PRE-OPERATIVE ASSESSMENT IN THE REDUCTION OF UNPLANNED HOSPITAL ADMISSION AND CANCELLED DAY CASES AND THE ROLE OF INFORMATION TECHNOLOGY IN THE 21ST CENTURY

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A DISSERTATION SUBMITTED TO THE UNIVERSITY OF DUBLIN, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN HEALTH INFORMATICS

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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Acknowledgements

My gratitude goes to God who has enabled me to start and finish this course.

Thanks to my darling husband Abimbola for his patience and encouragement;

even when I doubted myself for believing in me. To my children Anto, Alex,

Andrew and Andrea for supporting me in their own way.

To my technical gurus AJ, Zein and Serge for guiding me through the "hard stuff".

To N Al-Mane and K Foley for proof reading the document.

Thanks to the course coordinator Dr Lucy Hederman for giving me the

opportunity to do the course.

Thanks to my supervisor Mary Sharp, for her guidance and support.

To my colleagues at work for allowing me to be off every Friday, especially

Yvonne for "organising" the rota.

And finally to all my course mates for continuous inspiration, such a great Bunch to have been with!

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CHAPTER 1

1.1 Introduction

Given the times we are in, day surgery is becoming more common due to its cost effectiveness, patient acceptance, coupled with the high cost associated with the running of operating theatres and the expense of admitting patients to the hospital before the day of surgery (Tham and Koh 2002).

These are some of the reasons the pre operative assessment (POA) of patients is seen as both cost effective and efficient. But for this to be realised, POA must be done in such a way to minimise cost by preventing cancellation and unplanned admissions. This can be possible when the set criteria are adhered to. However, in spite of careful selection, it is impossible to avoid cancellation and unplanned admissions, but these can be reduced to the barest minimum. Employing the use of Information Technology (IT) can enhance data re-use, help to ensure that complete and relevant information is available to the physician to make informed choice thus further enhancing the POA process.

1.2 Background and Motivation

The author works in an acute hospital theatre department where many procedures are done as day cases. At the present, patients are pre assessed before the day of surgery but this is still being done by sending the notes of the patients that the pre assessment clinic nurses refer to the anaesthetists to the theatre department. Although there is a Theatre Management System (TMS) in use, the pre assessment function is not activated. The author aims to draw attention to the fact that the use of IT for pre assessment is beneficial; also that proper pre assessment can reduce cancellation and unplanned admissions. These reasons are the motivating factors behind the dissertation; the author aims to reiterate that pre assessing patients can reduce cancellation and unplanned admissions when the correct criteria are used; and that the use of IT will help to make the right decisions at the point of care.

1.3 The Research Question

Preoperative assessment of day surgery patients, does it reduce cancellation and unplanned hospital admissions? What is the role of Information Technology?

1.4 Overview of the dissertation

The literature review is presented in Chapter two; Chapter three discusses the information technology aspect and the different technologies available. Chapter four discusses pre operative assessment, day surgery and the selection criteria. Chapter five discusses cancellation of day cases, examined unanticipated admissions, the causes and consequences. The Research is presented in Chapter six, in Chapter seven the design of the prototype of the POA form is presented, the limitation and difficulties of the research are discussed, how it can be applied and suggested future work.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In order to have a better understanding of the study, this literature review sought to understand what is already known regarding this topic; and used this as a guide to frame and answer the research question.

Cancellation of elective surgical cases is an ongoing problem in hospitals both internationally and in Ireland. This causes a negative impact on the already scarce resources of hospitals. Day case or ambulatory surgery is on the increase, thus the method for assessing patients prior to surgical procedures have been affected.

POA of patients in the outpatient setting is seen as both cost effective and efficient. POA is "a basic element of anaesthetic care" (Garcia-Miguel et al. 2003). To realise the cost effectiveness of POA, day cases must be done as planned and not end up on admission due to inappropriate assessment. Hence certain criteria have been put in place to ensure this. When and if the criteria are properly followed surgical day cases will not end up on admission and cancellation will be minimised. When unplanned admissions occur, patients are subjected to adverse events; which inadvertently occur in hospitalised patients examples medication and transfusion errors.

In considering POA, the role of information technology cannot be ignored especially in the present time. The most basic being the computerization of patients' records. Evidence abound that computerisation have many identifiable benefits in the overall patient care (Chaudhry et al. 2006). There is better access, more complete data and legible records. To obtain the relevant information the following databases were searched.

2.2 Databases Searched and Information Sources:

- 1. Ovid MEDLINE 1966 to present
- 2. Cinahl 1982 to present
- 3. EMBASE 1974 to present
- 4. Medline/Pub med
- 5. Cochrane library
- 6. Bibliographies cited within references obtained were used
- 7. Internet Evidence Based Medicine Resources
- 8. Text book sources

2.3 Terms used for searches

{[(exp pre-operative assessment, surgical cancellation) OR (post-surgical complications.mp) OR (anaesthetic assessment.mp)]

AND

[(exp unanticipated hospital admission) OR (day surgery.mp) OR (relative risks.mp)]

AND

[(exp role of information technology) OR (recommendations for future improvement.mp)]}

All searches were limited to English language papers in human subjects.

2.4 Results of searches

This search strategy yielded 640 articles these were examined in order to assess their suitability. In total, 147 articles met the criteria for this dissertation after eliminating duplicates. There were no multicentre prospective randomised studies, no yield from the Cochrane library on this topic and no meta-analysis found. Additional information was from on-line searches of Medscape, Uptodate and Wikipedia.

The first section examined the literature on POA, day surgery and cancellation.

2.5 Preoperative Assessment, Day Surgery and Cancellation

A review of the literature on POA, Day or Ambulatory surgery and cancellation of surgical cases showed that these three are interwoven and the good management of one does affect the others.

A considerable number of articles support POA as a way of avoiding cancellation and preventing unplanned hospital admissions of surgical day cases (Pollard and Olson 1999; Ferschl et al. 2005; Tham and Koh 2002).

As far back as the 1960's POA have been used for surgical cases (Egbert et al. 1963), although day surgery is only now becoming common place.

Bond (1999) surveyed the provision of pre anaesthetic clinics in Ontario, Canada in 1997 through mail questionnaire of 300 hospitals. 260 of these hospitals replied to the questionnaire, which was 86.7% response. 131 (63%) of these hospitals actually provided general anaesthesia to their patients. Written guidelines were in place to determine which patients were referred to the clinics; these patients were seen by a nurse most of the time. The nurse then decided on the ones referred to the anaesthetist. Although the clinics were not specific for day cases, less than 20% of the scheduled surgical procedures were done as inpatients. They noted a decrease in the rate of cancellations after POA which was comparable to other studies. They acknowledged that some hospitals might find it expensive to provide a POA clinic, but this can be compensated for by the cost saving from day surgery as opposed to admitted cases.

Also in the same study it was found that having the time for better assessment of the patients, especially those considered at risk, can lead to better medical care. They concluded that more studies should be done to fully identify if better efficiency is achieved through less cancellations and unplanned admissions.

In another study, Pollard and Olson (1999) examined if early outpatient POA can help to reduce operating room cancellation.

They examined 529 patients that were divided into "standard or early" groups. The standard group had the POA within 24hours of surgery, while the early group was evaluated between 2-30days before their scheduled surgery. Both groups were matched for gender, age, American Society of Anaesthesiologists (ASA) physical status 3 and 4 and the type of surgery.

The study concluded that cancellation rates for both groups were comparable at 13.3 and 13.2% respectively. They noted four main reasons for cancellations, namely: insufficient operating room time, acute patient illness, patients' decision to cancel and more time needed "for further medical evaluation". Other causes were classified as miscellaneous. It was acknowledged that being an observational study, that bias might have been introduced by the patient selection. The authors noted that medical reasons were not always the cause of cancellations. Comparing their study to others, administrative reasons played a major role in cancellations.

Even though the study could not conclude that early POA reduced the rate of cancellations, they said that this can enhance the education of those that received early POA. It can also reduce anxiety. The conclusion was to schedule POA at the convenience of the patients and efficient for the institution.

Sjoling et al. (2003) considered the impact of POA with regards to the information the patients were given and the effect of the information on the state of anxiety in the post operative period.

This was done through an intervention study of two groups that were of equal size to reduce bias. The control group was given routine information while the intervention group received specific information.

The first objective of the study was to find out if information given to patients before surgery will help with better pain management. The second objective was to determine the effect of preoperative information on the state of anxiety in the post operative period, to confirm if patients were satisfied with the pain management they got and finally to check their satisfaction with the nursing care they received.

The patients were then assessed for pain in the preoperative period, then every 3 hours in the post operative period in the first three post operation days. The visual analogue scale was employed to rate the level of pain the patients were experiencing.

The study concluded that pain is psychological. The patients in the intervention group positively responded to the pain treatment because they experienced less pain. They also had more satisfaction with the post operative management and less anxiety post operatively.

A study by the Australian Incident Monitoring Study (AIMS) by Kluger et al. (2000) on the other hand reviewed 197 reports in order to determine if adequate preoperative patient evaluation/preparation can reduce the rate of incidents post operatively.

6,271 cases were reported to AIMS. Cases were extracted if they fell under two categories: "pre-operative assessment inadequate/incorrect" or "pre-operative patient preparation inadequate/incorrect"; in order to find out if the pre-operative assessment or patients' preparation was inadequate/incorrect.

478 and 248 cases respectively fell under the above categories, total of 726 cases. This represented 11% of the total cases reported to AIMS.

Each case was then reviewed independently by three specialist anaesthetists. Information that was considered relevant was analyzed using Microsoft Excel spreadsheet. These are the data fields that were analyzed: nature of surgery, surgical category, whether seen by an anaesthetist pre-operatively, whether seen by the same anaesthetist pre-operatively, ASA status, outcome, whether the incident was preventable, and suggested corrective strategies.

The result showed that incidents relating to 197 of these cases (3.1% of the total cases in AIMS database) were as a result of problems with pre-operative assessment or preparation; 73 of these cases were general surgery which is one of the commonest specialties for day cases.

Of significance was the fact that 23% of these cases were seen by different anaesthetists pre-operatively and intra-operatively (to administer anaesthesia).

The ASA status was significant as well, buttressing the importance of following the pre assessment guidelines and recommendation. Inadequate patient evaluation, communication problem and poor airway assessment were the most common.

The study showed that POA was so important that if not properly done it can result in morbidity, major psychological changes or admission to the intensive care unit; 7 patients died in this instance. Of significance was the fact that 57% of these incidents were definitely preventable and 21% were possibly preventable.

Other issues highlighted from the study were unplanned admissions and cancellation of operations, which adequate POA could have prevented by ensuring that correct assessments were done and that patients were prepared accordingly.

The study concluded that an adequate and comprehensive POA is important. The findings reiterated the study by Simini et al. (2003), where they stressed the

importance of the same anaesthetist reviewing the patient also administering anaesthesia. Like most of the other studies this was a retrospective study, but they suggested corrective strategies for most of the issues that were identified. The study was able to identify and highlight many deficiencies in the POA process, for example cancellation of surgery due to differing opinion by another anaesthetist, lack of patient-doctor relationship and in case of litigation which anaesthetist will be held responsible, such that if these areas can be improved then it will be possible to reduce associated incidents.

Ferschl et al. (2005) also conducted a retrospective study to prove that POA can reduce operating room cancellations and delays. Charts of all surgical cases during a 6 month period were reviewed at the University of Chicago Hospitals. 6,524 cases qualified for inclusion in the study, these cases were cross referenced with anaesthetic preoperative medicine clinic (APMC) database and the effect of the clinic visit was analyzed.

The effect was significant enough to conclude that POA does affect day of surgery cancellations and delays. In the patients that were evaluated at the APMC 8.4% were cancelled, while 16.2% in non-evaluated patients (for same day surgery). In the general operating room 5.3% in evaluated patients and 13% in the non-evaluated patients. Both the same day surgery and the general operating room had a p value of < 0.001.

Most of the studies concentrated on the effect of POA, but Hepner et al. (2004) wanted to find out how the patients perceived POA. In their study they used questionnaires to assess patients' satisfaction with POA clinics. Approval was sought from the hospital's committee for the Protection of Human Subjects. One page questionnaires with 18 questions were given to patients attending the Preoperative Assessment Testing Clinics (PATC) during 3 different time periods. 4,243 patients visited the PATC during the 3 months, 1,200 questionnaires were distributed (20.2% of total attendees) out of which 857 were returned. Likert scale was used to rate the

satisfaction level. The preoperative period was used because in their opinion this was the time that patients have the most interaction with healthcare providers. They also noted that patient satisfaction is "a unique clinical end-point and an indicator of the quality of health care provided".

The POA is also unique because it is a time when preoperative requirements can be assessed and information given to patients, this reduces anxiety post operatively.

The response rate of the questionnaire was 71.4%, which was good. Questions varied from General, Anaesthesia to overall satisfaction. Patients were also asked if they preferred to have their POA over the internet. The wording and content of the questions were already tried and tested having been developed and imported from the institution's Primary Care Survey. The questions for the PATC were specifically developed by clinical leaders and providers. The reliability and consistency of the questions were confirmed using Cronbach Coefficient Alpha Test. The questionnaires were first tested on a small number of patients to ensure clarity and understanding; these patients were not included in the final analysis. The 5 Likert scale multi-item questions ranged from 5 (excellent) to 1 (poor). Patients could also record free text comments to ensure that their level of satisfaction was fully captured. The questionnaires were anonymous. Various criteria were used for inclusion in the study such as gender, ASA physical status to obtain a reasonably balanced and comparable data. The data analysis was done using the Cronbach Coefficiency Alpha to demonstrate that the instrument was reliable and consistent and that the set of items measured the patients' satisfaction construct well.

Mean calculations were done to determine the overall satisfaction level, then the correlation between the different scales were measured. Of the 857 questionnaires, 855 were analyzed as 2 were returned blank. The survey was not limited to general surgical day cases, all the specialties were covered.

Of note from the result was patients' dissatisfaction with the ease of locating the

PATC, length of time waiting to be seen and the surgeon's explanation of the PATC process. These were all non clinical elements and peculiar to the setting; nonetheless important to the patients. Most of the patients did not prefer a POA on the internet.

The authors admitted a few study limitations, first only 20.2% of the patients were surveyed, this may not be a good representation of the patients. Also, different patients were used at the different stages of the study. Time of distribution of the questionnaires could have influenced patients' response. The study may not be generalisable to other settings because of differences in practice standards.

But the study was able to set a tool that can be designed to assist PATC process and to identify areas of improvement.

Time pressure was highlighted, although the process of measurement varied with the 3 periods (2 before the implementation of a computerized time log system; 1 after).

The overall method used for the study and the analysis was thorough, and the findings provided a platform for further studies.

Hariharan et al. (2009) conducted a similar study at The Eric Williams Medical Sciences Complex (EWMSC) in Trinidad and Tobago to find out how patients perceived the utility of the Pre-anaesthetic Clinics (PAC). The study was carried out over 15 weeks; and all the patients who attended the PAC were enrolled. Of the total number of 220 patients, 204 patients participated (92.7%).

Similar to the above study, a questionnaire was used; a 5- point Likert scale with 15items questions ranging from "strongly disagree" to "strongly agree". Time was taken to explain the questions to the patients individually to ensure understanding and uniform response. Staff members working in the PAC were given a different set of questionnaires.

Data were analyzed using Statistical Package for Social Sciences Version 12.

The study showed that patients found that attending the PAC was useful. Like other

studies, time was an issue. The authors suggested more frequent clinics and telephone appointments.

The short duration of the study was a limitation, and there was no similar PAC to compare with within the region. The study could have been biased with regard to the responses, which could have been made worse by the individual explanations.

Taking these into consideration, there is room to further explore this study, and expand the scope by conducting comparative studies to further confirm the benefits of POA of the surgical patients.

Not too many articles in the literature specifically addressed POA in the Irish context, but Power et al. (2004) carried out a notable study at the University of Galway on patients who had Laparoscopic Nissen Fundoplication (LNF).

LNF is a procedure commonly done as a day case hence the importance of POA to ensure that the post operative period is free of complication.

In this study, Power et al. (2004) discovered that non-response to proton pump inhibitor (PPI) in the preoperative period should alert the surgeon in considering LNF or any anti-reflux surgery. This can only be picked up if the patients were properly assessed in the preoperative period.

The study analyzed 131 patients who had LNF by one surgeon. The aim was to find out why the surgical intervention was unsuccessful. 10.6% of the patients (14) were in the failure group. The statistical analysis identified that these patients had a large hiatus hernia pre operatively, their pH analysis in the upright position was abnormal and that there was a history of psychiatric problem. A comprehensive POA would alert the surgeon to all these and they could have been rectified preoperatively or given more time for treatment if possible.

This study emphasized the importance of POA and the very essence of having the patients in a state of readiness for surgery; to enhance recovery and success in the

post operative period. The next section examined the literature regarding unplanned admissions after day surgery.

2.6 Unplanned Admissions After Day Surgery.

Unplanned admission was defined as unanticipated admission after a day surgical procedure (Tham and Koh 2002).

In a study by Tham and Koh (2002), the reasons for unanticipated admissions were analysed with the aim of improving efficiency of day surgical services. A retrospective review of the records of the patients that were admitted over the two years study period was conducted. Data collected included peri-operative complications, physical status and the reasons for hospital admission. During the study period 10,801 cases were carried out in the day surgery centre; 163 of these patients were admitted, but only 148 were included in the study. The unanticipated admission rate was 1.5%. 75% of these cases were deemed potentially preventable, because the reasons for admissions were mainly for observation, social reasons and for post operative pain control. Other preventable, non life threatening reasons were due to delayed recovery, post operative nausea and vomiting.

A quarter of the total admissions were due to non preventable causes such as drug reaction, surgical bleed or difficult airway.

From the study, the potentially preventable causes can be minimized by better POA and better planning of the surgical cases. But as already noted by the authors, even with the most careful selection, unanticipated admissions can still occur. But monitoring the admission rate and finding solutions to the reasons for unplanned admissions will help to maintain a high quality of efficient and effective patient care.

In another retrospective study by Ganesan et al. (2000) which was conducted at the purpose built Royal National Throat, Nose and Ear Hospital, UK; 1,642 patients were

operated on as day cases in the 12 months study period, out of which 29 patients were unexpectedly admitted, 1.8% of operated cases. The reasons for admissions were due to haemorrhage in the immediate post op period (4 patients), 2 patients were for social reasons, 1 was anaesthetist/surgeon's request and 1 for reactionary haemorrhage. It was noted that no patient was admitted due to pain, nausea and vomiting. This was accredited to their selection criteria, strict adherence to the guidelines by the day care nurses and the establishment of accurate social histories before acceptance for day surgery. They emphasized the fact that the management of day surgery care depended on careful selection of patients, minimizing complication rates and avoiding unexpected admissions which subsequently disrupt inpatient services. The study was inconclusive regarding the reason for the haemorrhage; they questioned the length of time the nasal packs were left in situ and the technique used.

Although, the study was related to ENT surgery, it was also specific for day cases and the salient point was still brought to light regarding POA and unexpected admissions. If established and agreed guidelines are followed, unexpected admissions can be reduced.

The authors recommended a prospective study to further explore the issue of how long the nasal packs should be left in situ.

It is relevant and appropriate to note that adverse events most likely follow unplanned hospital admissions. In a study by Brennan et al. (2004), 30,121 randomly selected records from 51 randomly selected acute hospitals in New York, USA were reviewed. The result showed that 3.7% of the hospitalized patients had an adverse event (95% Confidence Interval). It was noted that most of the adverse events were as a result of negligence and substandard care.

Naessens et al. (2009) did a cross-sectional study to assess the frequency and type of adverse events, they noted that adverse events reporting was being done using

different methods, this resulted in inconsistencies in incidence reporting; and low rate of documented associated harm. They recommended that the reporting of adverse events using combined methods will increase the rate of reporting.

2.7 The Role of Information Technology In Pre Operative Assessment.

In reviewing the literature, it is obvious that not too many articles in the literature specifically dealt with POA as an entity. Most of the articles were generally addressing information technology (IT) in healthcare.

Barnes et al. (2000) however, enlightened us in a study about the use of a rule-based computer program. The program was designed by 2 doctors; the aim of the program was to enable trained nurses to conduct structured interviews with patients; also to enable them to order investigations as necessary. The study was carried out at the Chelsea and Westminster Healthcare Trust, UK.

The study, carried out over a 2 year period, aimed to test if the clinical information generated by this method was of good quality, and "to determine the rate at which Anaesthetists cancelled patients from the published operating lists".

In the first year the anaesthetists did not conduct any POA of the patients, but in the second year, a senior anaesthetist had to review the patients' notes with medical problems before admission. The computer program was called "The Orthopaedic Pre Admission Screening System" (OPASS) a rule-based expert system shell was used running under DOS. Both the nurse and the patient faced the computer screen while conducting the assessment.

The nurse typed the answers provided by the patients to the questions asked. This may be a source of distraction, the patient may feel neglected and even feel ignored, it would have been better if the information can be typed in later or even recorded.

Surgical, medical (both present and past) and drug history were some of the questions asked, also the patients' height, weight and urinalysis were recorded.

The OPASS rule base was able to generate forms appropriately for lab and imaging investigations. It also generated a clinical report, flagging any adverse events.

Results from investigations and reports from the OPASS were then passed to a Surgical House Officer (SHO) for any further action.

In the second year, screening was limited to only patients who were 65years or older, or patients undergoing replacement of major joints. Reports and results were passed onto a senior anaesthetist for review with the clinical case notes.

Data collected at the end of two years included the total numbers of patients screened, number of cases postponed, reasons for postponement, patients cancelled and clinical reasons for cancellation.

Two clinicians then cross checked to see if the reasons for cancellations were missed by the screening process or occurred after screening. If it was reported by the screening, it sought to know if it was dealt with appropriately.

The results showed that 939 patients were screened with the OPASS in the first year. 113 (13%) were problem free, 826 (88%) had one or more problems, which resulted in 75 (8.1%) of the cases being suspended. 84 (9.7%) of the cases did not attend (DNA).

The OPASS failed to pick up 2 patients with abnormality during screening, 18 patients had abnormalities that were reported by OPASS, but were not acted on by the clinical staff. This was due in part to the fact that SHOs had to act on this, and because of their limited experience, they failed to take the necessary actions.

In the second year 463 patients were screened. 118 (25%) had no problems, 345 (75%) had one or more problems. 50 (11%) of the cases were suspended, 14 (34%) DNA although cleared for surgery. The OPASS missed one patient's abnormality

during screening, reported 3 cases, but was not acted upon by clinical staff. For comparison of data from the two years, patients that were 65years and over were included, as well as those having major joint replacement.

415 patients were identified in the first year, only 20 (4.5%) of these patients were unfit for anaesthesia; report showed a decrease in cancellation in the second year of 1.8% compared to 4.8% in the first year.

Although the OPASS was specific for orthopaedic cases, not necessarily for day cases, it can be adapted for any POA.

It ensured that investigations were performed appropriately before surgery and left enough time for corrective measures, which is the whole purpose of POA.

It also ensured less cancellation as proven by the study, thus saving money for the hospital.

As with any computer program, the initial cost is always an issue, but when compared to other cost savings over time, this is relative.

The study highlighted that computer based programs can be useful in POA, and is possible to train health care professionals how to use them appropriately.

In another study by Vitkun et al. (1999), carried out at the Health Sciences Centre in New York, USA, they examined the patients' perception of an anaesthesia preoperative computerized interview. They noted that computer-based patient records have become a part of most hospitals and general practitioners' (GP) offices. These records provided pertinent information that was accurate and legible.

120 patients scheduled for surgery were asked 63 multiple choice questions that were relevant to anaesthesia. They were asked to fill out a questionnaire comprising 16 questions before and after completing the computerized interview; they were to express their feelings concerning the computerized interview. Comparisons were made with the before and after answers. Data included patients' age, gender and education level, to determine if these affected their perception.

Stuart-Maxwell statistical test was used to analyze the data collected to see if there was any change before and after the computerized interview. It made a comparison between the fraction "agreeing" before to the ones after, also compared the fractions "unsure" to those "disagreeing. The null hypothesis was that there will be no change in the before and after fractions, the alternative was that there were some changes. The statistical significance was measured using the p-value ($p \le 0.05$).

The result showed that the computerized interview was viewed favourably by the patients once they were assured that the doctor-patient relationship was not compromised.

Although only 120 patients were involved in the study, the indication was still clear that the process was favourable. Further study involving more patients will be beneficial.

Computerisation ensures that time is more profitably spent, and more information is obtained; but computers should never take away from the doctor-patient relationship, but rather enhance it.

The authors recognized that proper training is needed, and the computer must be used properly to realize the full potential. The study showed that IT does have a role in the POA process.

Another very interesting computerized POA tool was described by Parker et al. (2000); developed by the Department of General Anaesthesiology in conjunction with an Internal Medicine Peri-operative Assessment, Consultation and Treatment (IMPACT) Centre; and a Preoperative Anaesthesia Consultation and Evaluation (PACE) Clinic in Cleveland, Ohio.

They implemented a retrospective evaluation of 63,941 ambulatory surgical patients over a 3 year period using Health Quest (HQ) which is an outpatient preoperative

assessment and management computer program.

The HQ used a scoring system similar to the ASA physical classification system.

The current version of HQ uses a relational data base management system with a touch screen technology for patient interface via computer monitors. The aim of the study was to collect and analyse data to determine if the implemented POA process was successful and if there was a change in waiting time (which is always an issue), among other things.

Descriptive statistics were used for analysis and the Wilcoxon rank-sum test to determine difference in waiting times.

In total 50,967 patients used the HQ during the 3 year study period; 22,744 (35.6%) of these patients were not seen by the Anaesthesiologist until the day of surgery. The waiting time in the clinic was not significantly reduced in the study period; but the level of complaints reduced because patients were kept busy with other activities like preregistration and admission interviews. There was huge cost savings due to the decrease in unnecessary laboratory testing. HQ was found to be effective in "efficient, cost effective patient care".

Although the complete adaptation of the model may not be possible in most institutions, but some portion can be adapted and applied in different forms. Given the efficiency of HQ as demonstrated by the study, medical facilities will be in a better position to prepare the preoperative patient using best practice, timely, thorough and cost efficient methods. This will cause a decrease in surgical case cancellation.

Finally the preoperative and evaluation system designed and implemented by Jackson et al. way back in 1994 was looked at. The study reviewed data from preoperative evaluation that were completed between 1990 and 1992 from the above system; which had seven networked computers. The data were analyzed with

"Borland C program" for the waiting and examination periods. 2,511 were paper based evaluations, 8,342 were by computer.

The result showed that the average waiting period with computer was slightly higher, but the time saving was achieved through the "instantly retrievable preoperative evaluations that the computerized system produces" and the fact that the entries were legible.

The examination period was almost the same for both paper and computerized systems.

Time has always been a factor in POA, and is still a challenge. The effect of computerised systems just as this is achieved by the time saved by producing legible and instantly retrievable data.

2.8 Conclusion

POA when properly done can and does reduce case cancellations, prevent unplanned admissions; thus preventing hospital adverse events.

In the present disposition the influence and effect of IT cannot be ignored, IT will go a long way in improving the POA process by making information accessible, legible and complete both to the health care workers and the patients.

It will also help in data re-use, data transfer from one institution to another, aid teleconferencing thus enhance patient care in general.

The improvement of patient care requires system wide action; patient care improvement leads to improvement in patient safety, which is an issue that affects all health organizations both in the developed and developing countries (Pittet and Donaldson, 2006).

This is a challenge that affects all health care workers. Ultimately, patient safety, delivery of efficient, cost effective and high standard care is what we all strive for.

From the above literature review findings, the author's research question is to determine if POA reduces unplanned admissions/cancellation, and the role of IT.

CHAPTER 3

INFORMATION TECHNOLOGY IN HEALTH

3.1 Health Information Technology (HIT) In Ireland – Where We Are

Past, Present, Future

The Population Health Directorate is responsible for strategic planning of all aspects of the HSE. The Information and Communication Technology (ICT) in Healthcare in Ireland is currently under review; this has prompted the HSE to produce a series of documents that seek to address this issue and bring about a transformation of the Health System in Ireland (HSE 2008; McDaid et al. 2009).

One of such documents was released in 2004 by the National Health Information Strategy (Ryan and Healy, 2007); this white paper was the first national policy document on health information policy. The aim was to "rectify deficiencies in health information systems and to put in place the framework to ensure the optimal development and utilization of health information".

Recently the ICT Strategy for Healthcare in Ireland 2010 (Ryan and Healy, 2007) set out a long term vision for the use of ICT in healthcare and personal social services and how to activate that vision. The plans cover a period from 2011-2014; with a framework through which investment decisions can be made. To be able to support and enable the provision of quality healthcare, ICT will have to:

- Be patient centred and support clinical practice
- Provide access to information when and where required
- Provide timely, meaningful, relevant and accurate information
- Support greater efficiency and effectiveness in healthcare provision
- Be consistent with the individual/organization needs in the provision of optimum patient care

- Be based on information and technology standards
- Ensure the security of data and systems (Kenny et al. 2010).

Another strategic aim is to improve the primary care significantly such that dependence on acute hospital care is reduced. It is recognized that with the aging population on the increase, the need for acute hospital services will increase because of increase in chronic diseases and their management. This is also being addressed by the Transformation Programme in the Preferred Health System in Ireland by 2020 (HSE 2008).

This means that the IT development needs to improve; in the recent past the ICT spend was reviewed, and significant increase was made. This is in recognition that not enough investment has been made in the area of ICT. There is need for new ICT that are sufficiently developed and able to integrate care between the primary and hospital settings in order to reduce the need for hospital visits (Shekelle et al. 2006).

In order to achieve this, there is need to change the process of health care delivery and health care setting (Haux, 2006). HIQA was set up in 2005 to assume the responsibility for developing health information, setting and monitoring the standards; promoting and implementing quality assurance programmes nationally and over-seeing health technology assessments. This includes consideration of costs as well as clinical effectiveness and responsibility for most accreditation mechanisms for publicly funded health care services in Ireland (McDaid et al. 2009).

The development of standards for the collection and sharing of information across health and social services and interoperability of information systems are the other responsibilities of HIQA. These are very important to enhance the ideal machinery for the provision of health care in the primary care setting and integration of care such that patients can move easily between the hospitals and the primary health care.

HIQA also collaborates with key stakeholders on the development and implementation of EHRs and unique identification for health and social services in

Ireland; this is in recognition that the fragmented approach that has been in operation till now is unsustainable. The UK company i-soft was awarded a €56 million contract to develop an EPR system that can be used to facilitate the ICT progression; work is ongoing (McDaid et al. 2009). HIQA is also working on an Electronic National Patient Treatment Register (PTR). All these projects are on going to bring the ICT Strategy for Healthcare in Ireland into reality.

However, there are already other projects underway; one such project is the "Healthlink" between primary and secondary care sectors which was initiated at the Mater Hospital in 1995, but has become a national project which links GPs with hospitals. As of March 2010, 23 acute hospitals and 807 GP practices use the service; they have access to laboratory results and radiologic examination reports.

Although there are many areas that are still lacking any IT system, there are others that have the basic systems in place even though interoperability is still an issue.

Another good example of ICT in operation can be found at St James' Hospital where the telemedicine and telesynergy services are excellent. It has made it possible for consultants in various specialities to communicate through teleconferencing in order to discuss patients' diagnosis and treatment options, and to share their expertise using internet connections and multimedia imaging technologies.

Another example of ICT system in practice is the Beacon Clinic which is based in Ireland, but is linked to and overseen by the University of Pittsburgh in the USA, where their radiologic examinations like CT and MRI scans are reported.

To fully realize these potentials, there is need to improve the ICT systems throughout the Health System. As we have seen so many hospitals have one form of IT enabled system, but a national roll out as envisaged by the ICT Strategy for Healthcare in Ireland is urgently needed (Ryan and Healy 2007).

There is much talk about the NIMIS project as one of the starting points of this,

although people are apprehensive about it because of past experience with the PPARS in 1997 which was abandoned 10years after it was started having wasted so much money in the process (McDaid et al. 2009; Lang and Melia 2009; Kenny et al. 2010).

But as part of the European Union (EU), Ireland will benefit through e-health which is envisioned to transform the Health System through a unified, interoperable support system; which includes administrative systems.

Some of the benefits of IT are outlined in section 3.2. However, in the Country Brief: Ireland e Health Strategies, (Kenny et al. 2010; Berg 2001) some difficulties were identified that can hinder the development of ICT in Ireland. These are discussed below:

1. Technical perspective

This has been identified as a pre-requisite for the establishment of e-health infrastructure; it is the ability to uniquely identify health care professionals with IT knowledge. People with proficient IT skills are needed to enable IT projects to work and support the ICT infrastructures once they are established and running; a work force that is capable of leading IT implementation needs to be developed (Hersh 2004).

2. Organizational perspective

The implementation of IT enabled systems is complicated; systems must conform to the work flow of the organizations. But given the problem of the fragmented nature of the present e-health structures and not enough human resources with HIT knowledge, this issue is a major challenge.

3. Funding perspective

This involves the financial and reimbursement aspects of e-health. The initial cost as already stated is usually substantial, but the eventual or potential benefits are

sufficient incentives to proceed. Hersh (2004) identified this impediment as a result of misalignment of costs and benefits. Unfortunately, given the current economic conditions, ICT funding may take the back seat, unless concerted efforts are made.

4. Legal aspect

Legal and regularity of e-health in terms of privacy and confidentiality is a real concern; patients' privacy must be protected. It must be noted however, that privacy issues are not relevant to IT only, but also to paper based systems; and perfect security will never be achieved. Hersh (2004) said we must strive to instil a culture of privacy and confidentiality.

5. Standards

Standards are crucial for interoperability and meaningful exchange of information in healthcare systems. At present standards vary and a consensus on standards is required. As already stated HIQA is responsible for health informatics standard in Ireland. Standardization in storing, communicating and sharing health data is important and will be beneficial both nationally and internationally.

3.2 Benefits and Effects of Information Technology

In 2007, five hospitals in Ireland installed The TMS as part of decision support software. The TMS was installed by Newgate Technology which is a Scottish-based health software and data collection specialist. The TMS was originally developed to replace the paper based theatre log book that is used to record procedural activities and persons present during an operation. The hospitals have different programs; not all the functions are installed. Although the TMS has the capacity to manage the entire patients' episode from admission to discharge including billing, the TMS is being used in a very limited capacity.

In the acute hospital under review, the ability to book patients, create theatre lists and electronic operation records are in use. But the pre-operative assessment function is not currently in use; if this was functional, the data for this study would have been readily available and data re-use at the time of surgery will be possible. In order not to re-invent the wheel, the author has produced a prototype of POA, based on the paper form that is already in use to show that capturing this information using computer is better for ease of access and more complete information. Also to emphasise that if this is incorporated into the TMS that there are positive implications for the patients' safety, even though it is difficult to quantify all of these benefits. Some of these are high-lighted in the EPR section such as legible writing: illegible hand writing can lead to poor communication which is partly responsible for medication errors, also to loss of information. Communication is a root cause of nearly 70% of the events reported to the Joint Commission between 1995 and 2010 (Greenberg et al. 2007; Joint Commission, 2010). Although some of the benefits of IT are mentioned in other areas, it is worthwhile to re-emphasise some of these **benefits** in this section; and the barriers will be listed in the next section.

- Improved and efficient quality of patient care
- Improvement in provider performance with CDSS
- Readily accessible data with EHR (data re-use)
- Content specific information empowers provider in their work
- Improves communication between providers and patients
- Substantial savings from EHR with healthcare information exchange
- Safer and effective quality of care
- Increased adherence to guideline-based care
- Enhanced surveillance and monitoring, improves quality measurements
- Decreased medical errors through alerts and reminders
- Decreased utilization of care in preventive health
- Delivery of evidence-based decision support to providers
- Narrowed gap between evidence and practice
- Decreases expenses in the long run through electronic processing
- Improved health through disease prevention (screening) and management of
chronic diseases

• Leads to health care savings.

3.3 Barriers To The Adoption Of Information Technology

The barriers to the adoption of IT are issues that constantly deter organisations from investing in IT projects. Some of these are listed below, section 3.4 examined other technologies in IT.

- Costs
- Interoperability
- Lack of incentives/ lack of professional involvement
- Legal issues
- Complexity of informatics systems and healthcare organizations
- Wide array of healthcare organizations/providers
- Lack of standards
- Privacy, confidentiality, security of health information
- Lack of certification
- Perceived disruptive effects on practices

(Kenny et al. 2010; McDaid et al. 2009).

3.4 Related Technologies.

INTRODUCTION

IT applications can only be maximised when every link in the chain is linked and working together (Schulze et al. 2007) thus ensuring that healthcare workers are given the best tools to enable them to make appropriate and most efficient decisions that will be of most benefit to the patients. This can help either with process in healthcare, thus increasing efficiency, or by helping healthcare workers to avoid mistakes thus helping with decision making. The use of IT makes it possible for different organizations to have a model of communication, sharing pertinent information about the patients and enabling data re-use during surgery. This ensures continuity of care and more complete access for better diagnosis and treatment.

We cannot say much about IT in healthcare without mentioning Electronic Health Record (EHR) which is one of the fundamentals of IT, but each of the systems have a role to play in bringing it all together. The following are a list of some related IT applications that are available in this present disposition and this is by no means an exhaustive list; we will examine the role of each in relation to POA.

- Clinical Decision Support Systems (CDSS)
- Computerized Physician Order Entry (CPOE)
- Pharmacy Automation/Bar Coding
- Telemedicine Systems
- Electronic Patient Record/Electronic Medical Record
- Picture Archiving and Communications Systems (PACS) which includes Radiology Information Systems (RIS) and Hospital Information Systems (HIS)
- Radio Frequency Identification (RFID)

3.4.1 CDSS

CDSS provide clinicians and the patients with clinical knowledge and patient-related information that are intelligently filtered, or presented at appropriate times to enhance patient care Osheroff et al. (2005). CDSS has the potential to provide clinicians with "unbiased, evidence-based information" (McMullen et al. 2004). This information helps them to decide on the safety of drugs, how efficient they are and the cost in comparison to other therapeutic options.

Ravindranathan (2008) described the different ways CDSS can be categorized; alerts and alarm generators, therapy critiquing and planning, image recognition and interpretations, managing and diagnostic assistance. The effectiveness of CDSS depend on their acceptance, hence it is important to design them in such a way that they fit into the clinicians' workflow, this is the only way they can enhance performance. Using reminders and alerts that are easy to access will reduce medication errors, coupled with the use of CPOE which can check drugs during prescription for possible drug interactions (Bates et al. 2003).

Tamblyn et al. (2003) confirmed that inappropriate prescribing can be reduced with the use of computer-based information on dispensed prescription and automated alerts. The physicians feel they have control as long as they are given the autonomy of how they respond to these alerts, this will encourage use and reduction in prescription errors (Bates et al. 2003). Using the idea of the five rights of medication, Osheroff et al. (2009), described what an effective CDSS delivery needs: provide the right user with the right information in the right format, using the right channel at the right time. As already mentioned, a good CDSS design has a great potential for improvement of quality of healthcare, capability to increase efficiency and reduction in healthcare costs (Berner, 2009). CDSS makes it easy for the healthcare workers "to do the right thing" (Bates et al. 2003).

CDSS will help the clinicians in the pre-operative setting in recommending the appropriate medications, especially for patients with co-morbidity on multiple drugs in order to prevent unnecessary drug interaction and wrong dosage. With the system functions, correct diagnosis and treatment plans can be rapidly instituted. For the patients on unplanned admissions, adverse drug events and LOS are reduced. Although like any IT invention, CDSS are faced with challenges due to the dynamic environment of the clinical area, the cost of knowledge acquisition and keeping up with the changes are just a few mentioned by Mendoca (2004).

3.4.2 CPOE

Bates (2000) defined CPOE as an application which allow physicians to write orders on line. Of all automated interventions, CPOE has probably had the largest impact in the reduction of medication errors. This is mainly due to the fact that computerization of orderings improves safety by ensuring that all the orders are structured (include dosage, route of administration and the frequency). Orders are legible, thus eliminating errors in understanding what was ordered which is one of the ways ADEs occur. With the order entry data base, the physician can access information to help prevent ordering unnecessary medications, thus decreasing medication errors and improving quality of care; and finally all orders can be checked for problems like drug interactions, allergies, appropriate dosing and overly high doses even as the orders are entered (Teich et al. 2000). This is beneficial to the patients with co-morbidity attending the POA clinics.

While CDSS can reduce the frequency of ADEs, CPOE has the potential to prevent errors; it is a powerful and effective tool for improving physician prescribing practices. The remote access means that orders can be entered directly; verbal/telephone orders can be done away with which further reduces medication errors.

The benefits derived from the use of CPOE is evidenced in literature, in an evaluation of CPOE, Sard et al. (2008) introduced a paediatric medical list to a CPOE system to determine the impact on medication prescribing errors; they concluded that there was a significant reduction in medication prescribing errors.

Teich et al. (2000) in their study of CPOE in prescribing practices stated that there was better adherence to prescribing regimens with the use of guidelines and dose selection menus; this resulted in costs reduction and improved patient safety. They also realized that 56% of ADEs were as a result of prescribing errors, these are preventable ADEs.

In a randomized control trial (RCT), McDonald et al. (2004) found that there was 13% improvement in care efficiency with the use of CPOE. Physician order accounts for 80% of the entire care cost, the use of CPOE systems can cause physicians to make more cost effective choices.

Kuperman and Gibson (2003) reported another study in a hospital using RCT and found that the use of CPOE with decision support resulted in lower costs for patients on admission and also reduced LOS.

Bates (2000) described CPOE as a potent IT and suggested that it will become even more powerful and useful as more data become computerized. He also noted that the best medication processes never replace people, but will harness the strengths of IT, thus allowing people to make complex decisions.

3.4.3 PHARMACY AUTOMATION/BAR CODING

Although not directly related to the POA process, for the patient on unplanned admission this is a useful invention. Pharmacy automation is one of those IT inventions that should be used with caution; they are especially useful when they are linked with bar coding and are interfaced with HIS (Bates, 2000). The idea of automated dispensing devices is such that they can be used to hold drugs at certain locations and then dispense them only to specific patients. The use of robots is one form of automation that can be used for dispensing. Unfortunately, not too many data are available to support the use of robots. In a Dutch study by Moback (2006), a direct observation, time interval study was done to assess the merits of a robot at a community pharmacy. The study showed that the use of a robot resulted in decrease workload and waiting time; there was also a positive effect on the pharmaceutical care because of space creation. Like most IT systems, the initial cost was substantial, but they believed that the robots are effective financially after three years and then the benefits can be realized.

A before-and-after study of two teaching hospital sites of the NHS evaluated the

effect of automated dispensing machines in UK hospital pharmacy and found that the use of robot reduced dispensing errors in both sites and agreed with the other studies that storage capacity was also increased (Franklin et al. 2008).

Bar coding is only now being implemented in drug manufacturing, but most hospitals in the USA has already implemented this successfully. The Concord Hospital in New Hampshire is one such hospital; they associated bar coding with an 80% decrease in medication errors (Bates, 2002). Bar coding is said to reduce error rates about sixth of those due to using a keyboard entry, it is also less stressful to workers. It ensures that drugs at hand are actually the intended ones, it can be used to record who administered the drugs, to whom given and the time intervals.

E-prescription is another way to use IT to reduce medication errors, but currently only a few EU countries have implemented this. It is an electronic transfer of a prescription by a health care professional to a pharmacy for the retrieval of the drug by the patient (Kenny et al. 2010).

So as can be seen, the use of pharmacy automation and bar coding can positively affect ADEs, human involvement means there will always be a margin of error, but at least it can be controlled to a great extent. There is need for the healthcare industry to demand these technologies in order to enhance care.

3.4.4 TELEMEDICINE SYSTEMS

Telemedicine encompasses a wide range of telecommunication and information technologies and many clinical applications; almost every clinical speciality use telemedicine in some way. It encompasses teleconferencing, telepathology and teleradiology; and it covers a range of technologies such as telephone, radio, facsimile modem and video. Telemedicine is useful in the POA setting for rapid confirmation of diagnosis and for monitoring elderly patients especially following day surgery.

Telemedicine can be defined in many ways; Bashur (2009) defined telemedicine as an integrated system of healthcare delivery that employs telecommunications and computer technology as a substitute for face to face contact between provider and client. Another definition of telemedicine is the delivery of healthcare to individuals within the home or wider community, with the support of devices enabled by ICT (Tang et al. 2000).

With older people on the increase, there is an equal increase of pressure on the existing provision of health and social services. This means that new models of care must be sought to meet the increased demand; IT has enabled new technologies (Arnaert and Delesie, 2001). The increase in technological advancement has made this more possible than before; electronic health is more a reality now.

Telemedicine applications can be used via the web, which has become a standardized infrastructure that can give access to sophisticated telemedicine applications from virtually any machine and operating system. This is advantageous because it guarantees accessibility and usability to both patients and physicians (Bellazi et al. 2001). Telecare is a sub set of telemedicine, which Tang et al. (2000) defined as a remote provision of care and medical services to people in their homes using digital information and technology systems. Telecare brings the patient in the centre of their own care because they are actively involved in both care management and treatments. In a paper report by Percival and Hanson (2006), they stated that "telecare is advocated as a means of effectively and economically delivering health and social care services in people's homes using technologies that can monitor activities and safety, provide virtual home visiting, activate reminder systems, increase home security and convey information". They claimed that with telecare, fewer older people will require institutional care, thus encouraging day care. Telecare will allow the elderly to maintain their autonomy; this will strengthen their emotional, social and relational abilities (Emery et al. 2002; Arnaert and Delesie, 2001); most

elderly people now prefer home care to residential care. Telecare means that there is enhanced quality of life and increased choice of accessing care services from home. But there are associated disadvantages to telemedicine, such as increased isolation due to reduced physical face to face interactions with healthcare workers and other patients, intrusion on patients' privacy, especially with remote monitoring; Stanberry (2001) also reminded us that there are ethical issues about this "hospital without walls" such as confidentiality and liability, but that although they are not peculiar to telemedicine, we still need to be aware of them.

Another area where telemedicine has been useful is in the treatment of stroke. In Ireland, stroke is responsible for 7.2% of deaths; hence the campaign for the recognition and treatment of stroke has been intensified in the past months because it is recognized as one of the leading causes of death. The Department of Gerontology geriatricians based in AMNCH in collaboration with Naas General Hospital geriatricians pioneered telemedicine and stroke with the first distance thrombolysis in Ireland called Remote Presence-7 (RP7) (Robot doctor). The "robodoc" is networked between three hospitals, and are being used primarily in the emergency departments of the hospitals. It enables stroke specialists to examine patients from remote locations via a laptop, see and talk with the patients, observe and help conduct the assessment, view CT images and laboratory results, and make urgent treatment decisions. High resolution cameras are used to link the specialists with the patients over a broadband connection. The RP7 saves lives because the treatment of a stroke patient is time sensitive, treatment must commence within four and a half hours of stroke, earlier is even better. In the USA, the robodoc has been used successfully in 34 hospitals.

No doubt, telemedicine is one IT invention that has drastically changed the practice of medicine; it has created hospitals without walls indeed (Grigsby and Sanders 1998). The benefits are so numerous that one can dare to say that they outweigh the disadvantages.

Telemedicine will no doubt reduce the costs of hospitalization because patients can be monitored at home; thus reducing the additional adverse events characterized by hospital admissions. It can also help with faster assessment of patients in the perioperative period.

3.4.5 ELECTRONIC HEALTH RECORD

The electronic health record (EHR) is the bedrock of almost all health informatics technologies; it is no wonder that most of the articles in literature devote so much time to this singular topic. EHR as defined by the Healthcare Information and Management Systems Society (HIMSS) is "a longitudinal electronic record of patients' health information generated by one or more encounters in any care delivery setting" (Sidorov, 2006).

Safran and Goldberg (2000) defined electronic patient record (EPR) as the electronic collection of clinical narrative and diagnostic reports specific to an individual patient.

EHR and EPR are terms that are used synonymously. Electronic Medical Record (EMR) is made up of the EHR/EPR, the definition of EMR varies, but a complete EMR includes clinical documentation, patients' data, CPOE, messaging between providers and staff, decision support systems and patient access information (Keenan et al. 2006); because the records are in electronic form access is usually via a computer. In a review of literature by Hayrinen et al. (2008) they noted that the ongoing challenge around the world is to take into account all the different types of EHRs and the needs/requirements of different health care professionals and consumers in the development of EHRs; also the use of internationally acceptable terminologies in order to achieve semantic inter-operability. Concern about inter-operability was one of the barriers cited by Hanlon (2010) and Jha et al. (2009); others include maintenance cost, inadequate capital for the purchase, unclear return on investment, lack of available staff with adequate expertise in IT and resistance from physicians.

The concern about the physicians is that EHRs/EPR may take longer to use than the paper-based systems. The data that are recorded by other healthcare professionals provide information on patients; this will help to achieve efficient and high quality of patient care (Lang and Melia 2009).

But costs is a major hindrance to EMR adoption, Lenhart et al. (2000) in a study of the perception and use of EMRs among family practitioners said costs included not only the initial purchase of the work station, but the soft/hardware, the maintenance, integration of scheduling, patient data, diagnostic coding, billing, interfaces for laboratory, radiology, administrative support and the list goes on. Most of the costs are not predictable, which makes it even more difficult to plan. But even with all these, the advantages of EMRs cannot be overlooked, with the use of EPR (EMRs) organizational barriers will be broken with the adoption of the internet technologies, hence patients' data can be shared among carers (Safran et al. 2000). EMRs provide a vehicle for communicating information about the patients across time and providers. The adoption of EMRs may improve health care and reduce costs by enabling process control and decision support via computations using data from individual patients as well as the population. These will promote evidence-based quality and efficiency in the delivery of healthcare (Hazlehurst et al. 2005). As already stated there are many barriers/challenges regarding the implementation of EPR/EHR, but there are equally many benefits. In addition to the benefits mentioned in section 3.2, Sidorov (2006) identified more benefits such as optimization of billing due to fewer billing errors, reduction in clerical staff leading to worker productivity gain, avoidance of medical errors, ability to store other encounter data, reduction in malpractice and impact on outcomes. Valdes et al. (2004) also listed error reduction, quality improvement, reduced costs through integration of healthcare providers; which can come only through the adoption of EMRs. To buttress this, Bates et al. (2003) agreed that improved quality is a benefit of EMR, also safety and efficiency and increased ability to conduct research and education. Hillestad et al. (2005) in the analysis of a study by RAND Health Information Technology, made an estimation of \$77 billion potential efficiency savings per year if 90% EHR is adopted. Most of the savings they said could be from patients spending less time in hospitals.

Patient safety is an increasingly important issue in health care delivery, as already stated ambulatory care or home care is on the increase; the need to reduce in-hospital care is on the agenda. Patients on admission experience adverse events, which according to Wu and Straus (2006) are significant enough to prolong hospital admission and cause morbidity. They argued that some of the adverse events or errors are due to lack of information about the patient, sometimes due to lack of knowledge about therapy, but with computerization such as the use of EMR, errors can be prevented by improving documentation. The EHR of the future is promising especially with the internet offering ready access and EHR that "will be linked to clinical protocols and guidelines to drive the delivery of healthcare to the individual citizen" (Grimson, 2001). The shortcomings of the paper-based medical records such as missing notes, incomplete patient data, unavailability during consultation, illegible hand writing to name a few, will definitely become history. Patients will enjoy safe, efficient and improved quality of healthcare; adequate POA, less cancellation of surgery and reduced unplanned admissions.

In recent times, the Newgate Technology has introduced theatre electronic patient record software at the Belfast City Hospital in an attempt to make patients health records available to other healthcare workers. This will reduce any delays in the treatment of patients by making their records available thus ensuring continuity of care from POA to discharge.

3.4.6 PACS

Although we use the term PACS loosely, it actually involves other image managing systems like RIS which supports the workflow of the radiology department; and HIS which is responsible for the electronic records of patients; though not essentially a part of PACS, but necessary for its functioning.

"PACS is the best recognized application of informatics in radiology" (Branstetter 2007). The PACS is an infrastructure that has enabled the redesigning of the whole workflow process in radiology, and has maximized the workflow; it replaced the hard copy means of managing medical images (Dreyer et al. 2002).

This means that the process of radiologic procedures is faster and reports are available in a shorter time. For the patients attending the POAC, this means less time waiting for reports before decisions can be made regarding surgery. Wideman and Gallet (2006) observed a reduction in examination time of patients with the use of PACS in Christie Hospital NHS Trust in the UK. Also in Melbourne, Australia it was found that the average waiting time from the examination time to report was considerably improved (van de Wetering et al. 2006). Because PACS has replaced the hard copy films, healthcare workers spend less time routing through films thus increasing efficiency and better time management. Due to the quick turn-over in technological advancement, staff training, continuous updates and monitoring of equipments are essential. Like other IT systems, cost is a major consideration; but, given the efficiencies that can be derived from PACS, it is a worth-while investment.

3.4.7 RFID

Patient safety is one of the most important issues in hospital and RFID is related to patient safety. Recent advances in this technology are leading to promising means of significant enhancement of safety, quality and value of healthcare (Al Nahas and Deogun, 2007). RFID is a technology for automated identification of people and objects; they are small wireless devices (Juels 2006; Liao et al. 2006). RFID devices are likely to be used for applications with RFID wristbands for patient identification; the correct identification of patients is central to many other RFID-related processes in hospitals. RFID technology not only offers tracking capability to locate people and equipments in real time, but also provides efficient and accurate access to medical

data for doctors and other health care professionals thus enhancing clinical practice (Yao et al. 2010; Steffen et al. 2010). For the ambulatory patient, RFID offers monitoring from a distance; this reduces the need for hospitalization. This can be employed in the monitoring of elderly patients returning home after day surgery.

The wireless technology in RFID used for point of care patient identification can also be employed in specimen and product tracking, example for blood products and medications. This enables errors to be captured at the point of occurrence leading to improved safety and efficiency of clinical care (Porcella, 2005).

Huang and Ku 2008 demonstrated that using the grouping proof protocol, staff members can confirm the authentication and integrity of RFID tags that were embedded on inpatient bracelets and drug containers; this will correctly identify patients and will reduce medication errors.

RFID tags can be used on patients even during MRI and CT scans if these tests are required pre operatively; in a study at a hospital in Switzerland, Steffen et al. (2010) evaluated patient safety, data integrity and reliability of passive RFID devices under clinical conditions with MRI and CT scan; they concluded that patient's identification was not compromised and no data were lost. They noted however that the result was specific to the tested RFID tags. In his thesis, Aguilar (2007) noted that accurate information about the patient at the point of care is crucial to the successful delivery of medications and the care to patients in hospital. Misidentification can cause serious errors such as administering wrong drugs to wrong patients (the commonest AE in hospitalized patients), performing the wrong procedure, wrong diagnosis, thereby causing delay in commencing treatment on the right patient, wrong documentation leading to cancellation/delay in the surgical patient. The performance of the wrong surgery was the reason for the introduction of the "Time Out" by the WHO in 2007, but with the RFID technology point of care identification is possible. The technology can also be used to tag surgical instruments and swabs to prevent leaving them erroneously in the patients; this is a major cause of high fiscal impact in

the USA (Nagy et al. 2006).

Although RFID technology is promising in healthcare delivery, its adaptation is far behind earlier expectation. This is associated with the barriers perceived in healthcare such as the high costs, technological limitations and concerns about privacy (Steffen et al. 2010). These concerns are high-lighted in section 3.3.

3.5 Summary

IT has an important role to play in enhancing high quality health care going forward. Excellent IT and high quality health care are closely related, excellent IT leads to excellent clinical outcomes. Although HIT has not made a huge headway compared to banking, aviation and on line shopping industries, there are potentials for improvements.

There is need for more investments, which will translate to greater efficiencies and savings in the long run. As already stated, Hillestad et al. (2005) estimated that if there is 90% adoption of HIT, inpatients and outpatients care efficiency savings could be more than \$77 billion per year; an annual average savings of \$42 billion. They acknowledged that these are potential savings during the adoption period, but most savings will come from the reduction in hospital LOS by doing more cases as day cases. Nurses' administration time is less and drug usage in hospital is reduced since patients are not admitted.

To achieve this adoption of HIT, there must be process changes, resource reduction and successful implementation of the systems.

It must be emphasized that these efficiencies will not be immediately realized, but there must be a conscious and concerted effort to forge forward. There is no point implementing half measures, there is need to take the time to do it properly and do it right; to look forward to worthy IT investments with good returns and enhanced health care efficiencies.

The transformation and implementation of the Irish Healthcare System through ICT will result in more efficiency of health services, better service to the patients and improved patient outcomes (Øvretveit et al 2007). Health care and services will be more accessible to patients, they will be better informed about their conditions; and be in a better position to make informed decisions about their health care. Nationally this will translate to better community/primary health care, less hospital admission, less adverse events and less cost for the tax payers. Hersh et al. (2004) said that other IT professionals other than physicians must be included in the process.

Realizing the potential for patient empowerment to play an integral role in their health care and manage their information is the ultimate goal (Currie and Guah 2007).

CHAPTER 4

4.1 Introduction

POA constitutes a very important aspect of patients' care during the peri-operative period. It helps to identify risks during anaesthesia and to anticipate the resources needed post operatively (Ferrando et al. 2005).

Due to the fact that most of the cancellations for surgical cases were attributed to inappropriate or lack of medical clearance before scheduling patients, POA has become even more important. In a report by Knox et al. (2009), inappropriate or lack of medical clearance accounted for the majority of reasons for avoidable cancellations of scheduled surgical cases.

Day surgery or day case is becoming very popular and socially acceptable. It is deemed expensive these days to admit patients to hospital before the day of elective surgical procedure Bond (1999).

Unfortunately, not all cases or patients can be done as a day case; and for those that can be done, adequate assessment before scheduling for surgery plays a major role. According to Garcia-Miguel et al. (2003), POA is "a basic element of anaesthetic care". It is during this period that plans are made for eventualities, and time is afforded to sort them out. This is the time that the patients have the opportunity to ask questions, to discuss any issues they may have and to get explanations.

4.2 Definition of Pre Operative Assessment

POA is defined as "the clinical investigation that precedes anaesthesia for surgical or non-surgical procedures" (Garcia-Miguel et al. 2003).

4.3 PREOPERATIVE ASSESSMENT

The POA period is usually the first contact the patients have with the Anaesthetists.

Once the decision has been made to proceed with surgery, the initial POA should take place. This is of course at the convenience of the patient. This is the time that rapport is established. The consultation also enhances trust and confidence.

Pollard and Olson (1999) conducted a retrospective study to determine if conducting POA early was more effective than one done later; the conclusion was that there was no difference. So the most important thing is to conduct POA before surgical procedure.

It is recommended that the same Anaesthetist should ideally anaesthetise the patient, but this cannot be guaranteed because of the shift system of the rota. This recommendation is also due in part to the fact that another anaesthetist may have a different view of the involved anaesthetic risk Barnes et al. (2000). But the POA is aimed to improve surgical outcomes by "identifying potential anaesthetic difficulties" (Garcia-Miguel et al. 2003).

The POA affords the opportunity to consult and investigate patients without the expense of hospital admission (Bond, 1999; Ahmed et al. 2009).

The National Good Practice Guidance (2002) said that POA can take place in different ways: by telephone, face-to-face, questionnaire or even through secondary care. As already mentioned, the method should be agreeable to all and convenient for the patient. All pertinent information must be obtained.

Hence Pollard and Olson (1999) suggested that POA should commence early, so that time is allowed for more testing if this becomes necessary. This is echoed by van Klei et al. (2002) they said that outpatient POA allows for more "time for comprehensive assessment, treatment of co morbidity" before elective surgery. Sjoling et al. (2003) in an interventional study of two groups of patients concluded that when patients receive specific information before surgical procedures that the state of anxiety post procedure is reduced and they experience less pain post operatively. This they concluded because, pain and anxiety are partly psychological. This is supported by Kluger et al. (2000) in their report from AIMS. Here good communication with the patients, coupled with adequate POA was found to reduce "incidents associated with anaesthetic management".

The raging debate however is the issue of who should conduct the POA; most literature suggests that the Anaesthetist is naturally responsible for conducting it. But some agree that trained nurses can conduct the POA backed up by anaesthetists (Barnes et al. 2000). The National Good Practice Guidance on Preoperative Assessment for Day Surgery by the NHS, UK has set up guidelines to address some of these concerns. These include issues such as when it is appropriate to conduct POA, where it should be done and by whom. They believe that POA can be performed by any one as long as they have been properly trained and are deemed competent; although they reiterated that "the anaesthetist is ultimately responsible for the decision to proceed" on the day of surgery.

The most important point however is that no matter who conducts the POA that patients are adequately prepared for surgical procedures. This is where the need for pre-agreed protocols for pre-assessing patients must be established by the surgeons, the anaesthetists, trained pre assessment unit nurses and the staff of the Day Ward.

Roizen (2000) was considering the type of tests that patients undergo during pre assessment, and suggested that money should not be wasted on routine ordering of tests for patients undergoing simple procedures. If the POA is properly conducted by qualified physicians, Hepner et al. (2004) believe that even the need for laboratory tests will be reduced.

Roizen (2000) further reminded us that the aim of pre assessing patients before surgical procedures is to decrease cost and morbidity associated with surgery. It is also to ensure that the quality of care post-operation is optimised. This is supported by Ferrando et al. (2005) in their survey of pre-assessed patients they concluded that following proper pre-assessment guidelines will reduce the need for unnecessary tests without losing relevant clinical information. This is reiterated by Halaszynski et al. (2004), especially in relation to patients with co-morbidity.

With co-existing diseases, the risk of anaesthesia is increased, so is the associated complications post operatively. These are high risk patients and their management and planning for surgery should be specific in the pre-operative period. Special emphasis and attention is given to the pre-existing diseases. Sometimes the aim is to treat the diseases, or else to minimise the effect. POA affords forward planning of issues that can impact the patients' condition in the post-anaesthetic care period. Hepner et al. (2004) said that this time of interaction can reduce anxiety in the post operative period; patients are confident that their needs will be met because their requirements have been properly assessed. It must be noted however, that the Anaesthetists' fears of "medico-legal consequences" sometimes make them perform unnecessary tests. This has a major impact in implementing the pre-assessment guidelines. They try to cover themselves by performing routine tests, just in case something goes wrong, they can say that they had taken all risks into consideration (Ferrando et al. 2005).

Looking at the POA from the patients' point of view, Hepner et al. (2004) and Harihanan et al. (2009) both used questionnaires in their PATC to find out the patients' opinion of the clinics. The patients viewed the information they were given and the opportunity to communicate with the health practitioners as a very positive experience; although the time spent was not viewed in a positive light. Wisselo et al. (2004) confirmed that communication is good especially if it is relevant, hence the need to identify what the patients need to know.

Patients' satisfaction has been identified as one of the "unique clinical end-point and an indicator of the quality of healthcare provided" (Hepner et al. 2004); it is reassuring that patients view the POA as a worthwhile venture. In a review article by Foss and Apfelbaum (2001) they noted that most studies are in support of POA clinics especially with the cost saving in optimising scarce hospital resources.

The table on the next page shows the POA process in the day ward courtesy of The National Good Practice Guidance (2002).

Fig. 1 - The pre-operative assessment process in day surgery



4.3.1 Guidelines for POA

The Royal College of Anaesthetists (2006) recommends that the assessment of the patients should be based on their medical and social criteria. These criteria must be agreed with the Anaesthetic Department.

In a report by the ASA (Warner et al. 1999), although specific to fasting and the use of medications to reduce pulmonary aspiration risk, they reminded us that guidelines are only recommendations to assist health care workers to make informed decisions. The guidelines must however be adopted according to the clinical needs of the patients and local constraints.

Also there must be a protocol in place which has been agreed on a local level. The protocol should be reviewed at least every two years by a multidisciplinary team.

The purpose of guidelines is to enhance quality and efficiency of anaesthetic care by increasing patient satisfaction, minimization of peri-operative morbidity and to avoid case cancellation, delay or unplanned admission.

The ASA's social criterion for day surgery to be considered during pre-assessment takes the patients' residence into consideration. The patients must reside at a distance of one to one and a half hours to the hospital.

There must be an escort to accompany the patients home, either driving or in a taxi. The patients must have a responsible person to care for him/her post-operatively, especially in the first 24-48 hours. Access to a telephone is essential to enable contact with the hospital in case of unforeseen post-operative complications.

The medical criteria depend on the health status of individual patients. Patients with co-morbidities will need more investigations than others who are otherwise healthy. The National Good Practice Guidance (2002) on POA for Day Surgery does not support the idea of performing blanket, routine investigations on all patients. This is considered to be "inefficient, expensive and unnecessary". More so when we consider

that the very reason for day surgery is to minimize cost and enhance efficiency. So it is recommended that if a patient is 50 years or younger and *healthy*; then routine pre-anaesthetic investigation is unnecessary.

4.4 DAY SURGERY

4.4.1 Definition

Day cases refer to patients who are admitted to hospital for care and/or treatment which can take place on a day basis, who do not require the use of a hospital bed overnight and who are discharged as planned (HSE 2008).

4.4.2 Benefits of Day Surgery

Same day surgery, ambulatory surgery or outpatient surgery (all these terms refer to day case) is cost effective both to the patients and the institution.

As previously stated, day case has expanded rapidly especially in recent years. The economic climate has had a great deal to do with this with most institutions under cost curtailment. As day surgery increases, so does the issue of patient management.

The first benefit of day surgery is that patients have a shorter waiting time. Compared to patients that need hospital admission, day surgery patients do not need to have their surgery on hold while waiting for beds to be available. As will be discussed later, bed shortage in acute hospitals is a national issue. So the opportunity to have day surgery is really an added advantage for the patients. This means that their condition can be rectified very quickly without too much social interruption.

Another benefit of day case is the fact that patients can go home on the day of surgery without an overnight stay in the hospital, this translates to lower hospital costs (Ganesan et al. 2000). Also lower risk of cross infection/adverse events. There is minimal disruption to patients' routine and social/emotional rehabilitation is faster. Day surgery is cost effective both to the patients and the institution; also more and more of the day case procedures are done using more advanced surgical techniques using endoscopes. This enhances post operative pain control and earlier discharge of patients.

Day surgery is a quality approach to surgery. It cannot be emphasized enough that this is dependent on good selection, following agreed and set protocols for selection of patients and planned surgical procedures.

The National Good Practice Guidance (2002) has set out guidelines for selecting patients for day surgery. These are looked at in the next section.

4.4.3 Selection Criteria for Day Surgery

The British Association of Day Surgery (BADS) (Association of Anaesthetists of Great Britain and Ireland 2001) have selected a trolley of procedures which can be done as day cases subject to local agreement between the surgical team, anaesthetists and day ward staff. This can be up graded accordingly.

The first and most important criterion is that all patients for day surgery must be assessed to make sure they are suitable.

The next factor is to do with the patients, because all other criteria may be suitable; but if the patients are unwilling to be done as a day case, their wishes must be respected.

There are no age limits; it just means that certain age groups will require more investigations prior to surgery.

Home support is vital and this must be confirmed before surgical procedure. This includes access to phone, a responsible adult at hand and GP or nursing back-up.

Distance of patient's home to immediate care is important.

The general health of the patient is assessed using guidelines as set out by the ASA. Patients within grades 1-3 are acceptable for day surgery; unless they have other contraindications (Refer to appendix 1 for ASA guidelines). Patients with an ASA physical status of grades 4 and 5 are not suitable for day surgery (Ansell and Montgomery, 2004). This means that they have "life-threatening systemic disorders". These will be identified during assessment of specific organ systems and diseases. Examples are dyspnoea grades 2-4, patients on haemodialysis, advanced liver disease, to name a few (Chung et al. 1999); also drug and previous anaesthetic history if applicable.

The patients' body mass index (BMI) is another issue in the selection criteria. Most institutions do not have an absolute weight restriction, but the operating tables have maximum weight restrictions by the manufacturers. Patients with BMI of up to 40 are acceptable in the absence of other contraindications and the type of surgery (Refer to appendix 2 for BMI), this is supported by Atkins et al. (2002) in their study of day cases with BMI of more than 30; even though The Royal College of Surgeons (1992) recommended BMI of 30 or lower.

Once all the above criteria are met, patients are deemed eligible for day surgery.

CHAPTER 5

5.1 Introduction

In this chapter the effect of inappropriately conducted POA and poor selection criteria of day cases will be examined under the headings of cancelled elective surgical cases and unanticipated hospital admissions. Some of the causes and consequences of unanticipated admissions will be identified.

5.2 Cancellation of Elective Surgical Cases

Cancellation of elective surgical cases be it day cases or otherwise, is a major problem in many institutions. It is more obvious even now with fiscal constraints in place and every effort is being made to make the limited available funds go further.

Cancellation is costly in terms of theatre allocation, staff and equipments. It can also be distressful for the patients who would have been prepared for surgery physically and psychologically. One of the best ways to prevent case cancellation is to ensure that surgical cases are planned in such a way that all reasons that can cause cancellation are avoided (Schofield et al. 2005).

Here is where a case can be made for POA; it affords time for proper evaluation of patients before surgery. There is ample evidence in literature to support the fact that POA does reduce cancellation on the day of surgery (Rai and Pandit 2003; Ferschl et al. 2005).

POA clinics are the norm rather than the exception these days. They enable anaesthetists and nurses prepare patients for the administration of anaesthesia and subsequent surgery.

Most of these assessments are done in the outpatient pre-operative evaluation

clinics (OPE). Time is allowed for comprehensive assessment and treatment of any existing co-morbidity before the day of surgery, thus reducing the number of cancellations (van Klei et al. 2002). Dix and Howell (2001) identified hypertension as one of such co-morbidity and one of the "commonest avoidable medical indication for postponing anaesthesia and surgery". But as already mentioned, POA allows time for treatment, so that this will not be a cause for cancellation.

Pollard and Olson (1999) even suggested that conducting the POA early can reduce cancellation; they argued that early evaluation allows for time for further testing when indicated. There is also more time for patient education. They also identified that, apart from poor POA, cancellation can be due to a number of other reasons; hence they came up with a list of cancellations classification.

Accordingly, cancellation can be due to insufficient OT time or low level of staffing. An acute patient illness can be another reason. A case can be cancelled at the discretion of the surgeon or even by the patients' decision. The point here is that the POA could have been carried out as properly as humanly possible, yet case cancellation can still occur. This is supported by Sanjay et al. (2007) in a prospective study at a hospital Trust in the UK, they identified patient related reasons as the highest cause of cancellation of surgery; non-clinical reasons were next.

Robb et al. (2004) in a retrospective study at the Beaumont Hospital looked at another reason for cancellation of operations; the increase in bed usage by the medical specialty was identified. Although the emphasis here is on day surgery, it is still a requirement that beds be made available on the day of surgery for back up of unplanned admissions. With our aging population, there are more medical conditions; hence the need to use up available beds by the medical specialty to the detriment of the surgical unit.

While acknowledging that lack of beds can lead to cancellation, Perroca et al. (2007) also identified issues with scheduling of surgery and errors in communication, these

are organizational problems. This is a cause for concern because it raises the operational and financial costs within the organization.

Surgery cancellation can be due to so many reasons as we have identified, but evidence points to the fact that a proper, timely POA "can significantly impact case cancellations on the day of surgery".

5.3 Unanticipated Hospital Admissions

5.3.1 Definition

Unanticipated admission is defined as an unplanned admission after a day surgical procedure (Tham and Koh, 2002).

5.4 Causes of Unanticipated Hospital Admissions

Unanticipated or unplanned admission of day surgery cases can occur due to improper planning in the pre-operative period. The whole essence of ambulatory surgery is to reduce cost, both to the organization and the patients; it is also well accepted by most patients.

When patients are screened for day surgery, certain selection criteria are followed as already stated. If patients are selected despite not meeting the agreed criteria, then admission after surgery is always almost inevitable.

Theatre scheduling was mentioned as one of the reasons for cancellation of surgery; it can also be a cause for unplanned admission. If the scheduling is not done properly, not enough time is given to recover patients postoperatively; hence they end up on admission.

Most of the reasons that have been identified as causes of unplanned admissions are mainly non-life threatening, which are also preventable.

Both preventable and non preventable causes are highlighted in the table below:

POTENTIALLY PREVENTABLE	NON-PREVENTABLE
<u>1. Surgical related</u>	
Pain	Bleeding
Surgical observation	Other direct surgical complication
More extensive surgery than planned	
2. Anaesthesia related	
Delayed recovery	Allergic reaction
Nausea and vomiting	Difficult airway/secretions
Aspiration	
Perioperative dessaturation	
3. Miscellaneous	
Social reasons	Acute retention of urine
Late surgery	Unrelated medical problems
	Further investigation/treatment

 Table 1: REASONS FOR ADMISSION (Courtesy Tham and Koh 2002).

Ganesan et al. (2000) also identified anaesthetic, surgical and social reasons as causes of unplanned admission. While Fortier et al. (1998) felt that proper screening, the timing of surgery and good home support will prevent unplanned admission, they agreed that bleeding post operatively, uncontrolled pain and drowsiness will contribute to unplanned admissions.

From the research carried out by the author similar reasons for unplanned admissions such as pain, bleeding, social reasons (distance from the hospital) and anaesthetic related causes were identified. These results are shown in a table and charts in chapter 6.

5.5 Disadvantages of Unanticipated Hospital Admission

The social and emotional disruption to patients is a big disadvantage; patients are uprooted from their social network. This can hamper recovery in the post-op period and be an added source of anxiety.

Apart from the costs involved in hospital admission, many adverse events occur by

virtue of being in a hospital.

If unlucky enough to suffer an adverse event, there is the added burden of recovery, depending on the type of adverse event.

The Institute of Medicine (2000), defined adverse event as "an injury resulting from a medical intervention, or in other words, it is not due to the underlying condition of the patient".

5.6 **Consequences of Hospital Admissions**

5.6.1 Costs

The cost of admitting a post surgical patient to hospital in Ireland depends on the category of the patient. For a public patient, the cost of an overnight stay is €75; it must be noted that this is highly subsidised and does not reflect the true cost.

This cost is almost ten times if the patient is semi private; €693/day and €789 for a private patient. High Dependency and Intensive Care Unit beds are significantly higher (HSE 2011)

Typically, admission is to an acute hospital setting which has a high level of operating cost. Even with the best attempt at running the hospital efficiently, cost is still high because care must be taken not to compromise the quality of care that is being offered and the patients' safety.

Taking this cost into account is probably one of the reasons that day surgery is more popular and acceptable, there is also less disruption for the patients and less likelihood of adverse events associated with hospitalization which invariably increases the cost.

5.6.2 Bed Occupancy

Most of the patients that end up on admission following day surgery do so due to unforeseen post-operative complications. This often results in not just an overnight stay, but a few days on admission; which is dependent on the type of complication.

This now raises another issue of measuring the performance indicator and the return on investment of the hospital. This is typically measured by the length of stay (LOS) which is based on the discharges. LOS is calculated by dividing the number of days on admission by the number of discharges/deaths during a specific period of time, for example monthly.

Grouping hospitals with similar resources together, the Diagnostic Related Groups (DRG) system is used to classify hospital cases in order to compare the LOS in hospital for similar patient conditions. The DRG system is recognized internationally.

LOS has an effect on the financial situation of institutions, so a reduction in LOS no matter how little will significantly impact the financial state of the institution. Hence if patients are done as day cases, money will be saved.

Presently, Ireland has a total of 11,832 beds for public patients, this is hardly enough to cope with the increase in bed demand for inpatient activity which has increased by 37% since 1995 according to the HSE (2008) fortunately day cases have also increased to 68%. This will reduce the demand for inpatient beds.

HSE (2008) calculated that 4,335 beds will be required in order to meet the present demand. With the "Preferred Health System" this shortage should be significantly reduced and Information Technology will play a major role in this reformation.

In comparing other countries, the data from the OECD (2010) confirms that Ireland has less acute hospital beds per capita. When compared to the UK, the LOS in Irish hospitals is higher. This is due in part to medical patients spending more days on admission, also confirmed by Robb et al. (2004).

If the LOS in hospital can be reduced, then there is hope of meeting the never ending demand for hospital beds. Appropriate use of beds – proper planning, selection and preparation of day surgery will have a positive impact on this.

As already stated, ambulatory surgery is one of the ways to cope with the ever increasing demands in health care.

5.6.3 Adverse events

Most adverse events (AEs) are due to human errors, so they are preventable. All health care systems have the potential to unintentionally harm the people they are trying to help through inappropriate decisions and medical errors (Pittet and Donaldson 2006). This can also be in the form of wrong identification, falls, transfusion errors, hospital acquired infections (HAI) and iatrogenic illness (Madeira et al. 2007). "AEs in hospitals constitute a serious problem" some can lead to grave consequences. Almost 1 in 10 patients are affected by AEs while in hospital; 27. 6% of AEs are due to negligence. AEs are said to increase with age (de Vries et al. 2008; Brennan et al. 2004).

Neale et al. (2001) went further to associate AEs with "pre existing organizational factors that provide the condition in which errors occur". This means that organizational structures sometimes contribute to AEs.

Naessens et al. (2009) did a comparison of three different methods for detecting AEs. They recommended that combined methods should be used for reporting AEs and if possible adapted by all hospitals for uniformity of reporting. Some AEs are discussed below.

5.6.3.1 Medication Errors

Medication errors or adverse drug event (ADE) can easily occur when the "five rights" of medication are not observed – right patient, right medication, right dose, right date and right route. LaPoint and Jollis (2003) said that 36% of medication errors are

due to wrong drugs and 35.3% to wrong dose.

Evans et al. (2005) conceded that although most ADEs are due to medication errors, some occur as a result of pharmacologic properties of the drugs. They further went on to say that some ADEs are as a "result of patient-specific risk factors" such as patients' characteristics (gender, age, weight) and patient type. This point is supported by Ebbenssen et al. 2001 and Johnston et al. 2006; they identified elderly patients with co-morbidity on more than one drug as being potentially at risk.

ADEs are very common AEs in hospitals, most ADEs happen during the ordering and the time of medication administration. They represent nearly 1/3 of potential AEs (Coffey et al. 2009; Forster et al. 2004). They are seriously under reported, but unless reported, detection is difficult. Classen et al. (2005) carried out a research to find a way of developing a new method of detecting and characterizing ADEs in hospitals. They concluded that using hospital computer information system will potentially improve detection of ADEs and also make it easier to characterize these events. Snyder and Fields (2010) proposed a system focused approach that utilizes an array of detection methods for the detection of more ADEs. Al-Tajir (2005) suggested the use of trigger alerts to improve reporting. In a review article, Reckmann et al. (2009) said that using a CPOE has been found to have an impact on the reduction of medication errors. Like Naessens et al. (2009), they suggested uniformity in the definition of "error". This is echoed by Hoffos and Deilkas (2008), where they cautioned that there is need to "scrutinize AEs for errors", also suggested rethinking of the design of care delivery systems. In a systematic review of the effect of eprescribing on medication errors and ADEs, Ammenwerth et al. (2008) concluded that CPOE system can reduce the risk for ADEs.

Poon et al. (2006), in a before and after study using direct observation concluded that using a bar code technique substantially decreased dispensing errors and potential ADEs. The study recognized that many of the dispensing errors occur in pharmacies. Bar coding and scanning during dispensing will reduce medication

errors, this is further discussed in section 3.4.3. This is supported by Bates (2000) who even suggested using automatic dispensing devices. Medication errors can cause unnecessary diagnostic tests and treatment, and lead to prolonged hospital admission. Kozer et al. (2002) attributed medication errors to many variables such as drugs being administered by trainees, seriously ill patients and patients on multiple drugs.

Most of the time we think of ADEs in terms of the medication administered, but often forget the omission of regularly used medications when patients are on admission. This is equally an AE which can cause serious harm to the patients in terms of discomfort or clinical deterioration (Cornish et al. 2005).

To bring this into perspective, Baker et al. 2004 defined health care management AE to include the actions of both individual hospital staff and the broader systems/care process; which includes acts of omission and commission.

5.6.3.2 Adverse Drug Reactions

Adverse drug reactions (ADRs) inadvertently follow ADEs. Like all AEs, ADRs are under reported and are not being properly reported. This is due in part to the various methods of detection being used. Thurmann (2001) suggested the use of a common standardized procedure, this will help with better detection. ADRs can affect any bodily system; and clinical manifestations and severity differ. ADR is defined as "any noxious and unintended response to a drug that occurs at doses normally used in humans for the prophylaxis, diagnosis or therapy of disease". The most common drugs that cause adverse reactions are anti infectious agents and those that act on the central nervous system. Interestingly, 2/3rd of ADRs are potentially avoidable, but they are estimated to be between the 4th and 6th leading causes of death in the USA (Camargo et al. 2006; Davies et al. 2006; Davies et al. 2007).

Davies et al. (2009) claimed that 1 in 7 hospital patients experience ADR. This often leads to increased length of hospital stay (Senst et al. 2001; Gautier et al. 2003).

Suh et al. (2000) agreed that ADRs lead to increased length of hospital stay and that these patients also incur higher costs.

Geisslinger et al. (2000) compared computerized monitoring with stimulated spontaneous reporting of ADR. They implemented a computer based ADR monitoring system to achieve this; and to assess the LOS in hospital and the cost involved. The computerized system detected more cases than the stimulated monitoring system. This means earlier detection of ADR, reduction in LOS and monetary gain due to effective detection.

Baniasadi et al. (2008) in order to improve ADR reporting, also established a pharmaco-vigilance unit, this was also used as a monitoring system. This they claimed "initiated a culture of reporting among health care professionals".

If more focus and emphasis are placed on the improvement of medication system, ADEs/ADRs can be prevented (Bates et al. 1999).

5.6.3.3 Transfusion Errors

Transfusion errors occur when the wrong blood is administered to another instead of the intended patient, or when incorrect ABO or Rhesus group is issued for transfusion. Like other AEs, transfusion errors are due to human actions, so again they are preventable. About half of the errors occur outside the blood bank. In the study by Linden et al. (2000) in New York, USA, 38% of the errors were due to administration to the wrong patients. The risk of transmission of infectious disease from blood supply, especially if not properly screened is also an issue. This can cause an iatrogenic illness.

Iatrogenic illness is any complication related to diagnosis and treatment of disease, regardless of whether the condition occurs as a known risk of a procedure or through errors of omission and commission (Dictionary of Modern Medicine, 2002).

5.6.3.4 Hospital Acquired Infection

Hospital acquired infection (HAI) is defined as "a localized or systemic condition that results from an adverse reaction to the presence of an infectious agent or its toxin that occurs during hospital admission, for which there is no evidence the infection was present or incubating at admission, and meets body site specific criteria" (Klevens et al. 2007).

One of the deadliest and commonest is MRSA (Methicillin Resistant Staphylococcus Aureus); although ESBL (Extended-Spectrum β -Lactamase) was recognised as a major cause of HAI since the 1980s; it is only now becoming more popular (Pitout et al. 2005). In the USA 1.7million people were affected by HAI, 155,668 of these resulted in mortality, out of which an approximate 99,000 were associated or caused by HAI. Other types of HAI are pneumonia, bloodstream infection, urinary tract infection and surgical site infections.

The importance of hand hygiene is brought home by these infections, simple hand hygiene before contact with patients can reduce the rate of spread of infections. But despite this, the compliance of most health care workers is still very low, and there is variability between nurses and doctors. Using direct observational study, Saint et al. (2009) observed that nurses are more compliant than doctors.

Continuous and persistent health education, infection control and surveillance are needed. In most hospitals, alcohol gels are now provided for hand rub before patient contact, but hand washing is still needed. The alcohol rub can only protect clean hands, as the saying goes "clean hands are safe hands".

5.6.3.5 Wrong Patient Identification

Looking at the wrong identification of patients as an AE extends to other forms of AEs as we have already established in the form of giving the wrong medication to the wrong patient; transfusing the wrong patient with a wrong blood type. This again is
purely human error. Most hospitals now have a positive identification tag for each patient. This should be cross checked each time there is a need to attend to any patient. The tag is left on from admission till the time of discharge. If time and effort are taken to positively identify the patient each time, then wrong identification will be minimized. The use of RFID is a way of preventing wrong patient identification. This is further discussed in chapter 3.

5.6.3.6 Falls

Finally, falls as AEs in hospitalized patients are common among the elderly. Most of the time, this is due to confusion or disorientation especially under the influence of medications. Brand and Sundararajan (2010) listed dementia and delirium as contributory factors to the increased incidence of in-hospital falls. Of course this will increase the LOS and can lead to mortality. This is because falls in the elderly is more difficult to manage; there is less mobility and more porous bones. Less mobility means more complications, even bed sores, and increased cost of admission.

5.7 Summary

With proper POA the need for hospital admission is reduced; patients can be sent home on the same day in the absence of unforeseen circumstances. Thus the risk of AEs is reduced. It is reassuring to note however that most of the AEs are preventable with improved organizational structure, change in the system and the way we do things; also with continuous education, training and surveillance. Other prevention strategies suggested by Smits et al. (2010) are quality assurance/peer review and evaluation of safety behaviour of health care providers.

We may never come to a stage when AEs are completely non-existent, because the complexity of health care itself presents an ever present risk. But at least we can hope to reduce the risk by avoiding hospital admission when possible, by offering patients day surgery after a properly conducted POA.

CHAPTER 6

RESEARCH

6.1 Introduction

Cancellation and unanticipated admissions of elective surgical cases are ongoing problems in hospitals not only in the Republic of Ireland, but internationally. The high cost that is associated with the running of operating theatres (OT) and the effect of cancellations and unplanned admissions of scheduled surgical procedures such as adverse events have prompted health care providers to find new ways of minimizing cost (Pollard and Olsen, 1999).

POA is "a basic element of anaesthetic care" (Garcia-Miguel et al. 2003). It is "the clinical investigation that precedes anaesthesia for surgical and sometimes for non-surgical procedures". The aim of POA is to improve the surgical outcome.

The research seeks to analyse the effect of POA on cancellation and unplanned admissions of day cases as evident in literature and to review the selection criteria for day cases. POA helps to reduce risks associated with surgery by identifying them before surgery, and allowing time for further investigations as needed. The author will also seek to reiterate that IT has a vital role to play in this process; because with the patients' data available in electronic form all relevant information will be available to the clinician to make an informed decision regarding the patients.

6.2 Aims of the Research

 To examine the data of pre-assessed and not pre-assessed day cases in an acute hospital setting in order to determine if the cases were done as day cases as planned; if they were cancelled or if some of the cases ended up being admitted on the day of surgery. Of the admitted cases what was the cause(s) of admission, the consequences of admission and the cause(s) of cancellation.

- To examine whether the POA was able to alert us to the cause(s) of admission/cancellation, were these issues possible to be addressed prior to the day of surgery.
- To examine the criteria for the selection of day cases according to the ASA and The Anaesthetists Association of Great Britain and Ireland.
- To examine the role of Information Technology (IT) in the POA process.

6.3 Approach/Methodology

The research was conducted at an acute hospital which has a Day Ward; mainly general surgical procedures are done in the hospital theatre department with two operating theatres in use.

The research involved a retrospective review of the patients that were pre and not pre-assessed at the pre-assessment clinic for a period of six months from March to August, 2010. Some of the records were not available at the pre-assessment clinic, so the rest were obtained from the Statistics Department; all the records were hand written.

The pre-assessment clinic (PAC) is located in the same building as the Day Ward and is nurse-led, with patients being referred to the anaesthetists only if the nurse is concerned about specific issues or if patients have underlying diseases. A standard assessment form (document) is used which combines anaesthetic and day care assessments. The same document is used right through the patients' care pathway; from PAC, pre-operative care plan, observation record, intra-operative care (anaesthesia type, scrub counts), post-anaesthesia care unit (PACU), Day Ward (nursing progress note, discharge plan). This simply means that everything about the patients is recorded on this document. The patients are also accompanied by the medical charts and the prescription sheets to order post operative medications and intravenous fluids if necessary.

The POA involved screening for suitability for day surgery, the pre-assessment document contained a series of questions, patients with ASA 1 to 3 statuses are deemed suitable for day surgery. Patients with ASA 1 status are pre-assessed by the nurse, ASA 2 and 3 are referred to the Anaesthetists for further review before being passed for day surgery; most of the time these patients require additional tests such as X-ray and blood investigations. If after the pre-assessment and the additional tests the anaesthetists are not satisfied, such patients are scheduled as in patients; and although they were pre-assessed, they were not included in this study because they were not done as day cases.

The day cases were then extracted from these records. Only patients scheduled for day cases under general anaesthesia (GA) were included in the selection, not those for local anaesthesia (LA) although some of the patients for LA could have attended the PAC.

On the day of surgery patients are normally admitted to the Day Ward, which has six beds for the surgical patients, and then escorted to the OT by a nurse from the day ward, the records of the surgical procedures are therefore in the theatre department.

So the Theatre registers were used to match the cases that were done. A quantitative data was obtained from these selections to determine how many cases were done as day cases as planned, how many were cancelled and how many unplanned admissions.

After the surgical procedures, the patients are kept in the PACU which has five bays, here the vital observations are done and pain control is ensured before discharge to the Day Ward. The discharge criteria score is used to assess the suitability for discharge to the Day Ward. There are eight criteria used, each with a maximum score of 2 points, each patient must have a minimum score of 14 points in total before discharge from the PACU; a score of 16 points is mostly aimed for. The criteria used are: Respiration, Circulation, Sedation Level, Pain Score, Nausea/Vomiting, Wound

Status, Drainage Tubes and Vascular Access (including intravenous infusions); with scores ranging from 0-2. For patient discharge criteria scoring sheet see Appendix 3.

Patients are normally sent back to the Day Ward from the PACU for discharge home once the discharge criteria are met and the surgeons or anaesthetists are satisfied with the general condition of the patients; they are accompanied home by responsible, named adults. But in case of unplanned admissions, the patients go directly to the ward from the PACU after beds have been secured (this normally entails calling back and forth between the day ward, PACU nurse and the bed manager). Sometimes the patients may be kept in the PACU for an extended period until beds are available, or sent back to the Day Ward to wait for beds. The relatives are informed at this stage because there may be needs for other arrangements to be made at home and also to let them know which wards the patients can be located.

This then constituted unplanned admissions, so the study looked at the reasons for admissions and whether the reasons were avoidable or non-avoidable. One could surmise from the unplanned admissions that there was definitely an additional cost both to the patients and the institution.

The study also looked at how many cases were cancelled, and the reasons for cancellation.

The question was then asked if the selection criteria were followed, if they were followed were the reasons avoidable or non-avoidable.

A research proposal was submitted to the hospital, but no ethical approval was deemed necessary.

The IT aspect reviewed the different systems that are available for the POA process and examined some of the reasons why these are not being employed. Also other related technologies were examined. A prototype of the pre-operative assessment form was done to show how the information can be captured electronically.

The document that is already in use was employed to create the prototype in order not to re-invent the wheel.

The research is mostly a descriptive study, it is not a new one as literatures abound to support this, this is being undertaken to emphasize what is already proven and to encourage the use of POA clinics for day cases and improve the system with the use of available IT. There is no control group, so no comparisons were made; however a similar study by Tham and Koh 2002 was used to see if the rates of admissions were similar. It must be noted however that their study was done over a period of two years and the study group was larger; but the scope of this research did not allow for such an extensive and lengthy study.

6.4 Results

Following the selection of appropriate cases, quantitative data were collected for each month from March to August, 2010 under the following headings: Total numbers of pre-assessed patients, Total numbers of Day Cases, Numbers of patients for GA pre-assessed, Total numbers of pre-assessed day cases, Total numbers of patients cancelled/DNA in one table. The other table had the following headings: Total Day Cases, Pre-assessed Day Cases, Day Cases Not Pre-assessed, Reasons for Admissions for both pre and not pre-assessed.

The Total numbers of unplanned admissions were done for the six months collectively (not for individual month).

The reasons for admissions were collected under the different headings for the total six months period. The reasons for unplanned admissions that were identified from the study were: unresolved pain, bleeding, anaesthetic reasons, age of the patients, emergency (scheduled as day cases, but done as emergencies), medical reasons (diabetes/hypertension) and the distance lived from the hospital.

During the six months study period a total of 964 patients were pre-assessed, 185 of

these were GA cases, but 242 day cases were carried out in total; out of which 138 were pre-assessed; this accounted for 14. 3% of the total pre-assessed patients.

Approximately 25% of the pre-assessed day cases ended up on admission for the reasons already stated above and displayed in the table below.

The cancelled/DNA accounted for 26% of the pre-assessed day cases and 15% of the total day cases for the six months period. The number for patients that were not pre-assessed and cancelled was not available.

All these results are presented in the charts and tables below:

Table 2: STATISTICS FOR PRE-ASSESSEMENT

MONTH	TOTAL ND. Pre-Assessed	TOTAL Day cases	G.A. PRE- Assessed	PRE-ASSESSED Day cases	DNA Dr Cancelled	ADMISSIONS		
MARCH	75	42	48	19	5	REASONS FOR ADMISSION	TOTAL	
APRIL	161	46	35	34	5	PAIN (21%)	7	
MAY	157	47	28	27	10	BLEEDING (9%)	3	
JUNE	171	27	22	14	3	ANAESTHESIA (6%)	2	
JULY	200	47	24	28	4	AGE (24%)	8	
AUGUST	200	33	28	16	9	EMERGENCY(6%)	2	
TOTAL	964	242	185	138	36	MEDICAL: DIABETESE / Hypertension (6 %)	2	
						DISTANCE (28 %)	10	
						TOTAL	34	

MONTHS	TOTAL DAY CASES	PRE ASSESSED DAY CASES	DAY CASES NOT PRE ASSESSED	ADMISSIONS REASONS	PRE ASSESSED	NOT PRE ASSESSED
MARCH	42	19	23	PAIN	7	8
APRIL	46	34	12	BLEEDING	3	2
MAY	47	27	20	ANAESTHETIC	2	2
JUNE	27	14	13	EMERGENCY	2	0
JULY	47	18	19	MEDICAL	2	3
AUGUST	33	16	17	DISTANCE	10	0
TOTALS	242	138	104		34	17

TABLE 3: RESULTS OF PRE AND NOT PRE ASSESSED PATIENTS



Fig. 2: TOTAL DAY CASES



Fig 3: TOTAL GA CASES PRE-ASSESSED



Fig. 4: PRE-ASSESSED DAY CASES

6.5 Analysis of the Results

The results from the assessed patients' records were entered into excel spread sheet for data analysis. First the percentage of day cases was obtained from the total numbers of pre-assessed patients, to show the relative number of day cases from all pre-assessed patients; then the percentage of the patients that were done under GA in relation to total day cases. The percentage of the admitted patients out of the total GA was calculated. Each reason for admission was calculated in relation to the total pre assessed GA day cases and then the total unplanned admissions.

6.5.1 Analysis of Unplanned Admissions

It is note worthy that 16% of the reasons for total unplanned admissions in the preassessed cases were avoidable or preventable; even though the statistical analysis was insignificant (p<0.5), this means that these reasons could have been dealt with during pre-assessment. Only 9% of the reasons were unavoidable, these could not have been foreseen before surgery. From the results obtained from the analysis the unplanned admissions were avoidable or preventable; these findings are comparable to Tham and Koh 2002 where the preventable causes were more than the unpreventable ones for unplanned admissions. Although the hypothesis test of statistical difference was p<0.5, the percentages of admissions from both researches were high. Nausea and vomiting were noticeably absent from the causes of unplanned admission because the patients are given anti-emetics routinely after surgery.

As already stated there was no control group to compare with, the numbers that were not pre-assessed were small; and the difference between the admission rates of the pre and not pre-assessed was insignificant hence no conclusion could be drawn from the research. A before-and-after pre-assessment group will be desirable to measure this effect, but it is not within the scope of this study.

The results of the analyses are presented in the charts below:

REASONS FOR	TOTAL	PERCENTAGE OF TOTAL
ADMISSION		ADMISSIONS
Pain	7	21%
Bleeding	3	8.82%
Anaesthesia	2	5.88%
Age	8	23.53%
Emergency	2	5.88%
Medical	2	5.88%
(Diabetes/Hypertension)		
Distance	10	28%
Total	34	100%

TABLE 4: REASONS FOR ADMISSION



Fig. 5: REASONS FOR ADMISSION

6.5.2 Analysis of Cancelled Day Cases

As already stated the number of cancelled patients accounted for 26% of the pre assessed day cases and 15% of total cases for the six months. Some of the reasons were lack of beds, further review needed and patients' decision. The highest numbers of patients (19) were cancelled due to administrative reasons and patients' decision was the next. There were no comparisons made between the patients that were not pre assessed because the record was not available. The result is presented in table 5 and figure 6 below.

REASONS FOR CANCELLATION	NUMBERS CANCELLED
Patients' Decision	9
No Beds	19
For Further Review	6
Insufficient OT Time	2
Total	36

TABLE 5: CANCELLED CASES



Fig. 6: CANCELLED CASES (PERCENTAGES PER MONTH)

6.5.3 Analysis of the Selection Criteria

The other part of the research examined if the selection criteria were followed, but from the number of patients that were admitted especially due to the distance from the hospital to their homes (28%); the conclusion can be drawn that the selection criteria might not have been followed. This can be because the catchment area was too wide; hence it was not possible to adhere to this criterion.

Also 24% of the admitted cases were due to age, most of them were cleared for day surgery, but because of co-morbidity they ended up on admission on the day of surgery. These two reasons were the highest causes of unplanned admissions, but they were also avoidable reasons.

The criteria for POA could not have prevented admissions due to pain which constituted 21% of the unplanned admissions, because despite the best pre-operative screening, pain cannot be predicted and patients cannot be sent home with severe pain after surgery.

6.6 Summary

From the number of patients that were admitted due to preventable reasons, one could say that a properly conducted POA and adherence to selection criteria will make a difference. Although the difference in the admission rate was insignificant (p<0.5), this was because the number pre-assessed was very small, but it still compared favourably with other researches. The cancellations were mostly due to lack of beds, which was more an administrative problem. The selection criteria need to be stricter in order to reduce unplanned admissions.

CHAPTER 7

7.1 PROTOTYPE OF ELECTRONIC PRE-OPERATIVE ASSESSMENT

7.1.1 Introduction

This section will describe how the electronic POA form was designed. As already stated, the existing form was used; this form was recently designed and the author was part of the committee that formulated the design.

The idea was to create a document that recorded the entire patient episode from pre-assessment, to the day ward, to the operating theatre till discharge.

The TMS has an in-built POA, but this was not activated during the installation of the system. It is hoped that this prototype can be adopted since the form is already in use at the hospital.

7.2 Stakeholders

The people or systems with an interest in the design of the electronic POA form have been identified as stakeholders. These are the Day Ward Nurses, the Anaesthetists, the Surgeons, the Theatre Nurses, the Information Officer (theatre clerk), the patients and the Statistics Department. Some of these people were involved with the original form design with the author.

7.3 End Users

The Anaesthetists, Day Ward Nurses, Surgeons and the Theatre Nurses are the end users; these are people that are already familiar with the set up of the form which was piloted about three years ago. These are the people that will input data into the new design and receive data from it.

7.4 Design

In designing any system there are various methods that can be used; this is dependent on the system requirements, the end users and the developers.

The Centers for Medicare and Medicaid Services and Integrated IT Investment and System Life Cycle Framework (2008) suggested a variety of methodologies such as:

- Rapid Application Development (RAD)
- Spiral
- Incremental
- Waterfall
- Prototyping.

The prototyping methodology was used for this design. The prototyping method is not a standalone complete methodology it handles selected portions of a larger methodology. It improves user participation in system development and also improves communication among project stakeholders.

This method was used because the form was already in existence, and in order not to re-invent the wheel it was deemed appropriate to use the same form; also the anaesthetists, Day Ward nurses and theatre nurses are familiar with the set up of the form, as it was piloted only about three years ago.

In designing the prototype all the fields in the form were included; this is to prevent loss of information, and in order to tailor the electronic format to make it similar to the existing paper documentation. Manjoney (2004) said that this improves workflow while also providing a comfort level that eases the transition from paper to electronic. The electronic form was designed like a folder with tabs to bring users to the different pages this was to make it user friendly and allow users to have easier access to information.

The first page of the form displayed the procedure, the date, the consultant, patient's name, hospital number, address, date of birth, religion and telephone numbers; then the next of kin, relation to the patient, the address and phone numbers. The other information on the first page: known allergies, weight, height, BMI, current medications and past medical history. These were captured in screen shots 1-3, patient's identification, next of kin and health data respectively.

The next two pages of the form contained a series of 31 questions with yes, no, not applicable and some explanations if required; and finally the signatures of the nurse, the patient and the date. These are displayed in tabs A-F (screen shot 4). The last page made provision for Anaesthetist's comments, order investigations and confirm if the patient is suitable for day surgery (screen shots 5 and 6).

The database was built using Microsoft Access 2007; there are 132 fields. It was designed and installed on the author's lap top; the author did a test run to establish the ease of use and the practicality of the design. There was no pilot study done, but the end users had extensive training in the use of the TMS which has been operational for over six years now. The author felt that the use of the prototype will be easy and readily accepted because the TMS is of a similar design and is already in use in the hospital.

Screen shots of the electronic data base of the POA form are displayed in the following pages:

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SCREEN SHOT OF DATABASE 1: PATIENT'S IDENTITY.

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SCREEN SHOT OF DATABASE 11: ANAESTHETIST REVIEW

7.5 Limitations and Difficulties

The initial difficulty that was encountered with the research was due to access to the needed data; because these were in paper form most of the information was not readily available. Data were not available for cancelled patients that were not pre-assessed. Even when eventually located the writing was not always legible or some information might not have been entered; this necessitated the search of few locations and this consumed a lot of time. The limitations are due to the inconclusive results obtained, in hindsight a control of before pre-assessment should have been observed as well.

The IT aspect (production of POA form prototype) was quite tedious because of the

author's attempt to preserve all the fields in the original document. The limitation however was the fact that the prototype was not piloted.

7.6 Application and Recommendations

Following the research into the POA process, the author will like to see a properly set up POA clinic in operation in the hospital; where the nurse and the anaesthetists are working side by side to conduct a proper POA on the day cases. This will drastically reduce the number of patients that are ending up on admission and ensure a smoother assessment, thus improving the efficiency of the day surgery services.

It is recommended that the selection criteria be reviewed and put in practise.

The POA process itself should be computerised for ease of access to information for all involved. The prototype can be used to conduct a pilot study of how this process can be changed, the author is aware that more staff will be needed to run the clinic. Unfortunately, the need for cut backs might hinder this; but the outcome will be worthwhile.

7.7 Conclusion and Future Work

From the discussions in this dissertation, the author is of the opinion that the need for POA in day surgery cases in the reduction of cancellation and unplanned admissions has been highlighted. The benefits of day surgery and the prevention of adverse events are just few of the reasons.

Coupled with these, the benefits to be derived from electronic POA process will prove to be a huge incentive for the adoption.

More work is needed to get the true picture of the effect of POA on the day surgery patients in order to reduce cancellation and unplanned admissions.

The POA form prototype needs to be tested and fine tuned as needed. The use of HIT is not something we can avoid, with the trend in technology development it will be adopted ultimately. The need to provide efficient, safe and effective service to the patients through best practice will be the ultimate drive for the adoption of HIT.

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APPENDIX 1

SCORING SYSTEMS FOR ICU AND SURGICAL PATIENTS:

ASA PHYSICAL STATUS CLASSIFICATION SYSTEM

- 1 : A normal healthy patient
- 2 : A patient with mild systemic disease
- 3 : A patient with severe systemic disease
- 4 : A patient with severe systemic disease that is a constant threat to life
- 5 : A moribund patient who is not expected to survive without the operation
- 6 : A declared brain-dead patient whose organs are being removed for donor purposes

These definitions appear in each annual edition of the ASA Relative Value Guide. There is no additional information that will help you further define these categories.

Courtesy: asahq.org

APPENDIX 2

BMI Categories:

- Underweight = <18.5
- Normal weight = 18.5–24.9
- Overweight = 25–29.9
- Obesity = BMI of 30 or greater

TABLE: IMPERIAL BMI FORMULA

(weight in pounds * 703)

BMI =

(lbs/inches²)

height in inches²

TABLE: METRIC BMI FORMULA

=

weight in kilograms

BMI

 (kg/m^2)

height in meters²

- Patients with a BMI <34 are generally suitable for surgery, provided all other guidelines are met
- Patients with BMI 35 40 should be discussed with an anaesthetist. If there are no other problems, patients may be suitable

Patients with a BMI >40 are generally not suitable as day cases. However, individual cases may require discussion with the anaesthetist responsible for that particular list.

Courtesy: National Good Practice Guidance (2002)

APPENDIX 3: Patient Discharge Criteria – Scoring Sheet

Instructions:

- A Scoring sheet must be completed for each patient
- Total score is a guide only and should be used in conjunction with clinical judgement and patient's underlying status.

Score	2	1	0
Respirations	Normal rate	Laboured or >20 or <10	Supported or <10
	(12 – 15 breaths/minute)	breath/minute	
Circulation	Stable BP and HR with no	BP 20% above or below	BP increased or decreased
	significant changes	preoperative level	by 50% of pre-op level or
			HR >150 or <45 bpm
Sedation level	Awake communicating and	Rouses only on stimulation	Does not respond to
	seldom drowsy (0 – 1)	(2 – 3)	stimuli (4)
Pain Score	Pain free (0 – 3)	Uncomfortable (4 – 5)	Severe distressing pain (6 –
			10)
Nausea/Vomiting	Neither nauseated nor vomiting	Nauseated only	Nauseated and vomiting
Wound Status	Intact and dry	Stable with breakthrough	Uncontrollable bleeding
		ooze, requiring support	requiring extra
			intervention
Drainage tubes	Not applicable or patent and		Non-functioning or Excess
	draining		fluid loss
Vascular access including	Not applicable or Patent		Non-functioning
IV infusions			

Patient should attain a score of greater than or equal to 14 prior to discharge. If score is less than 14, patient must be reviewed by doctor before transfer to ward/clinical area

Scoring system for pain and sedation

	Sedation Score
	0 = awake & alert
	1 = normal sleep
Pain Score 012345678910	2 = slightly drowsy, easily roused
(No pain)	3 = frequently drowsy, rousable
	4 = unconscious, minimal or
	unresponsive to physical stimulation

Courtesy: The Association of Anaesthetists of Great Britain and Ireland (2002).

ABBREVIATIONS

ADEs	Adverse Drug Events
ADRs	Adverse Drug Reactions
AE	Adverse Event
ASA	American Association of Anaesthesiologists
BADS	British Association of Day Surgery
СТ	Computed Tomography
DNA	Did Not Arrive/Did Not Attend
DOS	Disc Operating System
DRG	Diagnosis Related Group
ESBL	Extended-Spectrumβ-Lactase
GA	General Anaesthesia
HIMSS	Health Informatics and Management Systems Society
HIQA	Health Information and Quality Authority
HIT	Health Information Technology
HQ	Health Quest
ICT	Information and Communication Technology
IMPACT	Internal Medicine Perioperative Assessment, Consultation and Treatment
IT	Information Technology
LA	Local Anaesthesia
MRSA	Methicin Resistant Staphylococcuc Aureus
NIMIS	National Integrated Medical Imaging System
OECD	Organisation for Economic Co-operation and Development
OPASS	Orthopaedic Pre Admission Screening System
OPE	Outpatient Pre Evaluation
PAC	Pre Anaesthetic Clinic
PACE	Preoperative Anaesthesia Consultation and Evaluation
POA	Preoperative Assessment
POAC	Pre operative Assessment Clinic
PPARS	Personnel Payroll And Related Systems