



University
of Glasgow

Smith, L.N. (2007) *Obesity: A Threat to Health. How Can Nursing Research Contribute to Prevention and Care?* Workgroup of European Nurse Researchers, Stockholm. ISBN 9789163303623

<http://eprints.gla.ac.uk/34271/>

Deposited on: 4 August 2010



Workgroup of European Nurse Researchers

Patient Safety in Europe: Medication Errors and Hospital-acquired Infection

A report to the European Federation of Nurses Associations

April 30, 2008

Jacqueline Burke, University College Dublin, Ireland, WENR
Professor Lorraine N Smith, University of Glasgow, UK (Editor), WENR
Professor Herdis Sveinsdóttir, University of Iceland, Iceland, WENR
Associate Professor Ania Willman, Blekinge Institute of Technology, Sweden, WENR

All correspondence to:

Professor Lorraine N Smith,
59 Oakfield Avenue
University of Glasgow
Glasgow G12 8LW
Tel: 0044 141-330 5498
Fax: 0044 141-330 3539
l.n.smith@clinmed.gla.ac.uk

To cite this Report:

Smith, LN (Ed), Burke, J, Sveinsdóttir, H, Willman, A (2008) Patient Safety in Europe: Medication Errors and Hospital-acquired Infection. Amsterdam, Workgroup of European Nurse Researchers

Executive Summary

This Report was commissioned by the European Federation of Nurses Associations (EFN) in November 2007 in order to support its policy statement on Patient Safety (June 2004). In that statement the EFN declares its belief that European Union health services should operate within a culture of safety that is based on working towards an open culture and the immediate reporting of mistakes; exchanging best practice and research; and lobbying for the systematic collection of information and dissemination of research findings.

This Report addresses specifically the culture of highly reliable organisations using the work of James Reason (2000). Medication errors and hospital-acquired infections are examined in line with the Report's parameters and a range of European studies are used as evidence. An extensive reference list is provided that allows the EFN to explore work in greater detail as required.

The Workgroup of European Nurse Researchers (WENR) argues that that a systems approach to patient safety medication should be adopted throughout the European Union (EU), particularly given the differences in error reporting across the EU and that EFN should champion this approach.

There is a vast literature aimed at improving hand hygiene compliance. The World Alliance for Patient Safety has produced WHO guidelines on Hand Hygiene. The Workgroup of European Nurse Researchers argues that EFN should work with these strategies and encourage interventions that are behaviourally-focused, multi-disciplinary in nature, evidence-based with specific outcomes measured and audited for sustainable success.

The voice of the Patient and the Public is currently not part of the European Federation of Nurses' statement. The Workgroup of European Nurse Researchers would encourage EFN to consider incorporating patient and public roles within their Patient Safety statement.

Finally reference is made throughout the Report regarding the variability of evidence at local, national and governmental levels. EFN and the Workgroup of European Nurse Researchers (WENR) should work together to identify health services priorities regarding the research evidence required to allow EFN to maximize its lobbying function within the European Commission.

Table of Contents

Page

Executive Summary	2
Table of Contents	3
Abbreviations	4
Acknowledgements	4
Definitions	5
<i>Medication</i>	5
<i>Hand Hygiene Practices</i>	6
1. Introduction	7
2. Report Remit	8
<i>Project Parameters</i>	8
3. The Highly Reliable Organisation (HRO)	9
4. Patient Safety: Medications	10
<i>Introduction</i>	10
<i>Size of Problem</i>	10
<i>Errors in the Delivery of Medication</i>	10
<i>Causation of Errors</i>	11
<i>Some Tested Strategies for Improved Medication Safety</i>	11
<i>Conclusion: Medication Error</i>	12
5. Patient Safety: Hospital Acquired Infection (HAI)/Nosocomial Infection/ Healthcare Associated Infection (HCAI)	13
<i>The Problem</i>	13
<i>The Cost of HAI</i>	13
<i>Risk Factors</i>	14
<i>Hand Hygiene and Nursing</i>	14
<i>Examples of Project-based Outcomes where HAIs have been reduced</i>	15
<i>Strategies for Improved Avoidance of HAIs</i>	15
<i>Future Research: Hand Hygiene</i>	16
6. Patient Safety: What do Patients and the Public Want	17
7. Conclusion	18
8. Recommendations	20
Appendices	21
Appendix I: EFN Policy Statement – Patient Safety (2004)	22
Appendix II: Search Strategies	23
<i>Table 1: Search strategy in PubMed. performed 2007-12-07: Medication Errors</i>	24
<i>Table 2: Search strategy in PubMed. performed 2008-01-31 Cross Infection</i>	24
<i>Table 3: Search strategy in Medline performed February 26th, 2008 Medication Errors/Cross Infection</i>	25
<i>Table 4: Search strategy in PubMed. performed March 11th, 2008 Medication errors/Infection</i>	26
<i>Table 5: UK Government websites: Medication Error & Hospital Acquired Infection November 2007</i>	27
<i>Table 6: Search strategy in PubMed. Search performed Dec 2007/April 2008 Medication Errors/Infection</i>	28
<i>Table 7: Search strategy performed 31/01/2008 Medication Errors</i>	29
<i>Table 8: Search strategy performed 31/01/2008 Hospital Acquired Infection</i>	30
Appendix III: Web-based Information Sources	31
References	34

Workgroup of European Nurse Researchers (WENR)

Abbreviations

ADE	Adverse Drug Event
ADR	Adverse Drug Reaction
CDC	Center for Disease Control and Prevention
DoH	Department of Health
EFN	European Federation of Nurses
EU	European Union
HCWs	Healthcare Workers
HAI	Hospital Acquired Infection
HCAI	Healthcare-associated Infection
HRO	Highly Reliable Organisation
NHS	National Health Service
UK	United Kingdom
USA	United States of America
WENR	Workgroup of European Nurse Researchers
WHO	World Health Organisation

Acknowledgements

Our personal thanks to those in our Universities and National Nursing Associations who supported us in our search for literature, who provided secretarial assistance and who thoughtfully read drafts.

Definitions

Patient safety: The UK National Patient Safety Agency (2003) defines patient safety as “the process by which an organisation makes patient care safer. This should involve: risk assessment; the identification and management of patient-related risks; the reporting and analysis of incidents; and the capacity to learn from and follow-up on incidents and implement solutions to minimize the risk of them recurring”.

Adverse events: Adverse events are incidents in which a patient is unintentionally harmed by medical treatment and adverse incidents in which patients are harmed by medical treatment (Vincent et al 1998). Brennan et al (2004) define an adverse event as an injury that was caused by medical management (rather than the underlying disease and that prolonged hospitalisation, produced a disability at the time of discharge or both.

Medication

Drug related problems: Included are medication errors (involving an error in the process of prescribing, dispensing or administering a drug, whether there are adverse consequences or not) and adverse drug reaction (any response to a drug which is noxious and unintended, and which occurs at doses normally used in humans for prophylaxis, diagnosis or therapy of disease, or for the modification of physiological function (van den Bemt et al 2000). Drug related problems are classified into two categories: medication errors and adverse drug effects (Fijn et al 2001).

Medication errors: The American Society of Hospital Pharmacists (1982) defines a **medication error** as a ‘dose of medication that deviates from the physician’s order as written in the patient’s chart for from standard hospital policy and procedures’. They qualify this by pointing out that, except for errors of omission, the medication dose must actually reach the patient (O’Shea 1999).

Wolfe (1989) defines **medication errors** as ‘mistakes during the prescription, transcription, dispensing and administration phases of drug preparation and distribution’. A **medication error** is a discrepancy between the dose ordered and the dose received. It excludes errors in prescribing (Barker et al 2002). A **medication error** is ‘any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health-care professional, patient or consumer (American National Coordinating Council for Reporting and Prevention 2001).

Near miss is used to describe situations that did not cause harm to patients, but could have done.

Medication preparation: Is ‘the phase in which the nursing professional, based on the medical prescription, separates, organises and prepares the medications the patient in the work will receive’ (Anselmi et al 2007).

Medication administration

Is the phase in which the nursing professional administers the previously prepared medication to the patients in the work unit. It is considered that the medication has been applied once the patient has effectively taken/ingested/received the drug (Anselmi et al 2007).

Workgroup of European Nurse Researchers (WENR)

Adverse drug reaction (ADR): Is any noxious, unintended and undesired effect of a drug, excluding therapeutic failures, intentional and accidental poisoning and abuse [World Health Organization 1986].

Hand Hygiene Practices (WHO Definitions in Whitby et al 2007)

Hand hygiene: A general term referring to any action of hand cleansing.

Hand cleansing: Action of performing hand hygiene for the purpose of physically or mechanically removing dirt, organic material or micro-organisms.

Handwashing: Washing hands with plain or antimicrobial soap and water.

Hand antisepsis: Reducing or inhibiting the growth of micro-organisms by the application of an antiseptic hand rubs or by performing an antiseptic handwash.

Handrubbing: Action of applying an alcohol-based hand rubs. Alcohol-based hand rubs is an alcohol-containing preparation (liquid, gel or foam) designed for application to the hands to reduce the growth of micro-organisms. Such preparations may contain one or more types of alcohol with excipients, other active ingredients, and humectants.

Inherent hand hygiene practice: Instinctive need to remove dirt from the skin when hands are visibly soiled, sticky or gritty. Likely to be established in the first 10 years of life and to drive the majority of community and HCW hand hygiene behaviour throughout life. For example, among nurses, it occurs after touching an 'emotionally dirty' area (axillae, groin or genitals).

Elective hand hygiene practice: Attitude to hand cleansing in more specific opportunities not encompassed in the inherent category and more frequently corresponding to some of the indications for hand hygiene during healthcare delivery. For example, among HCWs, it includes touching a patient such as taking a pulse or blood pressure, or having contact with an inanimate object in the patient environment.

Patient Safety in Europe: Medication Errors and Hospital-acquired Infection

1. Introduction

Patient safety has become a major concern for both society and policymakers and arguably is one part of the quality improvement movement. Patient safety is a complex issue with many factors that include human suffering and financial costs. Fitzpatrick (2006) has identified patient safety indicators and 'setting-specific' patient safety research in the following areas: medication errors, falls and injury prevention, hospital-acquired infections, patient safety in hospital acute-care units, medications in the perioperative environment and home visit programs for the elderly.

Even if patient safety is a major concern, hospitals are inherently unsafe given the nature of their business. Approximately 10% of all hospitalisations in the Industrial World incur an adverse event that results in injury, delayed recovery and sometimes death. In the United Kingdom (UK) reports indicate that approximately 10% of patients "have experienced an adverse event contributing to approximately 72,000 deaths" [<http://www.patientsafetyresearch.org/>]. The World Health Organisation (WHO) estimates that in developing countries, 50% or more of medical equipment is unsafe while 77% of counterfeit and substandard drugs are to be found in poorer countries [<http://www.patientsafetyresearch.org/>].

The American Institute of Medicine (IOM) report (Kohn et al 1999) on the quality of patient care entitled "To Err Is Human" drew international attention to the occurrence, clinical consequences and cost of adverse drug events in hospitals, which is estimated at \$2 billion and up to 98,000 deaths annually in the United States (USA) (Barker et al 2002, Flynn et al 2002). In the UK, the Department of Health (DoH) commissioned a report on 'An Organisation with a Memory (DoH 2000) which according to Tighe et al (2006) covered similar ground to the IOM report and led to the establishment of the UK National Patient Safety Agency whose objectives are to collect and analyse information on adverse events; to learn from these events and ensure feedback to practice; and to identify risks and produce solutions. Page and McKinney (2007) report that the Audit Commission (2001) pointed out that medication errors account for about 20% of deaths due to all types of adverse events in hospital and that this cost the UK National Health Service (NHS) around £500 million a year leading to an average 8.5 additional days in hospital. Two further reports, 'Building a safer NHS for patients' (DoH 2001) in which the UK Government stated its aim to reduce by 40% the number of serious errors in the use of prescribe drugs and 'Building a safer NHS for patients- improving medication safety' (DoH 2004) further emphasise the commitment to making drug treatment as safe as possible in the UK.

Of the nine Patient Safety Solutions approved by WHO April 2007, four relate directly to medication error while one is related specifically to hospital acquired infection through poor hand hygiene [<http://www.jcipatientsafety.org/>].

In the European Union (EU), patient safety is being addressed through three processes; first in collaboration with national ministries of health and stakeholders; secondly through the European Commission's patient safety working group of the High Level Group on Health Services and Medical Care and the Commission patient safety policy initiative 2008; and thirdly the EU is

Workgroup of European Nurse Researchers (WENR)

promoting patient safety through the health research theme of the 7th Framework Programme for Research.

2. Report remit

The remit for this work was agreed with the European Federation of Nurses Associations (EFN) November 2007 (email confirmation). The context was EFN's "input to the DG Sanco High Level Group Project EuNetpas and the European Parliament initiatives" and its work in 2008 on 4 key issues of which "Healthcare related infection [is the] top priority – relate[d] to [the EU's] health and safety directive". In particular the "focus on medication errors and infections is key."

The Workgroup of European Nurse Researchers (WENR) agreed with EFN that the project would be taken forward by a small WENR working group and would be completed for April 30, 2008.

Project parameters

The evidence-based and grey literature on Patient Safety is vast and ever-increasing. There are dedicated Patient Safety websites (Appendix III), conferences and government agencies some of which include clinical research guidance and ethics approval as for example in the UK's National Patient Safety Agency [<http://www.npsa.nhs.uk/>].

Consequently the project parameters were set with care given the remit, timeframe, volume of literature and that this work was unfunded. The literature was surveyed initially on a geographical basis as set out below with each working group member taking primary responsibility for one area while recognising there would be some crossover. As we were unable to identify specific Finnish studies that met the entry criteria, we made direct email contact that indicated there is ongoing work but it is not yet published.

- Sweden & Finland
- Ireland, Northern Ireland, other EU countries
- Iceland, The Netherlands, Denmark, Norway
- UK excluding Northern Ireland and theoretical background

Given that EFN's raison d'être is to be the voice of Nursing in the European Commission, inclusion criteria were set as follows:

- published research studies conducted by nurses and/or
- with a focus on nurses or nursing practice
- hospital-based studies
- adult-focused
- published from the year 2000 onwards
- limited to Swedish, Finnish, Icelandic, Danish, English, Norwegian, Dutch languages
- related to medication errors and hospital-acquired infections (HAIs) as agreed with EFN.

Non-nursing studies addressing specific hospital infection outbreaks, the operationalisation of infection surveillance, the incidence of hospital infection, screening among health care workers, infection related to surgical procedures were excluded as were all community-based studies.

Workgroup of European Nurse Researchers (WENR)

This is a snapshot of current work in the European areas surveyed. In the next sections, a brief outline of the ‘highly reliable organisation’ with reference to systems theory is presented. Patient safety as related to medication error and hospital acquired infection are described in two separate sections. Search strategies are detailed in the Appendices along with specific web addresses related to patient safety. A comprehensive reference list is provided if further details of specific studies are required by EFN.

3. The Highly Reliable Organisation (HRO)

Arguably two approaches to human fallibility exist; that of the ‘person’ approach or that of a ‘systems’ approach (Reason 2000). The person approach “focuses on the errors of individuals, blaming them for forgetfulness, inattention or moral inattention” while the systems approach focuses “on the conditions under which individuals work and tries to build defences” [systems] to prevent or lessen the impact of the effects. Patient safety is directed at establishing ‘a high reliability organisation’ where mistakes occur but their incidence or frequency is limited and systems are designed that can “better tolerate the occurrence of errors and contain their damaging effects” (Reason 2000).

Five key concepts are critical to the successful HRO (Hines et al 2008)

1. **Sensitivity to operations.** Hospital leaders and staff need to be aware of and alert to the systems and processes affecting patient care. “Awareness is key to noting risks and preventing them.”
2. **Reluctance to simplify.** While simple processes are good, simplistic explanations for failure (unqualified staff, lack of training, communication failure, etc.) are “risky” as they deny the complexity that is care delivery.
3. **Preoccupation with failure.** ‘Near-misses’ should be viewed as evidence that the system is working effectively rather than necessarily as proof that the system needs to be improved to reduce further risk.
4. **Deference to expertise.** Leaders and supervisors must “listen and respond to the insights of staff who know how processes really work and the risks patients really face.” Without such cultural openness, the highly reliable organisation is not achievable.
5. **Resilience.** All “leaders and staff need to be trained and prepared to know how to respond when system failures do occur.”

As noted in the Porto Patient Safety Conference (2007) report, “Errors by clinicians are only part of the problem of patient safety. Research shows that when there is an error, there is a cause, and failures in the way the system functions are at the heart of most problems. Patient safety is an issue in all health care settings including hospitals and community care, the home and in medical, nursing and technical practice” [<http://www.patientsafetyresearch.org/>].

4. Patient Safety: Medications

Introduction

Studies on medication safety and nursing are few; are heterogeneous in design making comparability between research reports difficult; and have a lack of evidence for effect despite literature reviews, descriptive studies and reports on implementation of guidelines. Few studies describe nurses' reactions to medication errors although there may be a significant impact on personal and professional development (Schelbred & Nord, 2007).

Size of problem

Reported, potentially life-threatening medication errors range from 3% to 21% while clinically significant errors range from 3.3% to 31% (Tissot et al 1999, 2003, Taxis & Barber 2004). A UK and German study reported error rates of 26% in the preparation of 337 intravenous medication doses and 34% in the administration of 278 doses with the majority of medication errors having a potentially moderate or severe outcome (Wirtz et al 2003). Another German study reported a global error rate of 48% (preparation - 19%; administration - 23%) in intravenous medications (Taxis & Barber 2004). One study looked at errors across the whole medication process in medical and surgical departments and found a 43% opportunity for errors (Lisby et al 2005).

Errors in the delivery of medications

An adverse drug event (ADE) is an injury due to medication. ADEs can be classified according to preventability, ameliorability, disability, severity, stage of the process, and person or group responsible. ADEs are not necessarily the result of a medication error. If a medication error is present, both the stages of the process where the error occurred, and the person responsible for the error, should be considered as set out in Morimoto et al's (2004) model below:

- ordering (physician, nurse practitioner, or physician assistant);
- transcribing (a secretary or a nurse);
- dispensing (pharmacist);
- administration (nurse, pharmacist, or patient); and
- monitoring (physicians or patients).

Specifically medication errors can occur at many levels within the delivery process and include the following: timing errors, wrong administration rates, preparation errors, wrong administration techniques, physiochemical incompatibility, dosing errors which include omission errors, unauthorised and wrong dose errors, labelling errors including ambiguous labelling of commercial drugs (Cousins et al 2005, Guchelaar et al 2004, Taxis & Barber 2004, Tissot et al 2003, Wirtz et al 2003). 'Wrong time' errors appear to be either the most or second most common type of error: Ireland (O'Hare et al 1995); France (Tissot et al 2003, Prot et al 2005); UK (Cousins et al 2005); Germany (Taxis et al 1999).

Causation of errors

It is extremely difficult to extrapolate a clear picture of causation given the many and sometimes confounding variables (Armitage and Knapman 2003). However factors include:

- knowledge deficits (Tissot et al 1999, Schneider et al 1999)
- workload factors (Tissot et al 2003)
- organisation issues, complex medication systems, labelling issues (Cousins et al 2005, Wirtz et al 2003, Tissot et al 1999, Taxis et al 1999)
- illegible or incomplete medicine orders (Tissot et al 2003)
- distracting environments (Wirtz et al 2003, Deegan 2001)
- an organisational culture of fear (Deegan 2001, Delandey 2006, Kirke et al 2007, Kirke & Delaney 2007).

Medication error information can be collected via (1) practice data (patient note reviews, computer-based triggers), (2) soliciting incidents from health professionals (self-reports), and (3) surveying patients for drug related events. These methods are complementary and a combination may be useful (Morimoto et al's 2004).

Summarised below are a number of reported, evidence-based strategies aimed at improving drug medication safety.

Some tested strategies for improved medication safety

1. Improving drug infusion safety requires a systems approach that is informed by a non-punitive culture of drug error and near miss reporting (Bucknall 2007, Burdeu et al 2006) and provides feedback to the organization and/or individual (Handler et al 2006).
2. The reporting of medication errors may be increased when paired with a high level of trust in the manager or the use of care pathways (Vogus & Sutcliffe 2007).
3. Shared charts for prescription and drug administration can aid safe and rational medical treatment (Heier et al 2007, Bourke et al 2002).
4. Protocols appear to improve drug safety administration but they need to be systematically implemented and monitored (Egerod et al 2005).
5. Pharmacy-provided protocols for the preparation of parenteral drugs can improve safe administration (van den Bemt 2002).
6. Multidisciplinary, intervention programs that promote the correct administration of drugs via enteral feeding tubes can reduce medication error (Van den Bemt et al 2006).
7. There needs to be a readily available medication error reporting system (Handler et al 2006).
8. Online reporting systems should be explored in greater detail (Ashcroft & Cooke 2006).
9. Clear labelling of drugs could reduce medication errors (Guhelaar et al 2004).

Workgroup of European Nurse Researchers (WENR)

Conclusion: medication error

The benefit of reporting systems is the gaining of knowledge of what errors have been made and the frequency with which they occur. In order to prevent drug errors and enhance patient safety we need to identify the types of errors and under what circumstances they occur.

Future research should capture the environmental and human context of error including the particular experiences of those who have made errors. Large-scale, multicentred surveys, sufficiently powered to provide statistically significant results, using multidisciplinary samples, are required to evaluate existing definitions of errors (Armitage & Knapman 2003). Qualitative research is required into how HCWs who have committed serious medication errors cope with the event and its consequences and that take on the behavioural aspects of the medication delivery process.

In summary a multi-layered strategy to medication errors is required that recognises inadequacies in existing approaches to medication errors; that moves away from the blaming culture to one where there is improved error reporting with opportunities for enhancing performance and understanding behaviour within the process of medication use (Moyen et al 2008).

A systems approach to patient safety medication, that includes an open culture, should be adopted throughout the EU, particularly given the differences in error reporting across the European Union and EFN should champion this approach.

EFN and the Workgroup of European Nurse Researchers (WENR) should work together to secure EU funding for multidisciplinary, health services research that uses a mixed methods approach to patient safety.

5. Patient Safety: Hospital Acquired Infection (HAI)/Nosocomial Infection/ Healthcare Associated Infection (HCAI)

The problem

There is general acceptance that a global hospital approach to hospital acquired infection (HAI) is required (Brusaferro et al 2003) such as that described by Schecker et al (1998). This involves minimum appropriate surveillance systems, the definition and implementation of specific policies for infection control and the presence of dedicated and trained health care personnel (e.g. physicians, nurses). However, surveys of Italian NHS teaching hospitals have revealed that the infrastructure for infection control is sub optimal when compared with international guidelines and surveys in other countries (Moro et al 2004, Brusaferro et al 2003).

Prevalence and/or incidence rates of HAI vary internationally, within countries (Doherty et al 2007, Creedon et al 2005, Whyte et al 2005), and in how they are reported (Brusaferro et al 2006). Most HAIs are endemic and result from cross-transmission related to inappropriate patient care practices (Pittet 2004). While there is much agreement on the importance of nosocomial infection and surveillance priorities, there are no agreed basic minimum standards for the resources and facilities necessary for HAI control and prevention (Cunney et al (2006).

The variation in HAI reporting across Europe is illustrated by the following statements: HAI prevalence rates of 4.9% in 45 Irish hospitals (National Disease Surveillance Centre 2006); an overall infection incidence-rate of 11.8 per 1000/patient-days in long-stay facilities in Italy (Brusaferro et al 2006); a MRSA prevalence rate of 14.0/100,000 population in the Republic of Ireland (ROI) compared to a rate of 11.4/100,000 in Northern Ireland (Burd et al 2003, McDonald et al 2003, Mc Donald et al 2002); surgical site infections (SSI) from 1.9% in Southeast France (Couris et al 2007) to 22.7% in Serbia (Maksimovic et al 2008); an overall HAI prevalence rate in north-Danish hospital wards of 5.2% - 7.1% with a bed occupancy rate of 93.7% - 98.9% (Scheel et al 2008).

The cost of HAI

HAI is a costly problem for patients and health services (Pirson et al 2008, Brusaferro et al 2006, Pirson et al 2005, Humphries & O'Flannagan 2001). For example: Patients who developed MRSA infection post head and neck surgery in Ireland had on average, a hospital stay 3-times longer than those who did not develop MRSA, with the costs of their first hospital stay, three times greater (Watters et al 2004). Patients with bacteraemia in a Belgian hospital had significantly higher mortality, a longer hospital stay and greater costs (€ 12,853) compared with controls (Pirson et al 2005). Three years later that figure was increased to €19,301 per patient (Pirson et al 2008).

Healthcare associated infection (HCAI) represents one of the most common adverse events affecting patients admitted to acute hospitals. HCAI affects hundreds of millions of people worldwide, complicates the delivery of patient care, contributes to patient deaths and disability, promotes resistance to antibiotics and generates additional expenditure to that already incurred by the patient's underlying disease. (Pittet & Donaldson 2005b). In particular multi-resistant bacteria such as MRSA present a significant challenge to healthcare institutions globally

Workgroup of European Nurse Researchers (WENR)

(Eveillard et al 2001, Burd et al 2003). In Ireland, MRSA is endemic in many hospitals (Doherty et al 2007, Creedon 2006, 2005). Eveillard et al (2001) suggest that in Europe the proportions of strains of MRSA vary from 1% in Scandinavian countries to 30% in Southern countries.

WHO has identified hand hygiene as a major patient safety issue in relation to HCAs and there is general agreement that effective hand hygiene remains the most important initiative in the control of infection (Tavolacci et al 2007, Moret et al 2004, Barrau et al 2003, Burd et al 2003).

Risk factors

Risks factors related to HAIs include length of hospital stay, presence of an invasive device, a Norton's pressure sore risk of more than 12 and being bedridden (Brusaferro et al 2006); rapid patient turnover, leading to increased work and overcrowding (Cunningham et al 2005); a lack of dedicated specifically trained infection control nurses, inadequate dissemination of information and insufficient production and updating of guidelines (Brusaferro et al 2003), residing in a long-term care facility (CDC 2008). Elsewhere protocols to prevent exposure to blood and body fluids that are not tailored to the differences in knowledge, risk perception and practical needs of different professional groups, increase risk (van Gemert-Pijnen et al 2006). In one Norwegian study, it was found that wearing a single plain finger ring by healthcare workers (HCWs) did not increase the total bacterial load on the hands, nor was it associated with an increased rate of carriage of Staph aureus but plain rings were associated with an increased rate of Enterobacteriaceae (Fagernes & Nord, 2007).

Hand hygiene and nursing

Preventing microbial pathogen cross-transmission and healthcare-associated infections is most effectively managed by hand hygiene (Whitby et al 2007). Handwashing is therefore a core element of patient safety for the prevention of health care-associated infections and the spread of antimicrobial resistance (Sax et al 2007, Pittet et al 2006, Barrau et al 2003, Hejazi et al 2000).

However, health care worker compliance is problematic worldwide with most practising hand hygiene less than 50% than they should (Abbate et al 2008, Sax et al 2007, Creedon 2005, 2006, Larson et al 2005, Arenas et al 2005, Pittet and Donaldson 2005a, Barrau et al 2003, Girard et al 2001, Pittet et al 2001). Factors associated with non-compliance include skin irritation (Larson et al 2006), a lack of knowledge of guidelines (Tavolacci et al 2006, Nobile et al 2002), psychosocial factors (Moret et al 2004), workload (Arenas et al 2005, Wendt 2004), being a physician (Tavolacci et al 2006), poor aseptic technique in practice (Cousins et al 2005, Wirtz et al 2003). While nurse compliance rates tend to be higher than physicians (Wendt et al 2004), non-compliance by nurses is a significant patient safety issue. In order to improve compliance with recommended practice, it is recommended that infection control teams should learn from behavioural science (Pittet 2004, Creedon 2005, 2006) using theoretical frameworks such as Azjen's Theory of Planned Behaviour.

The First Global Patient Safety Challenge 'Clean Care is Safer Care', launched by the WHO World Alliance for Patient Safety October 2005, developed new WHO Guidelines on Hand Hygiene in Healthcare with the specific aim of dealing with large-scale healthcare-associated infection. Since 2005 the Alliance has expanded educational and promotional tools developed initially for the Swiss national hand -hygiene campaign, for worldwide use (Sax et al 2007, Larson 2006).

Examples of project-based outcomes where HAIs have been reduced

Below are examples of a number of different European projects that have sought to reduce HAI.

- a significant reduction of the incidence of ventilator assisted pneumonia can be achieved by relatively simple changes in the nurse pulmonary care protocol (Wallis De Vries et al 2002);
- a randomized clinical trial on the effectiveness of teaching patients basic principles about the care of central venous catheters on the frequencies of CVC-related infections found a significant reduction in infections in the intervention group (Møller et al 2005).
- HCAI rates can be reduced by up to one third (Creedon 2005) if HCWs comply with HCAI guidelines issued by the Centre for Disease Control and Prevention (CDC) (Pittet et al 2000).
- education has been shown to increase compliance and reduce skin-irritation in Switzerland and Germany (Widmer et al 2007, Schwanitz et al 2003).
- implementation of barrier precautions is sufficient to ensure the control of HCAI in a large hospital Eveillard et al (2001)
- a French programme focused on barrier precautions and education led to a decrease in the incidence of MRSA by 17.9% and Entero bacteriaceae producing extended-spectrum β -lactamases (ESBL) by 54.9% (Eveillard et al 2001).

Some strategies for improved avoidance of HAIs

Human behaviour is complex, dynamic and multi-faceted. It is therefore critical to the success of any strategy to improve hand hygiene compliance, that the design and implementation of an intervention be grounded in an understanding of human behaviour (Whitby et al 2007). We should not be surprised when single interventions fail to produce sustained improvement in healthcare worker behaviour over time (Whitby et al 2007). Interventions must recognise behavioural complexity.

Creedon (2006, 2005) reports on the successful implementation of a multifaceted interventional behavioural hand-hygiene programme that resulted in a significant improvement in compliance with hand hygiene guidelines from 51% to 83%. Björholt & Haglind (2004) evaluated the cost-effectiveness of an 'Intensive MRSA Control Programme' in a large teaching hospital and found the programme was successful, eradicating an epidemic outbreak of MRSA with the programme demonstrated to >24 months of implementation. The 2nd Irish National Acute Hospitals Hygiene Audit indicates there has been a change in culture with hospitals more proactive and innovative in their approach in to improving hygiene standards compared to the first audit 6-months earlier.

In each of these cases, the approach adopted to HAI was multifactoral, required multidisciplinary solutions and specifically trained nurses and doctors.

Future research: hand hygiene

The WHO Global Patient Safety Challenge task force on behavioural considerations for hand hygiene practices has identified the following areas for future research in the understanding of and compliance with hand hygiene protocols (Whitby et al 2007).

- “Confirmation that behavioural determinants of hand hygiene can be generalized to other healthcare occupational groups in addition to doctors and nurses, and in varying ethnic and professional groups;
- Identification of which predictor has the greatest impact on hand hygiene for all groups of HCWs(HCWs) regardless of their ethnic origin to design the most cost-effective motivational programmes suitable for both high- and low-resource healthcare settings;
- Development of an alcohol-based hand rubs that does not leave a residual smell of alcohol to facilitate use of hand rubs by those HCWs from cultural and religious backgrounds where the use of alcohol is discouraged;
- Assessment of ethnography as a research tool for exploring hand hygiene barriers in diverse cultures;
- Assessment of market research methods to improve hand hygiene in HCWs in high, transitional and low-resource facilities;
- Refocusing of school-based hand hygiene programmes away from a self-protection practice towards a practice for the benefit of self and others;
- Assessment of the acceptance of adult patient engagement (not critically or mentally impaired patients) and their families from culturally diverse backgrounds in prompting HCWs to perform hand hygiene in a manner that does not offend;
- Effectiveness of an overt annual or biannual hand hygiene audit as a means of motivating hand hygiene behaviour with an evaluation of acceptance of short programmes using a peer-pairing system to prompt performance of hand hygiene in preparation for the annual overt hand hygiene audit.
- Further assessment of the influence of workload or staffing level on hand hygiene behaviour.”

EFN must ensure that strategies aimed at improving hand hygiene compliance should be behaviourally-focused, be multi-disciplinary in nature, be evidence-based with specific outcomes measured and monitored for sustainable success.

6. Patient Safety: What do Patients and the Public Want?

In the UK patients and the public as key stakeholders in healthcare have become pivotal in patient safety policy and implementation. As reported by Coutler and Ellins (2006), patients want more transparency and openness regarding medical errors. Patients want to be informed about the event, to receive information on what and why it happened, how its consequences can be mitigated and how to prevent any other recurrences can be prevented. In an increasingly litigious environment, 'honest disclosure' can increase patients' trust and satisfaction while reducing the risk of legal action (Mazor et al 2004).

EFN, as the voice of Nursing in Europe, could adopt a more proactive role in ensuring that the voice of the Patient and the Public is always heard in the European Commission.

7. Conclusion

As has been noted elsewhere an organisation which is transforming requires a workforce that is flexible, dynamic, open to change and possesses transferable skills and these are critical to delivering the Patient Safety agenda (Basford & Kershaw 2008).

The 10 point recommendations to emerge from the EU Patient Safety Conference (Porto 2007) provide a rational basis for a way forward.

Recommendations: EU Patient Safety Conference Porto 2007

- Target funding for patient safety research at European Union institution and member state levels
- Promote a joined-up system of local, national and international patient safety research supported by all stakeholders in Europe and ensure it is linked to evidence-based policies and practice
- Promote multidisciplinary research and the integration of disciplines relating to patient safety research
- Develop the effective use of IT for data collection and systems which promote safety and reduce adverse events
- Establish a pan-European electronic collection of patient safety research findings, readily accessible for both researchers and policy-makers
- Agree and fix a minimum data collection criteria for patient safety across Europe , building on the WHO International Classification for Patient Safety
- Provide healthcare professionals with a new culture on patient safety issues, more training opportunities on patient safety research and advice based on clinical evidence
- Develop indicator and monitoring systems within Europe to identify a whole range of healthcare incidents and risks
- Foster networks and joint research across the European Union, neighbouring regions and developing and transitional countries
- Develop strategies to involve patients in patient safety research programmes and activities.

EFN should lobby for these Recommendations and National Nursing Associations should consider how they can contribute to the taking forward of this agenda in their own countries.

In the EU, health care is strongly influenced by the concept of subsidiarity wherein national governments retain direct control of national health care systems (Craig & Smith 2008). Nevertheless 'Patient Safety' has allowed the EU to comment on a range of health-related measures and both recommend and legislate in matters that affect member states' health policies. Medication errors and infection control are two such examples.

For the purposes of this paper, we would draw a distinction between research as critical to the establishment of the evidence base for quality health care, and the implementation of policy and guidance and subsequent monitoring and audit which occurs at the local and organizational level.

Workgroup of European Nurse Researchers (WENR)

Patient safety research should be multidisciplinary and of sufficient scope and scale that it can 'make a difference'. While we have shown that patient safety can be improved and adverse events reduced by improving the organization of care, it is equally vital that research is required to understand system failures. As argued by the Porto 2007 Patient Safety Conference, "The role of patient safety research is.....to measure the extent of the problem, identify causes, to work with clinicians and policy-makers in developing solutions using scientific evidence, and to evaluate the effectiveness of interventions."

The search strategies employed for this paper are cited in the Appendices and give a good indication of the volume and depth of information available to support EFN's position papers in the field of patient safety. The reality is that for many areas that might reasonably lie in EFN's sphere of interest, the research evidence in nursing and for nurses is variable.

EFN must determine how and in what way it wants to have evidence produced and displayed in order to argue its case at the European Commission level to good effect.

This may include individual member NNAs taking the lead on information gathering/researching, presenting and promoting within the Commission, specified areas of work and working with the Workgroup of European Nurse Researchers.

8. Recommendations

In summary the Workgroup of European Nurse Researchers (WENR) makes the following five recommendations to the European Federation of Nurses:

1. EFN must determine how and in what way it wants to have evidence produced and displayed in order to argue its case at the European Commission level to good effect.
2. We are of the view that a systems approach to patient safety medication, that includes an open culture, should be adopted throughout the EU, particularly given the differences in error reporting across the European Union and that EFN should champion this approach.
3. EFN must ensure that strategies aimed at improving hand hygiene compliance should be behaviourally-focused, be multi-disciplinary in nature, be evidence-based with specific outcomes measured and monitored for sustainable success.
4. EFN and WENR should consider approaching DG Sanco formally for research funding into patient safety health services research.
5. There is an absolute role for EFN to play in ensuring and protecting that the Patient and Public voice is heard in respect of patient views and concerns in the European Union.
6. EFN should lobby for the EU Patient Safety Conference Porto 2007 recommendations to be taken up and National Nursing Associations should consider how they can contribute to the taking forward of this agenda in their own countries.

The Workgroup of European Nurse Researchers will host a symposium with the Greek Nurses Association on Cultural Issues and their Influence on Patient Safety in Athens October 2009.

Appendices

Appendix I: EFN Policy Statement – Patient Safety (2004)

Appendix II: Search Strategies

Table 1: Search strategy in PubMed. performed 2007-12-07: Medication Errors (Nillson & Willman 2008)

Table 2: Search strategy in PubMed. performed 2008-01-31 Cross Infection (Nillson & Willman 2008)

Table 3: Search strategy in Medline performed February 26th, 2008 Medication Errors/Cross Infection (Sveinsdóttir)

Table 4: Search strategy in PubMed. performed March 11th, 2008 Medication errors/Infection (Sveinsdóttir)

Table 5: UK Government websites: Medication Error & Hospital Acquired Infection November 2007 (Munro & Smith)

Table 6: Search strategy in PubMed. Search performed Dec 2007/April 2008 Medication Errors/Infection (Marlborough & Smith)

Table 7: Search strategy performed 31/01/2008 Medication Errors (INO Library & Burke)

Table 8: Search strategy performed 31/01/2008 Hospital Acquired Infection (INO Library & Burke)

Appendix III: Web-based Information Sources

Appendix I

EFN Policy Statement

Patient Safety

(EFN Position Statement – 18 June 2004)

Nurses are the largest occupational group in the EU health sector and play a pivotal role in initiating change and improvement at local and national levels.

The European Federation of Nurses believes that the Government, Nursing Associations and health system managers have a responsibility to ensure a culture of safety in EU health systems through:

- Working towards an open culture which promotes immediate reporting of mistakes;
- Exchanging research and best practice between EU Member States;
- Lobbying for a national reporting system which will ensure a systematic collection of data and communication of research findings.

Please contact **Mr. Paul de Raeve**, General Secretary of the European Federation of Nurses Associations for a position paper on this issue.

efn@efn.be or Tel: +32 2 512 74 19

Appendix II: Search Strategies

Table 1: Search strategy in PubMed. performed 2007-12-07: Medication Errors
(Nillson & Willman 2008)

1. When searching 'patient safety' in PubMed:s MeSH-database, the suggested MeSH-term is 'Safety management'. The MeSH-tree consists of three branches: In order to get the best result 'Accident Prevention', 'Risk Management' and 'Safety Management' are searched (searches #1, #2 and #3), and combined into one search-block (search #4).
2. The next step is to include articles on medication errors. The thesaurus of PubMed has 'Medication Errors' as a MeSH-term which is searched with the term 'Medication Systems' [MeSH] (searches #5 and #6) and combined (search #7).
3. The third step is to involve 'nursing' in the search. 'Nursing' is searched as a MeSH-term and in order to get as wide a search as possible the term was combined with a search on the truncated textword 'nurs*' (searches #8 and #9) and combined (search #10).
4. In the fourth step the combined searches (searches #4, #7 and #10) are added to each other with the term 'AND', thus reflecting articles on patient safety, medication errors and nursing (search #11).
5. The final step is to add limits to the last search, which means that search #11 is limited to articles published in the last ten years and written in English, German, Danish, Norwegian or Swedish.

Search	Search term	Results
#1	"Accident Prevention" [MeSH]	37 812
#2	"Risk Management" [MeSH]	101 050
#3	"Safety Management" [MeSH]	8 123
#4	#1 OR #2 OR #3	129 336
#5	"Medication Errors" [MeSH]	6 540
#6	"Medication Systems" [MeSH]	3 092
#7	#5 OR #6	8 660
#8	nurs*	485 721
#9	"Nursing" [MeSH]	180 589
#10	#8 OR #9	490 673
#11	#4 AND #7 AND #10	462
#12	#11 Limits: Published in the last 10 years, Language: English, German, Danish, Norwegian, Swedish	383
#13	#11 Limits: Publication Date from 2002/01/01 to 2009, Language: English, German, Danish, Norwegian, Swedish	330
#14	sweden	52 962
#15	#11 AND #14	1

All in all a total of 330 abstracts were read independently of each other. In an effort to try to identify articles from Sweden we added searches #14 and #15. The one article we found in search #15 were written in the year 2000 and discussed whether it was possible to delegate medication administration to a nurse aid in the community-based/home health care. After reading the 330 abstracts we agreed on assessing a total of 50 articles. When assessing the abstracts as well as the articles we sorted out articles not describing actual scientific studies, reviews assessing articles/studies that were old (ie published before 2000), articles suggesting educational programs (not implemented or evaluated) and articles describing medication systems not in use in Sweden or to our knowledge in Scandinavia leaving a total of 20 papers.

Workgroup of European Nurse Researchers (WENR)

Table 2: Search strategy in PubMed. performed 2008-01-31 Cross Infection
(Nillson & Willman 2008)

Any infection that a patient contracts in a health-care institution. Year introduced: HOSPITAL
`INFECTIONS was see under CROSS INFECTION 1971-1978, was see CROSS INFECTIONS 1963-
1970`

In this search, the search-block for nursing (search #5 and #6) was used in search #11 but then deleted in
search #12 as it seemed to limit the result in a negative way as articles about ‘hospital acquired infection’
and ‘patient safety’ were not necessarily related to nurses or nursing.

Search	Search History	Results
#1	"Accident Prevention" [MeSH]	38,214
#2	"Risk Management" [MeSH]	102,979
#3	"Safety Management" [MeSH]	8,297
#4	#1 OR #2 OR #3	131,478
#5	"Cross Infection" [MeSH]	33,633
#6	"hospital acquired infection" [Text Word]	440
#7	#5 OR #6	33,756
#8	nurs*	488,113
#9	"Nursing" [MeSH]	181,321
#10	#8 OR #9	493,087
#11	#4 AND #7 AND #10	166
#12	#4 AND #7	807
#13	#12, Limits: Published in the last 10 years, Language: English, German, Danish, Norwegian, Swedish	599
#14	#12, Limits: Publication Date from 2002/01/01 to 2009, Language: English German, Danish, Norwegian, Swedish	511
#15	Sweden [Text Word]	52,962
#16	#12 AND #15	5

Workgroup of European Nurse Researchers (WENR)

Table 3: Search strategy in Medline February 26th, 2008 Medication Errors/Cross Infection (Sveinsdóttir)

(ALL("patient safety") OR ALL("medication errors") OR ALL("risk management") OR ALL("hospital infection") AND ALL(nurs*)) AND (ALL(danmark) OR ALL(denmark) OR ALL(norge) OR ALL(norway) OR ALL(holland) OR ALL(netherlands)) AND (LIMIT-TO(PUBYEAR, 2008) OR LIMIT-TO(PUBYEAR, 2007) OR LIMIT-TO(PUBYEAR, 2006) OR LIMIT-TO(PUBYEAR, 2005) OR LIMIT-TO(PUBYEAR, 2004) OR LIMIT-TO(PUBYEAR, 2003) OR LIMIT-TO(PUBYEAR, 2002) OR LIMIT-TO(PUBYEAR, 2001) OR LIMIT-TO(PUBYEAR, 2000)) AND (LIMIT-TO(SUBJAREA, "NURS") OR LIMIT-TO(SUBJAREA, "SOCI") OR LIMIT-TO(SUBJAREA, "HEAL") OR LIMIT-TO(SUBJAREA, "MULT"))

Search **	Search History	Results
1	Medication Errors/	4,548
2	NURSES/	25.794
3	Denmark/	1.998
4	1 and 2 and 3	1
5	NORWAY/	2.027
6	1 and 2 and 5	0
7	NETHERLANDS/	5.392
8	1 and 2 and 7	0
9	1 and 3	3
10	1 and 3	3
11	1 and 5	3
12	1 and 7	4
13	Hospital infection, mn. or Cross Infection/	9.285
14	2 and 3 and 13	0
15	3 and 13	16
16	2 and 5 and 13	0
17	5 and 13	11
18	2 and 7 and 13	1
19	7 and 13	54
20	ICELAND/	343
21	2 and 20	8
22	1 and 20	0
23	13 and 20	0

*The searches were limited to English, Danish, Norwegian, Icelandic and Dutch and year 2000 to 2008.

**Abstract from studies detected in searches 4, 8-12, 14-19 and 21-23 were reviewed

Workgroup of European Nurse Researchers (WENR)

Table 4: Search strategy in PubMed. performed March 11th, 2008 Medication errors/Infection (Sveinsdóttir)

(ALL("patient safety") OR ALL("medication errors") OR ALL("risk management") OR ALL("hospital infection") AND ALL(nurs*)) AND (ALL(danmark) OR ALL(denmark) OR ALL(norge) OR ALL(norway) OR ALL(holland) OR ALL(netherlands)) AND (LIMIT-TO(PUBYEAR, 2008) OR LIMIT-TO(PUBYEAR, 2007) OR LIMIT-TO(PUBYEAR, 2006) OR LIMIT-TO(PUBYEAR, 2005) OR LIMIT-TO(PUBYEAR, 2004) OR LIMIT-TO(PUBYEAR, 2003) OR LIMIT-TO(PUBYEAR, 2002) OR LIMIT-TO(PUBYEAR, 2001) OR LIMIT-TO(PUBYEAR, 2000)) AND (LIMIT-TO(SUBJAREA, "NURS") OR LIMIT-TO(SUBJAREA, "SOCI") OR LIMIT-TO(SUBJAREA, "HEAL") OR LIMIT-TO(SUBJAREA, "MULT"))

Search*	Search History	Results
#19*	Search #8 AND #10 AND #17 Field: MeSH Major Topic, Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	129
#18	Search #8 AND #10 AND #17 Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	129
#17	Search #15 OR #16 Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	9784
#16	Search Hospital Acquired infection Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	9609
#15	Search Cross infection Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	9718
#13*	Search #8 AND #9 AND #10 Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	372
#14	Select 372 document(s)	372
#12	Search #8 OR #9 OR #10 Limits: Publication Date from 2000 to 2008, English, Danish, Dutch, Icelandic, Norwegian	214342
#11	Search #8 OR #9 OR #10	642105
#10	Search #6 OR #7	511182
#9	Search #4 OR #5	9132
#8	Search #1 OR #2 OR #3	135078
#7	Search Nursing	427098
#6	Search Nurs*	489923
#5	Search Medication Systems	3142
#4	Search Medication Errors	7013
#3	Search Safety Management	8629
#2	Search Risk Management	106017
#1	Search Accident prevention	38929

*Abstracts from studies detected in searches 13 and 19 were reviewed

Workgroup of European Nurse Researchers (WENR)

Table 5: UK Government websites: Medication Error & Hospital Acquired Infection November 2007 (Munro & Smith)

All titles read and content reviewed where appropriate as all available online.

Scottish Executive Publications website –

- Search on Hospital Acquired Infection – No hits post 2000
- Search on MRSA – 4 hits –
- MRSA and nursing – no hits

SHOW Search

- “Hospital Acquired Infection” and Nurse or Nursing – 9 hits (google powered search engine)
- Medication errors” and nurse or nursing – 2 hits: 0 appropriate
- Adverse events ” and nurse or nursing – 20 hits: 0 appropriate

Department of Health Publications Website:

- “Hospital Acquired Infection” – 107 hits search with for Nurse or Nursing - 26 hits: 0 appropriate
- “Medication and Error” – 5 hits – search with for Nurse or Nursing – 3 hits: 0 appropriate
- Search – “Patient Safety” – 1 hit. Search Patient and Safety – 97 hits – search within Nurse or Nursing – 10 hits: 1 appropriate
- Search Adverse Events – 13 hits –search with for nurse or nursing - 2 hits: 0 appropriate

Health & Safety Executive Website

- Search : Hospital Acquired Infection and Nurses or Nursing – 8 hits: 0 appropriate
- Search: Patient Safety and Nursing or Nurses – 68 hits: : 0 appropriate
- Search Adverse Events and Nurse or Nursing – 19 hits: 0 appropriate
- Search Medication errors and nurse or nursing – 1 hit: 0 appropriate

Workgroup of European Nurse Researchers (WENR)

Table 6: Search strategy in PubMed. Search performed Dec 2007/April 2008 Medication Errors/Infection (Marlborough & Smith)

Search	Search History	Results
1	(patient\$ and safety and (adverse effect* or medication error* or hospital acquired infection\$ or MRSA)).mp. [mp=title, original title, abstract, name of substance word, subject heading word]	4327
2	Medication Errors/nu [Nursing]	217
3	"Nursing Staff, Hospital"/ or "Nurse's Role"/ or "Patient Care Team"/ or "Nursing Assessment"/ or "Nursing Methodology Research"/ or "Nursing"/ or "Nursing Staff"/ or "Nurse-Patient Relations"/ or "Nurse Attitude"/ or "Nursing Care"/ or "Nursing Research"/ or "Nursing Process"/ or "Nurses"/	99240
4	"Medication Errors"/ or medication error*.mp. [mp=title, original title, abstract, name of substance word, subject heading word]	4507
5	"Patient Safety"/	0
6	exp united kingdom/	103806
7	(scotland or united kingdom or uk or england or wales).mp. [mp=title, original title, abstract, name of substance word, subject heading word]	74799
8	"New South Wales"/	4462
9	(eire or ireland or new south wales).mp. [mp=title, original title, abstract, name of substance word, subject heading word]	14354
10	(6 or 7) not (8 or 9)	123615
11	1 and 3 and 10	12
12	2 and 10	29
13	3 and 4 and 10	62
14	4 and 5 and 10	0
15	11 or 12 or 13 or 14	69
16	remove duplicates from 15	69
17	limit 16 to yr="2000 - 2008"	65

Workgroup of European Nurse Researchers (WENR)

Table 7: Search strategy performed 31/01/2008 Medication Errors (INO Library & Burke)

Search	Search History	Results
1	No fault mp	56
2	From 1 keep 17-18, 21-22, 24, 28-29, 46	8
3	No blame	10
4	From 3 keep 2,4,6,8,	4
5	Medication Errors/	4548
6	Exp EUROPE/	162942
7	5 and 6	248
8	Limit 7 to (research and English)	55
9	Europe/ or Andorra/ or Austria/ or Belgium / or france/ or germany/ or Greece/ or iceland/ or Ireland / or italy/ or lichtenstein/ or luxembourg/ or mediterranean region/ or monaco/ or Portugal/ or san marino/ or spain/ or switzerland/	26047
10	5 and 9	19
11	From 10 keep 1-4, 7-8, 10, 13-17, 19	13
12	Patient Safety/	11146
13	9 and 12	110
14	Limit 13 to (research and English)	31
15	2 or 4 or 11 or 14	52
16	From 15 keep 1-52	52
	Of these only four were relevant many were excluded as they referred to prescription errors, 19 excluded as they were related to specific drugs, blood, equipment, not relevant to nursing care or this review	
	Pubmed Search History	
Feb 08	medication error and Europe AND ("last 10 years"[PDat] AND (English[lang]) AND (Clinical Trial[ptyp] OR Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR Review[ptyp]))	53

'Snowballed' the references of relevant studies until no new pertinent citations emerged

Workgroup of European Nurse Researchers (WENR)

Table 8: Search strategy performed 31/01/2008 Hospital Acquired Infection (INO Library & Burke)

Search	Pubmed Search History	Results
	Hospital Acquired infection and Irish*	11
	Safety Culture and Ireland	8
	Medication Error and Europe (limits last 10 years, English and clinical trials, meta analysis RCTs and reviews).	52
	Relevant	6
#	Search History – Pubmed March 08	
1	Hospital acquired infection	34144
2	#1 (Limits English and from 01/01/2000)	9768
3	#3 and Ireland	57
4	Europe (Limits English and from 01/01/2000)	218311
5	#3 and #4	1918
6	((andora/ OR austria/ OR belgium/ OR france/ OR germany/ OR greece/ OR iceland/ OR Italy/ OR liechtenstein/ OR mediterranean/ OR Monaco/ OR portugal/ OR san Marino/ OR spain/ OR switzerland AND ("2000/01/01"[EDat] : "2008"[EDat]) AND (English[lang]))) AND ((hospital acquired infection AND ("2000/01/01"[EDat] : "2008"[EDat]) AND (English[lang]))) AND (("2000/01/01"[EDat] : "2008"[EDat]) AND (English[lang]))	66640
7	#6 and # 2 (Limits English and from 01/01/2000)	749
8	Nurs*	131140
9	#8 and #7	65

‘Snowballed’ the references of relevant studies until no new pertinent citations emerged.

In relation to accessing ‘grey literature’ the Irish Government, the Irish Health Service Executive (HSE) and the Irish Health Information and Quality Authority (HIQA), the Organisation for Economic Co-operation and Development (OECD) web pages and internet sites and the Google search engine were used. This helped to pick up on conference proceedings and fortunately the INO had hard copies of some of these presentations. The websites of tertiary referral hospitals, particularly in relation to their pharmacy, nursing and research departments were also searched.

Workgroup of European Nurse Researchers (WENR)

Appendix III: Web-based Information Sources

Opportunities	Information/Web addresses	Purpose
European Commission	http://ec.europa.eu/yourvoice/ipm/forms/dispatch?form=patientsafety	Public consultation on Patient Safety Deadline to respond is 20 May 2008
Joint Commission International Center for Patient Safety	http://www.jcipatientsafety.org/28091/	“We invite your participation in an important on-line survey for the World Health Organization's Collaborating Centre for Patient Safety. The survey seeks your help in determining the final content for the 2008 Patient Safety Solutions. Since the solutions will be distributed to all WHO member states, your assistance is needed to ready them for widespread adoption.”
Joint Commission International Center for Patient Safety	http://www.jcipatientsafety.org/24725/ Accessed April 2008	WHO Collaborating Centre for Patient Safety Solutions Nine Patient Safety Solutions
National Patient Safety Agency - UK	http://www.npsa.nhs.uk/patientsafety/ Accessed April 2008 http://www.nres.npsa.nhs.uk/ Accessed December 2007	“ The Patient Safety Division aims to improve patient care through the analysis of patient safety incidents, rapid response to incidents and the development of actions, in partnership, that can be implemented locally, to build a stronger culture of patient safety. A ‘patient safety incident’ is any unintended or unexpected incident which could have harmed or did lead to harm for one or more patients being cared for by the National Health Service (NHS).” “ The National Research Ethics Service (NRES) works to maintain a UK-wide system of ethical review that protects the safety, dignity and well being of research participants whilst facilitating and promoting ethical research within the NHS.”
Healthcare Systems and Ergonomics and Patient Safety	http://www.heps2008.org/ Accessed April 2008	Aimed at creating bridges among different disciplines (medicine and surgery, information technology, occupational psychology, clinical engineering and architecture, human factors and ergonomics) in order to share a strong interest in the promotion of human factors and ergonomics in healthcare and patient safety
International Conference on Patient Safety Research	The EFN General Secretary participated For further information: http://www.patientsafetyresearch.org/ Accessed April 2008	Patient Safety Research Conference: Shaping the European Agenda, September 24-26 2007, Porto, Portugal The conference was the first time that patient safety research

Workgroup of European Nurse Researchers (WENR)

<p>Organised by the UK Faculty of Public Health, University College London and the WHO World Alliance for Patient Safety, with the financial support of the European Commission and the Portuguese Ministry of Health</p>		<p>had been discussed at a European level. Its objectives were to: ensure collaboration on patient safety research at an international level; change the culture of patient safety within healthcare settings; and set the agenda for research support by Member States and the EU. Brought together researchers, policy makers, and research commissioners from across Europe but the clinicians were absent. It became clear that further efforts are needed to develop the dialogue between researchers and policy-makers.</p> <p>It became clear that strong consortiums, cost-effectiveness and impact assessments of research outcomes are needed to bridge the gap between the researchers and the politicians. During the event it was announced that the EU projects on Patient Safety, to which EFN signed up, had been signed by the Commission.</p>
<p>Patient Safety on Longwoods.com</p>	<p>http://www.longwoods.com/rss/patientsafety.xml Accessed April 2008</p>	<p>Latest articles about Patient Safety</p>
<p>Accent on Integration Introduces Patient Safety Screening Tool TM to Facilitate Early Detection of Sepsis</p>	<p>More information on the Patient Safety Screening Tool for Sepsis is available at the Accent on Integration Web site at http://www.accentonintegration.com/ Accessed April 2008</p>	<p>Microsoft releases software tool to monitor adverse events in hospitals 25 February 2008</p>
<p>The Public Health Portal of the EU</p>	<p>http://ec.europa.eu/health-eu/care_for_me/patient_safety/index_en.htm</p>	
<p>Center for Disease Control and Prevention</p>	<p>http://www.cdc.gov/</p>	
<p>WHO: Patient Safety</p>	<p>http://www.who.int/patientsafety/en</p>	<p>WHO Homepage for patient safety: In October 2004, WHO launched the World Alliance for Patient Safety in response to a World Health Assembly Resolution (2002) urging WHO and Member States to pay the closest possible attention to the problem of patient safety. The Alliance raises awareness and political commitment to improve the safety of care and facilitates the development of patient safety policy and practice in all WHO Member States. Each year, the Alliance delivers a number of programmes covering systemic and technical aspects to improve patient safety around the world.</p>
<p>National Board of Health and Welfare</p>	<p>http://www.socialstyrelsen.se/en/</p>	<p>Patient safety, analysis of risk pages</p>

Workgroup of European Nurse Researchers (WENR)

(NBHW), Sweden		
OECD Directorate for Employment, Labour and Social Affairs	http://www.oecd.org/document OECD Work in Patient Safety	OECD Health Care Quality Indicators Project: A particular focus for the HCQI Project is the review, testing and reporting of data for a targeted set of indicators of patient safety that can be reliably reported across OECD countries. This work is being undertaken in close collaboration with national and international organisations specialising in quality and patient safety, including the World Health Organization’s Global Alliance on Patient Safety, the European Commission-sponsored SIMPATIE Project and national safety organisations in OECD member countries. The HCQI Project has recently developed a manual to facilitate cross national comparisons of indicators for patient safety through the provision of detailed practical advice on calculating each indicator in a selected set of Patient Safety Indicators utilising national hospital administrative databases.
The Health Information and Quality Authority (Ireland)	http://www.hiqa.ie/	

References

1. Abbate R. Di Guiseppe G. Marinelli P. Angelillo I.F. and the Collaborative Working Group (2008) Patients' knowledge, attitudes and behaviour toward hospital-associated infections in Italy. *American Journal of Infection Control* 36 (1) 39-47.
2. Amooore J, Adamson L. Infusion devices: characteristics, limitations and risk management. *Nurs Stand.* 2003 Mar 26-Apr 1;17(28):45-52.
3. Andersen SE. [Drug dispensing errors] *Ugeskr Laeger.* 2006 Nov 27;168(48):4185-8. Danish.
4. Andersen, S.E. 2002. Implementing a new drug record system: a qualitative study of difficulties perceived by physicians and nurses. *Quality & Safety in Health Care*, 11 (1), p.19-24
5. Anselmi M. L. Peduzzi M. and dos Santos C.B (2007) Errors in the administration of intravenous medication in Brazilian hospitals. *Journal of Clinical Nursing* 1839-1847.
6. Apkon M, Leonard J, Probst L, DeLizio L, Vitale R. Design of a safer approach to intravenous drug infusions: failure mode effects analysis. *Qual Saf Health Care.* 2004 Aug;13(4):265-71.
7. Arenas M.D. Sanchez-Paya J. Barril G. Garcia-Vladecasas J. Gorritz J.L. Soriano A. Antolin A. Lacueva J. Garcia S. Sirvent A. Espinosa M. and Angoso M. (2005) A multicentric survey of the practice offhand hygiene in haemodialysis units: factors affective compliance. *Nephrology Dialysis Transplantation* 20 1164-1171.
8. Armitage, C. J. & Conner, M. (2001) Efficacy of the Theory of Planned Behaviour: A meta-analytic review *British Journal of Social Psychology* 40 p471-499
9. Armitage G. and Knapman H. (2003) Adverse events in drug administration: a literature review. *Journal of Nursing Management* 11 (2) 130-140.
10. Ashcroft DM, Cooke J. Retrospective analysis of medication incidents reported using an on-line reporting system. *Pharm World Sci.* 2006 Dec;28(6):359-65. Epub 2006 Nov 21.
11. Banning M. Medication errors: professional issues and concerns. *Nurs Older People.* 2006 18(3):27-32.
12. Barker, K. N., Flynn, E. A., Pepper, G. A., Bates, D. W. & Mikeal, R. L. (2002) Medication Errors Observed in 36 Health Care Facilities *Arch Intern Med* 162 16 p1897-1903
14. Barrau K. Rovey C. Drancourt M. and Brouqui P. (20203) Hand Antisepsis: Evaluation of a sprayer system for alcohol distribution. *Infection Control and Hospital Epidemiology* 24 (3)180-184.
15. Bennett J, Harper-Femson LA, Tone J, Rajmohamed Y. Improving medication administration systems: an evaluation study. *Can Nurse.* 2006 Oct;102(8):35-9.
16. Björholt I, Haglind E. Cost-savings achieved by eradication of epidemic methicillin-resistant *Staphylococcus aureus* (EMRSA)-16 from a large teaching hospital. *Eur J Clin Microbiol Infect Dis.* 2004 Sep;23(9):688-95.
17. Björholt I, Haglind E. Cost-savings achieved by eradication of epidemic methicillin-resistant *Staphylococcus aureus* (EMRSA)-16 from a large teaching hospital. *Eur J Clin Microbiol Infect Dis.* 2004 Sep;23(9):688-95.
18. Bourke, J., Bjeldbak-Olesen, I., Nielsen, P.M. & Munck, L.K. 2002. Shared charts for prescription and administration: Increasing safety of drug treatment. *Inter J of Risk and Safety in Medicine*, 15 (4/3), 183-191.
19. Bourke JL, Bjeldbak-Olesen I, Nielsen PM, Munck LK. [Joint charts in drug handling. Toward increased drug safety] *Ugeskr Laeger.* 2001 Sep 24;163(39):5356-60.
20. Bridge L. Reducing the risk of wrong route errors. *Paediatr Nurs.* 2007 Jul;19(6):33-5.
21. Brusaferrero S. Quattrin R. Barnone F. D'Alessandro D. Finzi G.F. and the GISIO (2003) Factors influencing hospital infection control policies in Italian hospitals. *Journal of Hospital Infection* 53 268-273.
22. Brusaferrero S. Regattin L. Silvestro A. and Vidotto L. (2006) Incidence of hospital-acquired infections in Italian long-term facilities: a prospective six-month surveillance. *Journal of Hospital Infection* 63 211-215.
23. Bucknall TK. Implementing guidelines to improve medication safety for hospitalised patients: experiences from Western Health, Australia. *Worldviews Evid Based Nurs.* 2007;4(1):51-3.
24. Burd M. Humphries H. Glynn G. Mitchell E. Mc Donald P. Johnson H. Mc Donnell B. Doyle D. and Rossney A.(2003) Control and the prevention of methicillin-resistant *Staphylococcus aureus* in hospitals in Ireland: North/South study of MRSA in Ireland 1999. *Journal of Hospital Infection* 53 297-303.
25. Burdeu G, Crawford R, van de Vreede M, McCann J. Taking aim at infusion confusion. *J Nurs Care Qual.* 2006 Apr-Jun;21(2):151-9.
26. Carlton G, Blegen MA. Medication-related errors: a literature review of incidence and antecedents. *Annu Rev Nurs Res.* 2006;24:19-38.
27. Cassidy I. (2006) Student nurses' experiences of caring for infectious patients in source isolation. A hermeneutic phenomenological study. *Journal of Clinical Nursing* 15 1247-1256.

Workgroup of European Nurse Researchers (WENR)

28. Chuo J, Lambert G, Hicks RW. Intralipid medication errors in the neonatal intensive care unit. *Jt Comm J Qual Patient Saf.* 2007 Feb;33(2):104-11.
29. Coulter A and Ellins J (2006) in *Patient-focused interventions A review of the evidence* Picker Institute Europe The Health Foundation
30. Couris C.M. Rabilloud M. Ecochard R. Metzger M.H. Caillat-Vallet E. Savey A. Fabry J. and Vanhems P. (2007) nine-year downward trend in surgical site infection in southeast France (1995-2003). *Journal of Hospital Infection* 67 127-134.
31. Cousins D. H. Sabatier B. Begue D. Schmitt C. and Hoppe-Tichy T. (2005) Medication errors in intravenous drug preparation and administration: a multicentre audit in the UK, Germany and France. *Quality and Safety in Health Care* 14 190-195.
32. Craig L & Smith LN (2008) The interaction between policy and education using stroke as an example *Nurse Education Today* 28(1) 77-84
33. Creamer E. Cunney R.J. Humphries H. and Smyth E.G. (2002) Sixteen years' surveillance of surgical sites in an Irish acute-care hospital. *Infection Control and Hospital Epidemiology* 23 (1) 36-40
34. Creedon S.A. (2005) Healthcare workers' hand decontamination practices: compliance with recommended guidelines. *Journal of Advanced Nursing* 51 (3) 208-216.
35. Creedon S.A. (2006) Healthcare workers' hand decontamination practices: an Irish study. *Clinical Nursing Research* 15 (1) 6-26
36. Cunney R. Humphries H. Murphy N. on behalf of the Strategy for the Control of Antimicrobial Resistance in Ireland infection Control Subcommittee (2006) Survey of acute hospital resources and services in the Republic of Ireland. *Journal of Hospital Infection* 64 63-68.
37. Cunningham J.B. Kernohan W.G. and Sowney R. (2005) Bed occupancy and turnover interval as determinant factors in MRSA infection in acute settings in Northern Ireland *Journal of Hospital Infection* 61 189-193
38. De Bie, J., Cuperus-Bosma, J.M., Van Der Jagt, M.A.B., Gevers, J.K.M., Van Der Wal, G. 2005. Risky procedures by nurses in hospitals: Problems and (contemplated) refusals of orders by physicians, and views of physicians and nurses. *International Journal of Nursing Studies*, 42 (7), pp. 759-771.
39. Dean B. (2003) Adverse drug events: what's the truth? *Quality and Safety in Health Care* 12 165-166.
40. Deans C. Medication errors and professional practice of registered nurses. *Collegian.* 2005 Jan;12(1):29-33.
41. Deegan C. (2001) Nurses' perceptions of the factors that influence the occurrence and reporting of drug errors. A dissertation submitted to University College Dublin, as part fulfilment for a Masters Degree in Nursing.
42. Dennison RD. A medication safety education program to reduce the risk of harm caused by medication errors. *J Contin Educ Nurs.* 2007 Jul-Aug;38(4):176-84.
43. Department of Health (UK) (2000) *An Organisation with a Memory.* London The Stationery Office.
44. Department of Health (UK) (2001) *Building a Safer NHS for Patients.* London: The Stationery Office
45. *Dimens Crit Care Nurs.* 2005 Nov-Dec;24(6):275-8.
46. Doherty T. Thomas T. Walsh J. Moore J. Morris -Downes M. Smyth E.G. and Humphries H. (2007) Isolation facilities for patients with meticillin-resistant *Staphylococcus aureus* (MRSA): how adequate are they? *Journal of Hospital Infection* 65 274-282.
47. Eveillard M. Eb F. Tramier B. Schmit J.L. Lescure F.-X. Biendo M. Canarelli B. Daoudi F. Laurans G. Etchells E. Juurlink D. and Levinson W. (2008) Medication errors: the human factor. *Canadian Medical Association Journal* 178 (1) 63.
48. Fagernes, M. & Nord, R. 2007. A study of microbial load of different types of finger rings worn by healthcare personnell. *Vård i Norden*, 27 (2), p. 21-24
49. Farrell C (2004) *Patient and Public Involvement in Health*, London, Department of Health
50. Fitzpatrick F. Murphy O.M. Brady A. Prout S. and Fenelon L.E. (2000) A purpose built MRSA cohort unit. *Journal of Hospital Infection* 46 271-279.
51. Fitzpatrick, J (Ed) *Nursing Research: Focus on Patient Safety: 24* Springer Publishing Co Inc
52. Flynn, Elizabeth A.; Barker, Kenneth N.; Pepper, Ginette A.; Bates, David W.; Mikeal, Robert Comparison of methods for detecting medication errors in 36 hospitals and skilled-nursing facilities *American Journal of Health-System Pharmacy.* 59(5):436-446, March 1, 2002
53. Fogarty GJ, McKeon CM. Patient safety during medication administration: the influence of organizational and individual variables on unsafe work practices and medication errors. *Ergonomics.* 2006; 49(5-6):444-56.
54. Fraher MH & Corcoran GD (2007) Re Meticillin-resistant *staphylococcus aureus* blood stream infection among patients attending the emergency department of an urban tertiary- referral hospital. *Irish Med Jour* 100(10) 1-2.
55. Franklin BD, O'Grady K, Parr J, Walton I. Using the internet to deliver education on drug safety. *Qual Saf Health Care.* 2006 Oct;15(5):329-33.

Workgroup of European Nurse Researchers (WENR)

56. Fry MM, Dacey C. Factors contributing to incidents in medicine administration. Part 1. *Br J Nurs*. 2007 May 10-23;16(9):556-8.
57. Fry MM, Dacey C. Factors contributing to incidents in medicine administration. Part 2. *Br J Nurs*. 2007 Jun 14-27;16(11):676-81.
58. Gabriele S. The role of typography in differentiating look-alike/sound-alike drug names. *Health Q*. 2006 Oct;9 Spec No:88-95.
59. Girard R, Amazion K, and FABry J. (2001) Better compliance and better tolerance in relation to a well-conducted introduction to rub-in hand disinfection. *Journal of Hospital Infection* 47 131-137.
60. Girou E, Chai S.H.T, Oppein F, Legrand P, Ducellier D, Cizeau F, and Burn-Buisson C. (2004) Misuse of gloves: the foundation for poor compliance with hand hygiene and potential for microbial transmission? *Journal of Hospital Infection* 57 162 -169.
61. Guchelaar, H.-J., Kalmeijer, M.D. & Jansen, M.E.P. 2004. Medication error due to ambiguous labelling of a commercial product. *Pharmacy World and Science*, 26 (1), p. 10-11.
62. Handler SM, Perera S, Olshansky EF, Studenski SA, Nace DA, Fridsma DB, Hanlon JT. Identifying modifiable barriers to medication error reporting in the nursing home setting. *J Am Med Dir Assoc*. 2007 Nov;8(9):568-74.
63. Heier K, Olsen V, S Rognstad J, Straand E, Toverud (2007) Helsepersonells oppfatninger om multidosepakkelegemidler *Lægeforen* 2007; 127:2382-5
64. Hejazi A, Auken H.M. and Falkiner F.R. (2000) Epidemiology and susceptibility of *Serratia marcescens* in a large general hospital over an 8-year period. *Journal of Hospital Infection* 45 42-46.
65. Hines S, Luna K, Lofthus J, et al. (2008) Becoming a High Reliability Organization: Operational Advice for Hospital Leaders. AHRQ Publication No. 08-0022. Rockville, MD: Agency for Healthcare Research and Quality. <http://www.ahrq.gov/qual/hroadvice/hroadvice.pdf>
66. Hinshaw AS. Navigating the Perfect Storm: Balancing a Culture of Safety With Workforce Challenges. *Nursing Research* 2008; 57(1) (Supplement):S4-S10.
67. Hughes RG, Edgerton EA. Reducing paediatric medication errors: children are especially at risk for medication errors. *Am J Nurs*. 2005 May;105(5):79-80, 82, 85 passim. Review.
68. Humphreys H. and O'Flanagan D. (2001) Surveillance of hospital acquired infection in the Republic of Ireland: past, present and future. *Journal of Hospital Infection* 49 69-73.
69. Joanna Briggs Institute Strategies to reduce medication errors with reference to older adults. *Aust Nurs J*. 2006 Oct;14(4):26-9.
70. Joch A. Drug safety for the long-term. Long-term care facilities have the same medication management concerns as hospitals, plus others. *Healthc Inform*. 2003 Jul;20(7):38.
71. Kirke C. and Delaney T. (2007) Drive out Fear: Closing the loop on medication safety incident management. Presented on November 8th at the Clinical Indemnity Scheme Medication Safety Seminar, Alexander Hotel Dublin. Access via Irish Nurses Organisation Library January 2008.
72. Kirke C, Tighe P, Colohan G, Harnett B, Creaton G, and Delaney T. (2007) A collaborative study of medication safety in four Irish Hospitals. *Irish Pharmacy Journal* February 68-73.
73. Koczmara C, Jelincic V, Dueck C. Dangerous abbreviations: "U" can make a difference! *Dynamics*. 2005 Fall;16(3):11-5.
74. Koczmara C, Jelincic V, Perri D. Communication of medication orders by telephone--"writing it right". *Dynamics*. 2006 Spring;17(1):20-4.
75. Koczmara C, Jelincic V. Neuromuscular blocking agents: enhancing safety by reducing the risk of accidental administration. *Dynamics*. 2007 Spring;18(1):28-32. Review.
76. Kohn LT, J Corrigan, MS Donaldson (2000) *To err is human: building a safer health system* Institute of Medicine National Academies Press
77. Krähenbühl-Melcher A, Krähenbühl S. [Hospital drug safety: medication errors and adverse drug reactions] *Schweiz Rundsch Med Prax*. 2005 Jun 15;94(24-25):1031-8. German.
78. Larson E, Girard R, Pessoa-Silva C.L, Boyce J, Donaldson L, and Pittet D. (2006) Skin reactions related to hand hygiene and selection of hand hygiene products. *American Journal of Infection Control* 34 (10) 627-635.
79. Leape, L. L. & Berwick, D. M. (2005) Five Years After *To Err Is Human*: What Have We Learned? *JAMA* 293 19 p2384-2390
80. Lefkowitz A, Zarowitz B. Top 10 lists - medications associated with adverse events and medications involved with errors. *Geriatr Nurs*. 2007 Sep-Oct;28(5):276-9. Review.

Workgroup of European Nurse Researchers (WENR)

81. Lindblom B, Stolpe E. [The National Board of Health and Welfare answers: It's still possible to delegate drug handling in home care to nurses' aides] *Lakartidningen*. 2000 Jun 14;97(24):3002. Swedish. No abstract available.
82. Lisby M, Nielsen LP, Mainz J. Errors in the medication process: frequency, type, and potential clinical consequences. *Int J Qual Health Care*. 2005 Feb;17(1):15-22.
83. Maidment ID, Lelliott P, Paton C. Medication errors in mental healthcare: a systematic review. *Qual Saf Health Care* 2006; 15(6):409-413.
84. Maksimovic J, Markovic-Denic L, Bumbasirevic M, Marinkovic J, and Vlajinac H. (2008) Surgical site infections in orthopedic patients: prospective cohort study. *Croatian Medical Journal* 49 58-65.
85. Mank, A. & van der Lelie, H. 2003. Is there still an indication for nursing patients with prolonged neutropenia in protective isolation? An evidence-based nursing and medical study of 4 years experience for nursing patients with neutropenia without isolation. *European Journal of Oncology Nursing*, 7 (1), p. 17-23.
86. Manojlovich M, Barnsteiner J, Bolton LB, Disch J, Saint S. Nursing Practice and Work Environment Issues in the 21st Century: A Leadership Challenge. *Nursing Research* 2008; 57(1) (Supplement):S11-S14.
87. McDonald P, Mitchell E, Johnson H, Rossney A, Humphries H, Glynn G, Burd M, Doyle D, and Mc Donnell R. (2002) MRSA bacteraemia: North/South study of MRSA in Ireland 1999. *J Hospital Infection* 52 288-291.
88. Møller, T., Borregaard, N., Tvede, M. & Adamsen, L. 2005. Patient education - A strategy for prevention of infections caused by permanent central venous catheters in patients with haematological malignancies: A randomized clinical trial. *Journal of Hospital Infection*, 61 (4), p. 330-341.
89. Moret L, Tequi B, and Lombrail P. (2004) Should self-assessment methods be used to measure compliance with handwashing recommendations? A study carried out in a French university hospital. *American Journal of Infection Control* 32 (7) 384-390.
90. Morimoto T, Gandhi TK, Seger AC, Hsieh TC, Bates DW. Adverse drug events and medication errors: detection and classification methods. *Qual Saf Health Care*. 2004 Aug;13(4):306-14
91. Moro M.L, Petrosillo N, Gandin C, and Bella A. (2004) Infection control in Italian Hospitals. *Infection Control and Hospital Epidemiology* 25 (1) 36-40.
92. Moyon E., Camire E. & Stelfox H (2008) Clinical review: Medication errors in critical care *Crit Care* 12(2) 208
93. National Patient Safety Agency (UK). <http://www.npsa.nhs.uk/>.
94. Nobile C.G, A. Montouri P, Diaco E, and Villari P. (2002) Healthcare personnel and hand decontamination in intensive care units: knowledge, attitudes and behaviour in Italy. *Journal of Hospital Infection* 51 226-232.
95. Neudorf K, Dyck N, Scott D, & Dick D 2008 Nursing Education: A Catalyst for the Patient Safety Movement *Healthcare Quarterly* 11 Sp p35-39
96. O'Connell B, McMahon G, Kelleher M, and Rossney A.S. (2007) Meticillin-resistant staphylococcus aureus blood stream infection among patients attending the emergency department of an urban tertiary- referral hospital. *Irish Medical Journal* 100 433-435.
97. Orsi G.B, Raponi M, Franchi C, Rocco M, Mancini C, and Venditti M. (2005) Surveillance and infection control in an intensive care unit. *Infection Control and Hospital Epidemiology* 26 (3) 321-325.
98. O'Shea E. Factors contributing to medication errors: a literature review. *J Clin Nurs*. 1999 Sep;8(5):496-504.
99. Page K, and McKinney A. (2007) Addressing medication errors- the role of undergraduate nurse education. *Nurse Education Today* 27 219-224
100. Pape TM, Guerra DM, Muzquiz M, Bryant JB, Ingram M, Schraner B, Alcalá A, Sharp J, Bishop D, Carreno E, Welker J. Innovative approaches to reducing nurse s' distractions during medication administration. *J Contin Educ Nurs*. 2005 May-Jun;36(3):108-16; quiz 141-2.
101. Pape TM. Applying airline safety practices to medication administration. *Medsurg Nurs*. 2003 12(2):77-93.
102. Peth HA Jr. Medication errors in the emergency department: a systems approach to minimizing risk. *Emerg Med Clin North Am*. 2003 Feb;21(1):141-58. Review.
103. Pettersen R, Saxby BK, Wyller TB. Poststroke Urinary Incontinence: One-Year Outcome and Relationships with Measures of Attentiveness. *Journal of the American Geriatrics Society* 2007; 55(10):1571-1577.
104. Pierson S, Hansen R, Greene S, Williams C, Akers R, Jonsson M, Carey T. Preventing medication errors in long-term care: results and evaluation of a large scale web-based error reporting system. *Qual Saf Health Care*. 2007 Aug;16(4):297-302.
105. Pirson M, Dramaix M, Struelens M, Riley T.V, and Leclercq P. (2005) Costs associated with hospital-acquired bacteraemia in a Belgian hospital. *Journal of Hospital Infection* 59 (1) 33-40.
106. Pirson M, Leclercq P, Jackson T, Leclercq M, Garrine M, and Sion C. (2008) Financial consequences of hospital acquired bacteraemia in three Belgian hospitals in 2003 and 2004 *J of Hospital Infection* 68 (1) 9-16.
107. Pittet D. (2004) The Lowbury Lecture: behaviour in infection control. *J of Hospital Infection* 58 (1) 1-13.

Workgroup of European Nurse Researchers (WENR)

108. Pittet D, Allegranzi B, Sax H, Dharma S, Pessoa-Silva C.L, Donaldson L, Boyce J.M. on behalf of the WHO Global Patient Safety Challenge, World Alliance for Safety (2006) Evidence based model for hand transmission during patient care and the role of improved practices. *The Lancet Infectious Diseases* 6 641-652
109. Pittet D. and Donaldson L. (2005a) Clean care is safer care: the first global challenge of the WHO World Alliance for Patient Safety. *American Journal of Infection Control* 26 (October) 476-479.
110. Pittet D. and Donaldson L. (2005b) Clean care is safer care: a world wide priority. *The Lancet* 366 1246-1247
111. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S, Perneger T.V. and members of the Infection Control Programme (2000) Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *The Lancet* 356 (October 14) 1307-1312.
112. Prot S, Fontan J.E, Alberti C, Bourdon O, Farnoux C, Macher M.A, Foureau A, Faye A, Beaufilets F, Fottot S, and Brion F. (2005) Drug administration errors and their determinants in pediatric in-patients *International Journal for Quality in Health Care* 17 (5) 381-389.
113. Rábano A, de Pedro-Cuesta J, Mølbak K, Siden A, Calero M, Laursen H; EUROSURGYCJD Research Group. Tissue classification for the epidemiological assessment of surgical transmission of sporadic Creutzfeldt-Jakob disease. A proposal on hypothetical risk levels. *BMC Public Health*. 2005 Jan 24;5:9.
114. Reutz J. Human error: models and management. *BMJ* 2000; 320(7237):768-770.
115. Rognstad, S. & Straand, J. 2004. Vet fastlegen hvilke mediciner hjemmesykepleien gir pasientene? *Tidsskrift Nor Lægeforen* 124 (6), p. 810-2
116. Roman N. Innovative solutions: Standardized concentrations facilitate the use of continuous infusions for pediatric intensive care unit nurses at a community hospital.
117. Rousseau F. and Thomas D. (2001) Evaluation of the contribution of isolation precautions in prevention and control of multi-resistant bacteria in a teaching hospital. *Journal of Hospital Infection* 47 116-124.
118. Sax. H, Allegranzi B, Uckay I, Larson E, Boyce J. and Pittet D. (2007) 'My five moments for hand Hygiene': a user-centered design approach to understand, train, monitor and report hand hygiene. *Journal of Hospital Infection* 67 9-21.
119. Scheckler W.E., Brimhall D, Buck A.S, Farr B.M, Friedman C, Garibaldi R.A, Gross P.A, Harris J.A, Hierholzer W.J. Jr, Martone W.J, McDonald L.L. and Solomon S.L. (1998) Requirements for infrastructure and essential activities of infection control and epidemiology in hospitals: a consensus panel report. *Society for Healthcare Epidemiology of America. Infection Control Hospital Epidemiology* 19 (2) 114-24
120. Schiøler T, Lipczak H, Pedersen BL, Mogensen TS, Bech KB, Stockmarr A, Svenning AR, Frølich A; Danish Adverse Event Study. [Incidence of adverse events in hospitals. A retrospective study of medical records] *Ugeskr Laeger*. 2001 Sep 24;163(39):5370-8.
121. Schneider MP, Cotting J, Pannatier A. (1998) Evaluation of nurses' errors associated in the preparation and administration of medication intensive care unit. *Pharmacy World & Science* 20 (4) 178-182
122. Schneider PJ, Pedersen CA, Montanya KR, Curran CR, Harpe SE, Bohenek W, Perratto B, Swaim TJ, Wellman KE. Improving the safety of medication administration using an interactive CD-ROM program. *Am J Health Syst Pharm*. 2006 Jan 1;63(1):59-64.
123. Schulmeister L. Look-alike, sound-alike oncology medications. *Clin J Oncol Nurs*. 2006 Feb;10(1):35-41.
124. Schulmeister L. Ten simple strategies to prevent chemotherapy errors. *Clin J Oncol Nurs*. 2005 Apr;9(2):201-5.
125. Schwanitz H.J, Riehl U, Schlesinger T, Bock M, Skudlik C. and Wulforth B. (2003) Skin care management: education aspects. *Internal Archives of Occupational Environmental Health* 76 374-381.
126. Simpson JH, Lynch R, Grant J, Alroomi L. Reducing medication errors in the neonatal intensive care unit. *Arch Dis Child Fetal Neonatal Ed*. 2004 Nov;89(6):F480-2
127. Skibinski KA, White BA, Lin LI, Dong Y, Wu W. Effects of technological interventions on the safety of a medication-use system. *Am J Health Syst Pharm*. 2007 Jan 1;64(1):90-6.
128. Smith G. Charting the Course for Patient Safety. *Nursing Research* 2008; 57(1) (Supplement):S22-S24.
129. Smith J. (2004) Building a safer NHS for patients: improving medication safety. London: Department of Health,
130. Talsma A, Grady PA, Feetham S, Heinrich J, Steinwachs DM. The Perfect Storm: Patient Safety and Nursing Shortages Within the Context of Health Policy and Evidence-Based Practice. *Nursing Research* 2008; 57(1) (supplement):S15-S21.
131. Tivolacci M.P, Merle V, Pitrou I, Thillard D, Serra V, Czernichow P. and the Alcohol-based Hand Rub Commission of Infection Control Committee (2006) Alcohol-based hand rub: influence of healthcare workers' knowledge and perception on declared use. *Journal of Hospital Infection* 64 149-1
132. Taxis K and Barber N (2003a) Causes of intravenous medications errors: an ethnographic study. *Quality in Safety in Health Care* 12 343-348.

Workgroup of European Nurse Researchers (WENR)

133. Taxis K and Barber N (2003b) Ethnographic Study of Incidence and Severity of Drug Errors. *British Medical Journal* 326 684-687. Available at: <http://bmj.com>
134. Taxis K and Barber N (2004) Incidence and severity of drug errors in a German Hospital. *European Journal of Clinical Pharmacology* 59 815-817.
135. Taxis K, Dean B. and Barber N. (1999) Hospital drug distribution systems in the UK and Germany- a study of medication errors. *Pharmacy World & Science* 21 (1) 25-31.
136. Tighe C.M, Woloshynowych M, Brown R, Wears B. and Vincent C. (2006) Incident reporting in one UK accident and emergency department. *Accident and Emergency Nursing* 14 27-37.
137. Tissot E, Cornette C, Demoly P, Jacquet M, Barale F and Capellier G. (1999) Medication errors at the administration stage in an intensive care unit. *Intensive Care Medicine* 25 (4) 353-359.
138. Tissot E, Cornette C, Limat S, Mourand J.L, Becker M, Etievent J.P, Dupond J.L, Jacquet M, and Woronoff-Lemsi M.C. (2003) Observational study of potential risk factors of medication administration errors. *Pharmacy World & Science* 25 (6) 264-268.
139. van den Bemt P.M., Cusell M.B., Overbeeke P.W., Trommelen M., van Dooren D., Ophorst W.R., Egberts A.C. 2006. Quality improvement of oral medication administration in patients with enteral feeding tubes. *Qual Saf Health Care*, 15(1), p. 44-7.
140. van Gemert-Pijnen, J., Hendrix, M.G.R., Van der Palen, J. & Schellens, P.J. 2006. Effectiveness of protocols for preventing occupational exposure to blood and body fluids in Dutch hospitals. *J of Hospital Infection*, 62(2), 166-173.
141. van Graffhorst, J.P., Foudraine, N.A., Nooteboom, F., Crombach, W.H.J., Oldenhof, N.J.J. & Van Doorne, H. 2002. Unexpected high risk of contamination with staphylococci species attributable to standard preparation of syringes for continuous intravenous drug administration in a simulation model in intensive care units. *Critical Care Medicine*, 30 (4), p. 833-836.
142. Van Tilburg, C.M., Leistikow, I.P., Rademaker, C.M.A., Bierings, M.B. & Van Dijk, A.T.H. 2006 Health care failure mode and effect analysis: A useful proactive risk analysis in a pediatric oncology ward. *Quality and Safety in Health Care*, 15 (1), pp. 58-64.
143. Vidal-Trecan G.M, Delamare N, Tchery-Lessenot S, Lamory J, Baudin F, de Pritwitz M, and Salmon-Ceron D. (2001) Multidrug-resistant bacteria infection control: study of compliance with isolation precautions in a Paris University Hospital. *Infection Control and Hospital Epidemiology* 22 (2) 109-124.
144. Vogus TJ, Sutcliffe KM. The impact of safety organizing, trusted leadership, and care pathways on reported medication errors in hospital nursing units. *Med Care*. 2007 Oct;45(10):997-1002.
145. Wallis De Vries, B.M., Van Der Hout, M., Polderman, K.H., Van Der Werf, T.S., Van Den Hul, I. & Girbes, A.R.J. 2002. Impact of a nurse pulmonary care protocol on the incidence of ventilator associated pneumonia: A prospective study. *Care of the Critically Ill*, 18 (1), p. 21-23.
146. Wanzer LJ, Hicks RW. Medication safety within the perioperative environment.
147. Watters K, O Dwyer T.P. and Rowley H. (2004) Cost and morbidity of MRSA in head and neck cancer patients: what are the consequences? *The Journal of Laryngology and Otology* 118 (9) 694-499.
148. Wendt C, Knautz D. and von Baum H. (2004) Differences in hand hygiene behaviour related to the contamination risk of healthcare activities in different groups of healthcare workers. *Infection Control and Hospital Epidemiology* 25 (3) 203-206.
149. Whitby, M., Pessoa-Silva, C. L., McLaws, M. L., Allegranzi, B., Sax, H., Larson, E., Seto, W. H., Donaldson, L. & Pittet, D. (2007) Behavioural considerations for hand hygiene practices: the basic building blocks *Journal of Hospital Infection* 65 1 p1-8
150. Whyte D, Monahan R, Boyle L, Slevin B, FitzGerald R, Barron D, De Freitas J, and Kelleher K. (2005) The incidence of S.Aureus Bacteraemia in acute hospitals of the Mid-Western Area, Ireland, 2002-2004. *Eurosurveillance* 10 (4-6) 75-77.
151. Widmer A, Conzelmann M, Tomic M, Frei R, and Stranden A.M. (2007) Introducing alcohol-based hand rub for hand hygiene. *Infection Control and Hospital Epidemiology* 28 (1) 50-54.
152. Widmer A.F. (2000) Replace hand washing with use of a waterless alcohol hand rub? *Clinical Infectious Diseases* 31 136-143
153. Wirtz V, Taxis K, and Barber N.D. (2003) An observational study of intravenous medications errors in the United Kingdom and in Germany. *Pharmacy World Science* 25 (3) 104-111.
154. World Alliance for Patient Safety (2006) WHO Guidelines on Hand Hygiene in Health Care: Clean hands are safer hands World Health Organisation <http://www.who.int/patientsafety/information>

Workgroup of European Nurse Researchers (WENR)



WENR, P.O. Box 3135, 3502 GC Utrecht, The Netherlands.
Tel: +31 30 291 9005; Fax: +31 30 291 9049; wenr@levv.nl