Can a Decision Support System assist in the prevention of inappropriate elective surgical admissions and reduce the spread of MRSA in a private hospital in Dublin?

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university.

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**Abbreviations**

CABG – Coronary Artery Bypass Grafts

CINAHL – Cumulative Nursing and Allied Health Literature

DoHC – Department of Health and Children

EARSS - European Antimicrobial Resistance Surveillance System

EU - European Union

EMBASE – Excerta Medica Database

HELP - Health Evaluation through Logical Processes

HIS – Hospital Information System

HSE – Health Service Executive

ICT – Information and Communication Technology

INR - International Ratio

IV – Intravenous

MEDLINE – Index Medicus Online

MRSA – Methicillin Resistant Staphylococcus Aureus
Summary
The admission process is where a patient's journey in hospital begins and it is imperative that this process is conducted in an efficient manner, for the patient, their loved ones and the hospital as an organisation. Policies and protocols are fundamental if evidenced based quality care is to be provided throughout the hospital departments and can be the solution to making hospital process more efficient (Sauter and Free 2005, Sullivan and Wyatt 2005). However, it is not enough to merely implement these guidelines into a hospital; it is imperative that staff adhere to them to ensure that evidenced based care is delivered to patients’. A DSS is an effective and efficient tool for utilizing expert knowledge and developing automated evidenced based answers (Fala, Clayton Masciantonio 1995) and as evidenced based practice is associated with high quality care, it appears that it is an obvious solution.

In the complex world of healthcare, on occasions patients arrive for surgery as planned and have consumed prescribed medication which may increase their hospital stay and indeed, put their lives at risk through bleeding during or after their operation. Consultants’ may decide to cancel this surgery and send these patients’ home at a huge inconvenience to them, their families’ as well as the financial implications on the hospital. In addition to this, the prevalence of Methicillin-resistant Staphylococcus aureus (MRSA) is increasing in Irish hospitals (EARSS 2005, Wernitz et al 2005b, Gilfeather 2004, Samad, Ghosh and Carbars 2002). Wernitz et al (2005a) suggest that the vast majority of patients who have MRSA can be identified at the time of hospital admission and other researchers concur (Whyte et al 2005, Wagenvoort 2000). This study aims at addressing these two problems with the use of a DSS.

The study begins by evaluating the number of patients who were admitted to the hospital and remained on contraindicated medication and also by recording the number of patients who were in a high risk MRSA group and assigned to a shared room which increases the risk of spread over a 2 month period. A prototype of a DSS was built using Exsys software and the hospital protocols were embedded into it. The DSS was then introduced into the admissions area as part of the admissions procedure for 2 months. The results were compared and positive results were identified in relation to both aspects of the research.
Chapter 1 Introduction

Healthcare is confronted with increased patient demands for high quality inpatient care and an infection free discharge (Kent et al 2001). The goal of management in the healthcare environment is to ensure that these demands are delivered whilst also making certain that it is conducted in a cost effective manner (Fala, Clayton Masciantonio 1995). However, the plans of hospital management are compounded by political pressure to reduce waiting lists and are further hindered by the financial constraints of tight budgets (Dempsey 2000). Bartholomew (2004) argues that hospital management are pressurised by politicians who force them to respond to the latest newspaper headlines as opposed to patients' primary needs which is high quality evidenced based care. Policies and protocols are fundamental to the organisational management if evidenced based quality care is to be provided throughout the hospital departments. However, it is not enough to merely implement these guidelines for staff; it is imperative that staff adhere to them to ensure that evidenced based care is delivered to patients and their relatives.

These issues are not confined to Ireland and there is a call for worldwide recognition of these obstacles within healthcare and a suitable solution is sought (Dempsey 2000). Researchers argue that Information and Communication Technology (ICT) in the form of decision support may be the solution to some of these problems (Sauter and Free 2005, Sullivan and Wyatt 2005). The ability of decision support systems (DSS) to influence the behaviour of clinical staff has been well established as has their ability to increase staff adherence to policies and protocols (Hulgan et al 2004). As a DSS can be an effective and efficient tool for utilizing expert knowledge and developing automated evidenced based answers (Fala, Clayton Masciantonio 1995) and as evidenced based practice is associated with high quality care, it appears that it is an obvious solution.

A wealth of knowledge exists in Irish hospitals and the aim within this research is to inspire and cultivate this expert knowledge and convert it into an organisational asset to allow staff to use this resource in a more informed manner. The desire to capture this expert knowledge in a DSS in order to make hospital processes more efficient by reducing the number of
inappropriate and sometimes dangerous elective admissions is the rationale behind the choice of research topic. For the purpose of this research an 'inappropriate admission' will refer to an admission that does not result in any significant benefit for the patient or which results in benefit which could have been obtained at a lower care level (Eriksen et al 1999). DSS are a way of capturing and preserving the knowledge of experts in their field and allowing users to utilise this knowledge in a more effective way (Fala, Clayton and Masciantonio 1995). Ball, Weaver and Kiel (2004) argue that DSS can improve clinical outcomes and reduce the cost of care which is a fundamental requirement for every healthcare organisation in today’s competitive market.

The admission process is the start of a patient’s hospital journey and this can be in the form of an emergency admission through accident and emergency or an elective admission which is when a patient is given a planned date for admission. It is imperative that this process is conducted in an efficient and effective manner, both for the patient and their loved ones and for the hospital as an organisation. However, in the world of healthcare this is not always possible and on occasions patients arrive for surgery as planned and have consumed prescribed medication which may increase their hospital stay and indeed, put their lives at risk through bleeding during or after their operation.

In addition to this, the prevalence of Methicillin-resistant Staphylococcus aureus (MRSA) is increasing (EARSS 2005, Wernitz et al 2005b, Gilfeather 2004, Samad, Ghosh and Carburns 2002). The Irish general public are concerned about this rise and also about the consequences associated with contracting MRSA (Whyte et al 2005). Screening patients before they come to the hospital for high risk group membership facilitates a cost effective opportunity to enable the implementation of isolation precautions which will reduce the possibility of spreading MRSA. Wernitz et al (2005a) suggest that the vast majority of patients who have MRSA can be identified at the time of hospital admission and other researchers concur (Whyte et al 2005, Wagenvoort 2000).

MRSA is now being deemed ‘a killer bug’ (Gilfeather 2004), patients are admitted to hospitals every day with the possibility of having this organism in their system and it is necessary to
identify them and isolate them accordingly to prevent cross contamination. This study aims to prove that technology in the form of a prototype DSS built using Exsys software (Exsys 2007) can prevent inappropriate planned surgical admissions to a private hospital in Dublin by identifying them before they arrive at the hospital. In addition, this study aims to prove that this prototype can also identify patients who are members of a high risk group in relation to MRSA prior to admission, isolate them as per the hospital protocol and in doing so, reduce its spread.

The study begins by evaluating the number of patients who were admitted to the hospital and remained on contraindicated medication over a 2 month period and also by recording the number of patients who were deemed to be in a high risk MRSA group and assigned to a shared room which increases the risk of spread. A prototype of a DSS was built using Exsys software and the hospital protocols embedded into it and this was introduced into the admissions area as part of the admissions procedure for 2 months. The results were compared and positive results were identified. This research will conclude with a discussion of the results and the impact this system will have on practice outcomes. Prior to a critical review of the literature where the evidence for this research project was extracted from, it will be necessary to look at the background of this research and where the idea for this research stemmed from.
1.1 Background to the Study

DSS are active knowledge systems that use two or more items of patient data to generate case specific advice and can be invaluable in fostering the uptake of clinical guidelines (Kotze and Brdaroska 2004). Assuming the clinical guidelines are evidenced based, this can result in improved practice and better patient outcomes. As an admission nurse working in a private hospital for the past 6 years, the inept processes which existed as part of the admission procedure became evident on a daily basis when admitting patients’ to the hospital. It therefore seemed logical to attempt to find a suitable solution to some of these inefficiencies as part of a Masters of Science in Health informatics. Below are 2 examples of the most common problems that are encountered as an admission nurse and the ones that have the most profound affect on the patients’ and the hospital and its employees.

**Example 1:** A patient arrives into the hospital for a surgical procedure and is seen by the admission administrative staff. The patient is then brought to the ward and is seen by the ward nurse. The necessary documentation is completed and the patient is sent for preoperative tests. The patient will visit the phlebotomy department and will have blood taken and also the cardiology department for an electrocardiograph (ECG). The patient will then be seen by an admission nurse. It is at this point, several hours later that the admission nurse establishes that the patient is currently taking aspirin or another contraindicated drug such as plavix or warfarin. These drugs are deemed contraindicated to surgery as they may cause excessive bleeding during or after the surgery (Dhiwakar 2006, Dickinson and Prentice 1998). The admissions nurse will then telephone the consultant or the consultant’s secretary to inform the surgeon who will decide whether to proceed with surgery.

In the interim, the admission registrar sees the patient and more documentation will be completed and any further tests deemed relevant will be ordered if required, for example a chest X-ray. The consultant may be contacted again by the admission registrar and a decision is made.
Fig 1: Current Process with Surgical Admissions
Depending on the surgeon and the surgery, the patient may be sent home and informed to stop the contraindicated medication again and given a new admission date. The vast amount of documentation that has been completed is now rendered useless as a new assessment must be completed on all admissions. The tests will automatically be repeated on the next admission and the theatre slot will not be used resulting in loss of profit for this private hospital and also an increase in the surgical waiting lists.

**Example 2:** A patient is transferred from another hospital for treatment and as in the example above is seen by the admission administrative staff who obtain demographical and insurance details. The patient is assigned their room based on the insurance details and in the majority of cases they will be assigned to a shared room. The patient is then brought to the ward and is seen by the ward nurse. The necessary documentation is completed and the patient is sent for tests. The patient will visit the phlebotomy department and will have blood taken and also the cardiology department for an electrocardiograph (ECG) and possibly the radiology department for X-rays or scans. They will then be seen by an admission nurse. It is at this point the admission nurse establishes that the patient has come from another hospital or has a history of MRSA or other criteria that warrants their inclusion in the high risk group.

The infection control nurse is informed and the patient is swabbed for MRSA as per protocol. If the patient is positive for MRSA, the patient will then be moved to a single room and isolated. The other 3 patients are swabbed as they have used the same toilet facilities and may have had direct contact with the affected patient. If the swabs results are positive for MRSA, they will be almost certainly have to stay longer and of course are at risk of other complications. In the interim, the shared bedded area cannot be used i.e. no admissions are allowed into that area until all of the patients have gone home. In this private hospital it has a direct affect on profits. In public hospitals this would result in patients waiting unnecessarily in A&E on trolleys for a bed and/or elective surgery is cancelled due to bed shortages. The affected area is then steam cleaned and all of the curtains, bed linen etc replaced at a financial cost. There are also the ethical and possible legal consequences should any of the other patients have contracted MRSA. Please refer to Figure 2 overleaf for an overview of this process.
Fig 2: Current Process in relation to MRSA high risk
The examples of cases above occur regularly in some format in healthcare and the researcher decided to attempt to address them through the use of ICT. The protocols and processes exist in this private hospital in order to prevent these problems occurring, however they are not being utilised by staff. It was therefore proposed that a possible solution was to build a DSS using Exsys software and embed these protocols into it which would make it mandatory to utilise the protocols which are in existence. It would first be necessary to measure the occurrences of cancellations due to contraindicated medication and also the number of patients who are deemed high risk in relation to MRSA prior to its implementation of the DSS to establish how effective it is. The specialised skills and clinical expertise that exists in the hospital have resulted in knowledge that is relative to best practice which is not disseminated in an effective manner which was resulting in poor hospital processes. It was thought these inefficient processes could be addressed through the appropriate application of ICT.

In relation to example 1 above where the patient has not stopped the contraindicated medication it may be argued that there are other methods of addressing this problems such as reminding the patient prior to admission. However, this occurs at present more than once before the date for admission. Consultants inform their patients’ verbally at the time of consultation and also in writing with details of their admission date. Unfortunately, this is not having an impact on the numbers of patients having their surgery cancelled due to contraindicated medication.

It may also be argued that in relation to identifying the patients in the high risk category MRSA group that every patient should be swabbed on admission. However, this would have huge cost implications for the hospital and would increase the workload of nurses’ who take the swabs and also the labatory workload as they analyse the swabs and provide the results. This would result in a need for more nursing staff and medical scientists’ at an added cost to the hospital. In addition to this, it takes 72 hours for the swab result to be deemed conclusive and the patient would have already been in contact with other patients and staff. This is the rationale for the proposal that these questions are asked prior to admission with the use of a DSS by administration staff that will have had no medical education and cannot be expected to make these decisions without some support.
Finally it may be suggested that a paper based decision tree may assist the admission administrative staff as opposed to an electronic DSS. However, DSS have the proven ability to make staff adhere to protocols (Hulgan et al 2004), and therefore that is the rationale and justification for this choice of technology. In addition, technology has the ability to make practices mandatory and it is suggested that use of this DSS will become a mandatory component of the admission process. It is now necessary to ensure that the existing protocols are consistent with the evidence in the literature available.
Chapter 2 State of the Art

A review of the literature began with a search of the databases which were cumulative index to nursing and allied health literature (CINAHL), Health Source Nursing, Science direct, MEDLINE (Index Medicus online), PubMed, ACM digital Library, EMBASE (Excerpta Medica Database) and Proquest and also a hand search of journals from the workplace and libraries. Medical, pharmaceutical, informatics and nursing texts were also explored as were the references lists from all of the articles located. The Boolean operators ‘AND’, ‘OR’ and ‘NOT’ were used to expand and narrow the search as appropriate. The keywords used and the database and results retrieved are summarised in the table below. The total result refers to the total number of articles retrieved using the keywords listed.

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<th>Database(s)</th>
<th>Keyword(s)</th>
<th>Total Result</th>
</tr>
</thead>
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<td>decision support systems AND hospitals AND implementation</td>
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</tr>
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<td>Embase, Blackwell Science</td>
<td>Surgery AND Warfarin</td>
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</tr>
</tbody>
</table>

Fig 3: Summary of Literature Search

The searches were saved and the key words were used on a monthly basis up until the date of submission to identify any additions to the databases which related to the research area. Some
duplication occurred across databases and not all of the articles retrieved were relevant to this research. A monthly internet search was also conducted using the search engine Google in an attempt to identify any unpublished work. The key words were also used in the library catalogue to identify any books that were relevant to the research. The most up-to-date theoretical, review and research articles were included and chronologically the search was carried out from 1987 up to 2007. However, some articles which were published prior to 1987 and were deemed to be very relevant were included to ensure a holistic approach to the study. The inclusion criteria for the initial selection of the literature that was established for this review was that the research included information related too

- ICT in healthcare
- Implementation/ Use of DSS in healthcare
- MRSA
- Aspirin, Plavix and Warfarin and surgery

The retrieved articles were categorised according to their theoretical orientation and therefore the review is divided into distinct but interrelated areas, and the first section will focus on the use of DSS in healthcare.

### 2.1 Decision Support Systems in Healthcare

In the early 1970's a DSS is noted as being described as 'a computer based system that aids decision making' and this definition progressed to an 'interactive computer based system which help decision makers utilize databases and models to solve ill structured problems' in the late 1970's (Holsapple and Whinston 1987). However, in the 1980's Elam, Henderson and Miller (1985) suggested that a DSS is 'the exploitation of intellectual and computer based technologies to improve creativity in decisions that really matter.' The definitions evolved over time as they encompassed the advancements in relation to ICT that had been made in recent decades. DSS have been proven to work in healthcare as they are an effective and efficient tool for developing automated evidenced based answers (Fala, Clayton Mascianonio 1995). They can explicate or clarify the dependencies for situations and provide a blueprint for
organising methods of conceptualising solutions to problems whilst also attaching weights and dependencies scales (Caelli, Downie and Caelli 2003). Kotze and Brdaroska (2004) argue that DSS were developed to improve the quality of patient care and describes them as an ‘active knowledge system that uses two or more items of patient data to generate case specific advice’ and for the purpose of the research this definition will be adopted. Wu, Lin and Tsai (2002) state that computers have made data acquisition and analysis more efficient in the healthcare arena and argue that integrating a DSS with a hospital information system (HIS) can strengthen the abilities of the hospital as an organisation and allow greater goal achievement.

Decision making is at the core of professional practice and is a vital component in a hospital organisation as healthcare professionals make decisions that impact directly on patient’s lives and the lives of the families and loved ones. Although decision-making in a clinical environment is a complex duty requiring a knowledgeable practitioner, evidenced based informational contributions and supportive surroundings in order to establish and manage the health needs of patients’ effectively (O Neill, Dluhy and Chin 2005). Dempsey (2000) argues that physician’s decisions have a direct impact on the cost of healthcare and this should be considered when examining quality of care and the association with costs. It is also suggested by Dempsey (2000) that the barriers to change in a hospital are mainly due to the physician’s sense of authority in the hospital organizational structure and their lack of trust in relation to trying alternative methods. However in the late 1950’s Ledley and Lusted (1959) reported in their article which examined the reasoning foundations of medical diagnosis, that the physicians were unsure of how they actually made a decision in relation to a patient’s diagnosis. Jones and Bowles (2005) concur with this conclusion and argue that a proportion of hospital admissions are not clinically justified but are a direct result of physician’s anxiety or uncertainty. However, DSS in the healthcare environment are built to enhance their capabilities and are not built to replace them (Hannah, Ball and Edwards 1999).

Hulgan et al (2004) believe that doctor’s decisions may be underpinned by their anecdotal beliefs rather than the evidence that is available in the literature. As a result of this Hulgan et al (2004) developed a web-based clinical decision support system for a hospital in Nashville to assist with antibiotic selection. They evaluated hospital processes and established that
doctor’s were choosing intravenous (IV) routes for antibiotic administration rather than oral despite there being no clinical reason to support their decision for example the patient being nil by mouth. However, IV antibiotics cost 3 or 4 times more than oral antibiotics and result in the patient having to have a cannulae or needle put into their arm which is often a painful procedure. Hulgan et al (2004) concluded that using this DSS resulted in an increase of oral antibiotic orders of 5.6% a week which saved the hospital a total of $6000 a year as well as preventing the unnecessary pain associated with cannulation of patients’ arms.

MYCIN was one of the earliest expert system and was developed by the Stanford Heuristic Programming Project in the 1970’s which sought to determine the organism causing the infection and choose the appropriate medication to treat it based on an interactive dialogue with a physician (Davis 1977). It consisted of over 400 rules that were based on IF <condition> THEN <implication> and each of these are associated with a certainty factor which indicated the level of confidence similar to the Exsys system. MYCIN was primarily a goal directed system that used backward chaining to examine the evidence submitted to match to over 100 diagnoses (Mitchie 1982). The system was evaluated against 8 medical professionals, 5 of which were members of the faculty in the division of infectious diseases in Stanford University (Buchanan and Shortliffe 1984). Mycin compared favourably to the 8 medical professionals obtaining the highest score (56%) in relation to treatment, however this DSS was never used in clinical practice due to issues surrounding its maintenance. Indeed, as a direct result of the lack of maintenance of up-to-date information held in this DSS, the decision support became out of date very quickly and it could no longer be used (Berner 2004).

Many other DSS emerged with the aim of benefiting those who worked in and utilised the health service such as ONCOCIN which encodes protocol knowledge also using IF-THEN rules for treatment in relation to chemotherapy management (Michie 1982). After examining the patient the physician used a display terminal to interact with ONCOCIN’s data acquisition program whilst reviewing time oriented data that existed from the patients previous visits and the information inputted by the physician, the system generated recommendations for tests and therapy (Shortliffe et al 1981). The system was put into use in Stanford’s oncology clinic,
however it took 6 weeks to enter and test the rules that were required to enter the paper based protocols and was therefore not deemed efficient due to the rapid advancements in cancer therapy (Musen 2005). CASNET was another prototypic system which was created with the intention of diagnosing and recommending treatment for glaucoma, which is an increase in intraocular pressure in the eyes which can lead to blindness, should it go untreated (Kulikowski and Safir 1976). It was created for use by opthalmologists, however, they had no use for the system as they knew exactly how to diagnose and treat this disease. Berner (2004) suggests it would have been more appropriately aimed at primary care givers with record management functionality included.

Sprague and Carlson (1982) argue that if evaluation of DSS’s occurs at all then it has not been widely reported however; this appears to have changed in recent decades. Evaluation of DSS has encouraged Leapfrog, an American assembly committed to reducing preventable medical mistakes and improving the quality of care, to develop DSS to be used in the clinical setting (The Leapfrog Group 2007). One such system is called e-prescribing which provides decision support in relation to medications based on drug reference medication and specific information in relation to the patient. Another such system is e-Lab which is a DSS that tracks results of tests sent to the laboratory for analysis and also acts as a data warehouse to store and retrieve the results. This system checks to ensure that the results of blood and other samples have been viewed and the results relayed to the patient ensuring good communication.

The Leapfrog group have found that automating these hospital processes in the form of DSS allows easier and speedier auditing and evaluation as opposed to previous manual processes. Currently in UTAH the United States, the LDS hospital is using a DSS called Health Evaluation through Logical Processes (HELP) which consists of an integrated clinical database, a frame-based medical DSS which is programmed to include hospital and administrative functions (Berner 2004). In addition to the decision support capabilities which assist the user with decisions in relation to blood gases, medication and radiology results, the HELP system also acts as a data warehouse and has alerting functionality (Haug et al 1994). This system also has the ability to highlight adverse drug reactions by not only ensuring that the prescribed drugs do not react with each other, but it also determines possible drug
reactions by other data entered into the system in relation to the patients care. The hospital had a voluntary manual reporting system in place should an adverse drug reaction occur and in one year, 9 reactions were documented. However, after the HELP system was introduced the 401 reactions were identified as a result of the system (Evans et al 1991).

The LDS hospital in Utah also uses a DSS to recognise hospital acquired infection and automatically generates alerts for these patients (Evans et al 1986). Evans et al (1986) evaluated system after surveillance staff had been using the system for 2 months and compared it to the traditional manual approach that had been in used. They established that the computers sensitivity was 90% with a false positive rate of 23% whilst the manual approach was found to have a sensitivity of 76% and a false positive of 19%. In addition to this when the amount of time it took to use each process was reviewed, the DSS was found to be twice as efficient as the manual process. The system also alerted its users to other data during these 2 months such as 37 patients were not receiving the appropriate antibiotic and 31 patients could have been receiving cheaper antibiotics. Evans et al (1986) concluded that using ICT to alert healthcare professionals to these conclusions can improve the efficiency of their time and thereby reduce costs and is another example of the positive application of DSS in the healthcare environment.

In summary, decision making is a complex duty which becomes more difficult when the decision may affect the lives of others. DSS are not used to replace the judgement of the user but merely support them by providing evidenced based answers. The literature is clear that DSS can be utilised effectively in the healthcare domain. Indeed, some researchers would argue that embedding a DSS into a HIS can improve the overall efficiency of a hospital and improve patient outcomes (Wu, Lin and Tsai 2002). However, prior to the introduction of the DSS for this study, it was first necessary to ensure that the hospital policies were indeed evidenced based and the following will discuss the evidence in literature in support of this.
2.2 Evidence behind Decisions in Decision Support System

Healthcare professionals must have the ability to justify their practice to their regulation body, management, colleagues and their patients with the use of evidence from research (Mc Sherry, Simmons and Abbott 2002). Evidenced based practice has been defined as providing care to patients for which there is evidence of clinical effectiveness (Regan 1998) and this evidence may be derived from research, expertise, audit and feedback from clients (Royal College of Nursing 1996). It is no longer acceptable to utter the words 'this is the way we've always did it' or 'trial and error' in the realms of patient care (Regan 1998, Blanchard 1996).

In summary, hospital policies exist to support employees make evidenced based decisions in relation to the care of the people that have arrived at the hospital and put their lives in their hands. Hospital polices and protocols that contain current evidenced based research ensure that their patients receive the best quality care and therefore decrease their chances of morbidity and mortality (Regan 1998). The literature is clear in relation to evidenced based practice; it improves patient outcomes. It is also clear in relation to anecdotal evidence: it is no longer acceptable practice in today’s healthcare. Using evidenced based practice in clinical care incorporates the conscientious use of current best practice from suitably designed studies (Overholt, Melnyk and Scultz 2005). The evidence which will be drawn on to support the decisions made in relation to the medications discussed below will also be from the literature search discussed above and will be critiqued prior to inclusion to ensure that they are indeed suitably designed studies.

2.21 Evidence behind decisions in relation to Aspirin

Over one hundred years ago aspirin or acetylsalicylic acid was launched commercially and is the most widely used medication in the world (Dickinson and Prentice 1998). Aspirin induces an irreversible inactivation of cyclo-oxygenase in blood platelets which lasts for the entire period that the platelets remain in the circulatory system, 7 to 10 days (Fijnheer, Urbanus and Nieuwenhuis 2006). Aspirin is used in the prevention or prophylaxis of cerebrovascular disease such as a stroke and/or myocardial infarction or heart attack (British National Formulary 2007).
Aspirin in layman’s terms thins the blood and therefore increases the risk of bleeding and if this occurs in surgery, increases the risk of morbidity and mortality. If a patient bleeds during surgery this blood will need to be replaced. This may result in unnecessary risk and distress to patients and their families as there has been much publicity surrounding blood products and the sometimes fatal consequences of their use (DoHC 2006). The risk associated with this is widely recognised and there has been a large amount of publications in the literature in relation to contaminated blood products being administered to patients (DoHC 2006). It is estimated that over 1700 Irish people were infected by Hepatitis C by the administration of blood products (Health Protection Surveillance Centre 2007) and whilst there are precautions currently in place to prevent this from happening again, the psychological trauma associated with receiving blood remains. The stopping of this medication is documented in the majority of consultant’s protocols who practice surgery in this private hospital (Appendix 1) and the evidence in the literature exists to support this practice.

Dickinson and Prentice (1998) examined the literature in relation to aspirin and surgical bleeding and established that patients who took aspirin 7 days prior to surgery were 30% more likely to bleed during their operation and require a blood transfusion. Bleeding during an operation is an unwanted complication although when the bleeding point is found it can normally be stopped. Korinth (2006) conducted a survey of 138 neurosurgeons in Germany in relation to whether they would operate on a patient who was currently taking aspirin. Over 80% of them had a hospital policy in place which stated that all patients should stop aspirin 7 days prior to surgery. Almost all believed that patients who were currently taking aspirin increased the risk of bleeding intraoperatively and over half had had personal experience of such bleeding. However, in addition to bleeding during an operation there is also the risk of bleeding afterwards when the point of bleeding is beneath bandages and sutures.

Post operative bleeding is also a concern for surgeons and a risk for patients’ as this may require further surgical intervention and re intubation, infection at site of surgery and a longer hospital stay in addition to hospital costs (Dickinson and Prentice 1998). Whilst a concern for surgeons, it is also a concern for anaesthetists who put patients’ to sleep. Anaesthetists worry about subdural bleeding or bleeding into the brain (Dickinson and Prentice 1998). Dhiwakar
(2006) conducted a retrospective cohort study in order to establish if aspirin increased the risk of bleeding or haemorrhaging in patients undergoing surgery to their head and neck over a 10 year period. 711 patients were studied of which, 320 were currently taking aspirin and whilst it was established that patients who were undergoing head and neck surgery were more likely to bleed afterwards than those not currently taking aspirin. It was also concluded that if a patient was undergoing a flap reconstruction where the surgeon takes a healthy piece of tissue and sews it onto an affected area the patient would be 124 times more likely to bleed after surgery compared with those who were not taking aspirin. Khalid, Hoh, Chinegwundoh (2006) concur with this research and established in their study of 287 urologists that 62% of surgeons inform their patients to stop aspirin prior to surgery and that 40% of would cancel a patients surgery if they were admitted and were currently taking aspirin. This results in further stress to patients and their families and theatre slots not being used which in turn will increase Ireland’s already soaring surgical waiting lists.

However, there are also opinions in the literature to dispute the stopping of aspirin before surgery. Fijnheer, Urbanus and Nieuwenhuis (2006) reviewed the published literature in Medline from 1996-2002 and compared the studies. They concluded that there is little scientific evidence to warrant withdrawing aspirin in all patients undergoing surgery. Although they did establish that according to the published research, patients are more likely to bleed during the operation if taking aspirin. However they suggest that it is only in the types of surgery where a minimal amount of bleeding can be detrimental to the patient’s recovery that it should be stopped such as neurosurgery. In addition to this Madan et al (2005) argue that the risk of excessive bleeding during or after operations often prompts surgeons to stop patients taking aspirin before their procedure. However, they studied 51 patients who were all taking between 75-100mg of Aspirin and were due to have minor oral surgery under local anaesthetic and only one patient bled excessively intra operatively. They concluded that most patients who are taking low dose aspirin can have minor oral surgery without stopping their medication. However, it could be argued that if all of these patients stopped their medication, no one would have bled during the operation.

Cahill et al (2005) contend that it is unclear whether aspirin should be stopped before surgery
and if so when should it be stopped. They argue that the period of time when aspirin should be withheld is controversial and aimed to establish the effect it had on the body and for what period. They recruited 51 participants and put them in 3 groups and administered one group a placebo tablet, one group 75mg of aspirin and the final group received 300mg of aspirin. They then measured the bleeding times or platelet function of the participants and concluded that aspirin should be discontinued 5 days before elective surgery with the operation being conducted on the 6th day.

In conclusion, aspirin induces an irreversible inactivation of cyclo-oxygenase in blood platelets which lasts for 7 to 10 days. Whilst there is research cited above that would suggest that Aspirin does not need to be stopped for all types of surgery, the vast majority of the research favours stopping aspirin 5-7 days before surgery and supports the evidence utilized in the consultants’ practice throughout the hospital.

2.22 Evidence behind Decisions in Relation to Plavix

Clopidogrel, or plavix as it is more commonly known amongst healthcare professionals and patients’, is a potent inhibitor of platelet aggregation and is primarily used in patients with acute coronary syndromes and in the prevention of atherosclerotic events in peripheral vascular disease (Chu et al 2005, British National Formulary 2007). The British National Formulary (2007) cautions its prescribers to discontinue the use of this medication 7 days before elective or planned surgery. It would be considered normal practice for consultants within the private hospital involved in this research to inform their patients to stop this drug before surgical intervention occurs. A review of the literature was conducted to ensure that the data that would be embedded into the DSS was indeed, evidence based.

Chu et al (2005) studied 312 patients undergoing a Coronary Artery Bypass Graft (CABG) over a 2 year period and divided them into 3 groups. The first had taken plavix within 4 days before their operation (n = 41), the second had continued on their plavix up until 5-8 days before their operation (n = 39) and the final group had stopped the drug more than 8 days before their surgery or where never taking the drug (n = 232). It was established that those in
the first group lost more blood intra operatively and were more likely to require further surgery for bleeding than those in the third group (14.6% compared to 1.7% respectively). In addition to this, according to multivariable analysis, plavix taken within 4 days of surgery is an independent risk factor for blood transfusion requirement and a longer hospital stay.

Ascione et al (2005) also investigated the outcomes of 473 patients who were administered the anticoagulants aspirin, plavix and heparin 5 days before their planned CABG surgery. They established that 2.3% or 11 of these patients died intra or post operatively and 7 of these patients’ had been exposed to plavix 48 hrs before their surgery. They concluded that the effect on the patients outcome were very different in patients who had been administered plavix up until 48hrs before their surgery compared to those who had not. Ascione et al (2005) results are consistent with the research findings above in that blood loss was 37% higher in those who took plavix and they were also more likely to need further surgery for bleeding (p < 0.001) and require a blood transfusion (p = 0.015) and their length of stay in hospital was also longer. They concluded that patients undergoing a CABG that have taken plavix within 5 days are at increased risk of mortality and morbidity and that the risk is greatest when the medication is administered 48 hours prior to surgery. Leong et al (2005) also evaluated the use of preoperative plavix on 24 patients due for CABG surgery and established the same results, the patient was more likely to bleed compared to those who are not taken the drug (p = 0.02), more likely to require a blood transfusion (p = 0.01) and have a longer hospital stay (p = 0.03) causing more stress for families and patients and using more hospital resources unnecessarily.

In layman’s terms, this medication also thins the blood which increases the risk of bleeding similar to Aspirin. Bleeding during or after surgery is associated with an increased risk of requiring a blood transfusion and the section above discusses the physical risk of disease that has previously been associated with this. However, there are also ethical and cultural aspects to receiving blood transfusions that need to be considered.

The religious beliefs of Jehovah Witness are such that they cannot receive a blood transfusion, however doctors have a legal obligation to treat all patients and this includes patients whose religious beliefs prevent them from some aspects of the required treatment (Finfer et al 1994). Their religious organisation, the Watchtower Society introduced this policy on the banning of
blood in 1945 and since 1961 has enforced a 'disfellowshipping' or expelling of members who receive blood (Muramoto 2001). In addition to this Muramoto (2001) explains that these people are not only extradited from their church but also shunned and ostracised as the 'wrongdoer' from the community.

Indeed, there has been much discussion in the law courts in relation to this (Donnellan 2006). In the court case re T. (Adult: Refusal of Treatment 1993) a woman who was 34 weeks pregnant was admitted to an Irish hospital following a road traffic accident and was diagnosed with pneumonia and given antibiotics and analgesia in the form of pethidine for the pain. The patient's condition began to deteriorate and she went into labour, the patient informed the nurse that although she was not a practising Jehovah’s Witness she was brought up as one and still retained some of her beliefs. The patient then signed the form refusing medical treatment in the form of a blood transfusion. The patient gave birth to a stillborn child and unfortunately her condition deteriorated and she was sedated and placed on a ventilator. Her father, supported by her boyfriend applied to the court to administer the blood transfusion and the judge concluded due to her poor medical condition and the narcotic medication she had received it, she should receive the blood and it was administered. However, on her discharge Ms T took the west midlands health authority as it was at the time to court because of this as she claimed that her rights had been violated, her appeal failed. It is clear from this one example that blood transfusion can cause ethical as well as physical problems.

In summary, the majority of the literature discussed above dictates that plavix should be stopped prior to undergoing surgical intervention. Indeed the manufacturer of this medication has documented instructions to stop this drug prior to all surgical interventions. It is also apparent in the literature that there are consequences associated with the administration of blood. However, in addition to aspirin and plavix, there is also another medication called warfarin which can also lead to intra and/or post operative bleeding.
2.23 Evidence behind decisions in relation to Warfarin

Warfarin Sodium or warfarin as it is more commonly known is the most widely available and utilised vitamin K antagonist because of its efficacy in the prevention and treatment of thrombo-embolisms or blood clots in the veins and arteries (Squizzato, Steidl and Ageno 2005). This drug was originally developed as a rat poison but has been replaced by more potent drugs (Wikipedia 2007). Patients who are prescribed warfarin require frequent monitoring of their blood as the medications narrow therapeutic index is very sensitive to foods and other medications and this further complicated by the drugs long lag phase of approximately 72 hours. This means that the drug can still have an affect on the patient’s blood 2-3 days after they stop the drug (Black 2004). The International Ratio (INR) is an index used to measure the anticoagulation and therapeutic index and depending on the reason the patient is on the warfarin the INR should be maintained at 2 - 3.5. People who are not on warfarin have an INR of 1. Therefore if a patient is on warfarin it is necessary to stop this medication to reduce the patients INR to <1.5 prior to surgery (Black 2004). Vitamin K can be given intravenously to reverse the affects of warfarin.

Shetty et al (2003) report that consultants are dealing with increased numbers of patients’ on warfarin due to the rise in embolisms, atrial fibrillation and prosthetic valve replacement surgery. They conducted a study to evaluate the current practice of 272 consultants in the UK in relation to elective surgical admissions. They established that 70% stopped warfarin approximately 3-4 days prior to surgery to reduce intra operative bleeding, however, less than half of these consultants had a protocol in place dictating this practice.

McLemore et al (2006) evaluated the affects of 88 patients who were on warfarin long-term and categorised them into 3 groups, those who remained on warfarin, those who stopped the warfarin completely and those who were given a substitute. They established that although the length of the operations which were to repair a hernia did not differ amongst the groups, the occurrence of a haematoma or a collection of blood at the surgical site was a lot higher (11% compared to 2%). Varkarakis et al (2005) concur with this evidence as they studied the records of 25 patients who were also on chronic warfarin therapy and were due for renal/adrenal surgery. They found that patients are significantly more likely to need a blood transfusion.
(24% compared to 5.2%, p < 0.005) and more likely to bleed after surgery (8% compared to 0.9%, p < 0.05) than patients who are not on warfarin.

However, Dayani and Grand (2006) also evaluated the risk of bleeding on patients who are currently taking warfarin. They reviewed the medical record charts of 54 patients with elevated INR and established that only 4 patients had post operative haemorrhaging. Although a small number, these 4 patients are at increased risk of infection and are more likely to have a longer hospital stay in addition to the high risk of requiring a blood transfusion and the risks and ethical considerations and hospital costs associated with it. Indeed Varney and Guest (2003) evaluated the annual costs of blood transfusions in Northern Ireland and the UK and found that in 2001 blood transfusions cost the National Health Service €898 million which is a 256% increase compared to 5 years previous. They argue with fewer blood donations and increased screening of bloods to prevent cross infection, these costs are set to rise putting further burden on hospital budgets. Glenngard, Persson and Soderman (2005) established that it costs €373 for a unit of blood and as the average given during surgery when a patient is bleeding is 3 units, this will add over €1000 onto a patients stay and that is without the added costs of the longer hospital stay. Heerey et al (2002) established that the average costs of treating a patient per day in an Irish hospital was over €300 and the average length of stay is 6.7 days (DoHC 2005) which means that it costs approximately €2000 to treat the average patient without complications. The longer hospital stays which are caused by bleeding during surgery results in costs which relate to ancillary items such as diagnostics and pharmaceuticals, nursing and physician labour costs in addition to the 'hotel costs' which relate to the bed and board. The already over stretched budget of our health service cannot deal with this added burden.

In conclusion to this section on medication, although these medications were discussed separately in relation to the literature they all ultimately have the same affect on the patient, they may put them at risk of increased blood loss and need for transfusion, increased risk of infection and increased hospital stay if operated on. This has a direct impact on the ethical considerations in relation to blood transfusion and religious beliefs which must be taken into account in today’s multicultural society. In addition, the added costs of blood products,
antibiotics to treat infection and longer hospital stays are adding to the strains of already over stretched healthcare budgets. Finally there are also the surgeons who will not operate on patients if they are currently prescribed these medications and will cancel the patient’s surgery. Patients and their families prepare psychologically and physically for a hospital admission for surgery. They arrange time off work and childcare and unfortunately sometimes in vain as the patients surgery is cancelled causing undue stress and inconvenience. In addition to this the theatre slots then remained unused and surgical waiting lists soar and political pressure grows. Indeed, pressure is also being applied to the politicians in relation to MRSA because of the detrimental affects that have been recorded in the Irish courts recently.

2.3 Methicillin Resistant Staphylococcus Aureus

MRSA is a bacterium caused by staphylococcus aureus which is resistant to many antibiotics including methicillin which is a type of penicillin. This bacterium was first discovered in 1961 approximately one year after the introduction of Methicillin (Reacher et al 2000). About one third of people carry MRSA on their skin or nose unaware as it is not harmful to them and this is referred to as being ‘colonised’ with MRSA (Malcomson Law 2007). An MRSA infection occurs when the bacteria enters the tissue or bloodstream and begins to multiply causing symptoms such as inflammation of wounds, high temperatures, fatigue and a general feeling of being unwell or in severe cases, death. MRSA is spread by direct contact, shaking hands or touching bedding or equipment that has been touched by a person with MRSA on their hands. Diagnosis of MRSA is relatively simple as swabs are normally taken from the nose, groin and throat and any open wounds and sent to the laboratory for analysis. The analysis involves streaking the swab on an agar and incubating at 35°C for 2-3 days (Wertheim et al 2005). The treatment of MRSA can be difficult and is routinely through the use of strong antibiotics such as Vancomycin and/or Teicoplanin which may need to be administered IV. However, new strains of MRSA are emerging that are resistant to these antibiotics which is causing serious problems in hospitals worldwide (Wagenvoort 2000).

The European Commission has funded a European Antimicrobial Resistance Surveillance System (EARSS) which aims to produce prevalence data from a central database in relation to
MRSA and other communicable diseases which will be used for comparison of rates throughout the European Union and Iceland and Norway (Veldhuijzen et al 2000). The prevalence of MRSA in the Netherlands is the lowest in the world with isolates or isolation of the bacteria below 1% (Wertheim et al 2005). The existence of MRSA in other countries remains high with France at 33%, Germany 19% and the United States at a staggering 50% (EARRS 2001). Below is a table listing the Irish figures and it is clear that this super bug is on the rise, however it should be noted that it was not until January 2004 that MRSA became a statutorily notifiable disease in Ireland (Whyte 2004).

<table>
<thead>
<tr>
<th>Year</th>
<th>Staph aureus Labs</th>
<th>Isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>11</td>
<td>511</td>
</tr>
<tr>
<td>2000</td>
<td>18</td>
<td>632</td>
</tr>
<tr>
<td>2001</td>
<td>19</td>
<td>798</td>
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<td>2002</td>
<td>22</td>
<td>998</td>
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<tr>
<td>2003</td>
<td>26</td>
<td>1108</td>
</tr>
<tr>
<td>2004</td>
<td>38</td>
<td>1286</td>
</tr>
<tr>
<td>2005</td>
<td>38</td>
<td>1360</td>
</tr>
</tbody>
</table>

Fig 4: Number of Laboratories and Isolates from 1999-2005 (EARRS 2005)

The table above shows that staphylococcus aureus infections have almost tripled in the past 5 years. Irish healthcare is challenged by attempting to reduce the spread of hospital acquired infections but is compounded by an increase in antimicrobial resistance and the lack of research in this area (Whyte et al 2004). MRSA has been present in our hospitals and wider communities for the past four decades, although it varies significantly between countries with high rates in the United Stated of America and considerably low rates in Northern Europe (Vandenesch and Etienne 2004). This would signify that it is possible to reduce its spread. Research produced by EARRS also provided data suggesting that in European countries MRSA is more prevalent in southern than northern countries (Goettsch 2000).
In 2006 a landmark verdict in the Irish courts occurred when a coroner established that the patient had died as a direct result of having contacted this ‘super bug’ (Rigel 2006). In this case a 74 year old man had contracted MRSA and died as a result of the complications that this bacterium produced shortly after contracting it. In February 2007, Bracken (2007) reports that the coroner once again recorded a verdict of death as being caused by MRSA. In this case, the patient had been swabbed for MRSA in a public hospital and was then admitted to a private hospital for surgery. However, the swab was positive for MRSA and this was not communicated to the patient or admitting hospital. The coroner described the death of this man as a ‘shocking failure’ in communication in relation to this vital piece of patient data. The court was informed that there was ‘no computer link’ between the hospitals as all Irish hospitals have different HIS, further supporting the argument for one patient identifier and one electronic patient record (EPR). However, a ‘computer link’ would not be necessary if the DSS proposed in the study is deemed successful as this patient would have been deemed ‘high risk’. Indeed, the hospital could be said to have gotten off lightly as in 1928 when the tugboat T.J Hooper sank and lost its barge of coal in a storm off the Jersey Coast the owner of the cargo which the boat was carrying sued the tugboat owner for damages. The court found that the tugboat owners negligent as they did not have a radio on board which would have warned them about the storm. The court did not accept that lagging in the adoption of technology as an excuse and ruled in favour of the cargo owner (Davis, Wright, Tremaine 2007).

It is clear that the government is taking the threat of this ‘killer bug’ seriously and have invested in projects aimed at combating this organism such as the Health Research Board. The government have granted €1.5 million to a research team in the School of Dental Science, Trinity College Dublin and the Royal College of Surgeons/Beaumont Hospital to investigate healthcare acquired infections which includes MRSA. However, €1.5 million is a relatively small amount of money and could be quickly spent in the four years given to conduct the research. In fact, it has been suggested that this money may have been better spent going to Holland and identifying how this country have managed to nearly eliminate this ‘killer bug’ (Mc Garr 2007). More recently, the Health Service Executive (HSE) has developed a 'Say No to Infection' campaign which aims to reduce MRSA by 30% through 'surveillance and
reduction of antibiotic use”. They also state that Ireland’s healthcare associated infection compares favourably to other countries with a figure of 4.9% compared to the UK at 7.6% (HSE 2007). However, whilst Ireland looks good when all hospital acquired infections are grouped together, MRSA rates are one of the highest especially when compared to the Nederland’s (EARSS 2005).

In summary, MRSA is a bacterium that does not pose a problem until it enters the bloodstream where it can ultimately kill. This bacterium is spread by direct contact and is easily diagnosed. However it is extremely difficult to treat because of its resistance to most antibiotics. The Nederland’s have almost eradicated this ‘killer bug’ from their hospitals which means it is possible to reduce its spread. They deem MRSA to be an important component in the risk profile of the hospital inpatient and deem assessment on admission as vital to reducing its spread (Wagenvoort 2000). The private hospital under study is aware of this and, although not currently conducted until it is too late, a policy to evaluate the patient profile on arrival does exist. To ensure the practices that this policy dictates are consistent with the literature, it will now be necessary to examine the literature in relation to MRSA.

2.31 Evidence supporting decisions in relation to MRSA Protocol

MRSA is a gram positive bacterium that colonizes the skin of about 30% of healthy humans. Although harmless in healthy people it has the potential to cause serious infection and is associated with a prolonged hospital stay and higher mortality rates because of its resistance to methicillin (Cosgrove et al 2003).

The private hospital included in this study has an MRSA policy in place (Appendix 2) which details how patients should be assigned their rooms depending on a number of risk factors. If it is decided that a patient belongs to this high risk group then they are assigned to a single room. In order to be in this group a patient must be currently MRSA positive, have had MRSA in the past 5 years, be a direct transfer from a long-term care facility or another hospital or have been an inpatient in hospital in the past month. The literature will now be examined in relation to these aspects of the policy to ensure that the policy in this private hospital is indeed
Samad, Ghosh and Carbarns (2002) studied the risk factors for MRSA colonization in 430 surgical patients in a hospital in Wales. They took swabs from the nasal passages of these patients in addition to any existing wound sites that they had. 23 or 5.3% of these patients were positive for MRSA – 15 of which were nasal carriers and the remainder had MRSA colonization elsewhere in the body. These researchers identified 4 risk factors which were previous admission to a nursing home as a ‘definite risk factor’ (P = 0.000), Age above 70 years in univariate analysis (P =0.002), being of Male gender (P = 0.054) and previous hospital admission (P = 0.051) which are minor risk factors when considered alone but where supported in multivariate analysis (P = 0.026 and P = 0.007). The previous hospital admission and transfer from a long-term care facility are two of the factors included in the hospital policy (Appendix 2).

Mulhausen et al (1996) studied the prevalence and patterns of acquisition in relation to MRSA and concluded that approximately 20-25% of patients who are admitted to long-term care facilities will already be carrying MRSA and a further 10% will contract it during their stay. They suggest that this could be cause of chronic illness and immobility and the exposure to antibiotics because of pressure ulcer and urinary catheters. All patients’ who are transferred from long-term facilities are deemed to be high risk in relation to the hospital policy. Capitano et al (2003) concurs with this research and states that MRSA is ‘endemic’ in nursing homes and proved this whey they established that 82% of the 90 patients with MRSA in a long term care facility had contracted the MRSA within 30 days of being admitted. They also established that it costs six times more to take care of a patient with MRSA. Goettsch et al (2000) supports this research, even in the Nederland’s where MRSA is lower than 1%, they found an extremely high rate in nursing homes and they also established evidence of transmission of MRSA from nursing homes to hospitals.

Wertheim et al (2004) states that less than 1% of all clinical isolates are MRSA in the Netherlands and suggests it is due to the implementation of the national search and destroy policy. This policy states that early identification of patients with MRSA is essential in order
to isolate and treat them appropriately (Infection Prevention Working Party 2007). They have identified different risk categories which are:

1. Proven MRSA carrier
2. High risk of being a carrier.
3. Moderately elevated risk of being a carrier.
4. No elevated risk of being a carrier.

The first category refers to patients who are currently MRSA positive which is consistent with the hospital policy included in Appendix 2. The second category relates to patients’ who have had treatment in a foreign hospital for more than 24 hours and/or patients who were transferred from other hospitals or nursing homes that are experiencing a MRSA epidemic. This again is consistent with the current hospital policy in this hospital however this hospitals policy does not specify that the hospital or nursing home should be experiencing an ‘epidemic’ due to the already high rates in our hospitals and nursing homes across Ireland. Category 3 refers to patients who have had treatment in a foreign hospital more than 2 months ago and have persistent infections or open wounds and category 4 are patients who were cared for in a foreign hospital more than 2 months ago minus the persistent infection or wounds. This is consistent with the hospital policy as patients’ who are treated as an inpatient within a month are more likely to have MRSA and therefore should be isolated.

In conclusion, the hospital policy in relation to the risk factors and MRSA concurs with the published literature. Wertheim et al (2004) argues that if patients are screened for risk factors and do not have any, then the risk for MRSA carriage is very low (0.03%). They conducted a study in the Netherlands to measure the prevalence of MRSA among patients who were not in the high risk group. They took swabs from 9,859 patients and only 3 were MRSA carriers. This research further validates the proposed study by suggesting that once patients are screened for membership of the high risk group and are isolated appropriately, the probability of the remainder of hospital admissions having MRSA are extremely low.
2.4 Implementing Decision Support Systems

Implementation of any ICT system is referred too as the process of preparing the organisation for the new piece of technology and introducing it in a method to ensure successful use (Tyran and George 1993). Forsythe et al (1992) suggest that for a DSS to be considered a valuable asset to the organisation it must be accepted and utilized by the decision makers who should deem it to ‘make sense’.

According to the published literature, for a DSS in the clinical arena to be successful it must complete a number of stages which include development, implementing and evaluation of the DSS (Berner 2004). The DSS should be developed to meet the documented informational needs of its users (Forsythe et al 1992) and the person who is developing the system should understand the processes involved thoroughly. A needs assessment or audit should be conducted to establish the frequency of use and the installation or making the DSS ready for use must be preceded by UAT (Sprague and Carlson 1982). This should initially occur outside of patient care and once justified, it can then be introduced to actual patient care delivery (Berner 2004). Short, Frischer and Bashford (2004) would concur with this conclusion. They conducted a study of the barriers to the adoption of DSS in the clinical arena and concluded that they have pivotal role in the implementation of evidenced based uniform practice, although they suggest that designers should consult more with the users and identify their knowledge base in relation to ICT.

Berner (2004) argue that most DSS are produced in an academic environment and do not have the funding to be implemented into organisations, however, both the IT director in this hospital and the developers of the existing HIS have given their support to this project (Appendix 3). It is therefore argued that this will not occur with this DSS. In summary, DSS can work effectively in healthcare if they firstly meet the needs of the users and secondly are implemented in an efficient manner.
2.5 Conclusion to Literature Review

Kalogeropoulos, Carson and Collinson (2003) argue that if two healthcare professionals are given the same data they will act in completely different ways. The aim here is the elimination of unnecessary variation and streamlining of the patient admission processes. This unnecessary variation results in confusion for patients and their loved ones. Research has shown that the use of DSS in a hospital environment can increase staff adherence to hospital policies (Hulgan et al 2004). If these policies are evidenced based then clearly they will result in improved patient care and better clinical outcomes.

As illustrated above with the evidence available in the published literature it is clear that the decisions which will be embedded into this prototype DSS are evidenced based. However, Berner (2004) argue the rule 'if it isn't broken, don't fix it' should be applied to the application of any DSS. The knowledge which is embedded into protocols which currently exist in paper format in this private hospital are not being utilized effectively which has resulted in inconvenience to patients and their relatives and unproductive use of hospital resources. Indeed it is not possible to evaluate the affects that the lack of adherence has had on patients and their relatives.

Kotze and Brdaroska (2004) argue that DSS facilitate improved quality of care by decreasing any variation in practices and ensuring that evidenced based advice is provided. This can only be of benefit to the patients’ of this hospital. The consequences of lack of decision support in Irish hospitals is clearly portrayed in the literature above (Riguel 2006, Bracken 2007), and it is proposed that implementing a DSS may prevent these tragic episodes occurring again.

Aspirin, plavix and warfarin taken prior to surgical procedures increase the risk of bleeding during and/or after the surgery. This poses significant consequences to patients’ and may result in longer hospital stays, increased risk of infection in addition to ethical complications. This also has a direct financial effect on the hospital.

Contracting MRSA has a direct affect on patients too both physically and psychologically. The coroner had recorded 2 deaths as being caused by this bacterium. The Nederland’s has
reduced its spread to <1% and whilst this private hospital has followed their lead by adopting the same policy as them, it is not being used.

In conclusion, Dawson (2000) suggests that the literature review should 'justify' the intended research by proving that you are not merely repeating the work of others whilst also putting your work into context. Whilst this specific type of research has not been conducted before, it is clear from the literature review that DSS can work effectively in healthcare and many of the quantitative studies above have demonstrated which would justify the methodology chosen. The evidence available in the literature clearly states that the decisions being made in this private hospital are evidenced based. These decisions will be embedded in a prototype DSS to ensure that firstly the policies are adhered too and secondly the care and advice patients receive is uniform and will result in improved patient outcomes.
Chapter 3 Design and Implementation

Health informatics lies at the heart of medicine and is therefore incorporated in all aspects of patient care and in turn, the process of clinical decision making (Georgiou 2002). Research within the discipline of health informatics facilitates constructive and analytical mechanisms which yield insights and outcomes that are of vast importance to healthcare (Moehr and Grant 2000). Research in general, is intended to add value to the body of theoretical knowledge and in the area of health informatics, improve patient outcomes (Georgiou 2002). Moehr and Grant (2000) concur and contend that research in the area of health informatics has had a profound effective impact on the practice of medicine and in turn has had a positive affect on patient outcomes.

Within the discipline of research the word ‘design’ is said to imply the organisation of elements into a ‘masterful work of art’ and its purpose is to provide a plan or framework for answering the research question (LoBiono and Woods pp188). This research study is a quantitative investigation which aims to identify if a DSS can prevent inappropriate surgical admissions and reduce the spread of MRSA in a private Dublin hospital. It is proposed that this will be done by embedding the existing hospital protocols into a DSS and making it mandatory for admission administrative staff to use the system as part of the admission process.

Quantitative research is influenced by positivism and adopts a pragmatic approach to its subject matter (Parahoo 1997). Cormack (2000) would support this concept by suggesting that quantitative research provides purposeful and objective facts in relation to the phenomena studied. Tarling and Crofts (2002 pp74) argue that quantitative research assumes that all human behaviour is open to measurement and gives the researcher the ability to ‘predict future behaviour’.

However, qualitative research is a type of research which is not deduced by ‘statistical procedures or other means of quantification’ (Strauss and Corbin 1997 pp11). Qualitative research methods allow the researcher to investigate and explore concepts (Hoskins and Mariano 2004). This type of research methodology is frequently linked with the investigation
of ‘reasons’ as opposed to ‘causes’ (Treacy and Hyde 1999 pp29) and consequently has been
described as ‘holistic’ in its methodological approach (Parahoo 1997 pp52). Qualitative
research seeks to ‘understand’ a phenomenon in contrast to quantitative research which aims
to ‘explain’ why a phenomenon occurs. The researcher in this study seeks to establish, as
opposed to comprehend if a DSS can prevent inappropriate surgical admissions and reduce the
spread of MRSA. In addition, quantitative research seeks to eliminate the researchers own
feelings or opinions from the study and instead is reliant on provable methods (Cormack 2000
pp19). Tarling and Croft (2002) argues that quantitative research allows the researcher to be
detached from its subject and decreases the effect of personal opinions or values.

The researcher’s opinions and beliefs are irrelevant to this study and the systematic process, to
which quantitative research facilitates, is more appropriate to this study. In addition to this, a
critical analysis of the research designs and methodology in the literature review facilitated the
decision use a prototype of a DSS as this method has proven ability to build on existing

3.1 Pilot Study

Polit, Beck and Hungler (2001 pp41) suggest that unforeseen problems may occur during the
research process and suggest carrying out a pilot study which they define as ‘a small scale trial
run’. As the literature recommends the DSS was tested ‘outside patient care’ (Berner 2004)
with 10 colleagues which consisted of nurses’, administrative and medical staff. The DSS was
utilized successfully on all 10 participants and no changes occurred to the research protocol.
However, before the research began it was necessary to ensure that all admission staff were
aware of the research plan and the rationale behind the research should they be asked any
questions by patients’ or relatives’ pertaining to the research. A presentation (Appendix 4)
was given and once all staff were educated the research could began.
3.2 Sample Selection

The target population for this study can be divided into 2 groups; the group of inpatients' whose details would be used for comparison purposes and the group of patients who would be asked questions based on the DSS prior to admission. The size of both groups of patients' was determined by the number of hospital admissions for each of the 2 month periods of data collection which were 1,658 and 1,680 respectively. Parahoo (1997 pp231) describes this type of sampling as 'accidental' as only those patients' being admitted on the dates selected by the researcher have an opportunity of being included in the research.

3.3 Methodology

In order to answer the research question and establish if the prototype was to be effective it was first necessary to obtain data for comparison. The admission nurses’ audited the number of surgical patients’ who were currently taking the contraindicated medication aspirin, plavix and warfarin and those who were in the high risk group in relation to the MRSA policy for a 2 month period. After this data was collected and securely stored, the DSS was introduced as part of the admissions process. The researcher contacted each patient the night before their expected admission and when verbal consent was obtained, the DSS was used to ascertain if firstly they were due for surgery and currently taking contraindicated medication. If this was the case, then the researcher contacted the patient's consultant and informed him/her of the patient's name and contact number, planned procedure and current medication. The consultant was then in a position to contact the patient if necessary and defer the patient and also arrange for another patient to be taken off his/her waiting list where possible.

The DSS also has the ability to identify patients' who were in the high risk group as per the MRSA policy (Appendix 2). If the DSS established this to be true, then the researcher would inform the admissions staff that the patient had to be isolated on admission until further notice and if the patient was a surgical admission they were placed last on the operating theatre list to reduce the chances of spreading MRSA. The infection control nurse was also notified and she then took swabs from the patient for analysis on admission. However, prior to the
commencement of this quantitative study it was first necessary to ensure that the ethical considerations of the patients and employees involved in this research had been considered by an appropriate body.

3.4 Ethical Considerations

The framework utilized for the ethical considerations in this research was adopted from Smith Iltis (2006) who combines the core principles from the relevant seminal publications which have been produced over the past century such as the Nuremberg Code, the Belmont Report and the Code of Federal Regulations and these principles where applicable, are discussed below.

The first principle discussed by Smith Iltis (2006) relates to beneficence and she argues that within research the benefits to participants must outweigh the risks. The potential benefits for the patients participating in this research are that if they are on contraindicated medication and due for a surgical procedure, they will be saved the inconvenience of arriving at the hospital, possibly from long distances and being asked to return home and stop their medication and return at a later date. Additionally, patients' who are in the high risk group in relation to MRSA are more likely to have the MRSA treated quicker and less likely to spread MRSA if identified and isolated on admission which benefits the other inpatients. The risks to the patients’ involved in this research are less than minimal as participation in this research involves answering a maximum of 12 questions by telephone. Admittedly, it was anticipated by the researcher that some participants would be concerned about being asked questions in relation to MRSA prior to coming into the hospital, however, this was not the case. In fact, some participants were pleased that this issue which, in their words 'has received so much media attention was being addressed prior to admission'. In addition to participants involved in the research, there are also benefits to other current inpatients that may have been potentially affected by the spread of MRSA.

The second principle considered was the selection of participants and obtaining their informed consent. According to Smith Iltis (2006), participants should not be recruited based on the fact
that they are poor or a minority and are more willing to participate. Participants for this research were selected on the basis that they were expected for admission into this private hospital during the time of admission. Smith Iltis (2006 pp110) defines informed consent as 'a mechanism to enable participants to control access of others to themselves... and is a means of respecting the principle of non-maleficence'. The participants in this study were firstly informed that the telephone call related to research, they were then informed about the purpose of the study and what they had to do should they decide to participate, i.e. answer a maximum of 12 questions relating to their medication and past medical/surgical history and finally their right not to participate in the research. Due to the less than minimal risk to participants involved in this research, a record of consent was not deemed as necessary by the ethics committee. Once verbal consent was obtained the questions were asked based on the patient’s history and the rules embedded into the DSS.

The third principle discussed by Smith Iltis (2006 pp108) relates to confidentiality and anonymity or justice. This author defines confidentiality as 'agreements about how identifiable information will be handled' in order to protect the interests of participants. The name of this hospital has not been used throughout the dissertation. In addition to this, all identifiable logos, names of employees and ethics committees have been removed from the body of the dissertation and the appendixes. In relation to anonymity, Smith Iltis (2006) argues that this term is used too loosely and states that the absence of a name on a form does not mean that it will be impossible to identify an individual; she suggests a more appropriate term is 'de-identified'. Whilst the researcher used the patients' booking forms which contains demographic details and the reason for admission to hospital, the researcher only recorded the following non identifiable information which was:

- date of the call
- number of calls made
- number answered
- number of surgical patients on contraindicated medication
- number of patients in the high risk group in relation to MRSA.
No identifiable material was recorded and the data that was recorded was secured for 3 months in a locked filing cabinet in a locked office that only the researcher had access too.

Whilst the above ethical principles were incorporated into the research plan, it is necessary to submit a research protocol and an application to an ethical committee to be reviewed prior to any research in healthcare involving humans. The private hospital involved in this study has a combined ethical committee with a public hospital and the application was made there in January 2007. In February 2007, the researcher and her clinical supervisor were requested to attend the ethics committee to discuss this research application. The chairperson of the ethics committee wished to see the questions that the DSS would ask and requested that they be submitted separately. Initially it was proposed in the research protocol that the admission administrative staff would use the DSS whilst they confirmed by telephone that the patient would be arriving the following day as planned. However, the chairperson had concerns in relation to the admission administrative staff using the DSS at this time stating that there were no clear boundaries in relation to what normal practice is and what the research was for the patient. It was then necessary to write to the committee documenting all of the possible questions the DSS could enquire and accepting the recommendation to make a separate telephone call to the patient. The researcher deemed it unfair to ask the admission administrative staff to double the amount of telephone calls to patients and therefore it was necessary for the researcher to conduct these calls. The research committee then deemed the application to meet the necessary standards established by the committee and approved the study (Appendix 5).

3.5 The Prototype

The prototype was built using Exsys Developer software, version 8, which can automate and disseminate decision making advice and recommendations (Exsys 2007). The prototype includes an explanation subsystem that will answer ‘How’ and ‘Why’ questions. ‘How’ questions give a trace of the reasoning that led to a recommendation or goal and ‘Why’ questions display the current rule that is attempting to fire. The screen shots below demonstrate to the reader how the prototype appears aesthetically.
This software was chosen as it was freely available from Trinity College Dublin and also on
the website. Although limited to 50 rules, it is easy to use, both when building the DSS and
also when using as a DSS and was therefore deemed ideal for the purpose of this study.
Evidenced based answers to the possible scenarios were obtained from the hospital protocols
and embedded into the prototype.

The developers of Exsys suggest that it has the ability to capture and distribute expert
knowledge, and emulates the interaction a user might have with an expert when attempting to
solve a problem with a minimal amount of training as all that is required is a minimal amount
of knowledge about IF-THEN-ELSE rule structures. It is possible to codify and collect
knowledge and store it as individual rules in a knowledge base. When the knowledge-based
system runs, a question-and-answer dialog prompts users for information about a specific
problem situation and about characteristics of the information they are seeking.
The Exsys Developer combines a rule editor with a flexible visual decision tree interface and features MultiLogic Exsys Inference Engine. Development is simplified by a combination of trees and individual rules to represent the decision-making logic of a system. The decision trees used in the development of this system are documented below and the DSS is located on a disc after the appendixes.
Fig 7: Medication Decision Tree as used in DSS
Fig 8: MRSA Decision Tree as used in DSS

The Exsys MultiLogic Inference Engine processes information. It then determines what additional input is required to offer a solution, based upon the knowledge base, the rules and the specific responses from the user. Confidence modes supported by Exsys Developer can deal with simple (yes/no) to highly complex (Fuzzy Logic) problems. The system also has an error message should the user enter incorrect data as show in the screen shot below.
The purpose of this research was to identify if using a DSS could prevent inappropriate surgical admissions and reduce the spread of MRSA in a private hospital in Dublin. As discussed earlier, for the purpose of this research an 'inappropriate admission' will refer to an admission that does not result in any significant benefit for the patient or which results in benefit which could have been obtained at a lower care level (Eriksen et al 1999). However, whilst the prototype can be used effectively to answer this research question, it was recognised that a separate system cannot be used in the long-term and as a result a requirements specification is detailed below. The current HIS in this private hospital was provided by iSoft Plc and it was imperative to establish if it was possible to integrate a DSS with the existing system. The director of IT in this private hospital personally contacted Ms Ann Giles, a senior project manager at iSoft and asked if and how would this be possible and documented her positive response in a letter (Appendix 3).

Fig 9: Error Message from DSS
3.6 Product Specification
It was decided to include a specification for this product to ensure speedy implementation should the research provide positive results and the hospital decide to implement this system.

3.61 Product Scope and Objectives
The hospital in which this system will be implemented is a private hospital in the Dublin metropolitan area which facilitates planned or elective admissions. The scope of this system is the support decision making for the admissions administrative staff to identify potential inappropriate surgical admissions and to also identify patients who are in a high risk group in relation to MRSA and advise accordingly. The hospital policy varies from consultant to consultant in relation to their views on operating on patients who are currently taking medication which may cause bleeding during surgery. It is therefore proposed that the system will identify these patients before admission to the hospital and inform the user to contact the individual consultant who will decide whether to allow the patient to have surgery or to schedule another patient instead. This will occur before the patient has arrived in to the hospital and will prevent unnecessary inconvenience to the patient and the hospital.

The system will also have a manual protocol embedded into it in relation to MRSA by using a series of rules and goals. The system will not be a replacement for the user’s professional judgement but will support the user with evidence based information which will be obtained from the hospital policies. It is imperative that it is highlighted here that the users' will have no clinical experience.

The system will incorporate two fundamental complementary paradigms:

1. Decision Support: Using the rules outlined by existing practices and protocols the system will determine based on a number of distinct factors, if a patient is on contraindicated medication and whether they belong to a high risk group in relation to MRSA.

2. Information Management: The system will automatically push and pull data based on the data it acquires from components of the existing HIS. This will include medication history, infection control alerts, medical or surgical bed details and insurance details.
The implementer will be responsible for all aspects of the system development including:

1. Development of the software.
2. Development of the required interfaces to the existing HIS.
3. Acquisition of any new hardware required.
4. Training of hospital staff.
5. Support and maintenance of the system post deployment.

3.62 Aims of the Product

The aims of this system are:

1. Improve the quality of patient care and enhance health outcomes for surgical patients by ensuring they are not put at risk of bleeding during or after their surgery.
2. Identify patients who may be at risk of spreading MRSA as per the hospital policy.
3. Prevent costs associated with underutilised theatres and tests.
4. Ensure uniform evidenced based care for all patients and improved patient outcomes.
5. Provide an audit function to establish effectiveness of system.

3.63 Project Benefits

The benefits of this system are enhancing patient care by:

1. Identification of patients who are on the contraindicated medication Aspirin, Plavix and Warfarin and may be at risk of bleeding peri or post operatively; this system aims at identifying them on admission.
2. Preventing surgical cancellations as a surgical procedure which is cancelled or deferred causes unnecessary stress and inconvenience to patients and their loved ones.
3. Patients and their families will be at a reduced risk of contracting MRSA by identifying patients who are in high risk groups as per the hospital policy and assigning them to a single room.

Additional benefits of this system are reducing costs by:

4. Identification of patients who are not suitable for surgery prior to admission allows staff time to contact another patient and therefore will prevent unutilised theatres and decrease surgical waiting lists. The evaluation prior to the implementation of the
prototype of this system established that an average of one patient was cancelled a week, based on this, the DSS could save the hospital an average of €156,000 per annum.

5 The reduction or elimination of the spread of MRSA will reduce costs associated with longer hospital stays, antibiotic treatments, and nursing care. According to the research patients' with MRSA cost six times the average cost of treating a patient.

### 3.64 Out of scope

The system will not implement any other protocols or hospital practices and will not deal with other types of medications or infectious diseases. However the system’s design must make provision for the future incorporation of additional medications and protocols.

### 3.7 Product Description and Perspective

This product will be standard windows based application, which will be integrated with the existing HIS and must comply with open standards namely TCP/IP, XML and HL7. The system will be deployed in the admissions department and will be accessed through thin clients.

### 3.71 System Integration

The system will integrated with the existing HIS which contains all patient demographic and clinical data and an interface is required to request patient data. The user will access the system through the existing HIS and via the current patient view icon which is used for registering admissions as highlighted below.
3.72 Product Functions

1. Use of this system will be a mandatory component of the admission process.
2. The system will obtain information such as history of medication, infection control alerts and insurance details and use this data to answer questions where relevant.
3. The system will prompt the user to ask the patient for data not recorded in the HIS.
4. The system will use the information obtained from the HIS and information inputted to determine if the patient is suitable for admission and the assignment of room type/bed number.
5. Based on this information the system will assign the appropriate bed and where applicable, place patient on the Theatre list in the appropriate sequence.

3.73 Constraints

1. The system must interface with existing HIS namely the iPatient manager.
2. The system must run on existing infrastructure and network.
3.74 Assumptions and Dependencies

The system must be able to support any future additions or alterations to the MRSA protocol or consultant practices in the hospital.

3.8 Functional Requirements

The system must support two fundamental decision trees outlined in figures 7 and 8. These trees determine a patient’s suitability for surgery based on medication and MRSA history. During the admission process the system, imbedded into the existing HIS, will prompt the admission staff to ask a number of questions. The system will then make recommendations, assign appropriate beds and theatre slots based on the questions asked and decision support implemented. The new process flow is documented below.
Fig 11: New Admission Process
3.9 Performance Requirements

3.91 General Performance

The system will:

- Store the volume of data required
  1. Retrieve data promptly
  2. Provide recommendations efficiently
  3. Allow audit function

3.92 Scalability

Design of the system will allow for extra capacity and make provisions for the future incorporation of additional protocols and practices within the hospital.

3.93 Response Times

Response times for all queries must be less than 1 second.

3.94 Simultaneous Users

The system must support up to 30 simultaneous users at any given time.

3.10 Security

1. All users of the system must be identified and authenticated by username and password.
2. The system will operate on the hospital’s existing LAN within the existing HIS.
3. Data integrity must be ensured through the use of appropriate mechanisms including nightly data backups.
4. An audit facility must be available.

3.11 Maintenance

The software implementer will conduct an annual check on the system and respond to support calls when necessary.
3.12 Summary to Design and Implementation

In summary, this research which is in the field of health informatics is intended to improve the efficiency of the admission process and patient outcomes and reduce the inconvenience to patients and surgeons. In addition to this, this research is intended to reduce the spread of MRSA and the costs related to treating patients with MRSA and preventing loss of profits by ensuring maximum utilisation of theatre slots. The autonomy of all participants was of an utmost concern for the researcher and whilst gaining ethical approval for this research was a long and laborious task it is imperative that the researcher ensured that the patients' rights were protected.

The policies exist in this hospital to ensure that patients' receive evidenced based care, however, they are not utilised effectively at present. ICT in the form of a prototype DSS can make use of these existing polices and protocols a mandatory part of the admissions process. Exsys was chosen as the software to build this prototype because it was suitable for the rules that were required to embed the protocols into the system and is also easy to use. Kotze and Braroska (2004) argue that the costly failure of ICT projects can sometimes hinder good ideas being implemented, however as this software is freely available on the web no financial assistance was required.

There would be little point in introducing a stand alone system into the admissions department as it would be necessary to input information that already exists in the HIS. However, should this private hospital decide to integrate the system as deemed possible by iSoft PLC with the existing HIS, a financial cost would be anticipated.
Chapter 4 Evaluation

The collection of the results is a crucial component of the research process, however, this data alone will not answer the questions the researcher has set out at the beginning of the project and the next step to answering these questions is analysing the data (Parahoo 1997).

4.1 Data Analysis and Results

A statistical package was not deemed necessary as the numbers and variables involved were not huge and as a result Excel was used to analyse the data. Data analysis occurred in 2 parts; the first related to the initial group of inpatients that the admissions nurses' had recorded as being on contraindicated medication and in the high risk group in relation to MRSA. The results of which are detailed below.

<table>
<thead>
<tr>
<th></th>
<th>Total No of Admissions</th>
<th>No of Surgical admissions</th>
<th>No on contra. Meds</th>
<th>No of Surgery Cancelled</th>
<th>No in High Risk MRSA Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>205</td>
<td>102</td>
<td>8</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Week 2</td>
<td>236</td>
<td>111</td>
<td>7</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Week 3</td>
<td>192</td>
<td>95</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Week 4</td>
<td>206</td>
<td>91</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Week 5</td>
<td>205</td>
<td>82</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Week 6</td>
<td>210</td>
<td>72</td>
<td>6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Week 7</td>
<td>157</td>
<td>97</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Week 8</td>
<td>247</td>
<td>132</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1,658</td>
<td>782</td>
<td>49</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

Fig 12: Results from Admission Nurses’ Audit

As is apparent from the information in figure 12, 6% of surgical admissions are currently taken what could be considered contraindicated medication prior to their surgical procedure
during the 2 month period of study. Of these, 5 patients’ had their procedures cancelled. The procedures which were cancelled included a Trans urethral resection of the prostate which costs €5000, 2 lumbar discectomys’ which cost €3000 each, an aortic valve replacement €23,000 and a hip replacement at a cost of €25,000. This resulted in a loss of revenue of almost €60,000 for the 2 month period under study. Once these results were analysed it was then necessary to compare them to the data obtained once the DSS had been introduced as prior to the admission process.

The table below breaks down the reasons for the patients were deemed to be in the high risk group in relation to the MRSA policy. The most common reason that occurred during the admissions nurses’ audit was transfers from other hospitals. In this situation, patients’ are transferred to this private hospital from a public hospital mainly because the surgical waiting lists in this private hospital are shorter. The patient arrives, normally in outdoor clothes as they will have travelled from all parts of Ireland and they attend the admissions administrative staff to give their demographic and insurance details. The admission staff are not aware that they have come from another hospital as they are dressed in their outdoor clothes; it is only when the admission nurse takes the patient’s history that this critical information is realised.

<table>
<thead>
<tr>
<th>Reasons for High Risk Group Membership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hx of MRSA</td>
</tr>
<tr>
<td>Inpt &lt; 1mth</td>
</tr>
<tr>
<td>T/F other hospital/longterm care facility</td>
</tr>
<tr>
<td>MRSA Currently</td>
</tr>
</tbody>
</table>

![Fig 13: Reasons for high risk group membership](image)

Although some of the research documented in the review of the literature concluded that certain sexes and ages are more likely to contract MRSA, demographic details were not recorded as part of this research as the researcher did not wish to have any identifiable
material recorded due to ethical reasons relating to patient privacy and confidentiality. It was also deemed unnecessary as the objective of this research was to ascertain if a DSS would work effectively in the admissions area by reducing the numbers of inappropriate admissions and the spread of MRSA and not to determine if there was any correlation between demographic data and the research question.

The second part of data analysis involved the results from the use of the DSS. In relation to the medication the results were unexpected as only 15 patients' stated they were currently taking aspirin, plavix or warfarin or had taken the medication in the last 3-7 days. This result is a lot lower than the data obtained from the admission nurses’ audit. This could be the reality at the time of the research or it could potentially be that the patients' do not know the names of the medication that they are currently taken and therefore may have simply answered 'no' when asked about medication. The patients' consultants were contacted and informed of the name and contact details of the patient, the planned surgical procedure that he/she would be conducting the following day and details of the patient's current medication status. Only 1 patient was deferred to a later date which was the patient who had not stopped the warfarin as advised, the remainder had their surgery as planned.

<table>
<thead>
<tr>
<th></th>
<th>Total No of Patients Contacted</th>
<th>No of Patients Spoken too</th>
<th>No of Surgical Patients</th>
<th>No on contra. Meds</th>
<th>No of Surgery Cancelled</th>
<th>No in High Risk Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>143</td>
<td>103</td>
<td>52</td>
<td>3</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Week 2</td>
<td>168</td>
<td>115</td>
<td>47</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Week 3</td>
<td>189</td>
<td>132</td>
<td>68</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Week 4</td>
<td>235</td>
<td>158</td>
<td>102</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Week 5</td>
<td>207</td>
<td>134</td>
<td>81</td>
<td>2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Week 6</td>
<td>210</td>
<td>109</td>
<td>47</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Week 7</td>
<td>259</td>
<td>145</td>
<td>62</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Week 8</td>
<td>269</td>
<td>181</td>
<td>71</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>1,680</td>
<td>1077</td>
<td>530</td>
<td>15</td>
<td>1</td>
<td>27</td>
</tr>
</tbody>
</table>

Fig 14: Results from use of DSS
The results in relation to the MRSA were also surprising, an average 3.75 patients' a week would have arrived into this hospital a week with a high risk of carrying MRSA. The high figure in relation to MRSA compared to the initial audit conducted by the admission nurses' can be explained by the fact that the patients were asked specific questions in relation to MRSA as opposed to the general questions in relation to their past medical and surgical history asked by the admission nurses'.

The admission nurses’ continued with their audit whilst the researcher was using the DSS as part of the admissions process. They did not find any patients’ in the high risk group in relation to MRSA, although, it should be noted that they do not ask any specific questions in relation to MRSA. However, 2 further patients’ had their surgery cancelled due to contraindicated medication, both of which were not contactable at the time of the research.

**4.2 Summary to Evaluation**

Comparison with international studies is hindered due to the lack of available studies in this area and also due to differences in design and area of implementation. Dawson (2000 p14) suggests that whilst generalisation allows the findings to be interpreted and applied to a variety of situations, researchers should specify limits on the generalisation of findings. This research was conducted in a private hospital where all admissions are planned, it would therefore be difficult to generalise these findings to public hospitals although the system could be tested in this setting very easily with full permission from the researcher.
Chapter 5 Conclusions and future work

Healthcare professionals must have the ability to justify their practice to their regulation body, management, colleagues and their patients with the use of evidence from research (Mc Sherry, Simmons and Abbott 2002). Research in general, is intended to add value to the body of theoretical knowledge and in the area of health informatics, improve patient outcomes (Georgiou 2002). Despite the challenges that were faced during this research, this system was found to have the potential to make significant improvements in the admissions process.

Lack of knowledge or lack of adoption of existing technology even when deemed relatively new is not an acceptable excuse in the law courts today (Donnellon 2006) nor was it over 80 years ago (Davis, Wright and Tremaine 2007). As scepticism about the use of ICT in healthcare lessens and more health professionals accept the advantageous that DSS can bring to patient care, patient outcomes will improve (Ball, Weaver and Kiel 2004). The research in the literature review clearly demonstrates that DSS can work effectively in healthcare, however, it is emphasised throughout this project that the proposed system is to be used to assist and not replace the users professional judgement.

Being admitted to hospital can be an anxious time for a patient and if this process is hindered by lack of communication, issues can arise making this process even more problematic. As an admissions nurse with 6 years experience working in this hospital, these 'communication problems' were witnessed on a daily basis. It was the researcher’s intention to address these problems and potentially solve them with the use of DSS. The research was a labour intensive task; contacting 1,680 patients' in a 2 month period. However, by doing so one patient was saved the inconvenience of being sent home minus his surgery and 29 patients' were isolated as per the hospital protocol on admission. The results of this project are promising and whilst during the 2 months of using the prototype only one patient was saved the inconvenience by being told his surgery would be cancelled prior to arriving at the hospital, this one patient and his family may deem this research a success. However, it will be for hospital management to decide whether embedding these rules into the proposed system would be beneficial for patients and cost effective for this private hospital.
The results in relation to MRSA surprised the researcher and when discussed with the hospital's infection control specialist she replied 'it is because the questions were asked; if they are not asked these specific questions and they do not come up in general conversation then we would never know.' This is the difference in the Nederland’s; patients' are identified as being high risk because they are asked the specific questions on admission relating to MRSA.

However, there are limitations to this work. Due to the recommendations made by the research ethics committee, the administrative staff did not use the DSS. The researcher therefore contacted the patients' directly and used the DSS the night before their admission after the admission administrative staff had contacted them. Although the researcher was uniform in her approach and consistent; using the same tool and using it in the same method with all participants, Parahoo (1997 pp63) would suggest that some bias may exist in these situations and states that in quantitative research the researcher 'knows' what results to expect and merely wants to 'confirm her knowledge'. The researcher would have to disagree with this statement as although the researcher was aware that these problems existed with the admissions process and believed that a DSS was the answer, only one patient out of 530 was saved the inconvenience of travelling to the hospital during the 2 months of research, the researcher expected this figure to be much higher. The researcher also believed that the number of patients in the high risk group in relation to MRSA would have been much lower. If this research had not been conducted 27 patients may have been assigned a shared room for their stay at the hospital. If half of this number was found to have MRSA, this may have resulted in approximately 40 other patients contracting MRSA.

In addition to the above limitations, the researcher could only contact 64% of the patients’ due in for admission as they were not reachable at the time of the call and not all were contactable by telephone as they had no number documented on the booking form or HIS. This means that the figures quoted in the results may have been a lot higher than recorded if the researcher had been able to contact 100% of expected admissions.

Finally, this is a private hospital where all admissions and procedures are planned, it would be difficult to generalise the findings in relation to the contraindicated medication to public
hospitals where the admissions process is a lot different. However, the findings in relation to MRSA could be generalised and as the Health Service Executive (HSE) has signed a multimillion euro deal with iSoft plc (HSE 2006), there could be potential to deploy this system nationwide and reduce Ireland's rate of MRSA drastically.

The initial aim of this project was to ascertain if an inappropriate surgical admissions and MRSA could be reduced by the use of a DSS. The answers were yes in varying amounts, but this research was conducted in a private hospital. Future research in the public domain may be warranted to ascertain if this system would work effectively in this environment.

The results of this research will be forwarded to the Chief Executive Officer, the IT director and also the Director of Nursing for a decision to be made about the possible integration of such a DSS with the HIS. It is also proposed that the results will be forwarded to and disseminated through the Irish Nursing Board quarterly publication to ensure dissemination of results to healthcare workers. Finally, an application will be made to present the findings at the health Informatics Society of Ireland annual conference in 2008.

In conclusion, this research has not been in vain. The positive results established by conducting this research has meant that policies and practices will undoubtedly change in this private hospital and the knowledge gained in the field of health informatics will be disseminated to those practicing and researching in the domains of healthcare and health informatics.
References:


Bibliography:


Appendix 1 – Consultant Protocol

Pre Op
- Usual admission procedure - make note of associated pain and discomfort.
- Sensory involvement and or motor involvement.
- Bladder or bowel difficulties.
- Fasting time pending time of theatre.
- If c/o temperature, cough or cold – inform consultant and anaesthetist
- If on Plavix, Warfarin, or Aspirin inform consultant immediately on admission.
- Analgesia to be charted regularly pre op.
- Encourage patient to shower early in the morning of procedure (after review by consultant) as backing markings carried out early morning.
- Check all old scans and x rays are available.

Investigations
- FBC, U&E. only if ordered by consultant – check admission sheet.
- Back markings only if ordered by consultant.
- CXR as ordered by Consultant and ECG if required - assessed on patient age and previous history.
- Mr. Bolger, Mr. Young and Mr. O’Laoire no type and screen needed
- Mr. O’Neill type and screen -stating procedure.

Post Op
- Nurse flat. (Patients under the care of Mr O’ Laoire may us whatever position their comfortable with).
- Routine post op vital signs.
- Hourly neurological including leg movements and sensation to be noted.
- Observe wound site.
- Patient may resume oral fluids and light diet when sufficiently awake. Check with post-op notes if contraindicated.
- If Temperature is elevated above 38 degrees for blood cultures – Mr ***** only.
- Continue IV fluids overnight pending observations, urinary output and fluid intake orally.
- Patient allowed to stand out of bed if having difficulty passing urine – unless contraindicated in post op notes. If unable to pass urine inform consultant.
- Encourage patient to log roll out of bed with supervision.

Consultant Protocol

1st Day post op
- Allowed out of bed – unless light headed and B/P unstable and IV fluids discontinued
- Mr ***** , Mr ***** patients may sit as tolerated.
- Give clip remover to patient on discharge GP will remove clips.
Appendix 2 – MRSA Protocol

MRSA : GUIDELINES FOR PREVENTION OF SPREAD OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS

1.0 AIMS OF PROCEDURE
1.1 The aim of this document is to provide staff with instruction on the management and care of patients with MRSA infection/colonization Thus ensuring:
- Department of Health guidelines are followed;
- Prompt identification of MRSA carriage;
- Prevention of the spread of MRSA.

2.0 SCOPE OF PROCEDURE
2.1 The procedure applies to all staff working in patient areas.

3.0 DEFINITIONS
3.1 MRSA: Methicillin resistant staphylococcus aureus. Methicillin is the Laboratory test for Flucloxicillin resistance

4.0 RESPONSIBILITIES
4.1 All staff caring for or in contact with patients are responsible for ensuring this procedure is followed.

5.0 SCREENING OF PATIENTS for MRSA
MRSA screen : Reserve swabs from the following areas:
- Nose- inside of both nostrils should be rubbed with a sterile swab
- Throat- swab back of throat with sterile swab
- Axilla-Both axilla should be rubbed briskly with swab
- Groin or Perineum- Swab should be rubbed along skin surface of both groins from groin to perineum
- Broken areas of skin, old IV sites, leg ulcers, wounds – swab each with sterile swab marking site clearly on swab
- Urinary catheter and Central venous catheter sample

5.1 All patients admitted from another hospital or inpatient care facility should be screened for MRSA on day of admission. (see sites above)
5.2 All patients admitted with history of inpatient stay in any hospital in the past month should be screened on day of admission
5.3 All patients with history of previous colonization/infection with MRSA should be screened for MRSA on day of admission
5.4 All patients for surgery requiring stay in ITU should have Nose and groin swabs for MRSA reserved on admission.
5.5 Swabs for ‘MRSA’ every Tuesday from long term patients in ITU.
5.6 Reserve MRSA screen every 2 weeks on long term patients on wards- (in patient > 3 weeks)
5.7 Reserve MRSA swabs from Nose and groin of all patients admitted to St Joseph’s ward except short stay cardiology patients (ie for PTCA)
5.8 Reserve MRSA swabs from all Oncology patients when readmitted.
5.9 Repeat screening specimens two days following the end of treatment and on two additional occasions when previous results are available (72 hr intervals)
5.10 If screening specimens remain positive, repeat treatment in consultation with Infection Control Team
5.11 Routine screening of Staff is not recommended. However, the Infection Control team may decide to screen staff during investigation of an out break.
5.12 Unless staff identified as carrying MRSA work in high risk areas such as ITU, Theatre, Orthopaedic units or Oncology unit, they do not require exclusion from work.
5.13 Staff positive for MRSA working in high risk areas should be excluded from work in these areas until 48 hrs after commencement of treatment.

6.0 Isolation Precautions for MRSA patients
6.1 Patients with MRSA should be nursed in single rooms with contact precautions until 3 consecutive negative screens have been obtained.
6.2 Patients admitted with History of MRSA (in past 5 years) should be admitted to single room until review by Infection control Nurse (ICN). Following assessment of risk, she will advise re necessity of maintaining single room, and/or contact precautions and number of MRSA screens required.
This will be dependant on length of time since patient was last positive for MRSA and number of previous negative screens on file for the patient. Senior nurse on house duty must be informed of patients at risk and outcome of review by ICN
6.3 Every attempt should be made to place patients transferred directly from other hospitals /care facilities into high risk areas in a single room until admission MRSA screen results available.

7.0 PROCEDURE FOR CARE OF PATIENTS WITH MRSA
*NOTE: ALL PATIENTS ADMITTED WITH HISTORY OF MRSA (in past 5 years) SHOULD BE CARED FOR IN A SINGLE ROOM UNTIL REVIEW BY INFECTION CONTROL NURSE. ALL PATIENTS DIAGNOSED WITH MRSA SHOULD BE TRANSFERRED IMMEDIATELY TO A SINGLE ROOM
The Senior Nurse on House Duty must be notified of patients admitted with a history of MRSA or diagnosed with MRSA

7.1 Staff Hand Care
• All staff including Doctors, Nurses, Physiotherapists, Radiographers and Porters should use an antimicrobial hand rub before and after handling the patient or his immediate environment.
7.2 Plastic Aprons
• Must be worn by all persons having direct contact with the patient or his bed linen.
7.3 Gowns
• Gowns are only necessary when the patient requires heavy nursing care e.g. lifting

7.4 Masks
• Necessary only during suctioning of the patient.

7.5 Gloves
• Disposable gloves must be worn by all persons having direct contact with the patient.
• Also essential when dealing with body fluids as part of standard precautions
• Hands must be washed with alcohol hand rub immediately after contact with the patient or his/her environment and when gloves are removed

7.6 Crockery & Cutlery
• Remove from room separately and take straight to pantry.
• Single use sachets of sugar/salt etc should be used for these patients. Unused sachets should be discarded when tray collected from room
• Wash hands after handling tray

7.7 Furniture
• Daily cleaning of bedrails, bed tables, lockers with a 1% hypochlorite solution (1000 ppm chlor-clean solution-1 tablet per litre water)
• Use fresh J-Cloth daily and dispose after use.

7.8 Linen
• Vigorous movements when changing linen must be avoided to prevent aerosol of micro-organisms.
• Change linen daily and place in Orange algenate bag for collection

7.9 Dressings
• All dressings placed in yellow risk waste plastic bags for incineration.

7.10 Instruments
• Use disposable and discard in yellow risk waste bags after use. If this is not possible, label as MRSA and send to CSSD as per normal.

7.11 Equipment
• All equipment including stethoscopes and BP monitoring devices should be kept for the patient’s sole use and should be cleaned daily with disinfectant wipes or chlor-clean 1,000ppm chlorine solution
• No piece of equipment should be brought out of an MRSA room prior to cleaning

7.12 Oxygen masks / Nebulisers
• Change equipment daily.

7.13 Visitors
• An attempt should be made to limit the number of visitors.
• Sitting on patient’s beds is strongly discouraged as MRSA can be transmitted in this way.
• Visitors should be asked to wash their hands after visiting and to use the antimicrobial hand rubs available.

7.14 Cleaning Equipment
• Separate cleaning equipment should be kept for ‘MRSA’ rooms.
• Use specific mop head and machine wash after use.
• MRSA rooms should be left until last and the vacuum cleaner wiped with disinfectant wipes after use on an MRSA room

7.15 Transferring of patient to another ward
• Patients should only be transferred when absolutely necessary.
• If it is necessary to transfer the patient to another Ward, the relevant ward should be notified in advance, giving ample time to prepare an Isolation room.
• Senior Nurse on House Duty must be informed of any transfer of patients

7.16 Transfer of Patient to another Hospital
• MRSA should not prevent the transfer of patients to another hospital or institution
• The receiving Hospital should be notified in advance of the MRSA status of the patient and any relevant treatment in progress.
• Transfer letters should be clearly marked with a yellow MRSA sticker.

7.17 Actions to be taken when new MRSA identified on ward
• If ICN on duty, she will inform patient of diagnosis and give the patient an information leaflet.
• In her absence, the patient should be informed by the Nurse Manager/Deputy or by the Consultant Microbiologist.
• Commence contact precautions and set up Infection Control trolley immediately
• Patient is in share room – Contact Bed manager/person on house and arrange to move the patient to single room as soon as possible.
• Arrange to take samples for MRSA from all other patients in the room and all other recent patient contacts. (le those in same room as patient during this admission, but transferred to another room) Nose, groin and wound sites should be sampled.
Room should be cleaned/disinfected when patient is transferred as detailed below. All other rooms patient was in on this admission should also be cleaned/disinfected as detailed below.
• Senior Nurse on House Duty to be informed.

8.0 Terminal Disinfection On Discharge Of Patient (REFER TO INF-GEN-033 FOR MORE DETAILS)
Staff engaged in final cleaning should wear plastic aprons, household gloves and practice Standard Precautions. Freshly prepared Chlor-Clean solution (1,000ppm available chlorine) should be used for all surfaces and equipment unless manufacturers instructions dictate otherwise.
It is the responsibility of the CNM to ensure that the ward attendant carries out the following duties:
8.1 The medical equipment in the room should be cleaned and then removed from the room where applicable
8.2 The room should be cleared of flowers, vases, jugs, urinals, drip stands, ear plugs toiletries etc. and these should be brought to the dirty utility for cleaning and disinfection or disposed of in bin in patient’s room.
8.3 The sharps bin and clinical waste bins should be sealed and brought to the dirty utility for collection
8.4 The bed should be stripped of all linen and the linen placed in algenate bags for collection.
The Housekeeping staff and Janitor are then responsible for the following:
8.5 The waste bins and bags should be emptied and tied and removed from the room
8.6 The bed and mattress should be steam cleaned and the fire blanket washed with Chlor-Clean as per manufacturers instructions
8.7 Curtains, in both room and bathroom, should be taken down, placed in algenate bags and sent for laundering
8.8 All furniture and horizontal surfaces and ledges including door handles should be cleaned
8.9 In a share room the curtains and furniture around the bed space only require cleaning
8.10 All equipment in the room including T.V., telephone, remote control etc. should be cleaned carefully with the disinfecting solution or rubbed with alcohol wipes.
8.11 All toiletries, soaps, towels etc. left in bathroom should be disposed of or sent for laundry and then the bathroom / shower should be steam cleaned thoroughly and a clean curtain hung
8.11 The walls should be washed and the carpet should be shampooed and then steam cleaned

9.0 RE-USE OF THE ROOM
9.1 The room should be left vacant for at least 1 hour with the windows open in order to ensure all surfaces are dry and full air changes have occurred. Preferably, the carpet should be allowed to dry also.

10.0 TREATMENT FOR PATIENTS COLONISED WITH 'MRSA'
10.1 Bedbath/Bathing
  • Use antiseptic detergent for Bathing daily for five days. No soap.
  • Use fresh J-Cloth/sterile pad each time and dispose after use.
  • Change patient’s night-clothes and bed linen daily after bathing.
  • Clean bath/shower seat thoroughly with Hypochlorite 1% (e.g.Chlor – Clean freshly prepared at 1 tablet to 1 litre of water) after use.
  • After bathing and drying, apply light dusting of Chlorohexadine powder or approved substitute to skin from waist to knee and axilla.

10.2 Hair
  • Wash twice during five day treatment with a small amount of antiseptic detergent
  • Rinse thoroughly
  *Please note that Hibiscrub neutralises Permanent Waves.

10.3 Nose
• For nasal carriage, Mupirocin 2% (Bactroban) Nasal Ointment or approved substitute should be prescribed and applied to front of nostrils three times daily for five days following consultation with the patient's consultant.
• Repeat Nasal Swabs on day 7.

10.4 Superficial skin excoriations/decubitus ulcers
• Mupirocin 2% (Bactroban) or approved substitute may be applied to the affected area twice daily, after consultation with the patient's consultant.

10.5 Throat
• Chlorhexidine spray or approved substitute should be sprayed on throat three times daily for five days following consultation with the patient's consultant.
• Repeat swabs day 7

10.6 Axilla/Groin/perineum colonization with MRSA
• Chlorhexidine powder or approved substitute should be applied to affected area twice daily for 5 days
• Daily BATHS with Chlorhexidine should be given in preference to daily Showers when patient condition allows.

11.0 PRECAUTIONS NECESSARY FOR CLEANING STAFF
• All staff should wash their hands carefully after contact with the patient’s furniture, bed, locker, bathroom etc.
• Antimicrobial hand rub will be outside the room near the door and should be used on leaving the room.
• Separate cleaning equipment should be kept for "MRSA rooms"
• Daily cleaning of bedrails, bed tables and lockers with 1,000 ppm chlorine solution, (Chlorclean 1 tablet to 1 litre). Use a fresh J-cloth and dispose after use.
• Clean bath daily preferably after the patient has bathed.

12.0 PRECAUTIONS NECESSARY FOR CATERING STAFF
• A food tray may be issued as normal to these patients
• Hands must be washed carefully after handling furniture, used trays, glasses or other equipment in the room.
• Hands should be washed with soap and water or alternatively, with an antimicrobial hand rub.
• It is recommended that trays should be removed separately from the room and all salt/pepper/sugar should be single use sachets only
* NOTE: It is not necessary to use separate utensils for these patients.

13.0 PRECAUTIONS FOR PHYSIOTHERAPY STAFF
13.1 Patients with MRSA on skin site or nose/throat
• Physiotherapy to be carried out in patient’s room until MRSA treatment regime in place for 24 hours
• Then physiotherapy need not be confined to room but may be carried out on the ward
• Apron, gloves and mask to be worn during chest physiotherapy / suctioning
• Apron and gloves necessary for mobilisation physiotherapy
• Remove apron, mask and gloves and dispose in yellow bag in room
• Wash hands immediately after removal of gown, mask and gloves with antimicrobial soap or use antimicrobial hand rub

13.2 Patients with MRSA in wound only
• Physiotherapy may be carried out in Physiotherapy department providing wound is covered
• Wipe down equipment used with Alcohol wipe and allow to dry
• Wash hands immediately after removal of gown and gloves with antimicrobial wash or wash with soap and water and then use antimicrobial hand rub
• Where practical, all MRSA patients should be treated by the one physiotherapist to reduce the risk of infection to other patients

MRSA –Who to Isolate in single rooms?
• All MRSA positive patients –regardless of site until 3 full negative screens
• All patients with History of MRSA in past 5 years
• All direct t/f’s from long term care facilities to Oncology/ITU
• All direct t/f s from long term care facilities to other wards
• All direct t/f s from other hospitals/nursing homes
• All those with History of previous hospital stay (in past month)

Screening For MRSA
• Nose/Groin + broken skin/wounds, urinary catheter, IVD tip
• All patients going to ITU
• All Pre op CT surgery patients
• All patients admitted to St Josephs (except short stay PTCA etc)
• All contacts of a newly diagnosed MRSA case
• Weekly for long term ITU patients
• Fortnightly for long stay patients on wards
• Full screen (as opposite + throat, axilla, perineum,)
• All transfers from other hospitals
• All patients in another hospital in last month (including our own hospital, remember Oncology readmits)
• All patients with History of MRSA
• As part of screen for patients after treatment for MRSA
Appendix 3 – letter from IT manager
Ms Melissa Lanigan
****** Hospital
Address Line 1
Address Line 2
Dublin

10th January 2007

Dear Melissa,
I have just returned from London where I met to discuss the plans for the implementation of phase II of the iPatient Manager with senior members of iSoft PLC. Whilst there, I took the opportunity to discuss the DSS you demonstrated to me before Christmas and the feasibility of integrating as part of Phase II.

Ms Ann Giles whom you have met on many occasions was very interested in your idea especially the component concerning MRSA and would like to see the prototype and your research results when completed.

Good luck with the remainder of your studies,

____________________________________
Director of IT
Appendix 4 – Admissions Presentation
Appendix 5 – Ethics Letter
Name of Clinical Supervisor
Hospital Address line 1
Hospital address line 2
Dublin
14th March 2007

RE: Can a Decision Support System (DSS) prevent cancellation of elective admissions and reduce the spread of MRSA in a private hospital in Dublin?

Dear Ms *********,

I acknowledge receipt of your correspondence received 12th March 2007 enclosing the specific questions it is proposed to ask participants for this research study and clarifying that the telephone call for the purpose of your research will be made separately to the call made to patients before their admission as requested by the ***** research ethics committee.

This correspondence has been noted and approval for the above research study to be carried out at the *** hospital has now been granted. This approval is valid until the 14th February 2009.

It is your responsibility to adhere to the study protocol without deviation (unless it has been agreed by the Research Ethics Committee), to submit annual reports setting out the progress of the research (giving details of the number of participants recruited, the number who have completed the study and details of any adverse events etc.) and to notify the Research Ethics Committee when the research is concluded.

Yours sincerely

____________________________
Chairman Research Ethics Committee

cc Ms Melissa Lanigan, Admissions Nurse, ***** Hospital.

Mr ***** *****, Chief Executive, ***** Hospital.