Can Meso-level Simulation Increase Medical Students' Confidence in Recognising and Responding to Clinical Deterioration in Adult Hospital Patients?

Doctorate in Education
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Declaration

I declare that I am the author of this dissertation, that I have consulted all sources cited and conducted the research on which the dissertation is based. I also confirm that the work has not previously been accepted in any form for a higher degree at any institution.

Dedication

This manuscript is dedicated to my late Mother, Jane (Jean) Ann Jones Hogg, whose inspiration; affection and direction supported me in my determination to discover and realise my potential and so make this Doctorate a reality.

Acknowledgements

I would especially like to thank my father, George R Hogg for his unfailing support and impetus to keep working through the difficult time after the sudden loss of Mum during the finishing stages of this work; also to my brothers, Steven and Stuart and Sister-in-Law, Sandra who have encouraged and supported me through the good and bad times.

I would like to express my sincere appreciation to my supervisors:
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Finally to my Best friend Paul Christie, thank you for being there through it all, quietly and confidently supporting me and being assertive with me when I needed it through the worst times.

Glossary

ABCDE

The ABCDE approach is a systematic approach to the assessment of the ‘sick’ patient recommended by the Resuscitation Council (UK). It stands for Airway, Breathing, Circulation, Disability and Exposure. It enables the recognition of the ‘sick’ patient and the most serious problems to be identified and dealt with first.

Accident

An accident is an unforeseen and unplanned event or circumstance, often with lack of intention or necessity. It usually implies a generally negative outcome which may have been avoided or prevented had circumstances leading up to the accident been recognized, and acted upon, prior to its occurrence.

Acute care

A pattern of health care in which a patient is treated for a brief but severe episode of illness, for the sequelae of an accident or other trauma, or during recovery from surgery.

Adverse event

Any untoward medical occurrence in a patient which does not necessarily have a causal relationship with treatment caused by medical management–rather than by the underlying disease–which prolongs hospitalisation, produces a disability at the time of discharge, or both.

Cardiac arrest

Is sudden cessation of the pumping function of the heart with disappearance of arterial blood pressure, indicating either ventricular fibrillation or ventricular standstill.

Cardiopulmonary resuscitation (CPR)

Is an emergency procedure for manually preserving brain function until further measures to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest.

Clinical deterioration

A deteriorating patient is one who moves from one clinical state to a worse clinical state which increases their individual risk of morbidity, including organ dysfunction, protracted hospital stay, disability , or death.

Critical care

Is a branch of medicine concerned with life support for critically ill patients. Often carried out within Intensive Care Units.

Error

An 'error' is a deviation from accuracy or correctness. A 'mistake' is an error caused by a fault: the fault being misjudgement, carelessness, or forgetfulness.

Escalation tool

Is a hierarchy of instructions designed to identify when a patient should be referred to a higher level experience of assessment and care.

Failure to rescue

Failure to rescue (FTR) refers to a death after a treatable complication.

Global Trigger Tool

The global trigger tool can be used to measure the frequency of adverse events and determine whether quality improvement efforts have reduced the risk of patient harm.

Governance (Clinical)

Clinical governance is a system through which NHS organisations are accountable for continuously improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish

Health Care Assistant

Healthcare assistants (HCAs) work in hospital or community settings under the guidance of a qualified healthcare professional.

High Dependency Unit

A high dependency unit is an area in a hospital, usually located closely to the intensive care unit, where patients can be cared for more extensively than on a normal ward, but not to the point of intensive care.

Human error

Human error means that something has been done that was not intended by the actor; not desired by a set of rules or an external observer; or that lend the task or system outside its acceptable limits. In short, it is a deviation from intention, expectation or desirability.

Iatrogenic

Means resulting from the activity of physicians; said of any adverse condition in a patient resulting from treatment by a physician or surgeon.

Intensive Care Unit

Is a hospital unit in which is concentrated special equipment and specially trained personnel for the care of seriously ill patients requiring immediate and continuous attention, also called critical care unit (CCU).

Institute for Healthcare Improvement

The Institute for Healthcare Improvement (IHI), an independent not-for-profit organization based in Cambridge, Massachusetts, is a leading innovator, convener, partner, and driver of results in health and health care improvement worldwide

Interprofessional Education

Also known as inter-professional education or “IPE” refers to occasions when students from two or more professions in health and social care learn together during all or part of their professional training with the object of cultivating collaborative practice for providing client- or patient-centered health care.

Junior doctor

Those doctors in their first two years of postgraduate training, starting at graduation.

Macro-simulation

Is simulation with a focus on an organisation or institution developing organisational fit for purpose skills in participants.

Meso-simulation

Focuses on clinical teams and the development of higher cognitive and behavioural (non-technical) skills.

Micro-simulation

Is focused on the individual and their development of basic motor and cognitive (technical) skills.

Major Incident

An untoward incident in healthcare which leads to serious harm, disability or death to the patient concerned.

Manikin

Is a life-sized anatomical human model used in medical education.

Morbidity

A diseased condition or state, or the incidence or prevalence of a disease or of all diseases in a population.

Mortality

Mortality rate is a measure of the number of deaths (in general, or due to a specific cause) in a population, scaled to the size of that population, per unit of time.

Moulage

French: casting/moulding is the art of applying mock injuries for the purpose of training Emergency Response Teams and other medical and military personnel.

National Patient Safety Agency

The National Patient Safety Agency (NPSA) was a special health authority of the National Health Service (NHS) in England. It was created to monitor patient safety incidents, including medication and prescribing error reporting, in the NHS within England and Wales.

National Confidential Enquiry into Patient Outcomes and Deaths

NCEPOD's purpose is to assist in maintaining and improving standards of medical and surgical care for the benefit of the public by reviewing the management of patients, by undertaking confidential surveys and research, and by maintaining and improving the quality of patient care and by publishing and generally making available the results of such activities.

Part-task trainer

For many purposes, especially for learning particular tasks and skills, it is only necessary to replicate specific portions of the patient or task. Part-task physical trainers provide just the key elements of the procedure or skill being learned e.g. an arm for the practice of phlebotomy.

Patient Safety First Programme

Patient Safety First, as a campaign, was designed in 2007, launched in June 2008 and came to an end in March 2010. Its aim was to focus on the safety culture in the NHS and to engage clinical staff as well as enable behavioural change leading to safer, better healthcare.

Physiological observations

An assessment of a patient’s condition, or analysis of data collected on one or more patients by the investigator/staff as required by protocol. Most usually the patient’s Respiratory rate, pulse, blood pressure, conscious level and temperature.

RADAR

An acronym for Recognising Acute Deterioration: Active Response which refers to the teaching programme developed as a result of the research for this project.

SBAR

An acronym for Situation, Background, Assessment, Recommendation, used as an emergency communication tool when seeking help from a more senior clinician.

SEWS

Standardised (or Scottish) Early Warning Score.

Simulated Patient

A simulated patient is an individual who is trained to act as a real patient in order to simulate a set of symptoms or problems. Simulated patients have been successfully used in medical education, nursing education, evaluation, and research.

Simulator

Any device or system that simulates specific conditions or the characteristics of a real process or machine for the purposes of research or operator training

Suboptimal care

Is defined as a lack of knowledge regarding the significance of clinical findings relating to dysfunction of airway, breathing and circulation or problems related to system failures that inhibits care delivery.

Vital signs

Are measures of various physiological statistics, often taken by health professionals, in order to assess the most basic body functions. The act of taking vital signs normally involves recording body temperature, pulse rate (or heart rate), blood pressure, and respiratory rate, but may also include other measurements.

WSE

A safe yet realistic busy clinical setting is created with simulated patients and teachers playing various roles. Students participate in their groups and function as a team to organise and manage the ward and deliver patient care.

Introduction

I have been a Registered General Nurse for 30 years during which I have worked in acute and critical care nursing, the Scottish National Blood Transfusion Service as a Clinical Nurse Specialist, and latterly in higher education within a Clinical Skills Centre. I am currently the Lecturer in Interprofessional Education responsible for ensuring that undergraduate medical students learn with, from and about nursing and the allied health professions (AHP) students. My interests however remain embedded in acute and critical care which is the basis of this submission for the degree of Doctor of Education.

The work is presented in two volumes and is a combination of a successful application for Recognition of Prior Learning (RPL), which was granted in respect of two modules of the Professional Doctorate (Volume 2). Volume 1 is an empirical study using Action Research to devise and evaluate a programme of teaching based on the problem of clinical deterioration (Cycle 1) followed by an extended literature review and a quantitative evaluation (Cycle 2) followed by a qualitative evaluation (Cycle 3) which when combined achieve the outcomes of the modules required for completion of the Doctorate of Education. The work is based on my interest in simulation-based medical education and demonstrates personal and professional development in the use simulation to teach medical students how to become safe practitioners.

The prevention of clinical deterioration is a component of the Acute Adult work stream of the Scottish Patient Safety Programme as well as other United Kingdom and Global Safety Agencies. This is the focus of the main body of the submission

which is the study. My aim in undertaking the Doctor of Education degree was to introduce a new and innovative way of teaching undergraduate medical students to recognise and respond to clinical deterioration. I had previously carried out a small scale action research project on hand hygiene in which I developed and evaluated a change to this area of the undergraduate medical curriculum. Whilst working on this change I found that the collaborative and participative nature of action research fitted well with my thinking and so was keen to use this in my doctoral work. Therefore, the third part of the work is grounded on a mixed methods action research study concentrating on the development and evaluation of a teaching programme for medical undergraduates.

Recognising Acute Deterioration: Active Response (RADAR) is a simulation based teaching session using simulated patients to portray acutely unwell adult hospital patients. The genesis, development and progress of RADAR will be discussed along with the findings of questionnaires and Small group interviews from two further cycles of action research. Readers will become aware of the impact which RADAR makes to the evidence and learning surrounding the recognition and assessment of clinical deterioration in adult hospital patients. The study investigated the impact of simulation on medical students' confidence in recognising and responding to clinical deterioration in adult hospital patients using simulation, simulated patients and moulage.

It has been said that 'Action researchers often experience a complicated research process, not only when conducting their research, but also when trying to report their processes and findings' (Robertson, 2000 p307). I have learned that this is true,

therefore, in the next section I have described what action research is and why I have chosen it as the method for this study.

1. Action Research

Research is a form of ordered inquiry leading to the generation of knowledge. Action research is an explicit method of conducting research by professionals and practitioners with the ultimate aim of improving practice (Koshy, 2009). It has been described as situated, collaborative, participatory and self-evaluative (Greenwood, 1984); as a means of bridging the theory-practice gap through the collaboration of researchers and practitioners (Badger, 2000); and it is problem focused, involving change and aiming at improvement (Elliott, 1994). In terms of the purpose of action research the following statement perhaps defines it most succinctly:

> 'The fundamental purpose of pedagogical action research is to systematically investigate one's own teaching/learning facilitation practice, with the dual aim of improving that practice and contributing to theoretical knowledge in order to benefit student learning' (Norton, 2009 p59).

There are generally considered to be two main movements in Action Research. The first is the American tradition which links research to bringing about social change (Lewin). The second is the British tradition that links research to improvements in practice and is education orientated (Stenhouse, Kemmis & Carr, McNiff & Whitehead, Zuber-Skerritt). In the next section the work of each of the key theorists named above will be described briefly in order to give the reader an insight into the development of Action Research as a method of educational research.

Action research (AR), was first described by Kurt Lewin in 1946 as a means of addressing some of the social problems associated with ethnic community groups within the United States of America (USA). Lewin proposed that AR would go beyond change alone since it would generate knowledge about social systems and that it would lead to a process of change in those systems instigated and led by

those most affected – the people themselves. This approach by Lewin was contradictory to the strong positivist research movement in the USA and AR was soon marginalised, its use dropping into decline. This decline was mainly due to the advocates of AR refusing to comply with the methodological requirements of positivism (Sanford, 1970).

The resurgence of AR was most prevalent in the 1970s amongst educational and curriculum researchers in the United Kingdom (UK). Many of the researchers as well as teachers themselves were annoyed by the amount of research which was being conducted for the sake of it, rather than to have an impact on teaching (Kemmis & Wilkinson, 1988). It was suggested that teachers' professional development could be enhanced by adding a research component to their role which would mean that such research was relevant, and that this would be best achieved using an AR design (Stenhouse, 1975). The UK version of AR differed from its USA counterpart in its rejection of positivistic research methodology in favour of the interpretive methodologies being employed in the social sciences (Carr, 2006). Since the resurgence there have been a number of theorists in action research with each one having a specific approach to the action research process. A description of some of the key theorists and their work of AR will now be described.

1.2 Key Theorists in Action Research

1.2.1. Kurt Lewin (US Movement)

The concept of action research (AR) was first proposed by Kurt Lewin as a method of investigation which would involve individuals in achieving long lasting social

change. Lewin first described AR as a spiral of steps (Lewin, 1946). His original work was not based in educational research but in industry and social relations. Lewin's model of AR was used widely in the United States of America until the scientific community pushed for its abandonment as a recognised research method because it did not accommodate the prevailing scientific models of research. Action research therefore became more or less obsolete until it was revitalised in the United Kingdom by Lawrence Stenhouse (1975).

1.2.2. Lawrence Stenhouse (UK Movement)

Stenhouse was focused on the concept of teachers as researchers; he wanted to move away from a focus on psychology, sociology, and history of education and let teachers focus on their personal professional development. He believed that teachers themselves were the best judges of what was involved in their own practice. He was committed to developing teachers who were able to reflect critically on their own practice and change that practice through research. Stenhouse was an advocate of teachers being supported in their research endeavours by academics, stating that 'fruitful development in the field of curriculum and teaching depends upon evolving styles of co-operative research by teachers and using full-time researchers to support the teacher's work' (1975 p162). The AR approach proposed by Stenhouse was used widely to develop and revise school curricula and teachers' practice for a decade until it was superseded by the work of Carr and Kemmis (1986).

1.2.3. Stephen Kemmis and Wilfred Carr

Stephen Kemmis based his work on the original concept of AR proposed by Lewin (1946). Kemmis focused on the socially and politically constructed nature of

education practice and in partnership with Wilfred Carr developed the term ‘educational action research’ (Carr & Kemmis, 2003). Once again Kemmis and Carr developed a reflective spiral model of planning, acting, observing, reflecting and re-planning as the basis for understanding how to take action to improve educational situations (See Figure 1 below).

Figure 1: The Cycle of Action Research by Carr and Kemmis (1986)

1.2.4. Jack Whitehead and Jean McNiff

Jack Whitehead and Jean M^{c}Niff have written extensively on action research both in partnership and individually. They are both of the opinion that action research is a method of researching your own learning, being participatory and collaborative and using reflection as a tool (McNiff and Whitehead, 2002).

All of the aforementioned exponents of action research suggest that it is cyclical, and includes observation, planning, reflection and action. However, it has been suggested, and I concur, that

> “Excessive reliance on a particular model, or following the stages or cycles of a particular model too rigidly, could adversely affect the unique opportunity offered by the emerging nature and flexibility which are the hallmarks of action research” (Kolshy, 2011, p7).

Finally, in planning this action research study I took account of the tenets of action research as proposed by O’Leary (2004) which are that action research:

- *Addresses practical problems* – I would suggest that teaching medical students to recognise and respond to deterioration is a practical problem as the response requires both technical and non-technical skills;

- *Generates knowledge* – All research should generate knowledge, this study will produce new knowledge on the use of simulation to facilitate students' confidence in recognising and responding to deterioration;
- *Enacts change* – The changes identified by this study will be enacted into the curriculum as and when they are identified and evaluated;
- *Is participatory* – This study will include students in the data collection and change as partners to the researcher;
- *Is a cyclical process* - Cycle 1 of the study was undertaken during 2009 and focused on my reflections of the issues in practice, identification of the problem, the areas to be improved, how this might be achieved and a plan on how to achieve the changes. Cycle 1 also included the literature review. Cycle 2 (2010) was the quantitative data collection phase following the first run of the programme and Cycle 3 was the qualitative phase during 2011 following adaptations to the programme based on the student feedback from 2010. Figure 3 below demonstrates the Action Research Cycles.

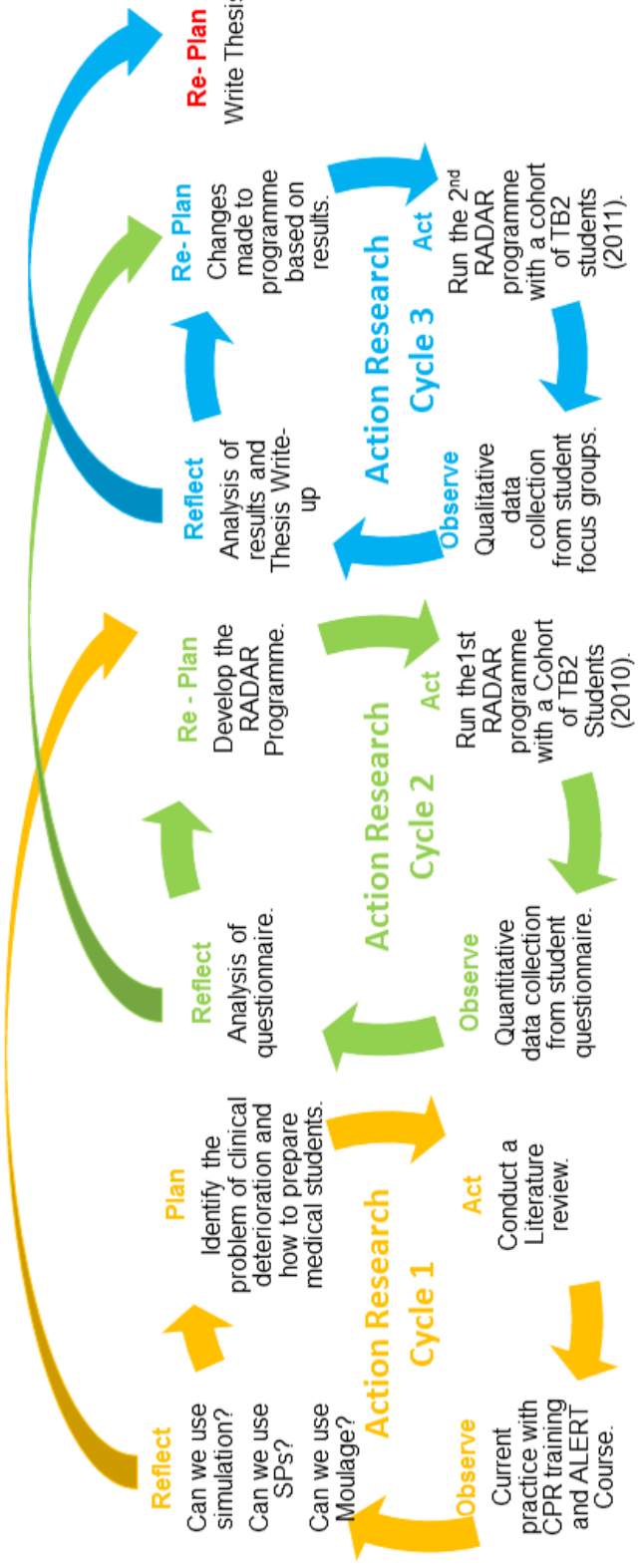


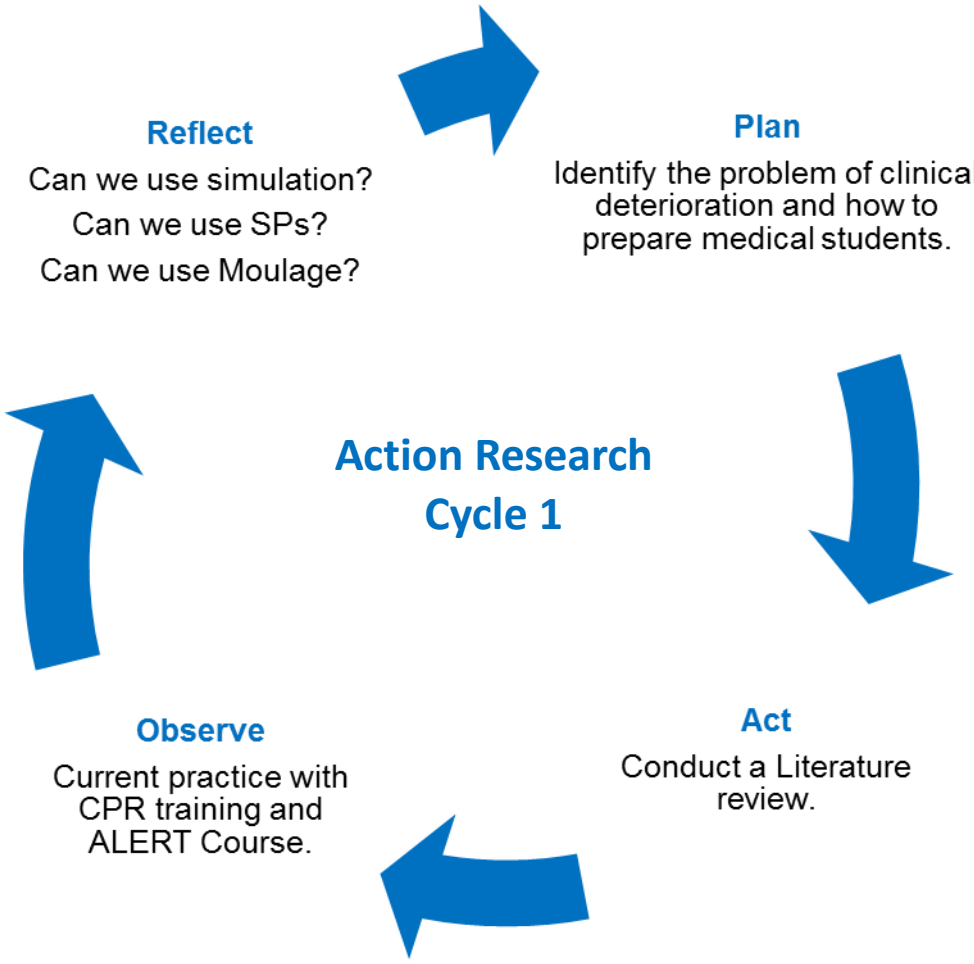
Figure 2: Showing the three cycles of action research.

The first step of an action research project is to identify the problem or issue that the researcher wishes to address. In my own case this was the problem of failure to recognise clinical deterioration in adult hospital patients. The attention of my research was to be undergraduate medical students and the study will demonstrate how three cycles of action research led to the development and evaluation of a teaching programme to promote students confidence in this complex aspect of clinical care.

The data were collected from student questionnaires and focus group interviews. The data revealed that students did perceive and report increased confidence in recognising and responding using simulation. Engaging with a ward simulation exercise and RADAR (Recognising Acute Deterioration: Active Response) scenarios encouraged students to develop a systematic approach to clinical deterioration.

The inclusion of simulated patients with moulage to portray changes in physical appearance, combined with a simulation based healthcare context provide high levels of realism to make RADAR a unique addition to the simulation based medical education field.

Action Research Cycle 1 (2009-2010)



2. The Problem of Clinical Deterioration

2.1. Introduction

In this section the reader will be introduced to the problem of clinical deterioration in adult hospital patients. When undertaking an action research project the practitioner must start with an issue from their practice which they see as a problem. In my own practice I identify closely with acute care and the unwell patient. From my personal experience and scholarship prior to starting the Doctorate I was aware that the issues of early detection and rescue of deteriorating patients was a major issue in health care. It was evident from my own practice in teaching undergraduate medical students that they did not have the real clinical experience or exposure to unwell patients to be able to asses and respond to the physical and mental changes which often accompany clinical deterioration.

In terms of thinking about teaching students to gain some experience I undertook the ALERT™ Course (Smith, Osgood & Crane, 2002) which is run by the local NHS trust as preparation for qualified practitioners. The course is designed to introduce participants to the deteriorating patient and how to respond appropriately. However, I personally felt that too much of the time was spent on presentations and lectures on ‘airway management’, ‘pain management’ etc. and not enough time spent practicing the skills needed to assess and rescue a deteriorating patient. In addition the afternoon was spent doing a series of scenarios. This was more engaging until a CPR manikin was used to simulate a patient who was supposedly alive, breathing but had chest pain. Along with a number of my peers I found it very difficult to engage and immerse myself in this type of simulation. This left me with a chequered view of ALERT™ and the impetus to do something better myself. Therefore, I started

to look in more detail at the problem of clinical deterioration in adult hospital patients and discovered a great deal. Patients who are admitted to hospital are entitled to assume that the care they will be given is effective and safe, and in 90% of cases this is the situation (Vincent, Neale, & Woloshynowych, 2001). However, there is evidence to suggest that in some cases avoidable or preventable cardiac arrests are still an issue (NCEPOD, 2005, 2012).In 2005 the second Confidential Enquiry into Patient Outcome and Death entitled 'An Acute Problem (NCEPOD, 2005) was published following an extensive audit within public and private hospitals in England and Wales. The report was the first to identify that whilst the number of inpatient beds was being reduced, the number of critically ill patient in hospitals was increasing. Similarly it was reported that in a major United States teaching hospital of 400 beds, 33% were devoted to high dependency and critical care patients.

The NCEPOD (2005) Report focused on Pre-Intensive Care Unit (ICU) care, patient observation and review criteria and patients who died. Prior to the publication of NCEPOD (2005) a number of studies had been carried out examining the care of patients before admission to ICU (Franklin & Matthew, 1994; McQuillan, et al, 1998; McGloin, Adam & Singer, 1998). In all of these studies suboptimal care was identified as contributing to morbidity or mortality in most instances. Suboptimal care is defined as

> 'a lack of knowledge regarding the significance of clinical findings relating to dysfunction of airway, breathing and circulation or problems related to system failures that inhibits care delivery.' (Massey, Aitken & Chaboyer, 2010, p128).

McQuillan et al (1998) identified that suboptimal care had five major components: failure of the organisation, lack of knowledge, failure to appreciate clinical urgency, lack of supervision and failure to seek advice.

In the second NCEPOD Report entitled ‘Time to Intervene?’ (2012) in which an audit of patients who had suffered an in-hospital cardiac arrest in England and Wales was reported, there were still issues surrounding avoidable and preventable incidents. It is the author’s opinion that these findings have major implications for medical educators as the reports are identifying little progress in the identification and management of deteriorating patients over a period of seven years.

2.2. Failure of the organisation

The published evidence linking suboptimal care with failure of the organisation is mainly concerned with the contribution of nursing staff numbers on workload and patient outcome (Aiken, Clarke, Sloane, Sochalski & Silber, 2003; Aiken, Clarke, Cheung, Sloane & Silber 2002; Rafferty, et al 2007; Shuldham, Parkin, Firouzi, Roughton & Lau-Waller, 2009; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002).

Aiken, Clarke, Sloane, Sochalski & Silber, (2003) identified from a study of Australian s0urgical nurses that hospitals with high patient to nurses ratios patients had higher mortality and nurses were more likely to experience stress burnout and job dissatisfaction. This study was followed by another which examined the level of education of nurses caring for surgical patients and identified that mortality was lower in areas with a high proportion of nurses trained at baccalaureate level (Aiken, Clarke, Cheung, Sloane & Silber, 2002). Similar references to the impact of nurse-

patient ratios were raised following work undertaken in the United Kingdom stating that the study ‘Provides evidence that the positive relationship between low nurse-patient staffing ratios and favourable patient and nurse outcomes is an international phenomenon’ (Rafferty et al (2007 p176). However, another paper published in the same year (Van den Heede, et al 2009) suggested that this was not the case stating that ‘A nationwide study in Belgian hospitals does not confirm US findings that acute care hospitals with the most (or best trained) nursing staff have better patient outcomes than those with less (or worst trained) nursing staff’ (p929). This confusion and criticism of the impact of nurse-patient ratios continued until a major study in the USA involving 197,961 hospital admissions and 176,696 nursing shifts found that ‘…staffing of RNs below target levels was associated with increased mortality, which reinforces the need to match staffing with patient’s needs for nursing care’ (Needleman, Buerhaus, Pankratz, Leibson, Stevens & Harris, 2011 p1037).

This was a large study which used data from a large tertiary academic medical centre which not only examined RN staffing levels similar to the previous studies but included admissions, transfers and discharges, which gave additional data. In addition this was the first of the studies of staffing levels to include statistical controls. The previous studies also failed to show a direct link between the levels of staffing and patient experience (Needleman, Buerhaus, Pankratz, Leibson, Stevens & Harris, 2011).

Whilst nurse-patient ratios play an important part in the care of deteriorating adults there are a number of wider organisational characteristics which must be taken into consideration. Within the NHS, resources and organisational factors, processes and

delivery of care, information management and communication systems, competence, training and behaviours of staff and clinical governance were all identified as impacting on deterioration detection and prevention by Bion & Heffner (2004).

In the literature review to this study it will be discussed how the systems, culture and structures in organisations such as the NHS can lead to adverse events and errors in some of the areas mentioned by Bion and Heffner (2004).

As well as the impact of failure of the organisation, lack of knowledge, particularly that of medical students and junior doctors, has been implicated in failure to rescue (FTR) deteriorating patients. This is the issue on which I might have the most impression and so is the theme on which the study will be based.

2.3. Lack of knowledge

Much has been published and written on the practice of cardiopulmonary resuscitation training for medical students and other healthcare students and practitioners (Phillips & Nolan, 2001; Graham & Scollon, 2002; Price, Bell, Janes & Ardagh, 2006). However, there is very little available on training in the care of the acutely ill (McAuley & Perkins, 2002). This is despite one of the recommendations in the NCEPOD Report (2005, p12) being that ‘Training must be provided for junior doctors in the recognition of critical illness and the immediate management of fluid and oxygen therapy in these patients’. The focus on resuscitation training was also discussed in the NCEPOD (2012) Report ‘Time to Intervene? In which an audit of patients who underwent CPR as a result of in-hospital cardiorespiratory arrest was carried out in England and Wales. The main findings of this report were that there are still cases of cardiac arrest occurring in patients who have had obvious changes in their physiological parameters, and deterioration over periods between 1 and 8

hours. The report ends with two recommendations of particular interest to the RADAR study,

‘This report therefore raises two main challenges to all health care professionals:

1. To ensure rapid and consistent recognition and management of acute illness in order to maximise patients’ chance of recovery.
2. To ensure that decision making about CPR is applied consistently, communicated effectively and that CPR is performed only on patients who are likely to benefit from it.’ (NCEPOD, 2012 p99).

This has implications for the training of medical students in terms of how we accommodate teaching in the recognition and response to acute ill health as well as the separate subject of CPR which will be discussed later in this report.

Two studies published by Edinburgh Medical School staff in 2011 have particular relevance to the concept of lack of knowledge in medical students and junior doctors in the care of the acutely ill patient. The first was a questionnaire study based on feedback from graduate doctors over three consecutive years between 2007 and 2009. The results showed that whilst graduates felt well prepared in consultation and communication skills, they were less prepared in prescribing and acute care (Tallentire, Smith, Wylde & Cameron, 2011). These findings were supported by the educational supervisors of the doctors who had responded. This is an important study which provides valuable evidence to support the development of an undergraduate training programme.

The second paper focused on the transition from medical student to junior doctor and identified that many UK graduates felt ill prepared for the onerous task of being able to rapidly identify and respond to acutely unwell patients (Tallentire, Smith,

Skinner, and Cameron, 2011). The study was based on Small group interviews with 36 clinicians and used a qualitative grounded theory approach. The study identified the issues under three main headings (See Figure 4).

1. Cognitive challenges	- transferring knowledge into practice - decision making - uncertainty
2. Roles and responsibilities	- acts and omissions - identity - expectations
3. Environmental factors	- medical hierarchy - performing under stress.

Figure 3: Issues in the transition from student to newly qualified doctor. (Tallentire et al 2011).

The paper demonstrates the complex interaction of the issues discussed in Figure 4 in the assessment and management of the acutely ill and suggests that

> 'The opportunity to rehearse acute scenarios without endangering patients, followed by expert debriefing that challenges, adds to, and at times deconstructs existing cognitive schemes is appealing as an educational strategy' (Tallentire, Smith, Skinner & Cameron, 2011 p1003).

Cognitive challenges, roles and responsibilities and environmental factors are central to the concept and content of the programme being reported on i.e. Recognising Acute Deterioration: Active Response (RADAR). Both of the aforementioned studies provide valid and useable data and in the second there is a very interesting model which describes a conceptual framework illustrating the influences and inter-relationships on the behaviour of newly qualified doctors (Tallentire, Smith, Skinner &

Cameron, 2011 p1001). This work will be referred to again in the discussion section of this dissertation.

2.4. Failure to appreciate clinical urgency

Failure to appreciate clinical urgency is closely linked to lack of knowledge in terms of impact on patient outcome. A study of the outcomes for patients who had a cardiac arrest in hospital identified primary cardiac processes were not the prime cause but were related to a number of other physiological changes (Schein, Hazday, Pena, Ruben and Sprung, 1990). Overall, 45 of 64 patients (70%) had either a deterioration of respiratory or mental function observed; 16 (25%) had a documented deterioration in both systems. The report went on to identify that

> ‘At least one change in patient behaviour or complaint in the 8 hours preceding (cardiac) arrest was found in 54 (84%) of patients; 23 (36%) had two and 1 had three; 34 patients (53%) had documented deterioration in respiratory function and 27 (42%) had alterations in mental function’ (Schein, Hazday, Pena, Ruben & Sprung, 1990, p1391).

In what is now considered a seminal paper in the field of failure to rescue, McQuillan, et al (1998) identified that the problem of failure to appreciate clinical urgency is not isolated to junior doctors. In a study of 100 adult emergency admissions they concluded that

> ‘Seriously ill patients may be identified by the clinical signs of life threatening dysfunction of the airway, breathing, or circulation, but these may be missed, misinterpreted, or mismanaged by clinicians of all grades.’ (McQuillan et al 1998, p1853).

This statement demonstrates that there is a need to identify early in a medical students career the need for training and preparation to manage the signs of clinical

deterioration. By incorporating a progressive programme of teaching which builds on experience it should be possible to increase the confidence of junior doctors and ultimately all doctors to manage these patients safely and effectively.

2.5. Lack of supervision

The issue of lack of supervision of junior doctors was first introduced in the 2005 NCEPOD Report in reference to the European Working Time Directive –EWTD (Omland, 2006). The EWTD was introduced in an attempt to reduce the long hours which junior doctors worked over a period of a week, often working all day and then being 'on call' during the night. According to NCEPOD (2005), the EWTD makes junior doctors less available for training and therefore less experienced than in the past. The report continues by stating that

> 'As a result, in complex cases, there is an inevitable risk that these doctors may provide care which is less than optimal and yet they are unused to seeking advice or supervision, particularly out of hours' (NCEPOD, 2005, p2).

A major concern is that the NCEPOD Report of 2012 – 'Time to Intervene?' reports very similar findings. Based on the established audit procedures from work on other subjects this particular NCEPOD report examined the pre, peri- and post-cardiac arrest care of patients within the NHS in England. In terms of acute emergency admissions it was found that an adequate history was not recorded in 70/489 cases (14%) and clinical examination was incomplete at first contact in 117/479[1] cases (24%). In response to these findings the report states that

> 'Hospitals must ensure appropriate supervision for doctors in training. Delays in escalation to more senior doctors due to lack of recognition of severity of illness by

[1] 10 case notes were lost or destroyed during the process of Audit which accounts for the discrepancy in numbers i.e. 489 > 479.

> doctors in training are unacceptable and place patients at risk' (NCEPOD 2012, p 12).

Lack of supervision of junior doctors is closely linked to their failure to seek advice, although studies have shown that this is also an issue with nursing staff (Cioffi, 2000).

2.6. Failure to seek advice

In a study of nurses' decisions to call for help during an emergency situation (Cioffi, 2000) it was identified that nurses tended to question whether they were 'doing the right thing' by calling an emergency team and that they would often collaborate with colleagues prior to calling, with most feeling nervous and anxious about doing so. Recognition of change in patients' condition and having a 'gut feeling' or '6th sense' were commonly reported by nurses during the study. However, many of the patients about whom the nurses experienced these feelings had no identifiable changes in physiological parameters and so did not 'trigger' evidence which a junior doctor would respond to; therefore nurses tended not to make a call until the physiological parameters had deteriorated to the point of acute illness (Cioffi, 2000).

Another study carried out on 112 patients with an unexpected cardiac arrest or unplanned admission to an Intensive Care Unit (ICU) had deterioration in the airway, breathing or circulation for at least one hour before the event. There was evidence that these patients had been reviewed by a junior doctor (median, twice, range 0-13) during the documented period of clinical instability (Buist, Moore, Bernard, Waxman, Anderson, & Nguyen, 2002). In addition to these studies, another conducted in a Danish University hospital which included 877 patients identified that 155 (18%) had

abnormal vital signs. Clinical staff were unaware of abnormal vital signs in 67 (43%) of cases (Fuhrman, Lippert, Perner, & Ostergaard, 2008).

The authors recommended that

> 'Strategies to improve identification of patients at risk should be an initial step in preventing serious adverse events on the general wards' (Fuhrman , Lippert, Perner & Ostergaard, 2008 p325).

It is clear from the evidence in the preceding paragraphs that there is an international issue surrounding the recognition and response to deterioration in acutely ill adults. This has important implications for the work being reported here in terms of dissemination and implementation to an international audience. It has an impact on the future doctors that graduate and has an impact on action researchers who see the issue in terms of a possible solution.

In the next section the reader will be introduced to documents published by the NHS, National Patient Safety Agency (NPSA) and Patient Safety First Campaign to address these issues at a National level in the UK. Although these papers are English publications, the NHS in Scotland have accepted that the issues are the same and is using the information to underpin the work of the Scottish Patient Safety Programme.

2.7. Responses to 'An Acute Problem'

Since the publication and widespread acceptance in the UK health services of the NCEPOD Report '*An Acute Problem?'* (2005) there have been three major pieces of work published on the subject of deterioration. The first of these was 'Recognising and responding appropriately to early signs of deterioration in hospitalised patients

(Luettel, Beaumont & Healey, 2007). This was based on an audit of 576 deaths reported to the NPSAs National Learning and Reporting System in the NHS in England (see literature review for details). Over the period of 2005 it was identified that 66 (11%) of deaths were as a result of unrecognised or inactive response to deterioration.

The report classified the findings into headings of communication factors, identifying areas of concern with both verbal and written communication leading to various examples of patient deterioration going unnoticed, working conditions and environmental factors, mostly relating to the staffing levels on wards especially during 'out of hours' periods. The category of task factors was interesting in that it identified the poor perception of the importance of recording vital signs and observations amongst registered nurses and the delegation of this 'simple task' to healthcare assistants (HCAs) and unlicensed staff (Luettel, Beaumont & Healey, 2007, p 18).

Education and training factors again were related to the increasing delegation of nursing procedures to HCAs without the assurance of proper and detailed educational underpinning e.g. recording vital signs without understanding the underlying anatomy and physiology. Some junior doctors also commented on their own lack of training in how to manage the acutely ill patient. Team and social factors were related to the high turnover of nursing staff and changes to junior doctors' working patterns imposed by the EWTD (Omland, 2006). Organisational factors were related to the lack of clinical guidelines on managing acutely unwell patients whilst equipment and resources factors implicated a lack of medical equipment. Finally

individual factors such as tiredness, and lack of concentration were mentioned by both medical and nursing staff. The main recommendations of the Luettel, Beaumont, & Healey (2007) Report were that

> ‘Every acute trust ensures leadership and coordinates efforts to improve the safety of patients who are vulnerable to unexpected deterioration by establishing a ‘Deterioration Recognition Group’ (p 27).

Following the publication of Luettel, Beaumont & Healey, (2007) the National Institute for Health and Clinical Excellence (NICE) produced a clinical guideline: ‘Acutely ill patients in hospital; Recognition and response to acute illness in adults in hospital (Armitage, Eddlestone & Stokes, 2007). Clinical guidelines are produced after extensive reviews of evidence and are expected to be used by healthcare professionals in exercising clinical decision making and judgement. The NICE guidelines utilised evidence from many of the studies mentioned in this chapter of the dissertation as well as the findings from the Luettel, Beaumont & Healey, (2007) document. The guidelines focused on the identification of patients at risk of deterioration, response strategies to manage patients at risk of deterioration and the transfer of patients from critical care to a general ward.

Despite widespread dissemination of the Guidelines (Armitage, Eddlestone & Stokes, 2007) in 2008, the Patient Safety First Programme (NHS England) produced more guidance: ‘*The ‘How to Guide’ for reducing Harm from Deterioration* (Patient Safety First Campaign, 2008).The guide acknowledged the work already undertaken by NPSA and NICE in relation to preventing deterioration and identified that there were six key areas which required urgent attention. These six key areas were:

1. Physiological observations should be recorded for all adult patients in acute hospital settings
2. Physiological observations should be recorded and acted upon by staff who have been trained to undertake these procedures and understand their clinical relevance
3. Physiological track and trigger systems should be used
4. There should be a graded response strategy
5. An escalation protocol should be in place
6. A communication tool should be used

(Patient Safety First Campaign, 2008 p7).

This document and these six key provide the basis for any intervention aimed at early recognition and rescue of a deteriorating adult patient and were included in the development and design of the intervention. The intervention will be discussed later in the dissertation.

The next stage of the action research journey is to find out all that one can about the issue to be addressed. This is most often achieved through a review of the published literature, reports, studies and other material. The next section of this dissertation is a Literature Review focusing on the development of patient safety from the early focus on medical harm and error prevalent in the 1960s.

3. The Literature Review

3.1. Introduction

During the 1980s it became clear that despite the power of modern medicine to care for and cure illness, hospitals were not the places of safety they might have been. Instead they were fraught with risk of patient harm. Since then patient safety has become known as a discipline with a body of knowledge and expertise which has the potential to revolutionise healthcare delivery. Patient safety theory has also lead to a greater understanding of why people make errors which lead to adverse events, shifting the focus from one of a single person blame and shame framework to one of a systems design approach. Traditional thinking in medicine and healthcare assumed that well qualified and trained practitioners did not make mistakes. This same thinking likened error to incompetence and saw punitive action as appropriate in these cases. The thought was that the punishment would make people more careful in future. However, this was ultimately found to have a noxious effect with people hiding or covering up mistakes rather than report them. This meant that it was impossible to learn from mistakes and it became the culture that legal teams and managers would encourage this approach in order to prevent malpractice claims being made against the hospital (Mills, 1978).

Things began to change in the 1990s in response to a number of studies (Brennan et al, 1991) in which medical injury was acknowledged as happening more frequently than first thought and that much of it was preventable. Secondly, the idea that ‘active errors’ at the ‘front-end’ of practice where patient and clinician meet are often caused by ‘latent errors’ in the systems, organisation, culture ‘blunt end’, were acknowledged in healthcare as well as other organisations (Reason, 1990).

Punishing individuals for these mistakes began to make little sense since the same are likely to happen until something was done to address the underlying causes. The idea that adverse events, defined as:

> '…unintended injury or complication that resulted in disability, death or prolonged hospital stay and was caused by the healthcare management rather than by the underlying disease process' (Wilson, Runciman, Gibberd, Harrison, Newby, & Hamilton, 1995 p461)

could provide information was not new (Schimmel, 1964). The need to identify and share information about the incidence of adverse events became urgent (HMPS, etc.). It also became clear that a knowledge of systems was needed in order to understand how things went wrong. Clinicians, senior managers, executives and middle managers were being encouraged to think in terms of building high reliability organisations. This would require a culture change to one that did not focus on 'sharp-end' blame for mistakes to one that viewed reporting and learning about mistakes, failures and near-misses as accepted practice (Leape et al, 1991).

Thus we reach the stage where patient safety is embedded in both the health services and educational programmes for healthcare students. Patient safety is defined as:

> 'A discipline in the healthcare sector that applies safety science methods toward the goal of achieving a trustworthy system of healthcare delivery. Patient safety is also an attribute of healthcare systems: it minimises the incidence and impact of, and maximises recovery from adverse events' (Emannuel et al, 2008 p6).

In the previous section, the problem of clinical deterioration to be addressed by this study was clearly identified from some of the published literature. It is clear that the problem of clinical deterioration is a widespread and complex issue and can be

caused by the presenting problem, a new problem or a complication of either of these or the management/treatment provided in hospital. The literature published on clinical deterioration can be described in three main themes as follows:

1. Early studies were based on retrospective observation of practice and outcomes of care with the focus on infection although it was not known at the time that this was the cause;
2. Traditionally studies have focused on the end result of clinical deterioration as an adverse event, with iatrogenesis and medical error seen as the main cause(s) leading to a focus on litigation;
3. More recently the focus has been on the patient outcomes in terms of learning from adverse events and patient assessment and monitoring (See table 4).

Table 1: Review of Major Studies in Patient Safety 1800-2002

Date	Reference	Study Design	Findings	Complications
1800s	Nightingale	Prospective review of outcomes of care	Higher death rates in hospitals	Wound infections
	Simpson	Retrospective review of complications post amputation	Higher death rates in bigger hospitals	Wound infections
	Semmelweiss	Prospective review of maternal death rates	Higher death rates in women attended by medical students	Cross infection from cadavers to labouring mothers
1964	Schimmel	Prospective review of complications in hospital patients	Prolonged stay due to adverse events	Diagnostic procedures, medicines, blood transfusions, infections
1978	Mills	Prospective case note review	Definition of adverse events in terms of litigation claims	Diagnostic procedures, medicines, medical devices, anaesthetics, nursing, general medical management
1981	Steel et al	Prospective monitoring of all admissions	Complications of management	Medicines, diagnostic and therapeutic procedures, falls, blood transfusion
1991	HMPS	Retrospective case note review	Identification of adverse events focus on medical error	Incidence, negligence, outcome, speciality, preventability
1998	McQuillan et al	Prospective observational study	Unplanned admissions to intensive care	Suboptimal care
2002	Hodgetts et al	Prospective observational study	Outcome post-cardiac arrest	Unidentified abnormalities in physiological parameters.

In the literature review which follows I will use these three key themes and the papers listed to describe the route from identifying and measuring adverse events to

actively preventing and managing them in terms of clinical deterioration. The journey will start with early studies of patient harm in the 19th Century through the phase of focusing on apportioning blame and measuring human error. It will finish with the realisation that human error is a major cause of adverse events and subsequently the reason that clinical deterioration is not recognised and acted on. This is the focus of the empirical study which will follow.

Readers should note that unlike most traditional research methods in which the main aim of the literature review is to identify gaps in the literature to be the focus of the subsequent study, action research is different. In this study the problem has been previously identified and supported with literature i.e. that of clinical deterioration. The literature review is conducted to:

- Establish a connection between previously conducted studies and the focus of the action research study i.e. to understand how patient safety has developed from the early focus on error to one of reporting and learning in which clinical deterioration is seen as an important issue;
- To connect my expertise as an educator to that of the practitioner experts in the field through analysis and synthesis of their publications;
- To make a strong case that the study is needed in order to contribute to the knowledge base which is already available, and in line with action research to provide a practical evidence based solution to the identified problem;
- To provide background information for people in decision-making positions that the solution is a valid one (Valcarcel-Craig, 2009 p57).

Readers will be introduced to early studies of the measurement of patient harm from the 19th Century when the biggest cause of adverse events and mortality was infection. In particular the work of Florence Nightingale will be discussed as she was the first person to start to maintain records and introduce statistics relating to patient harm. This focus on data is still prevalent in contemporary patient safety and quality improvement programmes. The work of James Simpson in examining the incidence of wound infection post amputation was the first national study undertaken in Scottish Hospitals. This work and that of Ignaz Simmelweiss on hand hygiene are again major components of the current patient safety agenda globally.Between 1960 and 1990 the focus very much remained on the actions of doctors in causing patient harm (iatrogenesis) and in the USA in particular there was a culture of 'blame and claim'. There was however some salient papers published in this period which were ahead of their time, but largely ignored until later when their importance was recognized.

The publication in 1991 of the Harvard Medical Practice Study was the catalyst for change not only in the USA but internationally. Studies of harm and adverse events in hospital patients were increasingly used to demonstrate the complexity of healthcare and the consequences of treatment. These studies and the formation of the Institute for Healthcare Improvement (IHI) in Boston, USA saw the move to learning from, and preventing adverse events.

Scotland was the first country out with the USA to establish a national Patient Safety Programme with the aim of reducing patient harm by 15%. Recognising and responding to clinical deterioration is one of the work streams in the programme

which is where the literature review will lead. Like many other aspects of contemporary society, medicine is constantly changing and evolving. It is not that long ago that people lived in fear of diseases such as tuberculosis, polio and smallpox, and death during and immediately after childbirth (of mother and sometimes child as well) was common.

Prior to the introduction of the National Health Service in 1947, hospitals were very often places to be avoided at all costs due to the risk of infection, poor care, and often high fiscal costs to the very poor (Pani & Chariker, 2004). Today, medicine has become ‘high tech’ with diagnosis based on Computerised Tomography (CT) and Magnetic Resonance Imaging (MRI) scanners, effective drugs and medicines, low impact (Key-hole) surgery and sophisticated care packages between hospital and community health services aimed at allowing us to live longer. These rapid changes have also led to an increase in surveillance on patient outcomes and care delivery with some studies suggesting that care is sometimes suboptimal (Brennan et al 1991). These concerns led to the development of the Patient Safety Movement (Institute of Medicine, 2000) and in order to understand the rationale for me undertaking research into the assessment and care of deteriorating adult patients it is important for readers to be aware of the developments which have been the creation for patient safety.

Patient safety as a formalised component of healthcare was operationalized by psychologists and others working in the field of human safety and it is important that readers first gain an understanding of the part which human error plays in the concept of medical error. Human safety and human error have mostly come to the

attention of the general public through the publication of incident reports into major accidents in aviation, nuclear power and the oil and gas industry e.g. Tenerife air disaster and the Three Mile Island Nuclear explosion in the USA. Major incidents involving multiple casualties are major news stories and it was common in the past, after months, or sometimes years of investigation to read that 'human error' was stated as the cause.

Formal investigation of major accidents were mainly focused on and attributed to mechanical failure (Shappell & Wiegman 2009). The process of accident investigation was adapted by the aviation industry in the 1920s. In 1999, following the publication of 'To Err is Human' by the US Institute of Medicine (2000), the Federal Government in the USA specified programmes to improve error in health systems with the creation of the Office of the National Co-ordinator for Healthcare Information Technology. This Department was to be responsible for gathering data on hospital adverse events and harm and circulating reports to ensure that the Health Services in the USA learned from these events.

Much of the work carried out on accident investigation during the period between 1920 and 2000, was based on what is known as the 'old theory' of human error which basically viewed human beings as the safety critical component of safe work systems. However, as we shall see, this theory has been replaced with a new theory which views the systems and organisation of work as the major causes of error in many cases.

The Scottish Patient Safety Programme (SPSP) is the operational division of the Scottish Patient Safety Alliance (SPSA) which is the first national programme in the World designed to reduce and prevent harmful incidents in healthcare through a progressive programme of quality improvement, measurement, reporting and learning from adverse events and harm to patients in hospital. SPSP differs from the NPSA in England in that it has Regional Teams who work within Health Boards to introduce quality improvement measures, education and training of staff and provide safety, governance and risk management facilitators who work with frontline staff to ensure the aims of the programme are met.

The identification and measurement of adverse events in hospitals has been the subject of many published studies, reports and literature, over the last 40 years which will be critically analysed in the main text of the literature review. Readers will be able to put into context the genesis of the SPSP, the work-stream category ‘General ward’ (a medical or surgical ward which deals with a wide range of conditions, as opposed to a ‘specialist’ ward such as Ear, Nose and Throat), and how the literature provides the evidence to support the need to research the early rescue, assessment and management of deteriorating adult patients in hospital.

Through the literature review the aim is to provide readers with the historical underpinnings of patient safety from the 1800s, where the focus was on the harm caused by infections, through the developments in healthcare technology and medical treatment of the 1960s -1980s; to the introduction of the Institute for Healthcare Improvement (IHI) in Boston, USA in 1990 and the current position of SPSP in Scotland during 2011. It will become evident that there has always been a

patient safety theme underlying medicine and hospital care but, perhaps it has not always had the same prominence as is required in today's healthcare systems.

The literature review will describe the first developments in patient safety through observation of practice in the 19th Century; onto the studies of actual patient harm which were conducted during the 1970s and 1980s; the influence on human safety and high reliability organisations such as aviation and the nuclear power industry; an ultimately, to the need to develop medical undergraduate students' learning in the early rescue, assessment and management of deteriorating adult hospital patients: a defined priority of the SPSP. The literature review will not include the literature which has been published on the concept of deterioration and failure to rescue. This literature is to be included in the subsequent empirical work which has been undertaken using an action research approach, to justify the need for action. The literature review will conclude with a summary directing the reader to this aspect of the work.

3.2. Rationale for undertaking the Literature review

Within the National Health Service in Scotland for the period ending 31 March 2011, there were 1,419,000 patients treated. These figures included 213,105 people aged between 65 and 74 and 5,365 who were aged 75 and over (NHS Scotland ISSD, 2011). These are huge numbers of people who through the normal processes of ageing are likely to require hospital treatment on more than one occasion. In the majority of cases the patient will receive safe and effective care from the healthcare team. However, it has been estimated that between 8% and 10% of patients (in all age groups, not just the elderly), will experience harm as a result of their healthcare treatment or management (Williams et al 2008; Vincent, Neale, & Woloshynowych,

2001). In 2000 the Department of Health (DoH) in England was the first in the world to introduce a national policy on patient safety, entitled ‘An Organisation with a Memory’ the document states:

> ‘…the time is right for a fundamental re-thinking of the way that the NHS approaches the challenges of learning from adverse healthcare events. The NHS often fails to learn the lessons when things go wrong, and has an old-fashioned approach in this area compared to some other sectors. Yet the potential benefits of modernisation are tremendous – in terms of lives saved, harm prevented and resources freed up for the delivery of more and better care’ (DoH, 2000 pxi).

The response in the NHS in England was the formation of the National Patient Safety Agency (NPSA) and the Patient Safety First Campaign. The role of the NPSA was to monitor and report on adverse events through the National Reporting and Learning Service, disseminating information to try and prevent further harm from the same or similar events. The Patient Safety First Campaign produces guidance for health care staff on various aspects of patient safety such as human factors and deterioration which is of particular interest to the focus of my subsequent research which will follow this literature review.

The Scottish Health Service Executive responded to ‘An Organisation with a Memory (DoH, 2000) by establishing NHS Quality Improvement Scotland (NHS QIS) – a Special Health Board with a remit for Quality Improvement and Patient Safety, and the publication of ‘Learning from Experience: How to improve safety for Patients in Scotland’ (NHS QIS, 2003). One of the key elements stated in the document was that ‘Staff must have confidence that learning and change, which reduces the chance of future harm, will follow from investigating incidents, this will encourage

reporting and opportunities for learning' (p4). Although this is the based on the same learning from experience approach taken by the NPSA, Scotland does not have a formal national reporting system. The impetus for teaching and learning patient safety in the undergraduate medical curriculum came as a result of these documents and the House of Commons Health Select Committee Report on Patient Safety (Health Select Committee, 2009) which identified 'serious deficiencies' (p5) in the undergraduate medical curriculum within the UK.

The recommendation that patient safety be integrated into the undergraduate curricula for all healthcare workers was accepted by the General Medical Council (GMC) and Included in the latest edition of 'Tomorrow's Doctors' (GMC, 2009). One of the Outcomes for Graduates (of medicine) is to 'Protect patients and improve care' and statement E in Tomorrow's Doctors states that doctors should 'Understand and have experience of the principles and methods of improvement, including audit, adverse incident reporting and quality improvement...' (GMC, Chapter 23, p 28). There have also been a number of studies evaluating various curricular innovations on patient safety which will be discussed fully in section 7 of the literature review (Patey et. al. 2007; Ellis, 2009; Nie et al 2011).

The Clinical Skills Centre at the University of Dundee Medical School first started teaching undergraduate medical students the concept of patient safety in 2005 in collaboration with the Scottish Patient Safety Initiative Pilot and staff from NHS Tayside. This exercise was a success and the programme of patient safety within Clinical Skills has expanded since to include infection prevention and control, Interprofessional management of a diabetic emergency (medical and nursing

students in year 2 of their respective courses) and an Interprofessional Ward Simulation Exercise where year three medical students learn with, from and about the roles of nursing students, pharmacy students and allied health professionals whilst caring for a group of patients in a simulated hospital ward environment.

As the Lecturer in Interprofessional Education and with a Professional background in acute and critical care nursing I have a particular interest in how we prepare undergraduate students for clinical practice. I am especially fascinated in how the issues of acute deterioration and failure to rescue patients can be addressed through the introduction of an educational programme for undergraduate medical students using simulation.

Through this literature review I will lead the reader from the concept of medical error and patient harm, to the current focus on patient safety and the specific issue of failure to rescue deteriorating adult hospital patients.

3.3. Literature Search method

A systematic bibliographic search of peer reviewed journal articles, reports and grey literature published between 1964 and 2010 on patient harm in hospital was conducted using Medline, PubMed, SCOPUS, CINAHL, Cross-search, (Medicine & Dentistry; Nursing & Midwifery, and Psychology), and the Cochrane Library. The search terms “Patient safety”; Medical AND Error; Human AND Error; “Adverse Events”; Patient AND Harm’ Iatrogenic illnesses AND Iatrogenic injury (iatrogenic meaning from the actions of a physician) ‘case note review’ and ‘retrospective case note review’ were used to identify published papers. These were then screened

using the abstract as a guide to identify empirical studies which were then critically reviewed in order to answer the following questions:

What was the focus of the study?

- What methods were used to collect the data?
- What were the strengths/weaknesses of data collection methods?
- What were the numbers of patients experiencing adverse events in hospital?
- How have the findings of the studies influenced practice in patient safety?

Studies in which the topic or main cause of harm was related to medicines administration, children, obstetrics or psychiatry were not included as the focus was adult patients in a general or acute hospital setting. Both retrospective and prospective case record reviews are methods of data collection using the patient's medical records, sometimes known as case notes. Case note review is carried out whilst the patient is still in the hospital, and retrospective case note review, after the patient has been discharged from hospital care. Other papers were obtained from collections in the University of Dundee Medical Library in Bound Journals which were pre-electronic subscription. One article which was not available through online searching or in the University of Dundee collections was obtained through inter-library loan from the University of St Andrews Medical School for which I am extremely grateful.

The literature review will begin with the historical perspective of patient safety. This is important as it demonstrates clearly that in the nineteenth century patient harm was seen as an affront to caring. Florence Nightingale, James Simpson and Ignaz Simmelweiss all demonstrated an understanding of quality improvement. Yet today

many see it as a new way of measuring, learning from and preventing adverse events.

3.4. The Historical Perspective of Patient Safety

In the Preface to her '*Notes on Hospitals',* first published in 1863, Florence Nightingale wrote 'It may seem a strange principle to enunciate as a first requirement in a hospital that it should do the sick no harm' (Baly, 1997 p59). Subsequently, during her tenure as Nursing Superintendent at the Scutari Military Hospital in the Crimea, Nightingale worked tirelessly to improve the physical conditions under which the injured were cared for; and the nursing and medical staff worked. She believed that disease was spread through the air and smells (miasma) and that if fresh air was allowed to circulate through buildings then health would improve, as the disease was eradicated. Whilst this is partly true in that some bacteria are transmitted via airborne spread, unknown to Nightingale and her contemporaries, the greatest risks to health were from water-borne bacteria in the sewage – the cause of the foul smell. Through detailed observation and statistical analysis Nightingale was able to demonstrate that most deaths were not caused by the horrific injuries men received, but the insanitary conditions in which they were nursed (Baly, 1997). Through disseminating her results in the form of the 'Polar Area Diagram' (See figure 5) which she adapted from the Pie Chart, Nightingale managed to obtain from the military powers the money, equipment and staff required to clean up the dreadful conditions in Scutari Hospital, cutting the death rate drastically.

Figure 4: Polar Area Diagram Taken from Notes on Hospitals
(Nightingale, 1863).

The polar area diagram above illustrates the numbers of deaths from wounds (pink area), deaths from preventable causes (infections) is the blue area and deaths from other causes in the black areas. The diagram is for the year between April 1854 and March 1855. Each coloured area represents deaths for a particular month during the period of recording and radiates from the centre of the graph. By using the polar area diagram Nightingale was able to show clearly the problem of infections causing more deaths than actual injuries which she felt was a better way to deliver evidence to the Generals and Politician's with whom she had to fight for funding (Neuhauser, 2003).

In the same era the Hungarian Physician, Ignaz Simmelweiss (1847), was the first to identify the transmission of infection on the hands of medical students as a source of maternal mortality through his use of observation of clinical practice. He noted that women attended by medical students had a 50% higher mortality rate from Puerperal fever (an infection occurring during or immediately after childbirth), than those attended by midwives in the same hospital. He observed that in the morning, medical students worked in the dissection room, moving and handling cadavers. The students then worked in the maternity ward in the afternoon examining women and helping at the delivery of children; he concluded (correctly) that the infection must be originating on the clothing or hands of the medical students, probably transferred from the cadavers. He instigated a regime of hand washing using chlorinated lime (bleach!) and through time the death rate in the Physician attended ward was cut dramatically. Unfortunately for Simmelweiss, the medical profession was more accepting of the theory of miasmas than that of infection spread by the hands and his ideas were mostly rejected. Rather than use evidence of his findings like the Polar Area diagrams which Nightingale used Simmelweiss tried to use his position

as a physician to press-gang others into believing him. He went as far as alienating the majority of the Vienna medical fraternity. He left Vienna in 1850 and died some years later in a Mental Asylum (Pittet & Boyce, 2001).

James Simpson (1888-1888) was surgeon to the Royal Infirmary of Edinburgh and carried out one of the earliest known studies of patient harm in hospitals between 1888 and 1888. He carried out a Scotland wide audit of harm following amputation, comparing outcomes in the major teaching hospitals of the time (The Royal Infirmaries of Edinburgh, Glasgow, Dundee and Aberdeen) with those carried out in smaller local hospitals. His findings were similar to Nightingales in that the majority of harm was caused post-operatively and related to wound infections. It is interesting to note that his study actually led to the move to increase the numbers of smaller local hospitals for the treatment of more common illnesses, thus leading to the development of the Cottage Hospital Movement in Scotland (Neuhauser, 2005).

Joseph Lister (1827-1912) was one of the pioneers of safer surgery who did believe what Simmelweiss and Simpson had said and developed the process of antiseptic surgery using Carbolic Acid spray. Lister believed that bacteria on and around the patient entered the body during surgery and was responsible for the large number of deaths which followed successful operations. He introduced the concept of the Carbolic spray which meant that the patient, surgeon, assistants and everyone else near the patient was soaked in the Carbolic acid, thus killing any bacteria and preventing post-surgical infections. By 1900 surgeons had swapped their frock coats for clean cotton gowns, cotton face masks and rubber gloves. Operations were carried out in clean rooms specifically for the purpose of surgery, the instruments

were sterilised using boiling water and steam and surgery had become phenomenally safer for those having operations (Porter, 2006).

Simmelweiss, Nightingale, Simpson and Lister should be considered pioneers in the field of harm prevention and patient safety. Through their work in observing, identifying causes of harm and changing practice, they were all using a system of patient safety which has changed little in contemporary healthcare practice.

3.5. Background to human error and human safety

Human error is a topic of research in almost every industry and profession in which people are key players, and is a term understood by many ordinary people. However, research would suggest that such understanding is not universal, even amongst those working and researching in the field. Hansen (2006) exemplifies this diversity in understanding by informing readers that human error is

> '…used to describe the outcome or consequence of human action, the causal factor of an accident, deliberate violations, and the actual action taken by a human being' (p 61).

Consequently, researchers and others involved rarely agree on a definition or how to fully prevent human error from occurring (Shappell & Wiegman (2009). Much of the research which followed on from the publicity surrounding major accidents was undertaken by psychologists and the next section will review some of the more important concepts which were developed or identified. One of the most respected writers on human error is James Reason, Emeritus Professor of Psychology at the University of Manchester who defined human error in 1990. The book itself, Human

Error (1990) is very detailed in terms of theory and terminology and, is widely accepted by cognitive psychologists as a seminal text (Spencer, 2000).

Human error was defined by Reason (1990) as

> 'Error will be taken as a generic term to encompass all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance agency' (p9).

Reason (1990) subsequently subdivides error in terms of mistakes, slips, lapses and violations. Mistakes occur when someone chooses the wrong course of action; Slips when the correct action is chosen, but is executed incorrectly, and if the incorrect execution involves failure of memory it is called a lapse. Violations are actions taken without reference to protocols and guidelines and are often deliberate, whereas unintended actions can be categorised as slips, lapses and mistakes which are part of normal behaviour (Reason, 1990). Violations fall into three groups. Routine violations occur when we cut corners; optimising violations occur when we do something to alleviate boredom and necessary or situational violations where we view a certain set of actions as being the only way to do the job without following the rules (Reason, 1995 p82). Figure 5 below illustrates the hierarchy of human error based on the work of Rasmussen (1983) and Reason (1990) and shows how unintended actions lead to slips and lapses which tend to cause skill-based errors. On the other side of the diagram intended actions can lead to mistakes which cause rule-based and knowledge based errors.

Figure 5: Classification of human errors
(Adapted from Reason 1995 and Rasmussen 1983)

These terms will be referred to further in this Literature Review when the reader is introduced to the concept of medical error and discover that the terms are often used inappropriately, when referring to the probable causes of patient harm in hospitals.
The core elements of error which are the setting of a goal, an attempt to achieve the goal and a failed attempt have a subset of failure known as the contextual elements of error. These contextual elements are the qualifications of the actor i.e. their ability to carry out the task, the situation in which actions occur and the tools and procedures available (Pani & Chariker, 2004 p132). The contextual elements are important when we consider the consequences of human error in terms of the way humans think and act in the workplace.

Whereas slips, lapses and mistakes are predominantly caused by information problems such as forgetting, inattention or lack of knowledge, violations tend to be associated with motivation and low morale, boredom, and non-compliance with the rules (Reason, 1995). Low morale and poor motivation are commonly reported in the nursing press (Strachota, Normandin, O'Brien, Clary, & Krukow, 2003) and fatigue has been implicated in some of the incidents reported in relation to medical incidents (Barger et al 2006). Major disasters in industry where there are numerous deaths will often have an impact on a huge number of different people whilst the majority of healthcare related adverse events result in harm to an individual patient. This in turn will have an impact on them as victim, next of kin, family, friends and the medical and nursing staff who are caring for them. Therefore, understanding the concepts of

error is critical in relation to healthcare adverse events and patient harm (Reason, 1990).

In the next section we will consider in more detail the psychological constructs of human error which relate to thinking and reasoning and how these impact on the causes of adverse events.

3.6. The psychological constructs of human error

In this next section, we will describe the following major psychological constructs of human error:

- Types of human error;
- Errors and accidents;
- Why ‘name, blame and shame’ systems are ineffective;
- Over-regulation in the prevention of errors.

3.7. Types of human error

Rasmussen (1983) classified human error in terms of knowledge-based, rule-based and skill-based error and Reason (1990) matched each of these concepts to mistakes, slips, and lapses. A knowledge based error is said to relate to a mistake which is caused by inadequate or incorrect information being received, these are the least common errors, occurring in about 11% of investigated cases (Reason, 2000). When the information received is correct, but the wrong method is applied, this is a rule-based error or lapse. Skill-based errors or slips, occur when the plan is good, but the action is faulty and are the most frequently occurring errors (60%) and also the ones which most people realise they have been involved in (Reason, 2000).

The figure below illustrates the types of human error and levels of conscious control (Rasmussen, 1983). The diagram shows how knowledge-based errors occur in situations which require high levels of attention with low familiarity i.e. learning something new. Skill-based errors tend to occur when the situation involves something with which we are highly familiar but are paying little attention to the detail. Finally, rule-based errors occur when we have the required attention and familiarity, but, for some reason do not follow protocol or guidelines.

Figure 6: Types of human errors and levels of conscious control
(Rasmussen's model 1983)

3.8. Errors and accidents

It is now known that major accidents are rarely caused by one mistake or one person, and are a result of multiple errors (Spencer, 2000). These multiple errors are termed latent errors and are found in systems rather than individual people (Reason, 2000). Armitage (2009) refers to the complexity of errors in terms of multiple causes and multiple defences (p196) and discusses the work of those investigating the consequences of major accidents in complex organisations (Perrow, 1983, Toft, 2001, Smith, 2010,). Armitage (2009) suggests that major accidents often occur when slips, lapses and mistakes connect to create what Reason (1997) refers to as 'latent conditions'. Human factors such as teamwork, communication, fatigue are commonly documented as potential contributory factors in incidents involving healthcare practitioners. Reason (2000) suggested that it is less time-consuming and less expensive to apportion individual blame than investigate fully the latent and system errors involved in an accident. This view is interesting as there are still cases of individual practitioners who are involved in minor errors being blamed and

disciplined by middle managers. However, as we shall see in the next section punitive action rarely results in a positive impact on error or accident prevention and is more likely to result in negativity, the risk of attributing blame inappropriately (Armitage, 2009) and a culture where fear leads to a lack of incident reporting and learning.

3.9. Why ‘name, blame and shame’ systems are ineffective

In the previous section we read about what Reason (2000) termed ‘latent conditions’ which suggests that these are not obvious. It follows that if these latent conditions, coupled with human factor failures result in human error which happens, not through aberrant thinking, but simply as a by-product of the same mental processes used in normal day-to-day thinking, then to blame and discipline individuals is unhelpful (Reason, 2000). This ‘name, blame and shame system’ was prevalent in medicine and healthcare for many years. The most likely reason, identified through this study, was fiscal. It was less expensive for big hospitals to apportion blame to an individual practitioner, leaving that individual to pay compensation through their own malpractice insurance, than for the hospital as a corporate body to pay compensation (Mills, 1978).

Edmondson (2004) argued that name, blame and shame systems are particularly ineffective in preventing error within healthcare because they ultimately lead to a culture where error is not reported due to there being little or no positive outcome for the report to affect the person making it. Whilst the aviation industry has an established no-blame reporting and learning system medicine and healthcare is lagging behind, with doctors in particular identified as a group poor at reporting error (Mahajan, 2010). It has been shown that some of the reasons for poor reporting are

a fear of punitive action, legal action or discrimination (Firth-Cozens, 2002), not knowing exactly what should be reported (Lawton & Parker, 2002) and not seeing how previous reports have impacted on safety (Edmondson, 2004), therefore failing to learn from previous mistakes.

3.10. Over-regulation in the prevention of errors

The attempt to prevent error by increasing regulations after an accident can lead to an increasing surplus of regulations which people seldom acknowledge or respond to (Spencer, 2000). It has been shown that over-regulation can lead to a situation where workers are forced to decide which rules to break in order to get the job done - violations (Reason, 1997). It has also been shown that increasing regulation will have little impact if the problem lies in latent conditions combining with systems failure which results in an accident (Spencer, 2000). Reason (2000) used the analogy of a Swiss Cheese Model to describe how a series of latent conditions can combine under certain circumstances and line up enough to make it through the holes in the cheese and cause an error.

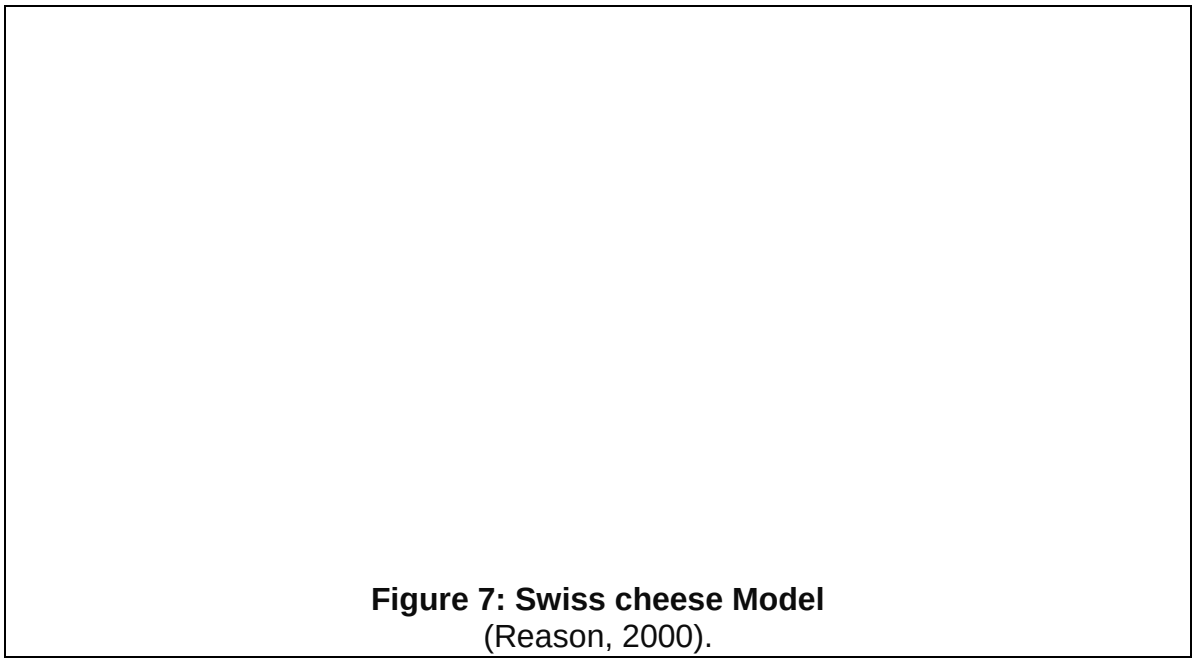


Figure 7: Swiss cheese Model
(Reason, 2000).

3.11. The Positive Aspects of Human Error

In a review of the psychological and medical literature on ‘surgical errors’ (errors occurring in the Operating Theatre), Cuschieri (2006) states that ‘errors under controlled conditions have a positive effect on learning and are thus important in training and acquisition of skills…’ (p643). This statement suggests that practising surgical techniques and procedures using simulation is a safe and controlled environment in which to make and learn from slips, lapses and mistakes. Simulation has been used in many areas of training for centuries (Bradley, 2006) and is a major training tool in aviation. We will read later in this literature review how simulation and simulated practice play an important part in the teaching and assessment of medical students clinical skills.

In this section we have read about the psychological constructs of human error in terms of cognitive psychology, systems theory and failure in terms of major industrial errors and accidents. Many of these papers describe the early work of pioneers in nursing and medicine as well as the theory and construct of human error. In the following section we will start to examine human error and accidents as they relate to medicine and hospital care. The section starts with a global perspective on patient safety; discusses the worldwide studies undertaken to uncover the incidence of healthcare harm in hospitals and ends by leading readers to the introduction of formal Patient Safety Programmes in the USA and Scotland.

3.12. Identifying the Incidence of Adverse events

One of the early modern studies of patient harm conducted was that undertaken by Schimmel (1964) which he designed to identify the incidence of patient harm in a major teaching hospital through audit of the numbers of patients with complications.

Whilst in post as the Chief Resident at Yale, Schimmel conducted the first prospective assessment of the risks to patients. The study was planned to investigate the type and frequency of complications occurring in patients in a medical unit. His findings were that the complications could be allocated to one of six categories (See Table 2).

Table 2: Types and Severity of Episodes from Schimmel (1964)

Type and Severity of episodes

Type of Episode	No of Patients	No of Episodes	No of episodes of each grade			Persistent episodes	No of deaths
			Minor	Moderate	Major		
1. Reaction to diagnostic procedures	29	29	10	6	13	17	4
2. Reaction to therapeutic drugs	103	119	61	44	14	46	4
3. Reaction to transfusions	24	31	17	11	3	9	0
4. Reaction to other procedures	24	24	11	11	2	14	2
5. Acquired infections	21	23	2	7	14	15	6
6. Miscellaneous hazards	13	14	9	3	2	4	0
Totals	198*	240	110	82	48	105	16

*Several patients had episodes of more than one type and only 198 different patients were affected.

Overlooking the reactions to medicines or therapeutic drugs as they were referred to in the study, the next highest cause of harm related to diagnostic procedures. These included reactions to endoscopy procedures, biopsies and interventional radiography procedures. Other procedures were invasive such as venous catheterisation and lumbar puncture. It is interesting to note that in his conclusions Schimmel states that

> 'To seek absolute safety is to advocate diagnostic and therapeutic nihilism at a time when the scope of medical care has grown beyond previous imagination and power'
>
> (Schimmel, 1964 p63).

The reason this is so interesting is that contemporary hospital patients are generally those who are elderly, have underlying chronic health issues, are in hospital for usually serious conditions and undergo a range of invasive interventions which places them at greater risk of deterioration. This study (Schimmel, 1964) was an example of what would become known as prospective record review as the focus was on the number of patients in the hospital at the time of the data collection.

Another major study of harm to hospital patients was conducted in 1978 by the California Medical Association (CMA) and California Hospital Association (CHA) which commissioned an investigation of medical malpractice in the acute care (non-psychiatric) hospitals in the State of California (Mills, 1978). The aim of the study was to identify the numbers of patients experiencing harm in hospital caused by their medical treatment, and to implement a process of malpractice insurance which was standardised and simplified from the contemporary position. In terms of tort law, anyone who was harmed by medical care had to endure a lengthy legal process which led to the apportioning of blame and monetary compensation from the health practitioner concerned.

The increasing costs of compensation and astronomical insurance premiums being paid by doctors led to what was to become known as the California Medical Insurance Feasibility Study [CMIFS] (Mills, 1978). CMIFS was the first study to use medical case note review as a data collection method. Additionally it also provided definitions of terms which are still used in contemporary healthcare practice, allocated a severity scoring to the harm which patients experienced and, suggested that rather than apportion blame and compensate patients', there should be a

change to focus on learning from, and preventing medical error and patient harm. The study was the first to create definitions and classifications of disabilities as a result of healthcare management which are still used in the literature and practice today. The main definitions were:

> 'Potentially compensable event (PCE) is a disability caused by healthcare management.
>
> A disability is a temporary or permanent impairment of physical or mental function (including disfigurement) or economic loss in the absence of such impairment.
>
> Causation is established when the disability is more probably than not attributable to healthcare management.
>
> Healthcare management includes both actions (commission) and inactions (omission) of any healthcare provider or attendant, whether or not the action constitutes legal fault (Mills, 1978 p361).

The randomly selected study sample was 20,864 patients from 23 hospitals in the State of California during 1974. Case notes were reviewed by a physician to identify whether or not a PCE had occurred after the patient was discharged from hospital care. Any PCE identified was then further analysed to identify any disability and whether this was caused by healthcare management. Disability was further classified as minor, temporary or major, temporary / permanent. Of the original sample of 20,864; 970 (4.65%) PCEs were identified; 80% of these were identified as temporary; 6.5% as minor permanent; 3.8% as major permanent and 9.7% were fatal. The study was designed to obtain information about patient disability consequential to healthcare management in order to understand the rise in medical compensation claims. This was achieved through the preceding data on PCEs and so the study was considered successful. The study concludes that most of the risks associated with healthcare management are unrelated to medical negligence and

that the risks and benefits of modern hospital care are inseparable (Mills, 1978 p365). This is similar to the findings of Schimmel (1964).

The reader will note further on in this literature review, how the conclusions made by Mills (1978) were used to develop what was to become generally accepted as the gold standard method for identifying instances of medical harm and medical error. The work undertaken by Schimmel (1964) and Mills (1978) was conducted in a culture of blame, litigation and compensation, especially in the United States of America (USA). Medicine and healthcare was advancing in terms of technology, complicated treatments and surgical interventions. The impact on patients was an increased risk of harm related to their hospital care and treatment. The focus on compensation for harm, malpractice claims against hospitals and doctors, continued for the next decade not only in the USA but across the Globe.

3.13. Retrospective case record review

Literature searches undertaken online using Medline, PubMed, SCOPUS, CINAHL, Cross-search (Medicine & Dentistry, Nursing & Midwifery, and Psychology) and the Cochrane Library failed to uncover any published literature on measuring patient harm between 1978 and 1991. However, a manual search of the bound journals in the University of Dundee Medical School Library discovered that the pilot study to validate the process of medical record review, the method used in the Harvard Medical Practice Study (HMPS) was published by Brennan, Localio & Laird in 1989; the data collection having been done in 1984 prior to the actual publication of the full study which was completed in New York State (Brennan et al, 1991).

Validity and reliability of the medical record review methodology was undertaken by Brennan, Localio & Laird (1989) in two teaching hospitals in New York State. A random selection of 360 medical records was subjected to multiple reviews, firstly by medical records administrators using predetermined criteria (RF1 – See Appendix 10); this was reported to have good reliability. The next step was to complete the same assessment of physicians using the second form RF2[2] this was also reported as reliable by an expert panel therefore medical record review using the double screening method was considered a valid and reliable tool for use in the study (Brennan et al, 1991). This study (Brennan et al, 1991) became known, through time, as the Harvard Medical Practice Study (HMPS) and is considered by many in the patient safety field to be a seminal text. The methodology for the study was adapted from Mills (1978) and was the first major study to use the retrospective record review methodology. The aim was to estimate the incidence of adverse events in healthcare facilities and understand the causes. Adverse events were defined as 'an unintended injury that was caused by medical management and that resulted in measurable disability' (Leape et al 1991).

Retrospective record review starts with the selection of a random sample of medical case notes from patients admitted during the preceding year. The next step is an initial screening of the selected case notes for evidence of an adverse event(s) by a registered nurse screener using the eighteen criteria listed in Appendix 10 (RF1). Any adverse events identified in the notes were then reviewed by two physicians, independently, to confirm whether or not an adverse event had occurred and to

[2] Please note that due to the length of this form a copy has not been included. A copy can however be accessed at http://www1.imperial.ac.uk/resources/E59E9984-9E2B-4E4B-941D-5DA10EA9F2B5/mrf2modularreviewform2.pdf if required for reference.

allocate a severity score to those that had using the screening criteria on Appendix 10 (RF2).

Positive adverse events were then further classed as having a negligent element or non-negligent element. Negligence was defined as ‘care which falls below the standard expected of a physician in their community, (Brennan et al 1991). The original sample for HMPS was 31,429 patients drawn randomly from 51 non-psychiatric hospitals in New York State. Psychiatric hospitals were excluded from the study as it was considered that the adverse events which were likely to occur in these institutions would have a high incidence of self-inflicted patient harm. Table 3 shows a summary of the main findings of HMPS (Brennan et al 1991).

Table 3: Summary of Published Papers using Retrospective Case Record Review

Reference	Focus	No of Patients	Data Collection	Strengths	Weaknesses
Brennan et al, 1991	Incidence, negligence, type of adverse event.	31,121	Retrospective Record Review.	Two stage review using identified criteria (18) by RNs followed by two MDs	Random sample. More than 1 a.e. not specified. Only looked at incidence and preventability.
O'Neil et al, 1993	Incidence and preventability of adverse event.	3,141	Retrospective Record Review with additional review of voluntary reporting by medics.	Two stage review using identified criteria (15) by medical records specialists followed by MDs. All admissions to a medical service over a 4 month period.	Medical patients only. Only looked at incidence and preventability.
Wilson et al, 1995	Incidence, preventability, outcome, provider of care, location and type of adverse event.	14,179	Retrospective Record Review.	Two stage review using identified criteria (18) by RNs followed by two MDs.	Human error identified as a prominent cause. Then contradicts this by need for better systems to prevent errors.
Thomas et al, 2000	Incidence, negligence, outcome, provider of care, location and type of adverse event.	14,700	Retrospective Record Review.	Two stage review using identified criteria (15) by medical records specialists followed by MDs.	Sample bias in choosing hospitals identified as having lowered estimate of a.e.
Vincent et al 2001	Incidence, preventability, outcome, provider of care, location and type of adverse event	1,014	Retrospective Record Review.	Two stage review using identified criteria (15) by medical records specialists followed by MDs. Included obstetrics.	Records randomly selected from two London Hospitals. Claimed to be a 'British' study. Case mix did not reflect hospital practice.
Davis et al, 2003	Incidence, preventability, outcome, provider of care, location and type of adverse event.	6,579	Retrospective Record Review.	Two stage review using identified criteria (18) by RNs followed by MD.	19.6% of the a.e. identified occurred out with hospital sample in doctor's surgeries, private

					hospitals, and care homes.
Baker et al, 2004	Incidence, preventability, outcome, provider of care, location and type of adverse event.	3,745	Retrospective Record Review.	Two stage review using identified criteria (18) by RNs followed by MD.	Random sample of admissions from 20 hospitals. Only focused on acute care areas.
Sari et al, 2007	Incidence only.	1,006	Retrospective Record Review with additional review of voluntary reporting by medics.	Two stage review using identified criteria (18) by RNs followed by MD. Included specialist areas e.g. Oncology.	Random sample of admissions in one hospital. Claims similar to Vincent et al (2001).
Williams et al, 2008	Incidence, preventability, outcome, provider of care, location and type of adverse event.	450	Retrospective Record Review.	Consensus group used to identify possible a.e.	Random sample from 1 hospital in Scotland. 50% of obstetric cases not used due to short hospital stay.
Zegers et al, 2009	Incidence, preventability, outcome, provider adverse event of care, location and type of adverse event.	7,926	Retrospective Record Review.	Included a power analysis based on Baker et al (2004).	Hindsight bias possibly reduced number of a.e. identified.
Soop et al, 2009	Incidence, preventability, outcome, provider of care, location and type of adverse event.	1,967	Retrospective Record Review.	Three stage reviews - two stage review using identified criteria (18) by RNs followed by MD involved with patient and then a member of scientific council.	Only 1 most significant a.e. was included.

Table 3 summarises the major papers using retrospective record review. The first thing to note is that apart from O'Neil et al (1993) who examined medical patients only, the rest of the study groups used random sampling. The issue here is that the sample groups range from 450 (Williams et al, 2008) in Scotland to the 31,121 notes

in the Harvard Study (Brennan et al, 1991) this huge discrepancy in study groups is very seldom taken into account when the numbers of adverse events are discussed, especially in the media. It also raises a point that none of the papers include the method used to choose the sample notes for inclusion. This could indicate a lack of understanding or use of the term ‘random sampling’ giving some readers some concern. A classic case is the Vincent, Neale, & Woloshynowych, (2001) study which was conducted in two London hospitals but became known as the ‘British’ study. The statistics were then used by the Chief Medical Officer to claim that 10% of British patients experience adverse events in hospital. However, in defence of this paper, it is one of only two, the other being that by Sari, Sheldon, Cracknell, & Turnbull, (2007) which included high risk patients (obstetrics) in the sample population. One also needs to be aware of the differences in hospital practice, staffing, teaching, cultures which exist across the world, different from here in the NHS which all impact on healthcare and possible adverse events.

Despite the small number of cases the paper by Williams et al (2008) examined a wide range of topics i.e. incidence, preventability, patient outcome, provider of care, location and type of adverse events as did many of the others, whereas, Sari et al (2007) only examined incidence of adverse events. However, on reflection it becomes apparent that incidence is perhaps the one thing that is important. After all there is little that can be done about preventability, patient outcome, provider of care, location and type of adverse events retrospectively.

The HMPS was the first major study of adverse events using retrospective record review in healthcare to state that there was a ‘substantial amount of injury to patients

from medical management and many injuries which were the result of substandard care' (Brennan et al,1991 p370).

Table 4: Results the Harvard Medical Practice Study

(Brennan et al 1991, p247).

Category	No of Records	Comments
Sample selected	31,429	Random sample from 51 hospitals.
Records not located on initial visit	1,234	
Records screened for possible AE• (first stage)	30,195	
Records referred for physician review after screening	7,817	Satisfied 1 or more of 18 screening criteria
Reviewed by physicians for presence of AE and negligence (second stage)	7,753†	Two physicians judge the likelihood of AE and negligence independently
Reviewed by a third physician to resolve disagreement (third stage)	1,808	Third review provided majority opinion.
AEs identified	1,133	Majority of reviewers combined confidence level at least 'more likely than not'.
AEs due to negligence	280	Majority found AE caused by negligence with confidence level at least 'more likely than not'.

• AE denotes adverse event. † Seventy four of the 7,817 records referred for review in stage 2 were not reviewed by Physicians (The study does not give any reason for this).

Retrospective review was considered by subsequent researchers to be the 'Gold standard' methodology and was applied to a number of studies on adverse events in healthcare carried out across the World. However, physician estimates of disability were a potential source if erroneous data. The decisions of the level of disability and compensation were purely based on the information in the hospital records. There

was no follow-up of patients post-discharge. Therefore there was no accurate assessment of disability despite it being reported in the study. Another major flaw was that the random sampling of errors did not take account of those patients who were already so ill that they would likely die anyway, those that had advanced directives and those that had refused CPR (Brennan et al, 1991 p 324).Despite these obvious flaws in methodology retrospective case note review using the HMPS methodology was replicated in Australia (Wilson, Runciman, Gibberd, Harrison, Newby & Hamilton, 1995), London (Vincent, Neale, & Woloshynowych, 2001), Utah and Colorado (Thomas et al 2000), New Zealand (Davis, Lay-Yee, Briant & Scott, 2003), Canada (Baker et al 2004), Spain (Aranaz-Andres et al 2008), Scotland (Williams et al 2008), Sweden (Soop, Fryksmark, Köster, & Bengt. (2009), Brazil (Mendes, Martins, Rozenfeld & Travassos, 2009), and Tunisia (Letaief, Mhamdi, El-Asady, Siddiqi & Abdullatif, 2010).

This has an impact on the subject for the RADAR programme as this is still the main method used to gather data on adverse events (including deterioration) and whilst identifying the incidence does little to change or improve the safety of patients in terms of deterioration and acute illness.

The Quality in Australian Healthcare Study [QAHCS] (Wilson, Runciman, Gibberd, Harrison, Newby & Hamilton, 1995) conducted a review of the medical records of 14,179 admissions to 28 acute hospitals in New South Wales. Although based on HMPS I (Brennan et al, 1991) which was concerned with gathering data on medical negligence and malpractice, QAHCS (Wilson, Runciman, Gibberd, Harrison, Newby, & Hamilton (1995) was focused on prevention. Adverse events were identified in

6,200 (43.7%) following primary screening by registered nurses. Following screening by physicians 2,353 (37.9%) were confirmed as adverse events. The study also allocated adverse events a score for causation (1-6) and preventability (1-6) based on the work of Bates, O'Neil, Petersen, Lee & Brennan (1995). Full details of the scoring system are shown at Appendix 3. The number of adverse events classified as highly preventable was 51% (Wilson, Runciman, Gibberd, Harrison, Newby & Hamilton, 1995) which is comparable with HMPS II (Leape et al, 1991) where 58% of adverse events were considered preventable.

In a study of two inner London Teaching hospitals using retrospective record review (Vincent, Neale, & Woloshynowych, 2001) identified 110 (10.8%) cases of adverse events from a random sample of 1,014 medical and nursing records. This is the first study to include the nursing records which are, in most hospitals separate from the patient's medical records, however, there is no distinction made between adverse events as a result of medical management or those related to nursing care. Like the studies by Wilson, Runciman, Gibberd, Harrison, Newby & Hamilton (1995) and Brennan et al (1991) approximately half of the adverse events were classified as preventable with normal standards of care.

However, a note of caution is needed here in that this was a pilot study conducted in two hospitals and the population for the study may well have given higher incidence rates by including geriatrics and obstetrics – both high risk areas for potential complications and patient harm. It is interesting to note that Sir Liam Donaldson, the former Chief Medical Officer for England and Wales and now Director of Patient Safety at the World Health Organisation, used the statistics in this paper (Vincent,

Neale, & Woloshynowych 2001) in the preface to a report alongside a claim that this demonstrated the state of adverse events in 'British Hospitals'. In a follow-up paper (Neale, Woloshynowych & Vincent 2001) the authors completed an in-depth review of 840 cases from general medicine, general surgery and orthopaedics, deliberately excluding obstetrics where few adverse events were identified in their previous study. The aim was to identify adverse events arising from problems in care in the specialities out with obstetrics where care is less structured than in childbirth. The paper (Neale, Woloshynowych & Vincent 2001) focused more on the contributory factors underlying adverse events by examining the grade of staff involved in the patients care, observation of the patient and involvement of allied health professionals. The main findings were that misdiagnosis and invasive procedures (taking blood, inserting intravenous lines) were responsible for 27% of preventable adverse events, whilst 58% were related to the development of bedsores and poor management of chronic disease, 11% were caused by medication errors and the remaining 4% due to resource issues. This paper was one of the first published to utilise retrospective record review to take a more detailed perspective on the background to identified adverse events.

Whilst the QAHCS (Wilson, Runciman, Gibberd, Harrison, Newby & Hamilton, 1995) and London (Vincent, Neale, & Woloshynowych, 2001) studies were undertaken with a focus on learning from adverse events the first cross-state study in Utah and Colorado (Thomas et al 2000) was still based on the litigation approach to adverse event measurement. The paper's authors suggest that the generalizability of the HMPS (Brennan et al, 1995) is questionable because the findings are based on data from only hospitals in New York State. The study (Thomas et al 2000) uses the

terms ‘negligence’ and ‘iatrogenic’ liberally and has a strong focus on blame. Case record review was used as the methodology, but there was more focus on extensive quality control and staff training than in the HMPS (Brennan et al 1991). The findings were based on 14, 700 records sampled from 71 hospitals in Colorado and 41 hospitals in Utah. Of these, 2, 014 cases from Colorado and 854 from Utah were identified on initial screening. The physicians reviewed 842 (98.6%) of the Utah and 1,978 (98.2%) of the Colorado records. A total of 587 (3.97%) adverse events were identified from both states which is similar to the HMPS (Brennan et al, 1991) which was 3.6%. The authors (Thomas et al 2000) relate their findings to the higher level of adverse events identified in QAHCS (Wilson, Runciman, Gibberd, Harrison, Newby & Hamilton, 1995) and suggest that subtle differences in methodologies and clinical practice might account for this anomaly. It is also possible that a culture of litigation and blame leads to less open recording of adverse events in the case records as opposed to one in which learning and prevention are paramount.

However, retrospective record review (see Table 3) has been the methodology in a number of studies worldwide and is cited as the gold standard for measuring adverse events in hospitals (Mendes, Martins, Rozenfeld, & Travassos, 2009 p 279).

Table 5: Summary of the figures for adverse events worldwide.

Reference	Year	Country	No of Hospitals	Number of records	Number of AEs	Number of Preventable AEs
Davis et al	2003	New Zealand	13	6579	850 (12.9%)	315 (37.1%)
Baker et al	2004	Canada	20	3745	255 (6.8%)	106 (41.6%)
Aranaz-Andres et al	2008	Spain	24	5624	525 (9.3%)	122 (42.8%)
Williams et al	2008	Scotland	1	450	28 (6.2%)	12 (42.9%)
Zegers et al	2009	Holland	21	7926	663 (8.3%)	283 (42.7%)
Mendes et al	2009	Brazil	3	1103	84 (7.6%)	56 (66.7%)
Soop et al	2009	Sweden	28	1967	241 (12.3%)	169 (70%)
Letaief et al	2010	Tunisia	1	620	62 (10%)	37 (60%)
Sari et al	2007	England	1	1006	87 (8.7%)	27 (31%)

Table 5 is a summary of identified retrospective record review studies showing the main findings in terms of number of hospitals, numbers of records reviewed, adverse events identified and preventable adverse events. The hospitals included in each study range from 1 in Scotland, Tunisia and England to the highest number - 28 in Sweden. The number of records reviewed in each study also varies widely between 650 and 7926. The percentage of adverse events ranges between 6.2% and 12.9%, whilst the percentage of preventable adverse events is between 31% and 70%. The wide range of values demonstrates that it is not possible to state with any clear evidence base the actual numbers of adverse events experienced by hospital patients across the world. However, the fact that adverse events include a number of

deterioration episodes it is important that we still take account of these occurrences, measure them but also act positively on them, as RADAR aims to do.

In each of the above studies retrospective record review was used to gather data on the incidence of adverse events in hospital. However, the studies by Zegers et al (2009) and Soop, Fryksmark, Köster & Bengt. (2009). used a three stage process as opposed to the usual two stage review. In line with all of the other studies above medical records were first reviewed by a registered nurse for initial identification of adverse event(s), this was then confirmed by a doctor. Zegers et al (2009) third stage was for the records to be reviewed by an independent doctor to verify the severity and preventability of the adverse events. However, the third stage of the Soop, Fryksmark, Köster & Bengt, (2009) study was a review by a member of the Scientific Council of the National Board of Health and Welfare (NBHW). This was required as the NBHW was the funding body for the study as this is one of the few truly National studies to have been conducted (Soop, Fryksmark, Köster & Bengt, 2009).

All of the studies excluded data from patients admitted to a psychiatric hospital or expectant mothers in obstetric units, as psychiatry was considered too high risk in terms of adverse events and obstetrics was said to be safer for mothers due to the nature of the high numbers of midwife and medical support as opposed to general hospitals (Brennan et al 1991). Davis, Lay-Yee, Briant, & Scott, (2003), Baker et al (2004) and Williams et al (2008) all stated in the discussion that the numbers of elderly patients (aged 65 and over) experiencing adverse events were higher than in other age groups. This supports the general trend in acute hospital care where the

population is growing and medical intervention is becoming more interventional and complicated.

Whilst all of these studies on retrospective review used the same definition, the incidences of adverse events varied comprehensively. There were differences in case note documentation between countries and studies were conducted with a different focus. In the US studies the focus was medico-legal whilst in the Australian study it was for quality improvement with the incidence of events considerably lower in those focusing on quality improvement (Wilson, Runciman, Gibberd, Harrison, Newby, & Hamilton 1995 and Davis, Lay-Yee, Briant, & Scott, 2003).

Retrospective record review has been criticised in terms of the high costs (staff time and salaries mostly), the low predictive value of the initial screening process by registered nurses which meant that at the second stage physicians were identifying high numbers of false positives, and limited application for monitoring adverse events in real time (Murff, Patel, Hripcsak & Bates, 2003). One way of overcoming these limitations is to conduct real-time or prospective record review.

3.14. Prospective record review

Prospective record review is a voluntary reporting method based on the work carried out in the aviation industry where adverse events are reported without blame in order to create and maintain learning and reporting systems (Barach & Small, 2000; Helmreich, 2000). The aviation industry has a culture which is non-punitive and blame-free. This is a necessity if voluntary reporting systems are to be effective (Helmreich, 2000).

The first prospective record review was the study by Schimmel (1964) which was planned to identify the number of complications occurring in 1000 hospital patients in a medical unit of a University Hospital in Connecticut, USA. All of the patients had been identified by junior doctors as having experienced a ‘noxious response to medical care’ (p58) or an adverse event as we would now know it. These ‘noxious responses’ which included complications of treatment, were reclassified as ‘episodes’ (p58) and during the 8 months of the study 240 episodes occurred in 198 (19.8%) patients. The study classified the episodes as reactions to diagnostic procedures, reactions to therapeutic drugs, reactions to transfusions, reactions to other therapeutic procedures, acquired infections and miscellaneous hospital hazards. It was the miscellaneous hospital hazards group which would become the focus of future studies as it included patients injured by falls, burns caused by therapy and injuries caused by the poor application of splints, all of which are preventable. The paper had one evident limitation in that the criteria for identifying an ‘episode’ was not specified; it was left to the clinical judgement of junior doctors to identify episodes and decide whether or not these were a result of harm or a consequence of the patients’ underlying illness.

The paper (Schimmel, 1964) was said to have ‘provoked much thought, but little which would be indicative of the view of the medical profession of the time which was that hospitals were known to be hazardous to patients and that this was to be expected in view of the increasingly complex nature of medicine and healthcare (Schimmel, 1964). However, the paper demonstrates the need for risk management and risk assessment well before these became prevalent in healthcare. It also raises the issue that there will always be some risk of harm to patients by the very nature of

hospitalisation. For example the population is ageing and with increasing age comes increased risk of ill health which leads to a greater risk of deterioration in someone who is unwell. Risk management and assessment is a crucial element in preparing for recognising and responding to acute deterioration and so this RADAR study.

Another study by de la Sierra et al (1989) used the same prospective review technique to identify that from 1,176 patients 295 (25.1%) developed 367 episodes of what they called 'iatrogenic illness' (iatrogenic means from or by a physician). The results were very similar to the Schimmel (1964) study in terms of the patient group being the elderly. The French national survey of adverse events (Michel, Quenon, Djihooud, Tricaud-Vialle & deSarasqueta, 2007) utilised prospective record review to collect data on 8 754 patients in 71 French hospitals.

In addition gathering the usual data on the incidence of adverse events, the French study included a session with a ward doctor to assess the clinical situation of the patient and identification of the main active errors (Michel et al 2007 p369). This is a change from many of the previous studies and provides an added layer of detection. There were 255 (3%) adverse events identified with 95 (37%) rated as preventable. The study identified that there were six advantages of prospective record review over retrospective record review thus:

> '...higher effectiveness in detecting preventable adverse events, better reliability of assessment of adverse events, a more appropriate estimate of incidence, better appreciation of clinical context and chain of errors leading to adverse event, smaller sample size needed to show variations, and better value for education and communication.' (Michel et al 2007, p375).

The last study included in the literature review to use prospective record review was the ‘Ibero-American study of adverse events (IBEAS) conducted by Aranaz-Andres et al 2011) the main study was conducted in Spanish, with the results published in English, therefore the study has been included in the literature review because of its importance. The study was conducted in 58 hospitals across Argentina, Colombia, Costa Rica, Mexico and Peru, and a total of 11,379 patients were identified as positive 3 853 (33.9%) after first screening and 1,754 (45.5%) after completion of the second stage. This is a particularly important study as the results have been instrumental in increasing the focus on patient safety in the countries concerned with national policies and structures for patient safety being introduced in response to the study findings (Aranaz-Andres et al 2011 p8).Prospective record review has been shown to be more cost effective, better for data collection and more suitable for education and communication than retrospective record review (Aranaz-Andres et al, 2011).

Retrospective review has drawbacks in terms of incomplete records which then result in incomplete data, disagreement between reviewers in terms of severity and causation of adverse events and in expense in carrying out large scale investigations across many hospitals. It has also been suggested that prospective record review increases the awareness and involvement of clinical staff in real time adverse events as opposed to retrospective adverse events which have occurred and passed (Michel et al 2007).

Both prospective and retrospective reviews are useful methods in identifying the incidence, causation and severity of adverse events and have been used

successfully in a number of studies throughout the world. Still there are other methods which have been used in studies which may be developed and enhanced in the future which are relevant to this literature review which will be discussed in the next section.

3.15. Other methods for measuring adverse events

Don Berwick the Chief Executive of the Institute for Healthcare Improvement in Boston, USA, stated in an editorial in the New England Journal of Medicine that although retrospective record review had been identified as a reliable method to establish the incidence of adverse events, it would have little impact on the problem of clinical care because doctors fail to see the problem, i.e. they are not directly involved in the data collection (Berwick, 1989). However, a paper by Steel, Gertman, Crescenzi & Anderson (2004) reported on a study which involved medical and nursing staff involved in the care of patients with identified adverse events. Adverse events were identified by monitoring all new admissions to a medical unit in a university teaching hospital in the USA. A standardised tool was used by the project staff to review patients' notes and any adverse events identified were discussed with the clinical staff involved. The authors identified similar results to Schimmel (1964) and suggest that the risks of hospitalisation had not diminished, and may have increased in the intervening period between the two studies. The study concluded with the authors suggesting that on-going assessment and measurement of adverse events would be necessary and that some form of education programme should be introduced for clinical staff to help reduce the incidence of adverse events and patient harm. This is one of the few papers to actually recommend education as a possible solution to the problem.

Forster et al (2011) utilised a similar approach to Steel, Gertman, Crescenzi & Anderson (2004) but called it clinical surveillance. In this method a trained observer monitored patients and clinical staff directly and indirectly during the period of hospitalisation. If an adverse event or critical incident was detected the observer recorded data which was then peer reviewed. The authors (Forster et al 2011) suggested that clinical surveillance has many advantages over other methods. These include active surveillance over voluntary reporting of incidents, prospective collection of data, and staff involvement through peer review when the incident is fresh in the minds of those involved. It is interesting to note that the authors' of this study (Forster et al, 2011) suggest that due to the wide variations in risk and adverse events found across specialisms in the study, it will be necessary for hospitals to devise speciality specific priorities to improve patient safety.

Another study which had as the aim '…to open the eyes of clinical staff to defects in clinical care...' (Neale, Chapman, Hoare & Olsen 2006, p157) used a clinical audit approach to the identification of adverse events and critical incidents.

Adverse events were defined as

> '...an unintended injury to a patient, as a result of healthcare management rather than the disease process, sufficiently serious to prolong hospital admission or to cause disability persisting after discharge or to contribute to death' (p 158).

Critical incidents were defined as '...an undesirable event in the management of the patient that could have led to harm or did so in a manner that did not fulfil the criteria for an adverse event' (p 158). An example of a critical incident would include an

incident in which the wrong blood is selected for a patient, but this is detected before the transfusion is actually started.

Using the same initial screening tool as in previous studies (Neale, Chapman, Hoare, & Olsen, 2006) ward based medical and nursing staff were recruited to undertake the screening with the aim that this would encourage the engagement of front-line staff. The medical and nursing staff' were also asked to comment on aspects of the patients' care which they felt were unsatisfactory. Another change from previous studies was that the second screening was carried out by one expert in retrospective record review. Unlike previous studies (Brennan et al, 1991, QAHCS, 1995) this one did not aim to identify the incidence of adverse events but, rather the nature and timing of the event from pre-admission to discharge; the relationship between the clinical deficiency (diagnosis, treatment, and monitoring) and the timing of the event;. Also included was the relationship between the clinical deficiency and the nature of the episode e.g. medication, infection, general care. An example of this is the relationship between clinical deficiencies and the period the patient was in a ward (see table 6)

Table 6 - Numbers of adverse and critical incidents associated with general ward care (Neal et al, 2006 p 161).

Clinical Deficiency Category	Ward Care	
	Adverse incident	Critical Incident
Diagnosis	1	1
Assessment	0	15
Skill/knowledge	0	2
Treatment	2	2
Monitoring	3	3
Future care	2	3
Organisation	1	4

The table shows that there were 30 critical incidents and 9 adverse incidents in ward care noted by clinical staff during the period of this study. The high number of critical incidents i.e. those which might have led to harm is most likely due to the ward in question being an acute medical admissions unit where there were increased staffing levels compared to a general medical ward. Acute medical units care for some of the sickest patients out with critical care. Many medical admissions patients are elderly and have underlying medical conditions such as heart disease and diabetes which often complicate their acute illness. Due to the nature of the work in acute medical units there are often increased staffing levels when compared to other wards in a hospital. This increased staffing level probably means that 'critical incidents' are detected quickly before they actually lead to patient harm. The authors (Neale, Chapman, Hoare, & Olsen, 2006) concluded that with '...appropriate support

clinical teams are able to undertake an integrated assessment of case records and so reveal systemic defects in care' (p161).

It is particularly interesting to note that the largest number of critical incidents noted in this study relate to the assessment period as this is an area which is core to the research on which this literature review is based. Neale et al (2006) finished by saying that they were attempting to develop a computer programme which would make it easier to collect and analyse data. Voluntary reporting of adverse events either using paper reporting forms or electronic reporting is becoming more common in hospital settings. A large study by Milch, et al (2005) analysed 92,547 reports from 26 acute care hospitals in the USA. Reports were submitted by any member of hospital staff via an online portal using a secure login. The online data collection process took 10 minutes and entries were only viewable by selected hospital personnel on completion. The study did not identify any great differences from other studies of the incidence of adverse events in terms of reported incidents. However, there was a suggestion from the authors that the lack of involvement of doctors in incident reporting and investigation raised by Berwick (2003) could be overcome using electronic incident reporting (Milch et al 2005).

Electronic retrospective review was tested in Boston by Murff, Patel, Hripcsak & Bates (2003) based on discharge summaries from 424 randomly selected medical admissions. A computerised screening tool was devised to search for trigger words related to possible adverse events on the free text discharge summary e.g. 'error' 'accident' 'complication' (Murff, Patel, Hripcsak & Bates p342). The results demonstrated that 251 (59%) of discharge summaries had a trigger word. After

manual review the tool detected 131(52%) adverse events. The authors (Murff, Patel, Hripcsak & Bates 2003) concluded that using electronic screening combined with manual review was a feasible method for the identification of adverse events. However, they also stated that more sophisticated trigger word searches would be needed to increase the reliability enough to remove the manual review stage.

All of the methods used to identify the incidence of adverse events whether manual, electronic or a combination of both has advantages and disadvantages over each other. Using prospective data collection can give up-to-date, real time evidence of adverse events and critical incidents which the team caring for a patient can review and respond to. However, this method leads to concerns about who should tell the patient, and what they should tell them regarding the actual or potential harm.

Retrospective review has drawbacks in terms of missing information and once again raises the question of what to tell patients about detected adverse events. This lack of a definitive detection method meant that the patient safety movement had a dilemma about how best to report and respond to adverse events. Currently the IHI Global Trigger Tool (GTT) (Griffin & Resar, 2009), is a widely used method for the detection of adverse events in the USA and UK. Classen et al (2011) carried out a study of adverse events comparing retrospective record review, the GTT, and manual reporting based on the voluntary reporting system of hospitals in the study. During the study 795 records were reviewed and adverse events were identified in 393 cases. The GTT identified 354 (90.1%) of adverse events. This study demonstrated higher detection rates for adverse events than many of these discussed earlier in the literature review e.g. HMPS and QAHCS. This might be

because the authors used a definition of adverse events that was broader than other studies i.e. ‘unintended physical injury resulting from or contributed to by medical care that requires additional monitoring, treatment, or hospitalisation, or that results in death’ Classen et al, 2011 p583).

However, a report by the Health Foundation in 2010 in which they carried out a review of published trigger tools, including the IHI GTT, found that there was little evidence to support the use and benefits of trigger tools (p7). The evidence surrounding the use of trigger tools was described as mainly descriptive with little evidence about the effectiveness of the tools reviewed (Health Foundation, 2010).On the other hand, it has been said that the GTT, is easily used with minimal training, is reliable and provides information which patient safety staff, managers and planners can use to identify and respond to adverse events (Griffin & Resar, 2009).

The GTT is currently the trigger tool of choice for the Scottish Patient Safety Programme and is widely used throughout the NHS in Scotland. GTT is used by healthcare staff to identify retrospective adverse events, however, there has been an increased focus on methods to elicit prospective identification of adverse events as close to occurrence as possible. Some studies have included patients and families in the identification and reporting of adverse events. An interesting review of methods to solicit patient reports of adverse events was undertaken by King, Cochrane, Taylor & Ansermino, (2010), the findings of which were that various methods were used to identify what patients’ personal reports of adverse events were. The methods of data collection identified included written questionnaires, in-person interviews; telephone surveys an online survey and spontaneous reporting. The

authors of the paper (King et al 2010) suggest that whilst the many sources of data which are available for the identification of adverse events are capable of giving good evidence, the best approach is one which uses information which is timely and continuous. Many on-line and electronic data sources take time to enter onto systems, to collate and edit, this often means that the data when received is already out of date.

In summary, a paper by Hogan et al (2008) which investigated the use of information from a wide source of electronic databases e.g. the Complaints database, Clinical Incident Database, as well as case records found that whilst these sources of information provide meticulous details about adverse events, there is invariably nothing achieved beyond identification of the incidence of adverse events. The aim of identification of adverse events should be to encourage learning and so prevention of recurrence.

If we are to be able to learn from and prevent adverse events in the future accurate identification is crucial (King et al 2010). Earlier studies of patient reporting of adverse events (Weingart et al 2005, Wasson, MacKenzie & Hall, 2007), identified that patients and carers are often aware of when an adverse event has occurred in practice. However, there is evidence that many of these patient events are not recorded or captured by incident reporting systems or case records (Weingart et al 2005). This suggests that learning and prevention is missed when using data collection such as retrospective record review and electronic surveillance methods. Whilst many of these incidents are relatively minor, there is still a concern that they happen at all (Wasson et al 2007). Other studies of patient reporting found similar

missing data on adverse events and suggest that there should be questions added to discharge summaries which are completed when the patient is discharged and sent to their family doctor (Weissman et al 2008). Whilst patient reporting has its limitations, it is important that hospitals continue to devise systems to gather the data to give evidence for learning and prevention (Thomas & Petersen, 2003). This relates especially to learning to recognise a deteriorating adult and in providing an early response.

Finally, it has been suggested that nurses report a higher number of adverse events than medical staff and that it is more difficult to include doctors in reporting and learning from adverse events Leape, Woods, Hatlie, Kizer & Schroeder,(1998). Weingart, Ship and Aronson (2000) conducted a confidential clinician supported surveillance of adverse events reports amongst junior doctors to identify if this was an effective method of event reporting as well as a tool to include more doctors in the reporting and learning process. The paper identified that junior doctors detected adverse events in a patients care journey and that using a confidential peer interview was ‘a promising method for identifying medical errors and substandard care’ (Weingart et al 2000 p470). This particular study does not indicate what impact this can have in achieving learning amongst the junior doctors. However, a further paper by Weingart, Lawrence, Callanan, Ship and Aronson (2001) in which junior doctors interviewed senior colleagues about possible adverse events in their patients progressed to suggest the development of training for doctors and healthcare professionals in disclosure and discussion about adverse events.

The inclusion of senior medical staff in this paper (Weingart et al 2001) led to an interesting discussion on one of the main factors for the lack of inclusion suggested earlier by Leape, Woods, Hatlie, Kizer & Schroeder (1998) – culture. The authors (Weingart et al 2001) suggest that within the culture of medicine cure and the prevention of harm is paramount, admitting that a patient has been harmed is psychologically difficult for most doctors (Weingart et al 2001 p297). In addition, doctors, nurses and other healthcare professionals receive little or no training in how to talk to patients and carers about harm and adverse events and so there is still a culture of underreporting (Kronman, Paasche-Orlow, & Orlander, 2011).

This section has identified that there are a myriad of methods used in the detection of the incidence of adverse events in hospitals. From electronic surveillance of hospital databases through online and telephone surveys to patient and carer self-reporting we have seen that identifying the incidence of adverse events purely in terms of numbers can be achieved relatively easily. However, there is a need for healthcare practitioners, managers and others involved in patient safety to take note of the findings of the studies of the incidence of adverse events and encourage learning. The importance of learning from adverse events will be discussed in the next section.

3.16. Learning from Adverse events

In this section which reviews the literature relating to learning from adverse events the papers will be split into two headings – those papers which relate to incident reporting systems and those which relate to organisational culture. The Institute of Medicine stated that

> '…quality problems occur typically not because of a failure of goodwill, knowledge, effort, or resources devoted to healthcare, but because of fundamental shortcomings in the ways care is organised' (Institute of Medicine, 2000 p25).

The organisation of healthcare is a complex mix of professional and personal behaviours coupled with different distinctive cultures. Some aspects of the culture are visible to the public through television programmes and documentaries which often show hospitals as "fast paced, intense, high-stake, and very personal settings" (Barach & Small, 2000 p16).

Other aspects remain hidden behind the climate and culture of the myriad of different groups involved in the care of hospital patients e.g. doctors, nurses, physiotherapists, pharmacists etc. We have read how retrospective record review and other audit and measurement tools can be used to identify adverse events but, not how clinical staff report incidents of potential or actual harm at the time or in the immediate aftermath of an event.

3.17. Incident Reporting Systems

The development of incident reporting systems in healthcare has been driven by the government via the Department of Health Paper 'An organisation with a memory' (DoH, 2000). The drivers for this were based on the success of incident reporting systems used in the aviation and other high risk industries. These systems have moved from analysing the infrequent, major events (disasters) to the more frequent near miss events. Near miss reporting allows pilots, power plant workers and others to report those accidents which didn't happen without fear of recrimination and blame (Johnson, 2003). All near miss reports are fed into a system and are reported back to the industry concerned via newsletters, alerts or reports. This approach facilitates

organisational learning through participation and inclusion of those at the sharp end. The sharp end of an organisation can be described as the people working on safety-critical tasks i.e. in healthcare, the nurses and doctors dealing directly with patient care (Flin, O'Connor & Crichton, 2008, p1). This kind of near miss reporting and feedback is critical if healthcare systems are to become as safe as other high risk industries.

There have been some attempts to introduce incident reporting systems into the NHS. In NHS England and Wales there is a National Reporting and Learning System (NRLS) which is part of the National Patient Safety Agency which gathers data on adverse events and disseminates the findings to NHS Trusts and agencies via Quarterly Reports. Until recently the data was for serious adverse events and incidents only. However, in late 2011 the NRLS data handling was transferred to the Care Quality Commission for England and Wales and included reports on near misses. The last report by the Care Quality Commission stated that in 2010/2011 1.25 million incidents were reported, an increase on the 1.19 million reported in the previous year (CQC, 2011). This demonstrates that incidents are being reported and the results demonstrated, however, as the report continued to state that this matches the year on year increases, it questions how much learning is being achieved through this method of reporting and dissemination.

There is evidence that the current system whereby front-line staff report adverse events and near misses though the local / national system and these reports are collated and then disseminated, is ineffective in promoting learning form adverse events (Benn, et al 2009). In this paper which carried out a systematic review of

feedback from incident reporting systems the authors concluded that within healthcare reporting the deficiencies lie not in the reporting, but in the feedback to staff, which they say needs to be within a close time frame, visible and credible. The authors suggest that multiple modes of feedback are required to achieve good quality systems in the NHS and achieve learning from adverse events. Although not obvious as an incident reporting system, the morbidity and mortality conference is a common way of promoting quality care through the analysis of adverse events in surgery and anaesthesia.

The morbidity and mortality conference can be traced to an early 20th Century surgeon in the USA - Ernest Amory Codman who developed the 'End Result System' which was revolutionary for the time. Between 1911 and 1916 he recorded 123 errors in hospital patients and measured the end result for the effected patients (Neuhauser, 2002). Codman used record cards to identify those effected and categorised the errors as those due to lack of skill, lack of judgement, lack of care or lack of diagnostic skills. The revolutionary part of his system was that he then published the results in an annual report which was available to the public as well as to hospitals throughout the USA (Neuhauser, 2002). Codman's work was expanded on by the Philadelphia County Medical Society who, in 1935 formed the Anaesthesia Mortality Committee to 'share knowledge about fatalities secondary to anaesthesia, and other interesting anaesthetic situations' (Ruth, 1945 cited in Orlander, Barber & Fincke, 2002). This Anaesthesia Mortality Committee was the precursor to the morbidity and mortality conference (M&MC). The M&MC brings together all doctors to examine cases that have had severe complications , adverse events or error to disseminate information, discuss outcomes and promote learning and prevention.

The ethos of an M&MC is the confrontation of error with open discussion of the causes (Orlander, Barber & Fincke, 2002).

A study carried out within all internal (general) medicine departments in the USA to identify if M&MCs were held in the department found that 90% of the departments who returned forms held M&MCs. (Orlander, & Finke, 2003). However, it was found that only 50% of the departments who held M&MCs used the meeting as a teaching session. Another study found that M&MCs held in many hospitals had no leadership, case selection method, timetable for meetings or presenters, but the difference was that the goals were learning and enhancement of care through the analysis of adverse events (Bechtold et al 2008). Based on their findings the authors introduced a new patient safety M&MC (PSMMC), into the University of Missouri Hospital in order to increase learning from adverse events and improve quality of care in a 'safe and nurturing' environment (Bechtold et al 2008 p211).

Morbidity and mortality conferences identify serious adverse events, errors or harm in care and disseminate the findings with the aim of learning and prevention. However, there are still a number of adverse events which go unreported, so why is this?

The following figures were obtained from the NHS in England and Wales. During the period 2010/2011 there was 14,890,844 admissions to hospital in England and Wales. If we exclude the 1.25 million adverse events reported during the period (8.4%) we are left with 238,253 (1.6%) unreported adverse events or near misses if we take the figure of 10% incident rates in the NHS per annum (Vincent, Neale, &

Woloshynowych, 2001). If these figures are correct, why are 1.6% of events not being reported? The answers may be found in the culture in which many healthcare staff still work which will be examined in the next section.

3.18. Organisational culture

Organisational culture as a concept is discussed in a wide range of literature e.g. psychology (Cooper, 2000), management (Reynolds, 1986), and healthcare (Firth-Cozens, 2002). Although there have been many different definitions of organisational culture, it is generally accepted by many safety critical industries e.g. aviation, nuclear power industry, that the definition by Hart & Hazelgrove (2001) is suitable for most industries as well as the culture of medicine form a personal point of view.

The definition given is as follows:

> '…refers to a set of shared understandings, values and beliefs which implicitly inform behaviour, provide members with a sense of identity, and are symbolically embodied and expressed through ceremonies and rituals of various kinds as well as in more mundane ways through policies, guidelines and procedures' (p257).

This definition provides an ideal example of the organisational culture in healthcare. Every health professional is governed by personal and professional values and beliefs, medicine especially is historically steeped in ceremony and ritual and as employees health professionals are responsible for providing safe practice by following policies, guidelines and procedures (Department of Health, 2000).

In a paper on teamwork in healthcare Firth-Cozens (2002) discussed individual learning, team learning and organisational learning in relation to improvements in patient safety. She uncovered why individuals are often seen as responsible for unsafe acts or risky behaviours at the sharp end of care (with patients) because it is

easier to view problems in terms of healthcare staff's lack of skills and poor communication, rather than look wider at the organisational implications of poor staffing levels, shift work and leadership. This focus on 'naming and shaming' individuals has been identified as completely the wrong approach to improving the complex systems and safety in healthcare (Reason, 1990).

This viewpoint is based on personal experience of being involved in a medicines administration error and having been involved directly with other staff members who have been formally disciplined for minor medicines errors which have not resulted in any harm to patients.

The result of this approach is suboptimal personal performance by the person 'accused' which leads to fear of punishment in the wider team/work group which inevitably results in errors being underreported or not reported in extreme cases (Leape, Woods, Hatlie, Kizer & Schroeder, 1998). The 'culture' of naming and blaming can also be traced back to what Shortell, Waters, Clarke and Budetti (1998) referred to as the old moral fabric for physicians when doctors held individual responsibility and accountability for patients and were responsible for all aspects of the patients stay in hospital, even down to directing the nursing staff on many areas of clinical care. This old model meant that adverse events were seen as a moral failure, unprofessional and punishable by the medical governing bodies (General Medical Council and Royal Colleges). This system placed the blame firmly on individual practitioners and so to avoid the humiliation and unpleasantness of having to admit to an error there was a tendency amongst some to hide them or ignore them.

Studies by Lawton and Parker (2002), and Leape, et al (1998) put the position on blame and shame into context by stating that:

> '…patients and physicians…live and interact in a culture characterized by anger, blame guilt, fear, frustration, and distrust regarding healthcare errors. The public has responded by escalating the punishment for error. Clinicians and some healthcare organizations generally, have responded by suppression, stonewalling, and cover-up' (p27).

The public response in 'escalating the punishment for error' was evidenced through the increases in complaints about care, an increase in malpractice claims against individual practitioners as well as health authorities and also a demonstration of decreased trust and dissatisfaction in the medical profession as reported by Gallagher, Waterman, Ebers, Fraser and Levinson, (2003). The public response is countered by the clinicians' response in suppressing error reporting and covering-up. These reactions are related to the culture that people work in within the NHS, which still sees adverse events as personal failures rather than opportunities for systems improvement (Cooke, Dunscombe & Lee, 2007).

A number of studies have aimed to measure organisational culture (Davies, Nutley & Mannion, (2000), Flin, Burns, Mearns, Yule & Robertson, (2006), Flin, (2007). Davies, Nutley & Mannion (2000) raised the issue of culture as something an organisation *is,* as opposed to something and organisation *has.* They go on to say that the distinction between the two is critical when looking at change and management of culture as this is easier to achieve if culture is something that the organisation has. The culture of any organisation is composed of artefacts (observable behaviours, norms), espoused values (beliefs) and assumptions

(unarticulated thoughts and feelings) of those working within it Carroll and Quijada, (2004).

Hospitals consist of many occupational cultures which make change and management difficult to achieve. For example nurses now share many of the practical tasks which used to be the remit of junior doctors which has meant that some junior doctors do not see the need to learn or be able to undertake these tasks e.g. giving intravenous antibiotics. This change in occupational culture can sometimes lead to differences of opinion as to who should undertake the task in practice Kunda and Van Maannen, (1999). It has been suggested that the aim should be to 'tilt' the culture rather than try to achieve a complete change (Carroll and Quijada, 2004).

Tilting the culture involves identifying the strengths of key individuals in a culture and using these individuals to support change by looking at new ways of working in collaboration with those at the front line of care. These key individuals might be selected from amongst the senior charge nurses who are responsible for the management of wards, for senior staff nurses who are working closely with patients or from managers who are seen as effective by the staff for whom they work.

Once workers are able to see the benefits of the new practices, associated with culture tilt, behaviours change and this causes the tilt at the top of the pyramid (see Figure 9). Once the top of the pyramid has shifted the deeper layers (espoused values and assumptions) are likely to follow (Carroll & Quijada, 2004).

Figure 8 Culture change by 'tilting' the culture
(Carroll and Quijada, 2004 pii17)

Tilting the culture is likely to achieve far more than directly attacking the underlying values and beliefs, which in healthcare have deep roots, as we have read earlier in this section. In terms of the culture of patient safety it is necessary to change the culture to one of openness and accountability as used in aviation and other high risk industries. One major difference between these industries and healthcare is the reporting of near misses.

Near misses have been defined as 'occurrences that could have harmed the patient, but did not cause harm as a result of chance, prevention, or mitigation (Aspden, Corrigan, Wolcott & Erickson, 2004, p227). Some researchers have estimated that near misses occur between 3 to 300 times more often than adverse events (Barach & Small, 2000, Aspden et al 2004). This large range may be due to the fact that in many cases near misses are noticed by the person involved, by others or by the patient before any actual harm has occurred.

For example it is standard practice to confirm a patients name and date of birth before administering a medicine and to check that they have not had any medicines since the last scheduled drug round. Errors have been detected at this final bedside check before administration which can be classed as a near miss because the patient did not actually receive the wrong medicine. This is one example of a near miss and there are many others which may account for the large range described previously.

Aviation, nuclear power and the railways have all made the distinction between active and latent (near miss) failures leading to a less punitive management approach to adverse events (Reason, 1997). Within healthcare it is common practice to measure and record actual adverse events as opposed to near misses which can give much more useful information than actual adverse events (Kaplan & Rabin Fastman, 2003).

Analysing near misses allows recognition of the actions taken to prevent harm or to prevent the event rising to harm and so provides better learning through the development of prevention strategies (Kaplan & Rabin Fastman, 2003). In addition because there is no actual harm to patients there is less risk of punitive action, less shame and less fear of litigation associated with near misses which means that clinicians are more likely to report them (Kessels-Habraken, Van der Schaaf, De Jonge & Rutte, 2010). In order to achieve patient safety organisations must learn from adverse events and near misses.

Reporting adverse events and near misses is the first stage in working towards learning, and as we have discovered, culture has a major influence on attitudes, beliefs and assumptions about learning from error. The culture of medicine with its roots in professional autonomy, self-regulation and hierarchy is not best suited to reporting adverse events. This is supported by a whole range of other professional cultures in the NHS which combines to increase the difficulties of achieving an effective reporting and learning system (Lawton & Parker, 2002).

In this section we have read about the negative impact of organisational culture on reporting and learning from adverse events and near misses. We have suggested why healthcare personnel are reluctant to report adverse events and near misses for fear of punitive action being taken against them. Despite some staff making reports of adverse events and near misses it has been argued that whilst the results are noted and disseminated there is a lack of feedback and learning throughout local or national healthcare organisations.

In the next section we will read how the NHS in Scotland is trying to change the systems of reporting and patient safety through the work of the Scottish Patient Safety Programme (SPSP), examine the areas that SPSP has identified as priorities and focus on the area of early rescue of the deteriorating adult hospital patient.

3.19. The Scottish Patient Safety Programme

The USA Institute of Medicine Report *To Err is Human* (IOM, 2000) described the disturbing occurrence of adverse events in healthcare in the USA and was the catalyst for the development of the patient safety movement worldwide (Devers, Hoangmai, & Liu, 2004). The report was a blueprint for healthcare organisations, governments and clinicians to help reduce adverse events. This was followed by a second report, C*rossing the Quality Chasm* (IOM, 2001) which focused more widely on the reinvention of healthcare systems to increase innovation, care delivery and quality improvement strategies. Both of these reports were forerunners to the *Patient Safety and Quality Improvement Act 2005* which was the first federal law making patient safety infringements a criminal offence. No other countries in the world have specific patient safety laws on their statute books.

However, the NHS in Scotland is the only other place outside the USA which has a national programme of patient safety in place with the aim of reducing adverse events in healthcare through a programme of quality improvement. The five year Scottish Patient Safety Programme Project (SPSP) was started in 2007 with the objective of facilitating a steady improvement in the safety of hospital care across Scotland. The programme focuses on gathering real time data on a ward by ward basis involving clinical staff directly caring for patients in the changes required.

Quality improvement methodology such as the Plan-Do-Study-Act cycle has been adopted from the Institute for Healthcare Improvement (IHI) in Boston with which there is close collaboration with NHS Scotland. Following publication of the Healthcare Quality Strategy for Scotland (Scottish Government, 2010) the SPSP became part of Healthcare Improvement Scotland which is responsible for:

> '…helping NHS Scotland and independent healthcare providers deliver high quality, evidence-based, safe, effective and person-centred care; and to scrutinise services to provide public assurance about the quality and safety of that care' (HIS Annual Report 2011 p5).

3.20. Summary

This literature review has taken account of the literature published between 1964 and 2011 on the subjects of medical error, human error, adverse events and harm in healthcare and patient safety. It has identified that the concern for patients and their safety has been the focus of doctors (Simmelweiss and Simpson) and nurses (Nightingale) since the early nineteenth century. The identification of causes of patient harm, mainly due to infection, and the prevention of further harm were the

focus of audit and research well before the identification of bacteria and introduction of antibiotics. The early work of these pioneers of patient safety was built on during the 1960s by Schimmel (1964) who separated error and adverse events as unwanted outcomes, from their definition as ‘side effects’ which many doctors of the time claimed were an inevitable consequence of the advances in treatment and surgery.

Whilst some harm was a result of the increasingly complex interventions, other was caused by human failure and it was this distinction which makes Schimmel’s work so important in the field of patient safety. Despite this importance little notice was taken of this work until the 1990s when it started to become clear that hospitals were not safe places to be despite the influence that modern medicine had to manage illness, prior to this in the 1970s a change of culture and a focus by patients on not accepting that adverse events were inevitable. This subsequently led to an increase in malpractice insurance claims made against individual practitioners and hospitals.

The California Medical Practice Study (Mills, 1978) was the first major study of adverse events and harm since Nightingale in 1860 and paved the way for possibly the biggest change to the measurement of harm with the publication of the Harvard Medical Practice Study in 1991.The HMPS not designed or powered to reach strong conclusions about the validity of medical malpractice claims. Despite this being amongst the weakest claims made by HMPS many researchers and policy makers considered it one of the classic papers in the field of patient safety research (Baker et. al. 2004). The HMPS saw the establishment of retrospective case record review as the standard tool for the measurement of adverse events.

During the ensuing years retrospective review was used across the globe and many studies were undertaken as late as 2010 to identify and classify adverse events in hospital care. The main issues in reviewing these papers include a lack of clear definition as to what constitutes an adverse event, the different numbers of records reviewed and the slight differences in methodology in terms of the review process. It is also important to note that healthcare practices differ across the world, case notes differ in content and accuracy and each of the studies produced substantially different incidence rates for adverse events.

Despite these issues it is clear from the literature that there is an issue with the incidence of adverse events and that active error at the front line of health care will continue until we can manage the latent errors caused by systems, culture and design.

Other methods such as prospective record review, morbidity and mortality meetings, patient and family reporting have been used to identify adverse events. However, as it has been shown, there is still no universal tool which can identify all adverse events which occur during hospital treatment. Whilst the Global Trigger Tool developed and used by IHI is widely used it is a retrospective view of the patients care, not a contemporaneous measure of harm. The publication of the Institute of Medicine Reports ‘To Err is Human’ in 2000 and ‘Crossing the Quality Chasm’ in 2001 in the USA were catalysts for the introduction of quality improvement and patient safety as a major concept in healthcare.

The continuing work of the Institute for Health Improvement in Boston lead to the first legislation on patient safety in the USA, and influenced the formation of the Scottish Patient Safety Programme (SPSP). The SPSP is the only national programme of progressive quality improvement in a healthcare system in the world. The SPSP was absorbed into Health Improvement Scotland in 2010 and is now an agency with the aim of continuing to improve the quality and safety of care in Scotland. One of the aims is to improve the early rescue of deteriorating health and this forms the basis of the research which will follow this literature review.

There is a world-wide concern surrounding the identification, assessment and management of acutely ill and deteriorating adult hospital patients, before they have a cardiorespiratory arrest, or die. There are many reasons for the issue, but one of the most important is the lack of teaching for medical and nursing students in how to identify and respond to these patients.

The identified issues and concerns surrounding deterioration have been verified by the literature on both adverse events and on clinical deterioration itself. This evidence can be used to form the basis of an educational intervention to help address these issues within the undergraduate curriculum. Being aware of the published literature concerning the problem, the impact of previous courses, culture, and politics are all crucial for someone developing an innovative new programme such as RADAR. Thus all of the work undertaken on the literature review concerning adverse events, human error, the development of the patient safety movement and clinical deterioration has been invaluable in preparation for the further development of RADAR in Part 2.

In the empirical work which is to follow this literature review I wish to answer the following research question. ‘Can Meso-level Simulation increase medical students’ confidence in recognising and responding to clinical deterioration in adult hospital patients?

4. Methodology

4.1. Introduction

Methodology has been defined as ‘a strategy, a plan of action, or a research design’ Creswell & Plano Clark, 2011 p 28). In this Chapter the author will describe the personal philosophical and worldview on which the study is based, state the research question; state why action research approach using mixed methods was chosen and then discuss the model of McNiff & Whitehead (2009) as the methodological framework adopted for of the study. The reason for using this model is that it describes a clear journey through an action research project. It is clear and concise and it suited the needs of this project very well.

In addition reasons for the rejection of other action research models will be discussed. This will be followed by a discussion and description of the selection of methods related to the objectives of the study, the selection of the sample, ethical considerations and finally, how the project adheres to issues of validity and reliability. The section will be completed with a description of the methods of analysis of the data and presentation of the results.

This Chapter will describe the justification for undertaking the empirical study of medical students’ confidence in recognising and responding to clinical deterioration in adult hospital patients using simulation. Within the Literature Review the reader was introduced to the concept of assessing medical error in the 1960s progressing to improving patient safety from 2001 to the present. Whilst there are, and probably always will be cases of adverse events in healthcare practice, it is important that we as educators make students aware of the good practices in the Health Service.

This Chapter will begin with the background to the issue of clinical deterioration in adult hospital patients by discussing some of the published literature on the subject starting with the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD, 2005). This was the first major publication to focus on the issues of acute care and deterioration and provides a basis for teaching medical students about the issues and possible solutions through improved teaching.

The five themes of Failure of the Organisation; Lack of knowledge; Failure to appreciate clinical urgency; lack of supervision and failure to seek advice will be discussed in relation to the findings of the NCEPOD (2005) audit as well as the other literature which has been written on each of these issues. The use of simulation as the main teaching tool will be discussed along with the reasons for including simulated patients as opposed to manikins.

The development of the Recognising Acute Deterioration: Appropriate Response (RADAR) teaching programme will then be described in terms of the concept, facilitation and evaluation. This will take the reader to the point of understanding the need for the empirical study to evaluate the students' confidence in recognising and responding to clinical deterioration in adults using simulation.

4.2. Simulation-Based Education

Simulation has been used as a method of training individuals and groups to reduce error and improve safety since 1910 (Fowlkes et al 1998) and offers a realistic, safe, cost-effective and flexible environment in which to learn the requisite competencies for a job. Simulation has been defined as:

> '…a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion' (Gaba, 2004, pi2).

The interest and development of simulation in medical education stems mainly from its use in the aviation, nuclear power, military and high hazard, high reliability organisations (Gaba, 2004). Used extensively in the military medical services to train individuals and teams for their role in the care of war casualties, simulation is being incorporated into undergraduate and postgraduate medical programmes with a wide range of applications. A systematic review of 109 papers identified a number of conditions suggested to facilitate learning using simulation (Issenberg et al 2005).

- Providing feedback 47% of papers
- Repetitive practice 39% " "
- Curriculum integration 25% " "
- Range of difficulty level 14% " "
- Multiple learning strategies 10% " "
- Capture clinical variation 10% " "
- Controlled environment 9% " "
- Individualised learning 9% " "
- Defined outcomes 6% " "
- Simulator validity 3% " "

(Issenberg et al 2005, p1).

The review acknowledged that feedback was the most important situation to expedite learning using high fidelity simulation, followed by repetitive practice and curriculum integration. These are seen as crucial elements in the development and implementation of RADAR as is, being able to capture clinical variation using

simulated patients and realistic situations, the controlled environment which allows students to practise safely and defined outcomes which gives SPs, students and tutors a foundation on which to guide the sessions.

In relation to the range of difficulty level listed above Arora & Sevdalis (2008) described a hierarchy of simulation which is a useful guide in developing one's own simulated activities. Micro-simulation is based on the needs of individual students and is composed of basic motor skills such as recording vital signs (TPR and BP). This is best suited to junior students and those new to a skill. Meso-simulation is the second stage and is based on the higher cognitive skills and behaviours of teams' e.g. non-technical skills of teamwork, decision-making etc. As these non-technical skills are crucial to the safe assessment and management of a deteriorating patient this is the area on which this study focuses.

Non-technical skills have been described as the 'social and cognitive skills which underpin practice' (Flin, Patey, Glavin & Moran, 2010). As noted earlier within the literature review, non-technical skills are often cited as causing error and leading to harm. In order to allow students to practise the non-technical skills involved in assessing and managing deterioration e.g. teamwork, observation, decision making and communication it was thought that a meso-level simulation would be the best approach to take. The highest stage in the model is Macro-simulation which is seen as the organisational level e.g. the Acute Medical Unit Ward Simulation Exercise and RADAR in which students function as a team and are expected to carry out clinical skills, make decisions communicate and manage a ward simulation.

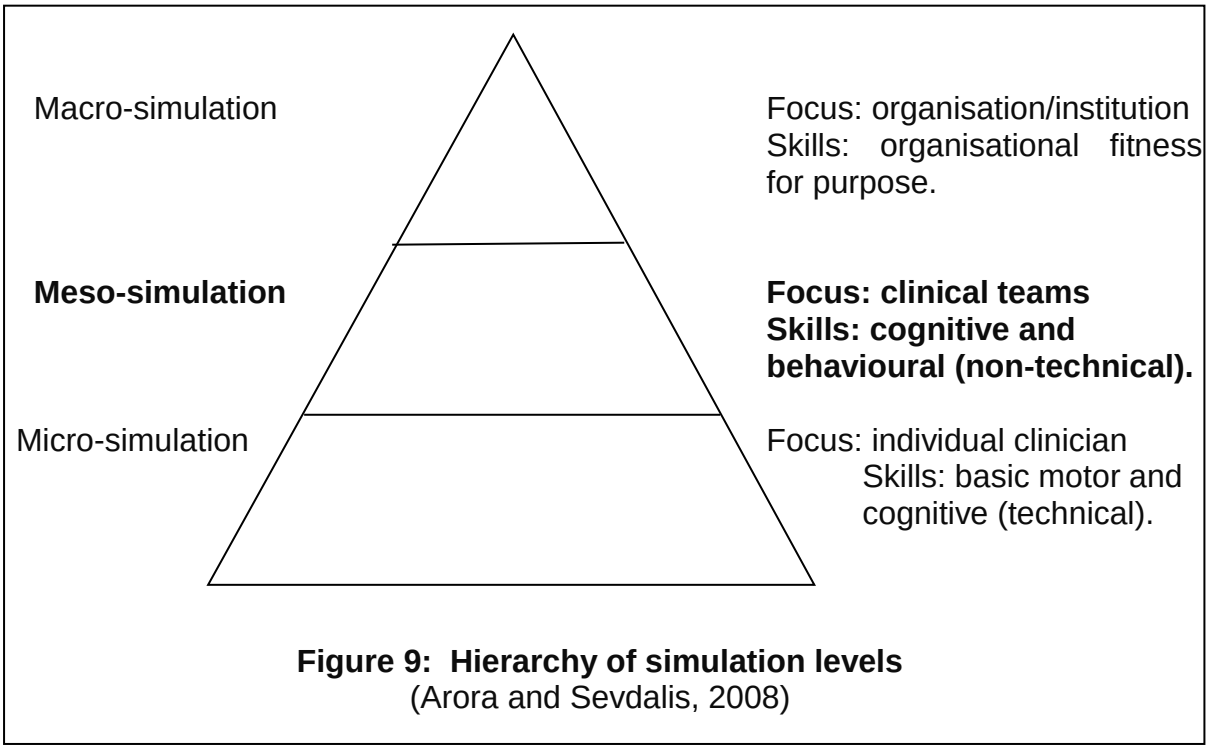


Figure 9: Hierarchy of simulation levels
(Arora and Sevdalis, 2008)

In the latest edition of *Tomorrow's Doctors* published by the General Medical Council, simulation is included as a recommended teaching approach:

> 'Students must have different teaching and learning opportunities that should balance teaching in large groups with small groups. They must have practical classes and opportunities for self-directed learning. Medical schools should take advantage of new technologies, including simulation, to deliver teaching'
>
> (GMC, 2009 p51).

Likewise the Nursing and Midwifery Council (NMC) which is the regulator for nurses in the United Kingdom identifies simulation as a source of teaching for student nurses:

> 'The evaluation suggests that, as an adjunct to practice learning, learning in a simulated practice setting can provide a safe and effective means of supporting learning and

> enhancing evidence-based direct care across the 4 branches[3]' (NMC Circular 36/2007 p2).

However, research undertaken by Salas et al (1999) indicates that simply adding simulation into a training programme does not make it more effective, and it will not mean that students learn more, learn better or learn the right things. Simulation training needs to be designed and delivered taking account of what we already know about learning and training theory.

A systematic literature review (Smith, Perkins, Bullock & Bion, 2007) investigating the undergraduate training for medical students in the care of the acutely ill patient identified a consistent theme of lack of confidence and competence in the recognition and management of the acutely ill adult. The same literature review identified that junior doctors were sometimes not confident to perform some acute care skills up to 3 years post qualification. Medical education is moving apace from the traditional didactic, teacher-centred model to a more integrated, interprofessional learning experience for medical students (GMC, 2009). This shift is necessary to bridge the gap between the need to have a comprehensive medical education and preparation the patient focussed realities of the clinical setting. It is incumbent upon medical educators to ensure that the teaching and programmes of learning are designed to prepare students effectively for their clinical role and so the RADAR course is an innovative approach to using simulation to achieve these aims. In the introductory chapter to the study, the background to the study was discussed in terms of the issues surrounding the suboptimal care of acutely unwell patients in hospital.

[3] The four branches of nursing practice are Adult, Mental Health, Child and Learning Disability Nursing.

The publication of the National Confidential Enquiry into Patient Outcomes and Death in 2005 was the first major inquiry which identified the issue of failure to rescue. These findings were supported by other studies and then in 2012 the second NCEPOD inquiry found that there is still a problem despite a seven-year period of supposed intervention and change. The literature demonstrates that the issue of failure to rescue is a complex phenomenon and that there are no easy answers to the adverse events which some people experience.

In terms of some of the components to failure to rescue, this chapter has discussed the failures which occur in healthcare organisations, such as reduced nursing staff numbers, poor preparation of staff for their role in caring for acute patients and the wider issues in a hospital which impact on acutely unwell patients such as communication breakdowns and processes of care delivery. Lack of knowledge amongst junior medical and nursing staff has been identified as a contributory factor in a number of the published papers and has been closely linked to failure to appreciate clinical urgency. This failure to appreciate that a patient is acutely unwell or deteriorating must be addressed through changes in the education and training of medical and nursing students during their undergraduate years, as well as in the first years of experience post-graduate i.e. as Foundation Doctors.

Lack of supervision and failure to seek advice have been related to the impact of the European Working Time Directive on reducing not only junior doctors' working hours but their exposure to patients with acute illness and how they manage these patients in conjunction with a more senior, experienced colleague. Also in the chapter the concept of simulation as the basis for the AMUWSE and RADAR was introduced as

was the inclusion of simulated patients to replace the more common manikin or human patient simulator. The use of simulated patients and moulage was introduced so that the realism of student encounter would be increased and that the students' would be able to look and see the changes in physical appearance which are often associated with deteriorating health.

Simulation based learning is now used widely, especially in anaesthesia teaching where crisis resource management based on the aviation model is used to facilitate individual and team learning (Salas, Wilson, Burke & Priest, 2005). However, despite the widespread use of simulation based learning in health care education it is unclear how it can be used most effectively in promoting patient safety (Jha, Duncan & Bates, 2001).

Much of the literature on simulation based learning also focuses on the technical skills aspect of training rather than the non-technical or interpersonal skills. Poor interpersonal skills failures can lead to adverse events; therefore it is important to review the inclusion of non-technical skills in any programmes being developed. Secondly, the published literature provides little information on how to design and deliver simulation based learning. This would be an immense help to educators considering using simulation in their own practice.

It is with these points in mind that the research to understand the impact of simulation on medical students' confidence in recognising and responding to deteriorating adults was undertaken. Finally the development and evaluation of the project is described using the ADDIE Model (Analysis, Design, Development,

Implementation, Evaluation) to underpin the aims, learning outcomes, content, the politics within departments and the ethos and environment of the institution (Kember, 2000 p25).

It has been suggested that when investigating the processes of learning and teaching it should be social, collaborative and practice based (McNiff & Whitehead, 2002). Any teaching or research in education has its roots in human issues; we are after all humans, teaching other humans. In medical education particularly the attitudes of students and politics within departments can have a major impact on research which requires making a change in practice as a goal. Change in practice requires changes in attitudes which can in some cases be the most difficult challenge.

One other area of consideration is the political issues and the ethos of the environment in which the research will be conducted. This is relevant within this researcher's own institution where the strong traditions of life sciences and medical research can lead to the perception that there is a lack of focus on teaching and educational research in favour of pure scientific research. This is not to say that any of these issues are hurdles; rather, that they need to be considered in conducting an inquiry of the nature of this study which crosses the boundary between educational and medical research.

4.3. Research Question

The original concept for this study emerged from the researcher's personal thoughts and experience regarding the issue of failure to rescue deteriorating patients in the clinical setting, and how as medical educators it might be possible to achieve a

change in medical students' learning. Earlier in this dissertation concerns in terms of the pre-study position in which medical students undertook a progressive programme of resuscitation training during their undergraduate years were articulated and discussed. The particular programme of resuscitation teaching described culminates in the completion of the United Kingdom Resuscitation Council Immediate Life Support Course which prepares year 5 medical students for clinical practice as a Foundation Doctor. However, the issue of concern to this study is how to teach medical students to prevent cardiorespiratory arrest by recognising the clinical signs of deterioration, respond appropriately to the deterioration, and so provide early rescue of the patient. Taking these issues into consideration, the following research question was developed: Can meso-simulation increase medical students' confidence in recognising and responding to clinical deterioration in adult hospital patients?

4.4. Setting for the study

The setting for this study was the Clinical Skills Centre (CSC) within an established Medical School located in the east of Scotland. The CSC is a multi-professional facility which was purpose-built to provide accommodation and education services to undergraduate students from the Schools of Medicine, Dentistry and Nursing as well local National Health Service (NHS) personnel.

At undergraduate level, medical dental and nursing students attend the CSC for teaching in core practical and procedural skills, communication skills and Interprofessional learning opportunities, such as the Acute Medical Unit Ward Simulation Exercise (AMUWSE) and Recognising Acute Deterioration: Active Response (RADAR) on which this study is based. At postgraduate level, NHS

Education for Scotland work in collaboration with CSC staff to provide national courses in Optometry, Pharmacy and the Assessment of Doctors requiring remediation.

The CSC facilities were recently expanded with the addition of a state-of-the-art Clinical Simulation Suite (CSS). This CSS is designed to provide students and practitioners with access to a contemporary healthcare environment in which to practise their practical and procedural skills, communication and non-technical skills. The CSS accommodation consists of a three room out-patient area, six hospital beds in two bays and a high dependency space within a single room. As well as being a safe, controlled, realistic physical environment, the CSS is equipped with high definition audio-visual recording equipment which can be used to record sessions which are then used to facilitate feedback and guidance to students.

4.5. Participants

The overall possible sample population for this study were all year three undergraduate medical students (N=165) who were registered to attend the Transition Block teaching sessions from which the data was obtained. During the period of primary data collection during June 2010 there were 158 (95.7%) medical students who attended the sessions and of these 130 (82.2%) completed data collection questionnaires. Four of the students who did not complete questionnaires were absent from the teaching and the other four did not wish to participate in the study and refrained from completing a questionnaire.

It has been suggested that in the design phase of a research project the lead should consider a power analysis in order to identify an appropriate sample size to ensure representation of the chosen sample (Punch, 2009). Power analysis is used in the design stage of a project to determine a sample size sufficient to minimise the risk of type-2 errors. Type -2 errors occur when we believe that the sample groups do not differ, when in fact they do. Mostly undertaken in clinical, psychological and increasingly nursing research, power analysis would not normally be considered necessary in a study of this kind (RADAR) which is an evaluative study of a new pedagogical approach. This suggests that it would be as important to guard against type-1 error i.e. when we think there is a difference between groups but there is not. This is crucial as making changes to a settled curriculum has numerous implications for administrative and teaching time, funding, and potential disruption to the students' educational experience – not to mention the possible impact on patient care. To accept this would point to a low alpha figure as in the study, rather than a high beta score.

Prospective power analysis is particularly valuable in planning replication studies and randomised controlled clinical trials. The RADAR study is based on a curriculum innovation and so does no fit within either of these categories. One of the difficulties of conducting power analysis would have been in estimating anticipated effect size as there would have been no previous studies with which to compare.

Transition block is a two week period of teaching towards the end of the third year in which medical students are prepared for the move from the mainly theoretical first three years, to the clinical placements and practice of years 4 and 5 within the health care setting. Medical students are required to complete a Register of Attendance as the sessions within CSC are mandatory due to the clinical nature of the teaching. If

for any reason they are unable to attend they must follow the University's formal process for reporting non-attendance.

In addition to the cohort of medical students there were also year 2 nursing students who attended some of the sessions (N=22). However the aim of the study was always to discover the impact of RADAR on medical students therefore the nurses were seen as a small convenience sample for inclusion in the study. They had been keen in volunteering and as this was an innovative educational idea their inclusion was seen as providing them with valuable teaching experience and the researcher with additional valuable data for the study. As a consequence the study title and question remained focused on the confidence of the whole cohort of medical students. It has been suggested that whilst convenience sampling can show a useful indication of trends, it needs to be treated with caution (Gray, 2013). It is also true that whilst these 22 volunteers may not represent the general view of a whole cohort of nursing students, in terms of educational research and the action research paradigm they could provide valuable and valid data for the study. Therefore, as the long term goal of developing RADAR was to make it an interprofessional teaching session the researcher took advantage of an accessible situation which fitted the research context and asked the nursing students to participate.

Unlike the Medical School which makes these sessions mandatory, the School of Nursing and Midwifery offer the sessions to student nurses who can attend if they wish. As the sessions are timetabled during 2rd year nursing students' clinical placements, this has a huge impact on the numbers who attend as many are unable to give up real clinical practice for simulated practice. This meant that the numbers of

medical to nursing students varied between sessions and is also why the numbers of nursing students who completed questionnaires is so limited.

Finally, the sample for the Small group interviews which were run after completion of the two week programme in 2011 was once again a non-probability sample of medical students who volunteered to give feedback on the programme. This was to form the main qualitative data collection which was based on the students' reported confidence and views on the content and process of the programme. Students were asked to volunteer to participate in the Small group interviews following attendance at the RADAR sessions and the volunteers who were willing to contribute to the Small group interviews were chosen.

4.6. Access to Site

There were no issues regarding access to site as the author is the Lead for Interprofessional Education during which the AMUWSE & RADAR sessions are timetabled. Sessions were booked in advance to ensure the use of the Clinical Simulation Suite during the eight-day period of the sessions. This forward planning was vital as the realistic environment provided by the CSS is central to the ethos of the sessions.

4.7. Philosophical approach

This research was conducted in the context of medical education within the author's own workplace. Medicine has a strong tradition of research based on the positivist approach. Positivism is based on the philosophy that scientific truths or laws exist which can be observed and measured (Cohen, Mannion & Morrison, 2007 p9).

Often referred to as the scientific or empirical method, positivism is strongly quantitative with observation, description and measurement the main skills required of the researcher. Positivist research starts with a hypothesis which the study aims to either prove or disprove through observation and the creation of theories (Cohen et. al. 2007). Researchers who are strongly drawn to the positivist approach believe that human behaviour is objective, purposeful and measurable and that with the right instrument or tool any aspect can be measured (Burns and Grove, 2009). Cause and effect relationships are central in the positivist approach combined with numbers, statistical analysis and tests to prove or disprove the hypothesis of the research (Burns & Grove, 2009).

At the opposite end of the research spectrum from positivism is subjectivism which is described as 'a systematic, interactive, subjective approach used to describe life experiences and give them meaning' (Burns & Grove, 2009 p22). Based on the anti-positivist philosophy, it has been suggested that '…truth can be discovered only imperfectly and in a probabilistic sense, in contrast to the positivist ideal… (Ford-Gilboe, Campbell & Berman, 1995 p16). Subjectivist research is naturalistic, interpretive and humanistic in its philosophical origins (Burns & Grove, 2009). Data in subjectivist research tends to be based on meaning, discovery and understanding using words, individual interpretation and observations. Whilst those who strongly defend the position of either a purely quantitative or qualitative approach continue to argue and debate the issues, the author of this study is drawn to the mixed methods approach.

Mixed methods research gives one the opportunity to present a greater range of diverse and divergent views (Tashakkori & Teddlie, 2002 p15). In devising, planning and implementing a new teaching programme it was important that the author gained insight into the thoughts and views of the students who would be learning from the programme. The views and opinions as to the impact on student confidence were central to the research (Interpretivist view) and so a mixed methods approach was the best way of gaining as wide and diverse a range of data as possible. However, the views and opinions need to be supported with evidence such as observation, feedback, reporting, which is strengthened by mixed methods research (positivist view).

As this study is focussed on the development of an innovative educational programme a mixed method, action research approach was considered the most appropriate combined with a pragmatist worldview (Creswell and Plano Clark, 2011).

Mixed methods research is defined as…

> ‘Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis and the mixture of qualitative and quantitative approaches in many phases of the research process. As a method, it focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone.’ (Creswell and Plano Clark, 2011 p5).

It is important to state that mixed methods research is not simply about using quantitative and qualitative data in the same study. In order to be considered a true

mixed method study there must be ‘integration of the data at one or more stages in the process of the research (Creswell, Plano Clark, Gutmann & Hanson, 2008 p 212). This integration of data will be discussed later in this section of the dissertation. Philosophically, mixed methods research is based on the pragmatic method and system of philosophy (Johnson & Onwuegbuzie, 2004) and is not new to the Social Sciences as a general belief system (Maxcy, 2003) or as in mixed methods research (Johnson & Onwuegbuzie, 2007).

Pragmatism is said to be ‘problem centred, pluralistic and real-world practice oriented’ (Creswell and Plano Clark, 2011 p40). Pragmatism also rejects dualisms such as facts versus values and takes a more moderate and common-sense view of philosophical dualisms based on how well they work together to solve a problem (Johnson & Onwuegbuzie, 2004). This is core to my stance on this study which aims to understand how to teach medical students how to recognise and respond to deterioration in adult patients. Being heavily based on this author’s personal practice and involving students in the design and evaluation of the study adds to the real-world orientation and practice base.

I believe that the outcomes of this study are the end goal and that a pragmatic approach is the best way to achieve this goal. In addition, my view is that the focus should be on a qualitative study with a quantitative adjunct as described by Sandelowski (2000) with the quantitative adjunct ‘guiding purposeful sampling, focusing information seeking and suggesting analytical paths’ (p249).

If I focus on my own study for example, the first cycle of action research aimed to identify using quantitative data, the opinions of the medical student cohort on the content of the programme, the impact on their confidence of the scenarios and their general views of the programme as a whole. This wide numerical analysis then led onto cycle 2 which was designed to focus on the detail of the programme and the students' perceptions of the content and the impact on their personal confidence.

Finally, the following statement by Baskerville and Wood Harper (1996) summarises the views of the author most eloquently in terms of the use of Action Research

> 'Action research is a method that could be described as a paragon of the post-positivist research methods. It is empirical, yet interpretive, it is experimental, yet multivariate, it is observational, yet interventionist…To an arch positivist it should seem very unscientific. To the post-positivist, it seems ideal' (p226).

Having identified that a mixed methods approach was most suited to the study, the next stage was to identify a research design which would be appropriate. Suitable research designs which were reviewed at this stage were Phenomenological research, Grounded Theory and action research. The next section will briefly discus each of these methods in terms of suitability/unsuitability and the reasons for choosing action research.

4.8. Phenomenological research

Phenomenological research is based on the philosophy of Edmund Husserl who is seen by many as the founder of this method (Goulding, 2005). The premise of this philosophy is that human beings can be understood from their personal (lived) experiences and that description and interpretations of them can be used as

qualitative evidence. In phenomenological research the researcher has often 'lived' the experiences that they are analysing so it is an important component of this method that the researcher makes this clear. This is called bracketing and requires the researcher to suspend their own experiences so that they can be open-minded about the data (Holloway & Todres, 2010).

Phenomenological research gives deep insight into the lived experiences of subjects; in the case of this study this would be the students' lived experience (Giorgi, 1997). The student's lived experience of assessing and responding to deteriorating adults is, in most cases, limited. Therefore the quality of the data which could be gleaned from the students might not be as rich as it could be by using another approach. The author therefore made the decision that phenomenological research would not be the most appropriate for this particular study.

4.9. Grounded Theory research

The second method considered, but rejected was grounded theory. This was developed by Glaser and Strauss (1967) based in Sociology and popular in nursing research (Holloway & Todres, 2010). Data gathered through the study builds into a theory. Typical questions which might be answered by grounded theory include 'How do participants make sense of their experience?' 'How do things change over time?' and 'What is happening in this setting?' (Gerrish & Lacey, 2010 p154). It is therefore conceivable that grounded theory could have been used in the author's study. However, as the aim was not to build theory, but understand it in the development of the learning experience and programme, grounded theory was also excluded in favour of Action Research.

4.10. Study Overview

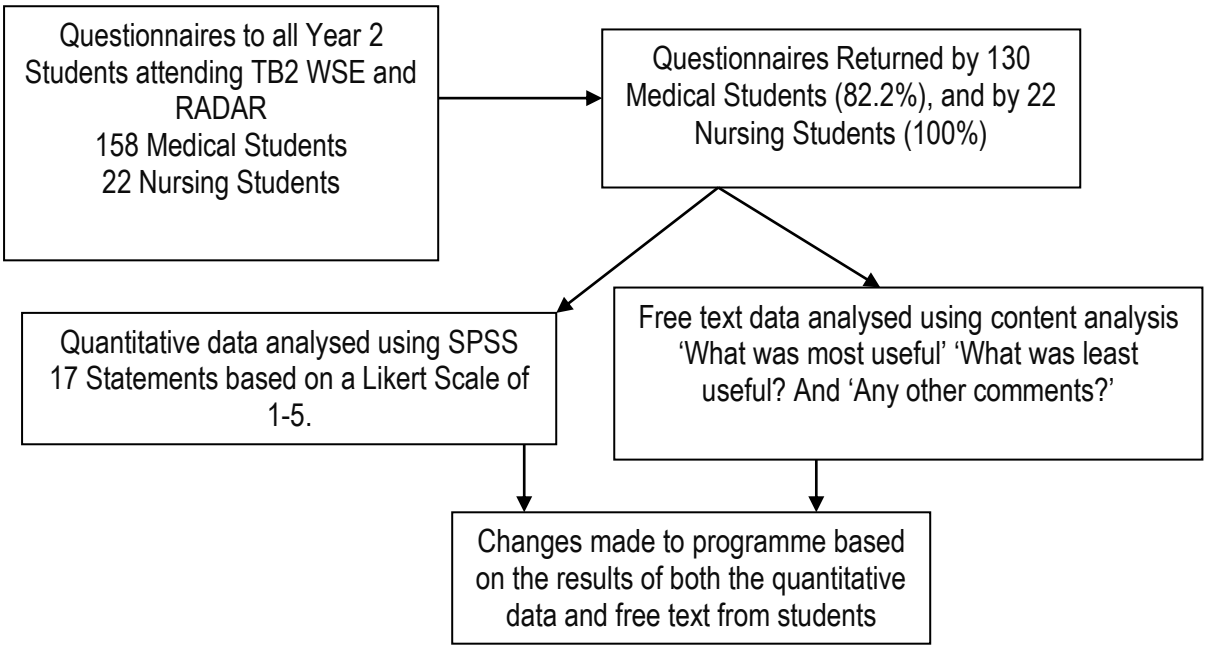
In using mixed methods research it is important to ensure that the approach taken uses qualitative and quantitative methods for different but well-coordinated purposes within the same project (Morgan, 1998)

> 'In other words, the first step in the research design process is to select a principal data collection method that has the strengths that are most important to the project's goals. The second step is to select a contrasting complementary method that offers a set of strengths that can add to the research design's overall ability to meet the project's goals (p 266).

This is what Morgan calls the 'Priority decision' which is followed by the 'Sequence decision'. The sequence decision concerns the order in which the quantitative and qualitative data are collected. In this study the sequence chosen was quantitative followed by qualitative data collection (see figure 15) so that the quantitative data gathered concerning the students' perceptions of the AMUWSE & RADAR would provide information regarding the appropriateness of the learning outcomes and content at the whole group level. It would also provide an overview of how the experience was affecting students' level of confidence.

The qualitative data collection which followed was obtained through the Small group interviews with a different cohort of students and focused more on the detail of the course experience, exploring issues arising from the quantitative data and looking at causal processes. Both the quantitative and qualitative data collection methods will be described in detail in the next section.

Action Research Cycle 1 – Data Collection Strand (2010)



Action Research Cycle 2 - Qualitative Data Collection Strand (2011)

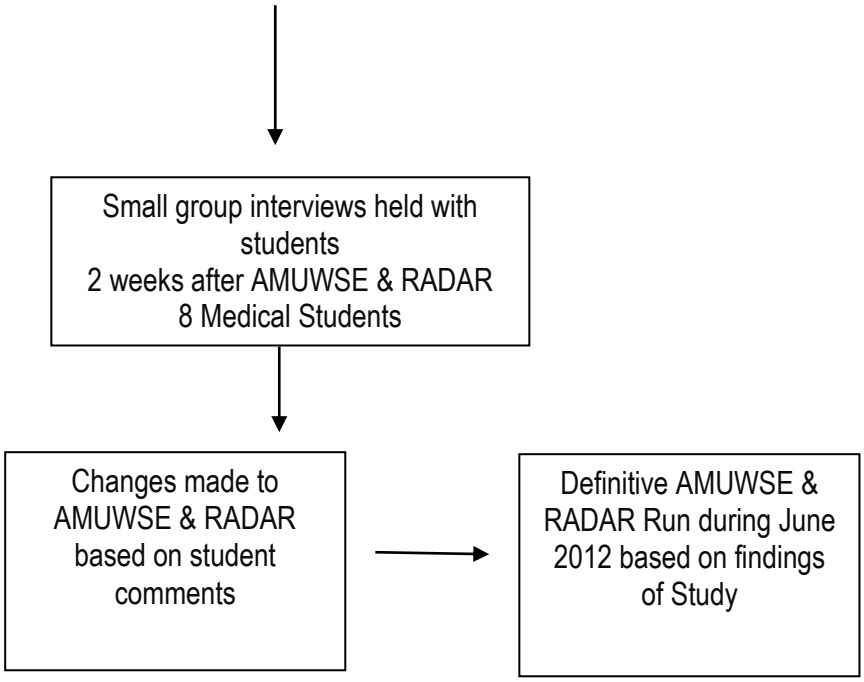


Figure 10: Data Collection Sequence.

4.11. Quantitative Data Collection and Analysis

The instrument used to gather quantitative data during the study was a questionnaire distributed to all students who attended for the AMUWSE & RADAR teaching sessions. The aim of the questionnaire (See Appendix 10) was to gather data on the design of the study day, the students' self-reported learning from the day, the impact on their confidence in assessing and managing an acutely ill adult patient, and the students' perception on what was good about the study day, what they might change and any other comments that they had about the day's content and activities.

The questionnaire was based on a similar tool used by Wiseman and Snell (2008) who completed a similar study although they did not ask exactly the same questions. That particular study was conducted with junior doctors and used manikins rather than real people to facilitate the scenarios. However, the content and validity of the sessions were the same. The questionnaire (Wiseman & Snell, 2008, p96) had two sections of Likert response scales, the first asking participants about the teaching session. Many of the questions in the study were used directly as it was relevant to gain the students' opinions. However, some modifications were necessary as the scenarios which are part of the teaching are designed to be stressful in order to prepare students for real practice.

I assumed that simply asking the students if the sessions were stressful would result in a yes/no answer, therefore the wording was changed to 'The RADAR sessions were challenging without being threatening' (see Questionnaire Appendix 10) to encourage them to think beyond the simple stress factor. The second section was once again a Likert type response, but the participants were asked to respond at two

time periods – before the session, and after the session. The author changed this to three time periods – before the session, at lunchtime and after the session. The added section at lunchtime was added to gauge students' opinion of the ward simulation exercise component of the programme which was attended in the morning before RADAR in the afternoon. This allowed me the opportunity to look at the effect of the two sessions in combination.

Prior to completing the questionnaire students were briefed on the reasons for the study, given a Participant Information Sheet and asked to complete a Consent Form. At this point students were assured that if they did not wish to participate in the study by completing the questionnaire that this would have no detrimental effect on their participation in the study day or any future teaching related to AMUWSE & RADAR. Students were also reminded that at any point during the study they could withdraw permission for their data to be used and that the author would comply with this request. Nursing students followed exactly the same process for information and consent as their medical student colleagues and were present with them during the briefing.

The students were given 15 minutes before the start of the study day to think about and complete the section of the questionnaire focusing on their knowledge of aspects of the day's content and activities. There were 7 statements which the student had to rate on a Likert-type scale of 1 (No confidence) through to 5 (Very confident), in terms of their knowledge at three set points during the study day. Time 1 was before the start of the day's activities, giving a base-line of the students' beliefs about their confidence in previous and current knowledge. Time 2 was at

lunchtime following participation in the AMUWSE when the students had revised some of the knowledge and skills. Finally, Time 2 was at the end of the RADAR sessions when students had practised more of the technical and non-technical skills. The aim of the timing was to see if there were reported changes in students' confidence over the period of the study day.

There were 165 medical students (a whole year's cohort), time-tabled to complete the AMUWSE & RADAR sessions and of these 158 (95.7%) were registered as having been present. Of the possible 158 cohort 130 (82.2 % of those present) completed questionnaires. In comparison, 22 nurses attended over period of the study and all (100%) completed questionnaires. None of the questionnaires were spoiled and they all had complete and useable data.

The quantitative data collected from the section of the questionnaire discussed previously was entered into SPSS 17 by the author. In addition to the 7 statements described in the previous section, there were 10 other statements which related to the core activities and content of the day. These were also based on a Likert-type scale of 1 (Disagree) to 5 (Completely Agree) but were once-only answers which the students completed at the end of the day's sessions. The data from each of the questionnaires relating to these statements was also entered into SPSS 17 and subsequently analysed. Details of the analyses conducted are provided as appropriate in the findings chapter.

4.12. Qualitative Data Collection and Analytical Approach

As well as the Likert-type scale statements discussed in the previous section the questionnaire included some free-text questions which the students were asked to complete. These were included to allow the students to give their views of the day in their own words. The three questions asked ‘What were the most useful aspects of the AMUWSE & RADAR sessions?’ ‘What were the least useful aspects of the AMUWSE & RADAR sessions?’ and ‘Do you have any other comments?’

These free-text statements were then analysed using a content analysis process using the following five stage approach suggested by Pope, Ziebland and Mays (2000).

Stage 1 Familiarisation - The start of this process involved the author in reading and re-reading the questionnaire responses and typed focus group transcripts to give a general indication of the themes and categories of information emerging from the answers e.g. particular phrases such as ‘*The ABCDE approach was most useful’*.

Stage 2 Identifying a thematic framework - the second stage was to allocate themes which developed from the phrases e.g. ‘*The most important bit was being able to use SBAR in a real life setting’* would be themed as ‘SBAR’ as this was the key word in the student’s response. Grids were developed with student responses in one column and a space for code in the second, a key to codes was developed by the author and printed then analysed identifying any recurring codes.

Stage 3 Indexing – The codes were then placed onto an index system with the statements from students relating to SBAR for example all on one sheet. Some statements included more than one theme so this was recorded on the index sheets.

Stage 4 – Charting – Each theme then had a chart which had all of the statements from the students written on it giving supporting evidence of the theme. These charts were then used in the final stage of the analysis.

Stage 5 – Mapping and interpretation – At this stage the author had what he thought were the themes from the student responses. In order to increase the rigour and introduce some detailed analysis associations between the themes had to be identified; did the responses match with the objectives of the sessions and the research? Were the themes which emerged congruent with the content of the day?

The final themes were then distributed amongst three colleagues who were familiar with the AMUWSE & RADAR sessions to achieve some corroboration. All were asked to review the themes independently and respond by agreeing or disagreeing with the author's interpretation. Should there have been any discrepancy, a process of reflection and discussion between the three co-raters would have been organised to achieve consensus. The main qualitative data for the study was collected in the second cycle of the study following the completion of the changed 2011 programme. Three weeks after the study day and the completion of the transition block, students were recruited to attend Small group interviews.

Small group interviews allow a researcher to gain a deeper understanding of the participant's viewpoints over a shorter period of time with participants often reacting to what other group members have said. This potentially leads to wider expressions of opinion which might not be divulged in one-to-one interviews e.g. the impact of real people as opposed to manikins as discussed by the students during the Small group interviews. The aim of these Small group interviews was to identify from students who had recently completed the study day their reflections and thoughts on

the AMUWSE & RADAR. Small group interviews are small structured groups with selected participants, normally led by a moderator' (Litosseliti, 2003 p1). They are used to explore specific topics through participants' views and experiences as 'a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment' (Krueger and Casey, 2000 p 6). Thus, Small group interviews were used in the second part of this study to understand the students' perceptions of the changes made to the AMUWSE & RADAR sessions based on the previous findings.

Two Small group interviews were conducted three weeks after the completion of the AMUWSE & RADAR sessions. Purposive sampling was chosen as the students attending the Small group interviews had to be in the cohort who had recently completed the AMUWSE & RADAR sessions. All students who had attended the sessions were sent an email asking if they would volunteer to take part in a focus group which would be held in the Clinical Skills Centre and would take between one and one and a half hours to complete. Refreshments would be provided and students would receive a Certificate of Participation for their Portfolios. Following this request 8 students volunteered and were allocated to one of two Small group interviews by the author. Dates and times of the groups were sent to students by email with a participant information sheet and consent form as attachments. The volunteers were asked to read the information and consider the information on the consent form.

When the students attended for the focus group, printed participant information sheets were available and the author reiterated the focus of the study, the reason for

the Small group interviews and the important ethical issues surrounding the volunteers' participation. The students were then asked to complete the consent forms should they wish to continue with the focus group. All 8 of the volunteers agreed to continue with the Small group interviews as planned. The volunteers were students who responded to an email request to the whole year cohort.

A pre-planned question guide was devised by the author before the Small group interviews in order to facilitate some discussion amongst participants. The whole proceedings were recorded digitally (with participants' full approval and consent) with the transcripts of these recordings used to analyse the data based on the five stage approach discussed above in relation to the qualitative questionnaire items (Pope, Ziebland & Mays, 2000). The digital recordings were transcribed verbatim by the author prior to being analysed. The digital recordings were then transferred and stored on CD Rom with the transcripts as PDF documents, to prevent any changes being made, and are secured in a locked drawer to which only the author has access.

This section has described how the data for the study were collected and analysed during the cycles of research. In the next section the author discusses aspects of validity of the findings, the final analysis of which are described in later in this dissertation

4.13. Validity and reliability

Validity is a term which refers to the degree to which a project accurately reflects or measures the specific concept that the researcher is attempting to measure (Tashakkori & Tedlie, 2009). Researchers must ensure that they address internal

and external validity. External validity relates to the extent to which the results of a study are generalizable or transferrable (Tashakkori & Tedlie, 2009). In action research the 'researcher does not set out to seek generalizable data, but to generate knowledge based on action within one's own situation' (Koshy, 2009, p37). Therefore any findings from this research are generalizable only within the context of RADAR and the research beliefs associated with it. Action research is characterised as being problem focused, involving change and aimed at improvement (Hart and Bond, 1995). It is context centred and aims to solve real life problems therefore it produces valid research results. Indeed one of its strengths is ecological validity – the extent to which research reflects what really happens in practice (the real world as opposed to a laboratory for example).

The biggest challenge facing us as action researchers is in communicating and extracting the results of our research in such a way that others not involved in the project will understand and believe. Precisely because the data, knowledge generated and results are embedded so deeply in a local context, it is a challenge to compare results across cases and generate generalisations. The extent to which the data can be generalised is dependent upon the characteristics of the different populations in question. The aim within this study is to help this is to make the methodology explicit so that readers are in a position to make such decisions. The aim is that the study might achieve Replicability i.e. the extent to which the study could be repeated because there is sufficient information about the procedures. Providing sufficient information about participants, for example, will allow a reader in another hospital or country to decide if the findings will generalise to their own context. This fact notwithstanding, the comments above about generalizability and

replicability are important here. Issues related specifically to the reliability and validity of qualitative data are addressed elsewhere in this section.

Reliability is the extent to which an experiment, test or study will give the same results if repeated (Hammersley, 1987). Within this study the author has used Interrater reliability to address the consistency of the qualitative data. Interrater reliability is when 'data are coded by the researcher, passed to other people and the coding compared for agreement' (Armstrong, Gosling, Weinman & Marteau, 1997 p597). This was achieved in this study by asking three colleagues to undertake a coding exercise using the qualitative feedback from the questionnaires.

Triangulation is another aspect of validity and reliability which must be considered and is described as…

> 'In triangulation, a comparison is made by looking at the same problem in different ways. The findings from alternate sources enable researchers to make more subtle and sophisticated analyses. Any marked differences can be highlighted, investigated and explained' (Dowell, & Smith, 1995 p26).

Within the current study I believe that triangulation has been addressed through the use of mixed methods in the data collection. The quantitative data collected in Cycle 2 gives data on the students' self-reported learning and views of the programme. This is supported by the qualitative data from the Small group interviews which provides more detail on the students' perceptions as well as unveiling some deeper understanding of the programme itself.

4.14. Ethical Considerations

Whilst the University Ethics Committee granted favourable ethical approval to this study after minor amendments to the application, it is clear that there were a number of ethical issues which must be considered during a study of this type. In terms of voluntary participation it was vital that the students' undertaking the AMUWSE & RADAR sessions were not in any way coerced into participating. This was particularly important in this cohort of students as the research was being conducted by a known teacher as part of the curriculum. This avoidance of coercion can be overcome by accountability as part of professional practice on the part of the researcher (McNiff & Whitehead, 2002). By displaying professional behaviour and being accountable to the students for the research as well as the teaching the author was able to maintain accountability for both. Students were reassured that non-participation in the study would have no impact whatsoever in their participation in the AMUWSE & RADAR sessions, that it would not impact on their learning, and that it would have no impact on any future activities with the author as teacher. The students were also informed that in order to achieve this they would have to enter their name and email address on the reverse of the questionnaire in order that the author could contact them to confirm removal.

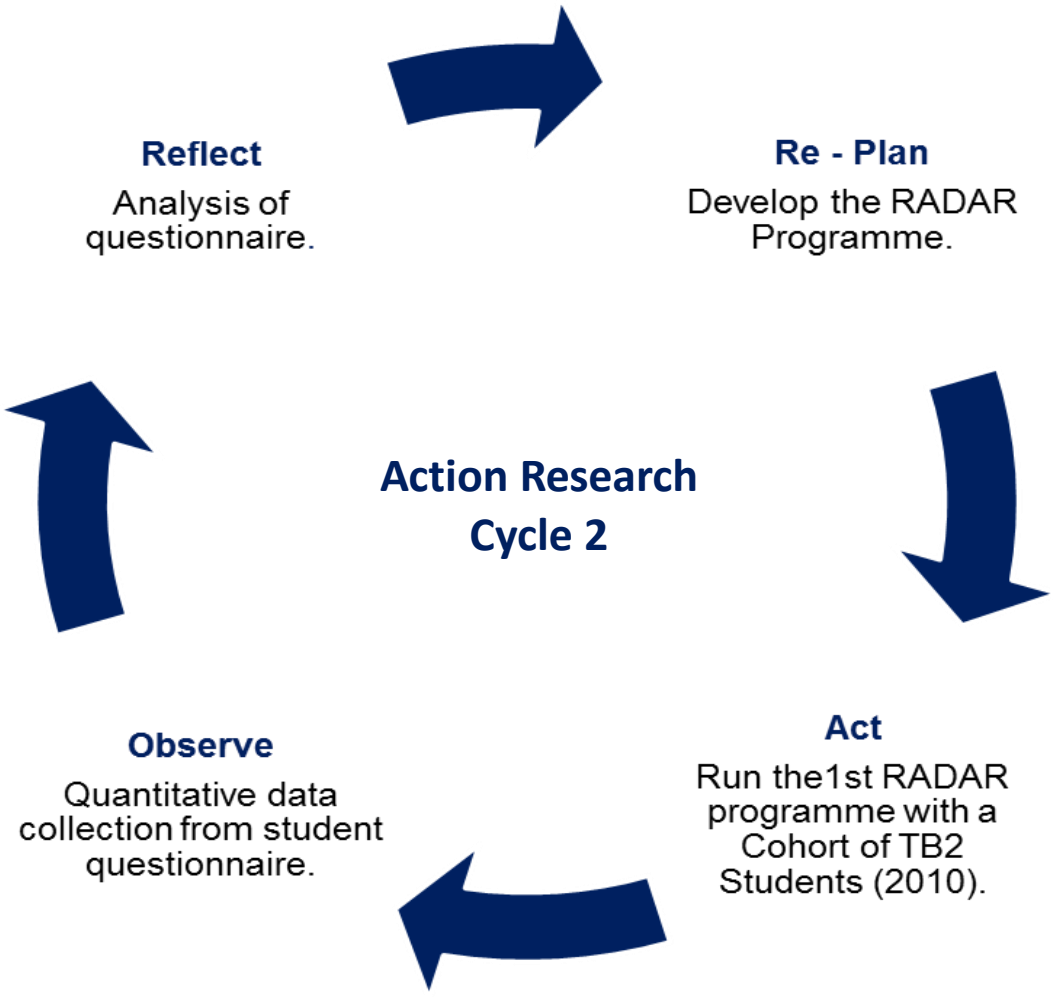
Although there was a section on the reverse of the questionnaire for students to enter their name and email address they were reassured by the author that this information would be kept in the 'strictest confidence'. That the students' identity would not be part of any data collection or analysis; that the completed questionnaires were to be held in a locked drawer in the author's office to which only he had access; and that should the student withdraw there would be no prejudice or

malice towards them. Closely related to issues of voluntary participation is that of informed consent which means that prospective participants must be fully aware of the risks and procedures involved in the research and give their full consent to participate (Trochim, 2006). There were no discernible risks to student participating in this study and the completion of questionnaires and participation on Small group interviews were very carefully discussed with students before they agreed to participate. Full information on all aspects of the study was included in the participant information sheets which were sent to students in advance of their participation.

Confidentiality was particularly important in this study which was conducted in the author's place of work with students who had been known for the previous 2 years. It was vital that confidentiality be maintained during and after the data collection, analysis and publication in order to reassure students that the author was reliable and trustworthy. As well as confidentiality, the stricter principle of anonymity must be addressed. Anonymity is an issue which must be discussed with students during the informed consent process. Students should be told that they will be allocated a number by the researcher and that this number will be used to identify what they say.

Therefore whilst the student and others may remember what was said, these outside and readers will not be able to identify the individual student. The security of the transcripts, questionnaires and all other data and paperwork related to the study was assured by being secured in an office drawer to which only the author has access and keeps the only key.

Action Research Cycle 2



5. Intervention - Recognising Acute Deterioration: Active Response (RADAR)

5.1. Introduction

This section will discuss the development of RADAR from the experience of Ward Simulation Exercises (WSE); the educational theories and underpinning of the RADAR curriculum; and, then the issues surrounding clinical deterioration and rescue of the deteriorating patient. Within the Clinical Skills Centre at the University of Dundee simulation has been used as a teaching technology since the development of the first WSE which was an interprofessional exercise for medical and nursing students (Ker, Mole & Bradley, 2003). Since then the WSE has continued to develop and be adapted to accommodate an undergraduate assessment (Ker, Hesketh, Anderson & Johnston, 2006), a postgraduate assessment for doctors in difficulty (Stirling et. al. 2012) and a teaching tool for newly qualified nurses (Stirling, Smith & Hogg, 2012).

The evidence and experience gained from these adaptations of the WSE was used as the basis for the WSE. A WSE allows students to work in a realistic but safe environment alongside other health professional students with supervision from qualified and experienced medical and nursing tutors. In addition to the learning gained from working in this realistic environment, students at the University of Dundee work with simulated patients from early in year 1 of the undergraduate curriculum.

A simulated patient (SP) is '…a person who has been carefully coached to simulate an actual patient so accurately that the simulation cannot be detected by a skilled clinician (Barrows, 1987 as cited in Cleland, Abe, & Rethans, p478). Simulated

patients have become indispensable in the education and training of medical, dental and nursing students within the Clinical Skills Centre at the University of Dundee. The SPs contribute to the '…creation of a safe, yet realistic, learner centred environment' (Ker et al 2005) and are central to students' learning communication, physical examination, procedural skills and non-technical skills.

5.2. Rescue of the clinically deteriorating patient.

The ultimate goal of RADAR is to increase medical students' confidence in recognising and responding to clinical deterioration by calling early for qualified clinical help. There are many reasons why students fail to seek early help some of which were identified in the literature review. For example the culture in the NHS still may have pockets of resistance to reporting adverse events (Lawton & Parker, 2002). There are also some who see adverse events as personal failures (Cooke, Dunscombe & Lee 2007) or those that think near misses need not be reported as the patient did not actually suffer any harm (Barach & Small, 2000, Aspden et al, 2004).

RADAR is based on simulation with the students acting as they would in real life as the aim is to prepare them for clinical practice and be safe and effective. RADAR is designed to avoid students using role-play defined as

> 'the act of imitating the character and behaviour of someone who is different from yourself, for example, as a training exercise, or in language learning' (Collins English Dictionary, 2012).

This is because the author believes that this distracts students from using their own experience in learning what they can and cannot do for their particular level of training. Students' need to be aware of what they will be able to do safely should

they encounter a deteriorating patient on a clinical placement without causing harm, delay in assessment or management of the patient. What they should be able to do and the order in which it should be done is summarised in the next section which demonstrates the RADAR concept.

5.3. RADAR Concept.

The mnemonic RADAR is primarily based on the words Recognising Acute Deterioration: Active Response, but it also encourages students to think about the wider context of RADAR. The original RADAR relates to the use of radio waves to detect aircraft in flight and, interestingly, was developed at the University of Dundee in the 1930s by Robert Watson Watt. Modern aerospace RADAR is used to constantly monitor the skies and ensure the safety of aircraft and passengers.

RADAR as in this project should become part of the medical students monitoring of patients to identify those at risk and respond to prevent harm. The concept of RADAR is shown in Figure 12 and is based on Recognise, Record, Respond, and Rescue. The concept is shown as a process from recognise to rescue to encourage learning. It is not a definitive pathway as a junior student for example might assess a patient using the ABCDE approach, decide that they have a specific problem which requires help outside the remit of their knowledge and skills and respond by immediately calling for help. Thus they have recognised the deterioration and responded, missing record. It is however important that at some point in the assessment of the patient the SEWS is recorded and this will often be ordered by the clinician once help has been requested.

Students are always encouraged to seek early qualified help during the scenarios and in actual practice. The student must follow the local escalation policy in order to

prevent systems failures which might lead to an adverse event for the patient concerned. This is where it is especially important that the tenet of RADAR which views students as students is followed so that students know what it is safe for them to do. On arrival of senior help students follow directions given to assist in the on-going care and rescue of the patient. It is important that in a real-life situation students stay with the patient and learn as much as they can. It is only through observation and practice that they will learn how to assess and manage these patients in the future.

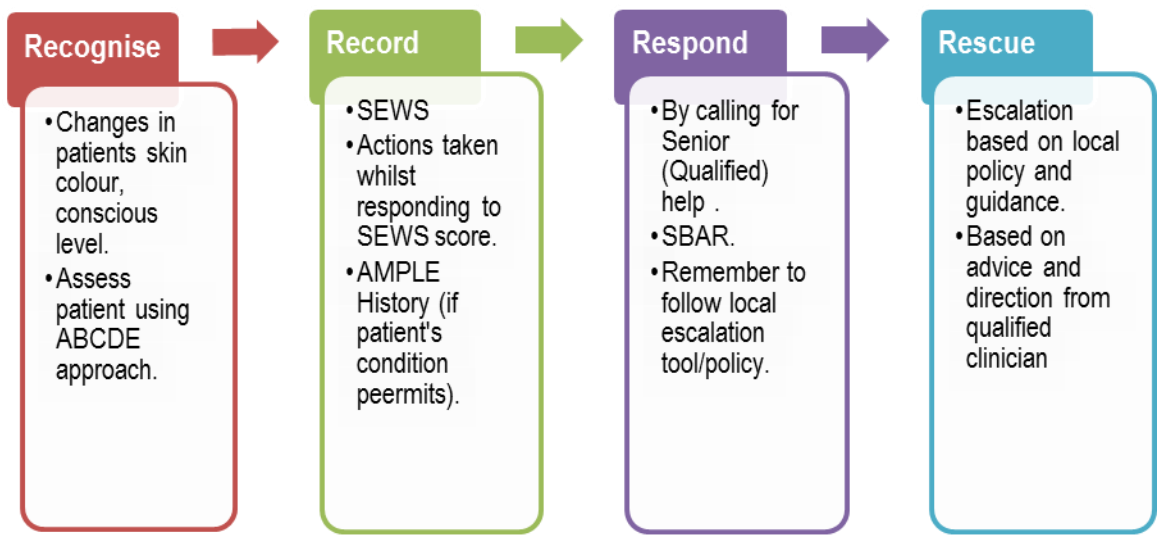


Figure 11: The Concept of RADAR

5.4. Development of RADAR

The initial development of RADAR was guided by the systematic design model of five phases known as ADDIE – Analysis, Design, Development, Implementation, and Evaluation refined by Dick & Carey (1996). Designed as an instructional model for

training programme development the ADDIE model provides a roadmap for educationalists and others to follow when thinking about programme development. For the purposes of the current dissertation the model is helpful to structure the information which follows, about the intervention on which the research is focused.

5.5. Analysis Phase

5.5.1. Who are the students?

The learners for RADAR are year 3 medical students who are completing the transition block teaching between the theory of years 1 to 3 and the apprenticeship of years 4 and 5 together with any volunteer year 3 nurses who participate during the same teaching. Transition block allows students to consolidate knowledge and skills learned during the first three years at medical school and focuses on the patient as a person, skills revision and some new learning. In preparation for the AMUWSE component and RADAR the students have completed a Basic Emergency Care (BEC) course in year 1which introduces them to the ABCDE of emergency care. ABCDE refers to Airway, Breathing, Circulation, Disability (nervous functions) and Evidence so far [4] and is a structured approach to assessing an acutely unwell patient based on a priority of needs which will identify life threatening conditions e.g. a problem with the patient's airway must be recognised and managed before one with their breathing etc.

[4] In courses other than RADAR this can relate to Environment, Exposure and Examination. However, in RADAR it is important that students gather evidence in terms of the SEWS score to back-up their call for senior help using SBAR.

Students also complete a basic life support course; and use the Situation, Background, Assessment and Recommendation (SBAR) communication tool. SBAR was originally developed by the United States Navy as an emergency communication tool for use by submarines in distress. It has since been adopted for use by hospitals as a way of giving structure to urgent conversations with medical staff required in an emergency.

5.5.2. What is the desired new behavioural outcome?

Students will become more confident in the recognition of the physical and physiological deterioration in a simulated patient. They will record deterioration using a Standardised Early Warning Score (SEWS); respond to the evidence of clinical deterioration using SBAR; and rescue the patient through escalation to senior care.

5.5.3. What type of learning constraints exist?

The students need to be able to recognise the physical characteristics of clinical deterioration i.e. changes in skin colour, conscious level etc. through observation of a real person. Resuscitation skills are by necessity taught using a manikin or resuscitation simulator; RADAR skills require a real person. Whilst Simulated Patients can be made to look ill using moulage (Make-up) and can replicate signs such as increased respiratory rate and changes in consciousness, the replication of abnormal physiological observations is a challenge. Whilst this could be overcome by the use of a high-fidelity manikin such as the Laerdal Medical SimMan which is available within the Clinical Skills Centre, the lack of a real person detracts from the aims of RADAR.

5.5.4. What are the delivery options?

The delivery options for the AMUWSE were predetermined by the previous work carried out on Ward Simulation Exercises (WSE) within the Clinical Skills Centre and earlier work by the researcher in 2010. In terms of the delivery options for RADAR the aim was to have small teams working with simulated patients. Small group teaching is said to work best with groups of 7-8 students and encourages active learning through group dynamics rather than individual learning from a lecture (McCrorie, 2013). The success of small group teaching is dependent on the tutor/facilitator creating a relaxed atmosphere, making the sessions effective but fun, directing the group and keeping them focused and managing any issues which might arise through group dynamics. A study of post-graduate medical staff in South Africa identified that the success of small groups was dependent on the following factors:

- Build on prior knowledge and experience
- Related to perceived learning needs of participants
- Involve active learning
- Be focused on problems
- Be immediately applicable to practice
- Involve cycles of action-reflection
- Allow the acquisition of skills (De Villiers, Bresick and Mash, 2003 p 816).

This is valuable information which is directly applicable to the development of RADAR and the delivery options available e.g. the scenarios will be based on real life problems which are applicable to the students practice. The scenarios will also take account of the students prior learning and experience and be based on commonly occurring causes of deterioration e.g. heart and lung conditions. In order

to encourage active learning the next step is to examine the place of adult learning theory.

5.5.5. What are the adult learning theory considerations?

The active participation of students as learners was taken into account during the analysis phase as was the need for the students to see personal applications for the new learning in AMUWSE & RADAR. As adult learners need to have a high degree of influence on how learning will be evaluated the results from the questionnaire (see Chapter 3 Methodology) had to be seen by learners to have been acted on (Knowles, Holton and Swanson, 2012).

Therefore, the design of the questionnaire and the programme content needed to be relevant to the student. The students learning and confidence from completing the programme had to be evident and any changes made as a result of the student feedback had to be visible and relevant.

5.5.6. Timeline for project completion

The date for completion of the RADAR project was August 2013.

5.6. Design Phase

The aim of AMUWSE and RADAR is to introduce medical students to the concept of acute medicine in order to develop their confidence in the recognition, response to, and rescue of, the deteriorating adult hospital patient.

5.6.1. Learning outcomes

Learning outcomes are specific and clear statements of what students are expected to learn and be able to demonstrate at the completion of their programme of study (Ramsden, 2003). A clear set of learning outcomes can inform and guide teachers and students and it is generally accepted that they should be SMART i.e. specific, measurable (observable), attainable, relevant and targeted (Doran, 1981). Bloom's taxonomy (Bloom, 1956) provides an accessible framework for describing learning outcomes according to different levels of cognitive complexity. The original taxonomy was revised by Krathwohl (2002) and is the version on which the RADAR outcomes were based. This was to ensure that the most relevant and up to date evidence was included in the RADAR sessions to maintain quality of content and delivery of the programme. The main differences between the two versions of the taxonomy are that verbs rather than nouns should be used to describe the learning outcomes. At the higher order thinking skills (top of triangle) creating now replaces evaluation.

Figure 12: Bloom's Taxonomy Bloom's (left) and Anderson's Taxonomy (right), based on Forehand (2010)

The RADAR learning outcomes specify the desired level of performance for students when participating in the scenario based element. The learning outcomes are based on students' ability to 'remember', 'understand' and 'apply' based on the revised version. The reason is that we want the students to develop and apply a systematic approach to the deteriorating patient and be able to apply this in simulated practice.

As they progress to their senior years the higher order thinking skills of analysing, evaluating and creating will be developed and increased. For example, towards the end of year three and beginning of year 4 the students complete six weeks of training known as transition block. This is designed to consolidate the mainly theoretical first three years of their course with the final two years which are clinically focused. Within the transition block students work on a case study of a patient admitted with multiple acute medical problems. The students must work individually and at some points, in teams to plan care, order investigations, analyse the findings of the investigations and change the patient's care based on their analysis and synthesis of a wide range of clinical information just as they would in real clinical practice.

This is a typical example of the progression that a medical student must make and why medical educators must develop and adapt learning outcomes which are relevant to the needs of the students at different levels. The next section will describe in detail the RADAR learning outcomes.

Learning Outcome 1: Discuss the use of the ABCDE[5] approach to an acutely ill/deteriorating adult patient. (Remembering, based on previous teaching in the Basic emergency care course and basic life support course). This outcome is assessing the students' ability to apply knowledge and skills learned and practiced during Years 1 and 2 of the medical undergraduate curriculum. In first year students use the ABCDE approach in assessing an unconscious patient during the Basic Emergency Care (BEC) Component. This is then developed in second year when students practise basic life support and resuscitation skills. These requirements have all been included deliberately in RADAR with the students undertaking three scenarios which all include ABCDE approach as the first step in recognising a clinically deteriorating patient.

Learning Outcome 2**:** Discuss the differences in applying the ABCDE approach to a (simulated) patient who is unwell and a manikin requiring 'resuscitation techniques'. (Demonstrating an understanding of the subtle differences in application). This Outcome relates to the differences between assessing a manikin which has no interaction with students to a real person who can talk, breathe and interact with the students.

Learning Outcome 3**:** Demonstrate how to recognise a patient is unwell/deteriorating using the ABCDE approach with a simulated patient (Applying knowledge to an actual situation). This is an important Outcome in developing the students' confidence through actually being able to demonstrate that they can carry out an

[5] ABCDE relates to Airway, Breathing, Circulation, Disability and Evidence and is a structured assessment used to identify and manage immediately life-threatening emergencies. In similar courses E usually means Exposure or Examination but for the purposes of RADAR it is assumed to be the Evidence that the student has gathered from their assessment of the patient.

ABCDE assessment with a real person. This is the crucial first step in assessing a deteriorating patient.

Learning Outcome 4**:** Identify that the simulated patient has changes in physiological parameters and calculate SEWS score. (Breakdown objects or ideas into simpler parts and find evidence to support generalisations). This is a skill which students learn and practice from semester 1 of the undergraduate curriculum and is assessed using an Objective Structured Clinical Examination (OSCE). It is the crucial first step in escalation of care and provides students with the evidence of changes in the patient's physiological parameters needed to call for qualified help.

Learning Outcome 5**:** Interpret evidence from ABCDE and SEWS in collaboration with qualified clinician to develop an escalation of care plan. (Make and defend judgements based on internal evidence or external circumstance). This is important as in RADAR students are being themselves. They are being taught how to respond to clinical deterioration as they would in a real clinical setting. It is therefore important that they action qualified clinical help early in the assessment and management of the patient so as to prevent unnecessary harm through delays in escalation of care.

Learning Outcome 6**:** Assemble evidence from the ABCDE and SEWS assessments and relay information to a qualified clinician using SBAR. (Compile component ideas into a new whole or propose alternative solutions). SBAR[6] is introduced to students during semester 1 of the undergraduate programme as an emergency communications tool. It provides a structure for the students to give critical

[6] Situation, Background, Assessment, Recommendations was first used by the United States Navy and developed for use in health care by Kaiser Permanente Health Care in the US as a critical communication tool.

information about the patient their condition which is relevant and concise to a qualified clinician. It is used widely in clinical practice and prevents time being wasted handing over information instead of actually treating the patient.

Learning Outcome 7**:** Summarise the recognition, recording, response and rescue of the patient during the scenario. (Creating new knowledge). This is carried out during the debriefing and feedback stage and is the start of encouraging the students to reflect and learn from the sessions.

Having defined the learning outcomes the next step was to determine which learning theories would be used to underpin RADAR as an educational intervention.

5.6.2. Adult learning theory

Knowles, et al (2012) in their seminal work on adult based learning or Andragogy as they called it, state that adult learning theory is based on the principles that effective training is relevant, engaging, active and learner-centred.

Relevant

Often, in a school situation children will attempt to learn content which is isolated from its application e.g. the times tables of multiplication which appear to have no practical use other than rote learning. However, adults learn best when they can see the relevance of the content to their own experience. By using action research the collaboration between researcher and learners is used to adapt and develop the learning experience based on the feedback and data from students after taking part in the intervention. The relevance to the students will be identified once the

questionnaire is analysed and subsequently any changes will be made based on these findings.

Engaging, learner-centred and active

It has been suggested that adult learners retain knowledge and concepts better when they are engaged in discovery and exploration rather than being a passive recipient of information (Knowles et al 2012). However, Kolb's (1981) learning cycle (see Figure 14) is widely used and suggests that in order to achieve learning, people take a different approach or learning style. As the RADAR sessions are planned to be used by medical and nursing students it is important that the different learning styles are considered.

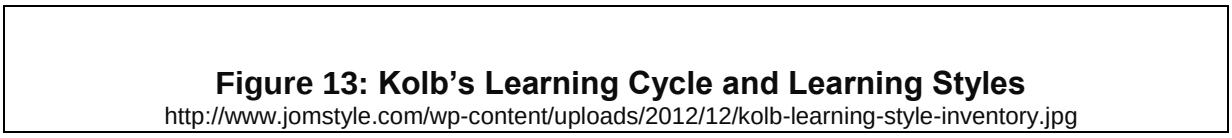


Figure 13: Kolb's Learning Cycle and Learning Styles
http://www.jomstyle.com/wp-content/uploads/2012/12/kolb-learning-style-inventory.jpg

During the RADAR sessions the facilitator is there to act as a guide, encourage interaction and communication between students, and to empower the students to utilise their skills and experience in promoting teamwork. The facilitator will also be responsible for providing students with debriefing and feedback on the scenario. Each scenario is designed to run for 10 minutes with the next 20 assigned to feedback and debriefing.

Feedback and debriefing

Providing students with feedback and debriefing on their performance during a RADAR simulation scenario will be crucial. Debriefing was first used within the military and was focused on the analysis of the mission based on educational and operational objectives to improve strategies for combat (Fanning & Gaba, 2007).

As the focus on simulation in aviation grew, debriefing was developed and McDonnell et al (1997) used a 3 stage model of debriefing of concept, analysis and line operations. Concept includes discussion of the learning outcomes; analysis identifies through discussion which steps were effective and which were not; and line operations reviews the outcomes and offers strategies for improvement.

The primary aim of debriefing is to reinforce the learning outcomes in an objective, non-judgemental atmosphere for the purpose of learning (Chronister and Brown, 2012). Jeffries (2005) describes debriefing as the time, immediately following the simulation when students and faculty engage in a reflective thinking session to examine what happened and what was learned (cited in Chronister & Brown, 2012 p282). Finally, the definition which the author views as most relevant and appropriate to RADAR is that by Driefurst (2009, p109) which states that ‘Learning occurs in

simulation through contextual task training and repetition, but significant learning occurs when deep insight is made explicit through reflection and debriefing'.

The criticality of feedback and debriefing is summed up eloquently by Van Ments (1999 as cited in Heukelom et al 2010, p94) as:

> 'The debriefing session is the most important part of the activity. It is here that the meaning of the enactment is clarified; the lessons to be learned are underlined; and the connections are made to what the students already know and what they need for the future'.

Facilitators for the scenarios will all be experienced clinicians and teachers who are briefed before the sessions. This briefing is undertaken to ensure that facilitators are supportive to students during the scenarios, provide students with the information they need, pull students back if they are doing things out with their remit and time the session so that 20 minutes is spent debriefing the students and giving feedback. During the course of the project facilitators will use a checklist to provide them with a structure to direct their thoughts and findings to the students.

Having identified the importance of debriefing and feedback the next step was to review the significance of situated learning theory to the students' confidence during and after the RADAR sessions. This will be discussed in the next section.

5.6.3. Situated learning theory

Situated learning theory or situativity theory refers to 'theoretical frameworks which argue that knowledge, thinking and learning are situated (or located) in experience (Durning & Artino, 2011 p188). The knowledge base for situativity theory is drawn

from the work of cognitive scientists (Vygotsky, 1980, Brown, Collins & Duguid, 1989 and Lave & Wenger, 1991). Situativity theory proposes that 'knowledge, cognition, and learning are situated in experience; that is they are situated within the participants, the culture, and the physical environment of an activity' (Durning & Artino, 2011, p198).

Situated learning is based on the core premise that people learn as they participate and become involved with a community of learning (Lave and Wenger, 1991). Thus, 'learning is situated in interactions among peripheral participants in a community of meaning. These interactions take place in the context of practice and are characterised by modelling of both mastery of practice and the process of gaining mastery' (Jacobson, 1996, p23). To facilitate an authentic community of practice the clinical simulation suite will be used to provide a realistic environment, students act as themselves during the RADAR sessions, thus they do not have the added pressures of role-play which mean they have to think about actions etc. of someone else. The simulated patients add to the realism of the sessions as do the facilitators acting as themselves as well.

5.6.4. Simulation-based learning theory

Simulation-based learning can be defined as:

> '…any educational activity which utilises simulative tools to replicate clinical scenarios. Simulation tools serve as an alternative to the real patient and permit educators to gain full control over a pre-selected clinical scenario, without distressing patients or encountering other unwanted aspects of learning on real patients' (Ziv, Ben-David and Ziv, 2005, p193).

Simulation in medical education covers a spectrum between low fidelity (Resusci Anne CPR manikin), through Intermediate fidelity (other resuscitation manikins) to

high fidelity (SimMan manikin) and simulated patients as utilised in RADAR. High fidelity simulation allows students to participate in clinical scenarios replicating actual clinical situations and is well integrated into the medical undergraduate curriculum. For example year 2 medical students work and learn with year 2 student nurses during a simulated diabetic emergency. Medical students use SimMan during advanced life support training and year 5 students are assessed using SPs in a ward simulation exercise in which the student must manage a ward of patients for 20 minutes with the help of a registered nurse.

Fidelity is the realism that a simulation presents to the learner (Feinstein & Cannon, 2002 p426). It has also been defined as 'the degree of similarity between the training situation and the operational situation which is simulated' (Hays & Singer, 1989 p50 as cited in Feinstein & Cannon, 2002). For a complex simulation like RADAR to be effective it must feel realistic to the students, simulated patients and facilitators. Figure 15 below demonstrates the different range of fidelities which had to be taken account of in the development and facilitation of RADAR, each of which will be discussed in more depth.

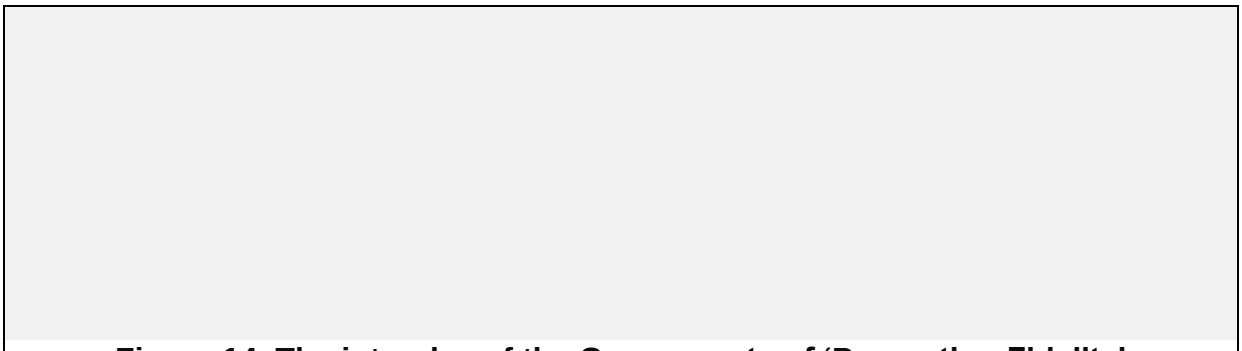


Figure 14. The interplay of the Components of 'Perception Fidelity'
Reproduced with permission from Khan, Pattison and Sherwood (2011, p.14)

Perception fidelity is ‘the sum total of all fidelities explained in the diagram and the subjective feeling (perception) of the participants about the ‘realness’ of the whole simulated scenario’ (Khan et al 2011 p14).

Action fidelity is based on the tasks given to the students during the scenarios e.g. using the SBAR tool to call for help based on the findings of the assessment of a real person (simulated patient) is as real as possible to actual clinical practice.

Environmental fidelity is dependent on the realness of the environment and is one of the variables most easily adjusted to accommodate the scenarios. However, the setting of RADAR in a clinical simulation suite which fully replicates the real surroundings of a hospital ward more or less guarantees that the environmental fidelity was preserved.

Temporal fidelity is linked to scenario design and is related to the scenarios following a realistic time line. For example when students’ are carrying out their initial assessment using the ABCDE approach and are recording respiratory rate, pulse rate etc. they must conform with the process before the facilitator will give them the findings i.e. they must count the pulse for I minute.

Equipment fidelity is the simplest to manage and is achieved by ensuring that the equipment student’s use is the same as that found in the clinical settings. This is a standardised approach within the clinical skills centre and clinical simulation suite.

Psychological fidelity depends on three factors.

1. The comfort of the student with the simulation, and their mental acceptance of simulation as an educational tool. Experience of working with students has led the researcher to the belief that this can sometimes be an issue with some nurses. It tends not to be a major issue with medical students, but can if present, interfere with the students learning gained from the sessions. These issues will be discussed further in later chapters.
2. The scenario design including action and temporal fidelity. This is managed in the RADAR sessions through the use of real life, anonymised scenarios taken from clinical practice. This means that the students are dealing with situations which they are likely to see in real life which makes the transfer of knowledge and skills between simulations and practice easier.
3. The environmental fidelity, which as stated earlier is as near real life clinical practice as it can be.

5.6.5. Simulated Patients (SPs)

SPs were first introduced in the early 1960s as a response to changes in medical education and assessment, the ethical issues of using hospital patents to practise skills on and the need to have reliable and valid methods of assessment (Cleland, Abe & Rethans, 2009). The first definition of SPs was that of Barrows (1987):

> ‘The simulated/standardized patient (SP) is a person who has been carefully coached to simulate an actual patient so accurately that the simulation cannot be detected by a skilled clinician. In performing the simulation, the SP presents the gestalt of the patient being simulated; not just the history, but the body language, the physical findings, and the emotional and personality characteristics as well’ (Barrows, 1987 as cited in Cleland, Abe & Rethans, 2009 p478).

There is sometimes confusion in the literature and in practice about the difference between a ‘standardised patient’ and a ‘simulated patient’. Adamo (2003) suggested that it is best to consider a simulated patient as one where the emphasis is on the simulation of the presenting signs and symptoms.

A standardised patient on the other hand is one where the emphasis is on consistency of performance e.g. during an assessment when it is important the each student has the same experience to ensure reliability and validity of the assessment process (Norman et al 1982). For the purposes of the research and teaching of RADAR the term simulated patient with the emphasis on presenting signs and symptoms is preferred.

5.6.6. Content and Programme

The content of the day was designed to incorporate the AMUWSE in the morning with the RADAR sessions in the afternoon allowing students to work and learn alongside each other for the whole day. The AMUWSE was designed to introduce students to the concept and change of pace required in an acute setting. Up to this point in their undergraduate programme the medical students have had limited ward experience and the majority of what they have has been in terms of practicing consultation skills. This is normally at a relaxed pace, whilst managing an acute/emergency situation requires the practice of other skills and a shorter consultation.

Six simulated patients are included in the AMUWSE and students work with qualified staff (medical and nursing), student nurses (if available) and other allied health professional students (Physiotherapy, Occupational Therapy etc.). The students

work with senior staff to admit, transfer between areas and sometimes discharge the patients within the WSE. The students also practice and refine practical skills such as blood pressure; examinations skills including chest examination; and consultation skills.

Much of the learning in the WSE centres around non-technical skills such as teamwork, communication, decision-making and situational awareness and the importance of these skills is discussed in the discussion chapter later. After the completion of the WSE students give the qualified staff a handover of the patients stating what has been done for them, the management and treatment plan and what still needs to be achieved.

After lunch students undertake a round-robin of the three (RADAR) scenarios. Working in small groups the students assess and manage within the limits of their experience an acutely ill/deteriorating SP. The focus of the scenarios is the practice of ABCDE, recording of vital signs and SEWS and then calling for a qualified clinician using SBAR. Students are given a clinical handover of the patient before the scenario, are directed by a tutor during the 5 minute session and then given feedback by the tutor for the final 15 minutes of the scenario. The groups then move around the other scenarios.

5.6.7. Lesson Plans

The sessions begin at 09.00 with an introduction from the lead tutor (researcher) to the students explaining the background to AMUWSE and RADAR the timetable for the day and then an orientation to the ward within the simulation suite. Students are then allocated the main ward, the assessment area or high dependency bay as their

work place for the morning. Qualified nursing tutors acting as senior nurses with medical tutors as senior doctors are on the ward as they would be in reality to guide and help the students assess and manage the patients. The WSE starts with a handover from the senior nurse responsible for each of the areas giving a handover on the patients already in the area. Other patients arrive at predetermined times over the first hour of the WSE. The WSE runs until 12.00 midday at which time the students' handover the patients to the qualified team and then go for lunch.

After lunch at 14.00 students return and are briefed about what will happen during the RADAR scenarios. The students are allocated to one of four groups and undertake the round-robin of four stations in the simulation suite. The sessions finish with a final feedback and debrief.

RADAR Lesson Plan

Students	Year 4 Transition	**Date(s)**		**Length**	1 week
Session	RADAR Scenarios: 1. Pulmonary Embolism/2. Acute Heart Failure/3. Stroke/4. Sepsis				
Aims	The aim of the session is to support students in recognising and responding to clinical deterioration using the above scenarios.				
Learning Outcomes	1. Demonstrate how to asses a simulated patient using the ABCDE approach. 2. Demonstrate how to conduct an AMPLE history from a simulated patient. 3. Demonstrate the use of SBAR to handover a deteriorating simulated patient to higher level care. 4. Discuss the role of the year 4 medical student in the recognition and response to clinical deterioration.				
TD[7] Outcomes	**Outcomes 1 The doctor as scholar and scientist**: 8g 'Make accurate observations of clinical phenomena and appropriate critical analysis of clinical data'. **Outcomes 2 The doctor as a practitioner**: 13a 'Take and record a patient's medical history, including family and social history, talking to relatives or other carers where appropriate'. 13c 'Perform a full physical examination'. 13g 'Provide explanation, advice, reassurance and support'. 14b 'Make an initial assessment of a patient's problems and a differential diagnosis'. 14f 'Make clinical judgements and decisions, based on the available evidence, in conjunction with colleagues and as appropriate for the graduate's level of training and experience. This may include situations of uncertainty'. 15d 'Communicate appropriately in difficult circumstances, such as when breaking bad news and when discussing sensitive issues'. 16a 'Assess and recognise the severity of a clinical presentation and a need for immediate emergency care'. 16b 'Diagnose and manage acute medical emergencies'. 16c 'Provide immediate first aid'. 16d 'Provide immediate life support'. 18a 'Be able to perform a range of diagnostic procedures **Outcomes 3 The doctor as a professional:** 21e 'Recognise own personal and professional limits and seek help from colleagues and supervisors when necessary'. 22b 'Understand the contribution that effective interdisciplinary team working makes to the delivery of safe and high-quality care'. 22c 'Work with colleagues in ways that best serve the interests of patients, passing on information and handing over care, demonstrating flexibility, adaptability and a problem solving approach'.				
Resources	Four bed spaces within the Simulation Suite (Four Simulated Patients). Oxygen (Medical Air) Supply and selection of masks. Sphygmomanometer, Pulse Oximeter, Thermometer, Stethoscope, Pen Torch. SEWS charts and pens. Case Notes. RADAR Posters.				
Anticipated Problems & Solutions	No Staff available – check around the Clinical Skills Centre, if no one available mix groups and only use three scenarios. This would be the same solution if an SP is not available. Check all equipment before session if issues speak to a member of the Technical Team.				

[7] TD = Tomorrow's Doctors, GMC, London.

Time	Content	Methodology/Interaction	Assessment	Resources
14.00	Register. Welcome. Link to last week's session. Today's aims and outcomes.	Lead Tutor to explain and check that all see relevance. Explain link to last week's session on Introduction to Clinical Deterioration. Students respond to questions on last week's session.	Responses to questions and answers. Quality of links to last week's session.	PowerPoint.
14.10	Briefing of students. Allocation of Groups. Introduction to Tutors.	Explanation of the circuit of patients. Students will be in groups of 4-5 and will see all four patients during the session. Careful explanation that the students are to act as themselves – no role play.	Students ask questions and are clear about plans for session.	Student/Tutor allocation sheets.
14.15-15.40	Scenarios: 1. Pulmonary Embolism 2. Acute Heart Failure 3. Stroke 4. Sepsis	Each scenario will last for 20 minutes. The tutor should brief the students using the patient handover. Facilitate assessment for maximum of 10 minutes and then provide feedback for the remaining time.	Students can assess patient using ABCDE**.** Work as a team to achieve speedy outcomes. Responses to questions and answers.	Tutor Guide. Patient details including vital signs. SBAR Charts. SEWS Charts. RADAR Posters**.** SHARP Tool for feedback. Tutor.
15.40 – 16.00	Group Debriefing. Review of Session aims and outcomes.	Lead Tutor to explain and check that all see relevance. Explain link to last week's session on Introduction to Clinical Deterioration combined with this weeks and links to future practice. Students respond to questions on last week's session.	Responses to questions and answers. Quality of links to last week's session. Clear links to practice.	Tutor Guide. Patient details including vital signs. SBAR Charts. SEWS Charts. RADAR Posters**.** SHARP Tool for feedback. Tutor.
16.00	**Finish**			

5.7. Development Phase

The development phase of the study consisted of the writing of scenarios which were based on real life cases taken from practice which were anonymised through changes in name, age and date of birth. In total nine scenarios were needed – six for the AMUWSE and three for RADAR. Each scenario is duplicated with a male and female character to allow for changes in the simulated patient during the running of the exercise e.g. Mrs Smith may have to be Mr Smith as the simulated patient available on the day is a man instead of a woman. In addition to patient scripts each scenario requires the production of hospital notes, SEWS charts, drug administration records, fluid charts etc. All of this preparation is vital in order to maintain the realism of the AMUWSE and RADAR.

The final stage is the planning and preparation of the moulage (make-up) so that patients are made to look unwell; this requires careful consideration of the supposed underlying pathophysiology and expertise in the application so that the moulage assists with the realism and is not a distraction from it.

5.8. Implementation Phase

The implementation phase was perhaps the easiest due to the fact that the staff and teachers in the Clinical Skills Centre are now experts in running and supporting ward simulation exercises. Administrative and technical support are the most important components at this stage in recruiting and training simulated patients, setting up and maintaining the ward environment and replacing any materials or sundries used during the actual running of the sessions. Simulated patients are recruited, trained

and briefed by the Patient Bank Team. Tutors are recruited by administration staff and are briefed by the researcher prior to each session.

A Tutor's Manual is produced for the guidance of staff and SPs. Within the manual are an introduction to the concept of AMUWSE and RADAR, timetables, lesson plans, the patients scripts and notes, student allocation lists, equipment lists for the technical support team and other relevant information for tutors and SPs. AMUWSE and RADAR sessions were run for eight days over a two week period with the students spending the morning completing the AMUWSE to introduce them to the concept of acute medicine such as the increased pace of history taking and examination required. In the afternoon the students undertake the RADAR session which consists of three scenarios in small teams with supervision and feedback from a clinician/tutor.

5.9. Evaluation Phase

The first evaluation was the student questionnaire which was distributed during the eight days of the AMUWSE & RADAR sessions in 2010. Subsequently, in 2011 an evaluation of the changes to the programme made as a result of the findings from the questionnaires, was undertaken using Small group interviews. Data collected from these evaluations form the basis of the research reported in the next chapter. Learning has been defined as 'a relatively permanent change in mental processing, emotional functioning and/or behaviour as a result of experience (Bastable, 2003 p44). A learning theory is a conceptual framework that describes how information is absorbed, processed and retained during learning (Illeris, 2004). Learning theory underpins the development and evaluation of learning programmes and different

theories were used in combination to support the development of the RADAR sessions.

5.10. Clinical Deterioration

Within the acute hospital setting clinical deterioration may be as a result of the patients presenting complaint (PC), a new problem related to the PC, or as a complication of the healthcare provided (adverse event). One of the major challenges facing clinical staff and educators is the lack of consensus as to what actually constitutes clinical deterioration i.e. there is no clear definition to work with (Jones et al 2013). In terms of studies of adverse events in which deterioration is sometimes perceived as an adverse event there were three clear time-frames. These were based on iatrogenesis (related to a physician) and medical neglect (1964-1991); discrete clinical complications (1991-2001) and currently, deranged vital signs (2001 -).

The Literature Review identified that the traditional frameworks for identifying deterioration focused on the end result (the adverse event), the influence of iatrogenesis and medical error. As noted earlier it was Schimmel (1964) who was one of the first to complete a study of adverse events in hospital patients at a time when clinical deterioration was perceived as consequence of medical management or ‘a noxious response to medical care’. The work undertaken by Schimmel was innovatory in being a prospective review of cases whilst the patients were still hospitalised. However, very little work was undertaken after the study until the California Medical Insurance Feasibility Study by Mills (1978). This study changed the focus to retrospective record review aimed at specifically identifying cases of medical error or negligence and this continued until publication of the Harvard

Medical Practice Study (HMPS, Brennan et al 1991). The HMPS was replicated world-wide (see Literature Review P 32) for details) and placed clinical deterioration within the realm of adverse events. The response to the findings of retrospective case review was the establishment of the Patient Safety Movement and publication of the Institute of Medicine (USA) report 'To Err is Human' (Institute of Medicine, 2000) which progressed to the creation of the Scottish Patient Programme. The problem with retrospective review is that it is dealing with issues after the event.

Recently work has focused on the early detection and management of deterioration through observation of vital signs and the patient's physical state which provide the foundations for RADAR (Odell, Victor & Oliver, 2009; McGaughey et al, 2010; Kyriacos, Jelsma & Jordan, 2011; Parham, 2012).

Currently the focus is on the detection and early response to clinical deterioration using early warning scores, observation and escalation of care to an appropriate level (Buist, Bernard, Nguyen, Moore, & Anderson, 2004, Cretikos, Chen, Hillman, Bellomo, Simon, & Flabouris, 2007; Moldenhauer et al 2009). Jones et al (2013) provide a clear and concise definition of clinical deterioration as

> 'A deteriorating patient is one who moves from one clinical state to a worse clinical state which increases their individual risk of morbidity, including organ dysfunction, protracted hospital stay, disability , or death' (p 3).

Whilst the patient is deteriorating there are physical and physiological signs which demonstrate their progression. It is these signs e.g. changes in skin colour, conscious level which are often missed and need to be reinforced to students through RADAR. The Patient Safety First campaign in England produced a 'How to

Guide' for Reducing Harm from Deterioration (Patient safety First Campaign, 2008) in which six key areas relating to deterioration were identified (see Figure 4). These six key areas were incorporated into RADAR. The relevant statement will be identified in each of the following sections to identify how it has been incorporated into RADAR.

Physiological observations should be recorded for all adult patients in acute hospital settings
Physiological observations should be recorded and acted upon by staff that have been trained to undertake these procedures and understand their clinical relevance
Physiological track and trigger systems should be used
There should be a graded response strategy
An escalation protocol should be in place
A communication tool should be used.

Figure 15. The six key areas relating to deterioration from Patient Safety First.

5.11. Recognising clinical deterioration

> *Physiological observations should be recorded for all adult patients in acute hospital settings.*
>
> *Physiological observations should be recorded and acted upon by staff that have been trained to undertake these procedures and understand their clinical relevance.*

All healthcare students are taught basic life support which includes training in how to conduct an Airway, Breathing, Circulation, Disability and Exposure[8] (ABCDE) approach. The ABC mnemonic was first described in the 1950s by Safar who discussed the importance of protecting the patient's airway and breathing as the

[8] For the purposes of RADAR, E is changed to 'Evidence' to encourage the student to think about what their findings indicate. Students should be calling for help early, based on the evidence and are not encouraged to carry out any examinations unless under the direction of a qualified clinician

most important aspects of resuscitation. Further studies by Jude, et al (1961) described the process of closed-chest massage and so C for circulations was added. The system was further adapted to include CDE following the introduction of Advanced Trauma Life Support (ATLS) courses and is now considered through expert consensus to be the standard approach to the assessment of acute and critically injured patients (Thim et.al, 2012). Once students have carried out an initial assessment and responded to any life threatening conditions using the ABCDE approach the next stage is to record their findings using the Standardised Early Warning Score[9] (SEWS).

5.12. Recording clinical deterioration

Physiological track and trigger systems should be used.

The reduction in the number of acute hospital medical and surgical beds has led to an increase in sicker and more dependent patients (McKeown, 2004). As a consequence these patients are more likely to experience complications and clinical deterioration which goes unnoticed.

The acute nature of patient's illness and reduced staffing levels was discussed in the literature review (Neale et al 2006) where it was identified that higher levels of nursing staff led to fewer adverse events. However, this study was conducted in a high dependency setting where there would be more nurses due to the nature of the service. However, a study by Needleman et al (2002) was clear in the conclusion that:

[9] A simple scoring system used at general ward level based on careful routine physiological measurement of heart rate, blood pressure, respiratory rate, temperature and conscious level each with an upper and lower score of 0-3 points from which a total score is calculated (Kyriacos et al, 2011, p313).

> ‘ A higher proportion of hours of nursing care provided by registered nurses and a greater number of hours of care by registered nurses per day are associated with better care for hospitalized patients’ (p1715).

Nevertheless, the numbers of registered nurses allocated to wards is out with the control of medical and nursing students, therefore the aim of RADAR is to instil in the students’ the importance of physiological observations. It is also made clear to medical students that the patient comes first and if they need to record the vital signs then they do them as a matter of course. This will start to alleviate the problem of missed vital signs leading to adverse events.

Predictive abnormalities in vital signs are often observed before adverse events (Harrison et al 2005), and within 6 hours (Franklin & Mathew, 1994), and 8 hours (Schein, Hazday, Pena, Ruben & Sprung, 1990) of cardiorespiratory arrest. Hypoxaemia (low blood oxygen levels) and hypotension (low blood pressure) are particular issues if not treated quickly (Smith, 2010).

Evaluations following the introduction of early warning scores have shown that the number of admissions to Intensive care units (ICU) (Stenhouse et al 2000; Cuthbertson et al 2007; McGaughey et al 2007) can be reduced using an early warning score. Within the Health Board Area in which the study was conducted a Standardised Early Warning Score (SEWS) was used based on a score of 1-3 for the physiological parameters (See Table 17).

Physiological Parameter	**Score**						
	3	**2**	**1**	**0**	**1**	**2**	**3**
Respiratory Rate	<8			9-20	21-30	31-35	36+
S_pO^2 Target	<85%	85-89	90-93	94+			
Temperature	34°C	35	36	37	38	38+	
Pulse Rate	<30	30-40	40-50	50-100	100-110	110-130	>130
Blood Pressure	50-80	80-100		100-190			>200
Neurological response			Alert	Verbal		Pain	Unresponsive

Figure 16: SEWS Scoring per physiological parameter (NHS Tayside)

5.13. Responding to clinical deterioration

There should be a graded response strategy.

A communication tool should be used.

Once it has been established by students using the SEWS score that the patient is unwell or deteriorating (A SEWS of 1 or more is abnormal), the next stage is to respond by escalating care. This is achieved by reference to the escalation tool (See Figure 18).

SEWS Score of 0 **Minimum 8 Hourly Observations**	**SEWS Score of 1** **Registered nurse to determine frequency of observations** **Minimum 4 Hourly Observations**	**SEWS Score of 2-3** **Inform the Nurse in Charge** **Increase frequency to hourly Observations**	**SEWS Score >4 or Score of 3 in one parameter** **Urgent Escalation** **15 minute observations until review**

Figure 17: NHS Tayside Escalation Tool

A communication tool should be used.

SBAR – Situation, Background, Assessment and Recommendation was developed by the United States Navy as an emergency communication tool for submarines. Attack submarines are deployed all over the world and an emergency at sea for this or any other ship requires urgent attention. SBAR is designed to give critical information in a sensible, structured way avoiding unnecessary talk in the process. In healthcare communication handovers are critical and breakdowns have been implicated in up to 90% of adverse events recorded (Chang et al, 2005).

In addition the differences in training between nurses and doctors generally tends to mean that nurses are very descriptive and detailed in communications, whilst doctors tend to use brief statements and summaries (Haig et al, 2006). This can often lead to frustration and communications failures which in an emergency could lead to an adverse event. The aim of escalation is to ensure that the right person sees the patient in a timely manner and that the patient is rescued from deterioration and cardiac arrest prevented.

5.14. Summary

In this section of the dissertation the author has discussed the methodology which was used to underpin the study of AMUWSE and RADAR. The research question which was identified from the author's thoughts and experience in terms of acute deterioration and failure to rescue was articulated as…

Can meso-simulation help medical students learn to recognise and respond to acute deterioration in adult hospital patients?

This was then followed by an introduction to the setting for the study which was the author's place of work as a lecturer. The recent addition of a new Clinical Simulation Suite and the positive impact that this had on student learning and the study was discussed along with a description of the facility and associated equipment. This had a major impact on the facilitation and outcome of the AMUWSE in terms of realism and student engagement and was an important issue in the conduct of the study.

The student sample for the study which consisted of all 165 medical students in year three of the undergraduate programme eventually became 150 participants who completed the questionnaire set for Phase 1 of the study. The medical students were supplemented by 22 nursing students who were participants in the AMUWSE and RADAR sessions in 2010. The second data collection process involved 8 medical students who participated in two Small group interviews. As well as the importance of the sample population for the study it is vital that a researcher is able to articulate their philosophical approach to a study and this followed in section 6 of the chapter.

As the study was being conducted in the authors' workplace and involved a major change in teaching and therefore students, an action research approach was thought to be the best. However, as with all philosophical approaches there were other issues to be taken into consideration such as the study being conducted in a medical education context with its strong traditions in positivism. This was counterbalanced by the strong qualitative traditions of action research which created possible tensions. However, this was reconciled by the use of mixed methods research with a pragmatic approach. Pragmatists take the view that the research question should decide the method to be used to answer it and this seemed eminently sensible to the author.

The theoretical underpinning of RADAR as an educational intervention has been described in terms of context, content and concept giving readers an understanding of the basis for data collection and analysis. Data collection and analysis procedures have been described in terms of the use of a questionnaire and Small group interviews along with the validity and reliability of the study. The ethical considerations in terms of informed consent, confidentiality, and anonymity have been explored and their particular importance in this study discussed. In the next chapter the findings of the study will be presented.

6. Findings from the Student Questionnaire (2010)

This chapter will present the results of the questionnaire distributed to medical and nursing students' in 2010 (Action Research Cycle 1).These will be followed by the findings of the qualitative Small group interviews with medical students conducted in 2011 (Action Research Cycle 2).The overall possible sample population for this study were all year three undergraduate medical students (N=165) who were registered to attend the Transition Block teaching sessions from which the data was obtained. During the period of primary data collection during June 2010 there were 158 (96%) medical students who attended the sessions and of these 130 (82% of those who attended) completed data collection questionnaires. Four of the students who did not complete questionnaires were absent from the teaching and the other four did not wish to participate in the study and refrained from completing a questionnaire.

In addition to the 130 medical student returns 22 nursing students who had volunteered to attend the sessions also completed forms, therefore the total number of forms analysed was 152 (86% medical students and 14% nursing students).

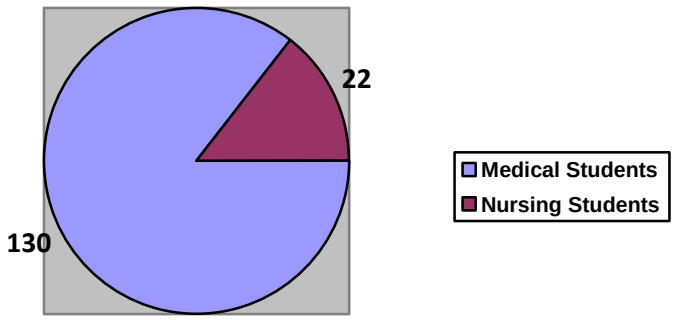


Figure 18: Numbers of medical and nursing students who completed a questionnaire.

6.1. Questionnaire Section 1

Section 1 of the questionnaire was based on 10 statements relating to the learning outcomes, student engagement with the sessions, feedback and general overview of the sessions from the students' perspective. Students were asked to rate each of the statements Likert scale of 1 (Not at all) to 5 (To a large extent). See Appendix 11.7 for a copy of the Questionnaire. The responses were entered into SPSS 17 and analysed using a parametric approach to analyse descriptive statistics, arithmetic mean and standard deviation in order identify how much scores deviate from the mean as well as a measure of spread of the scores. Also, in order to identify differences between the two groups independent samples t-tests were used to compare mean scores between medical and nursing students for each of the 10 statements. The independent t-test is an inferential test designed to state whether a difference between means of two samples is due to the effect of sampling or a true difference between the sample populations (Pallant, 2010). The results are displayed in table form and relate to the following statements:

'*The RADAR Practical Sessions (Afternoon) –*

1. *Had clear learning outcomes*
2. *Kept me actively involved*
3. *Were relevant to my learning needs*
4. *Were appropriate for my level of experience*
5. *Was challenging without being threatening*
6. *Helped me to integrate theory and practice*
7. *Stimulated my interest*

8. *Encouraged me to think through a clinical problem myself*
9. *Provided me with effective feedback*
10. *Increased my readiness to use what I have learned in the clinical setting*

Table 7: The RADAR Session had clear learning outcomes:

There were four learning outcomes for the session:

1. Demonstrate patient assessment using the ABCDE approach
2. Demonstrate how to record and calculate a SEWS score
3. Discuss the importance of early qualified clinical help during an acute/patient deterioration episode.
4. List the contents of SBAR and discuss importance of using this communication tool in early rescue of acutely ill patients.

	Medical Students	Nursing Students	Combined
Mean score	4.36	4.31	4.36
Standard Deviation	0.73	0.77	0.74

Table 8 shows that students overall tended to respond that the learning outcomes were clear, since all the means were over 4. The medical students seemed slightly more positive than the nursing students. An independent samples t-test was conducted to compare the scores for the two groups. There was no statistically significant difference between medical students (M=4.36, SD=0.73) and nursing students (M=4.31, SD=0.77; t (150) =0.29, *p= 0.76.*

Table 8: The RADAR sessions kept me actively involved:

	Medical Students	Nursing Students	Combined
Mean score	4.68	4.18	4.61
Standard Deviation	0.59	0.79	0.65

Overall, the combined mean of 4.61 indicates a high degree of satisfaction amongst the participants. This table demonstrates a statistically significant difference between the medical students (M=4.68, SD=0.69) and the nursing students (M=4.18, SD=0.79; t (150) =3.48, P<0.001. The medical students were significantly more positive about the extent to which the RADAR sessions kept them actively involved. This difference is supported by anecdotal evidence during the RADAR sessions where the nurses tend to stand back from the patient and allow the medical students to carry out the tasks as a group. In addition some nursing students commented in the free text section of the questionnaire that the 'sessions were for medical students'. These responses will be discussed later in the dissertation.

Table 9: The RADAR sessions were relevant to my learning needs:

	Medical Students	Nursing Students	Combined
Mean score	4.67	4.18	4.60
Standard Deviation	0.58	0.85	0.65

Again the combined mean of 4.60 indicates a high degree of satisfaction with the programme in relation to learning needs. There is a statistically significant difference between the medical student scores (M=4.67, SD=0.58) and the nursing students (M=4.18, SD=0.85; t (150) = 3.40, p<0.001. The medical students were more likely to say that the RADAR sessions were relevant to their needs as they had felt more actively involved in the sessions than the nursing students. Once again this will be discussed in more detail later in the dissertation. It is interesting to note that as a group the nursing students are not quite as positive as the medical students in valuing the RADAR sessions in terms of their learning. This might be related to the

previous statement where nurses view the sessions as ‘designed for medical students’ or it might be due to the fact that some nursing students see simulation based learning as inferior to real clinical learning. This has been suggested by some nursing students during or after the sessions, but not recorded.

Table 10: The RADAR Sessions were appropriate for my level of experience:

	Medical Students	Nursing Students	Combined
Mean score	4.60	4.18	4.54
Standard Deviation	0.64	0.73	0.66

Once again, the combined mean of 4.54 points to general satisfaction here. However, there were statistically significant difference in the scores of medical students (M=4.60, SD=0.64) and nursing students (M=4.18, SD=0.73; $t(150) = 2.78$, $p<0.006$ which indicates that medical students were more positive about the sessions being appropriate to their level of experience. This may be explained by the levels of real clinical experience being different between the two groups. The nurses were in year 3 of their programme having spent 50% of their time in class and the other 50% in clinical placements. This is the first opportunity that medical students have to consolidate what they have had in terms of theory with clinical practice, albeit in simulation. Conversely, some of the student nurses sometimes find engaging with simulation after three years of real clinical practice less meaningful.

Table 11: The RADAR sessions were challenging without being threatening:

	Medical Students	Nursing Students	Combined
Mean score	4.58	4.40	4.55
Standard Deviation	0.71	0.73	0.71

These overall scores are once again very positive. There is no significant difference between the scores for medical students (M=4.58, SD=0.71) and the nursing students (M=4.40, SD=0.73; t (150) = 1.09, p = 0.275. This means that medical students and nurse students did not differ in their response here. The nature of clinical deterioration, assessment and response are challenging and it is appropriate that the students completing the sessions should feel challenged if we are to replicate as close as possible real life. However, as the results above demonstrate it is possible to achieve this challenge without perceived threat to the medical and nursing students.

Table 12: The RADAR session helped me to integrate theory and practice:

	Medical Students	Nursing Students	Combined
Mean score	4.64	4.45	4.61
Standard Deviation	0.59	0.59	0.59

The medical and nursing students did not differ in their responses to this statement. The results for statement 6 suggest that the realism of the simulation combined with the context of a ward setting is helping the students to integrate the theory they have learned with the simulated clinical practice. There was no statistically significant difference between the medical students scores (M=4.64, SD=0.59) and those of the nursing students (M=4.45, SD=0.59; t (150) = 1.39, p <0.164. Again this is interesting and suggests that the sessions are at an appropriate level for students from both professions to gain something in terms of integration of theory and practice. This is a positive step towards thinking about the impact of RADAR on learning as well as confidence.

Table 13: The RADAR session stimulated my interest:

	Medical Students	Nursing Students	Combined
Mean score	4.70	4.13	4.61
Standard Deviation	0.56	1.12	0.69

Again the mean scores are for both groups are high. The student responses differed in this statement relating to interest in the sessions with the medical students being more positive than the nursing students. There is a statistically significant difference between the medical students (M=4.70, SD=0.56) and nursing students (M=4.13, SD=1.12; t (150) = 3.70, p <0.001. One possible reason may be a result of the nursing students' observed lack of engagement in simulation. The student nurses have spent 50% of their course in the classroom and 50% in clinical practice. They have had limited exposure to simulation as opposed to the medical students who have experienced it from early in their course. This may point to a need to make RADAR match clinical practice as much as possible and is an important point which is discussed later in the dissertation in terms of realism.

Table 14: The RADAR session encouraged me to think through a clinical problem myself:

	Medical Students	Nursing Students	Combined
Mean score	4.60	4.45	4.58
Standard Deviation	0.64	0.59	0.63

Once again there was no difference in the students' response to this statement. This is demonstrated in there being no statistical difference between the mean scores for medical students (M=4.60, SD=0.64) and the nursing students (M=4.45, SD=0.59; t (150) = 1.02, p<0.305.The sessions are designed so that the student is being

themselves i.e. they are acting as a third year student. In other teaching sessions out with AMUWSE and RADAR students may be asked to role play a more senior role, e.g. conduct an interview with a patient as a Foundation Doctor. This does not happen in the RADAR sessions and so students are encouraged to think and make decisions as they would in a real life clinical situation.

Table 15: The RADAR session provided me with effective feedback:

	Medical Students	Nursing Students	Combined
Mean score	4.44	4.00	4.38
Standard Deviation	0.64	0.59	0.63

The students' response to statement 9 were different in terms of their perception of feedback after the sessions. Effective feedback is a crucial element of the RADAR sessions and it is imperative that the students perceive that they have been given feedback which they can use. There is a statistically significant difference between the medical students (M=4.44, SD=0.64) and nursing students (M=4.00, SD=0.59; $t(150) = 3.01$, $p = 0.003$. This may mean that the some nurses may be less positive about the feedback because they see the feedback as being directed towards the medical students. In either scenario, this is of concern to the author and will be addressed later in the dissertation.

Table 16: The RADAR session increased my readiness to use what I have learned in the clinical setting:

	Medical Students	Nursing Students	Combined
Mean score	4.46	4.31	4.44
Standard Deviation	0.71	0.71	0.71

This final statement relating to being ready to use what had been learned during the RADAR sessions in clinical practice did not demonstrate any differences in the students' responses. This statement relates to the students' perception of simulation facilitating transferability to the clinical setting and is an important issue in simulation based learning. There is no statistically significant difference between the scores of the medical students (M=4.46, SD=0.71) and the nursing students (M=4.31, SD=0.71; t (150) = 0.91, p = 0.360).

In summary, the responses were generally very positive. They were all over 4.00, which indicates that the students' were confident that the sessions were helping them. There are statistical differences between medical and nursing students in relation to:

- Being kept involved
- The relevance and appropriateness of the RADAR sessions
- The level of interest and feedback.

There are no statistical differences between the two student groups in terms of:

- The learning outcomes
- The sessions being challenging, but not threatening
- The integration of theory and practice
- The ability to think through problems and the readiness to use the learning and confidence from the RADAR sessions when in clinical practice.

6.2. Questionnaire Section 2

Section 2 of the questionnaire was designed to identify the students' confidence in relation to specific aspects of the sessions and was based on seven statements rated on a Likert Scale of 1 (No Knowledge) to 5 (Greater Knowledge). In order to identify whether there were significant in the previous section we compared medical and nursing students (two groups). Ion this section we wish to compare means over three time periods in order to identify if there is a change in students' confidence as a result of the RADAR intervention. Statistical procedures such as a t-test that concern the comparison of two populations cannot usually be applied to three or more populations. To study more than two populations at once, we need different types of statistical tools. Analysis of variance, or ANOVA, is a technique from statistical inference that allows one to deal with several populations (Pallant, 2010). In order to identify any impact on students' confidence over the progression of the day's activities they were asked to respond to the following 10 statements:

'My confidence in my knowledge in relation to:'

1. *The ABCDE Approach*
2. *What to do when I am 'in over my head' during an acute episode*
3. *How to interpret observed rapid changes in a patient's condition*
4. *Effective communication during an acute episode*
5. *Getting help from senior colleagues during an acute episode*
6. *Approach to the specific emergency covered in this session*
7. *Using SEWS and SBAR to assess and call for help.*

Results for the combined group of medical and nursing students (N=152)

Mean scores were calculated for the entire group of participants. A one-way repeated measure ANOVA was conducted using SPSS17 to compare scores at

Time 1 (Pre AMUWSE), Time 2 (Post AMUWSE) and Time 3 (Post RADAR). The means and standard deviations are presented in table 18.

Table 17: Based on response to confidence in knowledge of the ABCDE Approach (Whole group – medical and nursing students):

Time Period	N	Mean	Standard Deviation
Time 1 (Pre AMUWSE)	152	3.37	0.88
Time 2 (Post AMUWSE)	152	3.61	0.84
Time 3 (Post RADAR	152	4.59	0.624

It can be seen that the mean scores rose following each of the sessions. In order to ascertain whether these changes might have arisen by chance, a one-way, repeated-measures ANOVA was conducted. There was a significant effect for time, Wilk's lambda = 0.31, F (2,150) = 167.18, p <0.001, partial eta squared =0.69 demonstrating that the confidence scores increased over the day. This is a very large effect size, based on the guidelines given in Cohen (1988, p247): 0.01= small, 0.06= moderate, and 0.14= large effect. Tests were also conducted to see if these differences were significant across all time periods. Table 5.1A shows the results.

Table 18: The Pairwise Comparisons based on ABCDE Approach Measure (Whole Group):

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.243*	.054	.000	-.373	-.114
	3	-1.217*	.075	.000	-1.398	-1.036
2	1	.243*	.054	.000	.114	.373
	3	-.974*	.056	.000	-1.109	-.838
3	1	1.217*	.075	.000	1.036	1.398
	2	.974*	.056	.000	.838	1.109

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni. (Copied from SPSS18 Data Set).

These findings showed that the gains between all time periods were significant. That is, students' responses were more positive after the morning session, and they became more positive again after the afternoon session. The same statistical tests were conducted for the remaining statements with each demonstrating a statistically significant change over the period of the intervention. For ease of reading the results for the statements are collated and presented in tabular form.

Table 19: The Combined Group results showing the mean, standard deviations and Wilk's lambda and eta squared for each statement:

Statement	Time 1		Time 2		Time 3		Wilk's			
	M	SD	M	SD	M	SD	Value	F (2, 50)	*p*	Eta squared
1. The ABCDE Approach	3.37	0.88	3.61	0.84	4.59	0.62	.31	167.18	.000	.69
2. What to do when I'm in over my head	2.63	1.12	3.26	1.03	4.20	0.74	.28	192.05	.000	.71
3. How to interpret observed rapid changes in the patient	2.81	0.96	3.31	0.90	4.26	0.75	.31	159.98	.000	.68
4. Effective communication during an acute episode	2.86	0.98	3.50	0.92	4.34	0.72	.283	189.92	.000	.71
5. Getting help from senior colleagues	2.89	1.11	3.51	1.06	4.43	0.75	.332	150.63	.000	.66
6. Approach to the specific emergencies covered	2.70	0.87	3.34	0.88	4.30	0.68	.262	211.02	.000	.73
7. Using SEWS and SBAR to call senior help	2.82	1.08	3.47	1.01	4.49	0.81	.332	150.64	.000	.66

It is worth noting that the effect sizes (right hand column) were consistently very high. Effect size is a measure of the magnitude of the changes – in this case, it can be viewed as the *educational* significance of the results. These would seem to indicate that from an educational perspective, the RADAR course has been successful in achieving its aims.

Results for the medical students (N=130)

As with the whole group data set, a one-way repeated measures ANOVA was conducted to compare scores on the medical students' confidence in knowledge reports at Time 1 (Pre AMUWSE), Time 2 (Post AMUWSE) and Time 3 (Post RADAR). The means and standard deviations are presented in table 21.

Table 20: Based on response to confidence in knowledge of the ABCDE Approach (Medical Students):

Time Period	N	Mean	Standard Deviation
Time 1 (Pre AMUWSE)	130	3.38	0.07
Time 2 (Post AMUWSE)	130	3.60	0.85
Time 3 (Post RADAR	130	4.60	0.64

Pairwise comparisons were then carried out which demonstrated significant changes over the three time periods.

Table 21: The Pairwise Comparisons based on ABCDE Approach Measure (Medical Students):

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.215*	.060	.001	-.360	-.070
	3	-1.215*	.082	.000	-1.415	-1.015
2	1	.215*	.060	.001	.070	.360
	3	-1.000*	.062	.000	-1.150	-.850
3	1	1.215*	.082	.000	1.015	1.415
	2	1.000*	.062	.000	.850	1.150

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni. (Copied from SPSS18).

In line with the tests conducted for the whole group, multivariate tests on the medical student data set demonstrated that there was a significant effect for time, Wilk's lambda = 0.31, F (2,128) = 142.03, p <0.001, partial eta squared =0.68, which is a very large effect size. This indicates that that the gains between all time periods were significant. That is, students' responses were more positive after the morning session, and they became more positive again after the afternoon session.

Table 22: The medical students' results showing the mean, standard deviations and Wilks lambda and eta squared for each statement:

Statement	Time 1		Time 2		Time 3		Value	F (2, 128)	*p*	Eta squared
	M	SD	M	SD	M	SD				
1. The ABCDE Approach	3.38	0.87	3.60	0.85	4.60	0.64	.311	142.03	.000	.68
2. What to do when I'm in over my head	2.58	1.13	3.22	1.04	4.22	0.75	.279	165.05	.000	.72
3. How to interpret observed rapid changes in the patient	2.78	0.94	3.31	0.87	4.29	0.66	.312	141.06	.000	.68
4. Effective communication during an acute episode	2.77	0.97	3.41	0.92	4.28	0.74	.284	161.69	.000	.71
5. Getting help from senior colleagues	2.81	1.12	3.44	1.08	4.40	0.77	.330	129.67	.000	.67
6. Approach to the specific emergencies covered	2.66	0.84	3.28	0.87	4.31	0.68	.245	196.95	.000	.75
7. Using SEWS and SBAR to call senior help	2.70	1.06	3.38	1.03	4.46	0.84	.315	138.92	.000	.68

Once again the table above shows high effect sizes in the Eta squared column indicating that student responses were more positive after the morning session, and they became more positive again after the afternoon session.

Section 3 presents the results for the same statistical tests (as conducted on the whole group and medical student group) for the nursing students' data set.

Results for the nursing students (N=22)

A one-way repeated measures ANOVA was conducted to compare scores on the medical students' confidence in knowledge reports at Time 1 (Pre AMUWSE), Time 2 (Post AMUWSE) and Time 3 (Post RADAR). The means and standard deviations are presented in table 24.

Table 23: Based on response to confidence in knowledge of the ABCDE Approach:

Time Period	N	Mean	Standard Deviation
Time 1 (Pre AMUWSE)	22	3.27	0.93
Time 2 (Post AMUWSE)	22	3.68	0.78
Time 3 (Post RADAR	22	4.50	0.51

Table 24: The Pairwise Comparisons based on ABCDE Approach Measure (nursing students):

(I) Time	(J) Time	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
1	2	-.409*	.107	.003	-.688	-.130
	3	-1.227*	.173	.000	-1.678	-.777
2	1	.409*	.107	.003	.130	.688
	3	-.818*	.125	.000	-1.145	-.492
3	1	1.227*	.173	.000	.777	1.678
	2	.818*	.125	.000	.492	1.145

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni. (Copied from SPSS18).

In line with the tests conducted for the whole group and medical students data, multivariate tests on the nursing student data set demonstrated that there was a significant effect for time, Wilk's lambda = 0.28, F (2,20) = 25.01, p <0.001, partial eta squared =0.71, a very large effect size.

Table 25: The nursing students' results showing the mean, standard deviations and Wilk's lambda and eta squared for each statement:

Statement	Time 1		Time 2		Time 3		Wilk's			
	M	SD	M	SD	M	SD	Value	F (2, 20)	*p*	Eta squared
1. The ABCDE Approach	3.27	0.93	3.68	0.78	4.50	0.51	.286	25.01	.000	.71
2. What to do when I'm in over my head	2.95	1.04	3.50	0.96	4.14	0.71	.191	42.47	.000	.80
3. How to interpret observed rapid changes in the patient	2.95	1.09	3.32	1.08	4.05	1.17	.310	22.13	.000	.69
4. Effective communication during an acute episode	3.36	0.90	4.05	0.65	4.73	0.45	.269	27.10	.000	.73
5. Getting help from senior colleagues	3.41	0.98	3.95	0.84	4.64	0.58	.281	25.60	.000	.71
6. Approach to the specific emergencies covered	2.91	1.06	3.64	0.90	4.23	0.75	.354	18.21	.000	.64
7. Using SEWS and SBAR to call senior help	3.55	0.96	3.95	0.72	4.64	0.58	.371	16.95	.000	.62

The figure below shows the partial eta squared for each of the 7 statements. This is a measure of the magnitude of a statistically significant change. Based on Cohen's Scale (Pallant, 2010) the nursing students show greater changes in terms of what to do when overwhelmed (Statement 2) and when to call for senior help during an acute episode (Statement 5). Conversely the scores for managing the specific emergencies (Statement 6) and using SEWS and SBAR (Statement 7) are slightly lower than those of the whole group and medics. There may be a number of reasons for this but the most likely is that the nursing students have not had experience of deteriorating patients in real life practice. It is common for students to be sent to do

other things when someone becomes unwell which of course means that their exposure is restricted. SEWS and SBAR are tools which the students should be familiar with. Anecdotal evidence and evidence from clinical audit (NHS), suggests that there are issues surrounding the completion of SEWS charts in clinical practice as well as suggesting that rather than being used as an emergency communication tool, SBAR is being used routinely in clinical areas. This can cause confusion and is something which will be discussed later in the dissertation.

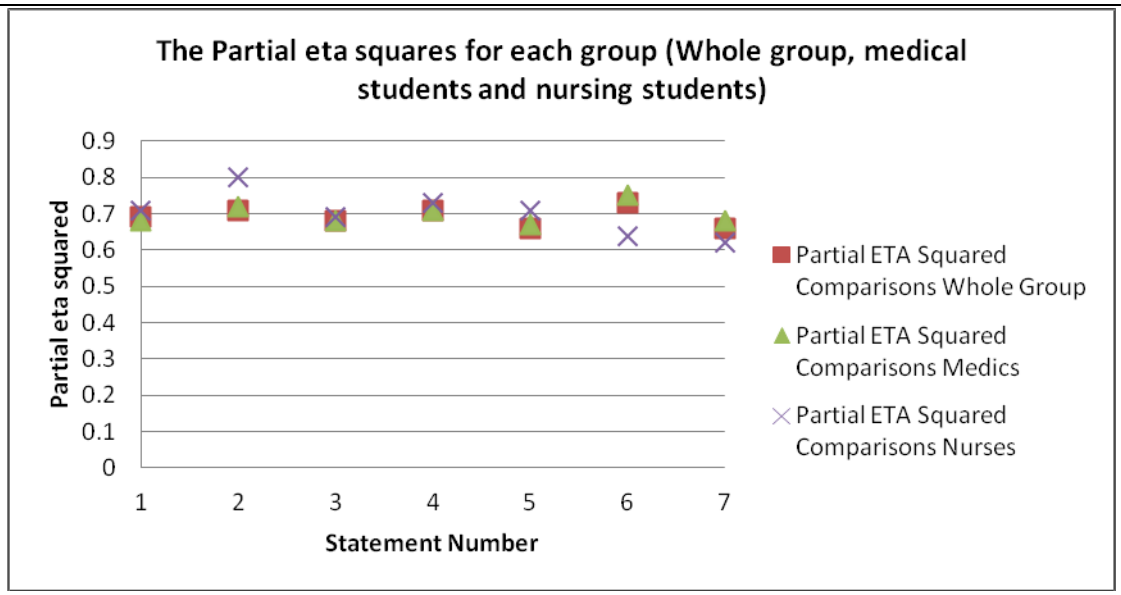


Figure 19. Comparison of effect sizes for whole group, medical students and nursing students

6.3. Questionnaire Section 3

The following results relate to the free text section of the questionnaire were analysed using the method previously described by Pope, Ziebland and Mays (2000).

Stage 1 Familiarisation - The start of this process involved the author in reading and re-reading the questionnaire responses and typed focus group transcripts to give a general indication of the themes and categories of information emerging from the answers e.g. particular phrases such as '*The ABCDE approach was most useful'*.

Stage 2 Identifying a thematic framework - the second stage was to allocate themes which developed from the phrases e.g. '*The most important bit was being able to use SBAR in a real life setting'* would be themed as 'SBAR' as this was the key word in the student's response. Grids were developed with student responses in one column and a space for code in the second, a key to codes was developed by the author and printed then analysed identifying any recurring codes.

Stage 3 Indexing – The codes were then placed onto an index system with the statements from students relating to SBAR for example all on one sheet. Some statements included more than one theme so this was recorded on the index sheets.

Stage 4 – Charting – Each theme then had a chart which had all of the statements from the students written on it giving supporting evidence of the theme. These charts were then used in the final stage of the analysis.

Stage 5 – Mapping and interpretation – At this stage the author had what he thought were the themes from the student responses. In order to increase the rigour and introduce some detailed analysis associations between the themes had to be identified; did the responses match with the objectives of the sessions and the research? Were the themes which emerged congruent with the content of the day?

The final themes were then distributed amongst three colleagues who were familiar with the AMUWSE & RADAR sessions to achieve some corroboration. All were asked to review the themes independently and respond by agreeing or disagreeing with the author's interpretation. Should there have been any discrepancy, a process of reflection and discussion between the three co-raters would have been organised to achieve consensus.

The students' written responses were analysed by the author to stage 4 at which point the coded extracts were then given to three independent verifiers to confirm that the codes were relevant. Each of the verifiers was a member of staff in the Clinical Skills Teaching Team who had facilitated or was familiar with the AMUWSE and RADAR sessions. The data were then entered in Microsoft Excel which was used to analyse numbers and produce the bar charts which follow. There were some minor discrepancies on the coding of 'communication' and 'seeking help' but raters reached consensus after some reflection and discussion.

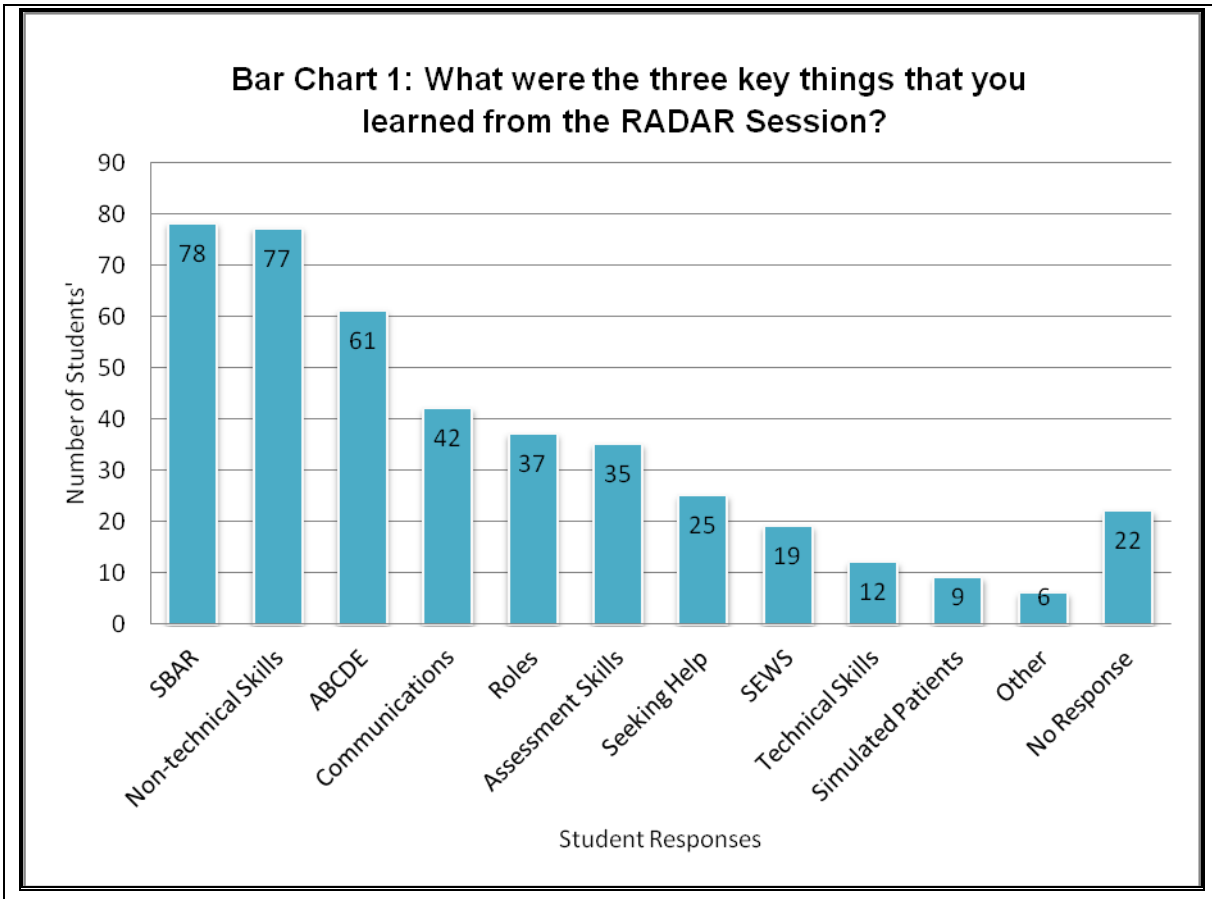


Figure 20: Graph showing the three key things students learned from the RADAR session

SBAR = Situation, Background, Assessment, Recommendation. ABCDE = Airway, Breathing, Circulation, Disability, Evidence. SEWS = Standardised Early Warning Score.

Figure 21 indicates that the key things learned during the RADAR sessions relate to the appropriate use of the SBAR tool to call for senior help (n=78), non-technical skills (situational awareness, decision making, team work) (n=77) and the use of the ABCDE approach in assessing the patient. At the lower end of the scale we see technical skills (pulse, blood pressure) (n=12) and other (non-specific responses) (n=6) which is what one would expect as both groups of students have been taught and have practised these technical skills since year 1 of their respective programmes.

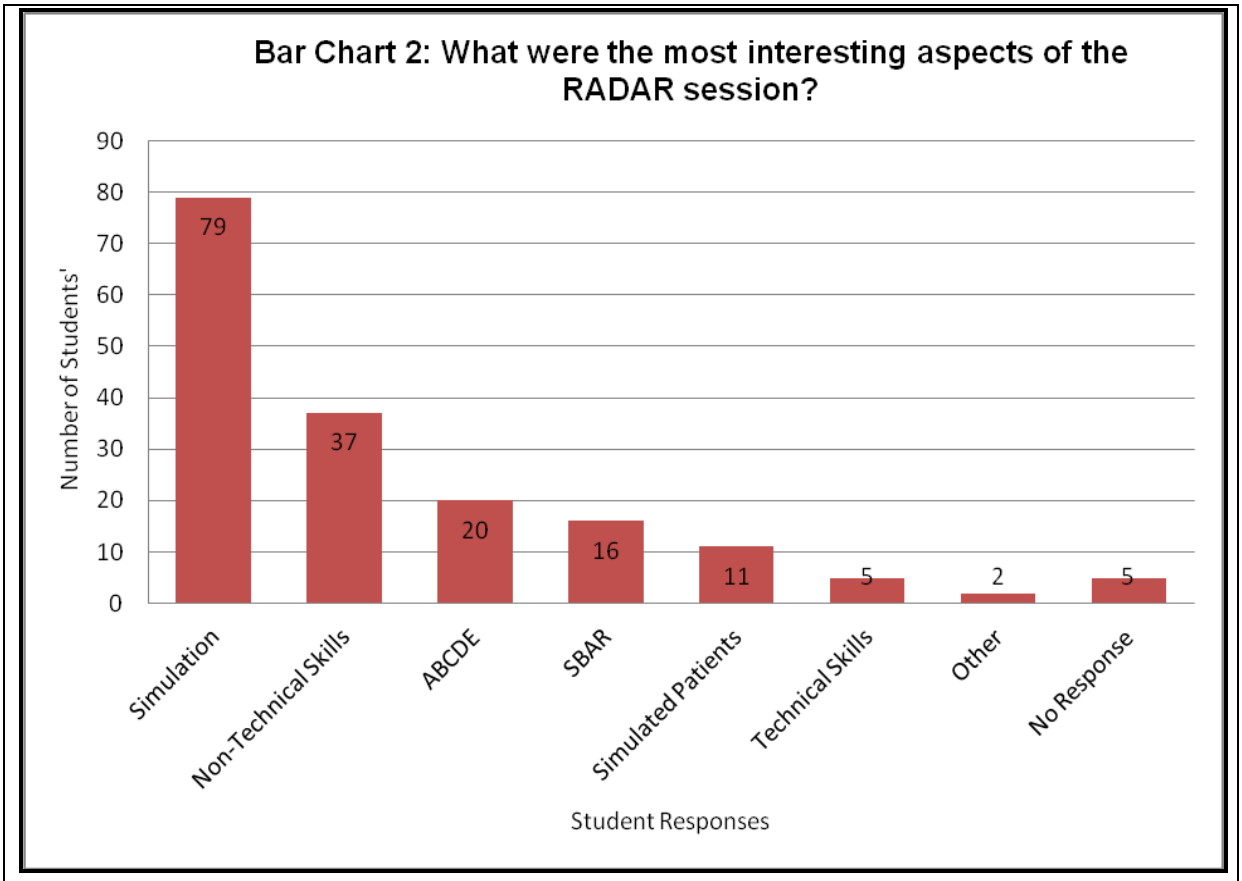


Figure 21: Graph showing results of the most interesting aspects of the RADAR session.

Non-Technical skills = communication, situational awareness, teamwork etc. Technical skills = blood pressure measurement, pulse etc.

Figure 22 displays that the students appreciate the use of simulation based learning (n=79) and the opportunity to practice non-technical skills (n=37) this is a good indicator that using simulation based education is an advantage. Once again technical skills (n=5) and other (n=2) were at the opposite end of the scale. This may be due to the fact that the students' are learning less technical skills.

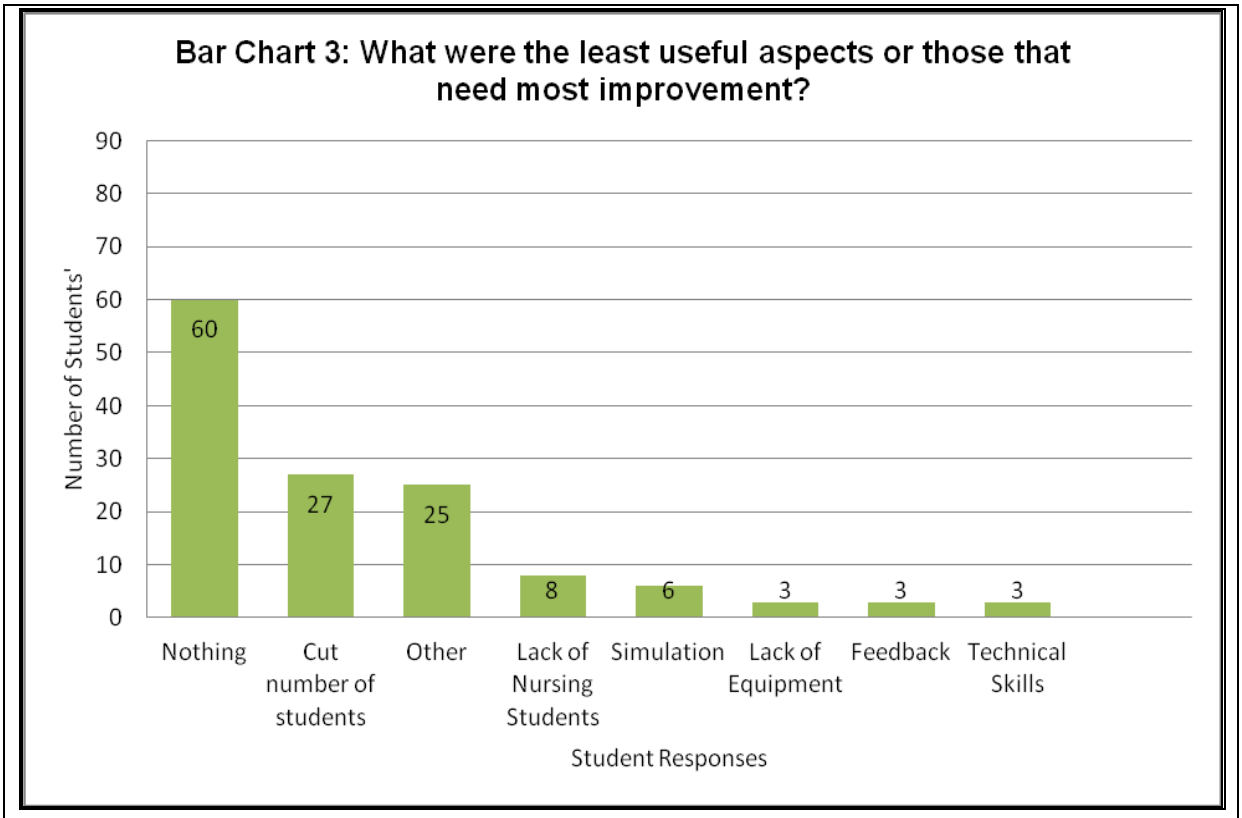


Figure 22: Graph showing the results of the least useful aspects or those that need most improvement.

In Figure 23 the interesting and encouraging point is that 60 students would not change anything in the sessions. Reducing the numbers of students at each session (n=27) is a pertinent point and it is surprising that higher numbers of students did not raise this as an issue. During the sessions there were approximately 10 students per patient. This is totally unrealistic and can impact negatively on the students' experience. This and the comments relating to student nurse numbers will be discussed further in the Recommendations section.

In summary, the key findings of the questionnaire were:

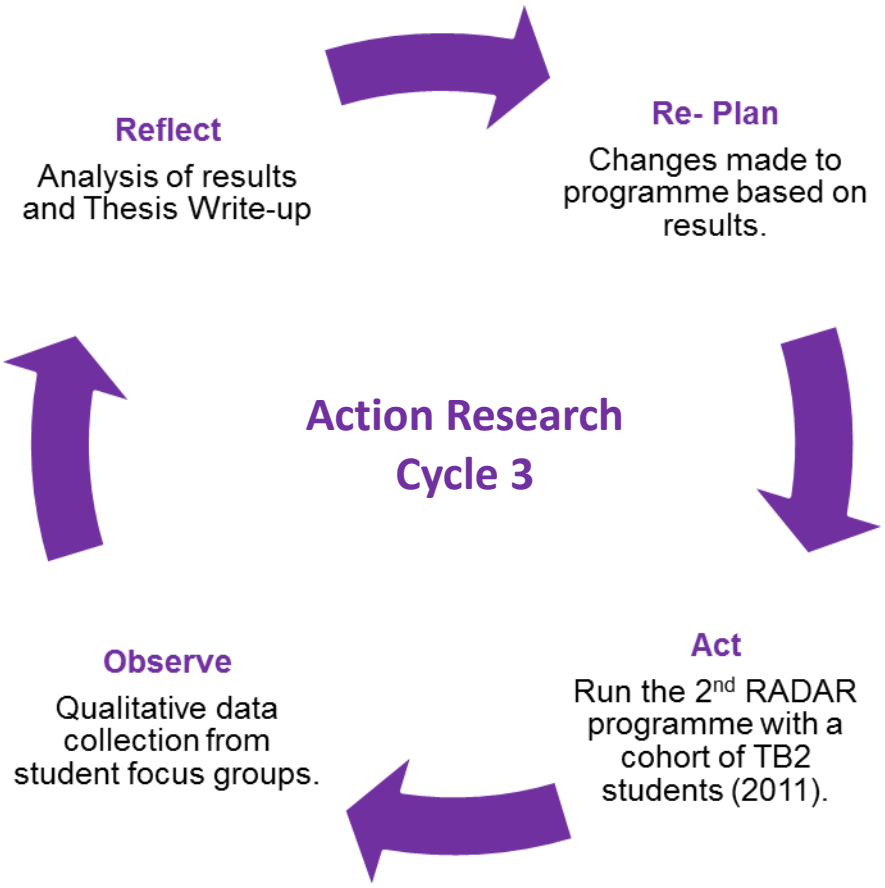
1. There were statistically significant changes reported in students' confidence over the period of the day's sessions starting with the AMUWSE and then

the RADAR scenarios. The students' mean scores for the questions relating to the content of the day's activities were all 4 and above which demonstrates that the students rated the sessions with a high degree of satisfaction.

2. The effect sizes (Partial eta squared) were consistently very high. Effect size is a measure of the magnitude of the changes – in this case, it can be viewed as the *educational* significance of the results. These would seem to indicate that from an educational perspective, the RADAR course has been successful in achieving its aims.
3. The learning outcomes; the sessions being challenging, but not threatening; the integration of theory and practice; the ability to think through problems; and the readiness to use the learning and confidence from the RADAR sessions when in clinical practice were all seen by both groups of students as relevant and appropriate for their practice. This is a positive finding in terms of the impact of RADAR on learning as it suggests that it is at a level commensurate with the students' knowledge and skills.
4. Being kept involved; the relevance and appropriateness of the RADAR sessions; and the level of interest and feedback were statements where there were statistically significant differences between the student groups. This is interesting and is an issue which will be addressed later in the dissertation.
5. In terms of the educational underpinning of the sessions the results suggest that RADAR is set at an appropriate level to achieve the aims and outcomes.
6. In relation to the clinical aspects of recognising and responding to clinical deterioration (ABCDE approach, teamwork, SEWS, SBAR etc.) there were

significant, positive changes identified over the three time periods. This is important and demonstrates that the scenarios are realistic, relevant and appropriate for the students' knowledge and skills.

Action Research Cycle 3



7. Findings from the Small Group Interviews (2011)

7.1 Introduction

Following the RADAR sessions in June 2011 I wished to find out from the students their thoughts and feelings of the sessions. I had already gathered information on the educational content and process of RADAR through the quantitative data gathered from the questionnaire from the cohort in 2010. However, I also wished to explore further the issues raised in relation to perceived learning, impact of simulated patients and moulage as well as the students future involvement in RADAR. In order to gather comprehensive data and ensure triangulation I chose to carry out small group interviews. The unit of analysis for this part of the project is the transcribed text describing students' experiences of RADAR. The context consists of two previous cycles of action research in which the programme was developed and then subtle changes made based on the findings of the student questionnaire. This series of interviews was being undertaken following the second cohort of students' completion of the AMUWSE and RADAR sessions in 2011 when three small group interviews were held.

There were 8 students in total who volunteered to attend from a cohort of 135, 3 male and 5 female all aged under 25. The interviews were held on three occasions with each interview lasting 45 – 60 minutes. The verbatim transcriptions of the interviews were analysed by manual analysis due to the small number involved (8 students).Due to the small numbers I chose to analyse the data using Qualitative description which has been described as:

> "QD differs from other qualitative methods in several ways. Firstly, in terms of analysis, the aim of QD is neither thick description (ethnography), theory

> development (grounded theory) nor interpretive meaning of an experience (phenomenology), but a rich, straight description of an experience", (Neergaard, Olesen, Andersen & Sondergaard, 2009 p 53).

When reporting the results of QD the researcher must stay close to the data and describe the participants' responses using similar language. Used in collaboration with quantitative data it is useful for intervention development, refinement of ideas and as used here to capture insider perspectives (Sandelowski, 2000). Therefore in this section I will give a description of what the students said during the small group interviews, followed by the themes which have been identified. In the descriptions (F) refers to a female student and (M) to male with their allocated number i.e. (F4) refers to female student number 4. The findings are given based on the structured questions used during the interviews which were:

1. What were your initial thoughts and feelings on the AMU WSE and RADAR teaching sessions you have just finished?
2. Can you think of anything you have learned from participating in the AMU WSE?
3. Can you think of anything you have learned from participating in the RADAR session?
4. Do you feel more confident in knowledge, skills or attitudes since completing the AMU WSE and RADAR?
5. What was the impact on your learning of using real people rather than manikins during the RADAR session?
6. How do you think the moulage impacted on your learning during the RADAR sessions?
7. How do you think we should teach RADAR in the curriculum in the future?

8. Would you be willing to attend RADAR sessions during your year 4 placements?
9. Would you recommend RADAR to other students? Why?
10. Is there anything you would change in the AMU WSE or RADAR?

1. What were your initial thoughts and feelings on the AMUWSE and RADAR teaching sessions you have just finished?

All of the students reported finding the sessions interesting and fun. Two reported having been nervous and anxious about attending the sessions as it was their first experience of immersive simulation. However they both stated that these feelings soon diminished once they started the scenarios "Beforehand *it was quite a nervous thing 'cause it's the first ward simulation ever, but we were guided through it very well, and at the end I really enjoyed it"* (F2), "*I felt terribly out of my depth as this is the first time we had done anything like this, but it was comforting and reassuring and coming to the end really exciting!"* (M4). Two students specifically mentioned feeling more confident at the end of the scenarios, one on terms of practical skills "*I had confidence that I could be doing these things soon as a fourth year"* (M1), and one in terms of personal learning "*This is definitely a positive step in helping me become confident in my learning(F5).* Five of the eight students reported the positive impact to the simulation and simulated patients in terms of realism e.g. "*It felt real, nurses, patients, ward set-up, actually doing things in real time…and no one broke character"(F7).* One student made specific reference to the difference between a manikin and the simulated patients in terms of engagement and realism, "It *was very positive…and the fact that we weren't using manikins made it" (F3).* Two of the students made reference to the session being challenging, i.e. "*We got pushed*

enough at the stations, putting on oxygen for the first time, and actually having to do it on a real person, was kind of, well…freaky" (F5), "It was kinda scary thinking wow I need to be able to do these things for real…soon" (F6). The last point raised by the students was that they wanted longer at each station and that the sessions should be more often during the curriculum.

2. Can you think of anything you have learned from participating in the AMU WSE

Two of the students stated that the most important thing they had learned from the sessions was about putting together what they had learned in the past in terms of history and examination i.e. *"Practising taking a brief history and combined examination …being able to condense history and examination and do it quickly"* (M1), and " *Confidence that I can approach a patient, examine them, take a history and then do something useful, rather than just say thanks and walk away as we have been doing up till now"* (F3). Two others referred to what they had learned about teamwork thus "*The practicalities of working in a team…this is the first time we've worked alongside nurses and found out exactly what they do and how we split up the roles"* (F2); "*I am starting to learn how to work in a team with nurses because I was unsure what each person does and what point you involve everybody in the care"* (F5). Three of the students identified that they had learned about their own role in the acute setting, "*It was really good to know what I can and can't do…like when I needed to get a doctor to sign for medicines or test forms needed signed off*" (M4); *"It was realising the difference in an acute situation…like when my patient needed oxygen and the nurse said well you need to give…I thought jeez I know how much but having to actually think well do it"* (F6); and *"I think I learned most about my role as a student and what I can and can't do" (F7).*

3. Can you think of anything you have learned from participating in the RADAR session?

Three students referred to using the ABCDE approach as follows "*I actually know we've been doing ABCDE for 3 years now but it didn't make much sense till now, and having to adapt it to a real patient and do it quickly" (M1); "I think that I learned to be more confident in approaching patients who are actually critically ill. I also learned that as well as ABC there's a lot of other things to deal with" (M4)* and *"I particularly learned to trim down my history taking because my first patient was coughing up blood so you think, well ABC is the priority here" (F5). Three other students talked about non-technical skills, 1 in terms of situation awareness; "It seems a small thing but taking the environment into consideration, for example, the second patient I saw had the hand gel and a bottle of coke hidden under her pillow, we thought she was drunk but couldn't work out how till we saw that (F7),* and 3 in terms of decision making as *"It was things like when do I call for someone senior, to take charge and direct us" (F2); "I learned how to set priorities first, for example, when you go in the first thing is not getting a history but to assess the patient and notice what is deteriorating" (M8) and "If the patient is clearly not doing well you need to get help, and don't be afraid to get it right at the start if you feel out of your depth" (F3).*

4. Do you feel more confident in knowledge, skills or attitudes since completing the AMU WSE and RADAR?

All students reported increased confidence in different aspects of the RADAR sessions, however three referred to the new experience of working with the student

nurses as "*I feel more confident now. I thought working with the nurses was great, we were able to figure out each other's roles, and learn to work with people so you're not alone"(F2); "I feel more confident about asking the nurses about, say, what form we need to fill in for bloods or the nurse would say you can't send that off like that or you need a doctor to sign that bit" (F3) and "I learned about what the nurses can do, like we had one student nurse who was really great and she was lovely, she would say like 'no I do that, you go and do the bloods"(M4).* Two of the students talked about RADAR giving them more confidence about going into year 4; "*I was warned about going into fourth year and feeling useless but having a day of looking after acute patients where I could get to grips with a few things, I just feel slightly more confident"(F5); "It's probably about taking what we learned to AMU on placement – the surroundings of a ward, having other groups there, like the patients and nurses and thinking about more than one patient" (M1) and "I feel more confident about going on the wards, at the start of the day it was a bit daunting but by the end I felt a lot better prepared"(F7).*Student 6 talked about learning to delegate and student 8 felt that they were more confident but still needed a lot of supervised practice.

5. What was the impact on your learning of using real people rather than manikins during the RADAR session?

Seven of the students stated that the real people (simulated patients) were superior to manikins for the RADAR session in terms of realism e.g. "*I think it was that thing of urgency, to be honest when you've got SimMan, OK it blinks, and it moans and it pukes, but it's not the same as a real person who genuinely looks in distress and has real fear in their eyes, which is what the simulated patients 'do really well" (F2); "I think people respond differently to real people rather than manikins, it's just your*

natural response when you see someone in agony or you see they're injured, I think it's just human nature to react and that doesn't happen with manikins" (M1); "I think if you've got manikins you feel a lot safer, I think that's the idea of them, but when you're faced with a real patient its someone you can connect to and you can see they're not doing so well so I have to do something now!" (F3). The final student talked about increased confidence achieved through the repeated practice of the RADAR scenarios as "*I definitely feel more confident, going from making mistakes we made in the first station, learning from it and taking it to the next station" (F6).*

6. How do you think the moulage impacted on your learning during the RADAR sessions?

All of the students stated that the moulage had increased the realism of the scenarios and so how they responded to the patient. However, one of the students summarised it nicely as "*We say that we look for this and that, but actually we don't really look at it, we just memorise it in our heads, but if we have a real patient with make-up like this it actually triggers us to focus on what we should look at" (M8).*

7. How do you think we should teach RADAR in the curriculum in the future?

All of the students felt that more RADAR sessions would be beneficial in each of the systems blocks of teaching in terms of skills fade; "*I definitely think it should be something at the end of each block, when you have an emergency you just forget everything, but if we had this you would start to remember it" (M4), " To be honest if you could fit RADAR into every block…the problem of forgetting what you've been taught during a real emergency would become less of a problem"(F2);* more practice, "*I think it was a good session and more would be good" (F6), "I think it is well placed*

where it is but having a full day with more patients would be beneficial"(F5), "To be honest I kinda wished we had more patient's, we had three in succession but I wouldn't have minded six because you would learn something new at each station" (M1) and reduced student numbers "*Smaller groups would be nicer and longer sessions would be nice too" (M8).*

8. Would you be willing to attend RADAR sessions during your year 4 placements?

All students responded positively to this question many simply as 'yes' but one student was more vocal stating that "*I would 'cause I just really, really enjoyed them and I think especially in fourth year it's important to keep on top of things so I would definitely be willing to attend, yup" (M1).*

9. Would you recommend RADAR to other students? Why?

All of the students would recommend RADAR for different reasons. Two talked about its impact on confidence as "*I would because I left the session feeling as though I was more confident and competent at doing things than I was before" (F2),"I would recommend it, probably to build up their confidence as we're all going to end up in situations like this, so the more exposure you can get" (F3).* Three discussed how RADAR simulation was preparation for future practice as "*Yes, I would recommend it, it gives you a chance to see how you would react in a situation that is made as life-like as possible, knowing that there is no chance of you doing any harm" (F5), "I would recommend it because it does as mentioned before, let you see how you would perform in these situations" (F6) and "Yeah I totally agree, it's a safe environment that you feel much more comfortable in and that you can make mistakes and improve on them" (F7).* Of the remaining 3 students, 2 talked about

RADAR allowing them to practise and revise knowledge and skills already gained through the curriculum "*I would, as I said before it's the closest thing to real life and encompasses everything we've learned" (M1), "Well I think RADAR is the only window for us to actually know what we are doing in the future and it actually reminds me what we have studied, so yeah" (M8).* Finally one student revealed that RADAR had identified his non-technical skills: *"Definitely, because it taught me so many things, one thing I was quite surprised at was leadership!"* (M4).

10. Is there anything you would change in the AMU WSE or RADAR?

In response to this question four of the students felt that more or longer sessions would be good "*Well, not really, as I said earlier we might do more sessions, but on the whole leave it all the same" (M1), "It would be good to have more throughout the year" (F7), "More would be good" (M4), "I suppose the session was a bit short, but in terms of what you learn and what you're doing I don't think there's anything noticeably worth complaining about" (F2).* Two felt that smaller groups would be preferable "*Yes, I think there should be smaller groups, but that would mean more patients and tutors, so probably just leave it as it is" (F3), "Smaller groups of that were possible, but in terms of content I wouldn't change anything"(F6).* One student wanted longer with each scenario "*Have a bit more time with each patient, follow them up a bit more, get them stable rather than just doing the acute part of it" (F5).* Finally, one student felt that pre-course reading would have helped "*It would be really great if we had some hand-outs to read or some experts sharing their experience at the beginning" (M8).*

7.6. Summary of Findings

The results of the focus group interviews provide further evidence that there are positive changes to the students' confidence on completion of the AMUWSE and RADAR sessions. Whilst some students reported feeling anxious and nervous prior to attending the sessions due to a fear of the unknown, this quickly passed when they realised that they were not expected to do things for which they were not prepared. With close supervision and support the students soon realised that by acting as themselves they were able to become more confident in approaching placements in year 4.

In terms of learning the main themes that emerged from the qualitative analysis were

- Development of student confidence in relation to acute care
- Enhancing previously learned skills in terms of applying the ABCDE approach to real people,
- Combining history and examination in an acute setting with limited time to find out important and relevant information,
- Practising non-technical skills such as team work, situation awareness and decision making as well as communication and identifying, through collaboration, the roles and responsibilities of themselves and the nursing students with whom they worked,
- Positive impact of simulated patients as opposed to manikins in terms of realism, reaction and interaction,
- Positive impact of moulage on helping to recognise the changes in physical appearance associated with clinical deterioration.

As far as the actual RADAR sessions were concerned the students described how their confidence had been increased due to perception fidelity through the use of simulated patients and moulage. The students were keen to recommend the sessions and attend further training in fourth year. They provided valuable information on how the sessions might be changed or adapted by suggesting that:

- The time for each scenario be increased,
- Smaller groups per scenario,
- More scenarios,
- Pre-course lecture and hand-outs,
- Enhance scenario so patient outcome is known.

This is of course one of the tenets of action research, that I as a researcher take note of what has been said, reflect and act. These small group interviews have given valuable data which enhances and supports that given in the questionnaire. This is important as it provides evidence that students find the sessions relevant, engaging and learner centred, all of which are crucial for adult learning. In the next section we will look at the analysis and synthesis of the combined results for the questionnaire and the small group interviews.

8. Analysis and Synthesis

8.1. Introduction

The purpose of this Action Research study was to explore with medical students the question '*How can simulation help medical students learn to recognise and respond to acute deterioration in adult hospital patients?'*

In this section the problem of clinical deterioration will be reviewed along with how this study was designed to address concerns regarding medical student preparation for their role in the assessment and management of clinical deterioration. This will be followed by analysis of the main findings, taking account of previous research in the field. Finally, there will be a discussion of how the findings from this project add to the body of knowledge on clinical deterioration and simulation.

Serious adverse events and unplanned admission to Intensive Care are frequently preceded by changes in physiological observations (Buist, Bernard, Nguyen, Moore, & Anderson, 2004). One study found that between 30% and 84% of patients who suffer a cardiac arrest show signs of deterioration in the 24 hours before the cardiac arrest (McQuillan et al, 1998). This suggests that many hospital deaths are potentially predictable and preventable (Smith 2006). Further studies identified that assessing and managing a deteriorating patient is a complex issue. Points where the process can fail include:

1. not taking observations;
2. not recognising early signs of deterioration;
3. not communicating observations causing concern; and
4. not responding to these appropriately (NPSA, 2007).

These four issues were identifiable in local case note reviews as well as the literature and were used as the preparation for RADAR. The findings presented in the previous section of this dissertation confirm that medical students' confidence in recognising and responding to clinical deterioration in adult patients can be increased using simulation. The mixed methods approach taken to the study has given robust evidence in terms of both qualitative and quantitative data. Students evaluated the course positively in terms of its aims, content and the experiences offered (first part of questionnaire). Furthermore, they highlighted several positive features of the course (open-ended part of questionnaire). And, importantly, there were statistically significant changes in their reported levels of confidence.

This was further supported by the findings of the Small group interviews held with a separate cohort of students who had the same learning experience and provided interesting insights into RADAR as an educational experience.

This cyclical approach is typical of an action research project and so the author will present the analysis and synthesis based on the findings from the student questionnaire (cycle 1 of AR) followed by the Small group interviews (cycle 2 of AR).

8.2. Student Questionnaire (Cycle 1 of AR)

The questionnaire was distributed to students after their participation in the first version of RADAR during June 2011. The questionnaire was based on one used in a similar study (Wiseman and Snell, 2008) which was scenario based, but used manikins as opposed to simulated patients.

The aim of the questionnaire was to identify from students their impression of the context and content of RADAR. Context in this case represents the theoretical underpinning of RADAR in terms of educational theory and learning. It is composed of Learning Outcomes, Adult learning theory; Situated learning theory and Simulation based learning.

8.2.1. Learning Outcomes

Both groups of students rated the learning outcomes as clear with a mean score of 4.36 for medical students and 4.31 for nurses. This would tend to indicate that in relation to the SMART mnemonic, the learning outcomes are specific, relevant and targeted. However, it does not indicate whether they are measurable or attainable. However, in terms of being measurable, in its current format RADAR has no formal assessment which would provide a determined measure of student's practice.

Observation of students' performance by an experienced facilitator however could be said to be a suitable alternative and the RADAR facilitator will observe students and give feedback on performance which some have argued is an acceptable alternative (Shumway & Harden, 2003, Kogan, Holmboe & Hauer, 2009). In line with the action research nature of the RADAR project, phase three, which will be post-doc, will focus on the development of an assessment tool. This is most likely to be an Objective Structured Clinical Examination (OSCE) type station.

An OSCE is defined as 'an approach to the assessment of clinical competence in which the components of competence are assessed in a planned or structured way with attention being paid to the objectivity of the examination' (Harden, 1988 p19). Students are assessed using a competency based checklist which details the critical

steps in the skill. This would be one suitable method of assessing a student's competence in assessing and managing and deteriorating patient and is discussed in the recommendations section.

8.2.2. Adult Learning Theory

Being relevant, active, engaging and involved are the tenets of adult learning according to Knowles (2012). Both groups of students in this study scored highly on the questionnaire in response to the statement 'The RADAR sessions were relevant to my learning needs' with medical student's mean score 4.67 and nursing students 4.18. Whilst there is a statistically significant difference between these means the results are similar to studies by Reilly and Spratt (2007); Godson, Wilson and Goodman (2007); and Liaw, Rethans, Scherpbier and Piyanee (2011) where nursing students were initially unnerved by simulation but then reported that they could see the relevance and learning that was possible using scenarios. It would therefore have been interesting to be able to have had nursing students attend the cycle 2 Small group interviews to note if any had after reflection changed their minds.

It is also thought-provoking to note that there was a very similar response to the statement 'The RADAR sessions kept me actively involved'. Once again there was a significant difference between the responses of the medical students with a mean score 4.68, and nursing students with a mean score 4.18.

The Interprofessional education (IPE) literature suggests that students' reactions to IPE are more constructive when they can see a direct correlation between the teaching and their current or future practice (Parsell &Bligh, 1998). It should be clear to both medical and nursing students that the early rescue of deteriorating patients is

a priority for both professional groups. However, there appears to be a divergence by the nursing students which might be explained by the results to the next statement.

The results for the statement ‘The RADAR sessions were challenging without being threatening’ show medical student’s mean scores of 4.58 and those of the nursing students 4.40. This statement was worded to avoid the word ‘stress’ as many students would simply answer ‘yes’, because the sessions are stressful. Managing a deteriorating patient is demanding and so there must be an element of stress built into the scenarios in order to maintain the realism if students are to be prepared effectively for real life situations.

8.2.3. Situated learning theory

The realism of the clinical setting, combined with the simulated patients, staff in role and students in role was reportedly a major enhancement for the student’s learning. There were positive responses to the statements ‘The RADAR sessions helped me to integrate theory and practice’ with the medical students’ mean score being 4.64, and nursing students 4.45, and ‘the RADAR sessions encouraged me to think through a clinical problem myself’ where the mean score for medical students was 4.60 and that of the nurses 4.45.

The final statement of the questionnaire – The RADAR session increased my readiness to use what I have learned in the clinical setting’ again had high mean scores from the medical students 4.46, and nursing students 4.31.

Taking the results of this study it can be seen that student’s self-reported confidence in relation to the clinical aspects of deterioration i.e. ABCDE approach,

communication, help, using SEWS and SBAR has increased as a direct result of the RADAR sessions. All of the results for these statements were statistically significant ($p<.001$). This confidence becomes evident to one as a facilitator as the groups progress through the four RADAR scenarios. However, in terms of competence it is less clear what impact the sessions will have on the students' ability to perform the skills in clinical practice. However, this project has shown that the combination of situated-learning within a realistic clinical simulation suite, repetition through different scenarios and feedback and debriefing can combine to enhance students' confidence in recognising and responding to clinical deterioration.

8.2.4. Interpreting physical changes

This aspect of patient assessment was assessed in Section 2 of the questionnaire which focussed on the clinical content of RADAR and asked students to respond to the statement 'How to interpret observed, rapid changes in a patient's condition'. Student's reported confidence for this statement increased over the three time periods with combined group means of 2.81 at time 1; 3.31 at time 2; and 4.26 at time 3. The changes are significant ($P<0.001$) and the individual results for medical and nursing students were very closely matched.

The qualitative data gathered during the Small group interviews supports these findings with students reporting the use of moulage as increasing the realism of the situation and their ability to recognise the physical changes which are associated with clinical deterioration. Medical students undertaking RADAR have had limited clinical exposure and so do not have the experience of seeing deteriorating or unwell patients in real life. The physical changes are often subtle and through the judicious

use of moulage these can be replicated. It is interesting to note that studies of registered nurses in both the UK and Australia identified that with experience nurses use patient's colour, and agitation as the main characteristics for recognising deterioration (Cioffi, 2000, Cutler, 2002; Cox, et.al, 2006). It was also thought-provoking to note in this study that one student reported that they thought the patient had erroneously removed some make up thinking that the patient should look more 'blue' than they were. This is a good indicator of how students develop their own perception of what the physical changes are, which then changes when they actually encounter someone displaying the changes.

8.2.5. ABCDE Approach

The students' reported confidence in using the ABCDE approach demonstrated a significant increase over the three time periods and is supported by the written findings with 61 students stating that ABCDE was amongst the top three things that they had learned, and 20 students stating that it was amongst the three most interesting things about the RADAR sessions. These results are similar to a study conducted in Northern Ireland where 182 nursing students were asked to rate the usefulness of practising ABCDE during a critical care course and 21.05% agreed and 74.44% strongly agreed (Gallagher, Rice, Tierney, Page & McKinney, 2011).

Interestingly, another similar study in Singapore, again with nursing students identified that the student's confidence in applying A, B, and C was better than Disability and Evidence and that this was probably due to student's past experience of a basic cardiac life support course (Liaw, et al, 2011).

The students in the RADAR study did not report any such findings but this would be an interesting follow-up in any future studies to see if it is relevant. Those students from the second cohort who took part in the Small group interviews also reported

ABCDE and its application in real patients as an important learning point during RADAR. This is crucial as being able to assess a patient using the ABCDE approach is the first stage in providing safe and effective care. Being able to practise the ABCDE approach on a real person as opposed to a resuscitation manikin is also important in preparing the students for clinical practice. RADAR would appear to achieve this goal.

8.2.6. SEWS and SBAR

Once students have carried out an initial assessment and responded to any life threatening conditions using the ABCDE approach the next stage is to record their findings using the Scottish Early Warning Score[10] (SEWS). SEWS is introduced to medical students early in year 1 and they practice using it throughout their time in clinical skills sessions. However, it would appear from the results of this study that being able to practice SEWS and SBAR in a realistic clinical setting with simulated patients increases the student's confidence in the use and combination of the tools to achieve escalation in care.

The combined mean scores for 'Using SEWS and SBAR to call senior help demonstrated a statistically significant finding. SBAR was also the most frequently identified benefit from the sessions with 78 students placing it first. These results are comparable with a study undertaken in Indiana (USA) where it was identified that nursing students had some difficulties in using SBAR in the clinical setting. Through the use of role play exercises and follow-up in the clinical setting it was shown that

[10] A simple scoring system used at general ward level based on careful routine physiological measurement of heart rate, blood pressure, respiratory rate, temperature and conscious level each with an upper and lower score of 0-3 points from which a total score is calculated (Kyriacos et al, 2011, p313).

the students' use of SBAR was improved (Thomas, Bertram & Johnson, 2009). The RADAR study has shown that simulation and contextual learning improve medical and nursing students' confidence in the use of SBAR significantly.

Once it has been established by students using the SEWS score that the patient is unwell or deteriorating (A SEWS of 1 or more is abnormal), the next stage is to respond by escalating care using the SBAR communication tool. This is achieved by reference to the escalation tool (See Figure 21). 'Getting help from senior colleagues' (Statement 5 on the questionnaire) had combined mean scores which showed a statistically significant change over the day. This indicates that the student's confidence in using the SEWS and response tool is increasing. It also suggests that repetitive use of the SEWS with simulated patients encourages active use and reinforces previous knowledge-based learning in the concept of early escalation and so rescue by a qualified clinician.

This is a significant finding as 'failure to appreciate clinical urgency' (Buist Jarmolowski, Burton, Bernard, Waxman, & Anderson,1999; Franklin & Matthew1994; McGloin et al 1998) and 'failure to seek advice' (Cioffi, 2000, Andrews &Waterman, 2005; Daffurn et al 1994, Smith & Poplett, 2002) have previously been identified as major causes of failure to rescue. If RADAR instils in students the recognition to seek early help as reported, then this is a major achievement in terms of new thinking and knowledge.

8.2.7. Communication and Non-technical Skills

Non-technical skills are the cognitive and social skills which scaffold a student's technical skills e.g. venepuncture, cannulation, physical examination etc. One of the most important non-technical skills is communication. Being able to communicate effectively during a deterioration incident is critical in preventing patient harm, achieving timely and effective care and ensuring appropriate escalation to achieve rescue. Responses for the combined group scores to the statement 'Effective communication during an acute episode' demonstrated significant increases over the period of the day. This is an encouraging response to the RADAR sessions which indicates that students are recognising the need for effective communication in addition to taking a history from the patient. This supports by the work of Merien et al 2010) who stated that:

> 'Simulator-based training is theoretically superior to conventional training in management of rare crisis situations because it allows unlimited practice in a safe, yet familiar, environment' p1030.

This suggests that RADAR is adding to the evidence base for the use of simulation-based learning in terms of team communication.

8.3Small Group Interviews (Cycle 2 of AR)

The results of the study indicated that simulation-based learning combined with the realistic ward setting and simulated patients were the key things that made RADAR a success as far as students were concerned. The students reported that being able to respond to real people in a realistic setting was far more effective than a scenario featuring a manikin or simulator. The crucial elements of clinical deterioration – recognising changes in physical appearance, changes in physiological parameters and changes in conscious level were demonstrated clearly and effectively using

Simulated Patients (SPs) and moulage. It was clear from the findings of the project that the SPs played a pivotal role in the students' learning and the success RADAR. Students reported the importance of SPs in both the questionnaire and Small group interviews where the SPs were identified as having a major impact on the consolidation of students' previous experience e.g. being more confident in assessing an ill patient, or being able to put previous learning in examination skills into practice in context. Previous studies have identified this important role of SPs in being able to portray accurately the problems obvious in a real patient (Tamblyn, 1998). This has major implications for future reproducibility of this research or introduction of RADAR into general use as the quality of the SPs and the moulage are crucial. An important aspect of RADAR is in allowing students to observe the physical changes which patients can develop during a clinical deterioration episode e.g. they may become very pale and clammy when shocked or have grey/blue tinge when lacking oxygen. These are signs which can be replicated using stage make-up or moulage which has proven to be very effective when combined with the SPs acting abilities, the scenarios and the ward environment.

This is the major new learning which RADAR adds to the field of simulation-based learning. Many papers have been published describing and evaluating courses on acute deterioration, both uniprofessional (Reilly and Spratt, 2007, Wiseman & Snell, 2008, Liaw, Scherpbier, Klainin-Yobas & Rethans, 2011, Liaw, et al 2011), McGaughey, Blackwood, O'Halloran, Trinder & Porter, 2010, and interprofessional (Smith et al 2002; Perkins, et al 2005). The one thing they all have in common is the use of manikins or high fidelity simulators to act as the deteriorating patient.

Currently only the military medical services and disaster management organisations (Red Cross) utilise real people in casualty simulation training (Sohn et al 2007a; 2007b). The UK Defence Medical Services 'Hospital Exercise 'Hospex'(Hayes and Ryan, 2011) is perhaps the most closely related to RADAR in that real people, some limbless ex-servicemen (and women) are made up with moulage to resemble severe trauma and are seen in a simulated hospital environment from the emergency department, through surgery, to a ward. The Hospex runs for three days as opposed to one day for AMUWSE and RADAR. As in Hospex the moulage was a crucial factor in allowing students who have had little clinical exposure the subtle changes which can herald early detection of deterioration, the SPs ability to portray changes in conscious level was also fundamental to the scenarios.

The differences between Hospex and RADAR are that Hospex includes staff in a whole hospital setting taking the SP from admission through surgery to ward and all the associated staff this entails. RADAR is based on the assessment and care of one patient already admitted. It is the level of simulation by and inclusion of the SP that is the common theme in the success of the two exercises.

9. Limitations

As discussed above, the evidence collected points to significant benefits to students from the RADAR sessions. However, some limitations of this study have to be acknowledged. These are now discussed.

Whilst the nursing students who attended the AMUWSE and RADAR sessions were enthusiastic and committed, there were only 22 of them involved in the data collection from the initial questionnaire. The 22 who did participate were volunteers

as there was no compulsion on nursing students to attend. These volunteers were committed and enthusiastic individuals and so it is not possible to say that they were representative of a whole cohort of nursing students. Therefore there is a need to be cautious of generalising the data gathered from these nursing students.

It was outside the remit and sphere of influence of the researcher to have any impact on this at the time of the study. Since then however, discussions between the researcher and staff within the School of Nursing and Midwifery, based on the students' feedback has led to the inclusion of student nurses in the RADAR sessions. This will be an opportunity to investigate a full cohort of nursing students, and comparisons with the sample of this study will allow judgements to be made about whether or not they were representative. Early negotiations are also in place to see the nursing students from the new School of Nursing BSc curriculum undertake Interprofessional education sessions with medical students in year 1 of both the medical and nursing programmes.

The second limitation was the low numbers of students who attended the Small group interviews (n=8). This was caused by timetabling and time constraints. Immediately after completion of the teaching block in which RADAR is situated medical students leave for their summer leave.

There were no nursing students at the Small group interviews as due to timetabling and practice placements there were none available to attend. There are implications here relating to content and relevance to nursing students as discussed earlier. The other reason for the small numbers was that the majority of students go on holiday or

leave Dundee which means that the researcher either waits until after the long holiday and run the interviews or recruits from the small number still in Dundee.

On this occasion I made the decision to go with the small numbers believing that the sessions would still be relevant and fresh in the minds of the students. The issue might have been addressed by waiting for the students' return. It should be acknowledged however, that this might be considered a weakness in the second cycle of the research. This matter would be relatively easy to adjust by extending the period of the research to accommodate timetabling issues in any repeat of the study.

The one limitation in using SPs is that we cannot change their physiological parameters at present. However, there is currently a project being undertaken at Dundee whereby a cuff or overlay placed on the patient's arm and chest will electronically replicate abnormal physiological parameters. A stethoscope is also available which replicates abnormal heart sounds Also, by making scenarios as real as possible in terms of action, environmental and psychological fidelity we can be reassured that the advantages tend to outweigh the limitations.

The last limitation of the study is the discrepancy identified between students' confidence and competence. Tentatively it is not unreasonable to suggest that confidence and competence may be inextricably linked. The study has shown that whilst the relationship between confidence and competence is important, this study has really focused on the latter, and there is a need now to do so.

Finally, whilst not a limitation it should be noted that undertaking an action research study of this kind was not an easy option. Firstly, action research is still seen by many traditionalists as not being ‘proper’ research which was a nagging concern as my research was based in medical education a traditional bastion of empiricism. However the central premise of action research is that action and research are brought together as Stringer (2004 p3) states

> ‘action researchers engage in careful, diligent, inquiry, not for the purposes of discovering new facts or revising accepted laws or theories, but to acquire new information having practical application to the solution of specific problems related to their work’.

This statement eloquently describes my own thoughts and feelings on action research and my journey through the RADAR project. This might explain why I have found it a challenge to communicate and analyse the data gathered in such a way that readers might fully understand what has been said through the findings.

Secondly, the RADAR project has very much been a part of my work life, home life and social life which is not easy. The tensions of being teacher and researcher in the same context are very different. As a teacher students respond differently to me depending on which role I am in that day. As facilitator they see me as an expert imparting my knowledge and skills to help them progress. At the opposite end of this they see me as examiner sitting impassively watch and ticking boxes as they complete their OSCE, or pacing up and down as they complete on-line exams. Both of these roles have a power dimension since I can influence the students’ progress.

Of course as teachers most of us have the desire for students to do as well as possible and we especially want our innovations in teaching to work. However, this passion can sometimes, if uncontrolled stop one from being a dispassionate

researcher. As a researcher one must be open and objective to students in a new programme making mistakes, doing things in a way different to how one envisaged them and not influencing the findings.

During the project I was aware that I was becoming focused, anxious, worried that things would not be perfect. However, I was also aware that the students were enjoying RADAR, getting something from the session and that there was a buzz around it. That is the reason that I chose to undertake an action research project as I see it as the closest form of research which legitimises the role of teacher/researcher. The secret is to be excited about ones work but be aware of the tensions and dangers I have described and try best to minimise them.

9.2. Summary

This chapter has discussed the findings of the questionnaire and Small group interviews used to evaluate medical and nursing students' experience of RADAR. The first section described the educational theory and underpinning of RADAR as an educational tool. The development of the learning outcomes, ensuring that they achieved the SMART objectives was identified and positively evaluated by the students in their feedback. Each of the outcomes was related to a specific question or statement in the questionnaire and all were rated highly by the students.

Adult learning theory suggests that adults learn best when they are active and engaged in learner-centred activities and the evidence suggests that RADAR achieves all of these aims.

The crucial issue of feedback and debriefing after a scenario was raised by the students' responses and has led to significant changes in the facilitation of RADAR. Students find feedback the most important aspect of the sessions as it allows them to identify their learning and encourages reflection. As Van Ments (1999) stated 'the debriefing session is the most important part of the activity' and this was certainly made clear by the students in this study. Closely related to feedback was the concept of situated learning and its importance in the success of RADAR. Situated learning theory like many other learning theories suggests that learning is based on experience. However, situated learning theory expands and posits that action is grounded in the concrete situation and that instruction must be done in complex, social environments.

This is where RADAR is unique in terms of the realism of the clinical simulation suite, simulated patients and moulage which provide a safe complex environment as real as possible to a hospital ward. The constructive elements of ward simulation preceding RADAR to introduce students to the concept of acute and time limited care also addresses another tenet of situated learning which is that training by abstraction is of little use. Therefore, making the connections enables students to get more from the RADAR sessions and leads to reports of increased confidence in the recognition and response to clinical deterioration which is the aim of this project.

Finally the use of a simulation environment which closely resembles a real hospital ward, simulated patients who give a realistic portrayal of deterioration and the addition of make-up (moulage) to recreate the physical changes associated with deterioration were identified as critical to the students increased confidence and learning.

The second part of this chapter focused on the ‘clinical aspects’ of deterioration. The ability to recognise clinical deterioration early is crucial in preventing harm and adverse events. Students practiced using the ABCDE approach to identify and manage immediately life threatening conditions (Recognise). The use of SEWS to measure and record physiological observations (Record) was used as evidence in the next step which was to call for senior help using SBAR (Respond). Finally the escalation protocol was used in conjunction with the senior help to Rescue the patient.

The next chapter of this dissertation will discuss what RADAR adds to the learning of medical students, what is new and unique about RADAR when compared to the myriad of courses already available and finally what the future for RADAR will be.

10. Conclusions and Recommendations

10.1. Conclusions

The purpose of this study was to investigate whether medical students' confidence in recognising and responding to deterioration in adult patients could be increased using meso-simulation during the RADAR course. The findings address four areas: (1) the educational underpinning and theory of RADAR; (2) the technical and non-technical skills of recognising and responding to deterioration; (3) the impact of simulated patients and moulage; and (4) simulation and contextual learning.

10.2. Educational underpinning and theory of RADAR

The first major finding of this research is that the educational principles on which RADAR is based seem to have been supported by the data collected. Whenever one is tasked with the development of a new teaching or learning programme getting the basics of curriculum and content right is fundamental to the success or failure of the programme.

Through the findings from the student questionnaire it was clear that the Learning Outcomes for the programme were clear and concise to the students; they were specific to what the students were expected to do and achieve during the scenarios; they were measurable by the facilitator who was observing the students during the session; they were achievable by the students after repeated practice during the scenarios; they were relevant as evidenced by the students responses to the questionnaire and finally that they were timely.

Adult learning theory suggests that adults learn best when the learning experience is engaging, active and learner centred. Once again the findings strongly suggest that this has been achieved with RADAR. The students reported feeling actively involved with the sessions; that they were relevant to their learning needs, and appropriate for their level of experience.

It was also clear that the students felt that the scenarios were interesting, helped them integrate theory and practice and started to make them think about the scenarios for themselves. These are all positive indications that the RADAR course is set at a suitable level for adult learners. A major part of learning in clinical skills is the acquisition of skills, both technical and non-technical. This was another major finding of RADAR.

10.3. Technical and non-technical skills

Technical skills, often referred to as procedural skills are those manual skills which are used to assess and manage patients. All technical skills require a mixture of dexterity and knowledge in order to achieve the aims. The main technical skills students were able to practice during the RADAR sessions were related to the recognition and recording stages.

The ABCDE approach requires students to carry out technical skills such as respiratory rate, pulse, blood pressure, temperature and temperature. It is not as simple as this though as students must also incorporate non-technical skills which are the social and cognitive skills which combine with technical skills. During an ABCDE assessment these would include communication with the patient; with other students, and with the facilitator; aspects of important decision making such as when

the situation is out with their control or level of experience and the student needs to call for help.

There are also aspects of leadership which start to develop during the sessions which are important as the medical student will ultimately be responsible for these patients when they qualify and are on the end of the SBAR call from the ward. With all of this complex mix of technical and non-technical skills the role of the facilitator is crucial in giving the students feedback and debriefing which will encourage reflection and learning from the scenarios. Thus a focus of the Post-Doc phase of this study will be to develop and implement standard training for RADAR facilitators to ensure a standardised approach. A DVD has been made and is affixed to the binding of this dissertation which demonstrates how a session should be facilitated correctly.The findings also indicate that the learning is increased through the inclusion of simulated patients and moulage as opposed to manikins.

10.4. The impact of simulated patients and moulage

The findings of the study suggest that the impact of a simulated patient portraying the physical signs of deterioration with moulage combined with the psychological signs of anxiety and distress are an effective means of learning how to recognise deterioration. High fidelity simulators (manikins) are useful in terms of allowing learners to practice invasive skills and procedures e.g. blood taking, intravenous cannulation etc. They can also be used to develop team working, decision making and other non-technical skills effectively during complex scenarios with multiple team members. However, they cannot portray the signs and describe the symptoms as well as a real person. The students in then study were very clear that the simulated

patient encounter gave them a completely different viewpoint from previous sessions with manikins.

Simulated patients also have a significant role to play in providing feedback to students on how well they felt they were cared for during a scenario. Changes in physical appearance and skin colour combined with alteration in conscious level have all been identified as important signs of deterioration.

A simulated patient and the appropriate use of moulage can achieve this with a level of realism that impacts a student's ability to recognise and respond to deterioration effectively.

10.5. Simulation and contextual learning

Simulation as a teaching tool is used widely in medical education. Many centres use high-fidelity simulators throughout a student's training achieving excellent results in terms of skills development. Others, like Dundee utilise a combination of simulators and simulated patients depending on the situation.

The findings of this study show quite clearly the usefulness of simulation and contextual learning on increasing medical students' confidence. The importance of realism in simulation was discussed in detail in an earlier part of this dissertation and it is clear that RADAR is achieving high levels of realism.

The environment, patients, moulage and scenarios are aligned and established to a level which is as near to reality as it can be. This is vital if students are to be

encouraged to take forward what they have learned in simulation to their clinical practice.

This is where the avoidance of role-play is crucial in RADAR as the aim is to prepare students for their role in a clinical deterioration, not that of any one else in the clinical team. Making the simulation as close to real practice as possible also has a positive impact on the students' situativity and experiential learning.

Situated learning as discussed previously is based on the concept that learning, knowledge and thinking are situated in experience. Experience is best achieved within the real practice setting, however, effective simulation as seen in RADAR can be used to replicate real practice in a safe and controlled environment for students and patients alike. This is combined with the emphasis on students and tutors being themselves and not taking on the roles of others to develop a simulated community of practice.

10.6. Confidence and Competence?

Caring for the acutely ill and deteriorating adult hospital patient is an essential prerequisite for junior doctors. It is a complex mix of individual technical and non-technical skills as well as teamwork. Patient safety considerations often limit what medical students are allowed to do for these patients in real life. The student is often relegated to the role of observer with little or no opportunity for 'hands-on' experience. Research has shown that whilst acutely ill patients are common in hospital practice it may be difficult for students to experience exposure to these patients in big numbers (Tallentire, Smith, Wylde & Cameron, 2011). In addition real-life situations are very often intimidating and anxiety provoking and so do not provide

the optimal learning environment. These factors all combine to create a complex relationship between procedural skills competence and confidence. Whilst confidence has been used as a measure of competence, the correlation is poor (Fitzgerald, White and Gruppen, 2003, Hays et al 2002, Byrne, Blagrove and McDougall, 2005).

It was found that medical student's confidence in their own abilities was often elevated, whilst in junior doctors it was sometimes exaggerated. There is still a lack of consensus on whether it is advisable to be using self-confidence scores as a measure of competence. However, the aim of RADAR is to build students confidence in recognising and responding to deterioration progressively. Exposing the student to increasing levels of complexity through the simulations will help to build on their confidence in a safe and controlled manner. In addition we are clear that the skills that students undertake during the sessions are within their own competence. Thus avoiding any destruction of confidence caused by an out of hand experience. In the literature whilst confidence has been used it is important at this point to define what is being discussed as confidence i.e*. a feeling of self-assurance arising from an appreciation of one's own abilities or qualities* and competence. *The ability to do something successfully or efficiently* (Oxford Dictionaries, 2014).

Being willing and able to carry out assessment skills such as vital signs measurement and recording, pulse oximetry etc. and be willing to ask for early help from senior qualified support are critical to the success of the recognising and responding to deterioration. If we can use deliberate practice in the safe and controlled environment of the simulation suite, allowing students to practices these skills alongside an increasingly complex mix of others we can increase the students'

confidence to respond in real life. This is demonstrated by the data from this study and from observation and anecdotal evidence form students, tutors and simulated patients. More importantly confidence is critical in ensuring that students can respond to an acute situation such as deterioration as a lack of confidence may adversely affect performance leading to further loss of confidence (Trumbo and Noble, 1972).

It is thought-provoking that a number of papers published within the medical literature include the words confidence and competence in the title, yet very few of those found actually define what they mean by the terms (Sulmasy et al, 1995; Barnsley et al, 2004). Stewart et al (2000) in an attempt to clarify the concepts came to the conclusion that in terms of self-evaluation of confidence and competence that '…the process of assessing oneself is complicated, and by its very nature can never be objective or free from the beliefs and values individuals hold about themselves' (p903). This is evident in some of the medical students observed during the RADAR scenarios where it is obvious that their confidence in their own abilities outweighs their competence. For example having practiced intravenous cannulation on a manikin arm, some students report being able to carry this out on the type of patient portrayed in the scenarios.

The student may well be competent and confident carrying out this procedure on a manikin; however, being able to cannulate a patient whose veins have retracted due to hypovolaemic shock (lack of circulating blood volume) is another situation entirely. A major review of the literature on self-assessment carried out between 1990 and 2005 (Colthart et al, 2008) identified that whilst self-assessment is integral to lifelong learning in healthcare there was little evidence that this was an accurate method of

reporting and that some form of tool was needed to provide individuals with a benchmark. It was also worrying that the study identified that ‘those who are least able are also least able to self-assess accurately’ (Colthart et al 2008, p142). This is a crucial point for this study because it has not involved a formal assessment of student’s competence.

10.7. Recommendations for Further Research

Based on the findings of this study the following recommendations are made for further study/research in relation to RADAR.

1. The study should be expanded to include a full cohort of nursing and medical students. Questionnaires from full cohorts of both student groups allow greater confidence in the data, and improve the generalizability of the findings.
2. A higher number of students, both medical and nursing should also be recruited to attend Small group interviews. Some of these groups might be for the medical and nursing students separately, but there might also be value in having mixed groups. This would allow us to explore whether students responded differently when in their own groups and mixed groups, providing insights into the communication and perception issues identified in this study.
3. The feedback and debriefing should be evaluated from the student and facilitator perspective to identify if it is suitable for use in RADAR sessions. This is important as good feedback helps to clarify what good practice is, facilitates students’ self-assessment (reflection) and delivers high quality information to students about their learning.

4. A study to identify how to better accommodate the different learning styles of medical and nursing students during the scenarios should be instigated. This will be particularly useful if the interprofessional sessions are introduced.
5. The relationship between confidence and competence should be addressed (i.e. does increased confidence necessarily reflect increased competence?), and a method of assessment devised to which helps to address both aspects of confidence and competence and the inter-relationship between them. It would be interesting to investigate whether competence also increases following attendance at RADAR.

10.8. What does RADAR add to the learning of medical students?

This mixed methods action research study started with a problem. The problem was that medical students' were encountering deteriorating patients in clinical practice and in some simulation exercises without proper preparation. They had been given training in how to perform basic life support and use an automated electronic defibrillator (AED) to manage cardiorespiratory arrest. However, their teaching in the prevention of such catastrophic events was negligible until the final years of training. Therefore RADAR was conceived and implemented with the following research question in mind – 'Can medical students' confidence in recognising and responding to deterioration in adults be increased using simulation?'

Now that the research is completed and the findings analysed the answer would appear to be 'Yes' we can increase medical students confidence…and the following are the reasons why this may be said.

1. RADAR is unique in using simulated patients (SPs), to portray the deteriorating patient. The simulated patient is able to communicate the onset

and symptoms of deterioration to students in a timely and realistic manner. Simulated patients are also able to depict the signs of anxiety and fear which no manikin or high fidelity simulator is able to reproduce.

2. Through the judicious use of moulage the students can actually see for themselves what the physical changes that occur in deteriorating patients look like. What do we mean by cyanosis (blueness to skin colour); does someone really look white? etc. These are all statements which everyone interprets differently. Moulage relieves the uncertainty by showing the student exactly what is meant by each of these signs.
3. The student learns what is expected of them as *themselves*. They are not expected to take on the role of foundation doctor, consultant or other staff member. They function and learn as a medical student in the simulated setting just as they would in a clinical setting. Thus we expect them to be more comfortable and confident that should they encounter a deteriorating patient on the wards they will be able to provide a safe and effective level of care.

The development, planning, implementation and evaluation of RADAR has been very challenging and a whole list of other moods and emotions. However, the outcome has been worthwhile. The story does not end with the publication of this dissertation however as Cycle 4 of the Action research approach has already been implemented. Compulsory attendance at RADAR sessions from Year 1 has been introduced into the medical and nursing curricula and data has been obtained from 239 students. In addition there are plans to carry out RADAR sessions in the clinical setting using in-situ simulation to better measure the transferability from the simulated ward to real practice.

11. Appendices

11.1 Reflective Summary No 1

This is the first reflective summary which has been written in anticipation of commencing the Professional Doctorate in Education Project. I have already completed the Claim for Recognition of Prior Learning and I am thinking ahead towards how I might continue the journey on a coherent and sensible pathway.
I was drawn to an Action Research (AR) approach based on a previous study for the Postgraduate Certificate in Teaching in Higher Education which included an AR project as a module.

Action research is a practical way of examining your own work to determine that it is as it should be (McNiff, 2002). The notion of self-reflection is central to AR which involves identifying a problem or issue in one's practice, imagining a possible solution, trying out the solution, evaluating if it worked, and changing practice in light of the findings.

The purposes of AR include professional understanding, personal growth and political empowerment (McTaggart, 1999). Staff development can be included in professional understanding leading to an increase in the knowledge base for teaching (Rearick and Feldman, 1999).

AR being cyclical in nature also seemed to me to be the most suitable approach for a modular programme where I could introduce the new programme in stages, assess the effect and then move onto the next step.

There have been many definitions of reflection since one of the first by John Dewey in 1933 who defined it as:

> 'Active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends' (Dewey 1933, p9).

Donald Schon (1987) has also had a great influence on reflection and describes two type of reflection – reflection-on-action and reflection-in-action. Reflection-on-action is

> 'Thinking back on what we have done in order to discover how our knowing in action may have contributed to an unexpected outcome. We may do so after the fact, in tranquillity or we may pause in the midst of action (stop and think).' (Schon, 1987, p26).

Reflection-in-action is defined as

> 'Where we may reflect in the midst of action without interrupting it. Our thinking serves to reshape what we are doing while we are doing it' (Schon, 1987, p26).

My own reflections will be undertaken after the completion of AR Cycles. This one has been written following submission of the RPL Claim. The next will be once I have ran the first RADAR teaching session and analysed the data from a student questionnaire, the third after the second cycle which will be another run of RADAR based on changes from the feedback and a focus group. Finally I will reflect on my personal and professional development as a result of completing the Doctorate and RADAR.

As I consider that I will be reflecting on what has been done it might be considered 'reflection-on-action (Schon, 1987). In addition the aim is to make me think about my

professional practice and so the following definition by Reid (1993) is the one which I sense best suits what I am about to do in terms of reflection

> 'Reflection is a process of reviewing an experience of practice in order to describe, analyse, evaluate and so inform learning about practice.' (Reid, 1993, p306).

For the purposes of the reflections associated with my project I have chosen as a basis the works of Chris John. John's model was developed from his work within the Burford Nursing Development Unit in the early 1990s and is based on uncovering and making explicit the knowledge that we use in practice.

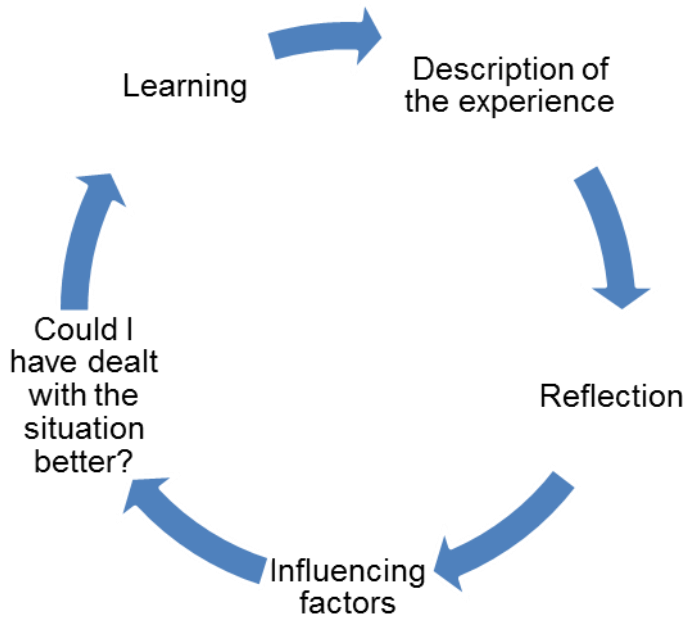


Figure 24: Johns Model of Reflection

My current position as a lecturer within the Medical School includes provision for one day a week in clinical practice in order to maintain currency with contemporary practice. My last position within the NHS was as a Transfusion Nurse Specialist with the Scottish National Blood Transfusion Service (SNBTS).

The central component of the role was transfusion risk management and safety and it was during the tenure of the post that my interest in patient safety and clinical governance as well as teaching and education developed. The SNBTS has a national training programme for blood transfusion safety which is well established; therefore it was inappropriate for me to work with them to develop an established and successful teaching programme.

I therefore used contacts to establish a base which would suit the study I was proposing and was put in touch with the local Safety Governance and Risk Department which includes the local staff of the Scottish Patient Safety Programme
The Scottish Patient Safety Programme was well established in the NHS Trust with which I was associated and so I joined the Safety Governance and Risk Team (SGRT) as a Patient Safety Educator one day per week with the remit of focusing on the General Ward Work stream – Deterioration. I was also co-opted onto an NHS short-term working group looking at the issue of suboptimal care of deteriorating patients.

After a short period of time it became clear that there were a number of issues which were leading to the problem of suboptimal care for patients who deteriorate. The SPSP gathers data on quality improvement in order to identify change and ultimately improvement in patient care.

There are five work-streams of which the general ward is one. In this stream prevention of deterioration is one of the key areas for improvement. During my time with the SGRT and whilst attending the working group meetings it was becoming

clear from the retrospective review of case notes post cardiac arrest that there were three recurring themes in the cases which were

- ward staff not recognising the signs of clinical deterioration,
- ward staff not recording SEWS, and
- ward staff not calling for help early into a deterioration episode.

My concerns focused on two specific educational issues related to these themes:

1. Why was this poor performance occurring?
2. What was the impact of ALERT course on these cases?
3. What could I do differently with my students to make things better?

In thinking about these three questions I was trying to achieve an outcome which would provide my students with a better preparation for practice. I want medical and nursing students to be able to recognise an unwell / deteriorating patient early. I want students to use the tools that are available to record the patient's physiological signs. I want students to be able to use the evidence they have gathered to call for senior qualified help early and therefore rescue the patient and prevent admission to intensive care of cardiac arrest.

The consequences for me are that the course I develop is a success and is introduced into the medical and nursing curricula. That it develops and becomes so successful that it is a national or international programme. On the other hand I might face the barriers of change and politics as the NHS already uses the ALERT™ course. More on this later!

The consequences for students are that they become better practitioners by being prepared to recognise, respond and recue deteriorating patients in a safe, structured and timely manner.

Finally, the hope is that patients will be better cared for and the consequences of deterioration managed safely.

Research has shown that a large number of patients who experience a cardio-respiratory arrest have recognisable changes in respiratory rate, pulse, blood pressure and consciousness, sometimes up to eight hours before the cardiac episode (Hillman et al 2001; Kause et al 2004).

It has also been proven that appropriate interventions undertaken in the early stages can prevent deterioration progressing to cardiac arrest (Smith, Osgood & Crane, 2002). The National Confidential Enquiry into Patient Outcome and Death (2005) identified similar findings to these studies with avoidable admissions to intensive care said to be 21% of cases. It also identified that communication failures, delays in referral to higher level care and poor essential care were contributing to increased morbidity and mortality.

In 2007 the National Institute for Health and Clinical Excellence (NICE) in England issued guidelines on the care, monitoring and treatment of acutely ill patient in hospital (Armitage, Eddlestone & Stokes, 2007). Included in the advice was how close monitoring with appropriate early intervention could prevent patients deteriorating. The National Patient safety Agency (the English equivalent of SPSP),

undertook a programme to examine the underlying causes and contributing factors in clinical deterioration episodes and identify how the factors connect.

The outcome was the Patient safety First publication entitled ‘The How to Guide for Reducing Harm from Deterioration’ (2008). This guide suggested that the following six key areas needed to be addressed in order to recognise and respond to clinical deterioration (Figure 16).

1. Physiological observations should be recorded for all adult patients in acute hospital settings
2. Physiological observations should be recorded and acted upon by staff who have been trained to undertake these procedures and understand their clinical relevance
3. Physiological track and trigger systems should be used (SEWS)
4. There should be a graded response strategy
5. An escalation protocol should be in place
6. A communication tool should be used.

Figure 16: The six key areas relating to deterioration intervention

There is an established course on the recognition and management of deterioration known as ALERT (Acute Life-threatening Events – Recognition and Treatment. This is described as ‘a one-day multidisciplinary course originally designed to give newly qualified doctors and nurses’ greater confidence and ability in the recognition and management of adult patients who have impending or established critical illness.’ (Smith, et al 2002 p281). ALERT is run regularly within NHST with the majority of

attendee's nurses. Attendance by medical staff is generally poor. ALERT does not accommodate undergraduate students.

I do not know if I could have dealt with this situation better until I have had an opportunity to run the course and assess and evaluate its impact in collaboration with the medical and nursing students who will participate. The plan that I developed was a programme for students which is active, relevant, engaging and learner centred (Knowles et al 2012), focused on the early recognition and response to clinical deterioration. Students should be able to see for themselves what an acutely ill patient looks like; therefore, simulated patients will be included in preference to a manikin/simulator. Students will practice taking and recording physiological observations and whilst it is not possible to alter those of the patient if I can achieve good enough fidelity in the scenarios this should not impact on the students learning. Students will practice using the SEWS tool and SBAR to call for senior help during the scenarios.

The course will be developed over a period of six months and trialled in transition block two during the summer. My second reflective summary will be written once I have completed the First Cycle of AR which will be evaluated using a questionnaire.
The course will use simulated patients instead of manikins as I believe that in order to be able to identify and notice the subtle changes in deteriorating patient's physical appearance students must see a real person. Through moulage students will be able to see the signs of pallor (whiteness), cyanosis (blueness) and flushing (redness) which often accompany or signal deterioration.

11.2. Reflective Summary No 2

This reflection is written after the first run of the Acute Medical Unit Ward Simulation Exercise (AMUWSE) and RADAR over the last eight days of Transition Block 2. There have been 150 medical students and 22 nursing students over the period which has been a busy time. We have also had 12 simulated patients per day which has put a strain on the patient bank.

However, as usual the SPs have been irreplaceable. I will of course be analysing and reporting the results of the 152 questionnaires (130 medics and 22 nurses) in the dissertation. However, this reflective account is based on my observations whilst supervising the AMUWSE.

The AMUWSE was designed to replace the old Interprofessional Ward Simulation Exercise (IPWSE) which has been running since 2003 with very little change. My reasoning was that by introducing students to the acute setting in the morning they would be better prepared for the RADAR sessions in the afternoon. Medical students have spent very little time of the first three years on the wards and clinical areas.
Much of the time is devoted to learning history taking and diagnosis with a minimum of 20 minutes and maximum of 60 minutes allocated to this task. Within an acute medical unit this is time which is not available as patients must be seen, assessed, investigations ordered and a management plan put in place within 30-40 minutes of arrival.

A classic example of this lack of insight into acute medicine was displayed when a group of students asked for chairs so that they could sit round the patient’s bed and

take a history. Shock and awe ensued when they were told that they had 40 minutes to achieve the tasks described. This led me to think about the issues of recognising the difference between a routine hospital admission and an urgent hospital admission for students and how I could incorporate this in future sessions.

There is an identified gap in medical student's knowledge and skills in caring for the acutely ill adult. Training in CPR and Basic life support is crucial but does not prepare students for the deteriorating patient. Students who have limited clinical exposure do not have the knowledge or skills to recognise clinical deterioration and respond to deterioration actively and effectively.

Whilst course such as ALERT™ have been developed and implemented there is little published evidence as to the effectiveness they have on students' knowledge and skills. The AMUWSE with a focus on acutely unwell adults combined with the RADAR Scenarios helps to introduce students to the increased pace required in assessing and managing deteriorating patients. The scenarios increase students' confidence in recognising the signs of deterioration whilst the AMUWSE introduces students to the nature of acute medicine.

This reflection has made me think about the gaps in students' knowledge of acute medicine. The impact of extended communication skills training and the need to introduce students early to the concept of deterioration as opposed to a focus on resuscitation has been demonstrated in my reflection.

The need to have complementary teaching in resuscitation and deterioration must be investigated. We should base this on the well-known saying that ‘prevention in better than cure’.

A systematic review by Smith, Perkins, Bullock & Bion (2007) identified that undergraduates and junior doctors lack knowledge (Smith and Poplett, 2002), confidence (Moercke & Eika, 2002), and competence (Morris, Tordoff, Wallis & Skinner, 1991) in most aspects of the care of acutely ill adults.

Disturbingly, the lack of knowledge amongst the 185 trainees in the Poplett & Smith (2002) study was related to basic acute care skills such as the use of oxygen masks, pulse oximetry and the signs of airway obstruction. In conclusion the authors stated

> ‘…Gaps in knowledge may be due to inadequate training in the ‘generic’ signs, symptoms, and management principles of acute illness. These deficits have the potential to contribute to error and to influence patient outcome. We recommend that all medical schools incorporate such training in their curricula urgently’ (Smith &, Poplett 2002, p338).

This is helpful and supports the aims of RADAR which are to give students the knowledge and skills to safely assess and manage an acutely ill/deteriorating adult hospital patient. In terms of junior doctor’s confidence in caring for the acutely ill Moercke & Eika (2002) sent questionnaires to 226 newly graduated Danish doctors asking about confidence in 210 skills. Similar to our own students 90% of the respondents claimed to have mastered history taking. However, these same respondents did not feel confident in 28 emergency medical procedures such as ‘assessing level of consciousness, ‘applying an oxygen mask’ and other basic skills included in basic life support teaching.

The Acute Life-threatening Events – Recognition and Treatment (ALERT™) course was developed in Portsmouth as a response to the dearth of training on the detection and management of acute illness. Designed as a one day multiprofessional course it consists of lectures, tutorials and discussions in the morning followed by practical scenarios in the afternoon. A 70 page course handbook is given as preliminary reading which includes all of the topics covered on the day.

Two published studies on the impact of ALERT™ have been carried out by personnel involved in its development. Both of these studies are reticent to say definitively that ALERT™ changes knowledge (Smith & Poplett, 2004) or attitudes and confidence (Featherstone, Smith, Linnell, Easton & Osgood, 2005). However, the authors suggest that the ALERT™ course format may have an impact on practitioners' assessment and management of the acutely ill adult (Smith & Poplett, 2004).

The main thing I have learned from this reflection is the unique ability of simulated patients to represent a deteriorating patient during simulation. Whilst a manikin simulator can be used to replicate the physiological changes e.g. increased respiratory rate, decreased blood pressure, experienced during deterioration. The anxiety and subtle changes in physical appearance can only be properly replicated and noted in a real person (SP). A good SP script, the appropriate use of moulage and an effective portrayal by the SP can overcome the drawbacks of altered physiology. Students become so immersed in the simulation that they soon work with the SP and facilitator to achieve the aims of the sessions.

11.3. Reflective Summary No 3

This is the final reflection having completed the study section of the doctorate. The route to this started with the claim for recognition of prior learning based on peer reviewed papers with a common theme of simulation. Whilst still employed by the Blood Transfusion service I worked with lecturers in the School of Nursing to develop a new teaching pack for student nurses learning the process of blood transfusion. The innovation here was the use of real blood and documentation to increase the student's perception of the complexity of checking and administering blood for transfusion.

The second project again featured the blood transfusion process but this time was focused on assessment of qualified practitioners who were transfusion trainers. This project again used real blood, documentation and the innovation was the use of a ward simulation exercise. Whilst this one-off project was successful, the complexity of the WSE in terms of staffing, numbers of simulated patients and fiscal costs meant that this particular project did not progress beyond this pilot stage.

The third and fourth projects were based on a communication exercise with a stroke patient with SPs acting as the patient and a ward simulation exercise for hospital at night practitioners. From these beginnings I recognised the invaluable resource that simulated patients were and how their talents could be utilised more widely in the undergraduate curricula of medicine and nursing.

As a registered nurse my interests had always been in trauma, intensive care and high dependency nursing therefore, when I had to choose a topic to investigate at

doctoral level I was immediately drawn to a critical care focus. I was aware that the Scottish Patient Safety Programme had a critical care work stream but when I had done some preliminary reading and research I discovered that the focus was not an area readily amenable to the educational needs of students. However, the general ward work stream included work on early warning and early rescue of deteriorating patients. Thus my mind was made up I wanted to see if I could devise a teaching programme for medical students which would include simulated patients to allow students to recognise and respond to clinical deterioration.

The development and evaluation of RADAR has been, frightening, boring, frustrating but ultimately enlightening. Working in collaboration with colleagues, students and simulated patients so closely was illuminating in terms of how much experience, knowledge and skills so often go untapped in our general working day. Simulated patients especially are a rich resource of life experiences and their ability to portray the signs and symptoms of clinical deterioration are incomparable. No manikin or simulator will ever achieve the level of realism which a simulated patient provides in preparing a student for recognising and responding to clinical deterioration.

Through the use of action research (AR) I feel that the collaboration made my task of evaluating RADAR very much easier. The cyclical nature of AR suited well my journey through the professional doctorate as well as my journey through the development, implementation and evaluation of RADAR. Action Research is not an easy approach to use, but is a very effective tool for the development and assessment of an educational intervention. As I discussed in the methodology section I chose to base the action research approach on the work of McNiff and

Whitehead (2009), combined with the Model by Zuber-Skerritt (2007). In planning an action research project the following critical questions were suggested as one way of ensuring that the project is conducted in a rigorous and systematic way (McNiff and Whitehead, 2009).

1. I review my current practice;
2. I identify an area I wish to improve;
3. I ask focused questions about how I can improve it;
4. I imagine a way forward;
5. I try it out, and take stock of what happens;
6. I modify my plans in light of what I have found, and continue with the action;
7. I evaluate the modified action;
8. I reconsider the position in light of the evaluation.

I have chosen to summarise the RADAR project by addressing each of the statements.

1. I review my current practice.

Like most current medical school curricula the focus in my own school is on resuscitation training and acute care training using resuscitation manikins. It is of course obvious that resuscitation training must use manikins. However, much of the acute care training other than trauma still uses manikins. I have thought for a number of years that whilst manikins are suitable for resuscitation, they do not provide the realism which is necessary to demonstrate to students the subtle physical and psychological changes which a deteriorating patient experiences and displays.

2. I identify an area I wish to improve.

I wanted to improve the teaching which students receive on the early rescue of deteriorating patients using simulation and simulated patients. The National Confidential Enquiry into Patient Outcomes and Deaths published in 2012 during the write-up of my dissertation audited cardiac arrest calls. One of the recommendations was that there should be a change of focus in healthcare training towards early detection of clinical deterioration and less on cardiopulmonary resuscitation. This is interesting as it suggests that RADAR is already ahead of the pack in terms of innovative teaching. The use of simulated patients has also shown that RADAR is a viable solution to the issues raised by the NCEPOD Report.

3. I ask focused questions about how I can improve it.

The main question I wanted answered about how I could improve the situation was:

“Can meso level simulation increase medical students’ confidence in recognising and responding to clinical deterioration in adult hospital patients?”

4. I imagine a way forward.

The way forward was to carry out a study with medical students in which I would develop a new teaching programme (RADAR) to allow them to assess and manage deteriorating patients using our bank of simulated patients. I needed to take account of the students’ limited exposure to clinical deterioration in their practice, their previous teaching on cardiopulmonary resuscitation and the possible restrictions on using simulated patients i.e. the changes in physiological parameters required. I decided that the ward simulation exercise should be adapted to focus on an acute

medical unit. This would introduce students to the concept of acute medicine and give them insight into the differences between acute medicine and routine care.

The acute medical unit ward simulation exercise (AMUWSE) would be followed up by RADAR in the afternoon. The scenarios would be based on common medical problems which can lead to deterioration and students would work in groups to assess and manage the patients. Students would rotate around each of the scenarios in small groups and then be given feedback on their performance.

5. I try it out and take stock of what happens.

The sessions as described were carried out during a period of eight days in 2011 and feedback was obtained from students using a questionnaire. The results of the questionnaire were positive with students reporting increased confidence in a number of important areas. The use of ABCDE, SBAR and SEWS in simulated practice was rated positively by students and the impact of the simulated patients was very clear with students reporting high levels of realism and engagement. It was also reported that this engagement was not possible with manikins.

6. I modify my plans in light of what I have found, and continue with the action.

Students suggested that changes be made to the AMUWSE and that the RADAR sessions should be slightly adapted and in line with AR these changes were made to the 2012 run of the sessions. Following Small group interviews post the 2012 run students were again positive and suggested that the sessions were very interesting and valuable with the main points being the inclusion of simulated patients, the moulage and the RADAR scenarios.

7. I evaluate the modified action.

The 2013 run of RADAR was adapted to include an introduction to non-technical skills (communication, team-work, decision-making and situational awareness) and how they related to clinical deterioration and early rescue. In addition RADAR was made compulsory for nursing students through the hard work of my colleague Fiona Paul (Lecturer in Nursing) with over 200 medical and nursing students attending the sessions. Questionnaires were distributed and have been entered into SPSS for analysis. Initial results are positive with similar responses to those in the main study.

8. I reconsider the position in light of the evaluation.

The current position with RADAR is that it is included in the interprofessional curriculum as a compulsory session for all Year 1 medical and Year 2 nursing students. Sessions are included into the cardiovascular and respiratory blocks of the medical curriculum. A non-technical skills workshop and RADAR are compulsory for Year 3 medical students and is planned for nursing students in 2014.

I have learned a great deal over the period of the work for the doctorate in education. However, there are three main areas that I feel are particularly relevant to myself.

The first thing relates to the RPL claim and the importance of ensuring that when publishing peer reviewed papers one ensures that contributors have actually contributed to the paper, not just the work to which the paper relates. Most journals now require that contributors confirm their level of input and when this is not included in submission guidelines I now ask co-authors to complete one.

The second thing I have learned is that Action Research is an effective method to use in developing an educational intervention. The cyclical nature of AR lends well to

developing, implementing and evaluating an intervention. In terms of RADAR I can also see that it will continue to develop and that evaluation of the changes will continue.

The third thing is that the only way that we can cut the numbers of failure to rescue patients is through education. Education based on RADAR is an effective and viable solution to the issue. Students need to be made aware of the issues surrounding early detection of deterioration; they need to be aware of the physical, physiological and conscious level changes which can occur. RADAR now needs to be widely publicised and published. This is now my next step following completion of the doctorate.

11.4. The screening criteria for potential and actual adverse events

1. Unplanned admission (including readmission) as a result of any healthcare provided during the 12 months prior to the index admission
2. Unplanned admission to any hospital during the 12 months following discharge from the index admission
3. Occurrence of injury or harm to patient during hospitalisation (including any harm, or trauma occurring during index admission)
4. Adverse drug reaction
5. Unplanned transfer to intensive care unit
6. Unplanned transfer from or to another acute care hospital (excluding transfers for specialised examinations, procedures or care not available in the original hospital)
7. Unplanned return to surgery
8. Unplanned removal, injury, or repair of an organ or structure during surgery, invasive procedure, or vaginal delivery
9. Other unexpected complications during index admission which are NOT a normal development of the patient's disease or an expected result of the treatment
10. Development of a neurological alteration absent at admission, but present at time of discharge from the index admission (includes neurological alterations related to procedures, treatments, or investigations)
11. Death
12. Inappropriate hospital discharge / inadequate discharge plan from index admission (excludes unauthorised discharge)
13. Reversed cardio-respiratory arrest
14. Injury related to abortion or labour and delivery
15. Hospital infection/septicaemia (excludes infections/septicaemia occurring fewer than 72 hrs after admission
16. Dissatisfaction with care received as documented on patient record, or evidence of complaint lodged (includes documents, documented complaint, conflicts between patient/family and healthcare professionals, and unauthorised discharge)
17. Documentation or correspondence indicating litigation, whether merely intent to sue or actual law suit
18. Any unwanted events note mentioned above.

11.5. Causation and Preventability Scores

Causation was present if the adverse event was caused by healthcare management rather than the disease process. It included acts of omission (failure to diagnose or treat) and acts of commission (incorrect treatment or management). A scale from 1-6 was used to determine whether an adverse event was caused by healthcare management or the disease process.

1= virtually no evidence for management causation:

2= Slight-to-modest evidence for management causation:

3= management causation not likely, less than 50-50 but close call:

4= management causation more likely than not, more than 50-50 but close call:

5= moderate/strong evidence for management causation: and

6= virtually certain evidence for management causation.

Preventability of an adverse event was assessed as 'an error in management due to failure to follow accepted practice at an individual or system level'; accepted practice was taken to be 'the current level of expected performance for the average practitioner or system that manages the condition in question' (Bates, O'Neil, Petersen, Lee & Brennan (1995).

The degree of preventability was scored on a 1-6 scale, grouped into three categories.

No preventability

1= virtually no evidence for preventability

Low preventability

2= Slight –to-modest evidence for preventability

3= Preventability not likely, less than 50-50 but close call

High preventability

4= Preventability more likely than not, more than 50-50 but close call

5= Strong evidence for preventability; and

6= virtually certain evidence for preventability

11.6. Reporting systems for non-medical events

Aviation

- Aviation safety reporting system (ASRS)
- Aviation safety airways programme (ASAP)
- Air Altitude Awareness Programme
- Canadian aviation safety reporting system (CASRS)
- British Airways safety information system (BASIS)
- Air safety report (ASR)
- Confidential human factors reporting programme (CHFRP)
- Special event search and master analysis (SESMA)
- Human factors failure analysis classification system (HFACS)

NASA

- Safety reporting system

Petrochemical processing, steel production

- Prevention and recovery information system for monitoring and analysis (PRISMA)

Nuclear (nuclear power and radiopharmaceutical industries)

- Licensing event reports (LER)
- Human performance information systems (HPIS)
- Human factors information system (HFIS)
- Nuclear Regulatory Commission allegations systems process (NRCAS)
- Diagnostic misadministration reports – regulatory information distribution system (RIDS).

11.7. Student Evaluation and Feedback Form 2010

University of Dundee College of Medicine, Dentistry & Nursing and College of Arts and Social Sciences

RADAR Recognising Acute Deterioration: Active Response

STUDENT EVALUATION & FEEDBACK FORM

Before you leave, and at strategic points during the day's sessions we would be grateful of you would take time to complete this evaluation form. This will help us to improve the teaching and make it more relevant to your needs and expectations.

Part 1: Please circle your opinion of the following statements based on 1 (Not at all) to 5 (To a large extent)

The RADAR Practical Sessions (Afternoon)					
Had clear learning outcomes	1	2	3	4	5
Kept me actively involved	1	2	3	4	5
Were relevant to my learning needs	1	2	3	4	5
Were appropriate for my level of experience	1	2	3	4	5
Were challenging without being threatening	1	2	3	4	5
Helped me to integrate theory and practice	1	2	3	4	5
Stimulated my interest	1	2	3	4	5
Encouraged me to think through a clinical problem myself	1	2	3	4	5
Provided me with effective feedback	1	2	3	4	5
Increased my readiness to use what I have learned in the clinical setting	1	2	3	4	5

Part 2: Please circle your opinion of the following statements based on 1 (No knowledge) to 5 (Greater Knowledge)

My Confidence in my knowledge in terms of:	Before I came Today					At Lunchtime Today					Now at the end of Today				
The ABCDE Approach	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
What to do when I'm in over my head during an acute episode	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
How to interpret observed rapid changes in a patient's condition	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Effective Communication during and acute episode	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Getting help from senior colleagues during an acute episode	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Approach to the specific emergencies covered in this session	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Using SEWS and SBAR to assess and call for help	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5

Continues Overleaf

Your Expectations and Realisations:

What were the three key things that you learnt from the RADAR Session?

What were the most interesting or useful aspects of the RADAR Session?

What were the least useful aspects or those that need most improvement?

Any other comments you have about today's sessions

We might contact you within the next six weeks to ask you to attend a focus group to find out more about what you thought about the RADAR sessions. If you would be willing to take part, please complete the section below.
Name…….
Email address……..@dundee.ac.uk

Thank You

11.8 RADAR Patient Scripts and Scenarios

Pulmonary embolism

Name: Alison / Alistair Cairns **DoB and CHI**: 23.04.44 0077 (70 y/o)

Scenario: Admitted to Acute Medical Unit (AMU) earlier today. You have been receiving treatment for diabetic leg ulcers from the District Nurse for the last six weeks. She visits twice a week to redress your legs.

You have type 2 diabetes on tablet control: Metformin.

You have high blood pressure: Amlodipine, Losartan and Doxazocin.

Your mobility has been restricted lately due to the pain in your legs and you have not been able to get out and about as you like. Last night you felt a bit short of breath which worsened so that you were breathless on minimal exertion i.e. going from the living room to the toilet. You told the District Nurse when she visited and she called the GP who had you admitted to AMU.

You are Allergic to Penicillin which gives you a rash.

As well as the diabetes and high blood pressure you have had no other health problems.

You had a cup of tea and toast for breakfast before you were brought into hospital.

Moulage: Both legs bandaged below knee (No ulcers required).

Role play: During the session you will be assessed by the medical students supervised by a tutor.

During the first 5-10 minutes of the scenario you are alert but anxious and agitated. You are finding it difficult to breathe and have a pain over the right breast if you are asked to take a deep breath. The students should examine you and record the following for which the tutor will give results:

Respiration rate	24 bpm, regular, shallow
Oxygen saturations	93% on room air
Pulse	110 bpm, regular, strong
Blood pressure	140/86 mmHg
Temperature	37.4^{o}C

The students should give you Oxygen (Medical Air) through a face mask, sit you up in bed, reassure you and call for qualified help early during the assessment.

The tutor will then provide some feedback to the students and you can rest and relax during this time.

Acute Heart Failure

Name: George/Grace Rice **DoB and CHI**: 21.03.42 0047 (72 y/o)

Scenario: Admitted to Acute Medical Unit (AMU) earlier today. You have feeling increasingly breathless with chronic tiredness over the last two weeks. You had a chest infection four weeks ago for which you had a course of penicillin and think that this might be what has caused you to be unwell now. You have had to sit up in bed at night with three pillows due to a night-time wheeze and coughing. You have noticed that your ankles have been swollen over the last two weeks.

You had heart attack when you were 58

You have high blood pressure: Atenolol and Bendrofluamethiazide, and Angina: Aspirin and GTN spray as required, Simvastatin at night.

You have been a smoker for 30 years and have tried to stop a few times. However, you have recently dropped from 20 per day to 10 and this has been less than 5 since you became so breathless.

You have no Allergies.

You had a cup of tea and half a slice of toast for breakfast before you were brought into hospital.

Moulage: Cyanosed cold extremities.

Role play: During the session you will be assessed by the medical students supervised by a tutor.

During the first 5-10 minutes of the scenario you are alert but anxious and agitated. You are finding it difficult to breathe. The students should examine you and record the following for which the tutor will give results:

Respiration rate	24 bpm, regular, shallow
Oxygen saturations	92% on room air
Pulse	112 bpm, regular, strong
Blood pressure	150/96 mmHg
Temperature	37.4^{o}C

The students should give you Oxygen (Medical Air) through a face mask, sit you up in bed, reassure you and call for qualified help early during the assessment.

The tutor will then provide some feedback to the students and you can rest and relax during this time.

Sepsis

Name: Aiden / Avril M^{c}kinney **DoB and CHI**: 12.04.56 0022 (58 y/o)

Scenario: Admitted to Acute Medical Unit (AMU) earlier today. You saw your GP five days ago with a persistent chesty cough and shortness of breath and had antibiotics (Amoxycillin). Today you felt very unwell with 'flu-like' symptoms – sweaty, headache, tired, and called the GP who was concerned and sent you into hospital.

You have had asthma since childhood but it doesn't really bother you if you take your brown inhaler regularly, you rarely use the blue inhaler.

No other medical problems or medicines.

You have never smoked and drink only on special occasions.

You have no Allergies.

You had a cup of tea for breakfast as you felt nauseas before you were brought into hospital.

Moulage: Pale with cold extremities.

Role play: During the session you will be assessed by the medical students supervised by a tutor.

During the first 5-10 minutes of the scenario you are very drowsy and respond only to voices by mumbling incoherently. The students should examine you and record the following for which the tutor will give results:

Respiration rate	24 bpm, regular, shallow
Oxygen saturations	89% on room air
Pulse	118 bpm, regular, strong
Blood pressure	87/56 mmHg
Temperature	38.4^{o}C

The students should give you Oxygen (Medical Air) through a face mask, reassure you and call for qualified help early during the assessment.

The tutor will then provide some feedback to the students and you can rest and relax during this time.

Stroke

Name: Karen / Kevin Page **DoB and CHI**: 16.02.56 0006 (58 y/o)

Scenario: Admitted to Acute Medical Unit (AMU) earlier today after sudden collapse at home. You have been troubled by headaches over the last three weeks which you have put down to tension. Your daughter recently returned to live with you following the break-up of her marriage and this has not really worked. You have been taking Paracetamol maximum dose most days for the last week. You cannot remember collapsing at home.

You are unable to smile and cannot speak properly. Your right arm is weak and you cannot lift it (Stroke).

Moulage: None

Role play: During the session you will be assessed by the medical students supervised by a tutor.

During the first 5-10 minutes of the scenario you are very drowsy, you are unable to smile and cannot speak properly. Your right arm is weak and you cannot lift it (Stroke).

The students should examine you and record the following for which the tutor will give results:

Respiration rate	22 bpm, regular, shallow
Oxygen saturations	95% on room air
Pulse	88 bpm, regular, strong
Blood pressure	170/100 mmHg
Temperature	37.2^{o}C

The students should give you Oxygen (Medical Air) through a face mask, reassure you and call for qualified help early during the assessment.

The tutor will then provide some feedback to the students and you can rest and relax during this time.

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