range of scores

The range of ward types and the different levels of compliance with the manual handling directive across the EU could allow large variation across the scale, so no restrictions on the score system were suggested.

4.3.11 Patient injuries

There were no studies that evaluated patient injuries as outcomes of patient handling actions. The definition for the outcome (Table 3.20) was used to develop a new measure.

4.3.11.1 Selection

The only sources of data that could be included for this section were any record of patient accidents resulting from patient handling actions e.g. mobility, falls, improper positioning etc, and the acquired pressure ulcer data that has already been linked with quality of care (IET Section 5, 4.3.5).

4.3.11.2 Data collection

Only management information from official data collection was used. The recording of pressure ulcer prevalence with local and organisational evaluation is very common across the EU.

4.3.11.3 Calculation

Section 11 score:

$$= \frac{\text{Number of reported incidents + Acquired pressure ulcer score}}{\text{Number of beds}}$$

The IET score is presented as an inverse percentage score i.e. high accident scores are recognised as poor performance. For a 12-month period more than five accidents per bed was calculated as the 0% score for poor performance.

4.3.11.4 Range of scores

As with the previous section this was a new definition and measure, so the range of values was not understood before the trials were completed.

The measurement of the patient injury outcome is one for future discussion. There is much overlap between the section definitions of 8, 9, and 11. Discussion within the project group and the peer-review panels raised the question that the relationship may exist that 8+9+11= quality of care (IET Section 5, 4.3.5).

4.3.12 Financial

In the priority list of outcomes the last included outcome was the financial evaluation of the intervention.

4.3.12.1 Selection

A small number of studies (10) were compliant with the inclusion criteria. The most suitable studies were included in Table 4.10.

Table 4.10 Financial– Selected outcome measures

		Paper ID	Quality	Measurement
82	1999	Evanoff	Compensation costs	Lost time workers comp
87	1997	Charney	Compensation costs	Compensation Days lost Investment
199	1993	Charney	Financial impact	Standardised accident rate Compensation calculation
210	2006	Nelson	Cost benefit	Injury –related Rx costs

		Workers compensation Days lost Investment
240 2006 Millar	Injury costs	Claims cost
251 2003 Passfield	Costs	Claims Workers comp
263 2005 Chokhar	Costs	Litigation claims Days lost Investment cost
296 2004 Collins	Workers compensation claims	Injury records Lost days OSHA logs Workers comp claims HR data
296 2004 Collins	Cost benefit analysis	Investment
248 2006 Charney	Financial loss	Total loss per claim Lost time, claims

The IET is not a replacement for a full financial evaluation, so complex cost benefit analysis procedures would be unnecessary for this application. A simple intervention costs versus organisational losses model was defined for this section.

4.3.12.2 Data collection

These organisational outcomes were recorded as part of the management interview. The financial values that need to be recorded were:

- Costs of days lost
- Costs of reduced capacity days
- Costs of MSD claims
- Costs of any treatment for the MSD (internal or external)
- Costs of the intervention extra to the organisational set up

The data will be standardised using the OSHA formula (Charney, 1997, Charney et al. 2006; and Collins et al., 2004). The calculation can then be used as a cost benefit model (e.g. Siddarthan, Nelson and Weisenborn, 2005), if required.

4.3.12.3 Calculation

The score for the IET section will be presented as a ratio of cost improvement per the investment costs for the intervention. Higher scores show higher success for the intervention.

Section 12 score = $\frac{\text{Losses before} - \text{Losses after}}{\text{Cost of intervention}}$

4.3.12.4 Range of scores

As with the other created calculations there are no restrictions on the scores for this outcome. There may be other values that are worthy of consideration in future developments; figures may be normalised for each EU country depending upon salaries, recognised working hours, etc, and the normal prevalence of MSD in each country. It is suggested that any loss represents a 0% score and 100% improvement on the costs would represent a100% score.

4.3.13 Summary

Table 4.11 shows a summary of the information required to create the IET score, and the source material for each section.

Table 4.11 Overview of IET development

Preferred outcome	Method for collection	Source papers
1.Safety Culture	PHOQS Documentation review	Hignett and Crumpton, 2005
2 MSD measures	Nordic Questionnaire (or derivative)	Kourinka et al., 1987 Dickinson et al., 1991
3 Competence Compliance	Observational checklist. DiNO	Johnsson et al., 2004
4 Absence or staff health	OSHA Logs Standardised data per population	Charney, 1997 Charney et al., 2006 Collins et al., 2004
5 Quality of care	Meeting the clinical needs of the patient, patient evaluation.	Nelson et al., 2008
6 Accident numbers	Standardised incident numbers and non-reporting ratio	Menckel et al., 1997 Engst et al., 2004
7 Psychological well being	Job satisfaction Psychosocial stressors	Evanoff et al., 1999 (Bigos Study)
8 Patient condition	Meeting the clinical needs of the patient, staff evaluation.	Care Thermometer (Arjo ab b) Nelson et al., 2008
9 Patient perception	Comfort Security/Fear	Kjellberg et al., 2004
10 MSD exposure measures	Patient handling demand	Knibbe and Friele, 1999 Cohen et al., 2004 Arjo Mobilty Gallery (Arjo ab d)
11 Patient injuries	Detrimental effects of poor case	New tool

	management	
12 Financial	Calculation of costs vs investment	Charney, 1997, Charney et al., 2006 Collins et al., 2004

4.4 Data collection for the IET

The IET creates section scores to measure the performance against the 12 priority outcomes, and a combination score evaluates the overall performance for patient handling management. The measurement for the 12 sections was examined and combined to create the simplest data collection format. The data collection format of the IET is outlined in Part B of Appendix H. Each section includes guidance notes for data collection, definitions of terminology, inclusion and exclusion criteria.

The IET required a level of skill in the Observer to complete certain sections, e.g. workload assessment and observation scores. Early field trials recruited experts in the patient handling field to assist with the data collection, training requirements will need to be considered for the wider recruitment of observers (Section 6.2 and 6.4).

4.4.1 IET Summary Sheet.

A front sheet is completed to collate the names and contact details for all the individuals collecting data and with details about the ward or unit being assessed.

4.4.2 IET Data 1. Organisational Review

The Observer collects information about, accidents, incidents, workload and the costs of MSD in the area being investigated. Data is gathered through the specialist advisors or managers in the organisation e.g. HR, H&S, ward manager, handling advisors.

4.4.3 IET Data 2. Safety Culture Audit

The Observer conducts a PH safety culture audit, which requires the area manager or senior healthcare person to show documentary evidence that a safe system of work is in place.

4.4.4 IET Data 3. Patient Handling Transfer Observation

The Observer completes a series of patient handling transfer observations, scores the task, and collects the staff and patient observations of the transfer. Twenty five percent of the patients requiring assistance will be observed, or a minimum of five transfers. If the patient is unable to complete the form, it will be removed from the survey.

4.4.5 IET Data 4. Ward/unit survey

The final part of the data collection is the completion of a staff and patient questionnaire including the MSD health, and compliance status, of the staff and the subjective experiences of the patients being assisted.

4.5 Scoring the IET

The calculations and range of scores is explained in section 4.3. The cumulative score for the IET is based simply on the priority order created by the focus group study (Chapter 3). The design of the voting sheets (Sheet 3, 3.2.1) requested a ranked selection from the participants, and even though accumulated values were calculated in Table 3.27, it was inappropriate to use anything other than a ranked list for the final contribution. Addition of the individual contributions was totalled and a percentage calculated. Table 4.12 shows a summary of all the calculation, range and score contributions for the IET. This format was used for data collection in the evaluation phase described in Chapter 5.

Table 4.12 Contribution for each outcome

Preferred outcome	Score description collection	Data collection	Possible range	Low score 0%	High score 100%	IET score
Safety Culture	Modified PHOQS score	Safety culture audit	0 -120	0	120	**12**
MS health measure	Average level of MS health in staff	Staff questionnaire	0-6	> 5 = 0%	<1 = 100%	**11**
Competence Compliance	Average modified DINO score	PH Observation	0-16	<4=0%	16	**10**
Absence or staff health	Standardised lost work time	Organisational review	0- 100 000	100 000	0	**9**
Quality of care	Average patient handling quality score	Patient questionnaire	0-4	0	4	**8**
Accident numbers	PH accidents per staff	Organisational review	0- not known	>1=0%	0	**7**
Psychological well being	Average psychological well-being score	Staff questionnaire	0-1	0	1	**6**
Patient condition	Average subjective assessment of weakness in PH system	Staff questionnaire	0-1	0	1	**5**
Patient perception	Average patient perception score	PH Observation	-4-+4	<0 = 0%	4	**4**
MSD exposure measures	MSD exposure measure based on workload per patient	Organisational review	0-14	14	0	**3**
Patient injuries	Patient injury ratio per bed per year	Organisational review	0- not known	>5 =0%	0	**2**
Financial	Standardised cost improvement for MSD per investment cost	Organisational review	Loss to savings	Any loss =0%	>x1 savings = 100%	**1**
						87 as %

CHAPTER 5

Evaluation of the IET

The long-term aim of developing a measurement device is to have confidence in the process. It is necessary to evaluate the IET as a whole, and its component parts, for a range of scientific qualities. For the process to be a success the IET will need to be evaluated for validity, to assess that it is a true measure of patient handling performance, and that it can differentiate between good and poor performance. It will need to be useable across the range of EU member states and the breadth of the EPPHE group. The instructions and calculations will need to be reliable for repeated measures in a single site intervention and across multiple sites with good inter-rater reliability for observer teams.

The process of validation for complex tools in the patient handling literature is limited. Some types of measures lend themselves to the validation process. Postural risk assessment tools e.g. OWAS (Karhu et al., 1977) and REBA (Hignett and McAtamney, 2000), both have validation in their original publications and have been accepted as transferrable tools. The same can be said of some of the biomechanical models, e.g. NIOSH (Warters et al., 1993) or the studies from the Dortmund Group (Jaeger et al., 2005; Jordan et al 2006). These biomechanical tools, though well validated by the physical nature of their measurement, are in some cases difficult to apply due to the level of equipment required (e.g. Marras et al., 1999) and the focus on a single transfer situation (e.g. McGill and Kavcic, 2005).

Other tools that are more widely used in patient handling applications have not been subject to the same rigour. The DiNO tool for assessing performance of single transfers identified weaknesses in inter-rater reliability in some phases of its calculation (Johnsson et al., 2004). The MAPO tool (Battevi et al., 2006) had a ten-year evaluation to show the consistency of use, but the validity of the measure was not clearly proven by even these considerable numbers. Subsequent evaluations in other locations have questioned the scoring process (Cotrim et al., 2006; and Fray, Hignett, Evans and Hunter, 2006).

In addition patient handling outcome measures lack the scientific evidence to show that a reduction in exposure to risk actually reduces the number of MS injuries (Amick et al., 2006; Dawson et al., 2007; and Martimo et al., 2008). A full process of validation and reliability testing will be discussed later (Section 6.3). The aim of this study was to develop a version of the IET to be used in hospitals with a minimum of training, and allow peer review and evaluation.

5.1 Methodology

The calculation of the individual section and total IET scores is described in Chapter 4. This format of 12 sections was complex and too time consuming for field data collection. A series of stages were used to evaluate the calculation methods and the data collection process (Figure 5.1).

During the development of the initial version of the IET (Vi), pilot visits to UK hospitals were completed to develop a useable process and accessible documentation. The findings of the pilot visits are summarised in Appendix I.

The full IET document (Vii) was reviewed with key national representatives from the UK patient handling arena. The suggestions from this peer review panel created an acceptable version to be used for the EU trials (Viii). The IET V(iii) was converted to a data collection format (see 4.4), translated into the three EU languages, peer reviewed and corrected by the facilitators before the trials. Two sites in each of the four EU countries were used to collect data to evaluate the IET. These data were presented at an EPPHE panel to complete the peer review process, and provide comments for the evaluation and recommendations for future use (Chapter 6).

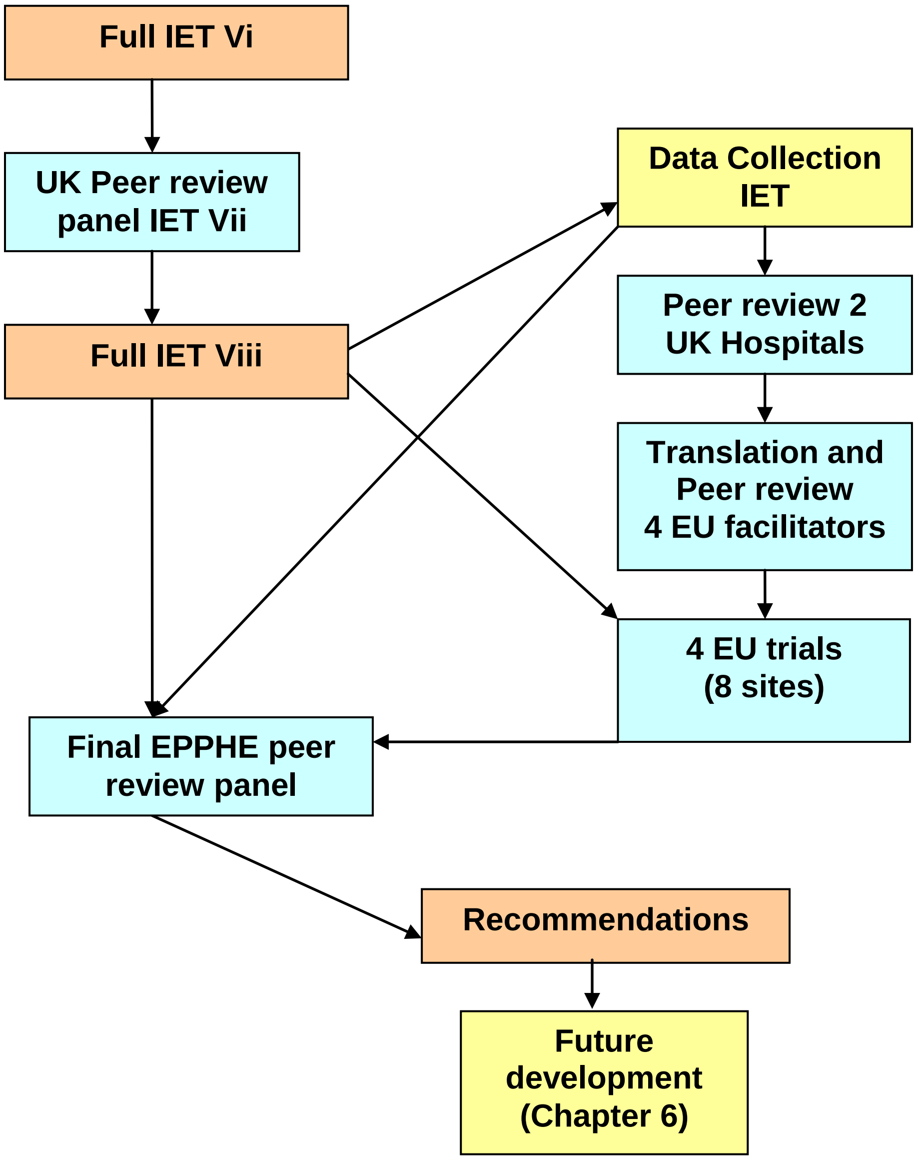

Figure 5.1 Review and evaluation process

5.1.1 Pilot visits

The IET (Vi) was reviewed in two NHS sites (acute and primary care) in the UK. A senior member of the back care team (acute hospital) reviewed the document. After minor modifications it was used to collect a set of data from a single orthopaedic ward. Modifications were made to the IET format and structure based on the reviewed feedback (Appendix I). The reviewed version (Vii) was taken to a primary care hospital and was reviewed by the Back Care Advisor. Access to a ward was not possible at the time.

5.1.2 UK peer review panel

The peer review panel, consisted of UK PHAs with high levels of experience in the management of patient handling systems, plus representation from the HSE, NPSA and NBE. Each participant was given a full copy of the IET (Vii) with supporting information. A focus group format was used to allow discussion of the each section. Feedback was requested on content, data selection, interpretation and the validity of the calculation method. Comments received at this panel were adopted into the EU trial version (Viii). It was decided not to add or change scoring systems or questions from the peer reviewed/ validated tools, to avoid conflict with existing validity. All participants were subject to the usual ethical procedures outlined in the Loughborough University procedures (Appendix C).

The IET (Viii) document used for the trials is in Appendix H.

5.2 IET EU trials

The next stage in the evaluation process was to return the IET to the four countries that had participated in the original focus groups, and complete an IET assessment on two separate ward areas. The data collection tools and instructions for data collection were translated. Each was sent to the EU facilitators for proofing and corrections. Many typographical and interpretation differences were corrected through the proofing process. The translation also added to the peer review process, as the facilitators had a working knowledge of the calculation format of the IET and raised questions about the specific nature and content of the questions and the required answers. MF met with all EU facilitators individually to discuss any corrections. The EU facilitators corrected the documents and a final proof was returned to the facilitators to affirm the corrections.

The EU trials were co-ordinated by the EU facilitators with the assistance of the managers and PHAs in each hospital. Where appropriate, the local permissions and ethical approval were obtained. The EU facilitators selected two ward areas in one or two acute hospital sites. The two locations represented a well-managed unit and a poorly performing unit. The data collection was completed by the EU facilitator or a named person in the hospital (not MF). If possible dual copies of observational data (IET Data 3, 4.4.4) were collected if more than one observer was present. The principal researcher (MF) was present through all the data collection and kept notes of the different situations and potential problems.

Table 5.1 Locations for data collection

Location	Hospital	Facilitator	Data Collectors
UK	London, St Mary's Hospital Ward 1 London, St Mary's Hospital Ward 2	Mike Fray	Claire Mowbray Jenefer Fraser
Portugal	Lisbon, Hospital Egaz Moniz Almada, Hospital Garcia de Orta	Teresa Cotrim	Teresa Cotrim Natalia Parente Claudia Frencito
Finland	Turku, Long term elderly care unit. Turku Geriatric Hospital	Leena Taminnen-Peter	Leena Taminnen-Peter Virpi Fagerstrom
Italy	Milan, Niguarda Hospital Vascular Surgery Ward Emergency Medicine Ward	Natale Battevi	Olga Menoni

The principal researcher (MF) took the completed data sheets and provided a report to each location. The trial data, feedback from the participants and the field notes are reported below.   This review information was used to create the discussion format for the final EPPHE review panel.

5.2.1 UK Trial

The chosen locations were situated in St. Mary's Hospital, which is part of Imperial College Healthcare NHS Trust and is one of the large London teaching hospitals and delivers acute health care. The two wards were part of the medical health care provision, one mainly for elderly patients, the other a specialist stroke ward.

5.2.1.1 Site 1 (Grafton Ward, St Mary's Hospital, Paddington)

The collection of the staff survey forms resulted in only four completed from the 11 required. A full set of patient surveys was collected.

PH tasks observed for IET Data 3

1.1Shower transfer with 2 staff

1.2 Hoist transfer toilet to bed

1.3 Hoist transfer bed to chair

1.4 Hoist chair to bed

1.5 Assisted mobility

No patient data were collected for observation 5 due to the cognitive level of the patient.

The following comments were noted during data collection:

- The non-availability of the lead person on the site created problems
- If staff are unavailable repeat visits may be required to complete the data collection
- The responses from multiple senior staff lead to differences in the data collected
- There was a lack of clarity over whether support staff (physiotherapy/occupational therapy) were included in staff numbers
- Individual interpretation of the questions created differences between staff and senior managers responses for quality of care.
- The workload assessment in IET Data 1 was considered complex without prior knowledge of the tool
- Training needs to be considered for data collectors and the senior staff assisting in the data collection
- The experience of the observer against the staff affected the judgements of how well the task had been completed
- Patient responses to questionnaires were difficult to collect without staff being present.
- The response rate for staff questionnaires in IET Data 4 was affected by the 12 hour shift pattern

5.2.1.2 Site 2 (Albert Ward, St Mary's Hospital, Paddington)

The general process for the second site was better than the first. A management difference observed in this area was the reliance on physiotherapy staff to assist and plan the getting out of bed activities. Eight staff survey forms and four patient survey forms were collected. As a secondary assessment two members of the back care team (JF and CM) collected DiNO assessments for this ward. Patient data were only collected via one observation due to cognitive issues.

Tasks observed for IET Data 3

2.1 Manual bed to chair
2.2 Lying to sitting
2.3 Assisted sit stand walk, bed to chair
2.4 Hoist chair to bed
2.5 Sit stand sit back in chair
2.6 Hoist bed to chair including rolling to fit sling

The following comments were noted during data collection:

- Regular shift patterns improved the data collection from staff
- A single injury recorded 12 months of decreased capacity to score high on lost time.
- Two different systems for documenting patient mobility assessments were recorded
- Equipment malfunction and availability affected the scores in the workload assessment
- Even with limited experience of the IET Data 3 there was close agreement between the two observers
- The level of cognition affected the numbers of patient surveys collected
- The reliance on physiotherapists to complete patient transfers meant tasks included an element of assessment of the patient's function

5.2.1.3 Summary of UK results

These are the key feedback points from the data collected:

Table 5.2 Summary results for UK trial

Measure	Site 1	Comments	Site 2	Comments
Safety Culture (PHOQS)	25	Very high score for safety culture, the secondary visit recorded very positive responses to the PHOQS scores but earlier information had questions over link workers	18	An acceptable score for PHOQS assessment. Errors seen for lack of formal communications of risk assessment and handling plans
MSD Workload	26 / 1.44	A total of 26 tasks were found to be uncontrolled against the care thermometer (1.44 per patient). Most problems were sitting hygiene and elastic stockings	21 / 1.05	Problems with hygiene in sitting and lateral transfers
Competence Compliance	7.5	4/5 observations were not supported by the risk assessment paperwork. The average on the original DiNO score was 12 the minimum acceptable score.	9.75	An improved score for both the DiNO scores and the compliance scores but still did not make the 12/16 minimum
MSD levels in staff	3.4	2/5 staff had the full score for MSD ill-health	3.0	3/8 staff had full scores for MSD ill health

5.2.2 Portugal Trial

The Lisbon visit was the first EU trial. To gain access to the healthcare system the organisations required instructions and preparation in the IET. The EU facilitator visited both sites to inform the managers of the tool, the processes and the structure of the visit. The staff survey forms were distributed via the head nurse the week before the data collection.

5.2.2.1 Site 1 (Hospital Egas Moniz, Lisbon, Internal Medicine Ward)

The patients are allocated to staff teams and not by room or location. The ward manager selected the tasks for observation and two staff demonstrated all the observed tasks. Fifteen staff surveys were completed but no patient surveys were possible.

Tasks observed for IET Data 3

1.1 Repositioning in bed with 2 staff, no slide sheets

1.2 Bed to chair, manual pivot transfer, sheet and bracelets used for restraint

1.3 Repositioning in bed with 2 staff, no slide sheets

1.4 Repositioning in bed with 2 staff, no slide sheets

1.5 Chair to bed, manual lift transfer

No patient data was collected for any of the observations due to cognitive limitations of the patients.

The following comments were noted during data collection:

- Planning and site visits by the EU facilitator improved data collection
- Sickness absence rates were recorded in the occupational health team
- Reduced capacity on the return to work was provided by the ward manager
- The lead nurse on the ward assisted with the completion of the workload scores and patient assessments
- Occupational health assisted in the completion of IET Data 2 for safety culture.
- No patient handling plans were located that gave guidance for handling
- The expectations and experience of the observers could have affected the observation scores for very high risk manual transfers

5.2.2.2 Site 2 (Hospital Garcia de Orta, Almada, Internal Medicine Ward)

Almada is a small suburb situated just over the major river crossing from the port of Lisbon. The hospital is relatively new. The same OH systems are in place as the previous site. The ward was also an internal medicine ward but with fewer patients. Physically, there was no height or position adjustment on any bed in the hospital, except for a small number on the intensive care unit. The beds and chairs were too high for the patients, and steps were used to assist transfers.

Tasks observed for IET Data 3
2.1 Manual bed to chair
2.2 Hoist bed to chair roll to fit sling
2.3 Assisted sit-stand-walk, bed to chair
2.4 Bed to chair Patient good mobility
2.5 Reposition patient in bed

No patient data was collected for most of the observations, due to cognitive issues of the patients, and so will not be analysed.

The following comments were noted during data collection:

- The provision of fixed height beds had a significant effect on the workload score but there was a lack of clarity regarding its effect on some of the scores. If the bed is part of any of the following it could score negatively: repositioning in bed, lateral transfers, general bed to chair transfers, transfers to bath, care on bed, application of elastic stockings. This scoring would have added a further 45 negative scores to the total, and this would raise the level of work per patient.
- Inexperienced observers reported difficulties assessing the performance of transfers with very dependent patients
- 17 staff surveys were returned.
- Patient surveys were collected by staff on the ward which could affect the feedback from patients

5.2.2.3 Summary of Portugal Results

These are the key feedback points from the data collected:

Table 5.3 Summary results for Portugal trial

Measure	Site 1	Comments	Site 2	Comments
Safety Culture (PHOQS)	13	Weak score for management systems. Central systems in OH not supported by locality information. Poor communications score in Q9&10	16	Poor mobility documented assessments and weak systems for disseminating information reduced the organisational score
MSD Workload	69 / 2.23	The workload score was high to indicate the high physical nature of the ward (2.23 manual tasks per patient). Lateral transfers, bathroom transfers and no hi/lo shower facility and the prevalence of elastic stockings scored highly.	29 / 1.21	This workload score did not accurately measure the postural and force loads placed on the staff. The effect of fixed height beds could have been interpreted more severely. If the adverse effects of beds were included the scores were 74 / 3.1
Competence Compliance	4.65	The converted DiNO score showed a poor level of competence (average 9.3) that was reduced to a very low combined score as there was no evidence of handling plans in the risk assessment process	5.2	The full DiNO scores averaged 10.4 which given the environmental considerations was high. No documented handling plans were observed so all scores were reduced in the combined score.
MSD levels in staff	2.73	No staff recorded having time away from work for MSD over the past 12 months2 staff recorded the lowest	2.94	3 staff recorded MSD sick leave in the last 12 months, only one recorded no pain in any area on the survey

5.2.3 Finland Trial

The EU facilitator (LTP) had arranged visits to two sections of the elderly care services of Turku health board. Like so many EU systems, the Finnish health and social care systems have been through many changes. The most recent has seen health and social services merged together.

5.2.3.1 Site 1 (Elderly Care Unit, Turku)

Geographically selected, this unit had been part of an intervention trial, but frequent management changes had meant some weaknesses in the continued implementation of change. Arrangements were made to collect the observational data (IET Data 3) early in the day, and the questionnaires (IET Data 4) had been circulated by the local manager.

This unit was well established with 35 patients in a 40-bedded unit. The patients were very long stay i.e. some in excess of 6 months. The health and social care system in Finland is integrated so long term systems are common.

Nineteen staff survey forms were collected, but as cognitive impairment was high very little patient data were collected.

Tasks observed for IET Data 3:

1.1 Assisted stand, with rollator
1.2 Sit to stand, with a transfer hoist
1.3 Off toilet, with transfer hoist
1.4 Bed to chair, with framed turning platform
1.5 Raise from bed and walk to breakfast
1.6 Off bed to chair
1.7 Off bed, walk with rollator to toilet

No patient data was collected due to the cognitive level of the staff for IET Data 3 and IET Data 4. No sling lift hoist was available on the day of the trial.

The following comments were noted during data collection:

- Different working patterns were reported at weekends to weekdays.
- A physiotherapist had much responsibility for PH decisions on this ward
- Four link workers were reported but had no specific training

- The hospital did not collate injury records. The health board collected this information with no feedback to sites. The senior nurse had collated her own records.
- The two observers (LTP, VF) were experienced in using many of the tools included in the IET.
- Observer found it difficult to score mechanical transfers for staff postures.
- Some differences were reported between the observer assessment and the staff assessment of some transfers

5.2.3.2 Site 2 (New PFI Build, Turku Geriatric Hospital)

The second site was a new build part of Turku Health and Social Care Board. The unit was opened in May 2009 and has recently won an award for the ergonomics of its design.   Ward 4 included two large ward areas. The trial took place in 4C, which has 33 patient beds, 40 staff and delivered long term care for the elderly.

Twenty two staff surveys were collected and three patient surveys were collected with the help of a senior staff nurse.

The observations that were completed included:

2.1 Raise form bed to Wheelchair, with stand-aid.
2.2 Off bed to Wheelchair, using walking frame with ski/sled attachments
2.3 Off bed to wheelchair, with roto-stand.
2.4 Lateral transfer to shower trolley.
2.5 Lateral transfer to shower trolley.
2.6 Bed to wheelchair, with handling belt.
2.7 Complex hoisting needs, bed to chair.

The following comments were noted during data collection:

Comments on Data Collection

- Different working patterns were reported at weekends to weekdays.
- Staff for two units were recorded in a single record
- Organisational systems were not as well developed in this site

- A physiotherapist had much responsibility for PH decisions on this ward
- Four link workers were reported but had no specific training
- Much of IET Data 1 for sickness absence was not collected due to the government recording process.
- If an observer has been involved in the intervention some influence or bias may be seen in the assessment.

A debrief discussion was completed with LTP, VF and MF. It was suggested that the observation scores were weaker at Site 2 due to poor performance of high-risk tasks. MF added that the risk assessments located on the computer system had not been completed so almost all tasks had lost 50% of scores. Site 1 had better clarity in the roles and structure for the link workers, and access to the OH physiotherapist. The new ward (Site 2) will also score zero for the sickness absence data, where Site 1 had higher absence but the local manager was very conscientious and recorded the information. It was clear that the environment was much preferred in Site 2, but with the systems and support Site 1 was the better performer for the IET.

5.2.3.3 Summary of Finland Results.

These are the key points from the data collected:

Table 5.4 Summary results for Finland trial

Measure	Site 1	Comments	Site 2	Comments
Safety Culture (PHOQS)	18	Good management systems were recorded (13/15). The communication processes were not clear or documented for Q9&10	20	Good management systems (11/15), were supported with good communication systems (9/15)
MSD Workload	33 / 0.95	Equipment provision was good and most tasks were compliant. 16 extra risks were noted in the other column to identify the effects of dementia behaviours	32 / 0.97	32 tasks were not fully controlled and they were all related to the manual assistance of class C patients with transfers and lack of compliance as an extra risk.

Competence Compliance	11.15	The original DiNO scores were positive (12.14). The risk assessment documentation was complete but some compliance points were lost for minor differences to the documented plans	7.52	The true DiNO score was fair at 11.5 though one scored a very low 6. 5/7 lost marks for not having a suitable documented plan of the task.
MSD levels in staff	4.1	7/19 recorded some MSD absence in the last 12 months and the highest score. Only 1 recorded no MSD. Only 3 staff recorded not having some MSD problem in the last 7 days. 2 staff are currently unavailable for work due to MSD and were added to the data	4.09	High cumulative figures for MSD and absence (8/22). More importantly all but 2 staff reported some problems in the last week (20/22) only 1 reported no pain or discomfort during the 12 month period

5.2.4 Italy Trial

The facilitator had arranged visits to two sections of the Naguarda Hospital in Milan (Osdpedale Maggiore). Naguarda has been a hospital site for 170 years and is the largest in Milan. Both units have been part of interventions trials and have been supervised by the EPM centre. Since 1999 there has been information for the selection of aids, patient handling training and an effectiveness checking process. Arrangements were made to collect the observational data (IET Data 3) early in the day. The staff and patient questionnaires, were circulated by the local manager. There was a large group of people present in the observation, and manager's data collection including: Head nurse for ward, senior member of staff, two head nurses for hospital, two people from safety team. This was difficult to manage for the observations.

5.2.4.1 Site 1. (Vascular surgery ward. Naguarda Hospital, Milan)

This ward was in the older part of the hospital. Patients were in four bedded spacious bays and corridors.

On the day of the survey 17 patients were recorded in 20 beds. Thirteen staff and 17 patient survey forms were collected.

Tasks observed for IET Data 3

1.1 Reposition in bed.

1.2 Move up bed.

1.3 Return to bed and roll into side lying.

1.4 Use of hoist, bed to wheelchair.

1.5 Bed to wheelchair.

Patient data was collected from most observations.

The following comments were noted during data collection:

Comments on data collection

- Poor availability of equipment was identified in the collection of IET Data 1.4.
- Patient handling demand was low due to many partially mobile patients on ward.
- There was a lack of clarity over the roles of link workers and physiotherapists on this ward.
- The same two staff were observed for all the tasks for IET Data 3, which will introduce bias to the score.
- The EU facilitator had experience with the DiNO tool.
- Patient responses were sought with the large numbers of observers in the room, which is likely to influence responses.
- The PHRA documentation was investigated during the trial, and little information was included for patient movement.
- The patient survey questionnaires were distributed in advance to all patients, not just those that needed assistance.

5.2.4.2 Site 2 (Emergency Medicine Ward, Niguarda Hospital, Milan)

The second site was part of a newer section of the hospital, but part of the same department with the same senior managers. The emergency medicine ward has an average stay of four days. The ward is usually full to capacity and on the day of the survey had 26 patients in 26 beds. The type of care delivered on the ward was acute emergency medicine. Patients were not bathed or showered, and may not have had the same number of transfers as other forms of care delivery.

Seventeen staff surveys were collected and 25 patient surveys were collected with the help of staff.

The observations that were completed included:
2.1 Hoist, to change mattress
2.2 Bed to chair, with minimal assistance
2.3 Move up bed, with slide sheets
2.4 Complex hoist requirements for CP/neuro condition
2.5 Bed to stand, and walk to toilet

The following comments were noted during data collection:

<u>Comments on Data Collection</u>

- The data collection for site 2 was completed after the IET Data 1 and 3 at Site 1.
- The interaction between the two data collections reduced accuracy of the primary researchers evaluation of the two sites.
- The quality of information for IET Data 1 was questioned, as the section was completed from memory with no evidence being shown.
- The safety team recorded incident data. The head nurse stated the absence was nil and it was assumed that costs were nil
- There was a lack of clarity over the roles of PHAs and link workers
- Patient responses were sought with the large numbers of observers in the room, which is likely to influence responses

The EU facilitator (OM) suggested that her observation and knowledge would rate site 2 as the ward with the better management systems.

5.2.4.3 Summary Results for Italy Trial

These are the key feedback points from the data collected:

Table 5.5 Summary results for Italy trial

Measure	Site 1	Comments	Site 2	Comments
Safety Culture (PHOQS)	6 (11)	Documented systems for management of PH were in the most part absent. No PH link worker means no score from Q9&10 but evidence was found to show communication to disseminate handling data.	11	The management systems scored 11/15 but as with site 1 no link system or named nurse to monitor PH so lost all points in second half.
MSD Workload	25 / 1.38	The measures for the 18 patients indicated 25 uncontrolled tasks	3 / 0.12	Only 3 tasks were not completely covered with the expected equipment provision. 16 out of 26 were recorded as A or B who need very little assistance
Competence Compliance	10.83	The original DiNO score averaged at 12.75 which is above the level of competency agreed in the tool. Compliance scores were lost for not meeting the specified technique exactly.	10.575	The competence scores again exceeded the criteria at 13.1. 2/5 tasks did not have documented information describing the task to be completed.
MSD levels in staff	3.46	Four staff recorded MSD sickness absence in the previous 12 months, only one recorded no MSD at all. 10/13 recorded some MS problem within the last week	0.65	The staff in the emergency medicine department were young. No staff recorded full scores and 9/17 recorded no pain or discomfort at all. This and the psychological data are both very positive scores

5.3 Discussion of EU trials.

The local knowledge and assistance of the facilitators created excellent access for the IET trials. All four of the locations were supportive in assisting with the collection of eight data sets. The objectives of the trials were to offer 1) real time and site experience in the data collection process to examine possible methodological changes and 2) to use the eight data sets to evaluate the scoring systems (Section 5.4).

5.3.1 Positive findings during data collection

a. The major success of the IET was that with little preparation on site it was possible to collect complete IET data on all eight of the trial sites.
b. The international nature of the tool supported by the EU facilitators and the translation service has clearly allowed the IET to be used and evaluated in four very different locations. The tool has validity enough to allow no major language discrepancies, whilst still picking up the differences in the provision of health care services. It may be necessary to record the important cultural differences country by country, if the tool is to be used in a wider application across the EU.
c. The range of data in the four data collection sections shows that in all areas of the IET there are subtle and obvious differences to show how each ward managed the different aspects of patient handling
d. Some evidence was not available, but the IET process always accepted that missing data shows that the location would not score positively for certain areas of the complex tool. These gaps are more clearly explained in Section 5.4.
e. The time taken to collect a full data set was found to be to less than half a day (approximately 3 hours). The first trial (UK) showed the weakness in not completing the observation tasks (IET Data 3, DiNO) in the early part of the visit. This also created the requirement to prepare the location for the visit with a pre-trial visit and information.
f. The delivery and distribution of the staff questionnaires (IET Data 4) before the data collection was a successful method, as the numbers required (50% of total WTE) is in many situations not feasible on the day.

g. No problems were raised with IET Data 4.3
h. In three countries multiple observer results were collected for IET Data 3. There was good agreement for most of the observations though approximately one in five scores did show clear variation. In Portugal and the UK some of the observers had no experience of the tools before the day of the visit.

5.3.2 Negative findings from trial

The successful collection of full data sets in four EU countries revealed that there were no significant barriers to the data collection process, but inconsistencies in some areas of the data collection were noted. Areas where clarity of the process may be improved are shown below:

5.3.2.1 IET Data 1. Organisational review

General language and format

a. There are differences across the safety sector on the concept and definition of risk assessment. It may be possible to check the language against the language of the EU directive and ISO standards to ensure standardisation.
b. The collection of several pieces of information from section 1 proved problematic.
c. The total number of hours worked needs to be calculated by the observer and shifts missed should be requested in Section 1.2

IET Data 1.3 MSD and levels of sickness absence

d. There were differences in the recording of PH caused sickness absence as in some areas local recording was observed, but in other areas hospital systems were required.
e. Partial incapacity was rarely recorded centrally, and local managers observed the return to work process.
f. No wards could provide financial data.

IET Data 1.4 Workload from patient dependencies

g. The Care Thermometer (CT) is a complex collection and calculation format, though the alternative format developed for the IET met with approval from the two observers who had experienced the CT previously (Finland).
h. Concern was recorded that completing a bed bath is not a negative score when using a hi/lo bed. The perception of staff is that these tasks are high effort for musculoskeletal load.
i. As with previous iterations of the CT, there is a complication with category C patients. The equipment options states the use of a sit-stand hoist only but there are many rehabilitation based professionals that consider the manual facilitation of sit, stand and walk functions very important, and when used with the right patient are very safe.
j. Taking the needs based approach there is no difference in the score of an A to the score of an E if equipment is provided. It would be interesting to consider the workload of a ward of category A patients against a ward of category E's. In the feedback report from the CT there is a chart to show ratios of the categories, but there is no added risk levels unless the equipment needs are not provided.
k. There were difficulties with B, C, and D definitions during the process. Specifically, difficulties with dementia patients who change due to behaviour (e.g. Bed 15 A by mobility C by behaviour).
l. Some observers questioned the boundary of the equipment definition e.g. rollator, framed turning platforms etc.
m. The Finland trial identified that the use of the CT did not involve the categories of passivity included in the CT, so any provision of equipment eases the workload on the staff, though it may be considered too much equipment in some circumstances.

<u>IET Data 1.5 Patient handling management systems</u>

n. The managers' perceptions were recorded clearly by all the senior people in the trial. An attempt to collect more versions of IET Data 1.5 met with mixed success. Safety officers in Italy, PHA in the UK and all observers were also asked to complete the questions. Questions 1-4 proved impossible for most who did not have hands on experience on the ward but the management commitment question (5) was a good addition to the data set.

5.3.2.2 IET Data 2. Safety culture audit

a. PHOQS has elements of organisational assessment and local area based assessment. There may need to be two score systems, or an organisation score and a local score that is combined to give an overall score. The wording of some of the questions (3 and 8) overlaps the evidence of a single ward versus the whole hospital.
b. The risk assessment described in PHOQS is the hospital wide systematic review of risks, with a priority based score system to place in order the outstanding risks to the organisation. But the second section is relative to the provision of a handling plan (mobility assessment) to assist with physical movement of a patient. This tool was originally to be collected by PHAs, but this role is not recognised in all EU countries. This needs clarification for the final version.
c. There is a need to clarify the language and definitions of RA, PHRA and PHP or mobility assessment.
d. Emphasis needs to be given for the evidence to support all sections of the PHOQS tool particularly Q9 & Q10. Q9 & Q10 need to be proven with physical evidence, considering one point for system present, and one point for evidence that it is used on day-to-day basis.
e. Further to the physical evidence, Q9 and Q10 of PHOQS suggest a high reliance on the provision of a link worker and documented systems. It is possible to show the documentary evidence with an effective management system, but without a named link worker.

5.3.2.3 IET Data 3. Patient handling transfer observation

a. Possibly out of all the data collection, 3.1 (Patient Handling Observation) based on DiNO (Johnsson et al., 2004) has the largest potential for inconsistency. It must be considered for the final version of the guidance, to tighten up the subjectivity of the following questions. The IET did not reproduce the full guidance for the DiNO observations as it adds significantly to the document but key points may need to be included in the final copy.

   a. Specific aspects of the assessment lacked clarity; hazardous under arm holds, lack of preparation for movement for Alzheimer's patient, unconfident staff made errors with the stand-aid procedure were all difficult to score.
   b. Some tasks were easier to score negatively e.g. lateral transfers with a high posture load, and handling belt transfers with a high force load.
   c. Situations where a high-risk method was used to reposition as a second move were difficult to score.

b. Question 2 has no definitive specification for enough space and caused confusion in some observations.
c. Questions 5 and 6 were sometimes left blank for transfers that required no equipment.
d. The performance phase questions (8-13) clearly needs better definition and reference to the original guidance to assist the observers.
e. The scoring of postures and efficiency when equipment is being used is difficult, as the level of effort is sometimes very different to the loads of patient handling.
f. The compliance factor (Q 17,18) required a quality judgement for the PHRA/PHP information. This suggests that the information written down should allow the observer to complete the task. In order to do this the manager/PHA or lead should inform the team of the risk assessment and management system that allows the staff to read a risk assessment and then deliver the PH task. There may be a possibility to include this in the PHOQS section and transfer it to the DiNO section. There could also be a minimum requirement for a documented PH care plan
g. There were differences between the staff perception of the method (IET Data 3.3) and the observer score, which is evidence of the expectation and knowledge of the different observers.

5.3.2.4 IET Data 4. Ward/unit survey

In general, the completion of the staff and patient surveys passed without much concern. The data sets showed much variation across the wards in the trial, which justified the methods and the question format.

a. Some questions were raised regarding staff who had high scores for many different joints in IET Data 4.1.
b. In IET Data 4.2, the staff well-being survey, there was some doubt about 11-13 as they are designed with an opposite bias to questions 1-10. Some groups of forms had a clear shift of recording e.g. Portugal but others did not e.g. UK.
c. The patient survey (IET Data 4.4) had the limitations of any questionnaire in areas where patients are elderly and may have cognitive impairment. It is important to collect this subjective view of the ward performance without bias from the staff or peer pressure from patients or family.

5.3.3 Limitations

- The selection process for tools in the IET included tools that had already been through a validation or evaluation process, and did not allow for any changes in the structure and format. This was necessary to avoid conflict with established validity, but did not allow for subtle changes in wording or direction of questions.
- The inclusion of four EU locations adds validity to in the development of a tool, but there are still limitations of only using eight separate areas.
- There was a convenience sample related to the selection of the EU locations. The areas were selected by facilitators and tended to be areas that have had some investment by the facilitator in the management systems. There is an interesting question for evaluation about the neutrality of the observer and whether anyone involved with the location can give un-biased results.
- Use of senior managers/nurses for data collection in the managerial sections is unavoidable. It was sometimes difficult to be sure that the evidence given resulted in a positive bias relative to the real data (UK Site 1). For the Italy trials, the Senior Nurse Managers from the hospital accompanied the full trial and this undoubtedly had an effect on carer and

patient feedback. The facilitator (NB) suggested that most of the difficulties in setting up the trial were due to the management considering that the research team were government inspectors.

5.4 IET calculation review

Table 4.12 records the calculation for each section and the total score for the IET. The data collected in the EU trials was put through the calculation formulae to calculate section and total scores. Table 5.6 shows the percentage score against each section, and Table 5.8 shows the contribution of each section to the total IET score. The first EU trial was held in the UK, and difficulties with collecting the staff and patient questionnaires were noted in this trial. The numbers of IET Data 4 questionnaires did not meet the requirements for the trial. No sites could provide the data for the financial calculation.   An italic score (in Table 5.6) shows that no scores were collected in the trial and the appropriate full positive or negative score is represented in the calculation for Table 5.8.

Table 5.6 EU trials - % scores for each IET section

	UK 1	**UK 2**	**Po 1**	**Po 2**	**Fi 1**	**Fi 2**	**It 1**	**It 2**
	% score	% score	% score	% score	% score	% score	% score	% score
Safety Culture	**55.6**	**46.7**	**13.8**	**23.3**	**30.7**	**39.8**	**15.6**	**25.2**
MS health measures	**40.0**	**50.0**	**55.0**	**51.5**	**22.6**	**21.6**	**38.5**	**100**
Compliance, competence	**29.2**	**47.9**	**3.5**	**11.5**	**59.6**	**29.3**	**56.9**	**29.6**
Absence or staff health	*0.0*	**10.7**	**95.9**	**64.6**	**71.2**	*0.0*	**100**	**99.5**
Quality of care	**75.0**	**80.0**	*100*	**69.0**	**64.2**	**86.7**	**88.8**	**79.5**
Incidents and accidents	*0.0*	**97.3**	**89.5**	**69.8**	**82.5**	**72.0**	**89.8**	**88.5**
Psychological well-being	**76.2**	**82.4**	**77.7**	**70.7**	**75.0**	**70.3**	**71.7**	**81.2**
Patient condition	**64.5**	**79.9**	**45.0**	**65.9**	**64.2**	**62.5**	**69.1**	**84.4**
Patient perception	**68.7**	*100*	*100*	**66.7**	*100*	**52.1**	**93.3**	**90.0**
MSD exposure measures	**64.0**	**70.8**	**52.1**	**55.2**	**79.4**	**75.8**	**71.6**	**97.1**
Patient injuries	*0.0*	*0.0*	**91.8**	**66.8**	**100**	**100**	**100**	**100**
Financial	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

The range of scores for: Absence, Accident numbers, MSD exposure and Patient injuries was unknown before the data was collected. The ranges recorded in this trial are in Table 5.7. To complete the scoring systems the ranges in Table 5.7 were adapted into the calculation for the IET (Table 4.12) and the scores are reported into Table 5.8.

Table 5.7 Range effect for IET calculation

	Scores recorded	Range for IET
4 Absence or staff health	0 - 17857	0 - 20000
6 Incidents and Accidents	0.11 - 1.208	0 - 4
10 MSD Exposure	0.1154 - 1.208	0 - 4
11 Patient injuries	0 - 1.3	0 - 4

Table 5.8 EU trials - Section scores and IET total

	UK 1	**UK 2**	**Po 1**	**Po 2**	**Fi 1**	**Fi 2**	**It 1**	**It 2**
	IET total	IET total	IET total	IET total	IET total	IET total	IET total	IET total
Safety Culture	6.7	5.6	1.7	2.8	3.7	4.8	1.9	3.0
MS health measures	4.4	5.5	6.1	5.7	2.5	2.4	4.2	11.0
Compliance, competence	2.9	4.8	0.4	1.2	6.0	2.9	5.7	3.0
Absence or staff health	0.0	1.0	8.6	5.8	6.4	0.0	9.0	9.0
Quality of care	6.0	6.4	8.0	5.5	5.1	6.9	7.1	6.4
Incidents and accidents	0.0	6.8	6.3	4.9	5.8	5.0	6.3	6.2
Psychological well-being	4.6	4.9	4.7	4.2	4.5	4.2	4.3	4.9
Patient condition	3.2	4.0	2.3	3.3	3.2	3.1	3.5	4.2
Patient perception	2.7	4.0	4.0	2.7	4.0	2.1	3.7	3.6
MSD exposure measures	1.9	2.1	1.6	1.7	2.4	2.3	2.1	2.9
Patient injuries	0.0	0.0	1.8	1.3	2.0	2.0	2.0	2.0
Financial	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
IET Total	33.5	46.1	46.3	40.0	46.5	36.8	50.8	57.1
IET %	38.5	53.0	53.2	46.0	53.5	42.3	58.4	65.6

The calculation for the full IET score was successful when using the scores and ranges identified. The range of total IET scores covered approximately 30% of the available range. Table 5.6 indicated full range scores for the individual sections but cumulatively the differences were cancelled out. For future development the section scores may prove to be more useful for the PHA, to identify the level of practice in each location. Larger data sets from future trials could be used to improve the range of the cumulative scores.

5.5 EPPHE review panel

The final evaluation process that was completed was an expert panel, to provide a continuation of the peer review process by inviting different experts to discuss the IET. The EU facilitators were invited to allow member checking and respondent validation, and cross-checking of the interpretation of the evidence collected in the EU trials.

The EPPHE panel was completed in the UK. Selected participants were provided with expenses to attend and accommodation was provided for the two-day event. The attendance at the group was:

- Primary researcher (MF)
- Representatives of the project group (1 x Loughborough University, 2 x Arjo ab, UK and NL)
- Representatives from each EU trial (UK, It, Fi, Po)
- Eight invited members of EPPHE (N-Author of Care Thermometer and Policy Mirror, UK-Scottish Ambulance Service, F-Strasbourg University, UK-Editor of HOP 5, I-Secretary of EPPHE, Ger-ISSA representative, Ger-EPPHE member, UK-NBE representative).

The two-day programme was structured to allow information from the development and EU trials to be presented to the group, and feedback was collected from all participants in open discussion. Field notes were taken by the project team (SH), and the primary researcher reviewed specific discussions. The expert level of the EPPHE panel was required to assess the efficiency, accuracy and validity of the IET process, data collection and calculations. The feedback was used to support the discussion and evaluation described in Chapter 6.2.   Issues relating to process and data collection are recorded in Table 5.9.

5.6 Recommendations for IET process

The pilot studies and UK peer-review panel improved the development of the IET to a system that could be used to collect data from four EU sites (IET Viii). The evaluation delivered from the EU trials and the subsequent EPPHE review panel further identified suggestions for the process of collecting data for the IET. If future development of the IET is to be completed, these issues should be included in the next version (Table 5.9). A more detailed discussion relating to the context and content of the IET is included in Chapter 6, leading to recommendations for content and philosophy for future developments.

Table 5.9 Recommendations for IET process

IET Section	Recommendations
Administration and background information	Staff surveys IET data 4 need to be distributed in advance to improve the return rate. The WTE numbers need to be clearer in the documentation. The manager needs to be primed for the visit to be able to access the information. Collection by an external observer will require proof of all processes and communications and will require more time. Absence and cost data may require secondary visits to other locations to collect information. Either computer based data collection or computer based calculation of the IET is essential for future development.
Safety culture	Ensure the language for IET Data 2 reads for ward-based collection. IET Data 2, Q9 and Q10. If no link worker is recorded the section score must be 0/15. It is possible that these actions can be delivered even though a named person is not in place. The evidence in the literature shows the positive effects of the inclusion of a link person / workplace supervisor so a balance needs to be drawn.
MS health measures	The Nordic Questionnaires and derivatives are common and have been used in many studies in and out of PH. The anomaly in this study was Po vs. Fi. The younger staff in Po reported little or no MSD, though they were doing high risk, high frequency tasks. The older more experienced staff in Fi, who rarely touched a hazardous task, all reported Hi MSD scores. Some questions to consider are: • Could it be age factored • Could it be scored against the organisation average • Could it be against the country average or EU average • Could a measure of turnover be used to correct the value

Compliance, competence	Differences between manual handling methods in different countries could add to the level of error for the EU use of the IET. Inter-rater reliability and validity across such different movement types will need to be controlled.
Absence or staff health	The absence ratio was designed to measure the relative shift in large numbers of employees across an organisation. This value is very susceptible to a single serious injury as it gives high absence time in limited numbers of WTE. As with the MS Health data the values could be factored to improve accuracy: • Could it be age factored • Could it be scored against the organisation average • Could it be against the country average or EU average • Could a measure of turnover be used to correct the value Clarify the numbers to be included in the staff WTE e.g. Lift teams, physiotherapists, occupational therapists, super-numery staff etc.
Quality of care	Little feedback has been recorded around the patient outcomes.
Incidents and accidents	Low numbers of accidents are recorded on each single ward. It may be useful to consider hospital ratios to deliver a larger data set for analysis. The use of non-reporting data changed the results in this section. The range of scores requires some further attention. The score for under-reporting could be an average of all participants or possibly 50% managers multiplier and 50% staff multiplier.
Psychological well-being	The questionnaires were clearly understood and scored. A secondary link with MSD for the EU trial could be investigated.
Patient condition	The participants all understood the language and philosophy of the question. The ranges of high and low scores will need to be considered
Patient perception	Problems with the question set for the elderly/confused.
MSD exposure measures	Difficulty with the concept of the CT judgements (1.4). When assisted all staff could complete section 1.4. Conflict was noted surrounding the manual movement of Class c patients. Concern was raised about the relative workload of different conditions, the level of dependency, the frequency of task completion. The data collection form needs to be improved with different pictures for patient groups. Section 1.4 needs to be completed by the observer and not the manager.
Patient injuries	Low numbers of incidents reported may cloud the performance issues.
Financial	This was not located in any ward area. There is a question whether it is simply the domain of the researcher or the safety department to conduct Cost Benefit Analysis data to justify rolling out an investment programme.

CHAPTER 6

Discussion

Introduction

The Chapters leading to this point have described the data collection and analysis undertaken to complete this project. The use of literature review (Chapter 2), focus groups across Europe to collate a priority list of outcomes (Chapter 3), and the selection of measurement tools to create the IET, have been used to develop a complex evaluation process. The IET can be used to compare the performance of patient handling management systems before and after interventions, or between organisations and can be used to guide future interventions in any healthcare location.

Patient handling is a relatively new area of study when compared to the roles of occupational health and safety or occupational medicine. The evidence supporting the practices of moving physically dependent patients from one position to another has grown rapidly since EU legislation promoted a change in practice in 1989 (EC Directive). There is a growing body of evidence specifically reporting the effects and outcomes of workplace interventions to assist the reduction of MSD, and the promotion of better healthcare by the improvement of the management of patient handling practice. The literature analysis section in this study (Section 2b), reported 101 intervention studies for the improvement of patient handling outcomes.

The process of systematic evidence reviews has become well published, and guidance for the completion and reporting of such reviews is high quality and plentiful. Cochrane Reviews (Van Tulder et al., 1997 and 2003) are the most highly regarded of these processes and several systematic scientific reviews have been published reporting patient handling evidence. The limitation of the philosophy of most of these reviews (Amick et al., 2006; Bos et al., 2006; Martimo et al., 2008) is the single focus on the reduction of MSD resulting from patient handling activities and the high physical workload. The focus of these reviews has shown two key facts: 1) the volume of high quality studies in this area is low, and 2) as with other areas of MSD prevention, there are so many confounding factors in the complex work organisations of worldwide healthcare that a definitive explanation of the relationship between MSD and patient handling is unlikely (Leboeuf-Yde et al., 1997). There is little in the evidence reviews to explain the restrictions to research in healthcare, i.e. ethical review systems and research governance controls.

What these high quality reviews fail to address is the reality of intervention research in healthcare, where there are many other outcomes that can be measured to prove the benefits of patient handling in a healthcare situation. The literature analysis (Chapter 2b) examined the range and detail of outcomes that could be measured to create evidence and prove the benefits of patient handling interventions. The range of staff, patient and organisational benefits show that given the weaknesses in the proven relationship with MSD reduction there are many other measures by which the benefits of PH interventions may be proved. The development of the IET uses the full range of outcomes, and puts into context the relationship between the losses from MSD and other measures of outcome.

6.1 The IET. The concept of a single EU measurement tool.

This study focussed on the outcomes from patient handling interventions, and how they can be combined into a single assessment tool to assess interventions. The evaluation of the IET has shown a successful tool that retrieved and analysed patient handling information from hospitals in four EU countries. The evaluation of the EU trials in Chapter 5 shows that the tool can collect information within an acceptable timeframe, and the calculation definitions showed differences in performance across the different sections.

6.1.1 Priority outcomes

The initial aim of this study was to evaluate the range of possible outcomes and use a range of EU PHAs to define the most important outcomes in priority order. The use of qualitative methods with focus groups and content, and thematic analysis, to identify the preferred outcomes showed many strengths. All of the outcome measurement tools (OMT) reviewed in 2b.6 were developed in a single country, and only some have then been subject to translation for EU wide use. The access to, and the involvement of, fur EU locations add much to the process.

Frey and Fontana (1993: p82) point out that the group interview is an excellent and friendly method for allowing different views and opinions to be generated, and subtly positioned against another standpoint, with a skilled facilitator. This process facilitated good discussion from all participants by:

- The selection of a homogenous group via the EU facilitator, consisting of people from similar positions, and all sharing an interest in patient handling.
- Gaining individuals consent to participate from the EU facilitator at the point of interview.
- Ensuring formal individual consent is developed at the start of the focus group by the use of an information sheet and signed consent.
- The process chosen (Langford and McDonagh, 2003 based on Higgins 1994), which allowed for the initial Sheet 1 to be completed as an individual process without any peer pressure. This allows each participant to formulate their own ideas to then discuss with the group.
- The impartial recording of all outcomes that created a list of points for discussion, which meant that there was no link between the individuals and the discussion, again avoided any pressure to justify their opinion.

The reliability and validity of each section of the tool will be discussed fully in 6.3, but the methodology explained in 3.4, suggested content validity from the range of sources, facilitator checking of the translations, and open peer-review in the panels, was good. The analysis of the EU focus group data against the expert panel's data added to the level of validity. The aim of the project was to include practitioner opinion and data. Concern was raised within the project group as to how well informed the practitioners would be in the different countries, and how much agreement there would be. The analysis (3.9) identified that the highest agreement was between the four EU priority lists and that the EU versus Expert comparison was not as strong. This difference is one area of concern, as the relationship between practitioners and the developers of tools for workplace use is often not effective. This can be identified by the list of audit tools or evaluation programmes that have seldom seen the public domain. Though the use of many countries is included as a strength in the focus group methodology, the limited number of participants is a concern. Even with the Expert groups included only 46 PHA were included, but the agreement was good across the different locations.

The question of applicability can also be raised regarding the transferability of assessment tools across the states of the EU. Many of the OMTs in Table 2b.23 were developed in a single country and have little use outside the country of origin. The countries of the EU are guided by the same overriding regulation; the EU directive (90/269/EEC) in manual handling covers all the participating states, which implies that risk management processes should have similarities. If this were true then there should be no barrier to a universal tool for performance management. The problems of translational shift and replication between the different healthcare systems are well documented (Hignett et al., 2007).

During the expert panel to review the IET (5.5), conflicting opinions were presented surrounding the usability across Europe. The facilitators from the EU trials (Fi, It and Po), who had experience of the translation process, all reported good success with the data collection using the IET. No parts of the data collection documents (Appendix H, Part B) required further clarification during the trials. Possible reasons for lack of transferability were political (Italy), and differences in PH methods (Germany). The growing body of skills and knowledge of patient movement is focussing on a series of methods that are becoming acceptable worldwide, and there is now much less variation in recommended practice across many countries. The recommendations considered for improving the reliability of the IET, including guidance and training, should allow access to any EU region.

6.1.2 Outcome measures for the IET

The creation of the list of 12 preferred outcomes lead to a format for the data required to calculate the IET score. The structure of this particular study restricted the inclusion criteria to OMs and OMTs that had previously been used in patient handling intervention studies. This limits the quality of each individual OM for each of the identified outcomes, but increases the applicability and hence the content validity for the process. Questions related to the specific tools for each section are described in 6.2.1. The incorporation of OM and OMTs previously used for patient handling studies also improves the accessibility of the IET to practitioners. Although the use of measurement tools is not widespread, many PHAs do recognise the scores and methods, which encourages potential users to be come involved. The inclusion criteria (4.2.1) gave some control, and the use of the academic scoring system (Downs and Black, 1998), and validation studies as criteria, improved the robustness of the process.

The development of the IET was focussed on creating a tool that was to be used in healthcare sectors across the EU. In order to facilitate this process the IET needed to deliver a level of detail that provided useful and insightful information about the performance in the observed site, but without being too complex and time consuming. The EU trial process focussed on the organisational issues of data collection and the data collection, process was reduced to approximately three hours with suitable pre-trial preparation.

The inclusion of 12 outcomes in the calculation of the IET showed some symmetry with four outcomes being for staff, organisation and patient benefit. It also showed the importance of MSD, as staff MS health and sickness absence were included in the highest priorities. Though the relationship between the intervention strategy and this set of outcomes has not been part of this study, the format of the IET is open for a wide spread of interventions to be evaluated.

Shaw et al. (2008) reported a review of papers describing occupational health interventions that used a return to work co-ordinator to some clear benefit. No papers were found that examined the specific management of MSD caused by patient handling. In the UK ‘return to work’ and sickness absence management are becoming much more high profile (Black, 2008). A small ongoing study in a Salford Hospital (Briody, 2009) is recording the effects of PHA on the return to work process. These types of interventions are aimed at a clear effect on Sickness absence (4), MSD level (2) and Financial losses from MSD (12). But by managing the MSD effectively there could be a secondary effect on psychological well being (7), and by managing the return to work process could assist the MSD exposure (10) for people with known problems. It is an important addition to the patient handling knowledge that all of these different intervention styles can be compared against the traditional measures. Though the entire tool may not be suitable, the performance in each section could prove valuable.

6.2 The development of the IET

6.2.1 The 12 Preferred Outcomes

Having discussed the IET as a full process each of the 12 preferred outcomes, the data collection and the calculations will be considered.

6.2.1.1 Safety Culture

There is a greater volume of research regarding the observation and modelling of safety culture and safety climate (Flin, 2008; Silvia, Lima and Baptista, 2004; Pousette, Larsson and Torner, 2008; Hahn and Murphy, 2008; Glendon and Stanton, 2000; Turnberg and Daniell, 2008; Johnson, 2007 etc.) in healthcare than most sections in the IET review. These studies however have not been applied to the behaviours and systems that surround patient handling. The use of a supplemented PHOQS score (Hignett and Crumpton, 2005) proved successful as

a score system. Participants and EU facilitators showed good understanding of the tool and accessed the required data efficiently.

The EU trials (5.2) and subsequent Expert panel (5.5) showed that the application to EU healthcare creates not only linguistic issues for translation, but also different societal interpretations. Some of these interpretation differences may confuse different users of the IET Data 2 as a format. The following topics or definitions have been identified as possible areas of confusion:

- 'Link worker' was a term not used in the German system of patient handling. The person responsible for patient handling within the ward environment was noted as different across many of the participating countries. The most familiar of these link workers is the Ergo-Coach. Developed in Holland, there is an international training and information network for the Ergo-coach (www.ergo-coaches.nl). In Finland the term 'vaastava' (EU trial Fi 1) is used to define 'the person responsible for', but in patient handling this role sometimes did not come with a suitable process of education and training. Other countries have various forms of locality based PH trainers or nominated staff that assist with the process of risk assessment and development of PHRA and PHP.
- 'Risk Assessment' since the introduction of the EU directive for management of health and safety is common parlance. The interpretation of the terminology however is varied across the EU. The major difference is the dual meaning of a document and a process. All areas of the EU follow the EU directive, and the local interpretation, that 'Risk Assessment' is a process for identifying, evaluating and controlling risks in the workplace. Guidance for different countries may put more or less levels of detail in the process but overall similarities are found. The physical documented risk assessment however allows for much breadth of interpretation. The Italy Trial (Site 1 and 2) demonstrated that risk assessment was a numerical process, that measured the overall risk for MSD for healthcare workers, and was clearly represented by the MAPO process (Battevi et al., 2006). Representatives from the UK and Finland trials gave evidence that risk assessment was a multi-level process, and could deliver documentation in many forms.
- The term 'Risk Analysis' was less regularly used in the groups and signified a higher level of interpretation, and was associated with a numerical approach.
- The evidence for the completion of a Patient Handling Plan (PHP) is compelling (Smith (Ed), 2005; Nelson (Ed), 2006; Radovanovic and

Alexandre, 2004; Hignett, 2001a and 2001b), The provision of a patient specific document that outlines the methods, equipment and staff numbers is the clearest demonstration that risks from PH have been controlled. It is also noted that the principle of risk avoidance implied in this process can only remove dangerous handling tasks. Therefore non-compliance with completing a PHP (or mobility assessments in PHOQS, IET Data 2) is compulsory if there is inadequate provision of equipment, as the completer of the PHP would be sanctioning dangerous tasks. During the expert panel (Section 5.5) the delivery of this process was varied across the countries represented.

For the process of the IET to be as repeatable as possible there needs to be clarity for the definitions. These definitions should be based on the content of the act described rather than on the linguistics. This allows for better translation and exchange of views in future studies. Using the EU directive on Risk Assessment (89/391/EEC), and documentation from the HSE (2006), the following definitions of the terminology have been developed for future use in this project.

- Generic Patient Handling Risk Assessment
- Patient Handling Risk Assessment.
- Patient Handing Plan
- Link Worker

Manual Handling Risk Assessment (HSE/HSC, 1998) described the process of identifying the MH hazards, evaluating the risks of those hazards for outcome and likelihood, and most importantly implementing a control system to remove the potential risks from the workplace. In this study the control systems were not always recorded in the documentation.

One concern about the scoring system for Section 1 was raised in the EU trial (Italy Sites 1 and 2) regarding the high reliance on the provision of a link worker. Fully 15/30 available points are awarded to Q9-10 in the PHOQS section of IET Data 2. The management structure in the trial site did not provide a named individual, and consequently the relatively high score of 11/15 in the first half of the assessment became a much lower score due to the 0/15 in Q9-10. The EU facilitator (OM) was concerned that the measure did not accurately score the safety culture that was evident in the area. A possible alternative is to make the format of Q9-10 observe two criteria. The additional criteria would be to ask for evidence that the specific information covered in the different areas was actually transmitted across the workforce without the intervention of the link worker. Wider management audit tools (e.g. ISO 9001), suggest that the recognised system for information and performance management is best supported through specific named people, who have responsibility for the process. The evidence in PH also suggests that link workers provide a significant support to this process. It would therefore be unrealistic to remove all reference to the named official, but the information to staff and the provision of competent risk assessment could be positively scored.

Table 6.1 Alternative question set for Q9-10

No	Question	Score
9a	What systems are in place to ensure patient handling risks are controlled in this area through the nominated manual handling supervisors?	Score 1 for each (Max 5)
	• Formal training sessions	Yes 1
	• Formal staff meetings	Yes 1
	• Informal meetings initiated by patient handling advisor	Yes 1
	• Informal meetings initiated by the ward supervisor	Yes 1
	• Ad-hoc meetings	Yes 1
10a	What systems are in place to inform the staff of patient handling issues and ensure their competence?	Score 1 for each (Max 10)
	• Training records	Yes 1
	• Assessing the quality of patient mobility assessments	Yes 1
	• Entries in patient records/notes	Yes 1
	• Ward meetings/handover	Yes 1
	• Personal development plans	Yes 1
	• Problem-solving sessions/documented supervision	Yes 1
	• Case conferences/multidisciplinary meetings	Yes 1
	• Electronic format training/training pack/ workbook	Yes 1
	• Informal documentation	Yes 1
	• Other (e.g. memos)	Yes 1

Overall the measure of Safety Culture covered in section 1 has much evidence to support the specific questions that have been included in the PHOQS tool. The areas of investigation are the provision of both generic and patient specific patient handling risks assessments, the provision of a link worker or named skilled individual to supervise the area, and the provision of supervision instruction and training to assist with the provision of safe handling activities. It is these control methods that have been proven to reduce patient handling risks most effectively according to the literature (Hignett et al., 2003).

6.2.1.2 MS Health Measure

The MS Health Measure utilises a shortened and validated version (Dickinson et al., 1991) of the Nordic Questionnaire (Kourinka et al, 1987). The full tool is widely used in MSD studies (Section 4), but in the context of the IET the full tool would be too time consuming. The aim of this section is to gain through an easy access survey a representation of the MS health status of the working population. The tool was designed to represent all MS health, and not to be very specific to LBP, which is the norm in patient handling studies. Studies by Menzel et al. (2004), Owen, Keene and Olson (2001), and Retsas and Pinikahana (2000), all show that the injuries caused by complex PH tasks are not just centred on LBP but can manifest in any limb or joint. The second consideration is that it may be unnecessary to record MS health issues that are not directly attributed to PH actions. Yet when considering the management of staff in a high risk field, if all staff carry some MSD then that clearly has an effect on the tasks and the possibility of further harm to the population.

A further consideration regarding the recording of all MS health issues was the relevance of other risk factors and their impact on MSD prevalence. The IET has a wide range of data included within the calculation structure; psycho-social and psychological well being (7), the physical workload issues (10), specific accidents showing PH injuries, and the accompanying sick leave (4,6), are all included in the calculation of the IET. Two remaining concerns were those of age and gender, which may require an alteration to the calculation in any future versions of the IET. The comparison between the MS health scores in the Finland Trials and the Portugal trials suggested an age effect (5.3.3). Even the age standardised score is not without complication, as there is evidence to suggest that people new to the care professions are also at risk of developing MSD (Videman et al., 2005; Nygaard-Jensen et al., 2009; and Van Niewenhuyse et al., 2004).

The EU trial required 50% of the staff to complete the staff survey document. In the three sites where the documents were pre-delivered the response was closer to 90%. Better validity is seen with higher percentage coverage, and increased numbers were possible with the improved data collection. It is also noted that it is important to include any staff members that are working with reduced capacity, and those that are unavailable to work with MSD problems, as they may be a significant addition to the MS health score. Discussions later will consider the validity of this shortened Nordic Questionnaire (6.3). One consideration may be to complete this question set over different time periods, to see if the level of MS Health remains constant, or varies with personnel changes on the ward, or with workload.

6.2.1.3 Competence and Compliance

This section encompasses the full DiNO score system designed and evaluated by Johnsson et al. (2004). During that validation study the author raised concerns about the inter-rater reliability that reported 61% agreement. A recent study conducted as part of a long term nurse practice study showed 90% agreement (Griffiths, 2009). The process described by Johnsson et al. (2004) suggests a three hour training and evaluation programme to ensure that agreement is improved. This development of high levels of accuracy and reliability are essential for the academic proofing of the IET, but consideration will be given later to the concept of usability in various workplaces and in different languages.

MacGregor (2009), Groves (2007), and Wonnacott (2005) have all been able to use the DiNO process in UK care settings, but reported terminology difficulties with the Performance Phase. Lomi, Lomi and Pinotsi (2006) and Barroso (2007) all included translations of the DiNO tool to measure the outcomes of intervention studies, but needed to translate terminology and guidance to improve data collection. Tamminen-Peter et al. (2008) reviewed many tools, compared her own learning based tool (SOPMAS) with DiNO, and evaluated DiNO favourably. There may need to be a specific investigation to evaluate whether the information and judgements described in DiNO can meet the requirements for inter and intra-rater reliability (Section 6.3).

All facilitators in the EU trials had high levels of experience in patient handling research, and the process of conducting hospital based audit. All had experience with the DiNO tool and did not feel a fuller explanation or training process was necessary. There could also be the consideration that a local observer known by the staff on the ward could suggest a similarly biased response from the ward. The Italy facilitator (OM) suggested that the selection of the individual to complete the observations could be very influential. It was understood that for future development and a wider range of observers, improvements to the training and guidance would be necessary. The improvements would allow a wider body of data collectors, but a level of competence may need to be defined. For the most part concerns about the use of DiNO as an observational tool are equal to concerns about any observational tool, but its widespread use appear to suggest that at present it is the most suitable for inclusion.

The two additional questions to measure compliance caused little feedback from the EU trials or the Expert Panel. The definition of risk assessment, and specifically the requirement for a patient handling plan (PHP) to explain the task details for moving a patient, produced different understandings in different locations (6.2.1.1). Other countries in this trial however were not confident of the process being in place though they did not deny its importance. The inter-rater reliability question could be an issue in terms of needing a definition for what component information constitutes an effective PHP. There could also be a level of expertise implied in the tool that scores negatively for methods or tasks that are perceived as being unsafe. The inclusion of an unsafe practice list for each country could develop the applicability of the tool, but it is the author’s opinion that one aim of any international evaluation process is to set one single standard. There is a high level interaction between this measure and the safety culture question 6, as the mobility assessment and the PHP are the same decision and document. In the UK there is agreement regarding the content of a PHP as follows (RCN 2001):

- Task to be completed
- Number of staff
- Equipment required
- Method or movement to be completed
- Specific guidance to assist with patient condition or known risks

These criteria make a suitable template for developing improved guidelines for Sections 1 and 3.

6.2.1.4 Standardised MSD Sickness Absence

The overall picture of MS health is measured in Section 2, and the detail of the specific patient handling errors and illness values are recorded in this section. The different definitions that exist across the EU describing low back pain, occupational diseases or workplace accidents will not affect this section, which requires each ward to calculate the sickness absence that is related to patient handling activities. This will include both traumatic onset injury and situations where a chronic condition may have been exacerbated by the ward activities.

The EU trial and the Expert Panel recorded the difficulties of data collection in all areas. The EU trials required information to be held at the ward level. For the future use of the IET, there will need to be of access to organisational data that may be held in occupational health, human resources or pay services. Information from Italy and Germany suggests that even those approaches would not yield the data. Individual privacy rules within those countries prevent disclosure of the reasons for absence being declared to the organisation. Both countries have conducted injury and absence intervention studies (Germany, Caffier, 2007, and Italy, Occipinti, 2007), but had to conduct self-completed questionnaires to identify the levels of illness.

The IET calculation for musculoskeletal sickness absence is standardised for exposure per work hour per individual, to allow comparison between work areas and different sizes of samples. It may also need to be corrected for age, and the background of long-term conditions prevalent in the sample. There is a suggestion that these complications could affect the score systems, but larger numbers would need to be analysed to accurately evaluate the differences. The calculation format using the standardisation process from OSHA (OSHA, 2009) creates a wide range of values. Further investigation will be required to create an accurate score that allows 0-1 values to qualify good and poor performers.

Numerically there is concern that, given the numbers of staff in any selected area, there is a high potential for one single serious case of MSD to overshadow the general effect of sickness absence in any area. The validity of sickness absence in smaller samples is investigated in 6.3. Alternative methods of scoring the sickness absence may need to be considered in future development.

6.2.1.5 Quality of Care

The quantification and assessment of the concept of ‘Quality of Care’ has challenged health researchers for some time. Many suggestions for the calculation of such a quantity have been published in health research, but only one study (Nelson et al., 2008) related the measures of quality to patient handling. The calculation included in this study was a complex observation of all aspects of care delivery, and over 30 different measures were included in the tool. When the measure of quality was used as one part of the IET, the process was too complex. The questions incorporated in this section were extrapolated from the core questions found in the Nelson paper, and evaluate the question of patient needs being met.

Given that ‘Quality of Care’ has such a wide set of applications, the context of its use is key in the IET. The focus group analysis collected the definitions for the preferred outcomes included in the IET, where four of the outcomes were patient outcomes. It can be argued that all of them in different ways are measures of quality of care, and make up the full measure of a patient’s response to their patient handling care on an immediate basis during observations, and longer-term to all patient handling activities.

Other qualities or measures that could be considered in this area are:

- Was I asked to be involved when being moved?
- Was I allowed to be in control when being moved?
- Was I moved enough times to meet my agreed care plan?
- Whether the judgement of the patient should include everyday care actions or not would also need to be addressed in this issue for future versions of the IET.

Though there is a lack of experience and proven validity with the question set, all participants agreed in principle that this outcome was an important part of the overall measure of patient handling.

6.2.1.6 Patient Handling Accident Numbers

There is clear definition in the literature regarding the difference between accidents and incidents (HMSO. HSG 65), but the enforcement systems in different countries adds some complexity to this section. None of the EU trial sites reported difficulties with this process, and all hospital sites had clear reporting structures in place. In other industries the avoidance of serious accidents can often be used as a performance target to encourage safe behaviour. Other industries consider this route to non-reporting, and suggest the reporting of incidents and near-miss situations to increase the awareness of potential problems. UK health systems would aim for the latter but many still consider there to be a culture of under-reporting at all levels (Geiger Brown et al., 2005). There is some suspicion that the reporting enforcement systems in different countries may show differences in the outcomes.

There is also the question of the effects of specific items or occurrences in ward areas, and whether they have a larger effect in smaller populations. Standardisation for numbers and possible workload may make this section a more robust score system.

The numerical analysis of this section also raises questions about what makes a good performer. No accidents or incidents in a fully responsive ward, is a perfect outcome. The extra questions that ask for evidence of hazardous handling tasks were completed by the staff, and increased the realism for the measure. The difficulty of reporting was investigated by a report from the UK Audit Office (1997), which suggested that in UK Acute Hospitals there was an expectation of one incident per staff per year. This level was however for all types of incidents and not just patient handling. Any scoring system for the reporting of patient handling accidents should include standardisation for staff numbers, expected accident numbers, and a measure of potential under-reporting.

6.2.1.7 Psychological Well-Being

The inclusion of psychological well-being as a desired outcome is not surprising given the clear evidence that links psychosocial evidence with MSD (Josephson et al., 1997; Kjellberg et al., 2004; Gonge et al., 2002; and Menzel 2007). What is unclear, and shown by the small number of intervention studies (Table 2b.11) that collected psychological data, is the relationship between psychological well-being and the management of MSD from patient handling. Evanoff's study (1999) used three scales to identify significant improvements of the psychological well-being in hospital orderlies who were empowered to create improvements in work practice. The psychological data matched the physical improvements through the study at three date recordings. One quality which is omitted from the Evanoff data is any subjective assessment of physical workload, and the contribution of this to the likelihood of musculoskeletal injury.

Other tools that might have been appropriate for inclusion in this study were the psychological sections of both the Work Screen tool (Gilworth et al., 2007) and the Workability Index (Tuomi et al., 1998). Ironically the full uses of these tools measure diametrically opposed descriptions of a similar objective. The Work Instability (WIS) method for nurses described by Gilworth et al. (2007) suggest a number of observations that indicate the likelihood that a nurse may be not managing their present work situation. The Workability Index (WAI) concentrates very clearly on measuring the workers ability and their subjective appraisal of their work performance. Both are tools and methods aimed at ensuring that individual staff can continue in work, though minor adaptations may be required. Both of these tools require subjective appraisal of physical and psychological workload and include a psychometric evaluation. Though both are designed to be applicable over wider job descriptions than the IET, the selection of some elements could improve the calculation used in the IET.

In addition both the processes have undergone detailed peer-review and validation trials. In particular the Workability Index has a proven track record of use in many countries and different industrial settings (Ilmarinen, 2005). The Nurse Instability Score was the first of a series of occupational instability scores that was developed after the process and concept of instability had been developed for patients that had specific illnesses e.g. ankylosing spondylitis or rheumatoid arthritis (Gilworth et al., 2007).

6.2.1.8 Patient Condition

As with all the patient outcomes, there has been little application of measuring patient condition in patient handling studies. The concept of being able to improve the patient's condition because of high standards of patient handling management is unproven, but has a high level of intent among practitioners. The PHA would find the evidence that patient condition was affected a powerful driver in all care organisations. This measure would be considered a clinical outcome, and move patient handling into a different area in the health management systems.

The opinion sought in this section was to consider the management of patient handling as a whole (i.e. 'equipment, space, environment, skills or knowledge'), which is complex question. This question could be broken down into a series of questions to give specific problem areas as part of a more detailed investigation. As a data collection tool little was reported about the question set that was delivered as part of the management and staff questionnaires. A range of comments was recorded across the full range of scores, with the exception of 'always'. The collection of opinions from a higher proportion of the workforce gave a better indication of the situation being observed.

The information recorded is subjective and as such is open to the interpretation of the situation, and is particularly indicative of the expectations of the ward and the experience of the staff. The subjective evaluation reported by the staff could give a skewed response, if staff were intending to promote a positive score. But in areas where patients were subjected to missing equipment and physical handling the scores were rated as poor in the trials. Much more research in this area would be needed before this measure could be converted to an objective measure, based on the condition and needs of the patient, and a projected movement plan.

It could be a benefit in the question set to consider the patient view of the questions in this section, but there would be concern over whether in-patients have the knowledge or experience to judge if they are receiving appropriate care or not. Questions like this could be construed as leading the patient into a negative assessment of their care package, which would not be of benefit to the organisation.

One concept which was omitted from the question was time. Most staff would consider that the part of operational restrictions that impairs PH and all care activities is the lack of time. A specific question related to time could add detail to the assessment, but the question would need to be investigated fully as there is a lack of clarity as to whether that is a patient handling issue or simply a health management issue.

6.2.1.9 Patient Perception

In comparison to the other patient outcomes, patient perception is recorded as a direct assessment of the transfer or task, completed in the observation section. As such the data is directly linked with the DiNO score recorded in IET Data 3. This is a comparison measure of the patient view against the observer measure of competence.

Due to the method of selection for the IET there was not an opportunity to involve patients in the assessment of what are the concepts or measures that are of value to observe after a patient transfer. The evaluation of patient objectives relative to patient handling tasks would be a useful addition to the knowledge base, and be a powerful outcome with which to influence change in healthcare organisations.

The format of the data collection tool could be improved in future developments. The question for the staff regarding the self-assessment of the transfer contains two questions, i.e. performed well and according to your plan. Changing this to two separate questions would make a direct comparison to the observer's ratings of the same matters in competence and compliance questions 17 and 18 of DiNO (IET Data 3.1). The use of a nine point scale was also discussed by some of the users, as it differs to many of the other tools. The 9-point scale was defined in the Kjellberg et al. (2004) study, and is delivered in isolation after the observation, and so has no interaction with other scales or decisions.

6.2.1.10 Musculoskeletal Risk Exposure

The source of information and calculation for the measure of MSD risk exposure is based on two concepts. Firstly that MSD is directly related to patient handling tasks in healthcare settings (Smedley et al., 1995), and secondly that the risk exposure measure can be accurately represented by a measure of patient handling workload (Yueng et al., 2002; and Stobbe et al., 1988). The selection of the patient handling workload tool was based on the suggestions from Knibbe and Friele (1999), which related the level of MSD and discomfort to the numbers of patient handling tasks completed over the work period. Warming et al. (2009) has added to the evidence of MSD workload. This study showed through a linear regression model, that there is a relationship between low back pain and knee pain and the number of transfers completed in one day. The reliability of the logbook process has been proven in previous studies (e.g. Hollmann et al, 1999) but all examples recommend repeated measures to gain the highest levels of accuracy. In this situation the formal collection of logbook registrations would be very time consuming for the staff in the observation area. The decision was made in the development of the IET to represent the workload with the quantities reported in the Care Thermometer. This decision was based on the validated history of the Tjil Thermometer (Knibbe and Knibbe, 2005) and meeting the aims of the industrial sponsors who had been involved in it's development.

The Care Thermometer (Arjo ab, b 2007), like many other patient handling outcome measurement tools, is a risk exposure score system. It observes patient handling situations in a given area, compares the equipment and environmental provision, and records the exposure to uncontrolled risks. The number of uncontrolled risks per member of staff was registered as the exposure score.

Several of the facilitators and the Expert Review panel had experience of the Care Thermometer prior to this project. The EU trials showed that the ward managers rarely had the knowledge of the patients to be able to complete Section 1.4 in the organisational review (IET Data 1). The senior nurse usually completed the form with the EU facilitator. Verbally, both facilitators and nurses considered the format of questions difficult, and the facilitators were required to have a good understanding of the no response, yes or no scores. The Finland facilitator reported that having used the CT in an intervention trial, the IET version of the data was easier to complete.

Due to the complexity of the decision making in IET Data 1.4, and because of the comprehensive development, more guidance information was included for the EU Trial documents. The 'Mobility Gallery' document indicated geriatric patient types and diagrams, which were reported as being difficult for some staff to relate to their ward situations. The material from Arjo (Arjo ab e 2009) has a wide range of different applications for the selection of patient types A to E. Inclusion of the different patient types would improve future developments. Little comment was recorded for the extra risk factors outside the original CT description. The non-compliance risk was the most regularly recorded extra risk factor when the patient's behaviour indicated such (Chapter 3).

The strongest discussion point surrounding the measure of MSD exposure risk was whether the calculation of uncontrolled risk actually represented the level of physical effort required by the staff. The data collected during the EU trials did suggest that the areas with lower dependencies and volume of handling scored lower than areas with high dependency elderly and demented patients, but the Expert Panel in particular considered some high risk situations to not be accounted for. The questions that would need to be investigated in further research or data collection were:

- Is the provision of equipment sufficient to negate the physical effort to assist a patient?
- Does a patient's condition have an effect on the workload for patient handling?
- Even in wards where all equipment is provided is it harder to assist a ward of category C patients than a ward of category A patients?
- Are there other risk identifiers that should be added to the included list in 1.4?
- Is it accurate to measure workload and MSD exposure risk on a single snapshot or would repeated measures improve the score?

The frequency of tasks actually completed by the staff was indicated as being the single biggest difference between the recorded logs and the IET calculation. Sometimes in hospital wards and care locations the workload can be high, despite a small number of tasks with small numbers of patients because of the number of times somebody needs washing, dressing, toileting etc. This characteristic could be included by adding a numerical score for frequency against each of the physical tasks that are completed by the staff. The suggested action for future developments of the IET MSD exposure score would be to conduct trials in ward areas, to measure the workload as recorded by log registrations and compare the IET Data 1.4 scores. This measure would need to be considered over a period of time to develop the validity of the summarised measures. The caveat statement that may also need to be added to the data collection document is 'Is the workload measured representative of your usual workload?'

<u>6.2.1.11 Patient Injuries</u>

The definition of patient injuries as recorded in the focus group study, and the lack of previous research, made the data collection format incorporated in the

IET very simple. The only route of data collection was to examine the accident reporting systems for patient harm accidents, and to consider the pressure ulcer prevalence score as being related to the movement and positioning of patients. The validity of these measures and the combination of the different scores is questionable. There are many factors that may confound this outcome score:

- The patient dependencies relate clearly to the possibility of developing pressure ulcers (Braden Scores are commonly recorded as a grade for pressure ulcer risk, www.bradenscore.com).
- Accident reporting relies heavily on the safety culture of the unit being investigated.
- Different EU locations have different reporting and management systems relating to pressure ulcers.
    - Italy will not support extensions in care packages due to acquired pressure ulcers.
    - Germany reported a National Standard on pressure care.
- Are there other specific injuries to be included in this section e.g. foot drop, nerve damage, contractures due to poor positioning?

Outstanding these limitations of the scoring the facilitators and expert panel regarded this outcome and the other patient clinical outcomes to be incredibly powerful, if the evidence for potential damage could be directly linked to poor patient handling performance.

6.2.1.12 Financial Outcomes

The focus on the PHA as the source of information for this study left the financial value low in the priority list. As previously discussed, using a different source of participants might have created a different order. In addition, this section in the EU Trials was not completed by any of the trial sites. The difficulties reported identified that the information was not to be found at Ward level and was likely to be higher located up in the organisation. A reasonable improvement would be to include guidance on the collection of the data, and allow the location of the assessment to identify the appropriate person in their organisation to be included in the data collection.

The format of the data collection tool was also limited to the simple models that had been reported in existing patient handling interventions studies. Future designs of this section could review the simple tool and consider further calculations and possibly other measures of financial loss, or gain. Some of those that have been identified through the EU trials and Expert Panel are:

- Positive improvements in time taken and productivity.
- Defining a financial link and value for improved quality of care.
- Information relating to the staff numbers and the relative values of nurses against nursing aides.

The financial outcome is the lowest ranked contributor to the 12 included sections relative to the focus group data. The complexity of the financial measure may well reflect its position in the PH system rather than the perception of importance. The day to day routine of the PHA mostly function at an operational level rather than strategic, and financial gain is only calculated secondary to physical PH problem solving. However if the future use of the IET develops into a series of 12 tools of equal importance, then the PHA then the detail should be investigated. The lack of financial data being available to PHAs may also have been a reason for its low position, the participants therefore ranked this low as they already know that the information will not be available, or will be so brief that it cannot be used to form a coherent argument to assist change.

6.2.2 The IET calculation

The IET creates 13 scores, 12 scores for the performance against each selected outcome, and an overall score. A benefit of this process is the ability to examine the performance against the individual outcomes, in addition to the overall performance. The EU trials and the EPPHE panel (5.3 and 5.5) considered the calculation and the development of usable scores.

6.2.2.1 The order of preferred outcomes.

The order of the 12 outcomes in the IET, was questioned by EU facilitators and the Expert panel (5.5). One particular issue was the low position of the financial outcome (12). A management review could have placed the financial outcome much higher in the preferred list.

Depending upon the focus of patient handling in each country, a different perspective will be recorded for the preferred list of outcomes. The final EPPHE review group indicated some concern over the position of MSD exposure (10) relative to MS Health (2), in addition to the high position of safety culture (1). Some countries have a different focus on their research and implementation processes and this shows in the perception of the preferred outcomes. Examples of the different focus could be:

- Germany produces high quality research in the biomechanics of lifting techniques and values the exposure to biomechanical risk
- Holland supported by a government programme considers the provision of transfer equipment to be key in the process
- UK has developed the role of the PHA in organisations that utilise the principles of health and safety management, such as policy, procedures, training, supervision etc.
- Equipment providers involved in the project focus on the cost benefits of interventions to facilitate improved sales

One noted limitation of the study is that the design of the project stated that the process was aimed at the specialists that assist the management of patient handling risks (PHA). Early in the research it was decided to include the opinions of those people only. The tool was designed to be used by patient handling specialists, those who are the implementers of change, and the designers of patient handling interventions and systems. The programme of research has gained high content validity by including the preferred outcomes of four different EU countries, with a range of backgrounds and qualifications, and compared those findings with findings from experts from academic conferences. The similarity between countries was analysed by the statistical test of Kendall's Concordance (Seigal and Castellan, 1988) that showed good agreement between the four EU locations. The use of a different source of participants could have created potential differences in content, order, and correlation.

The order was based on the voting scores from the focus group study. Each participant ranked the highest priority outcomes. The ranking philosophy was then carried through the analysis. This meant that some outcomes were differentiated by a single vote, and one by as much as nine. There was also a tie in one rank that was separated by using the total of votes. The similarities of these scores and rankings may point to the interactions between the outcomes having more of an effect on the overall IET score.

It could be considered important during the further validation of the IET that:

- The original research be completed with a range of participants from different areas of the healthcare structure, e.g.
    - Nursing Managers
    - Hospital Risk Managers
    - H&S Advisors
    - Occupational Health Nurses or Managers
    - Staff involved in transfers
    - Patients (past or present)
- The included outcomes of this study be evaluated by other participants to examine differences in content and order
- A secondary investigation is completed to examine the interactions between the 12 included outcomes, and re-calculate the contribution to the Total IET score based on the overall contribution rather than the ranked order. (6.3)

6.2.2.2 Inclusion and Exclusion Criteria

The use of the three classifications of outcome proved useful for the structure of the literature analysis and for the differentiation of outcomes for inclusion (Robson et al., 2007). Table 6.2 shows the Robson level for each of the 12 sections. Safety culture as defined in this project was considered by some in the EPPHE review panel as being a measure of the intervention. The development of the tool was based on the definitions and collated outcomes recorded in the focus groups and the voting scores (3.9). Robson Level 1 measures were excluded from the final list.

Table 6.2 Robson Outcome Level for 12 Outcomes

Improvements in:	Robson Score
Safety Culture	2
MSD measures	3
Competence Compliance	2 Q17-18 3
Absence or staff health	3
Quality of care	2
Accident numbers	3
Psychological well being	2/3
Patient condition	3
Patient perception	3
MSD exposure measures	2
Patient injuries	3
Financial	3

The definition of each outcome (Table 3.28) clarifies the qualities and measurement requirement of each. In addition there are interactions between the outcomes. Table 6.3 shows the different levels of the Robson definitions against the outcomes that raised concern in the review panels, and gives outcome measures to explain the different levels of measurement.

Table 6.3 Review of included outcomes with Robson Score

Robson Level		Safety Culture(1)	MSD Exposure(10)
1	Qualities and quantities of intervention	Writing policies and procedures, completion of risk assessment	Change of method, equipment provided to assist task
2	Outcome measures that have evidence based link with reduction of risk	Organisational or collective behaviour that proves the management systems are being followed (PHOQS, Hignett and Crumpton, 2005 and MARCH, Smedley et al, 2005)	Posture scores (Hignett and MacAtamney, 2000), reduction in force (Marras et al, 1999; Garg and Owen, 1992), reduction in frequency of tasks (Knibbe and Friele, 1999; Warming et al, 2009)
3	Real effects in target population	The real effects of the organisational behaviour is captured in different sections of the IET • Competence and compliance (3) • MS Health measures (2) • Financial (12) (The Finland focus group recorded management commitment as a very strong indicator of Safety Culture. This is recorded in the IET in the staff survey 4.3 and the managers survey 1.5)	The direct and real measure of the reduction of exposure is recorded in MS Health measures (2) and the reduction in accidents (4) and the resultant effect on Financial (12).

As the included outcomes were based on the preferred selections of the participants of the focus groups, any criticism could only be corrected by further studies or an increase in participant numbers.

The secondary supporting information was the inclusion of the measure in peer-reviewed literature that the defined link exists for a patient handling study. Hignett and Crumpton (2007), used the PHOQS tool to measure organisational behaviour (Safety Culture (1)), and the existence of management structures, and compared the scores with observed behaviour and application of knowledge to find a positive relationship. This paper also gave the most detailed match with the measures collected in the definition at the end of the EU focus groups (Table 3.28).

6.2.2.3 Interaction of 12 sections

The need for further analysis of the compiled list of 12 outcomes has some grounding in the established links already experienced in healthcare systems and patient handling interventions.   Figure 6.1 shows how if an improvement is made in one outcome there will be a related improvement in the other outcomes on the IET.

Some outcomes can be seen to have many effects on other outcomes, which raises the level of their contribution to the overall score. Safety culture (1) interacts with all other groups, while financial analysis interacts with no other outcomes, which in part may explain the order of importance.   Other high priority outcomes showed higher levels of interaction; competence and compliance (3), quality of care (5), and accident numbers (6), all had effects on eight or more other outcomes.   Several outcomes interacted with four to six others; MS health measures (2), psychological well being (7), patient condition (8), MSD exposure and patient injuries (11). This level of interaction creates a level of interpretation of the outcomes, which explains the order of the outcomes.

Improvements in:												
Safety culture	1	2	3	4	5	6	7	8	9	10	11	12
MS health measures	1	2	3	4	5	6	7	8	9	10	11	12
Competence compliance	1	2	3	4	5	6	7	8	9	10	11	12
Absence or staff health	1	2	3	4	5	6	7	8	9	10	11	12
Quality of care	1	2	3	4	5	6	7	8	9	10	11	12
Accident numbers	1	2	3	4	5	6	7	8	9	10	11	12
Psychological well being	1	2	3	4	5	6	7	8	9	10	11	12
Patient condition	1	2	3	4	5	6	7	8	9	10	11	12
Patient perception	1	2	3	4	5	6	7	8	9	10	11	12
MSD exposure measures	1	2	3	4	5	6	7	8	9	10	11	12
Patient injuries	1	2	3	4	5	6	7	8	9	10	11	12
Financial	1	**2**	3	4	5	6	7	8	9	10	11	12
Has an effect on:	Safety culture	MS health measures	Competence compliance	Absence or staff health	Quality of care	Accident numbers	Psychological well being	Patient condition	Patient perception	MSD exposure measures	Patient injuries	Financial

Figure 6.1 The interaction between outcomes

Figure 6.2 Strength of outcome by level of interaction

This view shows that a high priority placed on the financial outcomes can only be achieved with good performance in all the other sections, and that interventions aimed at 1, 3, 5, 6 should give the best return. The effect of this interaction will affect the selection of interventions to improve the IET performance.

The link between interventions and outcomes is the next level of interpretation of the IET and as such was outside the boundaries of this study. Findings from this study have indicated possible routes for development:

<u>Link intervention strategies with twelve outcome measures</u>
The literature analysis records academic quality, outcome type, intervention strategy, Robson level and statistical analysis. The relationship between intervention and outcome could be found with a detailed analysis of this interaction. The challenge of this analysis is the complexity of the strategies that are in place. Single strategies were found in only 41 intervention studies but multiple strategies in 60 studies and 28 studies had more than four recorded strategies. Since Nelson et al. (2006) there has been little analysis of single interventions, except in the biomechanical studies.

Intervention Scoring System

One suggestion for this analysis may be to consider the data that has been collected in the literature analysis. Each individual outcome was scored for the following:

Table 6.4 Scores for included intervention studies

Score	**Source**	**Range of scores**
Academic score (QR%)	(Downs and Black, 1998)	0-100%
Level of outcome measure (Robson)	(Robson et al., 2007)	1-3
Practitioner rating (PR)	(Hignett et al., 2003)	1-5
Position in priority outcome list (IET)	(Fray et al 2009)	1-13

If each score system is given parity, then an average (cumulative %) score can show the relative importance for the results of each study. The figure below describes the score system in two examples as a comparison.

Table 6.5 Intervention Scoring System

Study	Intervention strategy	Outcomes	QR % (a)	Robson (b)	PR (c)	IET (d)	Cumulative (a+b+c+d as %)	Study Total
Passfield et al (2003)	Change of policies/ procedures	Injury rate	67	3	4	2	84.8	
		Costs	67	3	4	12	65.5	150.3
Johnsson et al (2002)	Education and training	Compliance assessment	70	2	4	3	75.5	
		Perceived exertion	70	2	4	10	63.2	
		Patient comfort	70	2	4	9	63.9	202.6

The scoring system outlined shows the different factors scored on the scales used in the literature analysis. The cumulative score converts each score to a unit (1) and then calculates an average score. The cumulative score shows how important the specific intervention to outcome relationship is, and high scores are for very important studies. The study total shows the overall value of each study, and the value of its contribution to the body of knowledge. These values can be used to analyse the different contributions to each outcome measure, intervention strategy, author or study type.

This secondary investigation will enhance the value of the interpretation of the IET, and allow future interventions to be guided to be more effective.

6.2.3 Present and future uses for IET

One of the aims of this study was to develop a single tool and process that could measure the success of patient handling interventions. As such the development of the tool created a single score that could be used to compare the pre- and post-intervention states. In its present form the IET analysis delivers two sets of scores, 12 individual section scores rating a percentage score, and an accumulated total IET score. The patient handling experts and facilitators involved in the evaluation have indicated as much interest in the section scores as the total. It may be this difference that creates an opportunity for the future uses of the IET. The section scores become a detailed performance measurement tool for the PHA, or person responsible for managing patient handling in the organisation. Though there is a tendency for the total IET score to average high and low scores from each of the sections, during a long-term intervention repeated IET evaluations should record the performance in each section, and allow regular monitoring. The aim of the PHA will be to focus on improvements in specific sections whilst maintaining the scores in other sections. This will create an improvement in the total IET score. Short-term interventions are unlikely to show the benefits in sickness absence (4) or MS health (2), but there will be opportunities to improve scores in safety culture (1) and competence and compliance (3), and some patient assessments (5, 8, 9).

The UK trial site, in a large acute hospital, showed high levels of support for a tool like the IET to assist with the measurement of performance. The development of a larger database of assessments would enhance its validity and robustness. It is important to gain support from the target audience (i.e. the PHA in healthcare) and the development and expansion of the IET needs to be managed effectively. With the practical and organisational improvements suggested (5.6, 6.2.4) in this report, the IET could be used as:

- A pre- to post-intervention evaluation tool
- An intra- and inter-site comparison tool
- A between country comparison for similar healthcare providers

The evaluation has only been possible for single ward locations. The replication of the measurements to assess the performance across a hospital site, or a health service, have yet to be explored and will require future trials.

The development of a single score raised the issue that this could not only be used as an intervention evaluation, but also a benchmarking system for regular audit. The management systems observed in the UK Trial clearly showed that the healthcare system regarded the audit process highly, and assessment systems were already in place to support the use of a tool like IET (CNST 2009). One difference between the processes of assessment versus audit is the setting of standards of achievement. The observation of EU systems during this study would suggest a lack of agreement in various areas. The development of standard approaches is being developed as an ISO standard and EU performance indicators may be possible based on those standards.

6.2.4 Summary of recommendations for next generation of IET

The analysis of the EU trials, EPPHE panel results, and the discussion above, have identified that in future developments of the IET the following considerations could improve the content and assessment of the different sections and the IET total:

- Improve the clarity of definitions for various included items in the IET process, e.g. :
    - <u>Generic Patient Handling Risk Assessment</u>. This use of risk assessment examines the risks present in a geographical location by considering the tasks, patient dependencies and the

environmental configuration to identify the level of risk for that area.

  - Patient Handling Risk Assessment. The application here examines only the tasks and risks associated with an individual patient. The control measures identified by this process should be recorded in the patients medical notes or treatment plan as a Patient Handling Plan
  - Patient Handing Plan: A clear set of instructions to allow staff and carers to assist a patient to move from one position to another. The basic requirements of such should include the following: patient identifying descriptors, the task to be completed, known hazards to assisting movement, number of staff required, equipment to be used, a clear description of the movement to be completed. In some healthcare premises the description of the method could be held centrally or in a collection of PH procedures, to which the PHP refers.
  - Link Worker: A person working in a specific area who has the responsibility for assisting with the management of patient handling activities in that specific area. The roles they could complete are training and supervision in patient handling skills, completion of risk assessment for the area, and completion or assistance in completing patient handling plans.

- Consider the alternative question set for questions 9 & 10 in the PHOQS assessment to measure performance as well as named link workers.

- Evaluate the inclusion of age and experience factors in the MS health measure

- Consider and evaluate the process of training and guidance for observers especially in the observation of transfers (IET Data 3)

- Reporting of patient handling accidents should include standardisation for staff numbers, expected numbers and a measure of potential under-reporting

- Consider the addition of a measure of subjective assessment of workload to contrast both 7 and 10.

- The staff evaluation of each transfer IET Data 3.2 to be changed to 2 questions to match competence and compliance

- Add a frequency count to the workload assessment to improve the links with the logbook registrations for lift frequency

6.3 Validity and reliability

Scientifically, the validity of any measurement tool is paramount to encourage the confidence of the end user (Bryman, 2008). The IET in its 12 section format is complex. The interactions between the sections have already been identified, and some sections have already been identified as having little background. This section discusses the different aspects of validity with reference to the previous evidence, and makes suggestions for future improvements. The content validity (Bryman, 2008) is addressed in the multi-location, multi-participant generation of the tool. The IET is strengthened through the peer review and EU trials but external validity needs to be developed by a series of real world applications of the tool.

The question of measurement or construct validity (Bryman, 2008) however is open to investigation. The IET aims to measure the level of control of patient handling risks in healthcare, and use the data to compare across time and site. The EPPHE panel (5.5) reviewed the question of validity in detailed discussion. Some themes were identified that should be considered in this evaluation of the IET:

- MS health and sickness absence figures could be affected by age and experience variation
- The use of single time point data collection in some sections was considered as a potential weakness. A range of intervention studies should be investigated to examine if snapshot data collection proves effective.
- Sample size in the IET is kept deliberately low to assist the ease of data collection. The sample numbers need to give a true representation of the performance of the unit under examination across all the section scores.

To investigate some of the validity issues a survey of the tools included in the IET was completed. The information found to support the use of the different tools is included in Table 6.6.

Table 6.6 describes the development and validation processes for the different sections of the IET. Some of the included tools have a long history of use in epidemiology (Nordic Questionnaire), and some have specific validation for use in the measurement of PH studies (1,3,7,10), whilst others have little or no proven validity for this application.

Table 6.6 Validity of measurements for outcomes in IET

Outcome	Comments
Safety Culture	The PHOQS tool has both a development paper and use in a further trial
MSD measures	The Nordic Questionnaire has a log history in many epidemiogolgy studies. Its validity for small sample sizes needs investigating.
Competence Compliance	DiNO has development studies and comparison but questions over reliability remain
Absence or staff health	Large national data review from government systems
Quality of care	None
Accident numbers	Problems remain due to the mis-reporting issues
Psychological well being	The original tool has some validation but the application to PH is not tested
Patient condition	None
Patient perception	Likert scales and measures of patient comfort are common but the validation of this scale is not proven
MSD exposure measures	Two studies have attempted to validate the CT measures as a whole but the work is not complete
Patient injuries	None
Financial	There is no validation for this application

The EPPHE panel discussed the requirements for validation of the IET. The discussion focussed on two key issues: the use of small samples during the single site data collection, and the differences between interpretation across EU countries. When considering the development and validation of previous OMTs, all have been developed in their source language, validated and then translated (MAPO, DiNO, and PHOQS). Uniformly this has created difficulties with getting the OMT used outside the country of origin. To develop the measurement validity of the IET, the validity of the 12 sections need to be considered. In an ideal scientific methodology validation would be proven for:

- Each section score.
- The total IET score
- The total IET score in all participating languages

It would appear that if the IET can be simultaneously validated in the key EU languages, at its outset, then more widespread acceptance of the process could be expected. The previous lack of validation may have had an effect on why there has been no standard approach that would have allowed the development of a tool like the IET.

6.3.1 Reliability

Given the EU application of the IET, one concern would always be the reliability of the measures with a wide range of observers. Some of the sections that have been through a recognised validation process, already have more complex guidance and instructions to assist the observer. The aim of the original development of the IET was to allow the highest level of access to potential observers.

The debate between developing a complex tool, with high levels of fixed and possibly objective measures against every criteria, would reduce the accessibility of the tool, and increase the skill and training required for any observers prior to use. The restriction of access to a limited group of expert observers would be a method to improve the accuracy and reliability (Johnsson et al., 2004; and Kjellberg et al., 2004). This group of expert observers could be used in the development phase and through any validation studies. Once the validation and guidance is clear, then assess the reliability as the range of observers is increased. The second consideration is to develop an accreditation system for IET observers. This system could assess the level of competence of an observer and increase the number of observers slowly, and country by country, or location by location. With either of these monitored growth options, a series of intra- and inter-rater reliability trials will be required (Figure 6.3).

6.4 Future research

The IET has been developed and evaluated as a measurement tool for assessing different levels of performance in the management of patient handling risks. The data collection has been proven to be efficient and accessible for different healthcare providers in four EU countries. For the IET to reach its full potential there needs to be a series of research studies to improve the reliability and validity of the process and tool. Section 6.2.3 shows that the IET could be extended for use in a range of settings. This would suggest that the route for future evaluations could:

a. Validate the IET as an assessment of patient handling performance;
   a. at ward level
   b. at hospital level
b. Develop the IET as a benchmark tool to improve EU practice
c. Develop the IET as an audit tool for an EU standard

The EPPHE review panel (5.5) suggested many possibilities for future research projects, including examining the cultural differences, adding a complex financial calculation, comparing occupations, and comparing educational systems. The robustness of the IET as a measurement tool must be the main focus of any future research, as the tool must be proven to measure effectively before any of the other investigations can take place. To this end an outline research process has been described to validate the IET as a ward based assessment tool in Figure 6.3.

Aims: Method	**Output**
Confirming the validity of the IET: A large number of sites and locations will be needed to expand the collective experience of measuring performance with the IET. Previous complex tools measuring patient handling have attempted to develop a large background database. Initially these site measurements can be a one off baseline IET score. User evaluations will be completed on all sites.	Database of site measures User evaluations

Given the existing validity of some sections of the IET and the complexity of the tool the sections of the tool can be evaluated in organisational, staff and patient groups. Evaluations could consider	
• Repeated measures in the same site to check for inter-rater reliability for the observation IET Data 3.	Inter-rater reliability of IET Data 3
• Repeated collection of IET Data 1 with different observers on the same site over small time frame changes to compare assessment of management and workload issues	Inter-rater reliability of IET Data 1
• Compare MSD exposure measure with other workload measures e.g. log registrations or subjective workload	Validity of workload measure
• Compare PHOQS score with other safety climate/culture measures	PHOQS validity
• The overall IET score could be compared with the subjective assessment of a panel of expert PHA to assess if the order of IET total agrees with judgement.	IET total validity
<u>Intervention Trial for IET</u> The IET will also need to be evaluated in intervention trials. Though the management of a multi-site evaluation across several EU locations will be difficult a full evaluation of the pre- to post-intervention trial is essential. This trial would examine the ability of the IET to differentiate between conditions and levels of compliance with best practice. The observer should be an expert IET practitioner, blind to the intervention to ensure accuracy with the IET scoring.	Between condition differentiation
A second option would be to conduct an RCT in a specific centre or comparable healthcare settings and evaluate case versus control interventions.	Blind RCT

Figure 6.3 Recommendations for future research

The importance of the interactions between outcomes in Figure 6.1 suggests that improved validity may be achieved by examining these links further. The methodology used in this study developed the 12 ordered sections from the preferences described from the focus groups. If each section is equally weighted an analysis could be conducted to evaluate the overall contribution of each section. When investigating the methods available for scoring complex tools, factor analysis or multivariate analysis models are common (Salkind, 2004). These statistical methods investigate how the different outcomes interact and show the links between the different contributions. An alternative may be to consider structural equation modelling (Salkind, 2004; Gotham et al., 2003) which could evaluate whether the 1-12 ranking scores are an acceptable score system. It is noted that one difficulty with any future investigation into the relative importance of each section to the overall performance score is the lack of a scale or single measurement method against which to compare the total score against.

The facilitators and EPPHE panel showed enthusiasm for developing the tool further. The IET has been incorporated into a research application in Portugal that examines the interactions between ageing, work ability and exposure to physical and mental demands among nurses (Cotrim et al., 2009). Given the drive to management performance indicators in modern healthcare, the development, and enhancement, of the IET as a method to measure and improve patient handling standards would be a suitable solution.

6.5 Comparison of IET against other tools

The development of the IET has added to the range of tools discussed in the analysis of OMT, described in Table 2b.23. The review showed that the range of OMT concentrated on a specific area of patient handling performance. Competence assessment and the appropriate provision of equipment were particularly well represented. There were no methods that allowed a comparison across the different outcomes or the OMT. The IET offers a structured approach to evaluating the whole range of outcomes based, on the priority list of PH practitioners across the EU.

The area of application of the IET is comparable with the other tools reviewed in this study. They are all designed to assess either the management, or the completion, of patient handling tasks. In many of the applications of patient handling practice, the boundary between the movement and positioning of a patient and the delivery of care tasks is difficult to unravel. Some research and guidance documents (Knibbe and Friele, 1999; Arjo ab, d, 2006) discuss bathing, toileting etc. as patient handling activities. It has been the author's experience that many people in the patient handling field consider the entire task as patient handling and then only deliver advice, guidance, training and documented safe systems of work for the patient movement and positioning aspects of the task. Collins et al (2006) define the role very specifically as, "require assistance for repositioning and movement". This definition observes the difference between the cleaning, treatment and care sections, and the patient movement actions. For the purpose of this project this was the accepted definition. There is however no doubt that the design of health care environments, and all the human and equipment interfaces that occur, are firmly in the domain of healthcare ergonomics. It is important to recognise that the interventions and methodological recommendations made in the growing volume of evidence are almost entirely aimed at patient movement tasks, and it would be improper to include the extension areas until the general format of patient handling interventions is extended to include all aspects of care.

The development of all the OMTs assist the PHA to identify the level of performance, but then expect an expert interpretation to create a solution for the recognised problems. The lack of EU standards for acceptable performance is a weakness in some of the trials. Only the equipment provision tools have robust levels of acceptance. Though the IET has not been able to develop the links with the intervention database in this study, there may be future opportunities. An interesting development of the IET post-validation would be to develop a definitive algorithm, that incorporates all the collected evidence to show which intervention types demonstrate the best scientific evidence, to improve the performance across the different sections. It should be possible using the literature analysis methods developed in Section 2b to rate the relative value of each study, and then group the papers into each IET section, to evaluate which intervention types and content have the proven effect. This development would be worthwhile after the IET has been validated and accepted as a suitable measure for the field of patient handling.

In contrast to all of the reviewed tools, the IET is a European tool, developed with EU participants, translated during development, and trialled in four EU centres. Previous tools have all been developed in one county and then translated for international use. Many tools indicate the context of where the different countries were in the development of safer patient handling systems. Italy as an example concentrates on improving equipment provision and developed the MAPO Index (Battevi et al., 2006) to show that equipment versus no equipment improves the MSD prevalence. Though evaluated, Cotrim et al. (2006) did not find the same relationship in Portugal, and Fray et al. (2006) recorded 'no risk' scores in acute healthcare areas that were not compliant with best practice. Evidence from countries with improved patient handling systems also indicate the reliance on equipment provision and the Care Thermometer (Arjo ab d, 2007) is very much evidence for the same. This is in part, contradictory to the multi-factorial approaches suggested by Nelson et al. (2006) and Hignett et al. (2003).

The depth and detail in the IET measure many different aspects of organisational, staff and patient management systems, and offer much more than any of the single measure OMTs. The EU trials have proved data collection can be effective and efficient, differences in performance have been shown in the sections, and that the overall IET score differentiates between levels of performance. The evidence from the EU trials indicates that this method and process can indeed offer a measure of value to those with poorly developed systems to show faults and omissions in the system, but also has something to offer the better performing locations, to become systems of excellence with all areas of a high performing unit being measured. This has all been developed with application in four different locations across the EU making it a truly EU based assessment tool.

CHAPTER 7

Conclusions

The research question posed in this study asked whether it was possible to develop a single assessment method to evaluate the management of patient handling risks in healthcare locations. A mixed method approach was used to include the opinions and considerations of practitioners and experts across the EU. Focus groups in four EU countries and two Expert panels at international conferences were used to explore the range of outcomes required by patient handling practitioners. A priority scoring system created a list of the 12 most important outcomes. A systematic review of literature selected the most suitable methods for measuring the 12 outcomes, and compiled a single data collection format. This Intervention Evaluation Tool (IET) was evaluated by field trials in four EU countries, and peer-reviewed by an expert panel from the EPPHE group. The conclusions drawn from this project are:

- The study of patient handling management systems is new and research support for many interventions is weak.
- The focus on musculoskeletal prevalence though logical excludes many valuable outcomes that support patient handling interventions.
- A systematic literature review showed staff, patient and organisational outcomes were measured in patient handling intervention studies.
- Focus group studies in four EU countries created a priority list of 12 clearly defined outcomes, with good agreement between the four sites.
- A single tool (IET) was created to measure the performance of patient handling risk management against the 12 outcomes.
- Data was successfully collected in eight EU sites in four countries.
- Positive feedback reported that the IET can be used to score across the 12 outcomes included in the tool.
- The IET can differentiate between different levels of performance in the 12 outcome sections and in the overall total.

This study has created and evaluated the IET, but the limitations of developing and evaluating a 12 section assessment tool across four EU countries is recognised. The positive feedback from the trial sites, and the recommendations enclosed in this study (Chapter 6), suggest that this process has many opportunities for development across the EU, but as with other complex processes a more robust version will need to be supported by further research, to improve the reliability and validity of the IET.

References

Abe D., Muraki S., Yasukouchi A. (2008). Ergonomic effects of load carriage on the upper and lower back on metabolic energy cost of walking. *Applied Ergonomics* 39:342-358

ACC Worksafe (2003) *The New Zealand Patient Handling Guidelines. The liten up approach*. Download from www.acc.co.nz/injury-prevention/safer-industries/health/phg

Agruss C., Williams K., Fathallah F. (2004). The effects of feedback training on lumbosacral compression during simulated occupational lifting. *Ergonomic*s 47: 10, 1103-1115

Ahlberg-Hulten G.K., Theorell T., Sigala F., (1995). Social support, job strain and musculoskeletal pain among female health care personnel. *Scandinavian Journal for Work, Environment and Health*, 21: 435-439.

Albayrak A, van Veelen M, Prins J, Snijders C, de Ridder H, Kazemier G. (2006). Reducing muscle activity of the surgeon during surgical procedures. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Alexandre, N.M. Benatti, M.C. (1998) Occupational accidents involving the spine: study on nurses at a university hospital.[Portugese]. *Revista Latino-Americana de Enfermagem* 6:65-72*.*

Al Naseeri A., Campbell R.H. Bell F., (2002). Ergonomic analysis of a podiatric workplace: a pilot study. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 69-73

Amick B., Tullar J., Brewer S., Irvine E., Mahood Q., Pompeii L., Wang A., Van Eerd D., Gimeno D., Evanoff B. (2006). *Interventions in health-care settings to protect musculoskeletal health: a systematic review*. Toronto: Institute for Work and Health.

Alovosius M.P.,and Sulzer-Azarof B., (1985). An on the job method to evaluate patient lifting technique. *Applied Ergonomics*, 16: 4, 307-311.

Arjo Ab a (2007). *Quick Scan Report*. Mobility levels and equipment for transfers and care. Arjo Ab Internal Report.

Arjo Ab b (2007). *The Care Thermometer* Arjo Ab Internal Report www.carethermometer.com (Accessed Sept 2007)

Arjo Ab c (2007) *The Policy Mirror* Arjo Ab Internal Report

Arjo Ab d (2006) *The Residents Gallery*. Arjo Publication.

Arjo Ab e (2009) *The Mobility Gallery*. Arjo Publication. (www.carethermometer

.com/mobilitygallery. Accessed Aug 2009)

Aust B., Rugulies R., Skakon J., Scherzer T., Jensen C. (2007). Psychosocial work environment of hospital workers: Validation of a comprehensive assessment scale. *International Journal of Nursing Studies* 44: 814-825

Aydin C., Bolton L., Donaldson N., Brown D., Buffum M., Elashoff J., Sandhu M. (2004). Creating and analyzing a state-wide nursing quality database. *Journal of Nursing Scholarship* 36, 4:317-378.

Baird A.J., Haslam R.A., Haslam C.O., (2006). Life, lifting and luck- a qualitative analysis of attitudes towards back pain at work. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Baldasseroni A, Tartaglia R, Mariani M, Zoppi O, Carnevale F.. (2000). Predictability of individual psychosocial state for the low back pain. A longitudinal study in a cohort of nursing students. *Proceedings of the IEA 2000/HFES Congress, The Human Factors and Ergonomics Society, California, Santa Monica. 5: 603*

Bao S., Howard N., Spielholz P., Silverstein B. (2007). Two posture analysis approaches and their application in a modified RULA evaluation. *Ergonomics*, 50, 12: 2118-2136

Baptiste A; Boda S; Nelson A, et al. (2006). Friction-reducing devices for lateral patient transfers: a clinical evaluation.: *American Association of Occupational Health Nursing Journal,* 54, 4:173-80

Barbour R., (2007). *Doing Focus Groups*. Sage Publishing UK.

Barroso M. (2007) Assessing the risk of MSD in nursing activities- - comparing use of MAPO and DiNO techniques at a Portuguese district hospital. *Proceedings of 6th PREMUS Conference, 27-30 August 2007, Boston, USA.*

Barroso M., Carneiro P., Braga A.C., (2007). Characterization of ergonomic issues and musculoskeletal complaints in a Portuguese district hospital. Risks for health care workers: prevention challenges. *Proceedings of ELINYEA and ISSA Health Services Section Conference, Athens, June 2007*.

Bartys S., Burton K., Wright I., Mackay C., Watson P., Main C.,(2002). Organisational obstacles to recovery (black flags) from musculoskeletal disorders. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 112-116

Battevi N, Columbini D, Ricci MG, Menoni O.(2000). Investigation on risk and damages of musculoskeletal apparatus of health care workers: A case study of 3800 nurses. *Proceedings of the IEA 2000/HFES Congress, The Human Factors and Ergonomics Society, California, Santa Monica. 5: 793-796*.

Battevi N., Menoni O., (2006a). MAPO Index: ten years after – analysis and proposals. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Battevi N., Menoni O., (2006b). Selection criteria of ergonomic aids for patient handling. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Battevi., Menoni O., Ricci M.G., Cairoli S., (2006). MAPO index for risk assessment of patient manual handling in hospital wards: a validation study. *Ergonomics*, 49, 7: 671-687.

Beaton D., Bombardier C., Kats J., Wright J., (2001). A taxonomy for responsiveness. *Journal of Clinical Epidemiology*, 54, 1204-1217. In Bos E.H., Krol B., Van Der Star A., Groothof J.W., (2006), The effect of occupational interventions on reduction of musculoskeletal symptoms in the nursing profession. *Ergonomics,* 49, 7: 706-723.

Beevis D. (2003). Ergonomics – costs and benefits revisited. *Applied Ergonomics,* 34: 491-496.

Beevis D. and Slade I. (2003). Ergonomics – costs and benefits. *Applied Ergonomics,* 34: 413-418

Benevolo, E., Sessarego, P., Zelaschi, G., Franchignoni. F., (1993). An ergonomic analysis of five techniques for moving patients. [Italian]. *Giornale Italiano di Medicina del Lavoro,* 15: 139-44.

Benner P., (1984). *From novice to expert: Excellence and power in clinical nursing practice*. Menlo Park: Addison-Wesley pp. 13-34.

Bernard, B.P. (Ed.). (1997) Musculoskeletal disorders and work place factors. A critical review of epidemiologic for work-related musculoskeletal disorders of the Neck, Upper Extremities and Low Back. *NIOSH: US Department of Health and Human Sciences.*

Bertolazzi, M. and Saia, B. (1999). Risk during manual movement of loads. *Giornale Italiano di Medicina del Lavoro ed Ergonomia,* 21, 2:130-133.

Best, M. (1997) An evaluation of manutention training in preventing back strain and resultant injuries in nurses. *Safety Science* 25, 1-3: 207-222

Biddle E., Ray T., Owusu-Edusi K., Camm T. (2005). Synthesis and recommendations of the economic evaluation of OHS interventions at the company level conference. *Journal of Safety Research*. ECON proceedings 36: 261-267

Bigos S., Battie M., Spengler D., Fisher L., Fordyce W., Hansson T, Nachemson

A., Wortley M. (1991). A prospective study of work perceptions and psychosocial factors affecting the report of back injury. Spine 16:1.

Black C (2008). Working for a healthier tomorrow. Department of Health. http://www.workingforhealth.gov.uk/documents/working-for-a-healthier-tomorrow-tagged.pdf. (Accessed Jan 2010).

Borg G. (1998). *Perceived Exertion and Pain Scales*. Human Kinetics.com, USA.

Bos E.H., Krol B., Van Der Star A., Groothof J.W., (2006), The effect of occupational interventions on reduction of musculoskeletal symptoms in the nursing profession. *Ergonomics* 49, 7: 706-723.

Bourbonnais R., Brisson C., Vinet A., Vezina M., Abdous B., Gaudet M. (2006). Effectiveness of a participative intervention on psychosocial work factors to prevent mental health problems in a hospital setting. *Occupational and Environmental Medicine,* 63: 335-342

Brinkhoff A., Knibbe N., (2003). The Ergostat program: pilot study of an ergonomic intervention to reduce static loads for care givers. *Professional Safety*, 5: 32-39

Briody K. (2009) An evaluation of return to work systems in an NHS Trust. Unpublished MSc Thesis Loughborough University

Brown W., Li G. (2003). The development of Action Levels for the quick exposure check (QEC) system. *Contemporary Ergonomics, 2003*, Taylor and Francis. pp 41-46

Bryman A., (1988). *Quantity and Quality in Social Research*. London: Unwin Hyman.

Bryman A., (2008). *Social Research Methods. 3rd Edition.* Oxford University Press, Oxford UK.

BLS. (2009). Bureau of Labor Statistics. How to compute incidence rates. http://www.bls.gov/iif/osheval.htm (Accessed Jan 2010)

Caffier, G., Hermann, S., Babel, F., Liebers, F., Schützel, G.(2007). Back-protective patient transfer (bppt) – good practice of successful Implementation of an ergonomics-based patient handling program. *Proceedings of the 6th PREMUS Conference, 27-30 August 2007, Boston,USA.* p353

Cappiello E, Righini R, Trevisani F, Tovoli D. (2005). A survey on the ergonomics quality of the house to house nursing aid services of the local health unit of Bologna. *Healthcare Systems Ergonomics and Patient Safety Conference, Florence 2005.* Ed Tartaglia R, Bagnara S, Bellandi T, Albolino S. Taylor and Francis Group.

Carrivick, P J.W., Lee, A.H. and Yau, K.K.W. (2001) Consultative team to assess manual handling and reduce the risk of occupational injury. www.occenvmed.com *(Accessed May 2006)*

Carrivick P.J.W., Lee A.H., Yau K.K.W., Stevenson M.R.. (2005). Evaluating the effectiveness of a participatory approach in reducing the risk and severity of injuries from manual handling. *Ergonomics*, 48, 8: 907-914.

Catino M., Albolino S., Vannucci A., (2005). An organisational multi-level model for the analysis of failures in medicine – The case of a fortuitous connection. *In proceedings of the International Conference HEPS, Florence, 2005.* Ed Trataglia R., Bagnara S., Bellandi T., Albolino S. Taylor and Francis.

Charney, W. (1997) The lift team method for reducing back injuries: A 10 hospital study. *American Association of Occupational Health Nursing Journal,* 45, 6:300-304.

Charney W. and Hudson A, (Eds) (2004). *Back injury among health care workers: causes solutions and impacts.* Lewis Publishers, CRC Press.

Charney W., Simmons B., Lary M., Metz S. (2006). Zero Lift Programs in Small Rural Hospitals in Washington State: Reducing Back Injuries Among Health Care Workers. *American Association of Occupational Health Nursing Journal,* 54, 8: 355-8

Charney, W., Zimmerman, K. and Walara, E. (1993) A design method to reduce lost time back injury in nursing. Chapter 8. In Charney, W. and Schirmer, J. *Essentials of Modern Hospital Safety. Volume 2,* Lewis Publishers. 313-324

Chhokar R., Engst C., Miller A., Robinson D., Tate R., Yassi A. (2005). The three-year economic benefits of a ceiling lift intervention aimed to reduce healthcare worker injuries. *Applied Ergonomics*, 36(2): 223-9

Choudry R., Fang D., Mohamed S. (2007). The nature of safety culture: A survey of the state of the art. *Safety Science,* 45: 993-1012

Chung M.K., Lee I., Kee D. (2005). Quantitative postural load assessment for whole body manual tasks based on perceived discomfort. *Ergonomics,* 48, 5: 492-505

Ciavarro G., Cassavia G., Taloni S, Santambrogio G., Andreoni G. (2006). Index based quantification of low back pain risk for nursery activities. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.Proceedings of the IEA 2006 Congress, Mastricht, Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd.*

CNST (2009) NHSLA Risk Management Standards for Acute Trusts, Primary Care

Trusts and Independent Sector Providers of NHS Care. NHLSA, London www.nhsla.com/publications.

Cochrane (2005) Cochrane manual. www.cochrane.org/admin/manual.htm. (Accessed Nov 2005.) In Amick B., Tullar J., Brewer S., Irvine E., Mahood Q., Pompeii L., Wang A., Van Eerd D., Gimeno D., Evanoff B. (2006). *Interventions in health-care settings to protect musculoskeletal health: a systematic review*. Toronto: Institute for Work and Health.

Cohen M., Village J., Ostry A., Ratner P., Cvitkovich Y., Yassi A. (2004). Workload as a Determinant of Staff Injury in Intermediate Care. *International Journal of Occupational and Environmental Health,* 10, 4: 375-83

Collins J.W., Wolf L., Bell J., Evanoff B. (2004). An evaluation of a 'best practices' musculoskeletal injury prevention program in nursing homes. *Injury Prevention*, 10: 206-211

Collins JW, Nelson A, Sublet V. (2006), *Safe Lifting and Movement of Nursing Home Residents*. NIOSH. http://www.cdc.gov/niosh/docs/2006-117/

Coman R. (2007). Personal communication, Incomplete, unpublished PhD study.

Conneeley, A.L. (1992) The Impact of the Manual Handling Operations Regulations on the Use of Hoists in the Home: the Patient's Perspective. *British Journal of Occupational Therapy* 61,1: 17-21

Connelly A., Higgins A., Dockrell S., Flynn T. (2001). A comparison of slides used in patient handling. *British Journal of Therapy and Rehabilitation*, 8, 5: 166-173

Coole C., Haslegrave C., (2000). Reducing risks for work related musculoskeletal disorders in school nurseries. *Contemporary Ergonomics, 2000*, Taylor and Francis. pp 317-321

Cooper H., and Hedges L. (1994). *The Handbook of Research Synthesis*. New York, Russell Sage Foundation. In Amick B., Tullar J., Brewer S., Irvine E., Mahood Q., Pompeii L., Wang A., Van Eerd D., Gimeno D., Evanoff B. (2006). *Interventions in health-care settings to protect musculoskeletal health: a systematic review*. Toronto: Institute for Work and Health.

Cote P., Cassidy J., Carroll L., Frank J., Bombardier C. (2001). A systematic review of the prognosis of whiplash and a new conceptual framework to synthesize the literature. *Spine*. 2001; 26 (19): E445-E458. In Amick B., Tullar J., Brewer S., Irvine E., Mahood Q., Pompeii L., Wang A., Van Eerd D., Gimeno D., Evanoff B. (2006). *Interventions in health-care settings to protect musculoskeletal health: a systematic review*. Toronto: Institute for Work and Health.

Cotrim T. et al. (2009). Interactions between ageing, work ability and exposure to physical and mental demands among nurses. Research proposal to Fundacao para a Ciencia e a Technologia - Projectos De Investigação Científica.

Cotrim T, Ramalho F, Duarte AP, Simoes A. (2006) Assessing the exposure to low back pain at nurses related with patient handling using MAPO. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Craib K., Hackett ., Buck C., Critkovich Y., Yassi A., (2007). Injury rates. Predictors of workplace injuries, and results of an intervention program among community health workers. *Public Health Nursing*. 24, 2: 121-131

Crawford J.O., McHugo J., Vaughan R., (2002). Diagnostic ultrasound: the impact of its use on sonographers in obstetrics and gynaecology. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 21-26

Crozier L., Cozens, S., (1998) The Neuromuscular Approach to efficient moving and handling. In Lloyd P., (ed) *The guide to the Handling of Patients (revised 4th Edition)*. Teddington, Middlesex: National Back Pain Association/Royal College of Nursing.

Crumpton E. and Johnson C. (2005). Introduction to practical chapters. Chapter 11 in Smith J (Ed) (2005). *The Guide to The Handling of People. (5th edn)* RCN, Back Care London.

Daraiseh N., Genaidy A.M. Karwowski W., Davis L.S., Stambough J., Huston R.L. (2003). Musculoskeletal outcomes in multiple body regions and work effects among nurses: the effects of stressful and stimulating working conditions. *Ergonomics*, 46, 12: 1178-1199

David G., Woods V., Li G., Buckle P. (2008). The development of the Quick Exposure Check (QEC) for assessing exposure to risk factors for work related musculoskeletal disorders. *Applied Ergonomics* 39, 1: 57-69

Dawson A.P., McLennan S.N., Schiller S.D., Jull G.A., Hodges P.W., Stewart S. (2007), Interventions to prevent back pain and back injury in nurses: a systematic review. *Occupational and Environmental Medicine*, 64: 642-650

Dawson, A.P., Steele, A.J., Hodges, P.W., Stewart, S. (2009). Development and test-retest reliability of an extended version of the Nordic Musculoskeletal Questionnaire (NMQ-E): A screening instrument for musculoskeletal pain. The Journal of Pain, 10, 5: 517-526.

Daynard D; Yassi A; Cooper J, Tate R, Norman R, Wells R (2001) Biomechanical analysis of peak and cumulative spinal loads during simulated patient-handling activities: a sub-study of a randomized controlled trial to prevent lift and transfer injury of health care workers. *Applied Ergonomics, 32(3): 199-214*

Dehlin, O., and Lindberg, B. (1975) Lifting burden for a nursing aide during patient care in a geriatric ward. *Scandinavian Journal of Rehabilitation Medicine*. 7: 65-72.

Dempsey P. (2002). Usability of the revised NIOSH lifting equation. Ergonomics 45, 12: 817-828

Dempsey P., Mathiassen S. (2006). On the evolution of task-based analysis of manual materials handling, and its applicability in contemporary ergonomics. *Applied Ergonomics,* 37: 33-43.

Dempsey P., McGorry R., Maynard W. (2005). A survey of tools and methods used by certified professional ergonomists. *Applied Ergonomics,* 36: 489-503.

Dempsey P., Sorock G.S., Ayoub A., Westfall P., Maynard W., Fathallah F., O'Brien N. (2002). Prospective investigation of the revised NIOSH lifting equation. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 77-81

Denzin N K and Lincoln Y.S. (eds) (2005). *The Sage Handbook of Qualitative Research*. London Sage.

D'Errico A., Gore R., Gold J.E. Park J.S. Punnett L. (2007). Medium and long-term reproducibility of self reported exposure to physical ergonomics factors at work. *Applied Ergonomics* 38: 167-175.

Dickinson C., Campion K., Foster A., Newman S., O'Rourke A., Thomas P. (1991). Questionnaire development: an examination of the Nordic Musculoskeletal Questionnaire. *Applied Ergonomics,* 23, 3: 197-201.

Dolan P. Adams M. (2000). When do bending stresses on the spine rise to damaging levels? *Proceedings of the IEA 2000/HFES Congress, The Human Factors and Ergonomics Society, California, Santa Monica. 4: 635-638*.

Downs S. and Black N. (1998). The feasibility of creating a checklist for the assessment of methodological quality of both randomised and non-randomised studies of healthcare interventions. *Journal of Epidemiological Community Health* 52: 377-84.

Edlich R.F., Woodward C.R. Haines M.J. (2001). Disabling back injuries in nursing personnel. *Journal of Emergency Nursing* 27: 150-155.

EN ISO 10535 (1998). *Hoists for the transfer of disabled persons – Requirements and test methods.* BSI London.

Engels, J.A., Van der Gulden, J.W.J., Senden, T.F. and van't Hof B. (1996) Work related risk factors for musculoskeletal complaints in the nursing profession: Results of a questionnaire survey. *Occupational and Environmental Medicine,* 53: 636-641.

Engels, J.A., van der Gulden, J.W., Senden, T.F., Kolk, J. J. and Binkhorst, R.A. (1998) The effects of an ergonomic-educational course. Postural load, perceived physical exertion, and biomechanical errors in nursing. *International Archives of Occupational and Environmental Health,* 71:336-342.

Engels, J.A., Brandsma, B., van der Gulden, J.W.J., (1997). Evaluation of the effects of an ergonomic-educational course. The assessment of "ergonomic errors" made during the performance of nursing tasks. *International Archives of*

Occupational and Environmental Health, 69 (6) 475-481

Engkvist I-L. Hagberg M., Hjelm E., Menckel E., Ekenvall L., PROSA study group. (1995). Interview protocols and ergonomics checklist for analysing overexertion in back accidents among nursing personnel. *Applied Ergonomics,* 26, 3, 213-220

Engkvist, I-L., Kjellberg, A., Wigaeus, H.E., Hagberg, M. , Menckel, E. and Ekenvall, L. (2001). Back injuries among nursing personnel – identification of work conditions with cluster analysis. *Safety Science,* 37: 1-18

Engkvist I-L. (2004). The accident process preceding back injuries among Australian nurses. *Safety Science,* 42: 221-235

Engkvist I-L. (2006). Evaluation of an intervention comprising a No Lifting Policy in Australian Hospitals. *Applied Ergonomics,* 37: 141-148.

Engkvist I-L. (2008). Back Injuries among nurses – A comparison of the accident processes after a 10-year follow up. *Safety Science,* 46: 291-301

Engst C; Chhokar R; Miller A, Tate R., Yassi A. (2005). Effectiveness of overhead lifting devices in reducing the risk of injury to care staff in extended care facilities. *Ergonomics,* 48(2): 187-199

Engst C., Chokar R., Robinson D., Earthy A., Yassi A. (2004). Implementation of a scheduled toileting program in long term care facility *American Association of Occupational Health Nursing Journal,* 52(10): 427-435

EC Directive (1989). The framework directive (89/391/EEC). 12 June 1989.

EC Manual Handling Directive (1990) The manual handling directive (90/269/EEC). 29 May 1990.

Europa.eu (2009). www.europa.eu (Accessed Dec 2009). http://europa.eu/abc/european_countries/eu_members/index_en.htm

Eriksen W., Bruusgaard D., Knardahl S. (2004) Work factors as predictors of intense or disabling low back pain; a prospective study of nurses' aides. *Occupational and Environmental Medicine*, 61: 398-404

Estryn-Behar, M., Kaminski, M., Peigne, E., Maillard, M.F., Pelletier, A., Berthier, C., Delaporte, M.F., Paoli, M.C., and Leroux, J.M. (1990) Strenuous working conditions and musculo-skeletal disorders among female hospital workers. *International Archives of Occupational and Environmental Health.* 62: 47-57.

Evanoff, B.A., Bohr, P.C., and Wolf, L.D. (1999) Effects of a participatory ergonomics team among hospital orderlies. *American Journal of Industrial Medicine* 35, 4: 358-365.

Faculty of Occupational Medicine (2000). *Occupational Health Guidelines for the management of low back pain at work. Evidence Review and Recommendations.*

London: Faculty of Occupational Medicine. pp 27-28

Fanello, S., Frampas-Chotard, V., Roquelaure, Y., Jousset, N., Delbos, V., Jarmy, J. Penneau-Fontbonne, D. (1999) Evaluation of an educational low back pain prevention program for hospital employees. *Revue Du Rhumatisme, (English Edition),* 66, 12: 711-716.

Fanello S; Jousset N; Roquelaure Y, et al. (2002). Evaluation of a training program for the prevention of lower back pain among hospital employees. *Nursing and Health Science.* 4,(1-2): 51-4

Feldstein, A., Valanis, B., Vollmer, W., Stevens, N. and Overton, C. (1993) The Back Injury Prevention Project pilot study. Assessing the effectiveness of back attack, an injury prevention program among nurses, aides, and orderlies. *Journal of Occupational Medicine,* 35: 114-20.

Feldstein A., Vollmer W., Valanis B., (1990). Evaluating the patient handling tasks of nurses. *Journal of Occupational Medicine.* 32, (10): 1009-1013.

Ferguson S., and Marras W. (1997). A literature review of low back disorder surveillance measures and risk factors. *Clinical Biomechanics,* 12, 4: 211-226.

Fischer F, Rotenberg L, Soares N, Santa Rosa P, Tanaka L, Nagai R, Steluti J, Latorre M, Landsbergis P, Borges F. (2006). Work ability among nursing personnel. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Fischer S., Albert W., McLellan A., Callaghan J. (2007). Methodological considerations for the calculation of cumulative compression exposure of the lumbar spine: A sensitivity analysis on joint model and time standardization approaches. *Ergonomics* 50, 9: 1365-1376

Flin R. (2008). Measuring safety culture in healthcare: A case for accurate diagnosis. *Safety Science* 45: 653-667

Fortuna R., Ricci M.G., (1999). Manual lifting of patients: results of assessment of exposure to specific risk and of clinical studies in a rehabilitation centre. *Giornale Italiano di Medicina del Lavoro*. 90, 2: 317-329 [Italian]

Foster, L. (1996) Manual handing training and changes in work practices. *Occupational Health,* 48: 402-406.

Franche R., Cullen K, Clarke J., MacEachen E., Frank J., Sinclair S and the Workplace-based return-to-work intervention literature review group. (2004). *Workplace-based return-to-work interventions: A systematic review of the quantitative and qualitative literature*. Toronto: Institute for Work and Health.

Fray M.J. (2006) *Progress report for Arjo/EPPHE PhD programme* 2nd October 2006.

Fray, M and. Hignett, S, (2006) An Evaluation of Outcome Measures in Manual Handling Interventions in Healthcare. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Fray M.J. and Hignett S.M. (2007a) Have the intentions of patient handling interventions changed over time? *Risks for health care workers: prevention challenges. Proceedings of ELINYEA and ISSA Health Services Section Conference, Athens June 2007.*

Fray M. and Hignett S. (2007b) Are there any differences between the expected outcomes of patient handling between health and social care. *Proceedings of the 6th PREMUS Conference, 27-30 August, 2007, Boston, USA*. p349.

Fray M and Hignett S (2009). Measuring the success of patient handling interventions in healthcare across the European Union. *Proceedings of the 17th World Congress on Ergonomics,* 10-14 August 2009, Beijing, China.

Fray M.J., Hignett S., Lloyd Evans N., Hunter G., (2006) An evaluation of the MAPO Index as an audit tool in a UK acute NHS Trust. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Fray M. et al., (1999), *Care handling of adults in hospitals and community settings – A code of practice*. Derbyshire Inter-Agency Group.

Frey J and Fontana A. (1993). The group interview in social research. In Barbour R., 2007. *Doing Focus Groups*. Sage Publishing UK.

Friesdorf W. and Marsolek I (2005) Macro-ergonomics in health care systems – Basic models for the analysis, design and management of complex working processes. I*n Human factors in Organizational Design and Management – VIII. Ed Carayon P., Robertson M., Kleiner B., Hoonakker P.L.T. IEA Press*

Fujishiro K., Weaver J., Heaney C., Hamrick C., Marras W. (2005). The effect of ergonomic interventions in healthcare facilities on musculoskeletal disorders. *American Journal of Industrial Medicine*. 48(5): 338-47

Gagnon M. (2003). The efficacy of training for three manual handling strategies based on the observation of expert and novice workers. *Clinical Biomechanics*. 18: 601-611

Gagnon M. (2005). Ergonomic identification and biomechanical evaluation of workers strategies and their validation in a training situation: Summary of research. *Clinical Biomechanics*. 20: 569-580

Gagnon I, Cloutier, Ledoux E, Bourdouxhe M, Ouellet F. (2006). Anticipating risk: a question of experience and organization for home care workers. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Garb, J.R., and Dockery, C.A. (1995) Reducing employee back injuries in the perioperative setting. *Association of peri-Operative Registered Nurses Journal*. 61, 6: 1046-1052.

Garg, A., and Owen, B. (1992). Reducing back stress in nursing personnel: an ergonomic intervention in a nursing home. *Ergonomics* 35, 11: 1353-1375.

Garg, A. and Owen, B. (1994) Prevention of back injuries in healthcare workers. *International Journal of Industrial Ergonomics* 14: 315-331.

Garg, A., Owen, B., Beller, D., and Banaag, J.A., (1991) Biomechanical and ergonomic evaluation of patient transferring tasks: bed to wheelchair and wheelchair to bed. *Ergonomics* 34, 3: 289-312.

Garg, A., Owen, B., and Carlson, B. (1992) An ergonomic evaluation of nursing assistants' job in a nursing home. *Ergonomics* 35, 9: 979-995.

Garg A., Hegmann K., Thiese M. (2003). In home assessments of manual patient transfers. *Proceedings of the 14th Triennial International Ergonomics Association Congress, 2003, San Diego, USA*.

Geiger Brown J., Trinkoff A., Rempher K., McPhaul K., Brady B., Lipscomb J., Muntaner C. (2005) Nurses' inclination to report work related injuries. Organizational, work group, and individual factors associated with reporting. *American Association of Occupational Health Nursing Journal*, 53, 5: 213-217

Genaidy A. Lemasters G. Lockey J., Succop P. Deddend J., Sobieh T., Dunning K. (2007). An epidemiological appraisal instrument- a tool for evaluation of epidemiological studies. *Ergonomics* 50, 6: 920-960

Gilworth G., G. , Bhakta B. , Eyres S. , Carey A. , Chamberlain M.A. & Tennant A. (2007). Keeping nurses working: development and psychometric testing of the Nurse-Work Instability Scale (Nurse-WIS). *Journal of Advanced Nursing* 57(5): 543–551.

Gingher, M.C., Karuza, J., Skulski, M. and Katz, P. (1996). Effectiveness of lift systems for long term care residents. *Physical and Occupational Therapy in Geriatrics* 14, 2: 1-11

Glendon A., Stanton N. (2000). Perspectives on safety culture. *Safety Science* 34: 193-214

Glover W., McGregor A., Sullivan C., Hague J. (2005). Work related musculoskeletal disorders affecting members of the Chartered Society of Physiotherapy. *Physiotherapy* 91: 138-147.

Gonge H., Jensen L.D., Bonde J.P. (2002). Research Note: Are psychosocial factors associated with low back pain in nursing personnel. *Work and stress*, 16, 1: 79-87

Gotham H. Sher K., Wood P. (2003). Alcohol involvement and development task completion during young adulthood. *Journal of Studies on Alcohol*. 64 (1): 32-42. In Salkind N. (2004) *Statistics for people who (think they) hate statistics*. 2nd Edition, London Sage Publications.

Granger C.V., Hamilton B.B., Linacre J.M., Heinemann A.W., Wright B.D., (1993). Performance profiles of the functional independence measure. *American Journal of Physical Medicine and Rehabilitation*. 72: 84-89.

Griffiths H. (2009). Inter-rater reliability and validity in a study using the DiNO tool. *Proceedings of the National Back Exchange Conference 2009. NBE Northampton*.

Griffiths, J. and McArthur, M. (1999). A qualitative study exploring the meaning of manual handing training in a working environment at risk of back injury. *Advancing Clinical Nursing* 3: 179-186

Groves R. (2008). *An evaluation of people handling systems for new starters in social care.* Unpublished MSc project, Loughborough University

Gundewall, B., Lijequist, M., and Hansson, T. (1993). Primary prevention of back symptoms and absence from work. A prospective randomised study among hospital employees. *Spine* 18, 5: 587-594.

Gurses A. and Carayon P. (2006). Performance obstacles and nursing workload in intensive care units: a cluster analysis approach. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Hahn S. and Murphy L. (2008). A short scale for measuring safety culture. *Safety Science* 46: 1047-1066

Hammersley M. (1990). *Reading Ethnographic Research: A Critical Guide*. Longmans: London.

Hammersley M. (1992). *Whats wrong with ethnography: Methodological Explorations*. Routlege: London.

Hantikainen, Tamminen-Peter and Arve (2002) *The SOPMAS Tool*. Translated from Finnish original document from FIOH Helsinki.

Hartvigsen J, Bakketeig LS, Leboeuf-Yde C, Engberg M, Lauritzen T. (2001). The association between physical workload and low back pain clouded by the "healthy worker" effect: population-based cross-sectional and 5-year prospective questionnaire study. *Spine*, 26: 1788-1792.

Haslam C, Clemes S, McDermott H, Shaw K, Williams C, Haslam R, (2007), *Manual handling training : Investigation of current practices and development of guidelines. HSE Research Report, rr583*. HSE Publications London.

Haslam R. A. (2002). Targetting ergonomics interventions - learning from health promotion. *Applied Ergonomics* 33: 241-249

Hellsing, A.L., Linson, S.J., Andershed, B., Bergman, C. and Liew, M. (1993). Ergonomic education for nursing students. *International Journal of Nursing Studies* 30: 499-510

Hendrick H. (2003). Determining the cost benefits of ergonomics projects and factors that lead to their success. *Applied Ergonomics,* 34: 419-427.

Higgins, J. M. (1994). *101 Creative Problem Solving Techniques*. Florida: New Management Publishing Company.

Hignett, S. (1996a). Work-related back pain in nurses. *Journal of Advanced Nursing* 23: 1238-1246.

Hignett S (1996b) Manual handling risks in midwifery - identification of risks factors. *British Journal of Midwifery*. 4, 11: 590-596

Hignett, S., (2001a) Manual Handling Risk Assessments in Occupational Therapy. *British Journal of Occupational Therapy*. 64, 2: 81-86

Hignett, S. (2001b). Embedding ergonomics in hospital culture: top-down and bottom-up strategies. *Applied Ergonomics* 32: 61-69.

Hignett S. (2003a). Intervention strategies to reduce musculoskeletal injuries associated with handling patients: a systematic review. *Occupational and Environmental Medicine*, 60(9): E6

Hignett S. (2003b). Systematic review of patient handling activities starting in lying sitting and standing positions. *Journal of Advanced Nursing*, 41 (6) 545-552

Hignett S., and Crumpton E. (2004). *Measuring the effectiveness of competency based education and training programmes in changing the manual handling behaviour of healthcare staff*. HSE Research Report 4440/R68.085. http://hse.gov.uk/research/rrhtm/rr315.htm

Hignett S., and Crumpton E., (2005). Development of a patient handling assessment tool. *International Journal of Therapy and Rehabilitation,* 12(4): 178-81.

Hignett S, and Crumpton E. (2007) Competency based training for Patient Handling. *Applied Ergonomics* 38: 7-17.

Hignett S. Crumpton E., Ruszala S., Alexander P., Fray M., Fletcher B. (2003) *Evidence based patient handling: tasks equipment and interventions.* London, Routledge.

Hignett, S., Fray, M., Rossi, M. A., Tamminen-Peter, L., Hermann, S., Lomi, C., Dockrell, S., Cotrim, T., Cantineau, J. B., Johnsson, C. (2007). Implementation of the Manual Handing Directive in the Healthcare Industry in the European Union for Patient Handling tasks. *International Journal of Industrial Ergonomics* 37, 5: 415-423

Hignett, S. and McAtamney, L. (2000). Rapid Entire Body Assessment (REBA). *Applied Ergonomics*. 31: 201-205

Hildebrandt V.H. (1995). Back pain in the working population: prevalence rates in Dutch trades and professions. *Ergonomics.* 38,6:1283-1298.

Hogston R. (1995). Quality nursing care: a qualitative enquiry. *Journal Advanced Nursing.* 21: 116-124.

Hoogendorn W., Van Poppel M., Bongers P., Koes B., Bouter L. (2000). Systematic review of psychosocial factors at work and private life as risk factors for back pain. *Spine*, 25: 2114-2125

Hollmann S, Klimmer F, Schmidt KH, Kylian H: (1999). Validation of a questionnaire for assessing physical work load. *Scandinavian Journal of Work, Environment and Health*, 25: 105-114.

HMSO (1974). Health and Safety at Work etc Act 1974.

HMSO (1999) *Management of Health and Safety at Work Regulations 1999. Approved code of practice.* L21 HSE Books, London.

HMSO (1998) *Provision and Use of Work Equipment Regulations. Guidance on Regulations* L22 Books, London.

HMSO (2004) *Manual handling operations regulations L23. Guidance on Regulations* L23 Books, London.

HMSO (HSG 65) (1997). *Successful Health and Safety Management*. (HSG 65)1997. HMSO London.

HSE/HSC (1998). *Manual handling in the health services*. HMSO London.

HSE (2006) *Five steps to risk assessment*. INDG163 (rev2) Revised (06/2006) Accessed web Aug 2006.

Hutchinson A, Dean J, Cooper K, Patterson M, McIntosh A, Stride C, Smith C, Laurence B. (2006). Assessing the usefulness of a safety climate questionnaire in UK healthcare. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Hye-Knudsen CT, Birch L, Arjnberg G, Schibye B. (2005). Comprehensive training in patient handling techniques_ Does it make a difference*? Healthcare Systems Ergonomics and Patient Safety Conference Florence 2005* Ed Tartaglia R, Bagnara S, Bellandi T, Albolino S. Taylor and Francis.

Hyytiainen K., Saarela K.L.(1990). Comparison of methods to identify risk factors for low back injuries at work. *Journal of Occupational Accidents*, 11: 57-170

Ilmarinen J. (2005). *Towards a longer working life! Ageing and the quality of worklife in the European Union*. FIOH, Finland.

ISO 9001: 2008. *Quality Management Systems – Requirements*. www.iso.org.

Jäger M., Theilmeier A, Jordan C (2005). Biomechanical analysis of patient-transfer activities for the prevention of spine-related hazards of healthcare workers. Proceedings of the Improving Patient Safety Conference 2008, 'From Safe Design to Safety Practice', 16-18 July 2008, Cambridge, UK. (*www.heps2008.org/abstract/data/pdf/JAEGER.pdf)*

Janowitz I.L. Gillen M., Ryan D., Rempel D., Trupin L., Swig L., Mullen K., Rugulies R.,Blanc P.D., (2006). Measuring the physical demands of work in hospital settings: Design and implementation of an ergonomics assessment. *Applied Ergonomics*, 37, 5: 641-658.

Johnson S., (2007). The predictive validity of safety climate. *Journal of Safety Research* 38: 511-521.

Johnson S.E., Hall A. (2005). The prediction of safe lifting behaviour: An application of the theory of planned behaviour. *Journal of Safety Research*. 36: 63-73

Johnsson C, Carlsson R, Lagerström M (2002). Evaluation of training in patient handling and moving skills among hospital and home care personnel *Ergonomics*, 45(12): 850-865

Johnsson C., Kjellberg K.,Kjellberg A., Lagerström M (2004). A Direct Observation Instrument for Assessment of Nurses' Patient Transfer Technique. *Applied Ergonomics*, 35 (6), 591-601

Jordan C, Theilmeier A, Luttmann, Jager M, and the DOLLY group. (2006). Lumbar-load analysis for health-care workers during patient transfer activities. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Josephson, Lagerstrom M., Hagberg M., Hjelm. (1997). Musculoskeletal symptoms and job strain among nursing personnel: a study over a three year period. *Occupational and Environmental Medicine.* 54, 9: 681-685

Julien B., Nadeau S., Voyer N., Roy C., (2005). Use of logic trees to evaluate corporate performance in ergonomics, health and safety. *Contemporary Ergonomics, 2005*, Taylor and Francis. pp 318-321

Kamberelis G and Dimitriadis G. (2005) Focus Groups. Strategic articulations of pedagogy, politics and inquiry. In Denzin N K and Lincoln Y.S. (eds) *The Sage Handbook of Qualitative Research*. London Sage. Chap 35

Karhu, O., Kansi, P. and Kuorinka, I. (1977). Correcting working postures in industry: a practical method for analysis. *Applied Ergonomics*. 8, 4, 199-201

Karwowski W. (Ed) (2006). *International Encyclopeadia of Ergonomics and Human Factors*. Taylor and Francis, London.

Kerr M., Knott D., Moss M., Clegg C., Horton R. (2008). Assessing the value of human factors initiatives. *Applied Ergonomics* 39: 305-315

Kindblom-Rising K., Wahlstrom R., Ekman S. (2007). Nursing staff's perception of changes in patients transfer habits after a course _ a phenomenological – hermaneutic study. *Ergonomics,* 50, 7: 1017-1025

King, N. (1994) The qualitative research interview. In C. Cassell and G. Symon, (eds) *Qualitative Methods in Organizational Research*. London Sage p271

Kirk J., Millar M. (1986). *Reliability and Validity in Qualitative Research*. London Sage.

Kjellberg K., Johnsson C., Proper K., Olsson E., Hagberg M., (2000). An observation instrument for assessment of work technique in patient transfer tasks. *Applied Ergonomics,* 31: 139-150.

Kjellberg K, Lagerstrom M, Hagberg M. (2003). Work technique of nurses in patient transfer tasks and associations with personal factors. *Scandinavian Journal of Work, Environment and Health.* 29(6):468-77

Kjellberg K, Lagerstrom M, Hagberg M. (2004). Patient safety and comfort during transfers in relation to nurses work technique. *Journal of Advanced Nursing,* 47, 3: 251-259

Kjellberg K., Lindbeck L., Hagberg M., (1998). Method and performance: two elements of work technique. *Ergonomics*. 41, 6: 798-816.

Klemmert K. (1995). A method assigned for the identification of ergonomic hazards-PLIBEL. *Applied Ergonomics* 26, 3, 199-211

Knibbe J. and Friele R. (1999). The use of logs to assess exposure to manual handling of patients, illustrated in an intervention study in care home nursing. *International Journal of Industrial Ergonomics* 24:445-54

Knibbe J.J., Knibbe N.E.,(2005). *Een hap uit de Oliphant*. LOCOmotion, Netherlands. (Chapter 4 translated)

Knibbe JJ, Knibbe NE. (2006a). Monitoring the effects of the ergonomics convenants for workers in Dutch health care. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Knibbe J.J., Knibbe N.E.,(2006b). ErgoCoaches in Dutch healthcare: Key workers promoting ergonomic changes: exploring their profile and effect. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Knibbe H.J.J., Knibbe N.E., A.J.W.M. Klassen, (2007). Safe patient handling program in critical care using peer leaders: Lessons learned in the Netherlands. *Critical Care Nursing Clinics, North America,* 19: 205-211.

Koningsveld E.A.P., Dul J., van Rhijn G.W., Vink P. (2005). Enhancing the impact of ergonomics interventions. *Ergonomics*. 48, 5: 559-580

Kristensen T. (2005). Intervention studies in occupational epidemiology. *Occupational and Environmental Medicine*, 62: 205-210

Kristensen T., Hannerz H., Hogh A., Borg V. (2005). The Copenhagen Psychosocial Questionnaire - a tool for the assessment and improvement of the psychosocial work environment. *Scandinavian Journal of Work, Environment and Health*, 31: 438-449.

Krueger R.A. and Casey M.A. (2000). *Focus Groups. A practical guide for applied research. (3rd Edition)*. London, Sage Publishing Ltd.

Kumar S., Moro L., Narayan Y. (2004). Perceived physical stress at work and musculoskeletal discomfort in x-ray technologists. *Ergonomics,* 47, 2: 189-201

Kumar S, and Narayan Y. (2006). Cumulative spinal load among x-ray technologist: A field study of techniques, frame rate and prediction. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Kuorinka I., Jonsson B., Kilbom A., Vinterberg H., Biering-Sorenson F., Andersson G. Jorgenson K., (1987). Standardised Nordic Questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18, 3: 233-237

Lamkull D., Hanson L., Ortengren R. (2007). The influence of virtual human model appearance on visual ergonomics posture evaluation. *Applied Ergonomics.* 38: 713-722

Landstat B.J., Gelin G., Malquist C. Vinberg S. (2002). A statistical human resources costing and accounting model for analysing the economic effects of an intervention at a workplace. *Ergonomics* 45, 11: 764-787

Langford J and McDonagh D (Eds) (2003) *Focus Groups. Supporting effective product development.* Taylor and Francis, London. Chap12

Lavender S. (2000). A test of the lift trainer: An aggressive approach for preventing back injuries through training. *Proceedings of the IEA 2000/HFES Congress, The Human Factors and Ergonomics Society, California, Santa Monica*. 4: 463-465.

Leboeuf-Yde C, Lauritsen JM, Lauritzen T. (1997). Why has the search for causes of low back pain largely been non-conclusive? *Spine*, 22: 877-881.

Le Bon, C. and Forrester, C. (1997). An ergonomic evaluation of a patient handling device: The elevate and transfer vehicle. *Applied Ergonomics*. 28, 5/6: 365-374.

Lee K. (2005). Ergonomics in total quality management: How can we sell ergonomics to management? *Ergonomics,* 48, 5: 547-558

Lemerle P., Klinger A., Cristalli A., Geuder M. (2008). Application of pressure mapping techniques to measure push and gripping forces with precision. *Ergonomics*, 51, 2: 168-191

Littlewood C., May S. (2007). Measurements of range of movement in the lumbar spine-what methods are valid? A systematic review. *Physiotherapy* 93: 201-211

Lomi C, Lomi G, Pinotsi D. (2006) Translation and cultural adaptation of a patient handling assessment tool. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Lu C, Yeh E. (2006). Ergonomics approach of musculoskeletal injuries of caregivers in disability services centers. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Lynch, R.M., Freund, A. (2000). Short-term efficacy of back injury intervention project for patient care providers at one hospital. AIHAJ: *Journal for the Science of Occupational & Environmental Health & Safety* 61:290-294.

MacGregor H. (2009) *Is there a difference in training outcomes between staff who have had classroom based training and staff who have had training on the ward?* Unpublished MSc project, Loughborough University.

MacLoed I. (2003), Real world effectiveness of ergonomic methods. *Applied Ergonomics* 34: 465-477

Madsen M., Andersen H. (2005). Measuring safety culture: Consistent differences in levels of safety culture between hospital units. *Healthcare Systems Ergonomics and Patient Safety Conference Florence 2005* Ed Tartaglia R, Bagnara S, Bellandi

T, Albolino S. Taylor and Francis Group 2005.

Marras W, Davies K, Kirking B, Bertsche P, (1999). A comprehensive analysis of low-back disorder risk and spinal loading during the transferring and repositioning of patients using different techniques, *Ergonomics 42 (7): 904-926.*

Marras W, Knapik G, Ferguson S, (2009). Lumbar spine forces during manoeuvring of ceiling-based and floor-based patient transfer devices. *Ergonomics, 52, 3: 384-397.*

Martimo K.P., Verbeek J., Karppinen J., Furlan A.D., Takala E.P., Kuijer P., Jauhianen M., Viikari-Juntura E. (2008). Effect of training and lifting equipment for preventing back pain in lifting and handling: systematic review. *British Medical Journal,* 336: 429-431.

Mason J. (2002) *Qualitative Research*. *(2nd Edition)* London Sage Publications Ltd

Mastrominoco E, Motta G, Barresi A, Corbizzi Fattori G. (2005). Handling heavy loads risk assessment in long term care steeings: A comparative analysis among different applied methods. *Healthcare Systems Ergonomics and Patient Safety Conference Florence 2005* Ed Tartaglia R, Bagnara S, Bellandi T, Albolino S. Taylor and Francis Group 2005.

Mawle S. (2005). The HSE manual handling chart (MAC) benefits. *Contemporary Ergonomics, 2005*, Taylor and Francis. pp.42-46

McGill S M, Kavcic N. (2005). Transfer of the horizontal patient: The effect of a friction reducing assistive device on low back mechanics. *Ergonomics* 48, 8: 915-929

McGuire, T., Moody, J., and Hanson, M. (1996). An evaluation of mechanical aids used within the NHS. *Nursing Standard*. 11, 6: 33-38.

McGuire, T., Moody, J., and Hanson, M. (1997). Managers' attitudes towards mechanical aids. *Nursing Standard*. 11, 31: 33-38.

Menckel, E., Hagberg, M., Engkvist, I.L., and Wigaeus-Hjelm, E. (1997). The prevention of back injuries in Swedish health care – a comparison between two models for action-oriented feedback. *Applied Ergonomics.* 28, 1: 1-7.

Menoni O., Ricci M.G., Paciera D., Battevi N., (2004). Assessment of Exposure to manual patient handling in hospital wards: MAPO Index (movement and assistance of hospital patients. In: Hedge A., Brookhuis K., Salas E., Hendrick and Stanton N., (Eds). *Handbook of human factors and ergonomics methods*. London CRC press.

Menzel N., (2004). Back pain prevalence in nursing personnel: measurement issues. *American Association of Occupational Health Nursing Journal,* 52: 54-65

Menzel N. (2007). Psychosocial factors in musculoskeletal disorders. *Critical*

Care Nursing Clinics, North America 19: 145-153

Menzel N, Brooks S, Bernard T, Nelson A, (2004). The physical workload of nursing personnel: association with musculoskeletal discomfort. *International Journal of Nursing Studies. 41: 859-867*

Miller A., Engst C., Tate R., Yassi A. (2006). Evaluation of the effectiveness of portable ceiling lifts in a new long-term care facility: *Applied Ergonomics*. 37(3): 377-85

Monnington S., Quarrie C., Pinder A., Morris L. (2003). Development of manual handling assessment charts (MAC) for health and safety inspectors. *Contemporary Ergonomics, 2003*, Taylor and Francis. pp 3-8

Nastasia I., Lortie M., Delisle A., Gagnon M. (2007). Perception and biomechanics data in a manual handling task : a comparative study. *Ergonomics,* 50, 12: 2059-2081

National Back Exchange (2002) *Essential back-up. Revised 2002.* NBE Northampton UK.

National Back Exchange (2005) *Manual handling standards*. NBE Northampton UK.

Nelson A., (Ed) 2006 *Safe patient handling and movement. A practical guide for health care professionals*. New York, Springer.

Nelson A., Baptiste A.. (2004). Evidence-based practices for safe patient handling and movement. *Online journal of issues in nursing* [electronic resource]. 2004 Sep 30; 9(3): 4

Nelson A., Collins J., Siddharthan K., Matz M., Waters T. (2008). Link Between Safe Patient Handling and Patient Outcomes in Long-Term Care. *Rehabilitation Nursing*. 33, 1: 33-43

Nelson A., Matz M., Chen F., Siddharthan K., Lloyd J., Fragala G. (2006). Development and evaluation of a multifaceted ergonomics program to prevent injuries associated with patient handling tasks. *International Journal of Nursing Studies.* 43(6): 717-733

Nelson A., Lloyd J., Fragala G., Matz M., Amato M., Bowers J., Moss-Cureton S., Ramsey G., Lentz K. (2003). Safe patient handling and movement. *American Journal of Nursing.* 103(3): 32-43.

NHS Wales (2003). A*ll Wales NHS Manual Handling Training Passport and Information Scheme.* Publ. NHS Wales, Welsh Assembly Government, Health and Safety Executive. http://www.wales.nhs.uk/documents/NHS_manual_handling_passpor.pdf),

NIOSH (2001). *A Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries.* Dept of Health and Human Services, NIOSH.

Noyes J., Bruneau D. (2007). A self-analysis of the NASA-TLX workload measure. *Ergonomics* 50, 4: 514-519

Nygaard Jensen J., Albertsen K., Borg V., Nabe-Nielsen K. (2009). The predictive effect of fear-avoidance beliefs on low back pain among newly qualified health care workers with and without previous low back pain: a prospective cohort study. *Bio-Med Central (BMC) Musculoskeletal Disorders*, 10:117

Nyran, P.I. (1991). Cost effectiveness of core-group training. In Karwowski, W. and Yates, J W. (Eds.) *Advances in industrial Ergonomics and Safety lll*.. *Taylor & Francis.* pp 778-782

Occhipinti E. (2007) Musculoskeletal risks in healthcare in the Lombardi region. *Risks for health care workers: prevention challenges. Proceedings of ELINYEA and ISSA Health Services Section Conference, Athens June 2007.*

Occhipinti E. and Colombini D. (2007). Updating reference values and predictive models of the OCRA method in the risk assessment of work related musculoskeletal disorders of the upper limbs. *Ergonomics*, 50, 11: 1727-1739

OSHA (2008), *Guidelines for Nursing Homes, Ergonomics for the prevention of musculoskeletal disorders*. http://osha.europa.eu/publications/e-facts/efact28

OSHA (2009). *Occupational Safety and Health Administration. Establishment Specific Injury and Illness Rates.* http://www.osha.gov/pls/odi/establishment_search.html

Okunribido O., Haselgrave C. (2008). Ready steady push – a study of the role of arm posture in manual exertions. *Ergonomics*, 51, 2: 192-216.

Ore T. (2003). Manual handling injury in a disability services setting. *Applied Ergonomics* 34: 89-94

Oregon Nurses Association (2004). *Safe Patient Handling in Health care. A Guide for Instructors*. Oregon Nurses Association

Owen, B.D. (1988) Patient handling devices: An Ergonomic Approach to Lifting Patients. In Aghazadeh, F. (Ed.) *Trends in Ergonomics/Human Factors V.* North Holland, Elsevier Science Publishers BV. pp721-728

Owen, B.D. and Fragala, G. (1999). Reducing perceived physical stress while transferring residents: An ergonomic approach. *American Association of Occupational Health Nursing Journal.* 47: 316-323.

Owen B., and Garg A., (1991) Reducing risk for back pain in nursing personnel. *American Association of Occupational Health Nursing Journal*, 39, 24-33.

Owen, B. and Hasler-Hanson, C.R (1999). A study comparing three methods of repositioning “patients” up in bed.. *Journal of Healthcare Safety Compliance and*

Infection Control 3, 8: 362-267.

Owen B., Keene K., Olson S. (2001). Patient handling tasks perceived to be most stressful by hospital nursing personnel. *Journal of Healthcare Safety Compliance & Infection Control* 5, 1-7.

Owen B; Keene K; Olson S. (2002). An ergonomic approach to reducing back/shoulder stress in hospital nursing personnel: a five year follow up.: *International Journal of Nursing Studies*. 39(3): 295-302

Passfield, J ; Marshall, E ; Adams, R. (2003). "No lift" patient handling policy implementation and staff injury rates in a public hospital. *The Journal of Occupational Health and Safety, Australia and New Zealand*. 19, 1: 73

Pawson and Tilley (1997). *Realistic Evaluation*. Sage, London.

Perakyla A. (2005). Analysing Talk and Text. In Denzin N K and Lincoln Y.S. (eds) *The Sage Handbook of Qualitative Research*. London Sage. Chap 34.

Pinder A. (2002). Power considerations in estimating sample size for evaluation of the NIOSH lifting equation. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 83-86

Pinder A. (2003). Benchmarking of health and safety inspectors' manual handling assessment charts (MAC). *Contemporary Ergonomics, 2003*, Taylor and Francis. pp 15-20

Plamondon A., Delisle A., Larue C., Brouillette D., McFadden D., Desjardins P., Lariviere. (2007). Evaluation of a hybrid system for 3 dimensional measurement of trunk posture in motion. *Applied Ergonomics* 38, 6: 697-712

Pohjonen, T., Punakallio, A., and Louhevaara, V. (1998). Participatory ergonomics for reducing load and strain in home care work. *International Journal of Industrial Ergonomics*. 21: 345-352.

Pousette A., Larsson S., Torner M. (2008). Safety climate cross-validation, strength and prediction of safety behaviour. *Safety Science* 46: 398-404

Powney J. and Watts, M. (1987) Interviewing in Educational Research, London: Routledge and Kegan Paul. P271, 278,282. In Robson C. *Real World Research (2nd Edition)* (2002) Blackwell Publishing, Oxford. Chaps 9 and 14

Pretorius A., Cilliers P.J. (2007). Development of a mental workload index : A systems approach. *Ergonomics* 50, 9: 1503-1515

Putz-Anderson V., (1988). *Cumulative trauma disorders: a manual for musculoskeletal diseases of the upper limbs*. London, Taylor and Francis Ltd.

QSR International (2006) *NVivo 7 Qualitative Computer Package*. www.QSR International.com

Radkiewicza P., Widerszal-Bazyla T.M., and the NEXT-Study group.(2005) Psychometric properties of Work Ability Index in the light of comparative survey study *International Congress Series 1280*: 304-309

Radovanovic C.A.T., Alexandre N.M.C., (2004) Validation of an instrument for patient handling assessment. *Applied Ergonomics* 35: 321-328.

Raine E., (2001). Testing a risk assessment tool for manual handling. *Professional Nurse*, 16, 9: 1344-1348

Ramsay J., Denny F., Szirotnyak K., Thomas J., Corneliuson E., Paxton K. (2006). Identifying nursing hazards in the emergency department: A new approach to nursing job hazard analysis. *Journal of Safety Research*. 37: 63-74

Redinger, C.F., Levine, S.P. (1998). Development and evaluation of the Michigan occupational health and safety management system assessment instrument: A universal OHSMS performance measurement tool. *American Industrial Hygiene Association Journal.* 59: 572-581

Reid S., Mirka G. (2007). Learning curve analysis of a patient lift assist device. *Applied Ergonomics* 38: 765-771

Retsas A., and Pinikahana J. (2000). Manual handling activities and injuries among nurses: an Australian hospital study, *Journal of Advanced Nursing* 31 (4): 875-883

Rice M, Wooley S, Waters T, (2009). Comparison of required operating forces between floor-based and overhead-mounted patient lifting devices. *Ergonomics* 52, 3 : 112-120

Rivils I., Van Eerd D., Cullen K., Cole D., Irvin E.,Tyson J., Mahood Q., (2008). Effectiveness of interventions on health outcomes: A systematic review. *Applied Ergonomics* 39: 342-358

Robson C. (2002). *Real World Research (2nd Edition)* Blackwell Publishing, Oxford. Chaps 9 and 14

Robson L., Clarke J., Cullen K., Bielecky A., Severin C., Bigelow P., Irvin E., Culyer A., Mahood Q. (2007). The effectiveness of occupational safety management system interventions: A systematic review. *Safety Science* 45: 329-353

Rockerfeller K, Silverstein B, Howard N. (2000). Getting to zero lift in Washington State nursing homes. *Proceedings of the IEA 2000/HFES Congress, The Human Factors and Ergonomics Society, California, Santa Monica*. 5: 430- 433.

Roman-Liu D. (2007). Repetitive task indicator as a tool for assessment of upper limb musculoskeletal load induced by repetitive task. *Ergonomics.* 50, 11: 1740-1760

Royal College Of Midwives, (1999) *Handle with care*. Royal College of Midwives, London

RCN (2001) *Manual handling assessments in hospitals and in the community. An RCN guid*e. London, RCN. Publication code 000605.

RCN (2003). *Safer Staff, Better Care*. London, RCN. Publication Code 001975

Rugeli D. (2003). Low back pain and other work related musculoskeletal problems among physiotherapists. *Applied Ergonomics* 34: 635-639

Russell S.J., Winnemuller L., Camp J.E., Johnson P.W. (2007). Comparing the results of five lifting analysis tools. *Applied Ergonomics* 38: 91-97.

Russo A., Murphy C., Lessoway V., Berkowitz J. (2002). The prevalence of Musculoskeletal symptoms among British Columbia sonographers. *Applied Ergonomics* 33: 385-393

Ruszala S., Musa I. (2005). An evaluation of equipment to assist patient sit-to-stand activities in physiotherapy. *Physiotherapy* 91: 35-41

Ryan B., Haselgrave C. (2007). Use of concurrent and retrospective verbal protocols to investigate workers thoughts during a manual handling task. *Applied Ergonomics* 38: 177-190

Salkind N. (2004) *Statistics for people who (think they) hate statistics*. 2nd Edition, London Sage Publications.

Santaguida P., Pierrynowski M., Goldsmith C., Fernie G. (2005). Comparisons of cumulative low back loads of care givers when transferring patients using overhead and floor lifts. *Clinical Biomechanics* 20: 906-916

Schibye B; Hansen AF; Hye-Knudsen CT, Essendrop, M., Bocher M.,Skotte J., (2003) Biomechanical analysis of the effect of changing patient-handling technique. *Applied Ergonomics*. 34(2): 115-23

Schibye, B. and Skotte, J. (2000). The mechanical loads on the low back during different patient handling tasks. *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 5: 785-788.

Scott, A. (1995). Improving patient moving and handling skills. *Professional Nurse*. 109, 11: 105-6.

Seigel and Castellan (1988) *Non-parametric statistics for the behavioural sciences*. McGraw Hill Book Co.

Shaw W., Hong Q., Pranskey G., Loisel P. (2008). A literature review describing the role of return to work co-ordinators in trial programs and interventions designed to prevent workplace disability. *Journal of Occupational Rehabilitation*. 18: 2-15

Siddarthan K., Nelson A., Weisenborn G. (2005). A business case for patient care ergonomic interventions. *Nursing Administration Quarterly.* 29, 1: 63-71

Silverman D. (2001) *Interpreting Qualitative Data. Methods for analysing talk, text and interaction. 2nd Edition.* London Sage publications Ltd.

Silvia S., Lima M., Baptista C. (2004). OSCI: an organisational and safety climate inventory. *Safety Science* 42: 205-220

Simon M., Tackenburg P., Estryn-Behar M., Conway P.M., Hasselhorn H.M. (2008). Back or neck pain related disability of nursing staff in hospitals, nursing homes and home care in seven countries- results from the European NEXT study. *International Journal of Nursing Studies* 45: 24-34

Singleton W.T. (1974) *Applied Ergonomics Handbook*. Butterworths, London Chap 1, p10

Skotte J.H., (2001) Estimation of low back loading on nurses during patient handling tasks: the importance of bedside reaction force measurement. *Biomechanics* 34: 273-276

Slavin R. (1995). Best evidence synthesis: an intelligent alternative to meta analysis. *Journal of Clinical Epidemiology*. 48 (1): 9-18

Slin K., Nini E., Forestier D., Kwiatkowski F., Panis Y., Chipponi J. (2003). Methodological index for non-randomised studies (MINORS): development and validation of a new instrument. *Australian and New Zealand Journal of Surgery*. 73: 712-6

Smedley, J., Egger, P., Cooper, C. and Coggon, D. (1995). Manual handling activities and risk of low back pain in nurses. *Occupational and Environmental Medicine*. 52: 160-3.

Smedley J., Poole J., Waclawski E., Stevens A., Harrison J., Buckle P., Coggon D., (2005). Assessing investment in manual handling risk controls: a scoring system for use in observational studies. *Occupational and Environmental Medicine.* 62: 63-65.

Smedley J., Trevelyan F., Inskip H., Buckle P., Cooper C., Coggon D. (2003). Impact of ergonomic intervention on back pain among nurses. *Scandinavian Journal of Work, Environment & Health*. 29(2): 117-23

Smith G. and Seccombe I. (1996) *Manual Handling: Issues for Nurses*. Institute for Employment Studies, London

Smith J (Ed) (2005). *The Guide to The Handling of People. (5th edtn*) RCN, Back Care London.

Smith J., Rose P., Love J., Berry M., (2005). *Hoist Identification Tool (HIT)*. Sunrise Medical, Inc. 0705/000690275.UK/SD Rev. A.

Spradley J. (1979). *The Ethnographic Interview*. New York: Holt, Rinehart & Winston.

Stake R. (1994). Case Studies. In Denzin N and Lincoln Y. (eds) *Handbook of Qualitive Reseach* Sage Publications p243.

Stanton N.A, Baber C. (2003). On the cost effectiveness of ergonomics. *Applied Ergonomics.* 34: 404-411

Stanton N., Salmon P., Walker G., Baber C., Jenkins D. (2005). *Methods book Human Factors Methods: A Practical Guide for Engineering and Design*. Ashgate Publishing, UK.

St. Vincent M., Tellier C., Lortie M., (1989). Training in Handling : an evaluative study. *Ergonomics.* 32 (2), 191-210.

Steele, D. and Stubbs, D. (2002). Measuring working postures of midwives in the healthcare setting. In P.McCabe, (Ed.) *Contemporary Ergonomics. London:* Taylor and Francis. pp 39-44.

Stetler C., Burns M., Sander-Buscemi K. et al., (2003). Use of evidence for prevention of work-related musculoskeletal injuries. *Orthopaedic Nursing*. 22(1): 32-41

Stobbe T. Plummer R. Jensen R., Attfield M. (1988). Incidence of low back injuries among nursing personnel as a function of patient lifting frequency. *Journal of Safety Research*. 19: 21-28

Straker L. Burgess-Limerick R., Pollock C., Egeskov R. (2004). A randomized and controlled trial of a participative ergonomics intervention to reduce injuries associated with manual tasks: physical risk and legislative compliance. *Ergonomics*, 47, 2: 166-188.

Strong G.(1999). Reducing Patient Handling Injuries with a Zero-Loft Policy. A mixing-and-matching of available technology can minimize back injuries. *Nursing Homes : long term care management*. 48, 10: 50

Sutherland C., Albert W., Wrigley A., Callaghan J. (2007). The effect of camera viewing angle on posture assessment repeatability and cumulative spinal loading. *Ergonomics* 50, 6: 877-889

Sutherland C., Albert W., Wrigley A., Callaghan J. (2008). A validation of a posture matching approach for the determination of 3D cumulative back loads. *Applied Ergonomics*, 39: 199-208

Switzer, S. and Porter J.M., (1993) The lifting behaviour of nurses – in their own words. In Darby, F., and Turner, P. (Eds.) *Proceedings of 7th Conference of New Zealand Ergonomics Society. Wellington 2-3 Aug 1993.* pp33-43

Tak S., Punnett L., Paquet V., Woskie S., Bucholz B. (2007). Estimation of compressive forces on lumbar spine from categorical posture data. *Ergonomics*, 50, 12: 2082-2094

Tamminen-Peter L. (2004). *Description of SOPMAS Tool*. Finnish Institute of Occupational Health (Internal Document).

Tamminen-Peter L., Fagerstrom V., Moilanen A. (2008). Comparison of risk assessment tools of patient handling. Finnish Institute of Occupational Health, NES, 2008 http://www.nes2008.is/media/files/LeenaTamminenComparisonofriskassessmenttoolsofpatienthandling.pdf

Tapley S.E., Buckle P. (2003). Reliability of manual handling assessment charts (MAC) developed for regulatory inspectors in the United Kingdom. *Contemporary Ergonomics, 2003,* Taylor and Francis. pp 9-14

Taveira A., James C., Karsh B-T., Sainfort F. (2003). Quality management and the work environment: an empirical investigation into public sector organization. *Applied Ergonomics,* 34: 281-291

Tesch R. (1990) Qualitative Research: Analysis types and Software Tools. New York: Falmer. In Miles M.B. and Huberman A. M. (1994) *Qualitative Data Analysis: An Expanded Sourcebook*. London, Sage.

Thompson, E. (2000). Safer Birthing Positions. A choice for Mother and Midwife. *The Column*. 12, 2: 17-22.

Thornton A., Stuart-Buttle C., Wyszynski T., Wilson E. (2004). Physical and psychosocial stress exposures in US dental schools: the need for expanded ergonomics training. *Applied Ergonomics* 35: 153-157

Toupin C. (2006). Experience and compromise in the activity of hospital nurses in night shifts. *In Pikaar, R.N., Konigsveld, E.A.P., Settels, P.J.M. (Eds.) Proceedings of the XVth Triennial Congress of the International Ergonomics Association, Meeting Diversity in Ergonomics 11-14 July 2006, Maastricht, Netherlands.*

Troup, J.D. and Rauhala, H.H. (1987). Ergonomics and training. *International Journal of Nursing Studies*. 24, 4: 325-330.

Tuomi K, Ilmarinen J, Jahkola A, Katajarinne L, Tulkki A. (1998) *Work Ability Index (2nd revised edn).* Finnish Institute of Occupational Health, Helsinki.

Turnberg W., Daniell W. (2008). Evaluation of a healthcare safety climate measurement tool. *Journal of Safety Research* 39: 563-568.

Turner C., Rohrer B., James T. (2002). Use of ergonomic chairs in a dental clinic. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 27-32

Van Nieuwenhuyse A., Fatkhutdinova L., Verbeke G., Pirenne D., Johannik K., Somville P.R., Mariaux P., Moens G.F., Masschelein R. (2004). Risk factors for first-ever low back pain among workers in their first employment. *Occupational Medicine*, 54: 513-519.

Van Nieuwenhuyse A., Somville P.R., Crombez G., Burdorf A., Verbeke G., Johannik K., Van den Bergh O., Masschelein R., Mariaux P., Moens G.F., the BelCoback Study group. (2006). The role of physical workload and pain related fear in the development of low back pain in young workers: evidence from the BelCoBack Study; results after one year of follow up. *Occupational and Environmental Medicine*, 63: 45-52.

Van Poppel M, Hooftman W, Koes B, (2004). An update of a systematic review of controlled clinical trials on the primary prevention of back pain at the workplace. *Occupational Medicine*, 54 (5) : 345-352

Van Tulder M., Assendelft W., Koes B., Bouter L. (1997). Method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group for Spinal Disorders. *Spine*, 22: 2323-2330.

Van Tulder M., Furlan A., Bombardier C., Bouter L. (2003). Updated method guidelines for systemmatic reviews in the Cochrane Collaboration back review group. *Spine*. 28: 1290-9

Vasey J., Crozier L., (1982). A move in the right direction. *Nursing Mirror*, May 12:28-31.

Videman T, Ojajarvi A, Riihimaki H, Troup JD: (2005) Low back pain among nurses: a follow-up beginning at entry to the nursing school. *Spine*, 30: 2334-2341.

Village J., Frazer M., Cohen M., Leyland A., Park I., Yassi A. (2005). Electromyography as a measure of peak and cumulative workload in intermediate care and its relationship to musculoskeletal injury: An exploratory ergonomics study. *Applied Ergonomics* 36: 609-618

VISN8 (2006). *Safe Bariatric Patient Handling Toolkit.* VISN8, Patient Safety Center of Enquiry, Department of Veteran Affairs, Florida.

Vredenburgh A. (2002). Organizational safety: Which management practices are the most effective in reducing employee injury rates? *Journal of Safety Research*. 33: 259-276

Wachs, J.E., and Parker, J.E. (1987). Registered Nurses' Lifting Behaviour in the Hospital Setting. In Asfour, S. (Ed.). *Trends in Ergonomics/Human Factors* IV, 883-890. North Holland, Elsevier Science Publishers BV.

Waldenström, U. and Gottvall, K. (1991). A randomised trial of Birthing Stool of Conventional Semi-recumbent Position for Second-Stage Labour. *Birth*. 18, 1: 5-10

Wallin A-M, Ahlstrom G. (2006). Cross-cultural studies using interpreters: systematic literature review. *Journal of Advanced Nursing*. 55, 6, 723-735.

Ware J., Snow K., Kosinski M., Gandek B. (1993). *SF36 health survey manual and interpretation guide.* Boston, MA; New England Medical Center, Health

Institute.

Warming S., Ebbehoj N., Wiese N., Larsen L., Duckert J., Tonnesen H. (2008). Little effect of transfer technique instruction and physical fitness training in reducing low back pain among nurses: a cluster randomized intervention study. *Ergonomics* 51, 10: 1530-1548.

Warming S. Johnsson C., 2004. Letter to the editor. *Applied Ergonomics.* 35: p615

Warming S., Juul-Kristensen B., Ebbehoj N.E., Schbiye B. (2004). An observation instrument for the description and evaluation of patient transfer technique. *Applied Ergonomics.* 35: 603-614

Warming S., Precht D., Suadicani P., Ebbehoj N. (2009). Musculoskeletal complaints among nurses related to patient handling tasks and psychosocial factors – Based on logbook registrations. *Applied Ergonomics* 40: 569-576.

Waters T.R., Lu M.L., Occhipinti E. (2007). New procedures for assessing sequential manual lifting jobs using the revised NIOSH lifting equation *Ergonomics*, 50, 11: 1761-1770

Waters T., Putz-Anderson, V., Garg A., Fine L., (1993). Revised NIOSH equation for the design and evaluation of manual lifting tasks. *Ergonomics* 36: 749-776

Whysall Z., Haslam R., Haslam C. (2004). Processes, barriers, and outcomes described by ergonomics consultants in preventing work-related musculoskeletal disorders. *Applied Ergonomics* 35: 343-351

Wickel E., Reiser R. (2008). The effect of floor slope on sub-maximal lifting capacity and technique. *Applied Ergonomics* 39: 296-304

Wiitavaara B., Barnekow-Bergkvist M., Brulin C. (2007). Striving for Balance: A grounded theory study of health experiences of nurses with musculoskeletal problems. *International Journal of Nursing Studies,* 44: 1379-1390

Williams M., Medland A. (2002). An optimization approach to ergonomic evaluation and motion analysis. *Contemporary Ergonomics, 2002*, Taylor and Francis. pp 157-161

Wilson J. and Corlett N. (ed) (2005). *Evaluation of Human Work. 3rd Edition.* Taylor and Francis, London.

Wilson J. and Morrisroe G. (2005). Systems analysis and design. Chapter 10 in Wilson J. and Corlett N. (ed) (2005). *Evaluation of Human Work. 3rd Edition.* Taylor and Francis, London. p241-279

Winkelmolen, G.H.M., Landeweerd, J., and Drost, M.R. (1994). An evaluation of patient lifting techniques. *Ergonomics*. 37, 5: 921-932.

Wonnacott L,. (2006) Unpublished MSc thesis. *A comparison of lateral transfer* *methods in two NHS Trusts*. Loughborough University

Wood, D.J. (1987) Design and Evaluation of a Back Injury Prevention Program within a Geriatric Hospital. *Spine.* 12, 2: 77-82.

Yassi A., Cooper J., Tate R., Gerlach S., Muir M., Trottier J., Massey K. (2001). A randomized controlled trial to prevent patient lift and transfer injuries of health care workers. *Spine*. 26(16): 1739-46

Yeung S.S., Genaidy A.M., Karwowski W., Leung P.C., (2002). Reliability and validity of self reported assessment of exposure and outcome variables for manual lifting for manual tasks: a preliminary investigation. *Applied Ergonomics* 33: 463-469

Zink K. (2005). From industrial safety to corporate health management. *Ergonomics*, 48, 5: 534-546

Zhuang, Z., Stobbe, T.J., Collins, J.W., Hsiao, H., and Hobbs, G.R. (2000). Psychophysical assessment of assistive devices for transferring patients/residents. *Applied Ergonomics*. 31: 35-44.

APPENDIX A

Literature Analysis (328 studies)

i. Included reference list
ii. Full data extraction for literature analysis

Paper No	Reference
1	Peers, M.L. (1998) Prevention of nursing strain injuries in the Long Term Care Setting: the Fairview Lodge experience. *Perspectives* 22, 1: 23-24
2	Gingher, M.C., Karuza, J., Skulski, M.D. and Katz, P. (1996) Effectiveness of lift systems for long term care residents *Physical and Occupational Therapy in Geriatrics* 14, 2: 1-11
3	Scott, A. (1995) Improving patient moving and handling skills. *Professional Nurse*. 109; 11:105-6.
4	Gray, J., Cass, J., Harper, D.W. and O'Hara, P.A. (1996) A controlled evaluation of a lifts and transfer educational program for nurses *Geriatric Nursing* 17, 2: 81-85
5	Holliday, P.J., Fernie, G.R. and Plowman, S. (1994). The impact of new lifting technology in long term care. *AAOHN Journal* 42, 12: 582-589
6	Santoro, M. (1994) Lifting teams can help hospitals eliminate costly back injuries to nurses. *Hospital Employee Health* 13, 7: 81-87
7	Newman, S. and Callaghan, C. (1993). Work-related back pain. *Occupational Health* 45:201-205.
8	Overd, A. (1992). Should we lift or should we roll? Nursing practice following prosthetic hip surgery. *Professional Nurse*. 7:311-319.
9	Harber, P., Pena, L., Hsu, P., Billet, E., Greer, D. and Kim, K. (1994) Personal history, training, and worksite as predictors of back pain of nurses. *American Journal of Industrial Medicine* 25:519-526.
10	Meyer, E. (1995). Patient lifter in a practical test. A spine-saving aid or bulk in the storage room?. [German]. *Pflege Aktuell*. 49, 9:597-600.
11	Addington, C. (1994) All the right moves. A program to reduce back injuries in OR nurses. *AORN Journal* 59, 2: 483-488.
12	McKeller, N.B. and Shaw, H. (1986). Back breaking work (lifting patients in the operating theatre). *NATNEWS* 23:14-6.
13	Tracz, S. and Rose, I. (1982). Beating low back pain. Dimensions in Health Service. 59:20-23.
14	Griffiths, J. and McArthur, M. (1999) A qualitative study exploring the meaning of manual handing training in a working environment at risk of back injury. *Advancing Clinical Nursing* 3: 179-186
15	Lavender, S.A., Conrad, K.M., Reichelt, P.A., Meyer, F.T. and Johnson, P.W. (2000b). Postural analysis of paramedics simulating frequently performed strenuous work tasks. *Applied Ergonomics*. 31,1: 45-57.

16	Zelenka, J.P., Floren, A.E. and Jordan, J.J. (1996). Minimal forces to move patients. *American Journal of Occupational Therapy*. 50, 5: 354-361.
17	Bewick, N. and Gardner, D. (2000) Manual handling injuries in health care workers. *International Journal of Occupational Safety & Ergonomics* 6, 2: 209-221.
18	Bertolazzi, M. and Saia, B. (1999) Risk during manual movement of loads. [Italian]. *Girnale italiano di Medicina del Lavoro ed Ergonomial* 21, 2:130-133.
19	Engels, J.A., van der Gulden, J.W., Senden, T.F., Kolk, J. J. and Binkhorst, R.A. (1998) The effects of an ergonomic-educational course. Postural load, perceived physical exertion, and biomechanical errors in nursing. *International Archives of Occupational & Environmental Health* 71:336-342.
20	Monaghan, H., Robinson, L. and Steele, Y. (1998). Implementing a no lift policy. *Nursing Standard* Sept. 2. 12, 50:35-37.
21	Allen, S. K. Wilder, K. (1996) Back belts pay off for nurses. *Occupational Health & Safety* 65:59-62.
22	DeGeorge, P. and Dunwoody, C. (1995) Transfer techniques of the lower extremity with an external fixator. *Orthopaedic Nursing* 14:17-21.
23	Wright, A., Smith, L.A., and Landers, J. (1991). Design and Evaluation of an Ergonomic Patient Lifting Device. *Advances in Industrial Ergonomics & Safety*. Taylor & Francis. 3, 293-299.
24	King, L. (1994). Safe handling of Hip Replacement Patients. *Nursing Standard*. 8, 47: 31-35.
25	Gagnon, M., Sicard, C., and Sirois, J.P. (1986) Evaluation of forces on the lumbo-sacral joint and assessment of work and energy transfers in nursing aides lifting patients. *Ergonomics* 29, 3: 407-421.
26	Tracy, M. (1996). Campaign for safer patient handling. *Occupational Health*. 48:50-52.
27	Fazel, E. (1998). The pain of moving. *Occupational Health*. August. 22-23
28	Tracy, M. (1997) An Ergonomic Evaluation of Slide Sheets. *The Column* 21-26
29	Hignett, S., (2001a) Manual Handling Risk Assessments in Occupational Therapy. British Journal of Occupational Therapy. 64, 2: 81-86
30	Alexander, P. (1998) Risk Management in Manual Handling for Community Nurses. In Hanson, M. (Ed.) *Contemporary Ergonomics 1998* 87-91
31	Quintana, R., and Alonso, J. (1997) An Ergonomic Patient-Handling Methodology. *Procs of the Silicon Valley Ergonomics Institute San Jose Univ. California.* 67-74.

32	Switzer, S. and Porter J.M., (1993) The lifting behaviour of nurses – in their own words. In Darby, F., and Turner, P. (Eds.) *Proc. 7th Conf. NZ Ergonomics Soc. Wellington 2-3 Aug 1996.* 33-43
33	McGill, S.M., Potvin, J. and Norman, R.W. (1990) Estimating low back demands in ambulance attendants using a hybrid anatomical model. *Proceedings of the 23rd conference of the Human Factors Association of Canada, Ottawa, Canada 26-26 Sept. The Association, Mississauga, Ontario.* 191-195.
34	Edlund, C.K., Harms-Ringdahl, K., Ekholm, J. (1998) Properties of person hoist spreader bars and their influence on sitting/lifting position. *Scandinavian Journal of Rehabilitation Medicine* 30, 3: 151-158.
35	Bruno, C. and Davis, T. (1997). Redesign of the standard hospital wheelchair. *Proceedings of the RESNA 1997 Annual Conference, Pittsburgh, Pennsylvania.* June 20-24. S. Sprigle (ed). *RESNA press, Arlington, Virginia.* 175-177.
36	Duffy, A., Burke, C. and Dockrell, S. (1999) The use of lifting and handling aids by hospital nurses. *British journal of Therapy and Rehabilitation.* 6, 1: 20-24
37	Brulin, C., Winkvist, A. and Langendoen, S (2000) Stress from working conditions among home care personnel with musculoskeletal symptoms. *Journal of Advanced Nursing* 31, 1: 181-189
38	Connolly, M.J., Wilkinson, E. Flanagan, S. and Mulley, G.P. (1990) Nurses' attitudes to and use of patient hoists in hospital. *Clinical Rehabilitation.* 4: 13-17
39	Hui, L. Ng, G.Y.F., Yeung, S.S.M., Hui-Chan, C.W.Y., (2001) Evaluation of physiological work demands and low back neuromuscular fatigue on nurses working in geriatric wards. *Applied Ergonomics* 32: 479-483.
40	Paternoster, D., Salis, M. and Gisser, G.V. (1999) An experience in training of hospital staff with tasks involving manual load lifting in Bressanone Hospital: content and checking of efficacy. [Italian]. *Medicina del Lavoro*. 90, 2:381-392
41	Baglioni, A. (1999) Environmental features of hospital wards and interaction with patient handling. [Italian]. *Medicina del Lavoro*. 90, 2: 141-151
42	Daynard, D., Yassi, A., Cooper, J.E., Tate, R., Norman, R. and Wells, R. (2001) Biomechanical analysis of peak and cumulative spinal loads during simulated patient-handling activities: a substudy of a randomised controlled trial to prevent lift and transfer injury of health care workers. *Applied Ergonomics* 32: 199-214
43	Daws, J. (1981) Lifting and moving patients. 3. A revision training programme. *Nursing Times* November 25. 2067-2069
44	Billin, S.L. (2001) Safer handling practice in a neuro-disability environment. *The Column* February. 13.1: 25-27

45	Pain, H., Jackson, S., McLellan, D.L. and Gore, S. (1999). User evaluation of handling equipment for moving dependent people in bed. *Technology & Disability* 11: 13-19
46	Elford, W., Straker, L. and Strauss, G. (2000) Patient handling with and without slings: an analysis of the risk of injury to the lumbar spine. *Applied Ergonomics* 31:185-200.
47	Lavender, S.A., Conrad, K.M., Reichelt, P.A., Johnson, P.W. and Meyer, F.T. (2000a). Biomechanical analyses of paramedics simulating frequently performed strenuous work tasks. *Applied Ergonomics* 31: 167-177.
48	Fanello, S., Frampas-Chotard, V., Roquelaure, Y., Jousset, N., Delbos, V., Jarmy, J. Penneau-Fontbonne, D. (1999) Evaluation of an educational low back pain prevention program for hospital employees. *Revue Du Rhumatisme, English Edition* 66, 12: 711-716.
49	Owen, B.D. and Fragala, G. (1999). Reducing perceived physical stress while transferring residents: An ergonomic approach *AAOHN Journal* 47: 316-323.
50	Torri, P., Liboni, D., Milan, F. and Piccoli, R., (1999). An experience in management of risk due to manual lifting of patients in hospitals in the Veneto Region. *Medicina del Lavoro*. 90, 2: 362-380.
51	Fourie, J.A., Lief, E.M.P. and Dunne, T.T. (1992) Pillow positioning facilitates independent bridging for bedpan use in pelvic fractures. *South African Journal of Physiotherapy* 48, 3: 41-44.
52	Collins, M. (1990) A comprehensive approach to preventing occupational back pain among nurses. *Journal of Occupational Health & Safety – Australia & New Zealand* 6, 5: 361-368.
53	Gagnon, M., Roy, D., Lortie, M. and Roy, R. (1988b) Evolution of the execution parameters or a patient handling task. [French]. *Le Travail Humain.* 51, 3: 193-210
54	Engkvist, I-L., Kjellberg, A., Wigaeus, H.E., Hagberg, M. , Menckel, E. and Ekenvall, L. (2001) Back injuries among nursing personnel – identification of work conditions with cluster analysis. *Safety Science* 37: 1-18
55	Lynch, R.M., Freund, A. (2000). Short-term efficacy of back injury intervention project for patient care providers at one hospital. AIHAJ: *Journal for the Science of Occupational & Environmental Health & Safety* 61:290-294.
56	Dietz, E. and Baumann, M. (2000) Obstacles to change: discussion and points of view of health care professionals with regard to the application patient-handling training. *Archives des Maladies Professionnelles et de medecine du Travail* 61, 6: 389-395.
57	Nussbaum, M.A. and Torres, N. (2001). Effects of training in modifying working methods during common patient-handling activities. *International Journal of Industrial Ergonomics* 27: 33-41.

58	MacKenzie, M., Richardson, B., Kidd, R. and Tracy, M. (1997) A novel limb-support system to reduce postural load in theatres. *British Journal of Theatre Nursing.* 6, 10: 28-30
59	Love, C. (1986) Do you roll or lift? *Nursing Times* July 16. 82, 29: 44-46.
60	Menoni, O., Battevi, N., Colombini, D., Ricci, D., Occhipinti, E. and Zecchi, G. (1999) Assessment of risk due to manual lifting of patients. [Italian]. *Medicina del Lavoro*. 90, 2:191-200
61	Owen, B.D., Welden, N. and Kane, J. (1999). What are we teaching about lifting and transferring patients? *Research in Nursing and Health* 22, 3: 3-13
62	Tuffnell, C. (1989). Lightening the lifting load through education and quality assurance monitoring. *Australian Clinical Review*. 9: 123-126.
63	Troup, J.D. and Rauhala, H.H. (1987). Ergonomics and training. *International Journal of Nursing Studies*. 24, 4: 325-330.
64	Foster, L. (1996) Manual handing training and changes in work practices. *Occupational Health* 48: 402-406.
65	Furber, S., Moore, H., Williamson, M. and Barry, J. (1997) Injuries to ambulance officers caused by patient handling tasks. *Journal of Occupational Health & Safety – Australia & New Zealand* 13, 3: 259-265.
66	Best, M. (1997) An evaluation of manutention training in preventing back strain and resultant injuries in nurses. *Safety Science* 25, 1-3: 207-222
67	Lee, Y.H. and Chiou, W.K. (1994) Risk factors for low back pain, and patient-handling capacity of nursing personnel. *Journal of Safety Research.* 25, 3: 135-145
68	Garb, J.R., and Dockery, C.A. (1995) Reducing employee back injuries in the perioperative setting. *AORN Journal* 61, 6: 1046-1052.
69	Feldstein, A., Valanis, B., Vollmer, W., Stevens, N. and Overton, C. (1993) The Back Injury Prevention Project pilot study. Assessing the effectiveness of back attack, an injury prevention program among nurses, aides, and orderlies. *Journal of Occupational Medicine* 35:114-20.
70	Caska, B.A. Patnode, R.E., and Clickner, (1998) Feasibility of a nurse staffed lift team. D. *AAOHN* 46, 6: 283-288.
71	Backers Garrett, R. Johnson Perry A (1996). A safer way to move patients. *Occupational Health and Safety* 60-64.
72	Owen, B. and Hasler-Hanson, C.R (1999). A study comparing three methods of repositioning “patients” up in bed.. *Journal of Healthcare Safety Compliance and Infection Control* 3, 8: 362-267.
73	Garg, A. and Owen, B. (1994) Prevention of back injuries in healthcare workers. *International Journal of Industrial Ergonomics* 14: 315-331.

74	Benevolo, E., Sessarego, P., Zelaschi, G., Franchignoni. F. (1993) An ergonomic analysis of five techniques for moving patients. [Italian]. *Giornale Italiano di Medicina del Lavoro* 15:139-44.
75	Hignett, S. (2001b). Embedding ergonomics in hospital culture: top-down and bottom-up strategies. *Applied Ergonomics* 32: 61-69.
76	Hampton, S. (1998). Can electric beds aid pressure sore prevention in hospitals? *British Journal of Nursing* 7, 17: 1010-1017.
77	Ng, C. Phongsathorn, V. and Mitchell, S. (1997). Doctors should be trained in lifting patients *BMJ* August 30. 315:551.
78	Billin, S.L. (1998) Moving and handing practice in neuro-disability nursing. *British Journal of Nursing* 7, 10: 571-578 .
79	Goodridge, D. and Laurila, B. (1997). Minimizing transfer injuries. *The Canadian Nurse* 93, 7: 38-41.
80	De Looze, M.P., Zinzen, E., Caboor, D., Heyblom, P., Van Bree, E., Van Roy, P. Toussaint, H.M. and Clarijs, J.P. (1994) Effect of individually chosen bed-height adjustments on the low-back stress of nurses. *Scandinavian Journal of Work, Environment & Health* 20: 427-34.
81	Lagerström, M., and Hagberg, M. (1997). Evaluation of a three year education and training program for nursing personnel at a Swedish Hospital. *AAOHN* 45, 2: 83-92.
82	Evanoff, B.A., Bohr, P.C., and Wolf, L.D. (1999) Effects of a participatory ergonomics team among hospital orderlies. *American Journal of Industrial Medicine* 35, 4: 358-365.
83	Dixon, R. and Coleman, S. (1996) Defining and implementing a no lifting standard. *Nursing Standard* 10, 44: 33-36.
84	McGuire, T. and Dewar, J. (1995). An assessment of moving and handling practices among Scottish Nurses. *Nursing Standard.* 9, 40: 35-39.
85	Lavender, S.A., Thomas, J.S., Chang, D and Andersson, G.B.J., (1995) Effect of Lifting Belts, Foot Movement, and Lift Asymmetry on Trunk Motions. *Human Factors* 37, 4: 844-853
86	Garg, A., and Owen, B. (1992). Reducing back stress in nursing personnel: an ergonomic intervention in a nursing home. *Ergonomics* 35, 11: 1353-1375.
87	Charney, W. (1997) The lift team method for reducing back injuries: A 10 hospital study. *AAOHN Journal* 45, 6:300-304.
88	Lindbeck, L. and Engkvist, I.L. (1993). Biomechanical analysis of two patient handling tasks. *International Journal of Industrial Ergonomics* 12, 117-125.
89	Gagnon, M., Roy, D., and Lortie, M. (1988a) The risks associated with changes of direction of the movement when handling patients: a biomechanical approach. *Ergonomics International 88: Proceedings of the 10th Congress of the International Ergonomics Association*, 123-125.

90	Entwistle, M., Horman, M., Lister, L., and Rimeur, G. (1996) Safe manual lifting of patients. *Journal of the Association for Quality in Healthcare* 3, 3: 118-124.
91	Knibbe, N., and Knibbe, J.J. (1995). Postural load of nurses during bathing and showering of patients. Internal Report. *Locomotion Health Consultancy*, The Netherlands.
92	Green, C. (1996). Study of the moving and handling practices on two medical wards. *British Journal of Nursing* 5, 5: 303-311.
93	Roth, P.T., Ciecka, J., Wood, E.C. and Taylor, R. (1993). Evaluation of a unique mechanical client lift. Efficiency and perspectives of nursing staff. *AAOHN* 41, 5: 229-234.
94	Oddy, R. (1993). Legislation in action: must we lift? *Physiotherapy* 79, 12: 827-830.
95	Love, C. (1994). Rolling or lifting following hip replacement. *Professional Nurse.* April. 456-464.
96	Luntley, J. and Pearce, J. (1995). Lifting and handling of patients by anaesthetists. *Anaesthesia* 50: 729-732.
97	Robertson, H. (2000). The transfer slide sheet. A useful device to reduce nursing lifting demands. *Geriaction* 15, 2: 13-18.
98	Raistrick, A. (1981). Nurses with back pain – can the problem be prevented? *Nursing Times.* May 14. 853-856.
99	Rodgers, S. (1985b). Positive lifting. *Nursing Times*. January 23. 43-45
100	Rodgers, S. (1985a) Shouldering the load. *Nursing Times*. January 16. 24-26
101	Stubbs, D.A., and Osborne, C. (1979). How to save your back. A comparison between the nursing profession and the construction industry. *Nursing*. 3: 116-124.
102	Scholey, M. (1982). The shoulder lift. *Nursing Times*, March 24. 506-507.
103	Skarplik, C. (1988). Patient handling in the community. *Nursing* 3, 30: 13-16
104	Wright, B. (1981a). Lifting and moving patients; 1. An investigation and commentary. *Nursing Times*. November 11. 1962-1965
105	Ulin, S, Chaffin, D.B., Patellos, C., and Blitz, S. (1997). A biomechanical analysis of methods used for transferring totally dependent patients. *Scientific Nursing*. 14, 1: 19-27.
106	Varcin-Coad, L. and Barrett, R. (1998). Repositioning a slumped person in a wheelchair. A biomechanical analysis of three transfer techniques. *AAOHN*. 46, 11: 530-536.
107	Owen, B. (1999). Decreasing the back injury problem in nursing personnel. *Surgical Services Management* 5, 7: 15-21.
108	Waldenström, U. and Gottvall, K. (1991). A randomised trial of Birthing Stool of Conventional Semirecumbent Position for Second-Stage Labor. *Birth*. 18, 1: 5-10

109	Kothiyal, K. and Yuen, T.W., (2000). Manual Handling in Nursing Jobs: An Ergonomic Study of a Patient Transferring Aid. . *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 5: 610
110	Schibye, B., Skotte, J., Hye-Knudsen C., Faber Hanson A., Essendrop M (2000). The mechanical loads on the low back during different patient handling tasks. *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 5: 785-788.
111	Panciera, D., Menoni, O., and Ricci, M. (2000). Hoists; selection criteria and standards. . *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California* 5, 797-800.
112	Proteau, R.A. (2000). Ergonomics in home care. *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 4: 275.
113	Pan, C-C. and Freivalos, A. (2000) Ergonomic Evaluation of a new patient handling device. *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 4: 274
114	Kato, M., Muzima, M., and Nishiguchi, H. (2000). Application of industrial method to care work. *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 4: 268.
115	Caboor, D., Verlinden, M., Zinzen, E., Van Roy, P., Van Riel, M.P. and Clarys, J.P. (2000) Implications of an adjustable bed height during standard nursing tasks on spinal motion, perceived exertion and muscular activity. *Ergonomics* 43, 10: 1771-1780
116	Wood, J., Raudsepp, T., Miller, L., and Dazey, E. (2000). Improving Resident Transfers. *Nursing Homes Long Term Care Management*. 68-76.
117	Johnston, M. Handle with care. (1987). *Senior Nurse* 6, 5: 20-22.
118	Haigh, C. (1993). A study of micro-organism levels on nurses' footwear. *British Journal of Nursing* 2, 22: 1109-1112.
119	Thompson, E. (2000). Safer Birthing Positions. A choice for Mother and Midwife. *The Column*. 12, 2: 17-22.
120	Revie, M. (2000). Manual handling of the deceased in the funeral industry. *The Column*. August. 17-20.
121	Massad, R., Gambin, C., and Duval. L. (2000). The contribution of Ergonomics to the prevention of musculoskeletal lesions among ambulance technicians. *Proceedings of the IEA2000/HFES 2000 Congress. The Human Factors and Ergonomics Society. Santa Monica, California*. 4, 201-204.

122	Owen, B.D. (1988) Patient handling devices: An Ergonomic Approach to Lifting Patients. In Aghazadeh, F. (Ed.) *Trends in Ergonomics/Human Factors V.* North Holland, Elsevier Science Publishers BV. 721-728
123	Hignett, S. and Richardson, B. (1995). Manual handling human loads in a hospital: an exploratory study to identify nurses' perceptions. *Applied Ergonomics* 26, 3: 221-226.
124	Hignett S., (1996). Work related back pain in nurses. *Journal of Advanced Nursing,* 1996, 23, 1238-1246
125	Hignett, S. (1999). East Midlands Group: Ergonomic Produce Evaluation Sliding Sheets. *The Column* 11, 1: 20-24.
126	Hignett, S. (1996a). Manual handling risks in midwifery: identification of risk factors. *British Journal of Midwifery* 4, 11: 590-596.
127	Busse, M. (2000) Effective rehabilitation and hoisting equipment: a case study. *Nursing & Residential Care* 2, 4: 168-173.
128	Collins, B. (1994) Objective Manual Material Handling Assessments in the Ambulance Service Using the Lumbar Monitor Industrial Package. *Ambulance* 9: 10-14.
129	Collins, B. (1998) Back supports as part of an Integrated Programme of Back Injury Prevention in the Ambulance Service. *Ambulance UK* 13, 6: 281-284.
130	Knibbe, J.J. and Friele, R.D. (1999). The use of logs to assess exposure to manual handling of patients, illustrated in an intervention study in home care nursing. *International Journal of Industrial Ergonomics*. 24: 445-454.
131	Kitson, J. (2000). Mind your back: variable height cots. *Paediatric Nursing*. 12, 4: 26-27.
132	Knapik, J.J., Harper, W., Crowell, H.P., Leiter, K., and Mull, B. (2000). Standard and alternative methods of stretcher carriage: performance, human factors, and cardiorespiratory responses. *Ergonomics*. 43, 5: 639-652.
133	Stevenson, M.G. (1995). Mechanics of lifting patients on ambulance stretchers. *Proceedings of the Ergonomics Society of Australia, Glenelg, Adelaide.* 135-142.
134	Scopa, M. (1993). Comparison of Classroom Instruction and Independent Study in Body Mechanics. *The Journal of Continuing Education in Nursing*. 24, 4: 170-173.
135	Smedley, J., Egger, P., Cooper, C. and Coggon, D. (1995). Manual handling activities and risk of low back pain in nurses. *Occupational & Environmental Medicine*. 52: 160-3.
136	Scholey, M. (1983). Back stress; the effects of training nurses to lift patients in a clinical situation. *International Journal of Nursing Studies*. 20: 1-13.
137	St Vincent, M., Tellier, C., and Lortie, M. (1989). Training in handling an evaluative study. *Ergonomics* 32, 2: 191-210.

138	Stubbs, D.A., Buckle, P., Hudson, M.P., and Rivers, P.M. (1983). Back pain in the nursing profession – ll. The effectiveness of training. *Ergonomics*. 26, 8: 767-779.
139	Robertson, L.D., Changsut, R., Ramos, L.S., and Jones, D.W. (1993) Influence of job and personal risk factors on safety limits for kinesiotherapists performing a stressful clinical lifting task. *Clinical Kinesiology*. 47, 1: 7-16.
140	Pohjonen, T., Punakallio, A., and Louhevaara, V. (1998). Participatory ergonomics for reducing load and strain in home care work. *International Journal of Industrial Ergonomics*. 21: 345-352.
141	Petzäll J. (1996). Traversing step obstacles with manual wheelchairs. *Applied Ergonomics*. 27, 5: 327-341.
142	Olsson, G., and Brandt, A. (1992) An investigation of the use of ceiling mounted hoists for disabled people. Danish Centre for technical aids for rehabilitation and education. Denmark.
143	Owen, B.D. and Garg, A. (1994). Reducing back stress through an ergonomic approach: weighing a patient. *International Journal of Nursing Studies* 31: 511-9.
144	Owen, B., Garg, A., and Jensen, R.C. (1992). Four methods for identification of most back-stressing tasks performed by nursing assistants in nursing homes. *International Journal of Industrial Ergonomics*. 9: 213-220.
145	Owen, B. (1987). The need for application of ergonomic principles in nursing. In Asfour, S. (Ed.). *Trends in Ergonomics/Human Factors IV*. North Holland, Elsevier Science Publishers BV. 831-838
146	Owen, B., and Garg, A. (1989). Patient handling tasks perceived to be most stressful by nursing assistants. In Mital, A. (Ed.) *Advances in Industrial Ergonomics & Safety*. *London: Taylor and Francis*. 775-781.
147	Sparkes, V. (2000). Physiotherapy for stroke rehabilitation: a need for evidence based handling techniques. *Physiotherapy* 86, 7: 348-356.
148	Nestor, D. (1988). Hospital Bed Design and Operation – Effect on Incidence of Low Back Injuries among Nursing Personnel. In Aghazadeh, F. (Ed.) *Trends in Ergonomics/Human Factors V*. Elsevier Science Publishers B V. 729-740.
149	Nyran, P.I. (1991). Cost effectiveness of core-group training. In Karwowski, W. and Yates, J W. (Eds.) *Advances in industrial Ergonomics and Safety lll*.. *Taylor & Francis.* 778-782
150	Mital, A., and Shrey, D.E., (1996). Back problems in Health Professionals: Extent of the Problem and an Integrated Approach for its Management. *Critical Reviews in Physical and Rehabilitation Medicine*. 8, 3: 201-219.
151	Miller, M. and Johnston, C. (1992) Moving and Handling Skills for Carers. *TES Crossroads (Publisher*). 1-28.

152	Marras, W.S., Davis, K.G., Kirking, B.C., and Bertsche, P.K. (1999). A comprehensive analysis of low-back disorder risk and spinal loading during the transferring and repositioning of patients using different techniques. *Ergonomics*. 42, 7: 904-926.
153	Menckel, E., Hagberg, M., Engkvist, I.L., and Wigaeus-Hjelm, E. (1997). The prevention of back injuries in Swedish health care – a comparison between two models for action-oriented feedback. *Applied Ergonomics.* 28, 1: 1-7.
154	Mulligan, K.S., and Webb, L.Z. (1988) Developing an evacuation Procedure for a Nursery Complex. *Neonatal Network*. 6: 47-52.
155	McGuire, T., Moody, J., and Hanson, M. (1997). Managers' attitudes towards mechanical aids. *Nursing Standard*. 11, 31: 33-38.
156	McGuire, T., Moody, J., Hanson, M., and Tigar, F. (1996a). A study into clients' attitudes towards mechanical aids. *Nursing Standard*. 11, 5: 35-38.
157	Moody, J., McGuire, T., Hanson, M., and Tigar, F. (1996). A study of nurses' attitudes towards mechanical aids. *Nursing Standard.* 11, 4: 37-42.
158	McGuire, T., Moody, J., and Hanson, M. (1996b). An evaluation of mechanical aids used within the NHS. *Nursing Standard*. 11, 6: 33-38.
159	Zhuang, Z., Stobbe, T.J., Collins, J.W., Hsiao, H., and Hobbs, G.R. (2000). Psychophysical assessment of assistive devices for transferring patients/residents. *Applied Ergonomics*. 31: 35-44.
160	Zhuang, Z., Stobbe, T.J., Hsiao, H., Collins, J.W., and Hobbs, G.R. (1999). Biomechanical evaluation of assistive devices for transferring residents. *Applied Ergonomics.* 30: 285-294.
161	Winkelmolen, G.H.M., Landeweerd, J., and Drost, M.R. (1994). An evaluation of patient lifting techniques. *Ergonomics*. 37, 5: 921-932.
162	Wachs, J.E., and Parker, J.E. (1987). Registered Nurses' Lifting Behaviour in the Hospital Setting. In Asfour, S. (Ed.). *Trends in Ergonomics/Human Factors* IV, 883-890. North Holland, Elsevier Science Publishers BV.
163	Wood, D.J. (1987) Design and Evaluation of a Back Injury Prevention Program within a Geriatric Hospital. *Spine* 12, 2: 77-82.
164	Venning, P.J. (1988). Back injury prevention among nursing personnel. The role of education. *AAOHN* 36, 8: 336-341.
165	Videman, T., Rauhala, H., Asp, S., Lindström, K., Cedercreutz, G., Kämppi, M., Tola, S., and Troup, J.D.G. (1989). Patient-Handling Skill, Back Injuries, and Back Pain: An intervention study in nursing. *Occupational Health*. 41: 148-156.

166	Torma-Krajewski, J. (1987) Analysis of lifting tasks in the health care industry. In *Occupational Hazards to Health Care Workers*. *American Conference of Governmental Industrial Hygienists*. 51-68.
167	Takala, E.P. and Kukkonen, R. (1987). The handling of patients on geriatric wards. A challenge for on-the-job training. *Applied Ergonomics*. 18, 1: 17-22.
168	Le Bon, C. and Forrester, C. (1997). An ergonomic evaluation of a patient handling device: The elevate and transfer vehicle. *Applied Ergonomics*. 28, 5/6: 365-374.
169	Love C. (1996). Injury caused by lifting: a study of the nurse's viewpoint. *Nursing Standard*. 10, 46, 34-39
170	Laflin, K. and Aja, D. (1995). Health care concerns related to lifting: an inside look at intervention strategies. *American Journal of Occupational Therapy* 49: 63-72.
171	Lee, Y.H. and Chiou, W.K. (1995). Ergonomic Analysis of Working Posture in Nursing Personnel: Example of Modified Ovako Working Analysis System application. *Research in Nursing & Health*. 18:67-75
172	Ljungberg, A.S., Kilborn, A., and Hägg, G. (1989). Occupational lifting by nursing aides and warehouse workers. *Ergonomics* 32, 1: 59-78.
173	Love, C. (1996b). Ergonomic considerations when choosing a hoist and slings. *British Journal of Therapy and Rehabilitation.* 3, 4: 189-198.
174	Lusted, M.J., Carrasco, C.L., Mandryk, J.A., and Healey, S. (1996). Self reported symptoms in the neck and upper limbs in nurses. *Applied Ergonomics* 27, 6: 381-387.
175	Knibbe, J.J., and Friele, R.D. (1996). Prevalence of back pain and characteristics of the physical workload of community nurses. *Ergonomics* 39, 2: 186-198.
176	Kilbom, A., Ljungberg, A.S., and Hägg, G. (1985) Lifting and carrying in geriatric care. A comparison between differences in workspace layout, work organisation and use of modern equipment. In Brown I et al (Eds.) *Ergonomics International 85*. 550-553.
177	Jackson, J. and Liles, C. (1994). Working Postures and Physiotherapy Students. *Physiotherapy*. 80, 7: 432-436.
178	Khalil, T.M., Asfour, S.S., Marchette, B. and Omachonu, V. (1987) Lower back injuries in nursing: A biomechanical analysis and intervention strategy. In Asfour, S.S. (Ed.). *Trends in Ergonomics/Human Factors IV.* Elsevier Science Publishers. 811-821

179	Head, M., and Levick, P. (1996) Patient Handling: An ergonomic intervention. In *Proceedings of the 32nd Annual Ergonomics Society of Australia and the Safety Institute of Australia National Conference, 'Enhancing Human Performance*'. 22-25 September 1996, Canberra, Australia
180	Hellsing, A.L., Linson, S.J., Andershed, B., Bergman, C. and Liew, M. (1993). Ergonomic education for nursing students. *International Journal of Nursing Studies* 30: 499-510.
181	Garg, A., Owen, B., and Carlson, B. (1992) An ergonomic evaluation of nursing assistants' job in a nursing home. *Ergonomics* 35, 9: 979-995.
182	Gagnon, M., Sicard, C., and Sirois, J.P. (1986) Evaluation of forces on the lumbo-sacral joint and assessment of work and energy transfers in nursing aides lifting patients. *Ergonomics* 29, 3: 407-421
183	Garg, A., Owen, B., Beller, D., and Banaag, J.A., (1991a) Biomechanical and ergonomic evaluation of patient transferring tasks: bed to wheelchair and wheelchair to bed. *Ergonomics* 34, 3: 289-312.
184	Garg, A., Owen, B., Beller, D., and Banaag, J. (1991b) A biochemical and ergonomic evaluation of patient transferring tasks: wheelchair to shower chair and shower chair to wheelchair. *Ergonomics* 34, 4: 407-419.
185	Garg, A. and Owen, B. (1991) A biomechanical and ergonomic evaluation of patient transferring tasks, *Proceedings of 11th Congress of IEA, Paris 1991* 1**,** 60-62
186	Gagnon, M., Chehade, A., Kemp, F., and Lortie, M. (1987) Lumbo-sacral loads and selected muscle activity while turning patients in bed. *Ergonomics* 30, 7: 1013-1032.
187	Larthe de Langladure A. (2002). Number of working days lost. *The Column* 14.3 (16) Aug 2002.
188	Engst C., Chokar R., Robinson D., Earthy A., Yassi A. (2004). Implementation of a scheduled toileting program in long term care facility *AAOHN J* 52(10): 427-435
189	Fenety, A. and Kumar, S. (1992) An ergonomic survey of a hospital physical therapy department. *International Journal of Industrial Ergonomics* 9, 161-170:
190	Fragala, G. (1993) Injuries cut with lift use in Ergonomics demonstration project. *Provider* (October) 39-40.
191	Hutchinson K. (2002). Producing MH guidelines for physiotherapists and occupational therapists. *The Column* 14.4 (18) Nov 2002.
192	Hooghiemstra F. (2005). *How to reduce static overload without losing time*. Arjo publication August 2005.

193	De Looze, M.P., Zinzen, E., Caboor, D., Van Roy, P., and Clarijs, J.P. (1988) Muscle strength, task performance and low back load in nurses. *Ergonomics* 41, 8: 1095-1104.
194	Doormaal, M., Driessen, A., Landeweerd, J., and Drost, M.R. (1995) Physical workload of ambulance assistants. *Ergonomics* 38, 2: 361-376.
195	Dehlin, O., and Lindberg, B. (1975) Lifting burden for a nursing aide during patient care in a geriatric ward. *Scandinavian Journal of Rehabilitation Medicine*. 7: 65-72.
196	Dehlin, O., Hedenrud, B. and Horal, J. (1976) Back symptoms in nursing aides in a geriatric hospital. An interview study with special reference to the incidence of low-back symptoms. *Scandinavian Journal of Rehabilitation Medicine* 8: 47-53.
197	Coleman, S. and Brooke, S. (1999) Manual handling in the operating theatre. *Professional Nurse.* 14, 10: 682-686.
198	Charney, W., Zimmerman, K. and Walara, E. (1991) The lifting team. A design method to reduce lost time back injury in nursing. *AAOHN Journal* 39:231-4.
199	Charney, W., Zimmerman, K. and Walara, E. (1993) A design method to reduce lost time back injury in nursing. Chapter 8. In Charney, W. and Schirmer, J. *Essentials of Modern Hospital Safety. Volume 2* Lewis Publishers. 313-324
200	Conneeley, A.L. (1992) The Impact of the Manual Handling Operations Regulations on the Use of Hoists in the Home: the Patient's Perspective. *British Journal of Occupational Therapy* 61,1: 17-21
201	Botha, W.E., and Bridger, R.S. (1998) Anthropometric variability, equipment usability and musculoskeletal pain in a group of nurses in the Western Cape. *Applied Ergonomics.* 29,6: 481-490.
202	Ballard, J. (1994) District Nurses – who's looking after them? *Occupational Health Review* November/December 10-16
203	Bell, F., Dalgity, M.E., Fennell, M.J., and Aitken, R.C.B. (1979) Hospital ward patient-lifting tasks. *Ergonomics.* 22, 11: 1257-1273.
204	Bell, F. (1987) Ergonomic aspects of equipment. *International Journal of Nursing Studies.* 24, 4: 331-337.
205	Bell, F. (1984) *Patient-Lifting Devices in Hospitals. London: Croom Helm.* 120-209.
206	Atkinson, F.I. (1992) Experiences of informal carers providing nursing support for disabled dependants. *Journal of Advanced Nursing* 17: 835-840.
207	Alavosius, M. P. and Sulzer-Azaroff, B. (1986) The effects of performance feedback on the safety of client lifting and transfer. *Journal of Applied Behaviour Analysis* 19, 3: 261-267.

208	Aird, J., Nyran P., Roberts G. (1988), Comprehensive back injury prevention programme: an ergonomic approach for controlling back injuries in health care facilities. In Aghazadeh, F. (Ed.) *Trends in ergonomics human factors* V, 705-712. Holland, Elsevier Science.
209	Owen, B.D. (1988) Patient handling devices: An Ergonomic Approach to Lifting Patients. In Aghazadeh, F. (Ed.) *Trends in Ergonomics/Human Factors V.* North Holland, Elsevier Science Publishers BV. 721-728
210	Nelson A; Matz M; Chen F, et al., (2006). Development and evaluation of a multifaceted ergonomics program to prevent injuries associated with patient handling tasks. *International journal of nursing studies.* 2006 Aug;43(6): 717-33
211	Smedley J; Trevelyan F; Inskip H, et al. (2003). Impact of ergonomic intervention on back pain among nurses. *Scandinavian journal of work, environment & health*. 2003 Apr; 29(2): 117-23
212	Evanoff B; Wolf L; Aton E. et al. (2003). Reduction in injury rates in nursing personnel through introduction of mechanical lifts in the workplace. *American journal of industrial medicine*. 2003 Nov; 44(5): 451-7
213	Fujishiro K; Weaver J; Heaney C, et al. (2005). The effect of ergonomic interventions in healthcare facilities on musculoskeletal disorders. *American journal of industrial medicine*. 2005 Nov; 48(5): 338-47
214	Tamminen-Peter L, Stenholm S, Hantikainen V, Arve S. (2006). An ergonomic evaluation of three transfer methods. *Proceedings of the IEA 2006 Congress* Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
215	Wright, B. (1981b). Lifting and moving patients; 2. Training and management. *Nursing Times*. November 18. 2025-2028
216	Gagnon, M. and Lortie, M. A (1987) Biomechanical approach to low-back problems in nursing aides. In Asfour, S. (Ed.). *Trends in Ergonomics/Human Factors IV*, 795-802. North Holland: Elsevier Science Publishers BV.
217	Mughal W, Harrison D, Duke K, Helal N, Thomas-Olson L. (2006). Effects of ceiling lifts on nurse safety and patient safety. *Proceedings of the IEA 2006 Congress* Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
218	Proteau R-A, Marchand D. (2006). Impact of slippery surfaces and transfer methods used to reposition clients to the head of the bed. *Proceedings of the IEA 2006 Congress* Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006

219	Nicholls, J. A. ; Life, M. A. (1998). Training and patient-handling: an investigation of transfer. *Contemporary ergonomics : proceedings of the Ergonomics Society's Annual Conference.* (1998): 82
220	Swain K., Heaton N. (2003). Developing a manual handling policy within an NHS Trust. *Contemporary Ergonomics, 2003,* Taylor and Francis. pp 21-25
221	Ferreira J., Stanley L., (2005). Assessment of the use of carry chairs by UK ambulance staff. *Contemporary Ergonomics, 2005*, Taylor and Francis. pp 251-255
222	Swain J; Pufahl E; R Williamson G. (2003). Do they practise what we teach? A survey of manual handling practice amongst student nurses. *Journal of clinical nursing*. 2003 Mar; 12(2): 297-306
223	Trinkoff A., Brady B., Neilsen K. (2003). Workplace prevention and musculoskeletal injuries in nurses. *Jour Nursing Administration* (2003) 33(3): 153-158
224	Pinder A.D.J., Marlow P., Gould V., (2006). Management of manual handling in Welsh care homes *Contemporary Ergonomics, 2006*, Taylor and Francis
225	Hefti K., Farnham R., Docken L., Bentaas R., Bossman S., Schaefer J. (2003). Back injury prevention, a lift team success story. *AAOHN Journal*. 51 (6) 24-51 June
226	Crumpton, E., Hignett, S., Goodwin, R. and Dewey, M. (2002) Reliability study of a data extraction and quality assurance tool applied to literature on patient handling. In P.T. McCabe (ed.) *Contemporary Ergonomics 2002*, London, Taylor and Francis. 51-56
227	Kjellberg K, Lagerstrom M, Hagberg M. (2004). Patient safety and comfort during transfers in relation to nurses work technique. *Journal of Advance Nursing* Vol 47, No 3, August 2004, pp251-259
228	Ronald L., Yassi A., Spiegel J., Tate R., Tait D., Mozel M. (2002). Effectiveness of installing ceiling lifts. Reducing musculoskeletal injuries in an extended care hospital unit. *AAOHN J* 50(3): 120-127
229	Diana Weinel (2008). Successful Implementation of Ceiling-Mounted Lift Systems. *Rehabilitation Nursing*. Glenview:Mar/Apr 2008. Vol. 33, Iss. 2, p. 63-6, 87 (5 pp.)
230	Hignett S, Crumpton E. (2007). Competency based training for Patient Handling. *Applied Ergonomics* 38 (2007) 7-17.
231	Lavender S., Conrad K., Reichelt P , Gacki-Smith J., Kohok A. (2007). Designing ergonomic interventions for EMS workers, Part 1: Transporting patients downstairs. *Applied Ergonomics* 38 (2007) 71-81
232	Morgan A., Chow S. (2007). The Economic Impact of Implementing an Ergonomic Plan. *Nursing Economics*. Pitman:May/Jun 2007. Vol. 25, Iss. 3, p. 150-6 (6 pp.)

233	Heacock H., Raris-Seeley N., Tokuno C., Frederking S., Keane B., Mattie J., Kanigan R., Watzke J. (2004). Development and evaluation of an affordable lift device to reduce musculoskeletal injuries among home support workers. *Applied Ergonomics* 35 (2004) 393-399
234	Brinkhoff A., Knibbe N. (2003). The ErgoStat Program. Pilot study of an ergonomic intervention to reduce static loads for caregivers. *Professional Safety*, May 2003 32-39
235	Flint J., McLeod M., Gardiner A. Persistence in partnership. Evaluation of a back injury intervention by WorkCover NSW in the NSW Health Services Industry. E-mail: john.flint@workcover.NSW.gov.au
236	Ruszala S., Musa I. (2005). An evaluation of equipment to assist patient sit-to-stand activities in physiotherapy. *Physiotherapy* 91 (2005) 35-41
237	Santaguida P, Pierrynowski M , Goldsmith C, Fernie G. (2005). Comparisons of cumulative low back loads of care givers when transferring patients using overhead and floor lifts. *Clinical Biomechanics* 20, 906-916
238	Swann J. (2006). Assisting people with disabilities to bathe and shower. *International Journal of therapy and rehabilitation*. Jan 2006 13; 1: 36-40
239	Yeung S., Genaidy A., Deddens J., Sauter S. (2005). The relationship between protective and risk characteristics of acting and experienced workload and musculoskeletal disorder cases in nurses. *Journal of safety research*. 36 (2005) 85-95
240	Miller A; Engst C; Tate RB, et al. (2006). Evaluation of the effectiveness of portable ceiling lifts in a new long-term care facility.: *Applied ergonomics*. 2006 May; 37(3): 377-85
241	Knibbe JJ, Knibbe NE. (2006). Monitoring the effects of the ergonomics convenants for workers in Dutch health care. *Proceedings of the IEA 2006* Congress Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
242	Nelson A., Collins J., Siddharthan K., Matz M., Waters T. (2008). Link Between Safe Patient Handling and Patient Outcomes in Long-Term Care. *Rehabilitation Nursing*. Glenview:Jan/Feb 2008. Vol. 33, Iss. 1, p. 33-43 (11 pp.)
243	Knibbe JJ, Knibbe NE. (2006). ErgoCoaches in Dutch healthcare: Key workers promoting ergonomic changes: exploring their profile and effect. *Proceedings of the IEA 2006* Congress Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
244	Hess J, Kincl L. (2006). Evaluation of manual patient transfer techniques by a single care provider to establish best practices. *Proceedings of the IEA 2006 Congress* Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006

245	Pearce J.P., Morant C., Turner T. (2001). A multi-disciplinary approach to managing back injuries in British healthcare workers. *Contemporary Ergonomics, 2001*, Taylor and Francis. pp 139-144
246	Wardell H. (2007). Reduction of Injuries Associated With Patient Handling. *AAOHN Journal*. Thorofare:Oct 2007. Vol. 55, Iss. 10, p. 407-12 (6 pp.)
247	Hye-Knudsen CT, Birch L, Arjnberg G, Schibye B. (2005). Comprehensive training in patient handling techniques_ Does it make a difference? *Healthcare Systems Ergonomics and Patient Safety Conference Florence 2005* Ed Tartaglia R, Bagnara S, Bellandi T, Albolino S. Taylor and Francis Group 2005.
248	Charney W., Simmons B., Lary M., Metz S. (2006). Zero Lift Programs in Small Rural Hospitals in Washington State: Reducing Back Injuries Among Health Care Workers. *AAOHN Journal*. Thorofare:Aug 2006. Vol. 54, Iss. 8, p. 355-8 (4 pp.)
249	Allen R; Jackson S; Marsden H, McLellan D., Gore S. (2002). Transferring people safely with manual handling equipment. *Clinical rehabilitation*. 2002 May; 16(3):329-37
250	Nelson A; Lloyd JD; Menzel N, et al. (2003). Preventing nursing back injuries: redesigning patient handling tasks. AAOHN journal : official journal of the American Association of Occupational Health Nurses. (AAOHN J) 2003 Mar; 51(3):126-34
251	Passfield, J ; Marshall, E ; Adams, R. (2003). "No lift" patient handling policy implementation and staff injury rates in a public hospital. *The Journal of occupational health and safety, Australia and New Zealand*. 19, no. 1, (2003): 73 (14 pages)
252	Skotte, J H ; Essendrop, M ; Hansen, A F ; Schibye, B. (2002). A dynamic 3D biomechanical evaluation of the load on the low back during different patient-handling tasks. *Journal of biomechanics*. 35, no. 10, (2002): 1357 (10 pages)
253	Hye-Knudsen, C T ; Schibye, B ; Hjortskov, N ; Fallentin, N. (2004). Trunk motion characteristics during different patient handling tasks. *International journal of industrial ergonomics*. 33, no. 4, (2004): 327 (12 pages)
254	Yassi A; Cooper JE; Tate RB, et al. (2001). A randomized controlled trial to prevent patient lift and transfer injuries of health care workers. *Spine*. (Spine) 2001 Aug 15; 26(16): 1739-46
255	Johnsson C; Carlsson R; Lagerström M. (2002). Evaluation of training in patient handling and moving skills among hospital and home care personnel. *Ergonomics*. 2002 Oct 10; 45(12): 850-65
256	Engkvist I-L. (2006). Evaluation of an intervention comprising a No Lifting Policy in Australian Hospitals. *Applied Ergonomics* 37 (2006) 141-148.

257	Schibye B; Hansen AF; Hye-Knudsen CT, et al. (2003). Biomechanical analysis of the effect of changing patient-handling technique. *Applied ergonomics*. 2003 Mar; 34(2):115-23
258	Harrison P. (2005). Moving and handling patients with actual or suspected spinal cord injuries www.mascip.co.uk/sci-link (May 2005)
259	Garg A. (2006). Prevention of injuries in nursing homes and hospitals. *Proceedings of the IEA 2006 Congress* Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
260	Cohen M., Village J., Ostry A., Ratner P., et al. (2004). Workload as a Determinant of Staff Injury in Intermediate Care. *International Journal of Occupational and Environmental Health*. Philadelphia:Oct-Dec 2004. Vol. 10, Iss. 4, p. 375-83 (9 pp.)
261	Jordan C, Theilmeier A, Luttmann, Jager M, and the DOLLY group. (2006). Lumbar-load analysis for health-care workers during patient transfer activities. *Proceedings of the IEA 2006 Congress* Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
262	Keir P., MacDonell C. (2004). Muscle activity during patient transfers: a preliminary study on the influence of lift assists and experience. *Ergonomics*. 2004 Feb 26; 47(3): 296-306
263	Chhokar R; Engst C; Miller A, et al. (2005). The three-year economic benefits of a ceiling lift intervention aimed to reduce healthcare worker injuries. *Applied Ergonomics*. 2005 Mar; 36(2): 223-9
264	Andersen T.; Simonsen E. (2005). Sudden loading during a dynamic lifting task: a simulation study. *Journal of biomechanical engineering*. 2005 Feb; 127(1): 108-13
265	Engst C; Chhokar R; Miller A, et al. (2005). Effectiveness of overhead lifting devices in reducing the risk of injury to care staff in extended care facilities. *Ergonomics.* 2005 Feb; 48(2): 187-99
266	McGill S M, Kavcic N. (2005). Transfer of the horizontal patient: The effect of a friction reducing assistive device on low back mechanics. *Ergonomics* Vol 48, No 8 June 2005, 915-929
267	Sigvardsson H., Bogue B. (2004). No-Lift success story. *Occupational Health and Safety*.; Jul 2004; 73, 7; p46-50
268	O'Reilly M., Brophy A., Achimore L., Moore-Dawson J. (2001). Reducing incidence of low-back injuries reduces cost. *AIHAJ*. Fairfax:Jul/Aug 2001. Vol. 62, Iss. 4, p. 508-511 (4 pp.)
269	Silvia C.E., Bloswick D.S., Lillquist D., Wallace D., Perkins M. (2002). An ergonomic comparison between mechanical and manual patient transfer techniques (2002) *Work* (19) pp. 19-34
270	Bohannon R. (1999). Horizontal transfers between adjacent surfaces: forces required using different methods. *Arch Phys Med Rehabil* 1999; 80: 851-3

271	Baptiste A; Boda S; Nelson A, et al. (2006). Friction-reducing devices for lateral patient transfers: a clinical evaluation.: *AAOHN Journal* 2006 Apr; 54(4):173-80
272	Knibbe J. and Knibbe N. (2005). *Een hap uit de olifant. (*In Dutch, Chap 4 translated). Locomotion, Holland.
273	Mark B.A., Hughes L.C., Belyea M., Chang Y., Hofmann D.,Jones C.B., Bacon C.T. ((2007). Does safety climate moderate the influence of staffing adequacy and work conditions on nurse injuries? *Journal of safety research*, 38(2007) 431-446
274	Lavender S., Conrad K., Reichelt P., Kohok A., Gacki-Smith J. (2007). Designing ergonomic interventions for EMS workers, Part 2: Lateral transfers. *Applied Ergonomics* 38 (2007) 227-236
275	Lavender S., Conrad K., Reichelt P., Gacki-Smith J., Kohok A. (2007). Designing ergonomic interventions for EMS workers, Part 3: Bed to stairchair transfers. *Applied Ergonomics* 38 (2007) 581-589
276	Craib K., Hackett ., Buck C., Critkovich Y., Yassi A., (2007). Injury rates. Predictors of workplace injuries, and results of an intervention program among community health workers. *Public Health Nursing*. Vol 24. No 2. pp121-131
277	Reid S., Mirka G. (2007). Learning curve analysis of a patient lift assist device. *Applied Ergonomics* 38 (2007) 765-771
278	Cornish J., Jones A. (2007). Evaluation of moving and handling training for pre-registration nurses and its application to practice. *Nurse education in practice* (2007) 7, 128-134
279	Muir M., Heese G., McLean D., Bodnar S., Rock B. (2007). Handling of the bariatric patient in critical care: A case study of lessons learned. *Crit Care Nurs N Am* 19 (2007) pp223-240
280	Owen B; Keene K; Olson S. (2002). An ergonomic approach to reducing back/shoulder stress in hospital nursing personnel: a five year follow up.: *International journal of nursing studies*. 39(3): 295-302
281	Joseph A., Fritz L. (2006). Ceiling lifts reduce patient handling injuries. *Healthcare Design* Mar 2006; 6, 1; p 10-13
282	Logan P. (2000). Protecting carers' backs. *The Column* 12.4 (19) Nov 2000.
283	Meek P. (2003). Ambulance MH injuries come crashing down. *The Column* 15.1 (14) Feb 2003
284	Griffiths A. and Caan W. (2003). Half the problem. *The Column* 15.2 (24) May 2003.
285	Robotham R. (2003). Risk: the cost of not being prepared. *The Column* 15.3 (12) Aug 2003.
286	Peel A, Thompson E, Wear T. (2001). Further investigation into lateral transfer. *The Column* 13.4 (27) Nov 2001
287	Spencer J, Denton D, Smith J. (2001). Lateral Transfer Investigation. *The Column* 13.2 (19) May 2001.

288	Hunter N, Buckle H, Clarke S, Diaper S, Eldred R, Johnson C, Newman C, Scott K, Stanford P, Stephens M, Sturman M, Wilson P, Wright L, Wyatt L. (2002). Sliding or lifting. *The Column* 14.1 (10) Feb 2002.
289	Muphy D, Charles S, Monnington S, Powell R. (2005). The impact of profiling beds on manual handling risk and patient experience. *The Column* 17.4 Nov 2005 pp18-21.
290	Howlett N. (2006). Transfer of the horizontal patient: The effect of a friction reducing assistive device on low back mechanics. *Ergonomics* Vol 48, No 8 June 2005, 915-929
291	Gray H G, Warnock L, Wright L. (2006). Supine patient transfers: Muscle activity and perceived exertion using different slide sheets. *ICOH Conference proceedings* Milan 2006.
292	Fray M. (2006). Does the use of a handling belt impair the biomechanical methods of supporting a person in standing. *NBE Conference Proceedings* 2006
293	Michaelis M., Nienhaus A., Hermann S., Soyka M. (2006). Prevention of low back pain in nurses. A controlled intervention study. *Proceedings of the IEA 2006* Congress Ed Pikaar RN, Koningsveld EAP, Settels PJM. Elsevier Ltd. 2006
294	Hartvigsen J., Lauritzen S. Lings S., Lauritzen T. (2005). Intensive education combined with low tech intervention does not reduce low back pain in nurses. *Occup Environ Med* 2005; 62: 13-17
295	Nevala N., Tamminen-Peter L. (2004). Ergonomics and Usability of an electrically adjustable shower trolley. *IJIE* 34 (2004) 131-138
296	Collins J.W., Wolf L., Bell J., Evanoff B. (2004). An evaluation of a ‘best practices’ musculoskeletal injury prevention program in nursing homes. Injury Prevention 2004; 10: 206-211
297	McFarlane D. (2003). Measurements of the forces needed to transfer from beds to hospital trolleys. *Proceedings of the IEA Conference 2003*.
298	Pellino T., Owen B., Knapp L., Noack J. (2006). The evaluation of mechanical devices for lateral transfers on perceived exertion and patient comfort. *Orthopaedic Nursing* Jan 2006, Vol 25, No 1, p4-10
299	Best M. (2001). Manual handling risk management in health care using manutention *Safety Science* Monitor Vol 5 Issue 1 No 2
300	Owen B.D., Staehler K.S. (2003). Decreasing back stress in home care. *Home Healthcare Nurse* Vol 21 no 3 Mar 2003
301	Karahan A., Bayraktar N. (2004). Determination of the usage of body mechanics in clinical settings and the occurrence of low back pain in nurses. *Int Jour Nursing Studies*. 41 (2004) 67-75
302	Walls C. (2001). Do electric patient beds reduce the risk of lower back disorders in nurses? *Occup Med* (2001) vol 51 No 6 380-384

303	Victoria Government. (2004). *Victorian nurses back injury prevention project. Evaluation report. December 2004*. Published by Policy and Strategic Projects Division, Victorian Givernment. (www.nursing.vic.gov.au)
304	Connelly A., Higgins A., Dockrell S., Flynn T. (2001). A comparison of slides used in patient handling. *BJTR* May 2001, Vol 8, No 5, p166-173
305	Occhipinti E. (2007).. Patient handling in hospitals and nursing homes of Lombardy region. Preliminary results of systematic study. *Risks for health care workers: prevention challenges. Proceedings of ELINYEA and ISSA Health Services Section Conference*, Athens June 2007.
306	Kindblom-Rising K., Wahlstrom R., Ekman S. (2007). Nursing staff's perception of changes in patients transfer habits after a course _ a phenomenological – hermaneutic study. *Ergonomics* 50, 7,July 2007, 1017-1025
307	Mosses S. (2006). Radically changing training delivery systems. *The Column*, 18.4 Nov 2006, 28-30
308	Bar-Niv N., Ratzon N. (2008). The efficacy of universal intervention in reducing biomechanical workloads of hospital nurses. *Proceedings of HEPS 2008*, Strasbourg
309	Alexander P. (2008). Slings and things: the importance of assessment. *International Journal of Therapy and Rehabilitiation* Jan 2008, Vol 15, No 1, 44-49
310	Skotte J., Fallentin N. (2008). Low back injury risk during repositioning of patients in bed: the influence of handling technique, patient weight and disability. *Ergonomics* Vol 51, No 7, July 2008, 1042-1052
311	Warming S., Ebbehoj N., Wiese N., Larsen L., Duckert J., Tonnesen H. (2008). Little effect of transfer technique instruction and physical fitness training in reducing low back pain among nurses: a cluster randomized intervention study. *Ergonomics* Vol 51, No 10, Oct 2008, 1530-1548
312	Kuiper JI; Verbeek JH; Straub JP, et al. (2002). Physical workload of student nurses and serum markers of collagen metabolism. *Scandinavian journal of work, environment & health*. 2002 Jun; 28(3): 168-75
313	Speigel J., Yassi A., Ronald L., Tate R., Hacking P., Colby T. (2002). Implementing a resident lifting system in an extended care hospital. Demonstrating cost benefit. *AAOHN.Journal*; mar 2002; 50, 3, p128-134
314	Hignett S. (2003). Intervention strategies to reduce musculoskeletal injuries associated with handling patients: A systematic review. *Occup Environ Med* 2003; 60: e6. (www.occenvmed.com/cgi/content/full/60/9/e6)

315	Parry J Pennell G, Watson J, Murphy B, Morton H.. (2001). Manual Handling in Life Threatening Situations. *The Column* 13.4 (28) Nov 2001
316	Moreton H. (2002). Manual Handling in life threatening situations. *The Column* 14.1 pp21 Feb 2002.
317	Millar E, Esler A. (2004). Management of self strangulation incidents. *The Column* 16.3 (13) Aug 2004.
318	Betts M. (2006). Catching, supporting or letting go: an ethical dilemma. *The Column* 18.3 Aug 2006 pp12-15.
319	Rader J., Barrick A., Hoeffer B., Sloane P., McKenzie D., Talerico K., Glover J. (2006). The bathing of older adults with dementia. *AJN* April 2006, Vol 106 No 4, 40-48.
320	Palmer R. (2004). Moving and Handling bariatric patients safely: a case study. . *Int Journal of Ther and Rehab* Jan 2004, Vol 11 No 1 31-33
321	Kneafsey R., Haigh C. (2007). Learning safe patient handling skills: Student nurse experiences of university and practice based education. *Nurse education in practice* (2007) 27, 832-839
322	Love S. (2006). Sitting to standing: Front transfers. *The Column,* 18.4 Nov 2006, 11-18
323	Kothiyal, K ; Yuen, T W. (2004). Muscle strain and perceived exertion in patient handling with and without a transferring aid *Occupational Ergonomics* 4, no. 3 (2004): 185-197 (13 pages)
324	Guthrie P.F., Westphal L., Dahlman B. et al. (2004). A patient lifting intervention for preventing the work related injuries of nurses. *Work*. Vol 22(2) pp79-88
325	Berthellete D., Leduc N., Bilodeau H. (2008). Implementation of an ergonomic program designed to prevent back pain: explaining discrepancies between healthcare organizations. *Proceedings of HEPS 2008*, Strasbourg
326	Leduc N., Berthellete D., Bilodeau H. 2008). Assessing the gap between the design and the delivery of an ergonomics training program for safe patient handling. *Proceedings of HEPS 2008*, Strasbourg
327	Engkvist I-L. (2007). Back Injuries among nurses – A comparison of the accident processes after a 10 year follow up. *Safety Science* 46 (2008) 291-301
328	Engels J., Brandsma B., Van der Gulden J., (1997). Evaluation of the effects of an ergonomic-educational programme. The assessment of 'ergonomic errors' made during the performance of nursing tasks. *Int Arch Occup Environ Health* (1997) 69: 475-481

APPENDIX A

Literature Analysis (328 studies)

i. Included reference list
ii. Full data extraction for literature analysis

Legend:

Red = Intervention study (Included Appendix B)

PO = Professional Opinion (no QR scores)

NR = No result (Scoring not possible)

Paper No	Date	Author	No. of outcomes	Outcome	Outcomes measures	Beneficiary	Tested Y/N	Significant Y/N	Used in conclusions Y/N	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
1	1998	Peers	4	Staff absence	Lost time from injuries,	Org	No			4	5 10 13 15 20	37	3	3
				Staff absence	Lost time from recurrence,	Org	No			4		37	3	3
				Modified Work	modified work from new injuries	Org	No			4		37	3	3
				Modified Work	modified work due to recorrence	Org	No			4		37	3	3
2	1996	Gingher	3	Time for task	Speed of transfer,	Task	Yes	Yes	Yes	13		78	4	1
				Staff perception	Effect on staff,Questionaire	Staff	No		No	10		78	4	2
				Patient perception	Impact of resident from staff view	Patient	Yes	Yes	Yes	9		78	4	2
3	1995	Scott	1	Staff perception	Questionnaire of staff perceptions of hazards and interventions	Staff	No		Yes.	7		8	1	2
4	1996	Gray	2	Staff knowledge skill	Staff knowledge	Staff	Yes	Yes	Yes	4	5	43	2	2
				Psychological Well-being	Staff satisfaction	Staff	No		Yes	4		43	2	2
5	1994	Holliday	5	Time for task	Time to complete task	Task	Yes	NS	No	13	2	50	4.5	1
				Number of staff	Number of staff to complete	Task	Yes	Yes	Yes	13		50	4.5	1

				Staff perception	RPE staff	Staff	Yes	Yes	Yes	10				50	4.5	2
				Staff perception	Comfort score for staff	Staff	Yes	NS	No	7				50	4.5	2
				Patient perception	Comfort score for patient	Patient	Yes	NS	No	9				50	4.5	2
6	1994	Santoro	2	Staff injuries	Reduction in staff injuries	Staff	No			2			17	35	2.5	3
				Financial	Financial	Org	No			12				35	2.5	3
7	1993	Newman	1	Staff use of equipment	Questionnaire for vailablity and use of equipment	Staff	No			13				39	4	1
8	1992	Overd	1	PH techniques	Questionnaire for methods of positioning after hip surgery	Task	No			13				41	2	1
9	1994	Harber	1	Staff injuries	LBP	Staff	Yes	NS	Yes	2			5	73	4.5	3
10	1995	Meyer	2	Staff perception	Questionnaires to staff using hoists	Equip	No			10				32	4	2
				Staff perception	Practical evaluations in lab settings	Equip	No			10				32	4	2
11	1994	Addington	2	Staff injuries	Total back injuries reported	Staff	No			2	5	22		37	3	3
				Staff absence	Musculoskeletal sickness absnce	Org	No			4				37	3	3
12	1986	Mckellar	1	Staff perception	Informal interview	Staff	No			7				po	3.5	2
13	1982	Tracsz	1	Staff absence	Sickness absence	Org	No			4	2	5		33	4	3
14	1999	Griffith	1	Staff perception	Interviews to identify perceptions of workload and risk factors	Staff	No			10			5	42	3	2
15	2000	Lavender	2	Physical workload	posture analysis by Lumbar motion mtr	Staff	No			10				59	4.5	2
				Physical workload	Forces applied	Staff	No			10				59	4.5	2
16	1995	Zelenka	1	Physical workload	Forces to transfer	Staff	Yes	Yes	Yes	10				48	3.5	2
17	2000	Bewick	2	Staff injuries	Injury data for participants	Staff	No			2				55	4	3
				Staff use of equipment	Appraisal of equipment	Staff	Yes	NS		13				55	4	1

18	1999	Bertollazzi	2	Risk assessment	Observational checklist for environments	Staff				13		25	2	1
				Physical workload	load per worker	Staff	No			10		25	2	2
19	1998	Engels	3	Physical workload	OWAS posture scores	Staff	Yes	Yes	Yes	10	5 8 10	44	3	2
				Staff competence	Checklist for performance of staff	Staff	Yes	NS	No	3		44	3	2
				Staff perception	Borg score for perceived exertion	Staff	Yes	NS	Yes	10		44	3	2
20	1998	Monaghan	4	Training numbers	Training update numbers	Org	No			13	1 2 5 10 13	31	2.5	1
				Staff perception	Staff attitude	Staff	No			1		31	2.5	2
				Staff knowledge skill	Staff knowledge of policy and equipment	Staff	No			3		31	2.5	2
				Risk assessment	Number of patient assts completed	Staff	No			13		31	2.5	1
21	1996	Allen	1	Staff injuries	Injury rates for nurses	Staff	Yes	Yes	Yes	2		52	2.5	3
22	1995	DeGeorge	0									18	2.5	
23	1991	Wright A	2	Physical workload	EMG recordings for action	Staff	Yes	Yes	Yes	10		35	2.5	2
				Patient perception	Questionnaire Patient control	Staff	Yes	Yes	Yes	9		35	2.5	2
24	1994	King	1	PH techniques	Comaprisons of methods in consultation with surgeons	Task	No			13		25	3	1
25	1986	Gagnon	1	Physical workload	Complex biomechanical data and models	Staff	Yes	Yes	Yes	10		57	4	2
26	1996	Tracey	1	Incident/Accident	Staff incidents	Staff	No			6		po	4	3
27	1998	Fazel	1	Financial	Financial evaluation	Org	No			12		po	4	3
28	1997	Tracey	1	Physical workload	Forces to slide	Staff	No			10		26	3	2

29	2001	Hignett	1	Staff perception	Interviews to develop hierarchial tree	Staff	No			13		85	5	2
30	1998	Alexander	2	Staff perception	Quantitative survey of risk perceptions	Staff				10	1 2 6 11 13 16	50	5	2
				Staff perception	Semi structured interiews of managers	Staff	Yes	Yes	Yes	1		50	5	2
31	1997	Quintana	3	Physical workload	RWL NIOSH	Staff	No			10		po	3	2
				Time for task	Time taken per task	Task	No			13			3	1
				Financial	Cost evaluation	Org	No			12			3	3
32	1993	Switzer	2	Staff competence	Observations of practice	Staff	No			3		62	4.5	2
				Staff perception	Structured Interviews of staff	Staff	No			10		62	4.5	2
33	1990	McGill	1	Physical workload	Biomechanical loading model	Staff	No			10		32	3.5	2
34	1998	Edlund	1	Patient result	Angular measures for sitting position in sling and after move	Task	Yes	Yes	Yes	10		57	4.5	2
35	1997	Bruno	0		Design process description with no data presented							7	2.5	
36	1999	Duffy	1	Staff use of equipment	Questionnaire survey outlining use of equip and training	Staff	No			13		39	3	1
37	2000	Brulin	1	Staff perception	Interviews followed by grounded theory	Staff	No					73	4	
38	1990	Connolly	1	Staff use of equipment	Questionnaire survey on attitudes and use of eqpt	Staff	No			1		?	?	2
39	2001	Hui	3	Staff perception	Subjective assessment of severity of task	Staff	Yes	Yes	Yes	10		66	4	2
				Physical workload	Physical demands over a shift	Staff	Yes	Yes	Yes	10		66	4	2
				Staff injuries	Back Muscle fatigue	Staff	Yes	Yes	Yes	10		66	4	2
40	1999	Paternoster	1	Staff competence	Level of correctness of completed task	Staff	No			3	5 18	31	2	2

41	1999	Baglioni	0		Review of issues that have relevance to patient handling.								po	4	
42	2001	Daynard	3	Physical workload	Biomehanical loading for peak force	Staff	Yes	Yes	Yes	10	2 5		81	5	2
				Physical workload	Biomechanical loading over time	Staff	Yes	Yes	Yes	10			81	5	2
				Staff competence	Compliance with methods taught	Staff	Yes	Yes	Yes	3			81	5	2
43	1981	Daws	2	Staff injuries	Injury Data .	Staff	No			2		5	31	2.5	3
				Staff perception	Questionnaire on attitudes on eqpt, training etc	Staff	No			1			31	2.5	1
44	2001	Billin	0										23	3	
45	1999	Pain	2	Staff use of equipment	Use criteria scored for range of eqpt	Equip	Yes	Yes	Yes	13			5	2.5	1
				Staff use of equipment	Helpfulness and envisaged use	Staff	Yes	Yes	Yes	13			5	2.5	1
46	2000	Elford	3	Physical workload	Movement velocity and acceleration	Staff	Yes	Yes	Yes	10			76	3.5	2
				Physical workload	Spinal stressors from LMM data	Staff	Yes	Yes	Yes	10			76	3.5	2
				Staff perception	Rating of preference of the subjects	Staff	Yes	Yes	Yes	10			76	3.5	2
47	2000	Lavender	2	Physical workload	Observational data from LMM goniometer	Staff	Yes	Yes	Yes	10			61	5	2
				Physical workload	Biomechnical modelling of spinal stress	Staff	Yes	Yes	Yes	10			61	5	2
48	1999	Fanello	2	Staff injuries	Semi structured questionaire for LBP	Staff	Yes	NS		2		5	80	5	2
				Staff absence	Semi structured questionaire for Absence	Org	Yes	NS		4			80	5	2

49	1999	Owen	3	Staff perception	Rate of perceived exertion	Staff	Yes	Yes	Yes	10			59	4.5	2
				Patient perception	Patient comfort	Patient	Yes	Yes	Yes	9			59	4.5	2
				Patient perception	Patient security	Patient	Yes	Yes	Yes	9			59	4.5	2
50	1999	Torri	3	Physical workload	Risk exposure measurement	Staff	No			10	2 5		50	4	2
				Staff injuries	Health surveillance	Staff				4			50	4	3
				Staff absence	Sickness absence	Org	No			4			50	4	3
51	1992	Fourie	1	Patient result	Time to develop the skills of bridging	Patient	Yes	Yes	Yes	13			85	5	1
52	2001	Collins	1	Staff injuries	Injury rates	Staff	No			2	1 5 12 13 14		52	5	3
53	1988	Gagnon	1	Physical workload	Biomechanical	Staff	No			10			63	4	2
54	2001	Engkvist	1	Physical workload	MSD Risk factors	Staff	Yes	Yes	Yes	10	2 5		100	5	2
55	2000	Lynch	4	PH techniques	Changes in Work practice/method	Task	Yes	Yes	Yes	3		5	50	3.5	2
				Staff knowledge skill	Self reported knowledge	Staff	Yes	Yes	Yes	3			50	3.5	2
				Staff competence	Observed practice	Staff	No			3			50	3.5	2
				Staff injuries	Back injury statistics	Staff	No			2			50	3.5	3
56	2000	Dietz	3	Staff perception	Staff perceptions - semi struct interview	Staff	No			1		5	33	3.5	2
				Risk assessment	Documentation review	Org	No			1			33	3.5	1
				Staff competence	Staff performance	Staff	No			3			33	3.5	2
57	2001	Nussbaum	3	Staff perception	RPE	Staff	Yes	Yes	Yes	10		5	59	3	2
				Physical workload	Postures	Staff	Yes	Yes	Yes	10			59	3	2
				Physical workload	Forces	Staff	Yes	Yes	Yes	10			59	3	2
58	1997	MacKenzie	0										po	4.5	
59	1986	Love	0										po	4.5	
60	1999	Menoni	1	Physical workload	MAPO scores	Org				????			57	3	
61	1999	Owen	0										66	4	

62	1989	Tuffnell	1	PH techniques	Changes in method completed	Staff	No			3	5 10		29.5	1.5	2
63	1987	Troup	1	Staff competence	Task performance by the staff	Staff	Yes	Yes	Yes	3		5	54	3	2
64	1996	Foster	1	PH techniques	Self reported changes in practice	Staff	No			3		5	57	2.5	2
65	1997	Furber	1	Staff injuries	Injury rates	Staff	No			2			66	4	3
66	1997	Best	4	Staff injuries	Back pain Questionnaire	Staff	Yes	Yes	Yes	2		5	70	3	2
				Physical workload	Handling behaviour OWAS	Staff	Yes	Yes	Yes	10			70	3	2
				Patient perception	Patient comfort	Patient	No			9			70	3	2
				Staff absence	Sickness absence	Org	Yes	NS	Yes	4			70	3	3
67	1994	Lee	2	Staff perception	Risk factors questionnaire	Staff	Yes	Yes	Yes	10			39	3.5	2
				PH techniques	Model for Handling capacity	Staff	Yes	Yes	Yes	10			39	3.5	2
68	1995	Garb	2	Staff knowledge skill	Awareness and knowledge of the staff	Staff	No			3			56	3.5	2
				Staff injuries	Injury rates	Staff	No			2			56	3.5	3
69	1993	Feldstein	1	Staff injuries	Back pain	Staff	Yes	Yes	Yes	3	5 18		68	4	3
70	1998	Caska	1	Staff injuries	Injury rates	Staff	No			2		17	69	4	3
71	1996	Backers	1	Staff injuries	Injury rates	Staff	No			2					3
72	1999	Owen	2	Staff perception	Staff perception RPE	Staff	Yes	Yes	Yes	10			76	5	2
				Patient perception	Patient Perception Security and comfort	Patient	Yes	Yes	Yes	9			76	5	2
73	1994	Garg	8	Physical workload	Biomechanical Model	Staff	Yes	Yes	Yes	10			67	4.5	2
				Staff perception	Perceived Stress	Staff	Yes	NS	Yes	10			67	4.5	2
				Patient perception	Patient Comfort/security	Patient	Yes	Yes	Yes	9			67	4.5	2
				Time for task	Transfer Time	Task	No			13			67	4.5	1
				Staff perception	Acceptability Rate Staff perception	Staff	No			10			67	4.5	2

				Staff perception	RPE	Staff	Yes	Yes	Yes	10			67	4.5	2
				Staff injuries	Injury Rate	Staff	No			2			67	4.5	3
				Time for task	Transfer Time	Task	No			13			67	4.5	1
74	1993	Benevolo	4	Staff perception	Safety and comfort of staff perception	Staff	Yes	Yes	Yes	10			57	4	2
				Patient perception	Patient comfort/safety perception	Patient	Yes	Yes	Yes	9			57	4	2
				Staff perception	Ranking of staff preference/choice	Staff	Yes	Yes	Yes	10			57	4	2
				Time for task	Time to complete task	Task	No			13			57	4	1
75	2001	Hignett	2	Incident/Accident	Incident reports	Org	No						po	4.5	
				Staff absence	MSD absence days lost	Org	No						po		
76	1998	Hampton	1	Staff perception	Staff perceptions from questionnaire	Staff	No			10			76	3.5	2
77	1997	Ng	0										52	5	
78	1998	Billin	1	Staff injuries	Injury rates	Staff	No			2	2 5		54	2	3
79	1997	Goodridge	2	Staff injuries	Injury rates	Staff	No			2	2 13		44	3.5	3
				Audit performance	Compliance with audit	Staff	No data			1			44	3.5	1
80	1994	De Looze	1	Physical workload	Biomechanical exposure to hazard	Staff	Yes	Yes	Yes	10		2	72	5	2
81	1997	Lagerstrom	2	Staff perception	Subjective assessment of programme	Staff	Yes	Yes	Yes	13	2 5 18 19		76	3.5	1
				Staff injuries	Prevelance of MSD	Staff	Yes	NS	Yes	2			76	3.5	3
82	1999	Evanoff	4	Staff injuries	MSD Risk factors	Staff	Yes	Yes	Yes	10	1 3 4 6 7 9 10		58	5	2
				Staff absence	Lost time injuries	Org	Yes	Yes	Yes	4			58	5	3
				Financial	Compensation costs	Org	No		Yes	12			58	5	3
				Psychological Well-being	Psycho social stressors	Staff	Yes	Yes	Yes	7			58	5	2
83	1996	Dixon	1	Staff absence	Staff sickness	Staff				4	2 5 10		20	3	3
84	1995	McGuire	0										39	4	
85	1995	Lavender	1	Physical workload	Biomecahnical model	Staff	Yes	yes	yes	10			63	4	2
86	1992	Garg	5	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10	1 2 5		63	5	2

				Staff perception	RPE	Staff	Yes	Yes	Yes	10			63	5	2
				Staff use of equipment	Acceptability of equipment stff perception	Staff	No			13			63	5	1
				Staff injuries	Injury rates	Staff	No			2			63	5	3
				Time for task	Time taken to complete	Task	Yes	Yes	Yes	13			63	5	1
87	1997	Charney	2	Staff absence	Lost time from injuries,	Org	No			4		17	72	4	3
				Financial	compensation costs	Org	No			12			72	4	3
88	1993	Lindbeck	2	Physical workload	Biomechanical forces	Staff	Yes	Yes	Yes	10			52	4	2
				Staff perception	RPE	Staff	Yes	Yes	Yes	10			52	4	2
89	1988	Gagnon	1	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10			44	4	2
90	1996	Entwistle	2	Staff absence	Sickness absence	Org	No			4	2 5 10 13 22		35	3	3
				Patient perception	Patient comfort	Patient	No			9			35	3	2
91	1995	Knibbe	1	Physical workload	Postures Owas	Staff	Yes	Yes	Yes	10			56	4.5	2
92	1996	Green	1	Staff perception	Staff perceptions of risk factors	Staff	No			10			31	3	2
93	1993	Roth	3	Staff perception	RPE	Staff	Yes	Yes	Yes	10			57	4	2
				Staff perception	Rating for preference of method	Staff	No			10			57	4	2
				Time for task	Time taken for task	Task	Yes	Yes	Yes	13			57	4	1
94	1993	Oddy	1	PH techniques	Elimination of drag lift	Staff	no			3	3 6 10 13		50	3.5	2
95	1994	Love	0										po	3.5	
96	1995	Luntley	3	Staff knowledge skill	Staff Knowledge of transfers	Staff	No			3			52	4	2
				Physical workload	Staff postures during tasks	Staff	No			10			52	4	2
				Number of staff	Number of staff used and available	Task	No			13			52	4	1
97	2000	Robertson	1	Physical workload	Forces to slide using slide sheets	Staff	No			10			32	3	2
98	1981	Raistrick	1	Staff injuries	% back injuries per poulation	Staff	No			2			18	2	3

99	1985	Rodgers	1	Staff perception	Staff risk perception	Staff	No			10	5	38	3.5	2
100	1985	Rodgers	1	Staff competence	Hazardous lifts observed	Staff	No			3		38	3.5	2
101	1979	Stubbs	1	Physical workload	Biomechanical load on staff	Staff	No			10		31	4	2
102	1982	Scholey	1	Physical workload	Intra-abdominal pressures	Staff	Yes	Yes	Yes	10		41	4	2
103	1988	Skarplik	2	Staff perception	Risk Factors identified by staff	Staff	No			10		po	2	2
				Staff injuries	Back Injury and pain	Staff	No			2		po	2	3
104	1981	Wright	1	Physical workload	Observed hazards	Staff	No			10		11	2	2
105	1997	Ulin	2	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10		67	5	2
				Staff perception	RPE	Staff	Yes	Yes	Yes	10		67	5	2
106	1998	Varcin-Coad	1	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10		65	4	2
107	1999	Owen	2	Staff perception	Perceived Exertion	Staff	Yes	Yes	Yes	10		po	4	2
				Patient perception	Patient comfort and security	Patient	Yes	Yes	Yes	9		po	4	2
108	1991	Waldenstrom	4	Relative perception	Mothers experience	Patient	Yes	Yes	Yes	9		93	5	2
				Relative perception	Fathers experience	Relative	Yes	Yes	Yes	9		93	5	2
				Patient result	Obstetric outcomes	Patient	Yes	Yes	Yes	8		93	5	3
				Physical workload	Nurses postures	Staff	Yes	Yes	Yes	10		93	5	2
109	2000	Kothiyal	2	Physical workload	Muscle activity EMG	Staff	Yes	Yes	Yes	10		32	4	2
				Staff perception	RPE	Staff	Yes	Yes	Yes	10		32	4	2
110	2000	Schibye	1	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10		65	4	2
111	2000	Panciera	0									po	3.5	
112	2000	Proteau	0									po	4	
113	2000	Pan	3	Physical workload	Low back biomechanics	Staff	No			10		33	3	2
				Staff perception	RPE	Staff	No			10		33	3	2
				Time for task	Time taken to complete task	Task	No			13		33	3	2

114	2000	Kato	1	Time for task	Task efficiency	Task	No			10			32	2	2
115	2000	Caboor	3	Physical workload	Postures of staff	Staff	Yes	Yes	Yes	10			61	3.5	2
				Physical workload	EMG	Staff	Yes	NS	Yes	10			61	3.5	2
				Staff perception	RPE	Staff	Yes	NS	Yes	10			61	3.5	2
116	2000	Wood	4	Staff knowledge skill	Staff skill	Staff	No			3		5	46	3.5	2
				Risk assessment	Accuracy of risk asessments/mobility	Staff	No			1			46	3.5	2
				Staff perception	Staff perceptions	Staff	No			10			46	3.5	2
				Staff injuries	Staff injuries	Staff	No			2			46	3.5	2
117	1987	Johnston	2	Staff perception	Perception of Risks	Staff	No			10		5	43	3.5	2
				Risk assessment	Risk assessment process and info	Staff	No			1			43	3.5	2
118	1993	Haigh	1	Patient result	Transfer of micro-organisms	Task	No			13			52	5	2
119	2000	Thompson	1	Physical workload	Postures both owas and reba	Staff	No			10			57	4	2
120	2000	Revie	0										po	2.5	
121	2000	Massad	1	Physical workload	Accident causation measures	Staff	No			10			55	3.5	2
122	1988	Owen	1	Staff perception	Staff perceptions of equipment	Staff	Yes	Yes	Yes	13		2	57	4	2
123	1995	Hignett	1	Staff perception	Nurses perceptions	Staff	Yes			13	1 3 5 6 7 9 10		81	4.5	2
124	1996	Hignett	0										po	4.5	
125	1999	Hignett	1	Staff perception	Subjective assessment questionnaire	Staff	No			??			57	4.5	
126	1996	Hignett	1	Staff perception	Subjective appraisal of risk factors	Staff	No			10			96	5	2
127	2000	Busse	0										po	3.5	
128	1994	Collins	1	Physical workload	Biomechanics model Lumb Motion Mon	Staff	No			10			4	2	2
129	1998	Collins	1	Physical workload	Biomechanics model Lumb Motion Mon	Staff	No			10			19	2	2

130	1999	Knibbe	1	Physical workload	Log of pre and post task numbers	Staff	Yes	Yes	Yes	10		2	83	5	2
131	2000	Kitson	0										po	4	
132	2000	Knapik	3	Physical workload	Physiological response	Staff	Yes	Yes	Yes	10			57	4.5	2
				Staff perception	RPE	Staff	Yes	Yes	Yes	10			57	4.5	2
				Staff injuries	Pain or discomfort	Staff	Yes	Yes	Yes	2			57	4.5	3
133	1995	Stevenson	1	Physical workload	Biomechanical model	Staff	No		Yes	10			43	3.5	2
134	1993	Scopa	1	Staff injuries	Compliance with WRBME	Staff	Yes	NS	Yes	2		5	65	4	2
135	1995	Smedley	1	Physical workload	Risk factors for Nurses	Staff	No			10			82	4	2
136	1983	Scholey	1	Physical workload	Intra-abdominal pressures	Staff	Yes	Yes	No	10		5	78	2	2
137	1989	St-Vincent	1	Physical workload	Observation tool for posture movement	Staff	Yes	Yes	Yes	10		5	70	4.5	2
138	1983	Stubbs	3	Physical workload	Intra-abdominal pressures	Staff	Yes	Yes	Yes	10		5	55	4.5	2
				Staff perception	Nurse Comfort	Staff	Yes	Yes	Yes	10			55	4.5	2
				Physical workload	Intra-abdominal Pressure 2nd test	Staff	Yes	NS	Yes	10			59	4.5	2
139	1993	Robertson	1	Physical workload	Forces in lifting	Staff	Yes	Yes	Yes	10			71	3	2
140	1998	Pohjonen	3	Physical workload	Posture owas	Staff	Yes	Yes	Yes	10	1 2 3 7 9 10 11		58	4.5	2
				Physical workload	Heart rate	Staff	No			10			58	4.5	2
				Staff injuries	Work ability index	Staff	Yes	Yes	Yes	4			58	4.5	3
141	1996	Petzall	3	Physical workload	Forces	Staff	No			10			48	4	2
				Staff perception	Subjective appraisal of the staff	Staff	No			13			48	4	1
				Patient perception	Subjective appraisal of occupier	Patient	No			13			48	4	1
142	1992	Olssen	1	Staff perception	Questionnaire data from staff survey	Staff	No						75	3	
143	1994	Owen	4	Staff perception	Subjective ratings of the staff	Staff	No		Yes	10			50	4	2

				Physical workload	Biomechanical model	Staff	No		Yes	10		50	4	2
				Patient perception	Patient subjective ratings	Patient	No		Yes	9		50	4	2
				Time for task	Transfer times	Task	No		Yes	13		50	4	1
144	1992	Owen	4	Staff perception	Subjective ratings of the staff	Staff	Yes	Yes	Yes	10		82	4	2
				Staff perception	Ranking of tasks	Staff	Yes	Yes	Yes	10		82	4	2
				Staff injuries	Back tension	Staff	Yes	Yes	Yes	10		82	4	2
				Physical workload	L5/S1 compression	Staff	Yes	Yes	Yes	10		82	4	2
145	1987	Owen	2	Staff perception	Staff perception of risk factors	Staff	No			10		45	4	2
				Staff absence	Sickness absence Lost work hours	Org	Yes	NS	Yes	4		4	4	3
146	1989	Owen	1	Staff perception	Staff perception	Staff	Yes	Yes	Yes			po		
147	2000	Sparkes	0									po		
148	1988	Nestor	2	Staff injuries	Low back pain index	Staff	No		Yes	2		50	2.5	3
				Equipment	Bed design criteria	Equip	No			13		50	2.5	1
149	1991	Nyran	3	Staff injuries	Injury Rates	Staff	No		Yes	2	1 2 4 5	65	4	3
				Financial	Lost Time Claims	Org	No		Yes	4		65	4	3
				Staff perception	Subjective views of managers	Staff	No			13		65	4	2
150	1996	Mital	0									po		
151	1992	Miller	1	Carer perception	Questionnaire. Subjective responses of carers	Staff	No			10	1 5 10	50	3.5	2
152	1999	Marras	2	Staff injuries	Low back disorder model	Staff	Yes	Yes	Yes	2		72	5	5
				Physical workload	Biomechanical load model	Staff	Yes	Yes	Yes	10		72	5	5
153	1997	Menckel	2	Incident/Accident	Accident reports and feedback	Org	No	No	Yes	6	1 2 5 8	63	4	2
				Incident/Accident	Number reports completed	Org	No	No	Yes	1		63	4	2
154	1988	Mulligan	0									po		

155	1997	McGuire	1	Staff perception	Manager knowledge and attitude	Staff	No			1				64	5	2
156	1996	McGuire	1	Patient perception	Clients attitudes to equipment	Patient	No		Yes	9				50	3.5	2
157	1996	Moody	1	Staff perception	Nurses attitudes to equipment	Staff	Yes	Yes	Yes	13				41	4	2
158	1996	McGuire	3	Equipment	Equipment performance	Equip	Yes	Yes	Yes	13				54	3	1
				Staff perception	Staff perception of equipment	Staff	Yes	Yes	Yes	13				54	3	1
				Patient perception	Patient perception	Patient	Yes	Yes	Yes	9				54	3	2
159	2000	Zhuang	5	Staff perception	Subjective Forces	Staff	No		Yes	10				54	4.5	2
				Staff perception	Subjective ease of use	Staff	No		Yes	13				54	4.5	2
				Staff perception	Perceived time of task	Staff	No		Yes	13				54	4.5	1
				Patient perception	Patient comfort	Patient	No		Yes	9				54	4.5	2
				Patient perception	Patient security	patient	No		Yes	9				54	4.5	2
160	1999	Zhuang	2	Physical workload	Work posture	Staff	Yes	Yes	Yes	10				59	4.5	2
				Physical workload	Forces	Staff	Yes	Yes	Yes	10				59	4.5	2
161	1994	Winkelmolen	3	Physical workload	Work posture	Staff	Yes	Yes	Yes	10				63	4.5	2
				Physical workload	Biomechanical loading	Staff	Yes	Yes	Yes	10				63	4.5	2
				Staff perception	Perceived effort	Staff	Yes	Yes	Yes	10				63	4.5	2
162	1987	Wachs	1	Staff competence	Compliance with standards	Staff	No		No	3			5	86	5	2
163	1987	Wood	2	Staff injuries	Injuries	Staff	Yes	Yes	Yes	2	5	8		56	4	3
				Staff absence	Lost time	Org	Yes	Yes	Yes	4				56	4	3
164	1988	Venning	0											po		
165	1988	Videman	3	Staff knowledge skill	Skill assessment	Staff	Yes	Yes	Yes	3			5	41	3.5	2
				Staff injuries	Back Pain	Staff	Yes	Yes	Yes	2				41	3.5	3
				Staff perception	Subjective workload	Staff	Yes	Yes	Yes	10				41	3.5	2
166	1987	Torma-Krajewski	1	Physical workload	Spinal loading	Staff	No		Yes	10				43	2.5	2
167	1987	Takala	2	Staff perception	Subjective view on loads	Staff	No	Yes	No	10				50	3.5	2
				Physical workload	Postures	Staff	Yes	Yes	Yes	10				50	3.5	2
168	1997	Le Bon	4	Staff use of equipment	Equipment evaluation	Equip	No		Yes	13				41	3	1
				Patient perception	User trial data Patient	Patient	No		Yes	9				41	3	1

				Staff perception	User Trial Staff	Staff	No		Yes	13		41	3	1
				Equipment	Physical evaluation	Equip	No		Yes	10		41	3	2
169	1996	Love	2	Staff perception	Subjective perceptions of hazards	Staff	Yes	Yes	Yes	10		36	4	2
				Incident/Accident	Factors in accident	Staff	Yes	Yes	Yes	10		36	4	2
170	1995	Laflin	1	Physical workload	Biomech Models	Staff	No		Yes	10		46	4	2
171	1995	Lee	2	Physical workload	Postures OWAS	Staff	Yes	Yes	Yes	10		39	3.5	2
				Physical workload	Biomechanical Force	Staff	Yes	Yes	Yes	10		39	3.5	2
172	1989	Ljungberg	5	Physical workload	HR / VO2	Staff	Yes	Yes	Yes	10	2 6 7	65	4	2
				Staff perception	RPE	Staff	Yes	Yes	Yes	10		65	4	2
				Physical workload	Lift force	Staff	Yes	Yes	Yes	10		65	4	2
				Physical workload	Lift exposure/freq	Staff	Yes	Yes	Yes	10		65	4	2
				Physical workload	Postures	Staff	Yes	Yes	Yes	10		65	4	2
173	1996	Love	1	Equipment	Equipment measures	Equip	No		Yes			po		
174	1996	Lusted	4	Staff injuries	Injuries	Staff	Yes	Yes	Yes	2		66	4	3
				Staff injuries	Nordic Pain Questionnaire	Staff	Yes	Yes	Yes	2		66	4	3
				Physical workload	Heart Rate	Staff	Yes	No	Yes	10		66	4	2
				Staff perception	Subjective feedback	Staff	Yes	Yes	Yes	10		66	4	2
175	1996	Knibbe	2	Staff injuries	Back Pain Questionnaire	Staff	Yes	Yes	Yes	2		77	3	3
				Physical workload	Task Exposure	Staff	Yes	Yes	Yes	10		77	3	2
176	185	Kilbom	2	Physical workload	Forces on staff	Staff	No		Yes	10	2 6 7	27	3	2
				Time for task	Time taken	Task	No		Yes	13		27	3	1
177	1994	Jackson	1	Physical workload	Postures owas	Staff	Yes	Yes	Yes	10		66	4	2
178	1987	Khalil	1	Physical workload	Biomechanical loading	Staff	No		Yes	10		36	3	2
179	1996	Head	3	Staff injuries	Injuries	Staff	No		Yes	2	1 2 3 5	28	3.5	3
				Staff absence	Lost time	Org	No		Yes	4		28	3.5	3
				Financial	Cost	Org	No		Yes	4		28	3.5	3
180	1993	Hellsing	3	Training numbers	Training Outcomes	Staff	Yes	NS	Yes	13	5 18 19	58	3.5	1
				Staff injuries	Back Pain	Staff	Yes	NS	Yes	2		58	3.5	3
				Staff competence	Observed compliance with teaching	Staff	Yes	NS	Yes	3		58	3.5	2
181	1992	Garg	3	Staff perception	Perceived exertion	Staff	No		Yes	10		55	4.5	2
				Physical workload	Spinal loading	Staff	No		Yes	10		55	4.5	2

				Physical workload	Trunk angles	Staff	No		Yes	10		55	4.5	2
182	1986	Gagnon	1	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10		57	4	3
183	1991	Garg	4	Physical workload	Spinal Loading	Staff	Yes	Yes	Yes	10		48	4	2
				Staff perception	Subjective opinion of tasks effort	Staff	Yes	Yes	Yes	10		48	4	2
				Patient perception	Patient comfort	Patient	Yes	Yes	Yes	9		48	4	2
				Patient perception	Patient security	Patient	Yes	Yes	Yes	9		48	4	2
184	1991	Garg	4	Physical workload	Spinal Loading	Staff	Yes	Yes	Yes	10		80	4.5	2
				Staff perception	Subjective opinion of tasks effort	Staff	Yes	Yes	Yes	10		80	4.5	2
				Patient perception	Patient comfort	Patient	Yes	Yes	Yes	9		80	4.5	2
				Patient perception	Patient security	Patient	Yes	Yes	Yes	9		80	4.5	2
185	1991	Garg	4	Physical workload	Spinal Loading	Staff	No		No	10		48	4	2
				Staff perception	Subjective opinion of tasks effort	Staff	No		No	10		48	4	2
				Patient perception	Patient comfort	Patient	No		No	9		48	4	2
				Patient perception	Patient security	Patient	No		No	9		48	4	2
186	1987	Gagnon	2	Physical workload	Spinal Loading	Staff	Yes	Yes	Yes	10		57	4	2
				Physical workload	Muscle activity	Staff	Yes	Yes	Yes	10		57	4	2
187	2002	Larthe	1	Staff absence	Days lost	Org	No			4	1 5 8 10 13	22	2	3
188	2004	Engst	4	Patient result	Resident agitation	Patient	Yes	Yes	Yes	9	1, 2, 5, 7	63	4	2
				Physical workload	MSD exposure score	Staff	No			10		63	4	2
				Staff perception	Perception of MSD risk	Staff	Yes	Yes	Yes	7		63	4	2
				Incident/Accident	PH incidents	Staff	No			6		63	4	3
189	1992	Fenety	2	Physical workload	Lifting load	Staff	No		No	10		18	3	2
				Physical workload	Postures of staff	Staff	No		No	10		18	3	2
190	1993	Fragala	1	Staff injuries	Injury rates	Staff	No					po	4	
191	2002	Hutchinson	2	Staff perception	Perception of Risks	Staff								po
				Staff injuries	Self reported back pain	Staff								po
192	2005	Hooghiemstra	2	Physical workload	Postures	Staff					2 5		4	po
				Time for task	Time	Staff					2 5		4	po
193	1998	Looze	1	Physical workload	Spinal Loading	Staff	Yes	NS	No	10		66	4	2
194	1995	Doormaal	3	Physical workload	Posture	Staff	Yes	NS	Yes	10		64	3.5	2

				Staff perception	Questionnaire of perceptions	Staff	Yes	NS	Yes	10		64	3.5	2
				Physical workload	Force measures	Staff	Yes	NS	Yes	10		64	3.5	2
195	1975	Dehlin	1	Physical workload	Force plate measures for lift burden	Staff	Yes.	Yes	Yes	10		63	3	2
196	1975	Dehlin	1	Staff injuries	Back Pain.	Staff	No		No	2		75	4	3
197	1999	Coleman	0									39	3.5	
198	1991	Charney	2	Staff injuries	Injury Rates for Staff	Staff	No		Yes	2	17	37	2	3
				Financial	Financial impact	Org	No		Yes	12		37	2	3
199	1993	Charney	2	Staff injuries	Injury Rates for Staff	Staff	No		Yes	2	17	61	3.5	3
				Financial	Financial impact	Org	No		Yes	12		61	3.5	3
200	1998	Conneeley	1	Patient perception	Patient perspective	Patient	No	No	Yes	9		92	5	2
201	1998	Botha	2	Staff injuries	Back Pain questionnaire	Staff	No			2		75	5	3
				Staff perception	Subjective problem identification	Staff	No			10		75	5	2
202	1994	Ballard	1	Staff perception	Risk Factors for Nurses	Staff	No			10		66	4	2
203	1979	Bell	6	PH technique	Method to move patient	Staff	Yes	Yes	Yes	13		82	3.5	1
				Physical workload	Number patients to be lifted	Staff	Yes	Yes	Yes	10		82	3.5	2
				Number of staff	Number of staff to lift	Staff	Yes	Yes	Yes	13		82	3.5	1
				PH technique	Importance of the task	Staff	Yes	Yes	Yes	13		82	3.5	1
				Physical workload	Frequency of lifting	Staff	Yes	Yes	Yes	10		82	3.5	2
				Physical workload	Physical effort	Staff	Yes	Yes	Yes	10		82	3.5	2
204	1987	Bell	0									po		
205	1984	Bell	4	Equipment	Problems when operating hoists	Staff	No	No	Yes	13		33	4	1
				Equipment	Appraisal of range of hoists	Staff	Yes	Yes	Yes	13		33	4	1
				Time for task	Time to operate hoists Lab trial	Task	Yes	Yes	Yes	13		33	4	1
				Time for task	Time taken to operate hoist ward trial	task	Yes	Yes	Yes	13		33	4	1
206	1992	Atkinson	0									po		

207	1986	Alavosius	2	Staff competence	% tasks performed safely	Staff	No			3	5 8		39	3	2
				Staff perception	Subjective feedback of intervention	Staff	No			10			39	3	2
208	1998	Aird	1	Staff injuries	Injury rates	Staff	No			2	Hosp 2 5 9 12 18 20 21 NH 1 3 5 13		44	4	3
209	1988	Owen	2	Staff use of equipment	Use of equipment for tasks	Staff	Yes	Yes	Yes	3			57	4	2
				Staff perception	Perceived benefits	Staff	Yes	Yes	Yes	10			57	4	2
210	2006	Nelson	7	Staff injuries	Injury rate	Staff	Yes	Yes	Yes	2	1 2 10 13 23		70	5	3
				Staff absence	Lost days and modified days	Org	Yes	No	Yes	4			70	5	3
				Psychological well-being	Job satisfaction	Staff	Yes	Yes	Yes	7			70	5	2
				Staff competence	Self reported unsafe acts (compliance)	Staff	Yes	Yes	Yes	3			70	5	2
				Financial	Cost benefit	Org	No		Yes	12			70	5	3
				Staff perception	perceived effectiveness of intervention	Staff	No		Yes	7			70	5	2
				Staff perception	Perceived support of organisation (Culture)	Staff	No		Yes	1			70	5	1
211	2003	Smedley	3	Staff injuries	Low back pain	Staff	Yes	Yes	Yes	2	2 7 10 23		70	4	3
				Psychological well-being	Psychosocial stress	Staff	Yes	Yes	Yes	7			70	4	3
				Staff competence	Number of unassisted transfers(compliance	Staff	Yes	Yes	Yes	3			70	4	2
212	2003	Evanoff	2	Staff injuries	Injury rate	Staff	Yes	Yes	Yes	2		2	26	3	3
				Staff absence	Lost Time	Org	Yes	Yes	Yes	4			26	3	3
213	2005	Fujushiro	2	Staff injuries	MSD Rate	Staff	Yes	Yes	Yes	2	1 2		63	4	3
				Staff absence	Days lost	Org	Yes	Yes	Yes	4			63	4	3
214	2006	Tamminen Peter	4	Staff competence	Staff competence SOPMAS	Staff	Yes	No		3	5 7		37	2	2
				Physical workload	EMG	Staff	Yes	No		10			37	2	2

				Staff perception	RPE Borg	Staff	Yes	No		10			37	2	2
				Patient perception	Patient satisfaction	Patient	Yes	No		9			37	2	2
215	1981	Wright	0										11	2	
216	1987	Gagnon	2	Physical workload	Biomechanical models	Staff	No		No	10			35	4	2
216				Physical workload	Muscle activity	Staff	No		No	10			35	4	2
217		Mughal	4	Staff injuries	Injury data No claims	Org	Yes	No	Yes	4		2	48	4	3
				Staff absence	Days lost	Org	Yes	No	Yes	4			48	4	3
				Staff perception	Subjective staff	Staff	Yes	Yes	Yes	7			48	4	2
				Patient perception	Subjective Patient safety	Patient	Yes	No	Yes	9			48	4	2
218	2006	Proteau	3	Physical workload	Forces to slide	Staff	No			10	2 7		15	2	2
				Staff competence	Ratio lift to slide (Compliance)	Staff	No			3			15	2	2
				Physical workload	EMG	Staff	No			10			15	2	2
219	1998	Nicholls	2	Staff competence	Observation checklist	Staff	Yes	Yes	Yes	3		5	41	4	2
				Training numbers	Training evaluation questionnaire	Training	No			13			41	4	1
220	2005	Swain	0								5 10 15 23				NR
221	2005	Ferreira	1	Physical workload	Biomechanical	Yes	Yes	Yes		10		2	48	4	2
222	2003	Swain	2	Staff competence	Compliance Questionnaire	No				3		5	68	5	2
				Staff knowledge skill	Knowledge	No				3			68	5	2
223	2003	Trinkoff	1	Staff injuries	MSD prevalence (Nordic)	Yes	Yes	Yes		2	5, 2, 17		68	4	3
224	2006	Pinder	3	Staff perception	Perceptions of Management systems (safety culture?	Org	Yes	Yes	No	1				NR	2
				Staff injuries	MSD profiles	Staff	Yes	Yes	No	2				NR	2
				Staff perception	Perceptions of work risks	Staff	Yes	Yes	No	7				NR	2
225	2003	Hefti	3	Staff injuries	No Injuries	Staff	No			2	1, 2, 7, 17		44	4	3
225				Staff absence	Days lost	Org	No			4			44	4	3
225				Financial	Costs of injuries	Org	No			12			44	4	3
226	2002	Crumpton	2	Physical workload	Risk exposure (stady meter)	Staff	No			10		2	56	4	2

				Staff injuries	back pain MSD (SF36)	Staff	No			2		3	56	4	3
227	2004	Kjellberg	2	Staff competence	Work Technique (kjellberg method)	Staff	Yes	Yes	Yes	3			89	5	2
				Patient perception	Patient Percpetion	Patient	Yes	Yes	Yes	9			89	5	2
228	2002	Ronald	1	Staff injuries	MSD rates per 100 000 hours	Staff	Yes	NS	Yes	2		2	63	3	3
229		Weinel	3	Staff perception	RPE	Staff	No			10	2, 5		37	3	2
		Weinel		Equipment	Accessibility of equipment	Staff	No			13			37	3	1
		Weinel		Staff injuries	Injuries	Staff	No			1			37	3	3
230	2007	Hignett	4	Staff competence Org	Safety Culture PHOQS	Org	No			1			67	5	2
				Physical workload	Posture REBA	Staff	No			10			67	5	2
				Time for task	Time taken	Task	No			13			67	5	2
				Staff knowledge skill	Skill understanding/Verbal protocol	Staff	No			3			67	5	2
231	2007	Lavender	2	Physical workload	EMG	Staff	Yes	Yes	Yes	10		2	67	5	2
				Physical workload	Biomechanical LMM2	Staff	Yes	Yes	Yes	10			67	5	2
232	2007	Morgan	1	Financial	Costs	Org	No			12	1, 5, 10, 12, 15, 24		30	3	3
233	2004	Heacock	4	Staff use of equipment	Subjectiove ease of use	Staff	Yes	Yes	Yes	13		2	48	3	1
				Time for task	Time taken	Task	Yes	Yes	Yes	13			48	3	2
				Staff perception	RPE for body regions	Staff	Yes	Yes	Yes	10			48	3	2
				Patient perception	Patient perspective	Patient	No			9			48	3	2
234	2003	Brinkhoff	1	Physical workload	Postures OWAS	Staff	Yes	Yes	Yes	10	2 5 23			NR	2
235		Flint	1	Incident/Accident	Incidence rate	Staff	No			2	1 2 5 15 24			NR	3
236	2005	Ruszala	5	Time for task	Time taken	Task	Yes	Yes	Yes	13		2	63	5	2
				Staff use of equipment	Subjective ease of use	Staff	Yes	No	Yes	13			63	5	1
				Staff perception	RPE	Staff	Yes	No	Yes	10			63	5	2
				Physical workload	Posture REBA	Staff	Yes	No	Yes	10			63	5	2

				Staff perception	Subjective performance rating	Patient	No	No		9			63	5	2
237	2005	Santaguida	5	Physical workload	Biomechanical strain	Staff	Yes	yes	yes	10		2	67	5	2
				Time for task	Time taken	Task	Yes	no	yes	13			67	5	1
				Staff perception	RPE	Staff	Yes	Yes	Yes	10			67	5	2
				Staff perception	Ranking of preference	Staff	Yes	No	Yes	7			67	5	2
				Patient perception	Ranking of preference	Patient	Yes	No	No	9			67	5	2
238	2006	Swann	1	PH technique	Descriptive functions	Staff	No			13		2		NR	1
239	2005	Yeung	2	Physical workload	Workload exposure	Staff	Yes			10				NR	2
				Staff injuries	MSD Outcome	Staff	Yes			2				NR	3
240	2006	Millar	3	Staff perception	Risk perception	Staff	Yes	Yes	Yes	10		2	59	4	2
				Staff perception	Comfort	Staff	Yes	Yes	Yes	7			59	4	2
				Financial	Injury costs	Org	No			12			59	4	3
241	2006	Knibbe	4	Physical workload	Exposure to hazards	Staff	No			10	10 25		74	5	2
				Staff competence Org	Prevention strategies /Compliance Policy mirror	Org	No			1			74	5	2
				Staff injuries	LBP	Staff	No			2			74	5	3
				Staff absence	Sick leave	Org	No			4			74	5	3
242	2008	Nelson	1	Quality of care	Quality of care RAI tool p37	Patient	Yes			5	1, 2, 10, 13, 15, 23		59	4	2
243	2006	Knibbe	1	Staff absence	Absence	Org	No			4	5 23		68	4	3
244	2006	Hess	2	Staff perception	RPE Borg	Staff	Yes	Yes	Yes	10	2 7		67	3	2
				Physical workload	Biomechancal load	Staff	Yes	Yes	Yes	10			67	3	2
245	2001	Pearce	2	Staff absence	Lost time	Org	No			4	12 20		42	4	3
				Staff injuries	Pain reporting	Staff	No			2			42	4	2
246	2007	Wardell	2	Staff perception	Staff perception	Staff	No			7	1, 2, 5, 10, 23		44	4	2
				Staff injuries	Injury Rate	Staff	No			2			44	4	3
247	2006	Hye-Knudson	1	Staff competence	Compliance / skill (Warming tool	Staff	Yes	Yes	Yes	3		5	52	2	2
248	2006	Charney	3	Staff injuries	Injury Rates	Staff	No			2	2, 5, 10, 12, 24		52	4	3
				Staff absence	Time lost	Org	No			4			52	4	3

				Financial	Costs	Org	No			12			52	4	3
249	2002	Allen	1	Physical workload	L5/S1 compression	Staff	Yes			10		2	48	3	2
250	2003	Nelson	4	Staff perception	Comfort	Staff	Yes	Yes	Yes	10		2	48	4	2
				Physical workload	Lumbar force moment	Staff	Yes	Yes	Yes	10			48	4	2
				Physical workload	Muscle activity	Staff	Yes	Yes	Yes	10			48	4	2
				Physical workload	External applied force	Staff	Yes	Yes	Yes	10			48	4	2
251	2003	Passfield	2	Staff injuries	Injury Rate	Staff	Yes	Yes	Yes	2		10	67	4	3
				Financial	Costs	Org	Yes	Yes	Yes	12			67	4	3
252	2002	Skotte	3	Physical workload	Biomechanical model	Staff	Yes	Yes	Yes	10		7	67	4	2
				Physical workload	Muscle force	Staff	Yes	NS		10			67	4	2
				Staff perception	RPE	Staff	Yes	NS		10			67	4	2
253	2004	Hye-Knudson	2	Physical workload	Lumbar Motion	Staff	Yes	NS		10		7	67	4	2
				Physical workload	EMG	Staff	Yes	NS		10			67	4	2
254	2001	Yassi	4	Physical workload	Number lifts observed	Staff	Yes	Yes	Yes	10	2 5 10		67	4	2
				Staff perception	Subjective assessment of work effects	Staff	Yes	Yes	Yes	10			67	4	2
				Staff injuries	Pain/discomfort	Staff	Yes	Yes	Yes	2			67	4	3
				Staff injuries	Injury rate	Staff	Yes	NS	Yes	2			67	4	3
255	2002	Johnsson	3	Staff competence	Method assessment (Compliance)	Staff	Yes	Yes	Yes	3		5	70	4	2
				Staff perception	RPE	Staff	Yes	Yes	Yes	10			70	4	2
				Patient perception	Patient comfort	Staff	Yes	Yes	Yes	9			70	4	2
256	2006	Engkvist	5	Staff use of equipment	Use of Equipment	Staff	Yes	Yes	Yes	3	1 2 5 9 10 13 15 23 24		73	3	2
				Staff perception	RPE/fatigue	Staff	Yes	Yes	Yes	10			73	3	2
				Staff injuries	Pain Discomfort	Staff	Yes	Yes	Yes	2			73	3	3
				Staff injuries	Injury rates	Staff	Yes	Yes	Yes	2			73	3	3
				Staff absence	Time lost	Org	Yes	Yes	Yes	4			73	3	1
257	2003	Schibye	3	Physical workload	Biomechanical loads	Staff	Yes	Yes		10		7	63	4	2
				Staff perception	Perceived exertion	Staff	Yes	Yes		10			63	4	2
				Time for task	Time taken	Task				13			63	4	1
258		Harrison	1	Patient result	Clinical benefit	Patient								NR	
259	2006	Garg	1	Staff absence	Number injuries	Org	No			2		10	30	4	3

260	2004	Cohen	5	Number of staff	Resident to staff ratio	Staff	Yes			10			82	5	1
				Number of staff	Res dependency to staff ratio	Staff	Yes			10			82	5	1
				Staff injuries	Injury rate	Staff	Yes			2			82	5	3
				Staff absence	Time lost per injury rate	Org	Yes			4			82	5	3
				Staff absence	Lost days per FTE	Org	Yes			4			82	5	3
261	2006	Jordan	1	Physical workload	Biomechanical	Staff	No			10	2 7		59	4	2
262	2004	Keir	2	Physical workload	EMG	Staff	Yes	Yes	Yes	10	2 7		52	4	2
				Physical workload	Time product	Staff	No			13			52	4	1
263	2005	Chokhar	2	Staff injuries	MS injury rate	Staff	Yes	Yes	Yes	2	2 5 10		91	4	3
				Financial	Costs	Org	Yes	Yes	Yes	12			91	4	3
264	2005	Anderson	1	Physical workload	Lumber load	Staff	No			10			41	2	2
265	2005	Engst	3	Staff perception	Risk Perception	Staff	Yes	Yes	Yes	10	2 5 10		59	4	2
				Staff perception	Comfort	Staff	Yes	Yes	Yes	10			59	4	2
				Financial	Injury Costs	Org	Yes	Yes	Yes	4			59	4	3
266	2005	McGill	3	Physical workload	EMG	Staff	Yes	No		10	2 7		56	4	2
				Physical workload	Body movement	Staff	Yes	No		10			56	4	2
				Physical workload	L5/S1 loads	Staff	Yes	No		10			56	4	2
267	2004	Siguardsson	1	Financial	Costs	Org	No			12		2	11	2	3
268	2001	O'Reilly	3	Staff injuries	No LBP injuries	Staff	No			2	1, 4, 5, 12, 24		44	3	3
				Staff absence	Lost work days	Org	No			4			44	3	3
				Financial	Costs	Org	No			12			44	3	3
269	2002	Silvia	2	Physical workload	Forces on spine	Staff	No			10	2 7		41	3	2
				Staff perception	Subjective appraisal	Staff	No			10			41	3	2
270	1999	Bohannon	1	Physical workload	Forces to pull	Staff	Yes	Yes	Yes	10	2 7		41	4	2
271	2006	Baptiste	5	Staff perception	Comfort	Staff	Yes	Yes	Yes	10		2	59	5	2
				Staff perception	Ease of use	Staff	Yes	Yes	Yes	13			59	5	1
				Staff perception	Perceived injury risk	Staff	Yes	Yes	Yes	10			59	5	2
				Time for task	Time efficiency	Task	Yes	Yes	Yes	13			59	5	1
				Patient perception	Patient safety	Patient	Yes	Yes	Yes	9			59	5	2
272		Knibbe												NR	
273	2007	Mark	0											NR	

274	2007	Lavender	2	Physical workload	EMG	Staff	Yes	Yes	Yes	10	2 7		78	5	2
				Staff perception	RPE	Staff	Yes	No	No	10			78	5	2
275	2007	Lavender	2	Physical workload	EMG	Staff	Yes	Yes	Yes	10	2 7		78	5	2
				Staff perception	RPE	Staff	Yes	No	No	10			78	5	2
276	2007	Craib	2	Staff injuries	Injury rates	Staff	Yes			2	1, 2, 5		81	5	3
				Staff absence	Lost time injuries	Org	Yes			4			81	5	3
277	2007	Reid	2	Staff knowledge skill	Retention of knowledge	Staff	Yes			13		5	63	3	1
				Staff perception	Survey response	Staff	Yes	Yes		3		5	63	3	2
278	2007	Cornish	1	Staff perception	Subjective evaluation	Staff				10		5	69	4	1
279	2007	Muir	0											NR	
280	2002	Owen	5	Patient perception	Patient security	Patient	Yes	Yes	Yes	9	2 5 13		41	4	2
				Patient perception	Patient comfort	Patient	Yes	Yes	Yes	9			41	4	2
				Staff injuries	Injury reports	Staff				2			41	4	3
				Staff perception	RPE shoulder	Staff	Yes	Yes	Yes	10			41	4	2
				Staff perception	RPE back	Staff	Yes	Yes	Yes	10			41	4	2
281	2006	Joseph	1	Financial	Costs	Org	No			12		2	33	3	3
282	2000	Logan	1	Carer perception	Subjective views of carers	Staff	No	No	No	10			PO		
283	2003	Meek	0											NR	
284	2003	Griffiths	1	Incident/Accident	MH Incidents	Org				6	5 15 23		22	1	3
285	2003	Robotham	1	Financial	Financial	Org							PO?		
286	2001	Thompson	1	Physical workload	Force	Staff	No			10		2	9	2	2
287	2001	Spencer	1	Physical workload	Force	Staff	No			10	2 7		23	3	2
288	2002	Hunter	2	Physical workload	Force	Staff	No			10	2 7		23	3	2
				Staff perception	RPE	Staff	No			10			23	3	2
289	2005	Murphy	4	Physical workload	Postures REBA	Staff	No			10		2	26	3	2
				Physical workload	Number tasks observed	Staff	No			10			26	3	2
				Staff injuries	MSD symptoms	Staff	No			2			26	3	2
				Patient perception	Patient subjective ratings	Patient	No			9			26	3	2
290	2006	Howlett	0											NR	
291	2006	Gray	2	Physical workload	EMG	Staff	Yes	NS		10		2	57	3	2
				Staff perception	RBE	Staff	Yes	NS		10			57	3	2
292	2006	Fray	3	Physical workload	Observed movement	Staff	No			10		2	41	3	2
				Staff perception	Carer comfort	Staff	No			10			41	3	2

				Patient perception	Patient comfort	Patient	No			9			41	3	2
293	2006	Michaelis	4	Staff competence	Competence/ completed new methods	Staff	No			3	2 5 7 8 23		48	3	2
				Staff perception	Perceived work load	Staff	Yes	Yes	Yes	10			48	3	2
				Staff injuries	Back pain	Staff	Yes	Yes	Yes	2			48	3	3
				Staff absence	Sickness absence	Org	Yes			4			48	3	3
294	2005	Hartvigsen	1	Staff injuries	Back pain	Staff	Yes	NS	Yes	2		5	59	3	3
295	2004	Nevala	4	Physical workload	EMG	Staff	Yes	Yes	Yes	10		2	64	2	2
				Physical workload	HR	Staff	No			10			64	2	2
				Staff perception	Perceived strain	Staff	Yes	Yes	Yes	10			64	2	2
				Staff use of equipment	Useability	Staff	Yes	Yes	Yes	13			64	2	1
296	2004	Collins	3	Financial	Workers compensation claims	Org	Yes	Yes	Yes	12	2 4 5 10 12		59	5	3
				Staff absence	Lost work days	Org	Yes	Yes	Yes	4			59	5	3
				Financial	Cost benefit analysis	Org	Yes	Yes	Yes	12			59	5	3
297	2003	McFarlane	1	Physical workload	Force	Staff	No			10		2	27	2	2
298	2006	Pellino	3	Staff perception	Perceived exertion	Staff	Yes	Yes	Yes	10		2	55	5	2
				Time for task	Time taken	Staff	No			10			55	5	3
				Patient perception	Patient comfort	Patient	Yes	Yes	Yes	9			55	5	3
299	2001	Best	1	Financial	Claims	Org	No			4	1 2 5 8 10 15		46	2	2
300	2003	Owen	1	Staff perception	RPE	Staff	No								
301	2004	Karahan	1	Staff injuries	Back pain	Staff							NR		
302	2001	Walls	1	Physical workload	Biomechanical relative risk	Staff	Yes	Yes	Yes	10		2	50	3	2
303	2004	Victoria Aus	2	Financial	Nurse claims	Org	No			2	2 10 23 24 25		33	4	3
				Financial	Cost benefit analysis	Org	No			12			33	4	3
304	2001	Connelly	3	Staff knowledge skill	Perception of learning	Staff	No			13			27	3	2
				Staff use of equipment	Ease of use	Staff	No			10			27	3	2
				Staff competence	Competence assessment (observ)	Staff	No			3			27	3	3
305	2007	Occipinti	3	Risk assessment	Risk assessments										

				Equipment	Equipment provided											
				Training numbers	Training provided											
306	2007	Kindblom-Rising	1	Staff perception	Risk perception after training	Staff	No			7			5	85	4	1
307	2006	Mosses	1	Staff competence	Competency scores	Staff	No						5	PO		2
308	2008	Bar-Niv	3	Physical workload	Biomech load	Staff	Yes	Yes	Yes	10	5	8		26	2	2
				Psychological well-being	Psychosocial stress questionnaire	Staff	yes	NS		7				26	2	2
				Staff injuries	MSD (nordic)	Staff	Yes	NS		2				26	2	2
309	2008	Alexander	2	Training numbers	Training numbers in hoist skills	Org	No			3			5	27	4	2
				Staff knowledge skill	Number incorrect answers	Staff	No			3			5	27	4	2
310	2008	Skotte	1	Physical workload	Biomechanical load	Staff	Yes	Yes	Yes	10	2	7		78	5	2
311	2008	Warming	2	Staff injuries	Back pain injuries	Staff	Yes	NS		2	5	18		89	5	3
				Staff injuries	Severity of back pain	Staff	Yes	Yes	Yes	2	5	18		89	5	3
312	2002	Kuiper	1	Physical workload	Serum concentrations Physiological	Staff	Yes	Yes	Yes	10					NR	2
313	2002	Spiegel	1	Financial	Costs	Org	No			12				44	4	3
314	2003	Hignett	0		? Constitutes new presentation of data									PO		
315	2001	Moreton	0		Handling method									PO		
316	2002	Moreton	0		Handling method									PO		
317	2004	Millar	0		Handling method									PO		
318	2006	Betts	0		Handling method										NR	
319	2006	Rader	0		Handling method										NR	
320	2004	Palmer	0		Handling method										NR	
321	2007	Kneafsey	1	Staff perception	Confidence of staff post training	Staff	No			7			5	41	2	2
322	2006	Love	0		Mixed assessment	Staff				10						
323	2004	Kothiyal	2	Physical workload	Muscle effort	Staff	Yes	Yes	Yes	10			2	73	1	2

				Staff perception	RPE	Staff	Yes	Yes	Yes	10			73	1	2
324	2004	Guthrie	5	Staff injuries	Injuries	Staff	No			2	2 5 17		37	4	3
				Financial	Costs	Org	No			12			37	4	3
				Staff competence	Compliance	Staff	No			3			37	4	2
				Patient perception	Patient satisfaction	Patient	No			9			37	4	2
				Psychological well-being	Staff satisfaction	Staff	No			7			37	4	2
325	2008	Berthellete	2	Staff competence Org	Organisational support	Org								NR	1
				Training numbers	Efficiency of training	Org								NR	1
326	2008	Leduc	0	Training numbers	Training Outcomes										NR
327	2007	Engkvist	1	Staff perception	Subjective nurses	Staff									NR
328	1997	Engels	1	Staff competence	Errors	Staff	Yes	Yes	Yes	3		5	59	3	2

APPENDIX B

Literature Analysis
Intervention Studies (101 studies)

Intervention	Paper No	Date	Author	No. of outcomes	Outcomes measures	Beneficiary	Tested Y/N	Significant Y/N	Used in conclusions Y/N	Intervention Strategy	QR score %	PR score	Robson score
1	1	1998	Peers	4	Lost time from injuries,	Org	No			5 10 13 15 20	37	3	3
					Lost time from recurrence,	Org	No				37	3	3
					Modified work from new injuries	Staff	No				37	3	3
					Modified work due to recorrence	Staff	No				37	3	3
2	4	1996	Gray	2	Staff knowledge	Staff	Yes	Yes	Yes	5	43	2	2
					Staff satisfaction	Staff	No		Yes		43	2	2
3	5	1994	Holliday	5	Time to complete task	Task	Yes	NS	No	2	50	4.5	1
					Number of staff to complete	Task	Yes	Yes	Yes		50	4.5	1
					RPE staff	Staff	Yes	Yes	Yes		50	4.5	2
					Comfort score for staff	Staff	Yes	NS	No		50	4.5	2
					Comfort score for patient	Patient	Yes	NS	No		50	4.5	2
4	6	1994	Santoro	2	Reduction in staff injuries	Staff	No			17	35	2.5	3
					Financial	Org	No				35	2.5	3
5	9	1994	Harber	1	LBP	Staff	Yes	NS	Yes	5	73	4.5	3
6	11	1994	Addington	2	Total back injuries reported	Staff	No			5 22	37	3	3
					Musculoskeletal sickness absnce	Org	No				37	3	3
7	13	1982	Tracsz	1	Sickness absence	Org	No			2 5	33	4	3
8	14	1999	Griffith	1	Interviews to identify perceptions of workload and risk factors	Staff	No			5	42	3	2
9	19	1998	Engels	3	OWAS posture scores	Staff	Yes	Yes	Yes	5 8 10	44	3	2
					Checklist for performance of staff	Staff	Yes	NS	No		44	3	2

					Borg score for perceived exertion	Staff	Yes	NS	Yes			44	3	2
10	20	1998	Monaghan	4	Training update numbers	Org	No			1 2 5 10 13		31	2.5	1
					Staff attitude	Staff	No					31	2.5	2
					Staff knowledge of policy and equipment	Staff	No					31	2.5	2
					Number of patient assts completed	Staff	No					31	2.5	1
11	30	1998	Alexander	2	Quantitative survey of risk perceptions	Staff				1 2 6 11 13 16		50	5	2
					Semi structured interiews of managers	Staff	Yes	Yes	Yes			50	5	2
12	40	1999	Paternoster	1	Level of correctness of completed task	Staff	No			5 18		31	2	2
13	42	2001	Daynard	3	Biomehanical loading for peak force	Staff	Yes	Yes	Yes	2 5		81	5	2
					Biomechanical loading over time	Staff	Yes	Yes	Yes			81	5	2
					Compliance with methods taught	Staff	Yes	Yes	Yes			81	5	2
14	43	1981	Daws	2	Injury Data .	Staff	No				5	31	2.5	3
					Questionnaire on attitudes on eqpt, training etc	Staff	No					31	2.5	1
15	48	1999	Fanello	2	Semi structured questionaire for LBP	Staff	Yes	NS			5	80	5	2
					Semi structured questionaire for Absence	Org	Yes	NS				80	5	2
16	50	1999	Torri	3	Risk exposure measurement	Staff	No			2 5		50	4	2
					Health surveillance	Staff						50	4	3
					Sickness absence	Org	No					50	4	3
17	52	2001	Collins	1	Injury rates	Staff	No			1 5 12 13 14		52	5	3
18	54	2001	Engkvist	1	MSD Risk factors	Staff	Yes	Yes	Yes	2 5		100	5	2

19	55	2000	Lynch	4	Changes in Work practice/method	Task	Yes	Yes	Yes		5	50	3.5	2
					Self reported knowledge	Staff	Yes	Yes	Yes			50	3.5	2
					Observed practice	Staff	No					50	3.5	2
					Back injury statistics	Staff	No					50	3.5	3
20	56	2000	Dietz	3	Staff perceptions - semi struct interview	Staff	No				5	33	3.5	2
					Documentation review	Org	No					33	3.5	1
					Staff performance	Staff	No					33	3.5	2
21	57	2001	Nussbaum	3	RPE	Staff	Yes	Yes	Yes		5	59	3	2
					Postures	Staff	Yes	Yes	Yes			59	3	2
					Forces	Staff	Yes	Yes	Yes			59	3	2
22	62	1989	Tuffnell	1	Changes in method completed	Staff	No			5 10		29.5	1.5	2
23	63	1987	Troup	1	Task performance by the staff	Staff	Yes	Yes	Yes		5	54	3	2
24	64	1996	Foster	1	Self reported changes in practice	Staff	No				5	57	2.5	2
25	66	1997	Best	4	Back pain Questionnaire	Staff	Yes	Yes	Yes		5	70	3	2
					Handling behaviour OWAS	Staff	Yes	Yes	Yes			70	3	2
					Patient comfort	Patient	No					70	3	2
					Sickness absence	Org	Yes	NS	Yes			70	3	3
26	69	1993	Feldstein	1	Back pain	Staff	Yes	Yes	Yes	5 18		68	4	3
27	70	1998	Caska	1	Injury rates	Staff	No				17	69	4	3
28	78	1998	Billin	1	Injury rates	Staff	No			2 5		54	2	3
29	79	1997	Goodridge	2	Injury rates	Staff	No			2 13		44	3.5	3
					Compliance with audit	Staff	No					44	3.5	1
30	81	1997	Lagerstrom	2	Subjective assessment of programme	Staff	Yes	Yes	Yes	2 5 18 19		76	3.5	1
					Prevelance of MSD	Staff	Yes	NS	Yes			76	3.5	3
31	82	1999	Evanoff	4	MSD Risk factors	Staff	Yes	Yes	Yes	1 3 4 6 7 9 10		58	5	2
					Lost time injuries	Org	Yes	Yes	Yes			58	5	3
					Compensation costs	Org	No		Yes			58	5	3
					Psycho social stressors	Staff	Yes	Yes	Yes			58	5	2
32	83	1996	Dixon	1	Staff sickness	Staff				2 5 10		20	3	3

33	86	1992	Garg	5	Biomechanical model	Staff	Yes	Yes	Yes	1 2 5		63	5	2
					RPE	Staff	Yes	Yes	Yes			63	5	2
					Acceptability of equipment stff perception	Staff	No					63	5	1
					Injury rates	Staff	No					63	5	3
					Time taken to complete	Task	Yes	Yes	Yes			63	5	1
34	87	1997	Charney	2	Lost time from injuries,	Org	No				17	72	4	3
					compensation costs	Org	No					72	4	3
35	90	1996	Entwistle	2	Sickness absence	Org	No			2 5 10 13 22		35	3	3
					Patient comfort	Patient	No					35	3	2
36	94	1993	Oddy	1	Elimination of drag lift	Staff	No			3 6 10 13		50	3.5	2
37	99	1985	Rodgers	1	Staff risk perception	Staff	No				5	38	3.5	2
38	116	2000	Wood	4	Staff skill	Staff	No				5	46	3.5	2
					Accuracy of risk asessments/mobility	Staff	No					46	3.5	2
					Staff perceptions	Staff	No					46	3.5	2
					Staff injuries	Staff	No					46	3.5	2
39	117	1987	Johnston	2	Perception of Risks	Staff	No				5	43	3.5	2
					Risk assessment process and info	Staff	No					43	3.5	2
40	123	1995	Hignett	1	Nurses perceptions	Staff	Yes			1 3 5 6 7 9 10		81	4.5	2
41	130	1999	Knibbe	1	Log of pre and post task numbers	Staff	Yes	Yes	Yes		2	83	5	2
42	134	1993	Scopa	1	Compliance with WRBME	Staff	Yes	NS	Yes		5	65	4	2
43	136	1983	Scholey	1	Intra-abdominal pressures	Staff	Yes	Yes	No		5	78	2	2
44	137	1989	St-Vincent	1	Observation tool for posture movement	Staff	Yes	Yes	Yes		5	70	4.5	2
45	138	1983	Stubbs	3	Intra-abdominal pressures	Staff	Yes	Yes	Yes		5	55	4.5	2
					Nurse Comfort	Staff	Yes	Yes	Yes			55	4.5	2
					Intra-abdominal Pressure 2nd test	Staff	Yes	NS	Yes			59	4.5	2

46	140	1998	Pohjonen	3	Posture owas	Staff	Yes	Yes	Yes	1 2 3 7 9 10 11		58	4.5	2
					Heart rate	Staff	No					58	4.5	2
					Work ability index	Staff	Yes	Yes	Yes			58	4.5	3
47	149	1991	Nyran	3	Injury Rates	Staff	No		Yes	1 2 4 5		65	4	3
					Lost Time Claims	Org	No		Yes			65	4	3
					Subjective views of managers	Staff	No					65	4	2
48	151	1992	Miller	1	Questionnaire. Subjective responses of carers	Staff	No			1 5 10		50	3.5	2
49	153	1997	Menckel	2	Accident reports and feedback	Org	No	No	Yes	1 2 5 8		63	4	2
					Number reports completed	Org	No	No	Yes			63	4	2
50	162	1987	Wachs	1	Compliance with standards	Staff	No		No		5	86	5	2
51	163	1987	Wood	2	Injuries	Staff	Yes	Yes	Yes	5 8		56	4	3
					Lost time	Org	Yes	Yes	Yes			56	4	3
52	165	1988	Videman	3	Skill assessment	Staff	Yes	Yes	Yes		5	41	3.5	2
					Back Pain	Staff	Yes	Yes	Yes			41	3.5	3
					Subjective workload	Staff	Yes	Yes	Yes			41	3.5	2
53	172	1989	Ljungberg	5	HR / VO2	Staff	Yes	Yes	Yes	2 6 7		65	4	2
					RPE	Staff	Yes	Yes	Yes			65	4	2
					Lift force	Staff	Yes	Yes	Yes			65	4	2
					Lift exposure/freq	Staff	Yes	Yes	Yes			65	4	2
					Postures	Staff	Yes	Yes	Yes			65	4	2
54	176	185	Kilbom	2	Forces on staff	Staff	No		Yes	2 6 7		27	3	2
					Time taken	Task	No		Yes			27	3	1
55	179	1996	Head	3	Injuries	Staff	No		Yes	1 2 3 5		28	3.5	3
					Lost time	Org	No		Yes			28	3.5	3
					Cost	Org	No		Yes			28	3.5	3
56	180	1993	Hellsing	3	Training Outcomes	Staff	Yes	NS	Yes	5 18 19		58	3.5	1
					Back Pain	Staff	Yes	NS	Yes			58	3.5	3
					Observed compliance with teaching	Staff	Yes	NS	Yes			58	3.5	2
57	187	2002	Larthe	1	Days lost	Org	No			1 5 8 10 13		22	2	3
58	188	2004	Engst	4	Resident agitation	Patient	Yes	Yes	Yes	1 2 5 7		63	4	2
					MSD exposure score	Staff	No					63	4	2

					Perception of MSD risk	Staff	Yes	Yes	Yes			63	4	2
					PH incidents	Staff	No					63	4	3
59	198	1991	Charney	2	Injury Rates for Staff	Staff	No		Yes		17	37	2	3
					Financial impact	Org	No		Yes			37	2	3
60	199	1993	Charney	2	Injury Rates for Staff	Staff	No		Yes		17	61	3.5	3
					Financial impact	Org	No		Yes			61	3.5	3
61	207	1986	Alavosius	2	% tasks performed safely	Staff	No			5 8		39	3	2
					Subjective feedback of intervention	Staff	No					39	3	2
62	208	1998	Aird	1	Injury rates	Staff	No			Hosp 2 5 9 12 18 20 21/ NH 1 3 5 13		44	4	3
63	210	2006	Nelson	7	Injury rate	Staff	Yes	Yes	Yes	1 2 10 13 23		70	5	3
					Lost days and modified days	Org	Yes	No	Yes			70	5	3
					Job satisfaction	Staff	Yes	Yes	Yes			70	5	2
					Self reported unsafe acts (compliance)	Staff	Yes	Yes	Yes			70	5	2
					Cost benefit	Org	No		Yes			70	5	3
					perceived effectiveness of intervention	Staff	No		Yes			70	5	2
					Perceived support of organisation (Culture)	Staff	No		Yes			70	5	1
64	211	2003	Smedley	3	Low back pain	Staff	Yes	Yes	Yes	2 7 10 23		70	4	3
					Psychosocial stress	Staff	Yes	Yes	Yes			70	4	3
					Number of unassisted transfers(compliance)	Staff	Yes	Yes	Yes			70	4	2
65	212	2003	Evanoff	2	Injury rate	Staff	Yes	Yes	Yes		2	26	3	3
					Lost Time	Org	Yes	Yes	Yes			26	3	3
66	213	2005	Fujushiro	2	MSD Rate	Staff	Yes	Yes	Yes	1 2		63	4	3
					Days lost	Org	Yes	Yes	Yes			63	4	3
67	217		Mughal	4	Injury data No claims	Org	Yes	No	Yes		2	48	4	3
					Days lost	Org	Yes	No	Yes			48	4	3
					Subjective staff	Staff	Yes	Yes	Yes			48	4	2

					Subjective Patient safety	Patient	Yes	No	Yes			48	4	2
68	219	1998	Nicholls	2	Observation checklist	Staff	Yes	Yes	Yes		5	41	4	2
					Training evaluation questionnaire	Training	No					41	4	1
69	225	2003	Hefti	3	No Injuries	Staff	No			1 2 7 17		44	4	3
					Days lost	Org	No					44	4	3
					Costs of injuries	Org	No					44	4	3
70	226	2002	Crumpton	2	Risk exposure (stady meter)	Staff	No				2	56	4	2
					back pain MSD (SF36)	Staff	No				3	56	4	3
71	228	2002	Ronald	1	MSD rates per 100 000 hours	Staff	Yes	NS	Yes		2	63	3	3
72	232	2007	Morgan	1	Costs	Org	No			1 5 10 12 15 24		30	3	3
73	240	2006	Millar	3	Risk perception	Staff	Yes	Yes	Yes		2	59	4	2
					Comfort	Staff	Yes	Yes	Yes			59	4	2
					Injury costs	Org	No					59	4	3
74	241	2006	Knibbe	4	Exposure to hazards	Staff	No			10 25		74	5	2
					Prevention strategies/Compliance Policy mirror	Org	No					74	5	2
					LBP	Staff	No					74	5	3
					Sick leave	Org	No					74	5	3
75	245	2001	Pearce	2	Lost time	Org	No			12 20		42	4	3
					Pain reporting	Staff	No					42	4	2
76	246	2007	Wardell	2	Staff perception	Staff	No			1 2 5 10 23		44	4	2
					Injury Rate	Staff	No					44	4	3
77	247	2006	Hye-Knudson	1	Compliance / skill (Warming tool	Staff	Yes	Yes	Yes		5	52	2	2
78	248	2006	Charney	3	Injury Rates	Staff	No			2 5 10 12 24		52	4	3
					Time lost	Org	No					52	4	3
					Costs	Org	No					52	4	3
79	251	2003	Passfield	2	Injury Rate	Staff	Yes	Yes	Yes		10	67	4	3
					Costs	Org	Yes	Yes	Yes			67	4	3

80	254	2001	Yassi	4	Number lifts observed	Staff	Yes	Yes	Yes	2 5 10		67	4	2
					Subjective assessment of work effects	Staff	Yes	Yes	Yes			67	4	2
					Pain/discomfort	Staff	Yes	Yes	Yes			67	4	3
					Injury rate	Staff	Yes	NS	Yes			67	4	3
81	255	2002	Johnsson	3	Method assessment (Compliance)	Staff	Yes	Yes	Yes		5	70	4	2
					RPE	Staff	Yes	Yes	Yes			70	4	2
					Patient comfort	Staff	Yes	Yes	Yes			70	4	2
82	256	2006	Engkvist	5	Use of Equipment	Staff	Yes	Yes	Yes	1 2 5 9 10 13 15 23 24		73	3	2
					RPE/fatigue	Staff	Yes	Yes	Yes			73	3	2
					Pain Discomfort	Staff	Yes	Yes	Yes			73	3	3
					Injury rates	Staff	Yes	Yes	Yes			73	3	3
					Time lost	Org	Yes	Yes	Yes			73	3	1
83	259	2006	Garg	1	Number injuries	Org	No				10	30	4	3
84	262	2004	Keir	2	EMG	Staff	Yes	Yes	Yes	2 7		52	4	2
					Time product	Staff	No					52	4	1
85	263	2005	Chokhar	2	MS injury rate	Staff	Yes	Yes	Yes	2 5 10		91	4	3
					Costs	Org	Yes	Yes	Yes			91	4	3
86	265	2005	Engst	3	Risk Perception	Staff	Yes	Yes	Yes	2 5 10		59	4	2
					Comfort	Staff	Yes	Yes	Yes			59	4	2
					Injury Costs	Org	Yes	Yes	Yes			59	4	3
87	267	2004	Siguardsson	1	Costs	Org	No				2	11	2	3
88	268	2001	O'Reilly	3	No LBP injuries	Staff	No			1 4 5 12 24		44	3	3
					Lost work days	Org	No					44	3	3
					Costs	Org	No					44	3	3
89	280	2002	Owen	5	Patient security	Patient	Yes	Yes	Yes	2 5 13		41	4	2
					Patient comfort	Patient	Yes	Yes	Yes			41	4	2
					Injury reports	Staff						41	4	3
					RPE shoulder	Staff	Yes	Yes	Yes			41	4	2
					RPE back	Staff	Yes	Yes	Yes			41	4	2

90	281	2006	Joseph	1	Costs	Org	No				2	33	3	3
91	284	2003	Griffiths	1	MH Incidents	Org				5 15 23		22	1	3
92	289	2005	Murphy	4	Postures REBA	Staff	No				2	26	3	2
					Number tasks observed	Staff	No					26	3	2
					MSD symptoms	Staff	No					26	3	2
					Patient subjective ratings	Patient	No					26	3	2
93	293	2006	Michaelis	4	Competence/ completed new methods	Staff	No			2 5 7 8 23		48	3	2
					Perceived work load	Staff	Yes	Yes	Yes			48	3	2
					Back pain	Staff	Yes	Yes	Yes			48	3	3
					Sickness absence	Org	Yes					48	3	3
94	294	2005	Hartvigsen	1	Back pain	Staff	Yes	NS	Yes		5	59	3	3
95	296	2004	Collins	3	Workers compensation claims	Org	Yes	Yes	Yes	2 4 5 10 12		59	5	3
					Lost work days	Org	Yes	Yes	Yes			59	5	3
					Cost benefit analysis	Org	Yes	Yes	Yes			59	5	3
96	299	2001	Best	1	Claims	Org	No			1 2 5 8 10 15		46	2	2
97	303	2004	Victoria Aus	2	Nurse claims	Org	No			2 10 23 24 25		33	4	3
					Cost benefit analysis	Org	No					33	4	3
98	308	2008	Bar-Niv	3	Biomech load	Staff	Yes	Yes	Yes	5 8		26	2	2
					Psychosocial stress questionnaire	Staff	yes	NS				26	2	2
					MSD (nordic)	Staff	Yes	NS				26	2	2
99	311	2008	Warming	2	Back pain injuries	Staff	Yes	NS		5 18		89	5	3
					Severity of back pain	Staff	Yes	Yes	Yes	5 18		89	5	3
100	324	2004	Guthrie	5	Injuries	Staff	No			2 5 17		37	4	3
					Costs	Org	No					37	4	3
					Compliance	Staff	No					37	4	2
					Patient satisfaction	Patient	No					37	4	2
					Staff satisfaction	Staff	No					37	4	2
101	328	1997	Engels	1	Errors	Staff	Yes	Yes	Yes		5	59	3	2

APPENDIX C

Documentation for Focus Groups

i. **Ethics proposal permission statement**

ii. **Focus Group Scenario (Health)**

iii. **Focus Group Scenario (Social)**

iv. **Data Collection Sheets**

v. **Information Sheet for Facilitator**

i) Ethics proposal permission statement.

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ii) Focus Group Scenario (Healthcare)

You have recently been appointed as a patient handling advisor in a healthcare service provider. You have been requested to investigate the patient handling situation on Laurel Ward as they have reported a high rate of musculoskeletal problems in the staff, a poor performance on patient satisfaction scores and they recently performed poorly in a Health and Safety Management Audit.

Description of the Unit

The unit has 64 beds spread over two distinct care areas, Laurel A and Laurel B. All the care is delivered in single bed rooms with en-suite facilities. The unit delivers care to people with serious medical and neurological needs and has primarily older people in residence at the present time.

The handling needs of the patients are varied. They range from some that are dependent on the carers for all activities of care and movement, through a variety of conditions and levels, to some patients that require only monitoring or supervision and receive little physical assistance.

Laurel A has traditionally managed higher dependency patients than Laurel B

Staffing

There is a staff of 60 wte to fulfil the care delivery in this unit. Due to the nature of the workforce there are 90 individuals involved in the staff rota.

The staff breakdown is as follows:

Unit manager (Runs the unit and reports to the director of Nursing.)
2 x Senior (Sisters that manage the operational aspects of the units.)
10 x Senior Nurses
31 x Nurses
40 x Health Care Assistants
4 x Domestic Assistants
1 x Part-time Physiotherapist
1 x Part-time Occupational Therapist

Many other people deliver services to the unit but these are the only ones employed directly within the unit.

Patient Handling Information

- The unit has a Patient Handling Risk Assessment system.
- They have a hoist in each area and a small selection of slings.
- They have some small aids that are kept in the linen cupboard.
- The unit manager showed you some training records that showed that some staff had received training from a reputable source.

- The unit has a series of policies and working procedures for manual handling, occupational health, incident and accident reporting and Health and Safety

You are to be given a free license to identify the key points of a new risk management system and the finances will be made available to support your proposals and help with implementing the system.

The Scenario for you to Consider

You have carried out a series of detailed onsite visits with analysis of all aspects of the patient handling system and have made a series of recommendations for changes including guidance on:

- Risk Assessment Processes and Documentation
- Policy changes
- The development of key personnel in the unit
- Provision of equipment
- Training
- The management of the health status of the staff with Occupational Health

You are to make a presentation to the Senior Management Team to gain the Boards support for your recommendations. They have specifically asked you to point out how you are going to justify the investment.

What items, qualities or objective measures will you measure before and after the implementation of your system, to prove the success of your recommendations?

Our research here at Loughborough University would suggest that you should consider:
Benefits for the organisation as a whole
Benefits for the staff delivering the care
Benefits for the patient receiving the care
Benefits to the quality/performance of the delivery of care

Are there any other outcome criteria that you might consider measuring to help prove your case?

iii) Focus Group Scenario (Long Term Care)

You have recently been appointed as a patient handling advisor in a long term care service provider. You have been requested to investigate the moving and handling of clients in the Laurels Care Home as they have reported a high rate of musculoskeletal problems in the staff, a poor performance on patient satisfaction scores and they recently performed poorly in a Health and Safety Management Audit.

Description of the Unit

The unit has 64 beds spread over two distinct care areas, Laurel A and Laurel B. All the care is delivered in single bed rooms with en-suite facilities. The unit delivers care to people with serious medical and neurological needs and has primarily older people in residence at the present time.

The handling needs of the clients are varied. They range from some that are dependent on the carers for all activities of care and movement, through a variety of conditions and levels, to some people that require only monitoring or supervision and receive little physical assistance.

Laurel A has traditionally managed higher dependency people than Laurel B

Staffing

There is a staff of 60 wte to fulfil the care delivery in this unit. Due to the nature of the workforce there are 90 individuals involved in the staff rota.

The staff breakdown is as follows:

Unit manager (Runs the unit and reports to the director of the care company.)
2 x Deputy Managers (that manage the operational aspects of the units.)
10 x Senior Carers (That act as senior staff and shift supervisors)
31 x Carers (All have been through the NVQ3 programme)
40 x Care Assistants
4 x Domestic Assistants
1 x Part-time Physiotherapist
1 x Part-time Occupational Therapist

Many other people deliver services to the unit but these are the only ones employed directly within the unit.

Moving and Handling Information

- The unit has a Manual Handling Risk Assessment system.
- They have a hoist in each area and a small selection of slings.
- They have some small aids that are kept in the linen cupboard.
- The unit manager showed you some training records that showed that some staff had received training from a reputable source.

- The unit has a series of policies and working procedures for manual handling, occupational health, incident and accident reporting and Health and Safety

You are to be given a free license to identify the key points of a new risk management system and the finances will be made available to support your proposals and help with implementing the system.

<u>The Scenario for you to Consider</u>

You have carried out a series of detailed onsite visits with analysis of all aspects of the patient handling system and have made a series of recommendations for changes including guidance on:

- Risk Assessment Processes and Documentation
- Policy changes
- The development of key personnel in the unit
- Provision of equipment
- Training
- The management of the health status of the staff with Occupational Health

You are to make a presentation to the Senior Management Team to gain the Boards support for your recommendations. They have specifically asked you to point out how you are going to justify the investment.

What items, qualities or objective measures will you measure before and after the implementation of your system, to prove the success of your recommendations?

Our research here at Loughborough University would suggest that you should consider:
Benefits for the organisation as a whole
Benefits for the staff delivering the care
Benefits for the person receiving the care
Benefits to the quality/performance of the delivery of care

Are there any other outcome criteria that you might consider measuring to help prove your case?

iv) Focus Group data Collection Sheet (1) Code

Benefits to:	Outcome, Quality, Quanitity or Risk Identified	Give examples of the actual quantity you would observe or record
E.g. Staff benefit	Hazardous Postures	REBA, OWAS, Angle of inclination of trunk
The Organisation		
The Staff		
The person being cared for.		
The performance of the care tasks		
Other issues		

iv) Focus Group data Collection Sheet (2) Code

Benefits to:	Outcome, Quality, Quanitity or Risk Identified	Give examples of the actual quantity you would observe or record
E.g. Staff benefit	Hazardous Postures	REBA, OWAS, Angle of inclination of trunk
The Organisation		
The Staff		
The person being cared for.		
The performance of the care tasks		
Other issues		

iv) Focus Group Data Collection Sheet (3)

Using the items you have identified in column 2 of the previous two tables.

Outcome, Quality, Quantity or Risk Identified

Could you identify the 5 most important outcomes from the perspective of your role as a handling advisor. Please record them in the table in rank order where 1 is the most important in ranked order the 5 most important outcomes that you have discussed today

Ranking	Outcome, Quality, Quanitity or Risk Identified
1 Most important	
2	
3	
4	
5	

v) Instructions for Focus Group Facilitator

Circle or Square table
Microphone
Sheets
Tea Coffee Biscuits

1. Tea/Coffee on entrance

2. Introduction to Group

3. Consent Forms.

4. Personal History

5. Outline the scenario and allow to read BLACK PENS

6. Give data collection (1) Collect in and list top 5 points in each category plus any unusual or needing explanation. Give back to participants.

7. Develop discussion
8. The facilitator should try and ask the group the following series of questions:
   a. Why do you think that issue is important.
   b. How would you measure that in a real working situation
   c. Have you tried to use that measure in an intervention.
   d. Do you think senior management will appreciate that measure

9. Give data collection (2) Allow participants to add further information to second sheet as it comes up ? Different coloured pens for sheet 2

10. 15 minutes for each set of criteria plus any others

11. Question sheet (3). Ask the group to rank the top 5 in ascending order. Collect the sheets and thank the group for their participation

12. Tea coffee, expenses etc

13. Feedback on the focus group and the different phases.

Section	Outcome for discussion

APPENDIX D

Field Notes for Pilot Studies

Field Notes for UKAH Pilot Study

Observer - Anna Jones
Notes:

Organisational Data

Incidents and accidents- easier to collect

Sickness absence

- Organisations do not keep figures to access
- Datex system -3-4 months before available in the system
- Sometimes incorrectly coded e.g. patient assault coded as patient handling
- A couple of the group had recorded sickness absence case by case
- Some monitor on an annual basis – but 6 months after any financial assessment
- Need a year before there is any reliable data.
- Systems change so long-term data comparisons difficult to find
- Can get incident hotspots –type of wards, type of sickness, can look at trends, can get costs, not NHS wide system
- Some people work through sickness so not in data – need measure
- Powerful measure but difficult to measure
- Financial impact

Replacement and retention – Staff turnover, recruitment, people leave for lots of reasons- reasons given not always true, data could not be used alone. People move to other jobs to avoid injuries e.g. older peoples wards tend to be very heavy workload.

Staff morale – linked with job satisfaction - too complex for measurement. Some organisations are constantly advertising jobs, why is this.

Turnover rate – measure over entire Trust – Is there a level of expectation?

Bed-blocking – discharging less patients because of manual handling problems. Discharge from one organisation to another can't because of MH problems.

Poor practice and targets – compromise – adhere to poor practice to meet targets – people do not follow protocols.

Policies – not adhered to – is it monitoring that is needed – managers not aware of policies – compliance not good – people don't follow policies, most accidents would be avoided if followed policy.

Staff Data

Staff don't fill in incident reports – too busy – incident reporting not effective. Sometimes over-reporting e.g. 24 reports in 24 hours, for 3 incidents.

Name on a piece of paper, people don't report as they don't want ownership – link with culture.

Staff satisfaction linked with staff turnover – if staff valued then greater productivity, not always negative.

Staff treatment service – referred to physio home or work – measure number of people that use the service and how much longer staff could wait for service if not staff access.

Return to work – improve transition back to work, very positive feedback

Measure staff fatigue – compare old methods with new methods

Measures of physical work
- Task error measure
- Manual handling stress different day-to-day
- Workload measure Glenfield Hospital successful system
- To configure staff systems
- Complex system may not always be filled in
- Sometimes not give true picture of whole thing
- Meaningless to staff
- Could measure without such labour intensive methods

Training – Scrapped ? – doesn't work – management? – Changing practice on ward, is it any different to training outside ward, people get called away from the sessions.

Observation of staff PH – What are they doing – What equipment are they using – Minimising risk – problem solving.

<u>Patient Data</u>

Complaints – info about patient being moved – injuries to patient – M&H staff issue not a patient issue - don't get much info about patient injuries, incidents or complaints – only get incidents when everything has gone wrong. H&S depts. Are different to patient safety depts..

Patient independence – can be about equipment – profiling beds – enough therapeutic input – promoting independence – patient specific – don't automatically help patient.

PH issues related to patient care
- Delay
- Learn – then get faster
- Having equipment available
- People have to be invested in
- Not just staff problem – important for patient care
- Good manual handling determines good patient care
- Core skills but in present system is bolted on to other skills

- ‘Box in factory more care than patient in hospital’

Other Data

Staff time on wards - Have a good system and save staff

Electric beds implies good system for saving staff time and promoting independence.

Field Notes for UKLT Pilot Study

Observer – Sue Hignett
Notes:

Process

Consent e-mailed in advance
Introduction - round table – each station numbered
Tapes switched on (2 for backup)
Scenario to read individually
Context described, located in literature review.
Pro-forma handed out after 20 mins.
MF reviewed key points to give prompts for discussion (10 mins)
2nd sheet, discuss issues raised and if you hear a good idea, then add to the blue sheet

Measures used in practice

1. Tests as part of training – problem solve – activity – assessment of performance – evaluation of training, reaction to the session
2. Follow up training in workplace with observations
3. M&H audit of establishment – relies on 3rd hand (managers) opinion
4. Numbers for training – Not interested in outcomes – impact of training – effectiveness
5. Quantity versus quality
6. Income generation for organisation

Organisational benefits

About losses to organisation, aims to decrease MSD

Sickness absence

- V difficult to get figures
- Confidential, anonymous
- Bradford Score (PCT)
- Cause of sickness absence not always recorded
- Lack of detail in report
- Lack of knowledge by data inputters. What is MSD? What is other?
- Records periods or episodes

Financial

- Legal costs
- Recruitment – retention – retrain

- Sickness absence
- Claims
- Losses spread between many budgets therefore hidden

HSE prosecutions
- Outcome – lack of prosecution / HSE action
- Use as levelr for intervention, not as an actual outcome

Staff Morale
- Don't know how to measure, but sure it's a benefit
- Communication improves at all levels, expectations of self and others, archival document analysis e.g. minutes of meetings
- Better patient care
- Decease stress – related problems
- Decrease in-house bickering
- Improve recruitment
- Psychological measure – feel appreciated

Thoughts (Observer)
For non-english focus groups suggest have pilot in English for facilitator to understand process
2 stage focus group to get 1st proforma translated before discussion and so you can prepare / discuss prompts with facilitator before group. Supply lunch to allow for translation.

<u>Staff benefits</u>

- Measures usually sickness absence, for organisational measures.
- Fatigue
- Avoidance of ill-health, not prevention of illness/injury/ health promotion
- Occupational health data
- Ability to comply with training – peer pressure – observations – audit handling plans (not staff benefit)
- Staff confidence link with morale. Supports safe system of work
- Other measures – skills, postures, use of equipment, decision making, interactions with patients, competency
- Improve job satisfaction – secondary measure – based on primary measure, e.g. sickness absence, turnover etc

<u>Patient benefits</u>

Injuries to patient – lots of unreported e.g. bruising, laceration from hoists, falls. Falls is a patient handling issue (PCT) – factors that indicate patient is at risk and needs proactive systems e.g. movement indicator in bed – some PH methods encourage falling.

Improved independence – How to measure in the scenario? – Dependency levels – small goals /steps target setting / achievement in programme – decreased recovery time with rehabilitation and mobility

Quality of care –

- How to measure – but would be a very good outcome.
- Covers lots of areas, hygiene, food, interactions etc expectations
- Target of inspections
- Survey visitors and relatives
- Essence of care programme

Consistency
- Sticking to care plan
- Across different care givers
- Continual re-assessment
- Staff morale, working together

<u>Performance measures</u>

Decrease in incidents
Efficiency – quicker or better – decrease effort and not time link with staff or organisational outcome
Equipment availability, appropriate equipment, continuity of effort through use of equipment/machine, Need to measure how skills are maintained
Safety culture – custom and practice

APPENDIX E

Focus Group Data

i. UKAH – UK Acute Health
ii. UKLT – UK Long Term Health
iii. EXPA – Expert Athens
iv. EXPB – Expert Boston
v. Fi – Finland Group
vi. Po – Portugal Group
vii. It – Italy Group

UKAH – UK Acute Health

Page	Content	Outcome Theme
	<u>Organisational</u>	
2	Organisations do not keep records	MSD absence
3	Identification of hot spots MSD sickness absence needs to include MSD an still working. Not an absolute measure.	MSD absence
4	Need record of those leaving due to MSD Redeployment	Recruitment / retention
5	Feel like the organisation does not care Feelings filter through organisation Measure of job satisfaction	Morale Morale
6	Bed blocking Discharge management from outlook of patient and organisation	Bed blocking
	Appropriate PH discharge planning	Bed blocking
8	Compliance as an organisational issue as it leads to complaints and claims	Compliance
9	Compliance with policies procedures Organisational culture versus individual behaviour CNST	Policy procedures Compliance Audit
	<u>Staff</u>	
12	Incident and accident records, good record of problems	Accident reports
14	Management culture/ working culture and reporting or not reporting	Culture
15	Job satisfaction and staff felling valued	Psychosocial factors
16	Treatment services for injured staff, Numbers of referrals	MSD levels
18	Return to Work assessments Fatigue at work and subjective assessments of workload	MSD levels Psychosocial factors
19	Workload even across staff Workload relative to patient dependencies Staffing or understaffing based on workload	Workload

20	Perception of workload, forces and posture	Perception of workload
21	‘Organisational socialisation so training by itself is never going to work’ On site supervision Enforcement of best practice	Best practice
	Management responsibility for safe behaviour	Culture
25	Measure compliance by organisation	Compliance
26	Competent and compliant for best practice	Compliance
	<u>Patient</u>	
26	Complaints from patients	Patient injuries
27	Fracture to a patients arm from PH	Patient injuries
	‘Patient handling is a staff issue not a patient issue’	Organisational perception
29	Tissue viability measures Infection control outcomes Patient independence	Patient condition
	<u>Task performance</u>	
35-40	Management styles in organisations and the level of support given to PH. PH a core skill but largely ignored.	Management responsibility
41	Time taken to complete PH tasks.	Time taken
42	Supervision as route to compliance via observation	Compliance

UKLT – UK Long Term Health

Page	Content	Outcome Theme
	<u>Organisations</u>	
2	Completion of risk assessments	Risk assessment
	Competence through observations	Competence
	Consideration that organisations don’t want outcomes	Culture
		MSD records
	Difficult to get sickness outcomes from organisations	
		MSD causes
	Need causes of MSD	
3		MSD records
	Bradford Factor as measure of sickness absence	

	Set trigger point and interview all staff higher than trigger	
5	MSD costs, staff salaries and replacement costs, claims costs	MSD costs
6	MSD costs for recruitment and re-training Costs difficult to use as embedded deep in the organisation	MSD costs
7	Prosecution by enforcing authority HSE	MSD costs
9	Complaints	Complaints
10	Morale and positive communication/feedback	Morale
10-11	Psychological factors recorded by staff survey How do staff feel about the workplace	Psychosocial factors
12	Feeling valued, positive psychological environment	Well being
13	<u>Staff</u> Fatigue	Fatigue
	MS damage to staff MS health, fitness to work	MSD
	Subjective assessment of effort (Borg) and workload	Workload/ Psychosocial
15	MSD health status recorded by occupational health services In UK occupational health seen as treatment service, not management of problems, not improving health	MSD level
17	Some PHA record levels of MS health as part of training sessions. Are they fit to do the course and are they fit to work	MSD level
18	Links between occupational health data and MS health	MSD
19	Reluctant to attend occupational health as links with hiring and firing	Occ health
	Numbers of referrals to physio treatment services	MSD numbers
20	Compliance by observation	Compliance
	Compliance measured against handling plan Could complete handling plan audit to include RA, PHRA and PHP	Audit
21	Staff confidence with PH methods	Morale

22	Staff observations on wards and experimenter effect	Compliance
23	Audit and observation in home care situations	Compliance
23-24	How do organisations deal with non-compliance	Compliance
25	Competency by observation, measured with effective movement	Competence
26	Difficult to record and score staff attitude	Attitude
27	Patient Damage to patient, bruising, lacerations, falls	Patient injuries
28	Patient condition measured by independence and mobilisation	Patient condition
29	Recording dependency levels	
31	Relationship between level of dependency and demands on staff time and numbers and the ability to keep patient in certain areas for care	Workload/ staffing levels
33	Dignity in care tasks	Quality of care
36	Essence of care programme and quality of care measures Quality of care as patient and relative assessment	Quality of care
38	Consistency of movement leads to confidence from patient	Patient perception
39	Compliance and communication leads to consistency of PH	Consistency
40	Reduction in numbers of accidents	Incident numbers
41	Efficiency is a difficult quality to measure	Workload
42	Decreased effort	Workload
43	Remove or change methods of completing tasks, number of lifts, number of transfers	Workload
44-49	‘Custom and practice’. How does it effect culture and behaviour	Safety culture
50	Safety culture and links with morale	Morale

EXPA – Expert Athens

Page	Content	Outcome Theme
	<u>Organisation</u>	
1	MSD sickness absence as main outcome potentially difficult	MSD absence
2	Lack of specific MSD data in many organisations Some countries get good data but then don't use it 2-4 years to see effects of interventions Due to difficulties MSD not high on list of outcomes	MSD
3	Ability of MSD numbers to work as a measure. Need to consider functionality or workability	MSD
	Productivity as a measure	Productivity
4	Use health surveillance to measure MS health status Include capacity versus incapacity	MS Health
5	MSD absence is very important as links with costs and cost benefit	MS costs
	Could consider work available per staff member	MS measure
6	Government audits	Audit
7	Maintain staff health, job satisfaction and improve morale	Psychosocial factors
	Large under-reporting of accidents	Accidents
8	Quality of care. Includes accidents, claims, PH problems	Quality of care
	Cost benefit analysis is important measure but difficult to calculate	Costs
9	Quality of care calculated by incontinence accidents, pressure sore score, immobilising patients, discharge of patients, patient satisfaction (Holland)	Quality of care
10	Is quality of care different for each different ward area or type of care	Quality of care
11	Quality of care targets have an effect on workload	Quality of care
	<u>Patient</u>	
11	Patient perception of PH should be bad mechanical equals bad manual	Patient perception

12	(Finland) Manual methods used to improve patient movement Increases number of patients treated actively	Rehabilitation
13	Pressure sores	Patient condition
	Staff	
14	Measures for outstanding risk exposure	Risk scores
	(Holland) Risk review system government sponsored	Risk review
	Nordic questionnaires	MSD level
17	It is a big problem to compare our studies because we all have different scoring systems	Outcome comparison
17	MSD numbers and insurance company data	MSD numbers
18	Skills and knowledge in staff	Competence
18-19	Competence and compliance as positive feedback. Needs to be local (Ergo-coach). Will be linked with safety culture as improves compliance and equipment use.	Competence, compliance
20	Task performance Compliance measured buy changes in practice due to the intervention	Compliance
	Staff numbers important for quality of many measures	Staff numbers

EXPB – Expert Boston

Page	Content	Outcome Theme
	Organisation	
1	(Bel/Ger/Port) Not able to measure MSD sickness absence due to legislation / government	MSD not recorded
1-2	Recording of MSD and causes (US and Australia)	MSD levels
2	Organisational safety culture	Safety culture
	Measure MSD by Nordic questionnaire (Ger)	MSD levels
	Belgium 1/12 sick pay from hospital before government pays	Costs of MSD

3	Cost benefit analysis most important cost vs intervention Claims and compensation Costs to government linked to drive to create prevention programme E.g. Aus, Observed the other drivers of change to get an intervention to work and calculate values of intervention.	Costs of MSD
	Retirement and recruitment costs, training costs for new staff	Costs of MSD
4	Young workers leave early (Port)	MSD costs
4	Assessing healthcare quality	Audit and quality
5	Government based audits and risk reduction systems	
	Staff	
6	Accidents , incidents, number of MSD, comfort or discomfort can all measure staff health with range of tools: questionnaires, surveys, VAS	MS health or injuries
	Used accident analysis in training or staff	Accident analysis
	‘Subjective assessment of work gives good value of risks’ How the people felt about the work.	Staff perception
9	Psychological factors and assessment	Psychological risks
	Worker assessment of workload and hazards	Staff perception
	Measures of force, postures etc as research to develop best practice	Physical measures
10	Concepts of worker satisfaction and complaints	Psychosocial measures
	Government legislation for worker health	Legislation
11	Physical measures very powerful, decrease time, effort, forces.	Physical measures
11-12	Productivity for staff numbers	Productivity
	Patient	
12	Quality of care	Quality of care
12	Patient damaged by skin tears, skin care, falls, clothing changes, linen changes from incontinence accidents	Patient condition
13	Link between falls and PH	Patient injuries

	Positive measure can be 'better chance' of recovery or lack of deterioration.	Patient condition
	Accident recording	Patient accidents
	Patient fear or anxiety	Patient perception
14-16	Measure patient function and patient independence to give very strong indicators for positive patient outcome	Patient independence
17	Efficiency, professionalism	Productivity
	Compliance and competency Did they do what we wanted them to? Did they have the skills to do it?	Competency and compliance
18	Competency could be part of audit tool	Competency

Fi – Finland Group

Page	Content	Outcome Theme
1	<u>Organisation</u> MSD injury affects the ward process and has a relationship with recruitment	MSD
	Low levels of MSD can affect whether people want to work in an area or not	MSD
	Good risk management and risk controls decrease workload and the staff notice the difference	Risk and workload
	Finland in a bad position with recruitment so use interventions as a positive image	Positive image
	Senior Nurse was involved in PH assessment, control and communication.	Commitment
	Co-operation and improved communication	Communication
2	'With discussion and involvement staff consider being cared for, able to participate in training and join in with ergonomics project'	Well-being
	Well being at work indicates need to draw attention to work load	Unable to separate psych and physical
	Various processes surrounding management	Organisational

	commitment. Everyone involved, everyone encouraged, management priorities.	commitment
3-4	Management commitment to systems and employee commitment is vital. Put courses on and staff do not attend.	Is PH a priority
	Staff considered that safer methods are slower. Get time pressure from peers.	Time factors
5	Very low ratio of staff to patients, problems with recruitment and retention	Staff numbers
6	Costs; personnel, staff expenses, overtime, occ health and treatment costs. Annual reports from personnel include absence costs and expense details	Costs
7	Risk assessment discussion; Different processes and levels included in risk assessment Regular follow up Economics review	Risk assessment
8	Difficult to collect accurate data Have used MAPO in FIOH intervention study	
8	<u>Staff</u> Accident reporting and recording	Accident reporting
9	Increase in accident reporting after intervention. Role of occ health and safety	
10	Length of periods of sickness absence	MSD absence
	Assessment system rates worker as 1-10 less than 5 unable to work	MSD absence
	Relationship between MSD absence and aging	MSD absence
	Difficult to measure changes in absence over short term probably over 2 years	MSD absence
11	Detailed description of how analysis of workload is compared to ‘fitness and health’	Workload and fitness
12	Physical exposure measures; video-recording and analysis, heart rate, posture, physical fitness, personal experiences,	Physical measures
13	Patient transfer skills. Experience in group of using assessment tool (SOPMAS).	Competence
14		Equipment

15	Provision of equipment across hospital wards and departments Need to record use of equipment Use does not imply safe behaviour record mis-use, non-use, lack of space for appropriate use	Use of equipment
16	<u>Patient</u> Safety and comfort Improve functional capacity of patient E.g. Physio staff in neuro-ward will not accept poor levels of handling as it affects the patient rehab Could patient handling affect the length of stay?	Patient perception Patient condition Length of stay
17	Quality of care. E.g. one hospital developing manual for quality of care in elderly care. PH is part of the manual. Patient functionality or capacity indicators based on diagnosed illness Patient injuries, patient accidents and falls	Quality of care Patient condition Patient injuries/ accidents
19	<u>Task performance</u> Quality of movement for transfer, smoothness of transfer Consistency assists patient to be involved in transfer Use of PHRA and PHP by the bed Documented and on daily report but nobody follows them	Competence Patient perception Risk assessment documentation
20	One example is mobility card that travels with patient Suggestion to use observations of techniques to plan training, make specific for each area Management support for improving practice; meetings, head nurses, training, skills development group, positive management attitude Note: group freely discussed interventions and needed to be guided to consider outcomes and measures. Some OM and OMT discussions lead by Facilitator and FIOH studies.	Competence link to training Organisational culture

Po – Portugal Group

Page	Content	Outcome Theme
	Organisation	
1	Example of audit for management system King's Fund system is used	Audit
2	Involvement of senior management in PH issues	Organisational culture
	Various systems in place for managing risk; dynamic elements, local risk manager, quality cabinet (working group), risk register, ISO18001, IQ4397	
3	MSD is not a priority in system even though last year MSD was very high	Priority
3	Health surveillance	MS health
4	Have measured some reductions in sick leave	MSD absence
4	Accident causation, loads, patients, equipment Recording does not split accidents and incidents Time delay of MSD effect after the incident hinders recording	Accident recording
5	One system has a classification system to link with worker compensation	Accident recording
	Important to classify cause and type of MS accident	Accident recording
	Staff	
6	Observation of PH behaviour	Competence
	Description of safe behaviour	Behaviour
7	Insurance companies have a critical role in MSD	Insurance
	Discussion relating to why safe behaviour is not seen in healthcare. Require policy, procedure, strategy, official visits, audit	Safety culture
8	Problems with safety culture from nurse education	Safety culture
	Overload of work and lack of equipment provision	Safety culture
	Recording and registering MSD	MSD numbers
9	Difficult to prove the cause of MSD	MSD numbers
10	Grade patients on levels of dependence Ratio of staff to level of dependence	Workload

11	Create staff numbers based on musculoskeletal demand?	Staff ratios
12	Hospitals may require government guidance via Risk Management Commission	Legislation
12	Observed differences between physiotherapists and nurses	Behaviour
13	Leadership and management role is important in safety culture	Safety culture
13	Patient / Staff Organisation is much more likely to consider patient satisfaction rather than staff satisfaction; complaints, discharge questionnaires, patient falls. Is this all part of quality of care	Patient satisfaction and quality of care
14	Government system for falls evaluation	Falls
	Quality of care measures; falls, pressure ulcers, comfort and quality	Quality of care
15	Is quality of care considered to be a negative reporting system	Quality of care
17	Culture of responsibility and hierarchy, managers, supervisors and staff	Organisation culture
18	Measuring physical capability	Staff health
19	Discussion of poor equipment provision esp. beds	Equipment
20-22	Return to work procedures for adapting work plus processes for replacement staff	Return to work

It – Italy Group

Page	Content	Outcome Theme
	Note: Due to the prevalence of medics in the group many of the participants will have undertaken MSD epidemiology studies, intervention studies and published.	
3	<u>Organisation</u> Considered the decrease spend on new equipment as a positive outcome	Spend on equipment

	Costs included: Health – MSD-Lost work time Requests for transfers Requests for part-time work	Costs
	Measure against expenses, training, equipment	Cost benefit
4	Insurance covers the first episode of back pain or injury only	Insurance for MSD
	Investigating accidents and incidents	Incident reporting
	Monitoring MSD by causation and identifying MSD from PH	Investigating accidents
5	Government involvement in health planning, resources and process	Culture
6	Require long term investment to get good results	Return on investment
	Organisation of hospitals use, occ health, risk managers. Require finance to set up interventions, ward trials with post intervention observations. Usually very long process 10 years, with long term network of people	Occupational Health
8	<u>Staff</u> MAPO scores to show risk exposure	Risk exposure
	Injury rates	MSD numbers
	Assessment of training via observation. Consider that improved handling = improved quality of care and reduced MSD	Competence
9	(Refocused the group on outcomes and outcome measures) Injury rates via health surveillance	MSD numbers
10-11	Complications of getting illness and injury causes in Italian system	MSD numbers
12	Discussion relating to data collection in MAPO Provision of suitable numbers and type of equipment	MAPO
13	Discussion of PHRA and PHP indicating sound solutions and equipment provision	Risk assessment
13	Skills for problem solving	Competence
14	Skills with aids	Competence
		Compliance

	Number of times the hoists are used	
15	Patient Comfort, privacy, number of lifts	Patient perception
16	Falls, damage to patient, injuries from inadequate handling	Patient injuries
	Patient satisfaction, refusal to accept equipment / consent. ? as a direct result of PH	Patient perception
17	Record of complaints and injuries to patients	Complaints
	Assessment of method and equipment use (staff)	Competence
20	Safety culture as a measure of organisational behaviour	Culture
22	Compliance with documented PHRA and PHP	Compliance

APPENDIX F

Focus Group Results (Voting)

Theme	Definitions/ measures	Exp	It	Po	Fi	UK		EU	All
Accidents	*Accident figures*					**12**		***12***	***12***
	Incident numbers								
	Near miss								
Absence or staff health	**Sickness absence**	**16**	**12**	**4**	**17**	**16**		**49**	**65**
	• **Severity**								
	• **Length of illness**								
	Replacement staff costs					**4**		**4**	**4**
	• **Recruitment costs**								
	• **Turnover**					**1**		**1**	**1**
	• **Loss of experience**								
	Review occupational health interventions								
	• **Return to work**								
	• **Job displacement**	**2**	**1**					**1**	**3**
	• **Alternative work**								
	• **Moving or leaving**								
	• **Decreasing hours**	**2**							**2**
	Increased productivity								
	• **Decrease sickness**								
	• **Decreased turnover**								
	Improved well being								
Financial costs	*Financial costs*	***10***			***5***	**6**		***11***	***21***
	Decreased litigation								
	• *Insurance / claims*					**1**		***1***	***1***
	• *Compensation*								
	• *HSE prosecution*								
Staff ratios for care delivery	**Improved environment to deliver care**								
	Planning services on patient dependencies								
	• **Staff numbers**								
	• **Ratio of staff to patients**								
	Team work								
	• **Less time**								
	• **Less staff**								
	Task analysis								
	• **Amount of work**								
	• **Length of shift**								
	Shift times								
Training skills and compliance	*Compliance*								
	Number of people trained		***4***	***7***	***4***	**5**		***20***	***20***
	• *Lack of training*								
	• *Quality of training*								
	Improved co-operation								
	Behaviour								
	Expert local group(on site)								
Risk management tools	**Number of risk assessments**								
	Risk assessment improved	**2**		**5**		**6**		**11**	**13**
	Risk management system	**4**		**10**		**3**		**13**	**17**
	• **Policy**								
	• **Roles and responsibility**								
	Participation in risk assessment								
	• **Evaluating risks**	**7**	**20**	**1**				**21**	**28**
Provision of equipment	*Optimisation of equipment*								
	• *Number of aids MAPO*								
	Work environment								
	• *Workspace*								
	• *Furniture*								
	Provide and maintain appropriate equipment								
Satisfaction and image	**Patient complaints**								
	Staff morale								
	Staff satisfaction								
	Patient satisfaction								
	Image in public			**1**	**4**			**5**	**5**
Others	Communication								
	Delayed discharge								
	Commitment (Management)				**14**			**14**	**14**
	Humanisation of care								

Total Scores For Organisational Outcomes

Theme	Definitions/ measures	Exp	It	Po	Fi	UK		EU	All
Incidents and accidents	*Number of Incidents*								
	Number of accidents		**3**	**12**		**5**		**20**	**20**
MSD measures	**Injuries and Sick leave**								
	Discomfort								
	Treatment services for staff								
	Referral to Occupational Physician		**3**					**3**	**3**
	Fatigue					**7**		**7**	**7**
	Occupational health data								
	Stress Index	**11**	**10**	**8**	**4**	**26**		**48**	**59**
	Amount of diseases and injuries		**10**					**10**	**10**
	• **Low back injuries**					**1**		**1**	**1**
	• **Changes in health**								
	• **Personal effect**								
	• **Workability Index**								
	Increased physical capacity								
	• **Strength**								
	• **Endurance**	**3**							**3**
	• **Work capacity**								
	Job rotation								
	Staff not fit for jobs		**2**					**2**	**2**
	Substitution of staff to replace illness								
Exposure measures	*Decreased Effort Movement*	**7**		**3**	**9**			**12**	**19**
	Workload								
	Physical measures								
	• *Heart rate,*								
	• *EMG*	**3**							**3**
	• *Postures*								
	• *Force*								
	• *Loads*								
	Discomfort								
	Risk index from patient handling (MAPO)								
Compliance competence and use of equipment	**Training figures(current)**								
	Knowledge and skill level - competence	***4***	***7***	***11***	***4***	***8***		***30***	***34***
	Handling culture	***5***				***3***		***3***	***8***
	Compliance	***5***		***7***	***6***	***6***		***19***	***24***
	• **Are people using safe methods**	***8***							***8***
	• **Less risky postures**								
	• **Using equipment**								
	• **Use of aids**								
	Supervision of handling								
	Improved communication								
	Improved confidence								
	Supervision								
	Comply with training		***3***					***3***	***3***
	Interviews with staff involved								
	Consistency of assistance								
Psychological well-being	*Staff feel valued*								
	Job satisfaction- Morale		**1**	**6**	**2**	**21**		**30**	**30**
	Psychological stress								
	• *Well-being*	**3**	**1**					**1**	**4**
Others	Policy								
	Provision of equipment								
	• Lack of equipment								
	Availability of physiotherapy for staff								
	• Skills mix								
	• Risk assessment								
	• Communicate risks								
	• Training								

Totals Scores For Staff Outcomes

Theme	Definitions/ measures	Exp	It	Po	Fi	UK		EU	All
Patient injuries	*Injuries* • *Shear/friction* • *Pressure care* • *Injuries* • *Bruising* • *Laceration* • *Falls* *Infection control* *Safety* *Number of manual lifts* • *Reported to unit* • *Patient accidents*	***4***	***3***			**5** **3**		***8*** ***3***	***8*** ***3*** ***4***
Patient perception	**Comfort** • **Decreased pain** **Less fear, more trust** **Privacy** **Patient satisfaction** **Decreased complaints** **Patient accepts/refuses hoist**	**2**	**3**	**1**		**2** **8**		**2** **12**	**2** **14**
Patient condition	*Patient condition* • *Length of stay* • *Discharge* • *Re-admission* • *Recovery time* *Improved independence* • *Increased control* *Health plan (Care-plan)* *Level of participation* *Functional diagnosis tools*		***4***	***6***	***6***	**2**		***18***	***18***
Quality of care	**Standardisation of care** • **Consistency** **Confidence in the care** **Quality of care** **Audit/feedback** **Attitude of staff** **Meeting patient objectives** **Care and actions delivered on time** • **Clinical assessment** **Legal numbers of staff** • **Decreased quality**	***13***	***8***	***10***	***15***	***7*** ***12***		***7*** ***45***	***7*** ***58***

Totals Scores for Patient Outcomes

Theme	Definitions/ measures	Exp	It	Po	Fi	UK		EU	All
Compliance with safe methods	*Appropriate use of equipment* *Competence/skills Efficiency* • *Time taken* • *Movement quality* *Compliance with methods* *Agreed method for assisting the patient* *Quality of movement* • *Smooth* • *Co-ordinated* • *Skills* *Use of equipment* • *Small aids* • *Hoists and slings* *Work postures adopted* *Training*								
Equipment available	**Equipment available** **Ergonomie of rooms** **Bathroom/WC appropriate** **Space /furniture** • **Architectural obstacles** **Provision of aids** **Number of staff**		9 4	5	5	21		40 4	40 4
Documentation	*Documentation/Plans* *Good management system* • *Support in workplace* *Care-plans*	•		•		•		•	•
Others	Use of ergonomics tools Safety Speed/ Decrease time taken Better relationship between staff and patients	**2**				**3**		**3**	**3** **2**

Totals Scores for Task Outcomes

Theme	Definitions/ measures	Exp	It	Po	Fi	UK		EU	All
	Staff time on wards • Equipment increases time Supervisory levels Environments Custom and practice Professional skills Work motivation Work skills Safety culture • Risk awareness Psychosocial factors • Movement • Avoidance of hazards Accessible equipment • Storage Fitness • Relaxation • Lifestyle			7	6	13		26	26

Totals Scores For Other Recorded Findings

APPENDIX G

Development of the IET
Selection of tools for 12 sections

Section 1 Safety Culture

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
38	1990	Connolly	Staff use of equipment	Questionnaire survey on attitudes and use of eqpt	Staff	1		?	?	2
241	2006	Knibbe	Staff competence Org	Prevention strategies /Compliance Policy mirror	Org	1		74	5	2
210	2006	Nelson	Staff perception	Perceived support of organisation (Culture)	Staff	1		70	5	1
230	2007	Hignett	Staff competence Org	Safety Culture PHOQS	Org	1		67	5	2
155	1997	McGuire	Staff perception	Manager knowledge and attitude	Staff	1		64	5	2
153	1997	Menckel	Incident/Accident	Number reports completed	Org	1		63	4	2
30	1998	Alexander	Staff perception	Semi structured interiews of managers	Staff	1		50	5	2
116	2000	Wood	Risk assessment	Accuracy of risk asessments/mobility	Staff	1		46	3.5	2
79	1997	Goodridge	Audit performance	Compliance with audit	Staff	1		44	3.5	1
117	1987	Johnston	Risk assessment	Risk assessment process and info	Staff	1		43	3.5	2
229		Weinel	Staff injuries	Injuries	Staff	1		37	3	3
56	2000	Dietz	Staff perception	Staff perceptions - semi struct interview	Staff	1	5	33	3.5	2
56	2000	Dietz	Risk assessment	Documentation review	Org	1		33	3.5	1
20	1998	Monaghan	Staff perception	Staff attitude	Staff	1		31	2.5	2
43	1981	Daws	Staff perception	Questionnaire on attitudes on eqpt, training etc	Staff	1		31	2.5	1
224	2006	Pinder	Staff perception	Perceptions of Management systems (safety culture?	Org	1			NR	2

Section 2. MS Health Measures

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
103	1988	Skarplik	Staff injuries	Back Injury and pain	Staff	2		po	2	3
263	2005	Chokhar	Staff injuries	MS injury rate	Staff	2	2 5 10	91	4	3
311	2008	Warming	Staff injuries	Back pain injuries	Staff	2	5 18	89	5	3
311	2008	Warming	Staff injuries	Severity of back pain	Staff	2	5 18	89	5	3
260	2004	Cohen	Staff injuries	Injury rate	Staff	2		82	5	3
276	2007	Craib	Staff injuries	Injury rates	Staff	2	1, 2, 5	81	5	3
48	1999	Fanello	Staff injuries	Semi structured questionaire for LBP	Staff	2	5	80	5	2
175	1996	Knibbe	Staff injuries	Back Pain Questionnaire	Staff	2		77	3	3
81	1997	Lagerstrom	Staff injuries	Prevelance of MSD	Staff	2		76	3.5	3
196	1975	Dehlin	Staff injuries	Back Pain.	Staff	2		75	4	3
201	1998	Botha	Staff injuries	Back Pain questionnaire	Staff	2		75	5	3
241	2006	Knibbe	Staff injuries	LBP	Staff	2		74	5	3
9	1994	Harber	Staff injuries	LBP	Staff	2	5	73	4.5	3
256	2006	Engkvist	Staff injuries	Pain Discomfort	Staff	2		73	3	3
256	2006	Engkvist	Staff injuries	Injury rates	Staff	2		73	3	3
152	1999	Marras	Staff injuries	Low back disorder model	Staff	2		72	5	5
210	2006	Nelson	Staff injuries	Injury rate	Staff	2	1 2 10 13 23	70	5	3
211	2003	Smedley	Staff injuries	Low back pain	Staff	2	2 7 10 23	70	4	3
66	1997	Best	Staff injuries	Back pain Questionnaire	Staff	2	5	70	3	2
70	1998	Caska	Staff injuries	Injury rates	Staff	2	17	69	4	3
223	2003	Trinkoff	Staff injuries	MSD prevalence (Nordic)	Yes	2	5, 2, 17	68	4	3
73	1994	Garg	Staff injuries	Injury Rate	Staff	2		67	4.5	3
251	2003	Passfield	Staff injuries	Injury Rate	Staff	2	10	67	4	3
254	2001	Yassi	Staff injuries	Pain/discomfort	Staff	2		67	4	3
254	2001	Yassi	Staff injuries	Injury rate	Staff	2		67	4	3
65	1997	Furber	Staff injuries	Injury rates	Staff	2		66	4	3
174	1996	Lusted	Staff injuries	Injuries	Staff	2		66	4	3
174	1996	Lusted	Staff injuries	Nordic Pain Questionnaire	Staff	2		66	4	3
149	1991	Nyran	Staff injuries	Injury Rates	Staff	2	1 2 4 5	65	4	3
134	1993	Scopa	Staff injuries	Compliance with WRBME	Staff	2	5	65	4	2
86	1992	Garg	Staff injuries	Injury rates	Staff	2		63	5	3
213	2005	Fujushiro	Staff injuries	MSD Rate	Staff	2	1 2	63	4	3
228	2002	Ronald	Staff injuries	MSD rates per 100 000 hours	Staff	2	2	63	3	3
199	1993	Charney	Staff injuries	Injury Rates for Staff	Staff	2	17	61	3.5	3
294	2005	Hartvigsen	Staff injuries	Back pain	Staff	2	5	59	3	3
180	1993	Hellsing	Staff injuries	Back Pain	Staff	2		58	3.5	3
132	2000	Knapik	Staff injuries	Pain or discomfort	Staff	2		57	4.5	3
68	1995	Garb	Staff injuries	Injury rates	Staff	2		56	3.5	3
163	1987	Wood	Staff injuries	Injuries	Staff	2	5 8	56	4	3
226	2002	Crumpton	Staff injuries	back pain MSD (SF36)	Staff	2	3	56	4	3
17	2000	Bewick	Staff injuries	Injury data for participants	Staff	2		55	4	3

78	1998	Billin	Staff injuries	Injury rates	Staff	2	2 5	54	2	3
21	1996	Allen	Staff injuries	Injury rates for nurses	Staff	2		52	2.5	3
52	2001	Collins	Staff injuries	Injury rates	Staff	2	1 5 12 13 14	52	5	3
248	2006	Charney	Staff injuries	Injury Rates	Staff	2	2, 5, 10, 12, 24	52	4	3
55	2000	Lynch	Staff injuries	Back injury statistics	Staff	2		50	3.5	3
148	1988	Nestor	Staff injuries	Low back pain index	Staff	2		50	2.5	3
293	2006	Michaelis	Staff injuries	Back pain	Staff	2		48	3	3
116	2000	Wood	Staff injuries	Staff injuries	Staff	2		46	3.5	2
79	1997	Goodridge	Staff injuries	Injury rates	Staff	2	2 13	44	3.5	3
208	1998	Aird	Staff injuries	Injury rates	Staff	2	Hosp 2 5 9 12 18 20 21 NH 1 3 5 13	44	4	3
225	2003	Hefti	Staff injuries	No Injuries	Staff	2	1, 2, 7, 17	44	4	3
247	2008	Wardell	Staff injuries	Injury Rate	Staff	2		44	4	3
268	2001	O'Reilly	Staff injuries	No LBP injuries	Staff	2	1, 4, 5, 12, 24	44	3	3
245	2001	Pearce	Staff injuries	Pain reporting	Staff	2		42	4	2
165	1988	Videman	Staff injuries	Back Pain	Staff	2		41	3.5	3
280	2002	Owen	Staff injuries	Injury reports	Staff	2		41	4	3
11	1994	Addington	Staff injuries	Total back injuries reported	Staff	2	5 22	37	3	3
198	1991	Charney	Staff injuries	Injury Rates for Staff	Staff	2	17	37	2	3
324	2004	Guthrie	Staff injuries	Injuries	Staff	2	2 5 17	37	4	3
6	1994	Santoro	Staff injuries	Reduction in staff injuries	Staff	2	17	35	2.5	3
303	2004	Victoria Aus	Financial	Nurse claims	Org	2	2 10 23 24 25	33	4	3
43	1981	Daws	Staff injuries	Injury Data .	Staff	2	5	31	2.5	3
259	2006	Garg	Staff absence	Number injuries	Org	2	10	30	4	3
179	1996	Head	Staff injuries	Injuries	Staff	2	1 2 3 5	28	3.5	3
212	2003	Evanoff	Staff injuries	Injury rate	Staff	2	2	26	3	3
289	2005	Murphy	Staff injuries	MSD symptoms	Staff	2		26	3	2
308	2008	Bar-Niv	Staff injuries	MSD (nordic)	Staff	2		26	2	2
98	1981	Raistrick	Staff injuries	% back injuries per poulation	Staff	2		18	2	3
71	1996	Backers	Staff injuries	Injury rates	Staff	2				3
235		Flint	Incident/Accident	Incidence rate	Staff	2	1 2 5 15 24		NR	3
239	2005	Yeung	Staff injuries	MSD Outcome	Staff	2			NR	3
224	2006	Pinder	Staff injuries	MSD profiles	Staff	2			NR	2

Section 3 Competence and Compliance

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
162	1987	Wachs	Staff competence	Compliance with standards	Staff	3	5	86	5	2
42	2001	Daynard	Staff competence	Compliance with methods taught	Staff	3		81	5	2
256	2006	Engkvist	Staff use of equipment	Use of Equipment	Staff	3	1 2 5 9 10 13 15 23 24	73	3	2
210	2006	Nelson	Staff competence	Self reported unsafe acts (compliance)	Staff	3		70	5	2
211	2003	Smedley	Staff competence	Number of unassisted transfers(compliance	Staff	3		70	4	2
255	2002	Johnsson	Staff competence	Method assessment (Compliance)	Staff	3	5	70	4	2
69	1993	Feldstein	Staff injuries	Back pain	Staff	3	5 18	68	4	3
222	2003	Swain	Staff competence	Compliance Questionnaire	No	3	5	68	5	2
223	2004	Swain	Staff knowledge skill	Knowledge	No	3		68	5	2
230	2007	Hignett	Staff knowledge skill	Skill understanding/Verbal protocol	Staff	3		67	5	2
277	2007	Reid	Staff perception	Survey response	Staff	3	5	63	3	2
32	1993	Switzer	Staff competence	Observations of practice	Staff	3		62	4.5	2
328	1997	Engels	Staff competence	Errors	Staff	3	5	59	3	2
180	1993	Hellsing	Staff competence	Observed compliance with teaching	Staff	3		58	3.5	2
64	1996	Foster	PH techniques	Self reported changes in practice	Staff	3	5	57	2.5	2
209	1988	Owen	Staff use of equipment	Use of equipment for tasks	Staff	3		57	4	2
68	1995	Garb	Staff knowledge skill	Awareness and knowledge of the staff	Staff	3		56	3.5	2
63	1987	Troup	Staff competence	Task performance by the staff	Staff	3	5	54	3	2
96	1995	Luntley	Staff knowledge skill	Staff Knowledge of transfers	Staff	3		52	4	2
247	2006	Hye-Knudson	Staff competence	Compliance / skill (Warming tool	Staff	3	5	52	2	2
55	2000	Lynch	PH techniques	Changes in Work practice/method	Task	3	5	50	3.5	2
55	2000	Lynch	Staff knowledge skill	Self reported knowledge	Staff	3		50	3.5	2
55	2000	Lynch	Staff competence	Observed practice	Staff	3		50	3.5	2
94	1993	Oddy	PH techniques	Elimination of drag lift	Staff	3	3 6 10 13	50	3.5	2
293	2006	Michaelis	Staff competence	Competence/ completed new methods	Staff	3	2 5 7 8 23	48	3	2

116	2000	Wood	Staff knowledge skill	Staff skill	Staff	3	5	46	3.5	2
19	1998	Engels	Staff competence	Checklist for performance of staff	Staff	3		44	3	2
165	1988	Videman	Staff knowledge skill	Skill assessment	Staff	3	5	41	3.5	2
219	1998	Nicholls	Staff competence	Observation checklist	Staff	3	5	41	4	2
207	1986	Alavosius	Staff competence	% tasks performed safely	Staff	3	5 8	39	3	2
100	1985	Rodgers	Staff competence	Hazardous lifts observed	Staff	3		38	3.5	2
214	2006	Tamminen Peter	Staff competence	Staff competence SOPMAS	Staff	3	5 7	37	2	2
324	2004	Guthrie	Staff competence	Compliance	Staff	3		37	4	2
56	2000	Dietz	Staff competence	Staff performance	Staff	3		33	3.5	2
20	1998	Monaghan	Staff knowledge skill	Staff knowledge of policy and equipment	Staff	3		31	2.5	2
40	1999	Paternoster	Staff competence	Level of correctness of completed task	Staff	3	5 18	31	2	2
62	1989	Tuffnell	PH techniques	Changes in method completed	Staff	3	5 10	29.5	1.5	2
304	2003	Connelly	Staff competence	Competence assessment (observ)	Staff	3		27	3	3
309	2008	Alexander	Training numbers	Training numbers in hoist skills	Org	3	5	27	4	2
309	2008	Alexander	Staff knowledge skill	Number incorrect answers	Staff	3	5	27	4	2
218	2006	Proteau	Staff competence	Ratio lift to slide (Compliance)	Staff	3		15	2	2

Section 4 Absence or Staff Health

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
263	2005	Chhokar	Staff absence	Time lost per injury rate	Org	4		82	5	3
260	2004	Cohen	Staff absence	Lost days per FTE	Org	4		82	5	3
277	2008	Craib	Staff absence	Lost time injuries	Org	4		81	5	3
48	1999	Fanello	Staff absence	Semi structured questionaire for Absence	Org	4		80	5	2
241	2006	Knibbe	Staff absence	Sick leave	Org	4		74	5	3
256	2006	Engkvist	Staff absence	Time lost	Org	4		73	3	1
87	1997	Charney	Staff absence	Lost time from injuries,	Org	4	17	72	4	3
66	1997	Best	Staff absence	Sickness absence	Org	4		70	3	3
210	2006	Nelson	Staff absence	Lost days and modified days	Org	4		70	5	3
243	2006	Knibbe	Staff absence	Absence	Org	4	5 23	68	4	3
149	1991	Nyran	Financial	Lost Time Claims	Org	4		65	4	3
213	2005	Fujushiro	Staff absence	Days lost	Org	4		63	4	3
265	2005	Engst	Financial	Injury Costs	Org	4		59	4	3
296	2004	Collins	Staff absence	Lost work days	Org	4		59	5	3
82	1999	Evanoff	Staff absence	Lost time injuries	Org	4		58	5	3
140	1998	Pohjonen	Staff injuries	Work ability index	Staff	4		58	4.5	3
163	1987	Wood	Staff absence	Lost time	Org	4		56	4	3
248	2006	Charney	Staff absence	Time lost	Org	4		52	4	3
50	1999	Torri	Staff injuries	Health surveillance	Staff	4		50	4	3
50	1999	Torri	Staff absence	Sickness absence	Org	4		50	4	3
217		Mughal	Staff injuries	Injury data No claims	Org	4	2	48	4	3
217		Mughal	Staff absence	Days lost	Org	4		48	4	3
293	2006	Michaelis	Staff absence	Sickness absence	Org	4		48	3	3
299	2001	Best	Financial	Claims	Org	4	1 2 5 8 10 15	46	2	2
226	2004	Hefti	Staff absence	Days lost	Org	4		44	4	3
268	2002	O'Reilly	Staff absence	Lost work days	Org	4		44	3	3
4	1996	Gray	Staff knowledge skill	Staff knowledge	Staff	4	5	43	2	2
4	1996	Gray	Psychological Well-being	Staff satisfaction	Staff	4		43	2	2
245	2001	Pearce	Staff absence	Lost time	Org	4	12 20	42	4	3
1	1998	Peers	Staff absence	Lost time from injuries,	Org	4	5 10 13 15 20	37	3	3
1	1998	Peers	Staff absence	Lost time from recurrence,	Org	4		37	3	3
1	1998	Peers	Modified Work	modified work from new injuries	Org	4		37	3	3
1	1998	Peers	Modified Work	modified work due to recorrence	Org	4		37	3	3
11	1994	Addington	Staff absence	Musculoskeletal sickness absnce	Org	4		37	3	3
90	1996	Entwistle	Staff absence	Sickness absence	Org	4	2 5 10 13 22	35	3	3

13	1982	Tracsz	Staff absence	Sickness absence	Org	4	2 5	33	4	3
179	1996	Head	Staff absence	Lost time	Org	4		28	3.5	3
179	1996	Head	Financial	Cost	Org	4		28	3.5	3
212	2003	Evanoff	Staff absence	Lost Time	Org	4		26	3	3
187	2002	Larthe	Staff absence	Days lost	Org	4	1 5 8 10 13	22	2	3
83	1996	Dixon	Staff absence	Staff sickness	Staff	4	2 5 10	20	3	3
145	1987	Owen	Staff absence	Sickness absence Lost work hours	Org	4		4	4	3

Section 5 Quality of Care
Section 6 Incidents and Accidents

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
242	2008	Nelson	Quality of care	Quality of care RAI tool p37	Patient	5	1, 2, 10, 13, 15, 23	59	4	2
26	1996	Tracey	Incident/Accident	Staff incidents	Staff	6		po	4	3
188	2004	Engst	Incident/Accident	PH incidents	Staff	6		63	4	3
153	1997	Menckel	Incident/Accident	Accident reports and feedback	Org	6	1 2 5 8	63	4	2
284	2003	Griffiths	Incident/Accident	MH Incidents	Org	6	5 15 23	22	1	3

Section 7 Psychological Well-being
Section 8 Patient Condition

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
12	1986	Mckellar	Staff perception	Informal interview	Staff	7		po	3.5	2
306	2007	Kindblom-Rising	Staff perception	Risk perception after training	Staff	7	5	85	4	1
211	2003	Smedley	Psychological well-being	Psychosocial stress	Staff	7		70	4	3
210	2006	Nelson	Psychological well-being	Job satisfaction	Staff	7		70	5	2
210	2006	Nelson	Staff perception	perceived effectiveness of intervention	Staff	7		70	5	2
237	2005	Santaguida	Staff perception	Ranking of preference	Staff	7		67	5	2
190	2006	Engst	Staff perception	Perception of MSD risk	Staff	7		63	4	2
240	2006	Millar	Staff perception	Comfort	Staff	7		59	4	2
82	1999	Evanoff	Psychological Well-being	Psycho social stressors	Staff	7		58	5	2
125	1999	Hignett	Staff perception	Subjective assessment questionnaire	Staff	7		57	4.5	
5	1994	Holliday	Staff perception	Comfort score for staff	Staff	7		50	4.5	2
217		Mughal	Staff perception	Subjective staff	Staff	7		48	4	2
246	2007	Wardell	Staff perception	Staff perception	Staff	7	1, 2, 5, 10, 23	44	4	2
321	2007	Kneafsey	Staff perception	Confidence of staff post training	Staff	7	5	41	2	2
324	2004	Guthrie	Psychological well-being	Staff satisfaction	Staff	7		37	4	2
308	2008	Bar-Niv	Psychological well-being	Psychosocial stress questionnaire	Staff	7		26	2	2
3	1995	Scott	Staff perception	Questionnaire of staff perceptions of hazards and interventions	Staff	7		8	1	2
224	2006	Pinder	Staff perception	Perceptions of work risks	Staff	7			NR	2
108	1991	Waldenstrom	Patient result	Obstetric outcomes	Patient	8		93	5	3

Section 9 Patient Perception

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
107	1999	Owen	Patient perception	Patient comfort and security	Patient	9		po	4	2
108	1991	Waldenstrom	Relative perception	Mothers experience	Patient	9		93	5	2
108	1991	Waldenstrom	Relative perception	Fathers experience	Relative	9		93	5	2
200	1998	Conneeley	Patient perception	Patient perspective	Patient	9		92	5	2
227	2004	Kjellberg	Patient perception	Patient Percpetion	Patient	9		89	5	2
184	1991	Garg	Patient perception	Patient comfort	Patient	9		80	4.5	2
184	1991	Garg	Patient perception	Patient security	Patient	9		80	4.5	2
2	1996	Gingher	Patient perception	Impact of resident from staff view	Patient	9		78	4	2
72	1999	Owen	Patient perception	Patient Perception Security and comfort	Patient	9		76	5	2
66	1997	Best	Patient perception	Patient comfort	Patient	9		70	3	2
255	2002	Johnsson	Patient perception	Patient comfort	Staff	9		70	4	2
73	1994	Garg	Patient perception	Patient Comfort/security	Patient	9		67	4.5	2
237	2005	Santaguida	Patient perception	Ranking of preference	Patient	9		67	5	2
188	2004	Engst	Patient result	Resident agitation	Patient	9	1, 2, 5, 7	63	4	2
236	2005	Ruszala	Staff perception	Subjective performance rating	Patient	9		63	5	2
49	1999	Owen	Patient perception	Patient comfort	Patient	9		59	4.5	2
49	1999	Owen	Patient perception	Patient security	Patient	9		59	4.5	2
271	2006	Baptiste	Patient perception	Patient safety	Patient	9		59	5	2
74	1993	Benevolo	Patient perception	Patient comfort/safety perception	Patient	9		57	4	2
298	2006	Pellino	Patient perception	Patient comfort	Patient	9		55	5	3
158	1996	McGuire	Patient perception	Patient perception	Patient	9		54	3	2
159	2000	Zhuang	Patient perception	Patient comfort	Patient	9		54	4.5	2
159	2000	Zhuang	Patient perception	Patient security	patient	9		54	4.5	2
5	1994	Holliday	Patient perception	Comfort score for patient	Patient	9		50	4.5	2
143	1994	Owen	Patient perception	Patient subjective ratings	Patient	9		50	4	2

156	1996	McGuire	Patient perception	Clients attitudes to equipment	Patient	9		50	3.5	2
183	1991	Garg	Patient perception	Patient comfort	Patient	9		48	4	2
183	1991	Garg	Patient perception	Patient security	Patient	9		48	4	2
185	1991	Garg	Patient perception	Patient comfort	Patient	9		48	4	2
185	1991	Garg	Patient perception	Patient security	Patient	9		48	4	2
217		Mughal	Patient perception	Subjective Patient safety	Patient	9		48	4	2
233	2004	Heacock	Patient perception	Patient perspective	Patient	9		48	3	2
280	2002	Owen	Patient perception	Patient security	Patient	9	2 5 13	41	4	2
280	2002	Owen	Patient perception	Patient comfort	Patient	9		41	4	2
292	2006	Fray	Patient perception	Patient comfort	Patient	9		41	3	2
168	1997	Le Bon	Patient perception	User trial data Patient	Patient	9		41	3	1
214	2006	Tamminen Peter	Patient perception	Patient satisfaction	Patient	9		37	2	2
324	2004	Guthrie	Patient perception	Patient satisfaction	Patient	9		37	4	2
23	1991	Wright A	Patient perception	Questionnaire Patient control	Staff	9		35	2.5	2
90	1996	Entwistle	Patient perception	Patient comfort	Patient	9		35	3	2
289	2005	Murphy	Patient perception	Patient subjective ratings	Patient	9		26	3	2

Section 10 MSD Exposure Measures

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
31	1997	Quintana	Physical workload	RWL NIOSH	Staff	10		po	3	2
103	1988	Skarplik	Staff perception	Risk Factors identified by staff	Staff	10		po	2	2
107	1999	Owen	Staff perception	Perceived Exertion	Staff	10		po	4	2
282	2000	Logan	Carer perception	Subjective views of carers	Staff	10		PO		
54	2001	Engkvist	Physical workload	MSD Risk factors	Staff	10	2 5	100	5	2
126	1996	Hignett	Staff perception	Subjective appraisal of risk factors	Staff	10		96	5	2
108	1991	Waldenstrom	Physical workload	Nurses postures	Staff	10		93	5	2
130	1999	Knibbe	Physical workload	Log of pre and post task numbers	Staff	10	2	83	5	2
135	1995	Smedley	Physical workload	Risk factors for Nurses	Staff	10		82	4	2
144	1992	Owen	Staff perception	Subjective ratings of the staff	Staff	10		82	4	2
144	1992	Owen	Staff perception	Ranking of tasks	Staff	10		82	4	2
144	1992	Owen	Staff injuries	Back tension	Staff	10		82	4	2
144	1992	Owen	Physical workload	L5/S1 compression	Staff	10		82	4	2
203	1979	Bell	Physical workload	Number patients to be lifted	Staff	10		82	3.5	2
203	1979	Bell	Physical workload	Frequency of lifting	Staff	10		82	3.5	2
203	1979	Bell	Physical workload	Physical effort	Staff	10		82	3.5	2
260	2004	Cohen	Number of staff	Resident to staff ratio	Staff	10		82	5	1
261	2005	Cohen	Number of staff	Res dependency to staff ratio	Staff	10		82	5	1
42	2001	Daynard	Physical workload	Biomehanical loading for peak force	Staff	10	2 5	81	5	2
42	2001	Daynard	Physical workload	Biomechanical loading over time	Staff	10		81	5	2
184	1991	Garg	Physical workload	Spinal Loading	Staff	10		80	4.5	2
184	1991	Garg	Staff perception	Subjective opinion of tasks effort	Staff	10		80	4.5	2
2	1996	Gingher	Staff perception	Effect on staff,Questionaire	Staff	10		78	4	2
136	1983	Scholey	Physical workload	Intra-abdominal pressures	Staff	10	5	78	2	2
274	2007	Lavender	Physical workload	EMG	Staff	10	2 7	78	5	2
274	2007	Lavender	Staff perception	RPE	Staff	10		78	5	2
275	2007	Lavender	Physical workload	EMG	Staff	10	2 7	78	5	2

275	2007	Lavender	Staff perception	RPE	Staff	10		78	5	2
310	2008	Skotte	Physical workload	Biomechanical load	Staff	10	2 7	78	5	2
175	1996	Knibbe	Physical workload	Task Exposure	Staff	10		77	3	2
46	2000	Elford	Physical workload	Movement velocity and acceleration	Staff	10		76	3.5	2
46	2000	Elford	Physical workload	Spinal stressors from LMM data	Staff	10		76	3.5	2
46	2000	Elford	Staff perception	Rating of preference of the subjects	Staff	10		76	3.5	2
72	1999	Owen	Staff perception	Staff perception RPE	Staff	10		76	5	2
76	1998	Hampton	Staff perception	Staff perceptions from questionnaire	Staff	10		76	3.5	2
201	1998	Botha	Staff perception	Subjective problem identification	Staff	10		75	5	2
241	2006	Knibbe	Physical workload	Exposure to hazards	Staff	10	10 25	74	5	2
256	2006	Engkvist	Staff perception	RPE/fatigue	Staff	10		73	3	2
323	2004	Kothiyal	Physical workload	Muscle effort	Staff	10	2	73	1	2
323	2004	Kothiyal	Staff perception	RPE	Staff	10		73	1	2
152	1999	Marras	Physical workload	Biomechanical load model	Staff	10		72	5	5
80	1994	De Looze	Physical workload	Biomechanical exposure to hazard	Staff	10	2	72	5	2
139	1993	Robertson	Physical workload	Forces in lifting	Staff	10		71	3	2
66	1997	Best	Physical workload	Handling behaviour OWAS	Staff	10		70	3	2
137	1989	St-Vincent	Physical workload	Observation tool for posture movement	Staff	10	5	70	4.5	2
255	2002	Johnsson	Staff perception	RPE	Staff	10		70	4	2
278	2007	Cornish	Staff perception	Subjective evaluation	Staff	10	5	69	4	1
73	1994	Garg	Physical workload	Biomechanical Model	Staff	10		67	4.5	2
73	1994	Garg	Staff perception	Perceived Stress	Staff	10		67	4.5	2
73	1994	Garg	Staff perception	Acceptability Rate Staff perception	Staff	10		67	4.5	2
73	1994	Garg	Staff perception	RPE	Staff	10		67	4.5	2
105	1997	Ulin	Physical workload	Biomechanical model	Staff	10		67	5	2
105	1997	Ulin	Staff perception	RPE	Staff	10		67	5	2
230	2007	Hignett	Physical workload	Posture REBA	Staff	10		67	5	2
231	2007	Lavender	Physical workload	EMG	Staff	10	2	67	5	2
231	2007	Lavender	Physical workload	Biomechanical LMM2	Staff	10		67	5	2
237	2005	Santaguida	Physical workload	Biomechanical strain	Staff	10	2	67	5	2
237	2005	Santaguida	Staff perception	RPE	Staff	10		67	5	2
244	2006	Hess	Staff perception	RPE Borg	Staff	10	2 7	67	3	2
244	2006	Hess	Physical workload	Biomechancal load	Staff	10		67	3	2
252	2002	Skotte	Physical workload	Biomechanical model	Staff	10	7	67	4	2
252	2002	Skotte	Physical workload	Muscle force	Staff	10		67	4	2
252	2002	Skotte	Staff perception	RPE	Staff	10		67	4	2
253	2004	Hye-Knudson	Physical workload	Lumbar Motion	Staff	10	7	67	4	2

253	2004	Hye-Knudson	Physical workload	EMG	Staff	10		67	4	2
254	2001	Yassi	Physical workload	Number lifts observed	Staff	10	2 5 10	67	4	2
254	2001	Yassi	Staff perception	Subjective assessment of work effects	Staff	10		67	4	2
39	2001	Hui	Staff perception	Subjective assessment of severity of task	Staff	10		66	4	2
39	2001	Hui	Physical workload	Physical demands over a shift	Staff	10		66	4	2
39	2001	Hui	Staff injuries	Back Muscle fatigue	Staff	10		66	4	2
174	1996	Lusted	Physical workload	Heart Rate	Staff	10		66	4	2
174	1996	Lusted	Staff perception	Subjective feedback	Staff	10		66	4	2
177	1994	Jackson	Physical workload	Postures owas	Staff	10		66	4	2
193	1998	Looze	Physical workload	Spinal Loading	Staff	10		66	4	2
202	1994	Ballard	Staff perception	Risk Factors for Nurses	Staff	10		66	4	2
106	1998	Varcin-Coad	Physical workload	Biomechanical model	Staff	10		65	4	2
110	2000	Schibye	Physical workload	Biomechanical model	Staff	10		65	4	2
172	1989	Ljungberg	Physical workload	HR / VO2	Staff	10	2 6 7	65	4	2
172	1989	Ljungberg	Staff perception	RPE	Staff	10		65	4	2
172	1989	Ljungberg	Physical workload	Lift force	Staff	10		65	4	2
172	1989	Ljungberg	Physical workload	Lift exposure/freq	Staff	10		65	4	2
172	1989	Ljungberg	Physical workload	Postures	Staff	10		65	4	2
194	1995	Doormaal	Physical workload	Posture	Staff	10		64	3.5	2
194	1995	Doormaal	Staff perception	Questionnaire of perceptions	Staff	10		64	3.5	2
194	1995	Doormaal	Physical workload	Force measures	Staff	10		64	3.5	2
295	2004	Nevala	Physical workload	EMG	Staff	10	2	64	2	2
295	2004	Nevala	Physical workload	HR	Staff	10		64	2	2
295	2004	Nevala	Staff perception	Perceived strain	Staff	10		64	2	2
53	1988	Gagnon	Physical workload	Biomechanical	Staff	10		63	4	2
85	1995	Lavender	Physical workload	Biomecahnical model	Staff	10		63	4	2
86	1992	Garg	Physical workload	Biomechanical model	Staff	10	1 2 5	63	5	2
86	1992	Garg	Staff perception	RPE	Staff	10		63	5	2
161	1994	Winkelmolen	Physical workload	Work posture	Staff	10		63	4.5	2
161	1994	Winkelmolen	Physical workload	Biomechanical loading	Staff	10		63	4.5	2
161	1994	Winkelmolen	Staff perception	Perceived effort	Staff	10		63	4.5	2
189	2005	Engst	Physical workload	MSD exposure score	Staff	10		63	4	2
195	1975	Dehlin	Physical workload	Force plate measures for lift burden	Staff	10		63	3	2
236	2005	Ruszala	Staff perception	RPE	Staff	10		63	5	2
236	2005	Ruszala	Physical workload	Posture REBA	Staff	10		63	5	2

257	2003	Schibye	Physical workload	Biomechanical loads	Staff	10	7	63	4	2
257	2003	Schibye	Staff perception	Perceived exertion	Staff	10		63	4	2
32	1993	Switzer	Staff perception	Structured Interviews of staff	Staff	10		62	4.5	2
47	2000	Lavender	Physical workload	Observational data from LMM goniometer	Staff	10		61	5	2
47	2000	Lavender	Physical workload	Biomechnical modelling of spinal stress	Staff	10		61	5	2
115	2000	Caboor	Physical workload	Postures of staff	Staff	10		61	3.5	2
115	2000	Caboor	Physical workload	EMG	Staff	10		61	3.5	2
115	2000	Caboor	Staff perception	RPE	Staff	10		61	3.5	2
15	2000	Lavender	Physical workload	posture analysis by Lumbar motion mtr	Staff	10		59	4.5	2
15	2000	Lavender	Physical workload	Forces applied	Staff	10		59	4.5	2
49	1999	Owen	Staff perception	Rate of perceived exertion	Staff	10		59	4.5	2
57	2001	Nussbaum	Staff perception	RPE	Staff	10	5	59	3	2
57	2001	Nussbaum	Physical workload	Postures	Staff	10		59	3	2
57	2001	Nussbaum	Physical workload	Forces	Staff	10		59	3	2
138	1983	Stubbs	Physical workload	Intra-abdominal Pressure 2nd test	Staff	10		59	4.5	2
160	1999	Zhuang	Physical workload	Work posture	Staff	10		59	4.5	2
160	1999	Zhuang	Physical workload	Forces	Staff	10		59	4.5	2
240	2006	Millar	Staff perception	Risk perception	Staff	10	2	59	4	2
261	2006	Jordan	Physical workload	Biomechanical	Staff	10	2 7	59	4	2
265	2005	Engst	Staff perception	Risk Perception	Staff	10	2 5 10	59	4	2
265	2005	Engst	Staff perception	Comfort	Staff	10		59	4	2
271	2006	Baptiste	Staff perception	Comfort	Staff	10	2	59	5	2
271	2006	Baptiste	Staff perception	Perceived injury risk	Staff	10		59	5	2
82	1999	Evanoff	Staff injuries	MSD Risk factors	Staff	10	1 3 4 6 7 9 10	58	5	2
140	1998	Pohjonen	Physical workload	Posture owas	Staff	10	1 2 3 7 9 10 11	58	4.5	2
140	1998	Pohjonen	Physical workload	Heart rate	Staff	10		58	4.5	2
182	1986	Gagnon	Physical workload	Biomechanical model	Staff	10		57	4	3
25	1986	Gagnon	Physical workload	Complex biomechanical data and models	Staff	10		57	4	2
34	1998	Edlund	Patient result	Angular measures for sitting position in sling and after move	Task	10		57	4.5	2
74	1993	Benevolo	Staff perception	Safety and comfort of staff perception	Staff	10		57	4	2
74	1993	Benevolo	Staff perception	Ranking of staff preference/choice	Staff	10		57	4	2
93	1993	Roth	Staff perception	RPE	Staff	10		57	4	2
93	1993	Roth	Staff perception	Rating for preference of method	Staff	10		57	4	2
119	2000	Thompson	Physical workload	Postures both owas and reba	Staff	10		57	4	2

132	2000	Knapik	Physical workload	Physiological response	Staff	10		57	4.5	2
132	2000	Knapik	Staff perception	RPE	Staff	10		57	4.5	2
186	1987	Gagnon	Physical workload	Spinal Loading	Staff	10		57	4	2
186	1987	Gagnon	Physical workload	Muscle activity	Staff	10		57	4	2
209	1988	Owen	Staff perception	Perceived benefits	Staff	10		57	4	2
291	2006	Gray	Physical workload	EMG	Staff	10	2	57	3	2
291	2006	Gray	Staff perception	RBE	Staff	10		57	3	2
91	1995	Knibbe	Physical workload	Postures Owas	Staff	10		56	4.5	2
226	2002	Crumpton	Physical workload	Risk exposure (stady meter)	Staff	10	2	56	4	2
266	2005	McGill	Physical workload	EMG	Staff	10	2 7	56	4	2
266	2005	McGill	Physical workload	Body movement	Staff	10		56	4	2
266	2005	McGill	Physical workload	L5/S1 loads	Staff	10		56	4	2
298	2006	Pellino	Time for task	Time taken	Staff	10		55	5	3
121	2000	Massad	Physical workload	Accident causation measures	Staff	10		55	3.5	2
138	1983	Stubbs	Physical workload	Intra-abdominal pressures	Staff	10	5	55	4.5	2
138	1983	Stubbs	Staff perception	Nurse Comfort	Staff	10		55	4.5	2
181	1992	Garg	Staff perception	Perceived exertion	Staff	10		55	4.5	2
181	1992	Garg	Physical workload	Spinal loading	Staff	10		55	4.5	2
181	1992	Garg	Physical workload	Trunk angles	Staff	10		55	4.5	2
298	2006	Pellino	Staff perception	Perceived exertion	Staff	10	2	55	5	2
159	2000	Zhuang	Staff perception	Subjective Forces	Staff	10		54	4.5	2
88	1993	Lindbeck	Physical workload	Biomechanical forces	Staff	10		52	4	2
88	1993	Lindbeck	Staff perception	RPE	Staff	10		52	4	2
96	1995	Luntley	Physical workload	Staff postures during tasks	Staff	10		52	4	2
262	2004	Keir	Physical workload	EMG	Staff	10	2 7	52	4	2
5	1994	Holliday	Staff perception	RPE staff	Staff	10		50	4.5	2
30	1998	Alexander	Staff perception	Quantitative survey of risk perceptions	Staff	10	1 2 6 11 13 16	50	5	2
50	1999	Torri	Physical workload	Risk exposure measurement	Staff	10	2 5	50	4	2
143	1994	Owen	Staff perception	Subjective ratings of the staff	Staff	10		50	4	2
143	1994	Owen	Physical workload	Biomechanical model	Staff	10		50	4	2
151	1992	Miller	Carer perception	Questionnaire. Subjective responses of carers	Staff	10	1 5 10	50	3.5	2
167	1987	Takala	Staff perception	Subjective view on loads	Staff	10		50	3.5	2
167	1987	Takala	Physical workload	Postures	Staff	10		50	3.5	2
302	2001	Walls	Physical workload	Biomechanical relative risk	Staff	10	2	50	3	2
16	1995	Zelenka	Physical workload	Forces to transfer	Staff	10		48	3.5	2
141	1996	Petzall	Physical workload	Forces	Staff	10		48	4	2

183	1991	Garg	Physical workload	Spinal Loading	Staff	10		48	4	2
183	1991	Garg	Staff perception	Subjective opinion of tasks effort	Staff	10		48	4	2
185	1991	Garg	Physical workload	Spinal Loading	Staff	10		48	4	2
185	1991	Garg	Staff perception	Subjective opinion of tasks effort	Staff	10		48	4	2
221	2005	Ferreira	Physical workload	Biomechanical	Yes	10	2	48	4	2
233	2004	Heacock	Staff perception	RPE for body regions	Staff	10		48	3	2
249	2002	Allen	Physical workload	L5/S1 compression	Staff	10	2	48	3	2
250	2003	Nelson	Staff perception	Comfort	Staff	10	2	48	4	2
250	2003	Nelson	Physical workload	Lumbar force moment	Staff	10		48	4	2
250	2003	Nelson	Physical workload	Muscle activity	Staff	10		48	4	2
250	2003	Nelson	Physical workload	External applied force	Staff	10		48	4	2
293	2006	Michaelis	Staff perception	Perceived work load	Staff	10		48	3	2
116	2000	Wood	Staff perception	Staff perceptions	Staff	10		46	3.5	2
170	1995	Laflin	Physical workload	Biomech Models	Staff	10		46	4	2
145	1987	Owen	Staff perception	Staff perception of risk factors	Staff	10		45	4	2
19	1998	Engels	Physical workload	OWAS posture scores	Staff	10	5 8 10	44	3	2
19	1998	Engels	Staff perception	Borg score for perceived exertion	Staff	10		44	3	2
89	1988	Gagnon	Physical workload	Biomechanical model	Staff	10		44	4	2
117	1987	Johnston	Staff perception	Perception of Risks	Staff	10	5	43	3.5	2
133	1995	Stevenson	Physical workload	Biomechanical model	Staff	10		43	3.5	2
166	1987	Torma-Krajewski	Physical workload	Spinal loading	Staff	10		43	2.5	2
14	1999	Griffith	Staff perception	Interviews to identify perceptions of workload and risk factors	Staff	10	5	42	3	2
102	1982	Scholey	Physical workload	Intra-abdominal pressures	Staff	10		41	4	2
165	1988	Videman	Staff perception	Subjective workload	Staff	10		41	3.5	2
168	1997	Le Bon	Equipment	Physical evaluation	Equip	10		41	3	2
264	2005	Anderson	Physical workload	Lumber load	Staff	10		41	2	2
269	2002	Silvia	Physical workload	Forces on spine	Staff	10	2 7	41	3	2
269	2002	Silvia	Staff perception	Subjective appraisal	Staff	10		41	3	2
270	1999	Bohannon	Physical workload	Forces to pull	Staff	10	2 7	41	4	2
280	2002	Owen	Staff perception	RPE shoulder	Staff	10		41	4	2
280	2002	Owen	Staff perception	RPE back	Staff	10		41	4	2
292	2006	Fray	Physical workload	Observed movement	Staff	10	2	41	3	2
292	2006	Fray	Staff perception	Carer comfort	Staff	10		41	3	2
67	1994	Lee	Staff perception	Risk factors questionnaire	Staff	10		39	3.5	2
67	1994	Lee	PH techniques	Model for Handling capacity	Staff	10		39	3.5	2
171	1995	Lee	Physical workload	Postures OWAS	Staff	10		39	3.5	2

171	1995	Lee	Physical workload	Biomechanical Force	Staff	10		39	3.5	2
207	1986	Alavosius	Staff perception	Subjective feedback of intervention	Staff	10		39	3	2
99	1985	Rodgers	Staff perception	Staff risk perception	Staff	10	5	38	3.5	2
214	2006	Tamminen Peter	Physical workload	EMG	Staff	10		37	2	2
214	2006	Tamminen Peter	Staff perception	RPE Borg	Staff	10		37	2	2
229		Weinel	Staff perception	RPE	Staff	10	2, 5	37	3	2
169	1996	Love	Staff perception	Subjective perceptions of hazards	Staff	10		36	4	2
169	1996	Love	Incident/Accident	Factors in accident	Staff	10		36	4	2
178	1987	Khalil	Physical workload	Biomechanical loading	Staff	10		36	3	2
23	1991	Wright A	Physical workload	EMG recordings for action	Staff	10		35	2.5	2
216	1987	Gagnon	Physical workload	Biomechanical models	Staff	10		35	4	2
216	1987	Gagnon	Physical workload	Muscle activity	Staff	10		35	4	2
113	2000	Pan	Physical workload	Low back biomechanics	Staff	10		33	3	2
113	2000	Pan	Staff perception	RPE	Staff	10		33	3	2
10	1995	Meyer	Staff perception	Questionnaires to staff using hoists	Equip	10		32	4	2
10	1995	Meyer	Staff perception	Practical evaluations in lab settings	Equip	10		32	4	2
33	1990	McGill	Physical workload	Biomechanical loading model	Staff	10		32	3.5	2
97	2000	Robertson	Physical workload	Forces to slide using slide sheets	Staff	10		32	3	2
109	2000	Kothiyal	Physical workload	Muscle activity EMG	Staff	10		32	4	2
109	2000	Kothiyal	Staff perception	RPE	Staff	10		32	4	2
114	2000	Kato	Time for task	Task efficiency	Task	10		32	2	2
92	1996	Green	Staff perception	Staff perceptions of risk factors	Staff	10		31	3	2
101	1979	Stubbs	Physical workload	Biomechanical load on staff	Staff	10		31	4	2
176	185	Kilbom	Physical workload	Forces on staff	Staff	10	2 6 7	27	3	2
297	2003	McFarlane	Physical workload	Force	Staff	10	2	27	2	2
304	2002	Connelly	Staff use of equipment	Ease of use	Staff	10		27	3	2
28	1997	Tracey	Physical workload	Forces to slide	Staff	10		26	3	2
289	2005	Murphy	Physical workload	Postures REBA	Staff	10	2	26	3	2
289	2005	Murphy	Physical workload	Number tasks observed	Staff	10		26	3	2
308	2008	Bar-Niv	Physical workload	Biomech load	Staff	10	5 8	26	2	2
18	1999	Bertollazzi	Physical workload	load per worker	Staff	10		25	2	2
287	2001	Spencer	Physical workload	Force	Staff	10	2 7	23	3	2
288	2002	Hunter	Physical workload	Force	Staff	10	2 7	23	3	2
288	2002	Hunter	Staff perception	RPE	Staff	10		23	3	2
129	1998	Collins	Physical workload	Biomechanics model Lumb Motion Mon	Staff	10		19	2	2

189	1992	Fenety	Physical workload	Lifting load	Staff	10		18	3	2
189	1992	Fenety	Physical workload	Postures of staff	Staff	10		18	3	2
218	2006	Proteau	Physical workload	Forces to slide	Staff	10	2 7	15	2	2
218	2006	Proteau	Physical workload	EMG	Staff	10		15	2	2
104	1981	Wright	Physical workload	Observed hazards	Staff	10		11	2	2
286	2001	Thompson	Physical workload	Force	Staff	10	2	9	2	2
128	1994	Collins	Physical workload	Biomechanics model Lumb Motion Mon	Staff	10		4	2	2
234	2003	Brinkhoff	Physical workload	Postures OWAS	Staff	10	2 5 23		NR	2
239	2005	Yeung	Physical workload	Workload exposure	Staff	10			NR	2
312	2002	Kuiper	Physical workload	Serum concentrations Physiological	Staff	10			NR	2
322	2006	Love		Mixed assessment	Staff	10				

Section 12 Financial

Paper No	Date	Author	Outcome	Outcomes measures	Beneficiary	Ranked outcome list 1-12	Intervention Strategy	QR score %	PR score	Robson score
27	1998	Fazel	Financial	Financial evaluation	Org	12		po	4	3
263	2005	Chokhar	Financial	Costs	Org	12		91	4	3
87	1997	Charney	Financial	compensation costs	Org	12		72	4	3
210	2006	Nelson	Financial	Cost benefit	Org	12		70	5	3
251	2003	Passfield	Financial	Costs	Org	12		67	4	3
199	1993	Charney	Financial	Financial impact	Org	12		61	3.5	3
240	2006	Millar	Financial	Injury costs	Org	12		59	4	3
296	2004	Collins	Financial	Workers compensation claims	Org	12	2 4 5 10 12	59	5	3
296	2004	Collins	Financial	Cost benefit analysis	Org	12		59	5	3
82	1999	Evanoff	Financial	Compensation costs	Org	12		58	5	3
250	2008	Charney	Financial	Costs	Org	12		52	4	3
227	2005	Hefti	Financial	Costs of injuries	Org	12		44	4	3
268	2003	O'Reilly	Financial	Costs	Org	12		44	3	3
313	2002	Spiegel	Financial	Costs	Org	12		44	4	3
198	1991	Charney	Financial	Financial impact	Org	12		37	2	3
324	2004	Guthrie	Financial	Costs	Org	12		37	4	3
6	1994	Santoro	Financial	Financial	Org	12		35	2.5	3
281	2006	Joseph	Financial	Costs	Org	12	2	33	3	3
303	2004	Victoria Aus	Financial	Cost benefit analysis	Org	12		33	4	3
232	2007	Morgan	Financial	Costs	Org	12	1, 5, 10, 12, 15, 24	30	3	3
267	2004	Siguardsson	Financial	Costs	Org	12	2	11	2	3
31	1997	Quintana	Financial	Cost evaluation	Org	12			3	3

APPENDIX H

Accepted version of IET (Viii)

Intervention Evaluation Tool (IET)

The Intervention Evaluation Tool is a single measurement device for measuring how well the risks of patient handling are being managed within an organisation. Many tools have previously been created and used for measuring specific aspects of patient handling and the management of the aspects of risk. This process and score system will give a range of scores and a single overall IET score that will allow different areas from the same organisation to be compared and for different organisations to be compared. The structure of the IET has been developed by a partnership project completed by Loughborough University and ArjoHuntleigh ab Sweden.

The different areas for investigation have been developed from a series of studies in 4 European countries and a series of expert panels in Europe, the US and Australia. This resulted in a wide range of intended outcomes which were then ranked for importance. The 12 highest ranked outcomes are included in the IET.

The IET includes a set of data collection tools. These have been derived from a detailed literature review that identified tools used to measure outcomes in peer reviewed studies of patient handling interventions.

The outcomes included in the IET are:

Preferred outcome	Quality Measured
1.Safety culture	PHOQS documentation review for safety culture
2 MSD measures	Nordic MSD Questionnaire
3 Competence and compliance	Observational checklist and DINO
4 Absence or staff health	Sickness absence data Standardised data per population
5 Quality of care	Meeting the need of the patient and improving care delivery
6 Accident numbers	Standardised numbers of accidents Scale for level of non-reporting
7 Psychological well being	Job satisfaction and psychosocial stressors
8 Patient condition	Meeting the need of the patient and improving care delivery
9 Patient perception	Comfort Security/Fear
10 MSD exposure measures	Self reported exposure logs
11 Patient injuries	Avoidance of impairment
12 Financial	Calculation of costs and losses vs benefits

The IET Guidebook

The format of this document is to assist the information collection and the process of assessing a specific location to complete the IET and obtain:

a) Scores for each of the 12 outcome measures
b) A single value for the IET

These can be compared against other organisations, or parts of the same organisation, or be used over time to assess the progress of the management system.

The IET is a complex measure and requires the involvement of a number of different individuals to collect and co-ordinate the assessment:

The Observer: A person, external to the organisation being investigated, experienced in the management of patient handling systems who co-ordinates the IET process.
The Patient Handling Advisor: The most senior person responsible for patient handling inputs, advice and monitoring.
Senior Nurse: The person responsible for managing care delivery on the day of the assessment.
Local Patient Handling Advisor: A link worker, patient handling trainer, risk assessor or ergo-coach employed in the ward or unit.

Other people will be required to provide information, e.g. staff, patients, advocates and specialist staff from other parts of the organisation.

Part A: 12 outcome measurement tools

A long term study using patient handling specialists from several countries ranked the 12 most valued outcomes from a series of focus groups. Those 12 outcomes are listed in priority order with safety culture being the most important. A data collection system and scoring method has been devised for each of the 12 outcomes and is supported by guidance notes. The scoring system for calculating the total IET score is included.

Part B: Sets of data collection sheets

The collection of information to calculate the IET requires varied information from a range of sources. The collection process has been simplified to approach each participant once and collect all the information in a single visit. Each section includes guidance notes for data collection, definitions of terminology, inclusion and exclusion criteria

IET Summary Sheet.
A front sheet is required to collate the names and contact details for all the individuals collecting the data and general details about the ward or unit being assessed

Data Set 1. Organisational Review

The Observer (or Patient Handling Advisor) to collect information about, accidents incidents and the costs of MSD in the area being investigated. This will be gathered through the specialist advisors in the organisation e.g. HR,H&S, ward manager, handling advisors.

Data Set 2. Safety Culture Audit
The Observer will need to visit the chosen area and conduct a Patient Handling Safety Culture Audit (mostly section 1) which requires the area manager or senior healthcare person to show documentary evidence that a safe system of work is in place.

Data Set 3. Patient Handling Transfer Observation
The Observer (and or Patient Handling Advisor) is required to observe 10 patient transfers for a ward or unit with up to 50 beds with 24 hour occupancy. This number increases by a ratio of 10 observations to every 50 beds for each bed over 50. E.g. 70 beds =14 observations, 100 beds = 20 observations. The task observed will be scored for competence and compliance with the organisations safe systems of work. Part of the observation of the task requires some brief questions for the carer and the person being assisted. After each observation The Observer (and or PHA) will be required to distribute and collect a series of simple questionnaires as part of the assessment of patient transfers. For each transfer one member of the care team and one patient will complete a separate questionnaire. If the patient is unable to complete the form, it will be removed from the survey.

Data Set 4. Ward/unit survey
The final part of the data collection is to complete a staff and patient survey of the ward/unit. A Staff Questionnaire and a Patient Questionnaire collect data relating to the health and compliance status of the staff and the subjective experiences of the patients being assisted.

Scoring the IET

The data from all sheets in the survey are entered into an excel spreadsheet, scores for each section will be developed for comparison and the overall IET score. According to their ranking, each section will contribute in the following ratio.

Outcome	Conversion factor
Safety Culture	**12**
MSD measures	**11**
Competence Compliance	**10**
Absence or staff health	**9**
Quality of care	**8**
Accident numbers	**7**
Psychological well being	**6**
Patient condition	**5**
Patient perception	**4**
MSD exposure measures	**3**
Patient injuries	**2**
Financial	**1**
Total score	**78**

Each section will be calculated as percentage performance scores and the conversion factors above will be used to calculate the IET as a percentage score out of the total score (78).

Part A

Section 1 Safety Culture

Collection method:

- **Observer to interview unit manager or senior staff member for Questions 1-11.**
- **Question 12 to be given to manager, PHA, BCA, H&S advisor and staff**

Number of forms completed:

- **One interview document**
- **Repeated Question 12**

General Information:
The data for safety culture will be collected mostly from an interview with the ward/unit manager.

Questions 1-10 overleaf constitute the main body of the audit. This tool is entirely based on the Patient Handling Observational Question Set (PHOQS) tool devised and evaluated by Hignett and Crumpton 2005. The scores can only be allowed if documented evidence is seen by the Observer. This is particularly relevant when discussing the communication based questions (9 and 10).

An additional question (11), the subjective appraisal of commitment is added as an average score from the total of the responses recorded.

The total from 35 is calculated as a percentage and included in the IET total score.

Calculation: Modified PHOQS Ratio (Safety Culture 1)

Modified PHOQS score:

=PHOQS score x Commitment average score

$$\textbf{Modified PHOQS Ratio} = \frac{\textbf{Modified PHOQS score}}{\textbf{120}} = \textbf{as\%}$$

Section 1 Safety Culture

	Question	Scoring Categories	Score
1	Have you had an internal manual handling audit within the last 2 years?	Yes 1	
2	Was your last internal manual handling audit: • A service provision audit (organisation) • An equipment or training audit • Local monitoring and supervision • None	Only 1 score Yes 2 Yes 1 Yes 1 Yes 0	
3	Do you have a general manual handling risk assessment system? Is it: • Organisation wide • Local Level • Task-specific • No risk assessment system	Only 1 score Yes 2 Yes 1 Yes 1 Yes 0	
4	Are completed manual handling risk assessments held: • Centrally • Locally • Both • No completed risk assessment	Only 1 score Yes 1 Yes 1 Yes 2 Yes 0	
5	Are manual handling risk assessments reviewed at least annually? • Yes if yes, go to question 6a • No	Only 1 score Yes 1 No 0	
5a	Is the review system: • Formal • Informal	Only 1 score Yes 1 Yes 0	
6	Are patient mobility assessments held in: • Care plans • Separate forms • Both	Only 1 score Yes 1 Yes 1 Yes 1	
7	Are patient mobility assessments held: • With the patient • Separately (if yes go to question 8a)	Only 1 score Yes 2 Yes 1	
7a	If they are held separately, is there a reason?	Yes 1	
8	Do you have appointed manual handling supervisors? • For all wards and departments • For some wards and departments • No	Only 1 score Yes 2 Yes 1 No 0	
9	How is contact maintained with the manual handling supervisors and their competence ensured?	Score 1 for each (Max 5)	

	• Formal training sessions • Formal staff meetings • Informal meetings initiated by back care advisor • Informal meetings initiated by manual handling supervisor • Ad-hoc meetings	Yes 1 Yes 1 Yes 1 Yes 1 Yes 1	
10	How do the manual handling supervisors maintain contact with the staff and ensure their competence? • Training records • Assessing the quality of patient mobility assessments • Entries in patient records/notes • Ward meetings/handover • Personal development plans • Problem-solving sessions/documented supervision • Case conferences/multidisciplinary meetings • Electronic format training/training pack/ workbook • Informal documentation • Other (e.g. memos)	Score 1 for each (Max 10) Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1	
		PHOQS Score (30)	
11	In terms of personnel, time and financial commitment, how well do you think the Org/Dept/Area supports the patient handling programme.	++ 4 + 3 Neutral 2 - 1 -- 0 (Calculate average score)	
		Total section score (120)	

Section 2 MSD Injury rates. (Simplified Nordic MSD Questionnaire)

Collection method:

- **All information collected by self-completed questionnaire given to staff in unit**

Number of forms completed:

- **Collect completed forms from 50% of the WTE numbers on the unit.**
- **The Observer must record the number of staff absent with MSD at the time of the survey and include numbers in the calculation**

General information:
The Nordic MSD questionnaire is a familiar tool. The simple version, reporting only recent MSD's is being used to provide an overall picture of MSD.

The calculation for the IET records any MSD as a negative score and any inclusions will add to the total prevalence.

Any response in the column A scores 1, any score in the column B scores 2 and any response in the time off column, C, scores 3. The worst score in any body part section = 6. When completing the IET the worst scoring row in each form will be added to the total. Therefore if all staff have had some time off in the past 12 months they will record a 100% prevalence score (6).

Calculation: MSD Injury Rate (Section 2)

MSD Injury Rate =

$$\frac{\text{Total score of worst row totals / Number of forms included}}{6} = \text{as\%}$$

Section 2 MSD Injury rates.

A. Have you at any time during the last **12 months** had trouble (such as ache, pain, discomfort, numbness) in:	B. Have you had trouble during the last **7 days**?	C. During the last **12 months** have you **been prevented** from carrying out your normal activities or job or been absent because of this trouble?	Score
Neck No Yes	Neck No Yes	Neck No Yes	
Shoulders No Yes Right Sh Yes Left Sh Yes Both Sh	Shoulders No Yes Right Sh Yes Left Sh Yes Both Sh	Shoulders (Both/Either) No Yes	
Elbows No Yes Right Sh Yes Left Sh Yes Both Sh	Elbows No Yes Right Sh Yes Left Sh Yes Both Sh	Elbows (Both/Either) No Yes	
Wrist or Hands No Yes Right Sh Yes Left Sh Yes Both Sh	Wrist or Hands No Yes Right Sh Yes Left Sh Yes Both Sh	Wrist/Hands(Both/Either) No Yes	
Upper Back No Yes	Upper Back No Yes	Upper Back No Yes	
Lower Back No Yes	Lower Back No Yes	Lower Back No Yes	
Hips Thighs or Buttocks No Yes	Hips Thighs or Buttocks No Yes	Hips Thighs or Buttocks No Yes	
Knees No Yes	Knees No Yes	Knees No Yes	
Ankles or Feet No Yes	Ankles or Feet No Yes	Ankles or Feet No Yes	
		Worst line score	

Section 3 Competence and compliance (DINO)

Collection method:

- **Observer (or Patient Handling Advisor) to watch a selected transfer make judgements on Questions1-16**
- **It may be necessary to interview the Senior Nurse for Questions 17-18**

Number of forms completed:

- **The observed transfers will be selected on a convenience basis. Observations should be taken for 25% of the patients in the unit over a 24 hour period (32 Patients= 8 observations). A minimum of 5 transfers should be observed in any assessment.**

General Information:
DINO gives a reliable method for assessing the basic competency of the staff in the completion of a single observed transfer.

The checklist gives a score for preparation, completion and result phases of the chosen transfer which allows for comparison between different units or hospitals. The additional questions relate more to the issue of compliance with identified practice or simply following the risk assessment or documented handling plan.

The calculation of the DINO score is a summed total from 16 points. This total is then modified by the two multiplier scores. The Adapted DINO is totalled for the final score below.

Calculation: Competence and Compliance (Adapted DINO Section 3)

Competence and Compliance Score =

$$= \frac{\text{Sum of Adapted DINO Scores}}{\text{No. of Observations}} = \text{as\%}$$

Section 3 Competence and compliance

Items	Score System	Scores	
Preparation phase	**Score** **0 1**		
1. Is the patient encouraged to cooperate appropriately?	No Yes		
2. Is enough space prepared for the transfer?	No Yes		
3. Wheelchair, and other objects that the patient is transferred between, positioned and locked away correctly?	No Yes		
4. Is the height of the bed correct?	No Yes		
5. Use of transferring aid(s)?	No Yes		
6. Correct use of the transferring aid(s)?	No Yes		
7. Are there enough staff?	No Yes		
Actual performance phase	**Score** **0 1 2 3 4**	0-4	0-1
8. Good balance	Not at all Totally		
9. Good coordination	Not at all Totally		
10. Good movement economy	Not at all Totally		
11. How is the load on the back and the shoulders?	High Low		
12. To what extent are the criteria in communication and interaction with the patient fulfilled?	Not at all Totally		
13. Is the patient allowed to participate according to her/his ability to perform voluntary movements?	Not at all Totally		
Result phase	**Score** **0 1**		
14. Does the transfer technique chosen by the nurse cause any pain to the patient?	Yes No		
15. Does the transfer technique chosen by the nurse cause any feelings of fear or uncertainty in the patient?	Yes No		
16. Is the patient in a functional position at the end of the transfer?	No Yes		
	DINO Score (16)		
After the task has been completed. 17. Does the ward/dept have a specific handling plan for the of transfer completed?	Yes then x 1 No then x 0.5	x	
18. Did the action observed meet the specific handling plan fully?	Fully x 1, Mostly x 0.875 Reasonable x 0.75, Hardly at all x 0.625, Not at all x 0.5.	x	
	Adapted DINO		

Section 4 Standardised MSD sickness absence score

Collection method:

- **Observer (or Patient Handling Advisor) to interview senior nurse for all questions.**
- **Some data may not be accessible on the ward/unit and questions may need to be referred to HR, personnel or central data systems.**

Number of forms completed:

- **One interview document**

General Information:

The ratio of recorded MSD sickness absence to the number of possible hours worked in the unit is represented in this section. The number of sickness absence days and reduced capacity days is recorded from the management systems and compared against the OSHA defined hours worked ratio. This needs additional information for the total hours delivered in the unit for 1 year against the total possible for 100 staff in 1 year. The resulting ratio gives a comparable value of lost time as a ratio of the hours worked.

Calculation:

a) **Time lost [9]=**

   (Sum of the days lost [6]) + (25% of Days on reduced capacity [8])

b) **Ratio score = Time lost [9] x OSHA Work Hours Factor**

   Time lost [9] x <u>Totals work for 100 staff (100 x [1] x[2])</u>
   Total productive hours ([3] x52)

Section 4 Standardised MSD sickness absence score

Total available hours for ward/unit:

Full weeks per year on standard contract ----------------------- [1]

Full hours per week on standard contract ----------------------- [2]

Actual hours worked per week on unit ---------------------- [3]

Number of W.T.E employed at present on ward/unit -------------------- [4]

Number of days lost due to MSD:

Number of episodes of MSD caused by patient handling or physical care incidents.

------------------------- [5]

Total days lost because of above for previous 12 months

------------------------- [6]

Number of staff that have returned on reduced work capacity due to episodes of MSD

------------------------- [7]

Total days worked on reduced capacity for previous 12 months

------------------------- [8]

Section 5. Patient Handling Exposure Quality Measure

Collection method:

- **Patient Handling Advisor to interview a number of patients who have been assisted to move.**
- **The questions will be delivered verbally and large print cards will be available for the Likert scales. Observer to record answers.**
- **It is acceptable to use a patient's advocate to assist in data collection where appropriate.**

Number of forms completed:

- **One score sheet document per patient**
- **25% of patients that receive assistance with movement will be included in the survey. Every attempt will be made not to include the patients that are included in the observations. A minimum of 5 forms must be completed.**

General Information:
This section aims to quantify the specific factors around the effect that patient handling may have on the perception of quality of care. To keep the data collection as straight forward as possible there are a minimal number of questions for the patient.

Where it is impossible to collect judgement from the patient population 100% compliance scores shall be inserted

The data and score for this section overlaps with the scores in section 8, 9 and 11. It contributes to the combination factor, 'Quality of Care' in the wider context of healthcare.

Calculation: Patient Handling Exposure Quality Measure (Section 5)

Patient Handling Exposure Quality Measure =

$$= \frac{\text{Total scores form all forms}}{25 \times \text{No. of forms}} = \text{as } \%$$

Section 5. Quality of Care Measure

Question	Answer					Score
I feel secure when the staff assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always	
I feel comfortable when the staff assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always	
The staff talk to me and give me verbal information when they assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always	
The staff ask my permission before they assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always	
My personal needs and requirements for dignity and decency are met when I am assisted to move	Never	Hardly Ever	Sometimes	Mostly	Always	
					Total	

Section 6 Patient handling staff accident numbers

Collection method:

- **Observer to interview unit manager or Senior Nurse for Questions 1-2.**
- **Question 3-6 will be given to the staff as part of the questionnaire for them to complete 50% of working population.**

Number of forms completed:

- **One interview document**
- **Repeated answers to Question 3-6, from staff questionnaire**

General Information:
The inclusion of incident numbers that have patient handling factors is unclear and complex. The score system includes scores for non-reporting by the unit manager and self reports of unsafe practice by the staff. The score should be negative for units with a lot of accidents and those with poor practice and poor reporting. There is a check question in the data [3] to detect if too many people report completing an incident form. In this case the data is erroneous and should be removed from the survey.

Calculation: Patient handling staff accident numbers (Section 6)

a) **Number of reported PH incidents =**

Number reported [1] x Ratio of none reported [2]

b) **Potential PH incidents =**

Sum of [4] + [5] + [6] for all participants

c) **Incident score =**

$$\frac{\textbf{Reported PH incidents (a) + Potential PH incidents (b)}}{\textbf{Number WTE on unit}}$$

d) **IET inclusion score = 1- (c) as %**

NB If total sum of 3 > [1] give 100% score <u>or re-conduct survey?</u>

Section 6 Patient handling accident numbers

Questions for incident reporting system (local manager):

How many PH incidents/accidents have been reported over last 12 months

------------------------- [1]

In your opinion are some PH incidents not reported especially if they do not result in an injury or damage to equipment

What is the ratio of under-reporting of PH incidents 1 in ------------------ [2]

Questions to staff as part of Questionnaire:

In the last 12 months have you reported a patient handling accident on the incident reporting system?

Yes No

If yes how many

-------------------------- [3]

In the last one month have you needed to use, or have you seen, a PH method that you considered to be dangerous?

Yes Score 1

No Score 0 [4]

In the last one month did you complete, or have you seen, a PH task without equipment when equipment was prescribed?

Yes Score 1

No Score 0 [5]

If either of the above was ‘yes’ did you report this as an incident?

Yes Score -1

No Score 0 [6]

Section 7 Psychological well being

Collection method:

- **All information collected by self completed questionnaire given to staff in unit**

Number of forms completed:

- **The aim is to collect completed forms by 50% of the WTE numbers on the unit.**
- **The Observer must record the number of staff that are absent with MSD at the time of the survey and include those numbers in the calculation**

General Information:
The link between psycho-social factors and the prevalence of MSD is well documented and one criticism of MSD risk factor studies is the omission of such factors. The scoring system for this section is defined by Bigos (1991) and uses questions 1-3 to give a score for job satisfaction, 4-10 scores for worker satisfaction and 11-13 scores for psycho-social factors. Questions 11-13 are scored in reverse to act as a check score in the data sheet. The calculation recovers the polarity to give positives as high scores for all sections. An average score as a percentage is included in the final IET score.

Calculation: Psychological well being
(Bigos model 1991)

a) **Job Satisfaction = Total score / 9 / No participants**
b) **Work Satisfaction = Total score / 21 / No participants**
c) **Psycho-social factors = (9 – Total score) / 9 / No participants**

Total inclusion score for IET = $\dfrac{a) + b) + c)}{3}$ **= as %**

Section 7 Psychological well being

Question	Rating			Score
1. How satisfied are you with your job	1 Hardly at all	2 Sometimes	3 Almost always	
2. How strongly would you recommend your job to someone else	1 Hardly at all	2 Sometimes	3 Almost always	
3. If you were looking for a job now, how likely is it that you would decide to take this job again.	1 Hardly at all	2 Sometimes	3 Almost always	
4. I am satisfied that I can turn to a fellow worker for help when something is troubling me	1 Hardly at all	2 Sometimes	3 Almost always	
5. I am satisfied with the way my fellow workers talk things over with me and share problems with me	1 Hardly at all	2 Sometimes	3 Almost always	
6. I am satisfied that my fellow workers accept and support my new ideas or thoughts	1 Hardly at all	2 Sometimes	3 Almost always	
7. I am satisfied that my fellow workers respond to my emotions such as anger, sorrow or laughter	1 Hardly at all	2 Sometimes	3 Almost always	
8. I am satisfied that my fellow workers and I share time together	1 Hardly at all	2 Sometimes	3 Almost always	
9. I enjoy the tasks involved in my job	1 Hardly at all	2 Sometimes	3 Almost always	
10. How well do you get along with your closest or immediate supervisor	1 Hardly at all	2 Sometimes	3 Almost always	
11. How often are you faced with conflicting demands of colleagues who you work with	1 Hardly at all	2 Sometimes	3 Almost always	
12. How often does your job leave you with too little time to get everything done	1 Hardly at all	2 Sometimes	3 Almost always	
13. How often is your supervisor willing to listen to your work related problems	1 Hardly at all	2 Sometimes	3 Almost always	
	Total			

Section 8 Patient Condition

Collection method:

- **All information collected by self completed questionnaire given to staff in unit**
- **The Patient Handling Advisor may assist with specific information and questions if required**

Number of forms completed:

- **The aim is to collect completed forms by 50% of the WTE numbers on the unit.**

General Information:
The EU study indicated that Patient Handling Specialists considered that high quality patient handling could improve the treatment and effectiveness of a care package. Quantifying that effect has been a challenge. This series of questions aims to identify any negative effects of poor patient handling systems. Each identified case of a negative effect reduces the score in the section. The consideration that the prevalence of pressure sores may also be a deterioration in the patient condition is included in Section 11.

Calculation: Patient Condition (Section 8)

$$\textbf{Patient Condition Score} = \frac{\textbf{Total score from survey}}{\textbf{16 x No of forms}} = \textbf{as \%}$$

Section 8 Patient condition

The effective management of patient handling issues can assist in the delivery of high quality healthcare. Not having the suitable working environment may be a barrier to the implementation of best practice.

Question	**Answer**					**Score**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients rehabilitation or maintenance programme	Never 4	Hardly Ever 3	Sometimes 2	Mostly 1	Always 0	
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients hygiene or care activities	Never 4	Hardly Ever 3	Sometimes 2	Mostly 1	Always 0	
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients discharge or transfer to another location.	Never 4	Hardly Ever 3	Sometimes 2	Mostly 1	Always 0	
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients positioning or comfort	Never 4	Hardly Ever 3	Sometimes 2	Mostly 1	Always 0	
					Total (16)	

Section 9 Patient Perception

Collection method:

- **This value is the simplest to collect and is recorded as part of the transfer observations completed by the Observer.**
- **After the observation the Observer questions the person that has been moved to rate safety and comfort on the bipolar likert scales.**
- **Question 3 is to be asked verbally of one of the staff completing the transfer**

Number of forms completed:

- **Little control can be expected over which transfers are observed but observations should be taken for 25% of the patients in the unit over a 24 hour period (32 Patients= 8 observations)**

General Information:
The general views of staff and management relating to the quality of the services provided is accounted for in other sections. This section is related to the safety and comfort of any patients that are assisted in movement. After the transfer has been completed large font copies of the likert scales will be presented to the patient and the questions asked verbally.

The staff question is to ascertain whether the choice of transfer of the method of completion of the task is the root cause for any poor perception. This is to be used as a cross check for the section score

Calculation:

Total for IET inclusion =

$$\frac{\textbf{Sum of Scores from patient questions}}{\textbf{Number of participants}}$$

Section 9 Patient Perception

Patient Perception	Score
Do you think the transfer you just experienced was safe and secure The transfer was: **-4 -3 -2 -1 0 +1 +2 +3 +4** **Very unsafe** **Very safe**	
Did you experience any additional discomfort because of the transfer? The transfer was: **-4 -3 -2 -1 0 +1 +2 +3 +4** **Very uncomfortable** **Very comfortable**	
Did the staff attempt to maximise your privacy and dignity during the transfer **-4 -3 -2 -1 0 +1 +2 +3 +4** **Not at all** **Maximum possible**	
In isolation staff view of their own actions during transfer: Did you think that the transfer you just completed was performed well and according to your plan? **-4 -3 -2 -1 0 +1 +2 +3 +4** **Very poor** **Excellent**	

Section 10 MSD Risk Exposure Measure

Collection method:

- **Observer to interview unit manager or senior staff member to review the patient handling load for a given 24 hour period**
- **Patient values to include patients admitted and discharged in the time frame.**

Number of forms completed:

- **One review document including a score for all patients over 24 hour period**

General Information:

There have been many studies that attempt to measure the exposure to MSD risks. Mostly the measures are in the form of epidemiological reviews or hazard identification investigations. The findings of most of these studies agree that the number of handling tasks increases the chance of injury. 24 hour recordings of actual tasks are not possible in the context of this tool, therefore an estimation of handling demand is proposed based on the measurement of the following factors.

a) The patient condition rated on the Arjo Resident Gallery
b) The weight of the patient
c) The functional activities that require assistance from staff AND are being completed
d) The provision of suitable equipment to manage the risks of transfers
e) Other additional risks perceived by the staff on the unit

The Care Thermometer guidance for safe transfers is as follows:
Repositioning in bed – Hi/lo bed and sliding aids
Lateral transfers – Requires sliding aids
General transfers – Active or passive lifter where appropriate
Hygiene in sitting – Hi/lo hygiene chair
Shower in supine – Hi/lo shower trolley
Bathing – Hi/lo bath
Transfers to bath – Hi/lo seat or hi/lo trolley
Care on bed – Hi/lo bed
Compression stockings – Stocking applicator aid

The final section allows the staff on the unit to identify further complications for the handling activities based on their experience, additional risks will be scored for poor equipment, poor environment and lack of compliance of patient.

The measurement is calculated as two separate ratios that can be used as comparisons between units. The first is to measure the average handling demand per patient and the second for inclusion in the IET is the average handling demand per WTE staff member.

Calculation:

a) **Average per patient [4] =**

Total score [3] / Number of patients in 24 hours [1]

b) **Average per staff WTE [5] =**

Total score [3] / Total WTE in 24 hours [2]

Section 10 MSD Exposure Measure

Bed No	Arjo Gallery Score					Weight kgs		Tasks needing assistance (Equipment provided)									Other risks			Total
	A	B	C	D	E	100-140	140+	Repositioning in bed	Lateral transfers	General transfers	Hygiene in sitting	Shower in supine	Bathing	Transfers to bath	Care on bed	Compression stockings	Poor / shortage equipment	Poor environment	Lack of patient compliance	
1	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
2	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
3	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
4	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
5	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
6	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
7	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
8	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
9	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
10	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
11	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
12	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
13	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
14	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
15	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
16	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
17	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
18	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
					Scoring	**+1**	**+2**	**0 +1**	**0 +1**	**0 +1**	**0 +1**	**0 +1**	**0 +1**	**0 +1**	**0 +1**	**0 +1**	**+1**	**+1**	**+1**	**Max =15**

Summary data

Total Number of patients over 24hrs	-------------------------- [1]
Total WTE on PH duties for 24 hrs	-------------------------- [2]
Total score for Handling Need	-------------------------- [3]
Average patient score	-------------------------- [4]
Score per staff member	-------------------------- [5]

Section 11 Patient injuries

Collection method:

- **Observer to interview unit manager or Senior Nurse for all questions**
- **It may be necessary to access some information from other sources if record keeping is not stored at a local level. E.g. Tissue viability nurse**

Number of forms completed:

- **One interview document**

General Information:

The value of patient injuries can only be scored by actual records of incidents, accidents and known deterioration of conditions. The source of all patient injuries/incidents will be recorded in the usual accident reporting processes.

In modern healthcare where pressure relieving beds and surfaces is the norm it has been suggested that any deterioration in tissue viability scores could have a link with patient handling, patient positioning or improper use of profiling beds (Ref).

Calculation:

Patient Injury Score =

Number of reported incidents[1] + Acquired pressure ulcer score [2,3]

Annual patient injury score = [1] + (4 x [2])

Or = [1] + (12 x [3])

Ratio for inclusion in IET = $\dfrac{\textbf{Annual patient injury score}}{\textbf{Number of beds [4]}}$

Section 11 Patient Injuries

Number of incidents recorded that resulted in a patient injury ?
E.g. Mobility, improper positioning, etc. For last 3 months

------------------------- [1]

Acquired pressure ulcer score:

for last 3 months ------------------------- [2]

or

for last 1 month ------------------------- [3]

Number of occupied beds in unit ------------------------- [4]

Section 12 Financial outcome

Collection method:

- **Observer to interview unit manager or senior staff member for Questions 1-4.**
- **Data for the costs of the intervention could be found with the patient handling specialist, occupational health or HR**

Number of forms completed:

- **One interview document**

General Information:
The data collected in this section may be difficult to locate in many organisations so there has been a multiplier calculation to find an average cost for the sickness absence calculated in Section 4.

The ratio of costs of MSD sickness absence and workers compensation, to the number of possible hours worked in the unit is represented in this section. The number of sickness absence days and reduced capacity days is recorded from the management systems and this is compared against the OSHA defined hours worked ratio. This needs additional information for the total hours delivered in the unit for 1 year against the total possible for 100 staff in 1 year. The resulting ratio gives a comparable value of financial losses as a ratio of the hours worked.

There are two methods for calculating the financial losses one as a benchmarking tool and one as an intervention measure.

Calculation:

a) Total costs [5]=

Losses from: MSD [1]+ Reduced capacity [2] + MSD claims [3] + Treatment costs [4] + Patient claims [5] + Care costs [6]

b) Ratio score = Total losses [5] x OSHA Work Hours Factor
(From Section 4)

$$\frac{\textbf{Total losses [5] x Totals work for 100 staff (100 x [1] x[2])}}{\textbf{Total productive hours ([3] x52)}}$$

When using the IET as a benchmarking tool the costs of the intervention are not included in the calculation. When using the IET as a intervention assessment to calculate the improvement then the financial score will be calculated as improvement per unit cost.

$$\textbf{Improvement IET} = \frac{\textbf{Losses before [5a] – Losses after [5b]}}{\textbf{Cost of intervention}}$$

Section 12 Financial outcome

Losses to organisation over previous 12 months:

1) Losses to ward/department due to MSD sickness absence

If unable to locate, calculate number of days lost x average salary/210

Days lost ---------------------- X Avge Salary ------------------------- / 210

= ----------------------

2) Losses to ward/department due to staff on reduced capacity

----

If unable to locate, calculate
(number of days on reduces capacity/4) x (average salary/210)

(Days lost ------------------ / 4) X (Avge Salary------------------------- / 210)

= ----------------------

3) Losses due to compensation claims for MSD over last 12 months

= ----------------------

4) Estimated treatment costs for staff receiving MSD at work

= ----------------------

5) Estimated costs for patient claims resulting from manual handling

= ----------------------

6) Estimated healthcare costs resulting from manual handling

= ----------------------

Costs of Intervention:

What did the intervention cost in terms of extra resources?
(This value cannot include regular staff time e.g. training, supervision, as it is a regularly defined job role)

a) Equipment costs
b) Extra training costs
c) External staff costs
d) Other costs (specify)

Section 13 Calculating the IET Score

All the section scores will be calculated a ratios or as percentages and then will be added to the final score sheet.

Outcome	Measure	Ratio Score [a]	Score [b]	Total [c] = [axb]
Safety Culture	Modified PHOQS ratio		**12**	
MSD measures	Proportion of staff with MSD		**11**	
Competence Compliance	Average modified DINO score		**10**	
Absence or staff health	Standardised lost work time		**9**	
Quality of care	Average patient handling quality score		**8**	
Accident numbers	Patient handling accidents per staff (wte)		**7**	
Psychological well being	Average psycho-social well-being score		**6**	
Patient condition	Recorded impairments per patient per year		**5**	
Patient perception	Average patient perception score		**4**	
MSD exposure measures	MSD exposure measure		**3**	
Patient injuries	Patient injury score per patient		**2**	
Financial	Standardised costs for MSD		**1**	
Totals score			**78**	

The final part of the process is to calculate the total IET score as a benchmark value,

Total IET score = Total contributions [c] / 78

Part B

Data Collection

Data Collection Guidance and Documents

Data Set 1. Organisational Review
The Observer (Patient Handling Advisor) to collect information about, accidents incidents and the costs of MSD in the unit being investigated. This will be gathered through the specific people in the organisation e.g. HR,H&S, ward manager, handling advisors.

1.1 Front sheet
1.2 Staffing and patient handling workload
1.3 MSD and levels of sickness absence
1.4 Workload from patient dependencies
1.5 Patient handling management systems
1.6 Intervention costs

Data Set 2. Safety Culture Audit
The Observer (Patient Handling Advisor) will need to visit the chosen area and conduct a Patient Handling Safety Culture Audit which requires the area manager or senior healthcare person to show documented evidence that a safe system of work is in place.

2.1 Patient handling safety culture audit

Data Set 3. Patient Handling Transfer Observation
The Observer (Patient Handling Advisor) is required to observe a sample of patient handling transfers, 25 % of the patients on the unit. E.g 32 beds = 8 observed transfers. There should be a minimum of 5 transfers per survey. The task observed will be scored for competence and compliance with the organisations safe systems of work. Part of the observation of the task requires some brief questions for the carer and the person being assisted. For each transfer one member of the care team (3.3) and the patient (3.2) will complete a separate question set. If the patient is unable to complete due to their condition the form will be removed from the survey.

3.1 Patient handling transfer observation
3.2 Patient handling transfer observation – patient feedback
3.3 Patient handling transfer observation – staff feedback

Data Set 4. Ward/unit survey
The final part of the data collection is to complete a staff and patient survey of the ward/unit. A Staff Questionnaire and a Patient Questionnaire collect data relating to the health and compliance status of the staff and the subjective considerations of the patients being assisted.

4.1 Staff MSD survey
4.2 Staff well being survey
4.3 Patient handling survey
4.4 Patient survey

Data Set 1 Organisational Review

Instructions: Sections 1.1 to 1.6 are collected by the Observer in consultation with the senior nurse or the unit manager

Collection method:

- **Observer (or Patient Handling Advisor) to interview senior nurse for all questions.**
- **Some data may not be accessible on the ward/unit and questions may need to be referred to HR, personnel or central data systems.**

Number of forms completed:

- **One interview document**

1.1 Front sheet
Records the details of the unit, the normal working systems and the management processes that are in place to manage patient handling risks. This section identifies the regular workload and staffing numbers that should be in place in this location.

1.2 Staffing and patient handling workload
This section records the staff and patient numbers on the day of the survey and identifies incident and accident data.

1.3 MSD and levels of sickness absence
The numbers of staff reporting sickness absence because of MSD and those on reduced capacity. The costs from compensation claims are also identified in this section.

1.4 Workload from patient dependencies
All patients in the unit need to be assessed for the level of manual or mechanical assistance they received. This relates to the demand on the staff over a 24 hour period

1.5 Patient handling management systems
This section is a management appraisal of whether there might be weaknesses in the systems that are provided.

1.6 Intervention costs
In most situations this assessment will be used as a moment in time survey to examine what systems and problems are identified. It is possible to use the tool to show how much change there has been with a specific intervention. If this has happened this section is used to record the intervention details.

1.1 Front Sheet for IET Assessment

		Details		
Name of Organisation				
Location of Assessment				
Description of Service				
Contact Details for Location		Tel	x	
Name of Unit Manager				
Name of Senior Nurse (s)				
Workload Overview		**Number of Beds/Patients**		
Normal Hours for full week		**Normal weeks in full year**		
Normal Staffing Levels for Care Tasks		Shift	Qualified	Non-Qual
		Early		
		Late		
Total WTE		Night		
Risk Management Structures				
Incident Reporting System				
Risk Management Audit System				
OH or Stress Audit System				
Acquired Pressure Ulcer Monitoring		Ward	Central	
Patient Handling Structures				
Patient Handling Advisor		Name Tel	Years in post	
Patient Handling Training System		Central	External	Cascade
Link Worker System		Yes / No		
Manual Handling Policy		Yes / No		

Additional Information:

Data Set 1 Organisational Review

Please answer the following as truthfully as possible. If data to answer the question is not available can you suggest someone we can approach to obtain the details.

1.2 <u>Staffing and patient handling workload</u>

You have given the normal shift patterns and staffing numbers in the overview. Could you confirm the workload and staffing for this week.

<u>Workload</u>				**Details**
Number of patients on ward/unit today / 24 hours. (Include admissions/discharge)				
Staffing Levels for Care Tasks This Week	Shift	Qualified	Non-Qual	
	Early			
Total WTE	Late			
	Night			
Actual hours worked this week				
<u>Accident Reporting</u>				**Details**
Do you have access to accident and incident data?				**Yes No**
How many Patient Handling incidents/accidents have been reported over last 12 months that have involved an injury to staff?				
In your opinion are some Patient Handling incidents not reported especially if they do not result in an injury or damage to equipment **What is the ratio of under-reporting of PH incidents** 1 in				**Yes No**
Number of incidents recorded that resulted in a patient injury ? E.g. Mobility, improper positioning, etc. For last 3 months:				
What is the acquired pressure ulcer score: for last 3 months or for last 1 month				

1.3 <u>MSD rate and levels of sickness absence</u>

Sickness absence costs	**Number**
Number of episodes of MSD caused by patient handling or physical care incidents.	
Total days lost because of above for previous 12 months	
Number of staff that have returned on reduced work capacity due to episodes of MSD	
Total days worked on reduced capacity for previous 12 months	
Losses to ward/department due to MSD sickness absence	
Losses to ward/department due to staff on reduced capacity	
Losses due to compensation claims for MSD over last 12 months	
Estimated treatment costs for staff receiving MSD at work	
Estimated costs for patient claims resulting from manual handling	
Estimated healthcare costs resulting from manual handling	

1.4 Workload from patient dependencies

All patients in the unit need to be assessed for the level of manual or mechanical assistance they receive. This relates to the manual handling demand on the staff over a 24 hour period.

The score table 1.4 shows the different judgements that need to be made.

Arjo Mobility Gallery
Each patient should be categorised against the descriptions A-E. The descriptors of the patient types are found in table 1

Arjo Care Thermometer Safe Transfer Guidance
According to the level of dependency (A-E) there is an expected level of equipment for each of the transfers noted. The levels of equipment required for each transfer or care task is found in Table 2.

Scores should be allocated under the following conditions:

- If the task is not part of the care package then leave blank
- Score no if the equipment level does not meet the information in the chart.
- Score yes if the equipment does meet the information in the chart

Weight Factor
Select the appropriate weight band if the patient is heavy

Perceived Increased Risk
The staff have an opportunity to identify any other factors that increase the physical demand on the staff with any patient.

Table 1 Arjo Mobility Gallery

Mobility Class	A 	B 	C 	D 	E 
	-Ambulatory but may use a cane for support -Independent, can clean and dress themselves -Can tire quickly -Stimulation of abilities is very important	-Uses walking frame or similar -Can support themselves to some degree -Dependent on carer present in demanding situations -Not physically demanding for carer -Stimulation of remaining abilities is important	-Sits in wheelchair -Is able to partially bear weight on at least one leg -Has some trunk stability -Dependent on carer in most situations -Physically demanding for carer -Simulation of remaining abilities is very important	-Sits in wheelchair -No capacity to support themselves -Cannot stand, is unable to bear weight even partially -Dependent on carers in most situations -Physically demanding for carer -Simulation of remaining abilities is very important	-Passive -Might be almost completely bedridden -Often stiff contracted joints -Totally dependent -Physically demanding for carer -Stimulation and activation is not a primary goal
Is patient independent	**YES**	**NO**	**NO**	**NO**	**NO**
Is there a chance of overloading staff due to care tasks	**NO**	**NO**	**YES**	**YES**	**YES**
Is the patient active or actively contributing to the movement	**YES**	**YES**	**YES**	**NO**	**NO**

Table 2. Arjo Care Thermometer Safe Transfer Guidance

Task	Equipment required				
	A	B	C	D	E
Repositioning in bed			**Hi/lo bed and sliding material**	**Hi/lo bed and sliding material**	**Hi/lo bed and sliding material**
Lateral transfers	**Sliding material**	**Sliding material**	**Sliding material**	**Sliding material**	**Sliding material**
General transfers			**Active lift**	**Passive lift**	**Passive lift**
Hygiene tasks in sitting		**Hi/lo hygiene chair**	**Hi/lo hygiene chair**	**Hi/lo hygiene chair**	**Hi/lo hygiene chair**
Showering in supine	**Hi/lo shower trolley**	**Hi/lo shower trolley**	**Hi/lo shower trolley**	**Hi/lo shower trolley**	**Hi/lo shower trolley**
Bathing		**Hi/lo bath**	**Hi/lo bath**	**Hi/lo bath**	**Hi/lo bath**
Transfers to/from bath		**Hi/lo seat**	**Hi/lo seat**	**Hi/lo shower trolley**	**Hi/lo shower trolley**
Care on bed > 1 min	**Hi/lo bed**	**Hi/lo bed**	**Hi/lo bed**	**Hi/lo bed**	**Hi/lo bed**
Compression stockings	**Stocking aid**	**Stocking aid**	**Stocking aid**	**Stocking aid**	**Stocking aid**

1.4 Workload from patient dependencies

Bed No	Arjo Gallery Score					Weight kgs		Tasks needing assistance (Equipment provided)									Other risks			Total
	A	B	C	D	E	100-140	140+	Repositioning in bed	Lateral transfers	General transfers	Hygiene in sitting	Shower in supine	Bathing	Transfers to bath	Care on bed	Compression stockings	Poor / shortage equipment	Poor environment	Lack of patient compliance	
1	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
2	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
3	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
4	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
5	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
6	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
7	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
8	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
9	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
10	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
11	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
12	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
13	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
14	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
15	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
16	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
17	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
18	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	

1.4 Workload from patient dependencies

Bed No	Arjo Gallery Score					Weight kgs		Tasks needing assistance (Equipment provided)									Other risks			Total
	A	B	C	D	E	100-140	140+	Repositioning in bed	Lateral transfers	General transfers	Hygiene in sitting	Shower in supine	Bathing	Transfers to bath	Care on bed	Compression stockings	Poor / shortage equipment	Poor environment	Lack of patient compliance	
19	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
20	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
21	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
22	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
23	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
24	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
25	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
26	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
27	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
28	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
29	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
30	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
31	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
32	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
33	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
34	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
35	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	
36	A	B	C	D	E	100	140	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Y N	Add Risk	Add Risk	Add Risk	

1.5 Patient Handling Management System

Given the patient dependencies and handling workload previously described could you answer the following by circling the appropriate answer

Rating
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients rehabilitation or maintenance programme **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients hygiene or care activities **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients discharge or transfer to another location. **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients positioning or comfort **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
In terms of personnel, time and financial commitment, how well do you think the organisation, department and area support the patient handling programme. **++** **+** **0** **-** **--** **Excellent** **Neutral** **Very Poor**

Any further considerations:

1.6 Cost of the intervention

If the assessment is being used to evaluate the effect of a specific intervention use this section to calculate the costs of the intervention.

Costs of Intervention:

What did the intervention cost in terms of extra resources? (This value cannot include regular staff time e.g. training, supervision, as it is a regularly defined job role)

Define the components of the intervention

Equipment costs

Extra training costs

External staff costs

Other costs (specify)

Data Set 2 - Patient Handling Safety Culture Audit

Collection method:

- **Observer to interview unit manager or senior staff member.**

Number of forms completed:

- **One interview document**

General Information:
The data for safety culture will be collected mostly from an interview with the ward/unit manager, the evidence of the systems for training and manual handling supervisors may be with the patient handling advisor or training department.

Questions 1-10 overleaf constitute the audit. Proof of the system being in place has to be seen and documented evidence should be provided. Examples of these would be policies, procedures, audit checklists or risk assessment documentation.

2.1 <u>Patient Handling Safety Culture Audit</u>

	Question	Scoring Categories	Score
1	Have you had an internal manual handling audit within the last 2 years?	Yes 1	
2	Was your last internal manual handling audit: • A service provision audit (organisation) • An equipment or training audit • Local monitoring and supervision • None	Only 1 score Yes 2 Yes 1 Yes 1 Yes 0	
3	Do you have a general manual handling risk assessment system? Is it: • Organisation wide • Local Level • Task-specific • No risk assessment system	Only 1 score Yes 2 Yes 1 Yes 1 Yes 0	
4	Are completed manual handling risk assessments held: • Centrally • Locally • Both • No completed risk assessment	Only 1 score Yes 1 Yes 1 Yes 2 Yes 0	
5	Are manual handling risk assessments reviewed at least annually? • Yes if yes, go to question 6a • No	Only 1 score Yes 1 No 0	
5a	Is the review system: • Formal • Informal	Only 1 score Yes 1 Yes 0	
6	Are patient mobility assessments held in: • Care plans • Separate forms • Both	Only 1 score Yes 1 Yes 1 Yes 1	
7	Are patient mobility assessments held: • With the patient • Separately (if yes go to question 8a)	Only 1 score Yes 2 Yes 1	
7a	If they are held separately, is there a reason?	Yes 1	
8	Do you have appointed manual handling supervisors? • For all wards and departments • For some wards and departments • No	Only 1 score Yes 2 Yes 1 No 0	

9	How is contact maintained with the manual handling supervisors and their competence ensured? • Formal training sessions • Formal staff meetings • Informal meetings initiated by back care advisor • Informal meetings initiated by manual handling supervisor • Ad-hoc meetings	Score 1 for each (Max 5) Yes 1 Yes 1 Yes 1 Yes 1 Yes 1	
10	How do the manual handling supervisors maintain contact with the staff and ensure their competence? • Training records • Assessing the quality of patient mobility assessments • Entries in patient records/notes • Ward meetings/handover • Personal development plans • Problem-solving sessions/documented supervision • Case conferences/multidisciplinary meetings • Electronic format training/training pack/ workbook • Informal documentation • Other (e.g. memos)	Score 1 for each (Max 10) Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1 Yes 1	
		PHOQS Score (30)	

Data Set 3 – Patient Handling Transfer Observation

Collection method:

- **Observer (or Patient Handling Advisor) to watch a selected transfer and score Questions1-16**
- **It may be necessary to interview the Senior Nurse for Questions 17-18**

Number of forms completed:

- **The observed transfers will be selected on a convenience basis. Observations should be taken for 25% of the patients in the unit over a 24 hour period (32 Patients= 8 observations). A minimum of 5 transfers should be observed in any assessment.**

General Information:

3.1 Patient handling transfer observation
The checklist gives a score for preparation, completion and result phases of the chosen transfer which allows for comparison between different units or hospitals. The additional questions relate more to the issue of compliance with identified practice or simply following the risk assessment or documented handling plan.

The preparation phase questions (1-7) are yes/no answers and relate to the selection and use of equipment for the task and setting up the work environment.

The performance phase questions (8-13) are graded on a 5 points scale. The score from the assessment should be written in the 0-4 column on the right of the scales. It is acceptable to consider the questions as an interpretation of the movement principles and safe practice adopted at the survey venue.

The result phase is scored as yes/no questions.

After the task it is important to complete Q 17-18 to examine the management guidance in place for the task.

3.2 Patient handling transfer observation – patient feedback
After the observation the 3 patient feedback questions should be asked of the person being moved. If they are unable to answer then this data will be removed from the survey. Observers should record that the patient was unable to answer.

3.3 Patient handling transfer observation – staff feedback
After the task 3.3 should be given to one of the staff involved**.**

For each task there should be one completed version of 3.1, 3.2 and 3.3.

3.1 <u>Patient Handling Transfer Observation</u>

Items	Score System	Scores	
Preparation phase 1. Is the patient encouraged to cooperate appropriately?	**Score** **0** **1** No Yes		
2. Is enough space prepared for the transfer?	No Yes		
3. Wheelchair, and other objects that the patient is transferred between, positioned and locked away correctly?	No Yes		
4. Is the height of the bed correct?	No Yes		
5. Use of transferring aid(s)?	No Yes		
6. Correct use of the transferring aid(s)?	No Yes		
7. Are there enough staff?	No Yes		
Actual performance phase 8. Good balance	**Score** **0 1 2 3 4** Not at all Totally	0-4	0-1
9. Good coordination	Not at all Totally		
10. Good movement economy	Not at all Totally		
11. How is the load on the back and the shoulders?	High Low		
12. To what extent are the criteria in communication and interaction with the patient fulfilled?	Not at all Totally		
13. Is the patient allowed to participate according to her/his ability to perform voluntary movements?	Not at all Totally		
Result phase 14. Does the transfer technique chosen by the nurse cause any pain to the patient?	**Score** **0** **1** Yes No		
15. Does the transfer technique chosen by the nurse cause any feelings of fear or uncertainty in the patient?	Yes No		
16. Is the patient in a functional position at the end of the transfer?	No Yes		
	DINO Score (16)		
After the task has been completed. 17. Does the ward/dept have a specific handling plan for the transfer completed?	Yes then x 1 No then x 0.5	x	
18. Did the action observed meet the specific handling plan fully?	Fully x 1, Mostly x 0.875 Reasonable x 0.75, Hardly at all x 0.625, Not at all x 0.5.	x	
	Adapted DINO		

3.2 Patient Handling Transfer Observation – Patient Feedback

Do you think the transfer you just experienced was safe and secure								
-4	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**
Very unsafe								**Very safe**
Did you experience any additional discomfort because of the transfer?								
-4	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**
Very uncomfortable								**Very comfortable**
Did the staff attempt to maximise your privacy and dignity during the transfer								
-4	**-3**	**-2**	**-1**	**0**	**+1**	**+2**	**+3**	**+4**
Not at all								**Maximum possible**

3.3 <u>Patient Handling Transfer Observation - Staff Feedback</u>

Did you think that the transfer you just completed was performed well and according to your plan?

-4	-3	-2	-1	0	+1	+2	+3	+4
Very poor								**Excellent**

Data Set 4 – Ward/Unit Survey

Data Collection:

4.1 Staff MSD survey
4.2 Staff well being survey
4.3 Patient handling survey

All 3 questionnaires are given to the staff as a single form and staff will complete all 3 sections before returning

Collection method:
- **All information collected by self-completed questionnaire given to staff in unit**

Number of forms completed:
- **Collect completed forms from 50% of the WTE numbers on the unit.**
- **The Observer must record the number of staff absent with MSD at the time of the survey and include numbers in the calculation**

4.4 Patient survey

Collection method:
- **Patient Handling Advisor to interview a number of patients who have been assisted to move.**
- **The questions will be delivered verbally and large print cards will be available for the patient to view. The Observer to record the answers.**
- **It is acceptable to use a patient's advocate to assist in data collection where appropriate.**

Number of forms completed:
- **One score sheet document per patient**
- **25% of patients that receive assistance with movement will be included in the survey. Every attempt will be made not to include the patients that are included in the observations. A minimum of 5 forms must be completed.**

4.1 Staff MSD Survey

Please circle any information that applies to yourself in A, B and C.

A. Have you at any time during the last **12 months** had trouble (such as ache, pain, discomfort, numbness) in:	B. Have you had trouble during the last **7 days**?	C. During the last **12 months** have you **been prevented** from carrying out your normal activities or job or been absent because of this trouble?
Neck No Yes	**Neck** No Yes	**Neck** No Yes
Shoulders (Both / Either) No Yes	**Shoulders (Both / Either)** No Yes	**Shoulders (Both/Either)** No Yes
Elbows (Both/Either) No Yes	**Elbows (Both/Either)** No Yes	**Elbows (Both/Either)** No Yes
Wrist/Hands(Both/Either) No Yes	**Wrist/Hands(Both/Either)** No Yes	**Wrist/Hands(Both/Either)** No Yes
Upper Back No Yes	**Upper Back** No Yes	**Upper Back** No Yes
Lower Back No Yes	**Lower Back** No Yes	**Lower Back** No Yes
Hips Thighs or Buttocks No Yes	**Hips Thighs or Buttocks** No Yes	**Hips Thighs or Buttocks** No Yes
Knees No Yes	**Knees** No Yes	**Knees** No Yes
Ankles or Feet No Yes	**Ankles or Feet** No Yes	**Ankles or Feet** No Yes

4.2 Staff Well-Being Survey

Please circle the comment that applies to yourself in the rating column.

Question	Rating
1. How satisfied are you with your job	**Hardly at all Sometimes Almost always**
2. How strongly would you recommend your job to someone else	**Hardly at all Sometimes Almost always**
3. If you were looking for a job now, how likely is it that you would decide to take this job again.	**Hardly at all Sometimes Almost always**
4. I am satisfied that I can turn to a fellow worker for help when something is troubling me	**Hardly at all Sometimes Almost always**
5. I am satisfied with the way my fellow workers talk things over with me and share problems with me	**Hardly at all Sometimes Almost always**
6. I am satisfied that my fellow workers accept and support my new ideas or thoughts	**Hardly at all Sometimes Almost always**
7. I am satisfied that my fellow workers respond to my emotions such as anger, sorrow or laughter	**Hardly at all Sometimes Almost always**
8. I am satisfied that my fellow workers and I share time together	**Hardly at all Sometimes Almost always**
9. I enjoy the tasks involved in my job	**Hardly at all Sometimes Almost always**
10. How well do you get along with your closest or immediate supervisor	**Hardly at all Sometimes Almost always**
11. How often are you faced with conflicting demands of colleagues who you work with	**Hardly at all Sometimes Almost always**
12. How often does your job leave you with too little time to get everything done	**Hardly at all Sometimes Almost always**
13. How often is your supervisor willing to listen to your work related problems	**Hardly at all Sometimes Almost always**

4.3 Patient Handling Survey

Please circle the comment that applies to yourself in the rating column.

Rating
In the last 12 months have you reported a patient handling accident on the incident reporting system? **Yes** **No** If yes how many ------------
In the last one month have you needed to use, or have you seen, a PH method that you considered to be dangerous? **Yes** **No**
In the last one month did you complete, or have you seen, a PH task without equipment when equipment was prescribed? **Yes** **No**
If either of the above was 'yes' did you report this as an incident? **Yes** **No**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients rehabilitation or maintenance programme **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients hygiene or care activities **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients discharge or transfer to another location. **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
Has the lack of suitable equipment, space, environment, skills or knowledge ever interfered with a patients positioning or comfort **Never** **Hardly Ever** **Sometimes** **Mostly** **Always**
In terms of personnel, time and financial commitment, how well do you think the Org/Dept/Area supports the patient handling programme. **++** **+** **0** **-** **--** **Excellent** **Neutral** **Very Poor**

4.4 <u>Patient Survey</u>

Please circle the comment that applies to the patient response in the rating column.

Question	Rating				
I feel secure when the staff assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always
I feel comfortable when the staff assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always
The staff talk to me and give me verbal information when they assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always
The staff ask my permission before they assist me to move	Never	Hardly Ever	Sometimes	Mostly	Always
My personal needs and requirements for dignity and decency are met when I am assisted to move	Never	Hardly Ever	Sometimes	Mostly	Always

IET Data Collection Checklist

Data Collection Sheets	Number needed	Number collected
Data Set 1. **Organisational Review** 1.1 Front sheet		
1.2 Staffing and patient handling workload		
1.3 MSD and levels of sickness absence		
1.4 Workload from patient dependencies		
1.5 Patient handling management systems		
1.6 Intervention costs		
Data Set 2. **Safety Culture Audit** 2.1 Patient handling safety culture audit		
Data Set 3**. Patient Handling Transfer Observation** 3.1 Patient handling transfer observation		
3.2 Patient handling transfer observation – patient feedback		
3.3 Patient handling transfer observation – staff feedback		
Data Set 4. **Ward/unit survey** 4.1 Staff MSD survey		
4.2 Staff well being survey		
4.3 Patient handling survey		
4.4 Patient survey		

APPENDIX I

Data collected from IET trials

Pilot Visit
Meeting with Back Care Advisor, Derby Hospitals.
Points raised:
Is there a need for demographic information related to the staff groups that are completing the forms. E.g. HCA, Reg Nurses? Time in service?
Need to create simple one page guide for possible 'Observers'.
Need to have specific routines for data collection in each set of data sheets. This should include numbers of participants, order of presentation, when how, who etc.
Final section to explain structure of scoring system 1-12 ratio scores and addition factors for final IET.

1. Safety Culture	Typo Scoring in Box 8 The structure of the PHOQS format is similar to the hospitals usual audit format. No problems identified. The DIAG document differentiates this hospital to others. Should we add a question regarding organisational wide protocols for management of PH tasks.
2. MSD measures	Previous studies in this hospital have used the Nordic. The front sheet of the form was very well completed by all participants. Problems were encountered in the joining of this form with other sections. Scoring system needs thought, could be a % reduction for the interventions. Due to needing MSD and Psych forms be careful of time commitment. Possible need for ½ workforce
3. Competence Compliance	This hospital conducts observational audits as part of their performance review. Usual time length is ½ day. 10 observations would be possible in ½ day.
4. Absence or staff health	Typo Last question fro. Data for hospital might be held in HR. Local 1/12 or 3/12 might be held or known locally. Local manager would have worker numbers and times completed.
5. Quality of care	As a combination factor with 8,9,11. Is it possible to request a range of scales to answer issues surrounding dignity, respect comfort and access to info and support from a group of patients with handling needs • Never, sometimes, mostly, always
6. Accident numbers	Local and central data for incidents reported. Question over whether management or staff will be honest regarding the non reporting issues. There is likely to be a link with culture and compliance in dept as a whole. Scoring system needs clarity.
7. Psychological well being	Typo box 12 tool. Psych info would have made a useful addition to

	the previous studies. Clear questions
8. Patient condition	This measure is about how PH affects the care of the condition. Specific cases could be reviewed to assess whether the moving and handling and mobility requirements form PH are being completed. Does the MH improve the condition/care Or does it impair. Delayed discharge, slow rehab, waiting for assessment, waiting for equipment
9. Patient perception	Typo box two, change safe for comfort. Straight forward.
10. MSD exposure measures	There was real reluctance to continue with the collection of logs over a long period of time. Compliance with over shift data is v poor and difficult to master. The QUIL staff should be ensuring that each patient is weighed so weight data should be available Is it possible to have observer collect data regarding numbers and timings of task performance? More preferable to assess handling needs form patient profiles. This set of data measures What might the workload be? Based on patient profile. • Amount of patients on ward over 24hrs • How many tasks do they require assistance with (DIAG 8) • Weight/Size • Compliance/behaviour • Hoisting • Other factors re complexity of handling needs e.g. orthopaedic fixators, callipers, medical attachments. • Consider score for not using appropriate methods or is it in compliance score • Calculate score for each patient • Calculate total/ratio for ward • Divide by WTE on patient handling Consider this as MSc? Do we need to compare with Cohen, Knibbe, etc. Check focus group data for baseline inclusion measures.
11. Patient injuries	Three factors were identified that might be collectable • PH incidents from records • Mobility accidents eg falls from records • Acquired TV/Pressure ulcer rates given that all patients are on PR bed surfaces, any recorded PU could be related to method position poor practice which can indicate

	PH source.
12. Financial	There was a question of whether this information would be available. The fall back score system was acceptable if true data was not available. Treatment costs needs full explanation as the model is based on an American model. In some services this might need to be scored as a percentage of services delivered e.g. fast track physio through HR/Occ Health provision. Need to explain the costs section clearly. Will need to have different scores for specific intervention model and benchmarking model.
Other comments	