

THE IMPACT OF PREOPERATIVE ASSESSMENT CLINICS ON SURGICAL CANCELLATIONS AND OPERATING THEATRE EFFICIENCY

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fulfilment of the requirements for the degree of Master of
Science in Health Informatics.



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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

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Abstract

Cancellation of elective day case surgeries is an enduring problem in every health care facility. Last minute cancellations of pre-booked operations causes anxiety, frustration and anger in patients and leads to the inefficient use of valuable operating theatre time and resources. Studies have reported that cancellations have depressive effects on patients and families due to the emotional involvement prior to surgery.

Preoperative assessment of patients have shown to reduce surgical cancellations on the day of the surgery. Preoperative assessment clinics prepare the patient for surgery and anaesthesia. The other reported benefits of preoperative assessment clinics are it reduces unnecessary laboratory and radiological testing, and specialist consultations.

The aim of this study is to evaluate the impact of Preoperative Assessment Clinics on surgical cancellations. This is a hospital based study conducted in a Model 2 Co. Dublin Hospital. The hospital management introduced a new protocol guided nurse-led preoperative assessment clinic where preoperative assessment of all elective surgical patients was made mandatory. The new clinic started functioning in February 2016.

The study was conducted over an 11 month period from July 2015 to May 2016. Surgical cancellation rates and theatre efficiency was studied for 7 months prior to introduction of the clinic and 4 months after the introduction of the new clinic. A quasi experimental study design was adopted. Data was collected through retrospective review of medical notes and the theatre register during the pre-intervention period. Special registers were introduced during the post-intervention period to record cancellations and delays, medical notes and theatre register were also reviewed on a need basis.

A significant reduction in the number of cancellations were demonstrated and theatre efficiency had doubled during the post-intervention period. All the results were statistically significant. The study concludes that preoperative assessment clinics can significantly reduce surgical cancellations and improve operating theatre efficiency

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Abbreviations

POA	Preoperative Assessment
AAGBI	Association of anaesthetist of Great Britain and Ireland
APMC	Anaesthesia preoperative medical clinic
ASA	American Society of Anaesthesiologists
COPD	Chronic Obstructive Pulmonary Disease
CAD	Coronary Artery Disease
CVA	Cerebro-Vascular Accident
DM	Diabetes Mellitus
DNA	Did not arrive
DOS	Day of Surgery
DOSA	Day of Surgery Admission
DSU	Day Surgery Unit
ECG	Electrocardigram
GP	General Practitioner

HTN	Hypertension
IEGH	Ireland East Hospital Group
LIS	Laboratory Information System
MI	Myocardial Infarction
NCPS	National Clinical Programme in Surgery
NHS	National Health Service
PAS	Patient Administration System
PATC	Preoperative Assessment Testing Clinic
PEC	Preadmission Evaluation Centre
PNC	Preoperative Nurse Clinician
POA	Preoperative Assessment
RCSI	Royal College of Surgeons in Ireland
RIS	Radiology Information System
SDA	Same Day Admission
SPSS	Statistical Package for the Social Sciences
SPU	Short Procedure Unit

Glossary of terms

Terms	Description
ASA 1	“A normal healthy patient Healthy, non-smoking, no or minimal alcohol use” (Miller et al., 2014).
ASA 11	“Mild systemic disease mild diseases only without functional limitations such as smoking, social alcohol drinker, pregnancy, obesity (30<BMI<40), well controlled DM/HTN, mild lung disease” (Miller et al., 2014).
ASA 111	“Severe systemic disease and functional limitations; One or more moderate to severe diseases such as poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, undergoing scheduled dialysis, history (>3 months) of MI, CVA, TIA, or CAD/stents” (Miller et al., 2014).
ASA 1V	“Severe systemic disease that is a constant threat to life, such as recent (<3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, sepsis, not undergoing regularly scheduled dialysis” (Miller et al., 2014).
ASA V	A Patient not expected to survive without the operation, such as ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction” (Miller et al., 2014).

ASA V1	“A declared brain-dead patient whose organs are being removed for donating purposes” (Miller et al., 2014).
Cancellations on the day of surgery	A cancellation on the day of intended surgery is defined as any operation that is either scheduled on the final theatre list for that day (generated at 15:00 on the previous day) or is subsequently added to the list, and that is not performed on that day (Schofield et al., 2005).
Co-morbidity	A medical condition that exists simultaneously with, but independently of another medical condition (Dictionaries).
Day Surgery	The definition of day surgery in the UK and Ireland is admission to hospital for a planned surgical procedure and return home within the same day. ‘True day surgery’ patients are day case patients who require full theatre facilities and/or a general anaesthetic, so this does not include procedures performed in outpatient or endoscopy departments.(Darwin, 2016)
Did not arrive	“The patient failed to arrive at the hospital for their operation” (McKendrick et al., 2014).
Efficiency	The ability to do something or produce something without wasting materials, time, or energy (Dictionaries).
Elective surgery	Surgery chosen by the patient rather than urgently necessary (Dictionaries).

Holistic Care	Treatment of the whole person, taking into account mental and social factors, rather than just the symptoms of a disease (Dictionaries).
Intraoperative	The course of the surgery (Dictionaries).
Medical cancellation	“The patient was cancelled by either the surgeon or the anaesthetist for medical reasons”.(McKendrick et al., 2014)
Patient cancellation	“The patient themselves decided against proceeding with the procedure, perhaps after receiving further advice or resolution of the problem.”(McKendrick et al., 2014)
Perioperative care	The period around the time of a surgical operation (Dictionaries).
Preoperative	Before a surgical operation (Dictionaries)
Preoperative assessment	“Pre- operative assessment is the process of clinical assessment by an anaesthetist, which precedes the delivery of anaesthesia care for surgery and non-surgical procedures” (American Society of Anaesthesiologists)
Postoperative	The period following a surgical operation
Operation theatre efficiency	“Efficiency can be considered as the extent to which the same output can be produced using fewer inputs (input-orientated) or the extent to which output can be increased using the same inputs (output-orientated)”.

Optimisation

(In this Study) Treating and managing symptoms of underlying medical conditions.

Chapter 1 INTRODUCTION

Cancellation of elective day case surgeries is an enduring problem in every health care facility. Last minute cancellations of pre-booked operations causes anxiety, frustration and anger in patients (Kennedy, 1969) and leads to the inefficient use of valuable operating theatre time and resources (Schofield et al., 2005). Studies have reported that cancellations have depressive effects on patients and families due to the emotional involvement prior to surgery (Tait et al., 1997).

Preoperative assessment of patients before elective surgery reduces cancellations on the day of surgery (McKendrick et al., 2014). Avoiding cancellations is not the only benefit of preoperative assessment (Fischer, 1996), it also prepares the patient for anaesthesia and surgery (Knox et al., 2009). Thorough preoperative evaluation is a predominant factor in perioperative patient care (Deutschman and Traber, 1996). Development of Preoperative Assessment clinics has modernised the preoperative experience for the patient by synchronising anaesthetic, surgical and nursing consultations and laboratory testing. The functioning of these clinics necessitated development of policies, protocols and guidelines and has had an impact on unnecessary laboratory testing, avoiding surgical cancellations and minimising consultations (Tsen et al., 2002). These advances are profitable for the hospital system.

This chapter will give a brief outline of the study setting and the background to the study. It then presents the research question and the aims of the study. It also includes an overview of the research and an overview of the dissertation itself.

1.1 Background

The author is employed by the HSE as an operating theatre nurse in a model 2 Co. Dublin Hospital which is affiliated to a large university hospital group since late 2012. There are three hospitals in the group. The hospital services were reconfigured in the latter part of 2012. The hospital where the author is employed offers services such as:

- Day surgery (where patients are admitted on the morning of the surgery and discharged on the same day)
- Ambulatory care (management of chronic diseases e.g. Diabetes Mellitus)
- Medical services (cardiac failure clinics, cardiac rehabilitation, COPD clinics etc.)
- Diagnostic services (blood tests, radiology tests, endoscopy etc.)

With a vision to expanding and promoting day surgery facilities in the study setting, the hospital management are adopting the guidelines outlined by the Royal College of Surgeons in Ireland – ‘Model of Care for Elective Surgery’ (RCSI 2013) which highlights the importance of preoperative assessment clinics for elective surgery.

The hospital management, anaesthetic department, surgical department and the operation theatre department have undertaken considerable measures to promote day surgery. Despite these measures there were still a large number of surgical cancellations on the mornings of operations which led to dissatisfied patients and frustrated staff. Extensive analysis of the reasons for such cancellations found that most of these cancellations were due to avoidable reasons. Had there been a well-entrenched preoperative assessment system in place these cancellations could have been avoided. Cancellation of operations on the day of surgery results in the underutilisation of hospital resources thus wasting hospital money. “Theatres are one of the financial powerhouses of the hospital. It costs up to €2.5 million/year to run an operating theatre in Ireland” (HSE 2010). It has also been reported that cancellations cause annoyance and anxiety to patients and inconvenience to families. The author has substantiated all of the above points with evidence from literature in the next chapter.

1.2 Research Question and Study Aims

In July 2015 the management at the study setting decided to introduce a protocol driven, nurse-led preoperative assessment clinic and the new clinic began functioning in February 2016. The research described in this dissertation assesses the impact of this new preoperative assessment clinic on surgical cancellations and operating theatre efficiency.

The research question for this study is: What is the impact of preoperative assessment clinics on surgical cancellations and operating theatre efficiency?

The aims of the study are to:

1. Classify the reasons for surgical cancellations.
2. Evaluate the rate of cancellation to determine if cancellations on the days of surgery have reduced.
3. Evaluate if operating theatre efficiency has improved.

1.3 Purpose of the Research

The purpose of this study is to highlight the importance of preoperative assessment for all patients undergoing elective surgery. It will emphasise the need for mandatory preoperative assessment of all surgical patients.

1.4 Overview of the Research

A literature review was first conducted to substantiate the role of preoperative assessment, the functioning of Preoperative Assessment (POA) clinics and their influence on the cancellation of day case surgeries.

The research question was addressed primarily by comparing the number of cancellations and the number of surgical cases carried out on any day, prior to and after introducing the preoperative assessment clinic. The number of cases cancelled over a seven month period prior to the introduction of the new clinic was obtained from the Patient Administration System (PAS) and the reasons for cancellation were acquired by a retrospective study of the medical notes of patients who were cancelled. The reasons for surgical cancellations were categorised by the author. The number of surgeries carried out per day was retrieved from the theatre register. This data was compared with the number of cancellations and the number of surgeries done per day, post implementation of the preoperative assessment clinic, for a period of four months.

The New South Wales Agency for Clinical Innovation defines operating room efficiency as:

“Efficiency can be considered as the extent to which the same output can be produced using fewer inputs (input-orientated) or the extent to which output can be increased using the same inputs (output-orientated). In the surgical setting, definitions of efficiency generally focus on time, where reductions in time related to a level of input translates into efficiency. In the operating theatre, the efficient production of surgical cases requires maximising the use of time and is dependent on minimising wasted time, minimising unused time and maximising output for a level of inputs”.

1.5 Overview of the Dissertation

This chapter has presented the journey of the elective surgical patient, the background of the research, the research question and aims and an overview of the research.

Chapter 2 presents the literature review. It first looks into some detail on preoperative assessment, preoperative assessment clinics, day surgery and day of surgery admissions and also elective surgery cancellation on the day of surgery. It then explores the impact of preoperative assessment on cancellation of surgery by examining the reasons of cancellation and also the cancellation rates. It finally looks into patient satisfaction with preoperative assessment and cost benefits of preoperative assessment.

Chapter 3 presents the context of the study. This will help in understanding the problem that exists in the study setting and the measures undertaken to overcome the problem which include the implementation of a POA tool, training the staff involved in using the tool and streamlining the care of surgical patients.

Chapter 4 presents the methodology design of the research study. It will describe the methods adopted to categorise and classify the reasons for surgical cancellations and the rate of surgical cancellations prior to and after the introduction of the new preoperative assessment clinic. Finally, it presents the methodology adopted to assess operating theatre efficiency.

Chapter 5 presents the data analysis and results of this study. The reasons for surgical cancellations are categorised and a comparison is made on cancellation rates and operating theatre efficiency prior to and after the introduction of the new preoperative assessment clinic.

Chapter 6 discusses the results, what the study found, what other studies have found and the significance of the results. It further discusses what happens to the cancelled patient and staff satisfaction levels with the introduction of the new preoperative assessment clinic. Finally, the benefits of an electronic preoperative assessment tool are discussed.

Chapter 7 concludes the dissertation by presenting the key findings and implications of the study. It then acknowledges the limitations and outlines some recommendations for future work that could be undertaken based on this study. It includes recommendations to Ireland East Hospital Group with regard to rolling out preoperative assessment clinics for day surgery across the hospitals in the group and considers possible work for the future. Lastly, the author reflects on this study.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Literature reviews ought to “objectively report on the current knowledge on the topic” (Green et al., 2006) and offer a precis of previous studies on a particular topic (Uman, 2011). They also put into context new perceptions and backgrounds (Torraco, 2005). New ideas can be obtained by integrating and recapitulating previous studies (Bolderston, 2008). The comprehensive search is targeted around a specific question allowing the researcher to gather evidence, plan and implement interventions and make recommendations for the future (Baker, 2016).

The literature review first addresses the concept of preoperative assessment clinics for day surgeries, their rationale and their functioning. It goes on to address surgical cancellations, the causes and the costs. It then comprehensively reviews literature on evaluation of the impact of preoperative assessment clinics on surgical cancellations and operating theatre efficiency. Finally, it will synthesise and summarise crucial facts to inform the current study and allow for comparison.

2.2 Search Strategy

This literature review is based on materials retrieved from a range of relevant sources using carefully selected search terms as described below.

2.3 Keywords and Search Terms

Keywords are used to find appropriate and informative facts during the search. The keywords chosen are important, as they are “the cornerstone of an effective search” (Fiona Timmins and Catherine McCabe, 2005). Timmins and McCabe also state that the search should be “rigorous, explicit and comprehensive”. Bearing this in mind, the keywords for the search were selected. The keywords for this literature search were, ‘preoperative assessment’ which is used interchangeably with ‘preoperative evaluation’ and ‘preanaesthetic assessment’, ‘preoperative assessment tools’, ‘day surgery’ and

'cancellation of surgery'. The search was limited to English language publications between 1993 and 2016. The speciality was restricted to anaesthesia and perioperative care.

2.4 Databases and Electronic Sources Searched

The databases included in the search are shown in Table 2.1. The articles retrieved mostly came from the following journals; British Journal of Anaesthesia, Canadian Journal of Anaesthesia, Anaesthesia and Critical Care, Journal of Clinical Anaesthesia, Journal of Perioperative Practice, Journal of Advanced Perioperative Care, Journal of Education in Perioperative Medicine, Journal of Perioperative Nursing in Australia, British Journal of Perioperative Nursing, Operating Theatre Journal and Association of Operating Room Nurses Journal. Articles were also selected from Google Scholar.

All websites were accessed primarily through the Trinity Online Library using Stella search and the HSE Online Library.

Table 2.1 Electronic Sources of Information

Database	URL	Keywords	Year	Results
CLINICAL KEY	www.clinicalkey.com	Preoperative assessment, day surgery, cancellations of day surgery	1995 - 2016	1,857
COCHRANE LIBRARY	www.cochranelibrary.com	Preoperative assessment, day surgery, cancellations of day surgery	1995 - 2016	1,342
CINHAL	https://health.ebsco.com	Preoperative assessment, day surgery, cancellations of day surgery	1995 - 2016	1,228
EMBASE	https://www.embase.com	Preoperative assessment, day surgery, cancellations of day surgery	1995 - 2016	6,649
PubMed	www.ncbi.nlm.nih.gov/pubmed	Preoperative assessment, day surgery, cancellations of day surgery	1995 - 2016	4,341
ScienceDirect	www.sciencedirect.com	Preoperative assessment, day surgery, cancellations of day surgery	1995 - 2016	5,381

2.5 The National Clinical Programme for Surgery in Ireland

The National Clinical Programme for Surgery in Ireland (NCPS) introduced by the Royal College of Surgeons in Ireland (RCSI 2013) in association with the Health Service Executive works to improve the elective surgical patient journey, which focuses on delivering efficient elective surgical care. The programme aspires to provide a 'model of care' guideline for preoperative assessment clinics, day surgery, admissions on the day of surgery and discharge planning. The programme is specifically designed to enhance quality of care provided to the patients coming for elective surgery. It also provides surgeons with pertinent and relevant information as regards their tasks and work patterns.

Irrespective of the nature of the surgery the 'model of care' aims to provide a safe, efficient and cost effective service through well-established high quality processes. These processes are developed in such a manner that they are much the same for each kind of operation throughout the country. Developing protocols and surgical care pathways may seem arduous but will curtail error and make the surgical admission a safe event. The capacity of any surgical system can be enhanced by revising the existing surgical care pathway and adopting the guidelines outlined by HSE (RCSI 2013).

2.6 Journey of the Elective Surgical Patient

Under the NCPS guidelines the elective surgical patient is referred to the surgical clinic by the General Practitioner (GP) or by other clinical teams within the hospital. A diagnosis is made through investigations. Arrangements are made to perform all radiology and laboratory investigations on the day that the patients come to the Preoperative Assessment Clinic (POA) or in such a manner that it minimises the number of hospital visits for the patient. Following this, the patients are referred to the Preoperative Assessment Clinic to facilitate full preoperative work before the day of the surgery. Preoperative assessments are being carried out in the outpatient clinic by nurse specialists and they organise investigations and referrals to other specialists if required (Nicholson et al., 2013).

Following the visit to the POA clinic, if patients are deemed fit for the surgery they are scheduled for the operation through the day surgery facility in the hospital.

Patients who do not satisfy the criteria for day case surgery are referred on to the anaesthetist or a medical specialist for optimisation of their underlying medical conditions. The diagram below represents the ideal patient journey as recommended by the National Clinical Programme for Surgery in Ireland. It shows the flow of an elective surgical patient from the time of referral by the GP through to the time that the operation is performed. The boxes marked with a star represent day surgery and the patient flow through a day surgery centre.

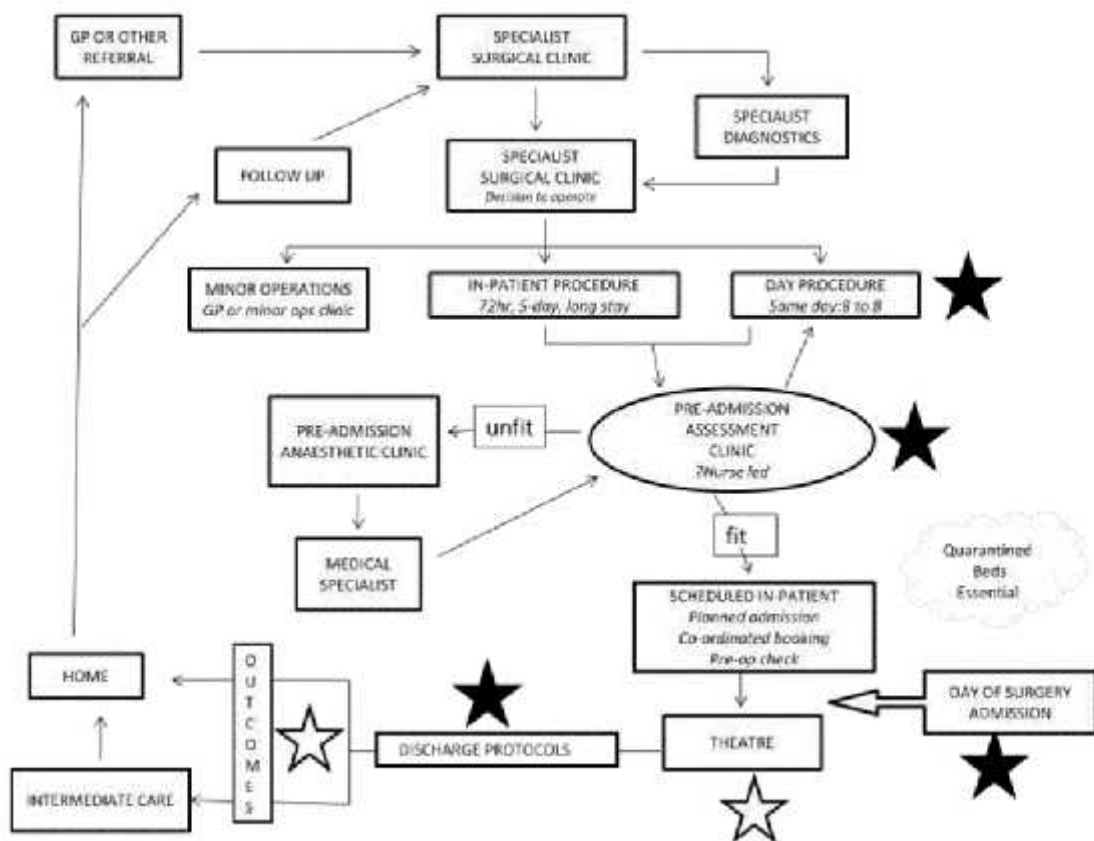


Figure 2.1: Journey of the Elective Surgical Patient (RCSI 2013)

Source: <https://www.rcsi.ie/files/2013/>

2.7 Introduction to Preoperative Assessment

All patients undergoing elective surgery should be assessed preoperatively in order to establish that the patients do not have any comorbidities. If any comorbidities are identified, these conditions are optimised to make surgery and anaesthesia safe. Preoperative assessments have been shown to minimise cancellations on the day of the operation and reduce patient anxiety (Rai and Pandit, 2003, Knox et al., 2009). There have also been cost benefits from reducing cancellations and unnecessary preoperative testing (Pollard et al., 1996). Though preoperative assessment varies markedly between hospitals, the essential objective is that the patient is fully prepared before the day of admission. The French law of December 4th 1994, has made preoperative assessments mandatory to identify risks, inform the proposed plan of care to the patient and obtain their approval (Auroy and Benhamou, 2010).

As early as the 1850s, John Snow, under the heading of 'Preparations for the Inhaling of Chloroform' stated that "the only direction which is usually requisite to give beforehand to the patient who is to inhale chloroform, is to avoid taking a meal previous to the inhalation." He also emphasised the importance of physical examination: "On feeling the pulse of a gentleman, about 21 years of age in March 1855, who had just seated himself in the chair to take chloroform, I found it to be small, weak and intermitting and it became feebler as I was feeling it. I told the patient that he would feel no pain, and that he had nothing whatever to apprehend. His pulse immediately improved. He inhaled the chloroform, woke up, and recovered without any feeling of depression. Now, if the inhalation had been commenced ... without inquiry or explanation, the syncope which seemed approaching would probably have taken place and it would have had the appearance of being caused by the chloroform, although not so in reality." Essentially, Dr. Snow had realised and emphasised the importance of the preanaesthetic physical examination and fasting. Traditionally preoperative assessment was intended for inpatient surgery, it was carried out on the evening before the surgery; this required the patient to

be admitted a day before the operation, which was an unwarranted expense for the hospital (Nicholson et al., 2013).

2.8 Pre-Operative Assessment (POA)

Definition: “Preoperative assessment is the process of clinical assessment by an anaesthetist, which precedes the delivery of anaesthesia care for surgery and non-surgical procedures” (American Society of Anaesthesiologists).

‘Preoperative assessment’ is not merely the physical status examination of the patient. It also involves psychological preparation and exchange of information pertaining to the operation which is crucial during the preoperative phase. *‘Preoperative preparation’* would rather be an appropriate explanation as it incorporates a holistic outlook to patient care (Gilmartin, 2004), thus reduction in cancellations is not the sole benefit of preoperative preparation as it has various other advantages (Fischer, 1996).

In recent years POA has become part of surgical care. This presents an opportunity to optimise comorbidities, treat acute illness and put in place a perioperative management plan (Burnside and Snowden, 2014).

2.8.1 Objectives

The objectives of preoperative assessment have been listed by Gray et al., (2015) as:

- Identify lurking and other medical conditions requiring optimisation.
- Arrange relevant preoperative investigations.
- Encourage lifestyle changes such as weight reduction, abate smoking and alcohol consumption.
- Systematise day of surgery admissions and decrease day of surgery cancellations.
- Refer high-risk patients to the anaesthetist for further assessment and discussion of anaesthetic techniques.

2.8.2 Steps of the assessment process

Gray et al., (2015) suggested the following to be carried out during preoperative evaluation. The pre-assessment process involves a detailed history collection, physical examination thorough assessment of the airway, medical comorbidities and American Society of Anaesthesiologists (ASA) physical status classification.

Table 2.2 Steps of the Preoperative Assessment Process

Source: Author

STEPS OF THE PREOPERATIVE ASSESSMENT PROCESS	
History	<p>A comprehensive history collection to identify:</p> <ul style="list-style-type: none"> - Existing comorbidities - Previous anaesthetic history (check anaesthetic records for problems) - Risk factors for gastro-oesophageal reflux (to plan appropriate airway management techniques) - Review of regular medications (instruct patients to continue or withhold according to local policy)
Physical examination	<p>A general physical examination to reveal:</p> <ul style="list-style-type: none"> - Obesity - Scoliosis - Other spinal problems <p>(all of these may have implications for positioning under anaesthesia)</p>
Airway assessment	<p>Airway assessment is the core component of preoperative evaluation. It helps to put in place appropriate strategy for predicted difficulty in intubation and extubation.</p>
Medical comorbidities	<ul style="list-style-type: none"> - Hypertension - Coronary artery disease - Valvular heart disease - Stroke - Chronic obstructive pulmonary disease - Respiratory tract infection - Diabetes <p>Patients with any of the above conditions should receive advice regarding medications, special tests and fasting times. Surgery may be postponed or cancelled if the above conditions are uncontrolled.</p>

American Society of Anaesthesiologists (ASA) – Physical status classification	Grade	Definition
	I	Normal healthy patient
	II	Mild systemic disease
	III	Severe systemic disease
	IV	Severe systemic disease that is a constant threat to life
	V	A moribund patient who is not expected to survive without the operation
	VI	A declared brain-dead patient whose organs are being removed for donor purposes

Laboratory tests, radiological examinations and consultations with the cardiologist, pulmonologist, neurologist or any other specialist are arranged if considered necessary. The type of surgery and the risks associated are to be discussed with the patient at the time of preoperative assessment. Major and complex surgeries are considered high risk (Gray et al., 2015). The different grades of surgery are shown in Figure 2.2.

Grade of Surgery	Example Procedures
Grade 1 (minor)	a) Excision of skin lesion b) Drainage of breast abscess
Grade 2 (intermediate)	a) Inguinal hernia repair b) Tonsillectomy
Grade 3 (major)	a) Total abdominal hysterectomy b) Thyroidectomy
Grade 4 (major +)	a) Total joint replacement b) Colonic resection
Cardiac surgery	
Neurosurgery	

Figure 2.2: Grades of Surgery - Source: www.fastbleep.com

2.9 Day Surgery and Day of Surgery Admissions (DOSA)

Day surgery or same day surgery has become the preferred choice for elective care. It is believed to have begun in the 1900s and subsequently has been followed in many countries. In the 1950s, surgeons debated the concept of imposed bed rest following surgery and envisaged the hazards that this exposed patients to (Palumbo et al., 1952). Surgeons also discussed the possibility of performing more surgeries by utilising the same number of beds due to the decrease in the length of hospital stay and the possibility to minimise waiting lists by embracing day surgery (Farquharson, 1955). 'Guidelines for Day Case Surgery' published by the Royal College of Surgeons of England in 1985 indicated that day surgery is the best alternative for 50% of patients who require elective surgery. The pathway for day surgery is strategic and preferably delivered in a stand-alone unit. Adequate preoperative preparation including selection and assessment, guided by protocol, and nurse-led discharge are essential components to the pathway (Darwin, 2016). The patient pathway for day surgery typically begins with a referral from the general practitioner to surgical out-patient clinics proceeding onto the POA clinic and finally onto the Day Surgery Unit (DSU). While patients are being assessed for day surgery, surgical, medical and social factors are taken into consideration. The surgical procedure should be

uncomplicated with minimal or no risks. Medical conditions should be optimised if unstable prior to surgery (Ng and Mercer-Jones, 2014).

2.10 Elective Surgery Cancellation on the Day of Surgery

Cancellation of elective surgery is an ongoing problem in all healthcare facilities. Incidences of cancellation differ amongst centres and vary between different surgical specialities. Various centres have reported cancellations ranging from 3.9% (Jiménez et al., 2006) to as high as 40% (Chalya et al., 2011). Recurrent cancellations have effects on patient satisfaction and staff morale (Robb et al., 2004). It also causes major emotional trauma to the patients and their families (Zafar et al., 2007).

Several studies have reported the following drawbacks of cancelling the surgery on the scheduled day of surgery:

- Theatre time being wasted i.e. delays in surgery start times as a result of preparing patient on the morning of the operation and the time taken to allocate the slot to a different patient if possible (Pollard et al., 1996).
- Increased cost due to theatre resources being wasted (Correll et al., 2006).
- Probable loss of earning for the patients due to the time taken off work (Knox et al., 2009).
- Anxiety and inconvenience for the patients and families (Fischer, 1996).

Studies have reported that cancellations have a depressing effect on patients (Tait et al., 1997), and great level of emotional connection to the surgical event (Ivarsson et al., 2002). Schofield et al., (2005) studied the scheduled operations between May and November 2002 at a major metropolitan hospital in Australia. 7,913 surgeries were scheduled during this time. 941 (11.9%) of these surgeries were cancelled, the main reasons being; no theatre time for 176 cases (18.7%), clinical change in patients condition in 161 cases (17.1%) and administrative reasons in 43 cases (4.6%). It was revealed that 60% of the cancellations were possibly avoidable (Schofield et al., 2005).

Surgical cancellations have been classified in many different ways. The classification process appears to be primarily the choice of the researcher. The broad classification would be either avoidable or unavoidable reasons. Some studies have classified them into patient related or hospital related reasons and preoperative preparation related reasons.

The remainder of this section reports on various studies of rates and patterns of elective surgery cancellations and their causes. Three studies looked at reasons for cancellations, Trentman et al., (2012) studied 238 cancellations of 12,176 surgeries in Phoenix, Fayed et al., (2016) studied 6,048 cancellations of 54,419 surgeries in Saudi Arabia and Garg et al., (2009) studied 482 cancellations of 1,590 surgeries in India.

Trentman et al., (2012) conducted a one year review of cases cancelled on the day of surgery between July 2009 and June 2010 in a tertiary care hospital in Phoenix. Data entry of cancelled cases was done by the operating room receptionist. The common reasons for cancellation were categorised into avoidable and unavoidable causes. 12,176 cases were scheduled for surgery during the study period. A very small number of these (232) were cancelled on the day of surgery, 109 of which were arbitrated to be avoidable and 123 were unavoidable cancellations.

The principal finding of this study is that day of surgery cancellations can be reduced to less than 2%. However, this study was not designed to understand and investigate the methods to reduce day of surgery cancellations but they claim that the low cancellation rate may perhaps be due to preoperative evaluation of surgical patients and the availability of a shared electronic medical record (Trentman et al., 2012).

Fayed et al., (2016) conducted a study in a super-speciality hospital in Saudi Arabia. They studied the rate of cancellations prior to and after the opening of the new operating theatre facilities in the hospital in June 2011. The number of scheduled and cancelled surgeries were obtained from the theatre register. January 2009 to May 2011 and July 2011 to December 2012 were considered the pre and post interventional phases respectively. 54,419 surgeries were booked over the study period of three years, 6,048 of these cases were cancelled which revealed a cancellation rate of 11.11%. The 1,813 cancelled cases in the year 2012 were examined to describe the various reasons for the cancellations. The

reasons were categorised into the following three groups: patient related, preoperative preparation related and hospital related. 'No show' of patients accounted for 27% of the cancellations. The cancellations owing to the need for further optimisation accounted for 24.3%. Respiratory and other infections, abnormal blood results were some of the reasons identified which required further treatment prior to surgery. 19.5% of the cancellations were due to the lack of theatre time (Fayed et al., 2016).

Garg et al., (2009) conducted a study over six months in a 1,542 bedded public hospital with 16 operating theatres. 1,590 patients were booked for surgeries but there were 482 (30.3%) cancellations on the day of the operations. Of these cancellations 288 (59.7%) were owing to unavailability of theatre time, 52 (10.8%) were cancelled due to medical reasons and 78 (16.2%) patients did not arrive on the day of surgery. Their study had listed inefficient preoperative preparation as one of the leading causes of cancellations. Some of the medical conditions that were inadequately optimised preoperatively were hypertension, diabetes mellitus, acute cardiovascular symptoms and respiratory tract infections (Garg et al., 2009).

Incidences, causes and pattern of elective surgery cancellations were studied by Chalya et al., (2011). Their study was conducted in a University teaching hospital in Tanzania. Out of the 3,604 patients that were booked for elective surgery over a period of one year 644 (17.87%) were cancelled. General surgery had a cancellation rate of 31.5% which was the highest, followed by orthopaedic surgery 25.5%. Lack of theatre space accounted for 53% of the cancellations and lack of theatre facilities for 28.4%. Their study revealed that the high cancellation rate was due to ineffective use of theatre resources which also resulted in increased cost of patient care.

The table below summarises the various reasons for cancellations as described by Fayed et al., (2016), Trentman et al., (2012) and Garg et al., (2009). The reasons for cancellation have been classified into patient related, preoperative preparation related and hospital related. Trentman et al. further classified these reasons into avoidable and unavoidable.

Table 2.3 Summary of Reasons for Cancellations

SUMMARY OF REASONS FOR SURGICAL CANCELLATIONS			
Authors and year of study	Fayed et al., (2016)	Trentman et al., (2012)	Garg et al., (2009)
Patient related reasons			
Patient did not arrive	485 (27.0%)	Not reported	78 (16.2%)
Patient refused procedure	159 (8.6%)	11 (4.62 %)	Not reported
Preoperative preparation related reasons			
Needs further optimisation	437 (24.1%)	85 (35.71 %)	52(10.8%)
Needs further investigation	105 (5.8%)	Not reported	Not reported
Abnormal test values	41 (2.3%)	9 (3.78 %)	Not reported
Change in treatment plan	54 (3.0%)	Not reported	26 (5.4%)
Hospital related reasons			
No operating room time	350 (19.3%)	5 (2.1 %)	288(59.7%)
Unavailability of surgeons/anaesthetists/ nursing staff	10 (0.6%)	10 (4.20 %)	20 (4.2%)
Equipment failure/not available	13 (0.7%)		18 (3.7%)

2.11 Preoperative Assessment Clinics

POA clinics may vary in staffing – this could be either nurse-led or consultant anaesthetist led. There can be variations in the structure and the manner in which they are run, nevertheless the main intention is to make the surgical event safe for the patient (Edwards and Slawski, 2016). These clinics would prospectively improve productivity of the operation theatre by improving time management and personnel planning resulting in monetary benefits (Siragusa et al., 2011). The visit to the POA clinic helps the patient to gain insight and knowledge of their treatment, develops a sense of trust on the perioperative team, alleviates anxiety and increases satisfaction (Siragusa et al., 2011). Currently POA clinics are run as an outpatient service with the involvement of the multidisciplinary team. Such clinics have also shown a positive impact on resource utilisation by avoiding unnecessary laboratory testing and minimising hospital visits for specialist consultation (Ferschl et al., 2005).

A need for further optimisation and investigations are two reasons that can be largely avoided by an effectively functioning preoperative assessment clinic. Essentially patient related reasons such as ‘did not arrive’ and ‘refused procedure’ can also be minimised by these clinics. Attending the POA clinic serves as a reminder to the patient about the surgery and alleviates fear and anxiety which could be the reason for patients refusing the procedure (Trentman et al., 2012).

Bond (1999) surveyed the facility of pre-anaesthetic clinics in Ontario. Mail questionnaires were sent out to 300 hospitals in 1997; 260 hospitals replied to the questionnaire. 131 (50.38%) of the hospitals provided general anaesthesia to the patients. These hospitals had written guidelines to regulate referrals to the POA clinics. The patients here were initially seen by the nurse and referred onto the anaesthetist where required. A decrease in the rate of cancellations were noted where patients had attended POA clinics. It was recognised that providing POA might be expensive, but can be balanced by the cost savings made through adopting day surgery rather than in-patient surgery. Further this study also found that extra time needs to be spent on careful POA of patients with comorbidities,

which leads to providing better care. Preoperative clinic visits help optimise pre-existing conditions and those conditions that are diagnosed for the first time during this visit (Correll et al., 2006).

2.11.1 Referral to the preoperative assessment clinic

The surgeon reviewing the patient in the surgical clinic decides if the patient needs to be referred to the preoperative assessment clinic. Referral is usually done by sending a referral form to the POA clinic and the patient is then notified of the appointment date.

The patient is reviewed in the preoperative assessment clinic which could either be nurse-led or consultant-led. If any problems are identified in the nurse-led clinic, the patient is referred on to the anaesthetist. Laboratory testing, radiological testing and specialist consultations are arranged as necessary. Patients suitable for surgery are then scheduled for admission as appropriate. Patients scheduled for major operations are reviewed by the consultant anaesthetist, who then guides the patient through further, i.e. scheduling the date for the surgery, referring to other specialities, organising further investigations or cancelling the procedure for patients who are deemed unfit for the operation. The figure below shows the flow of patients through the pre-admission assessment clinic.

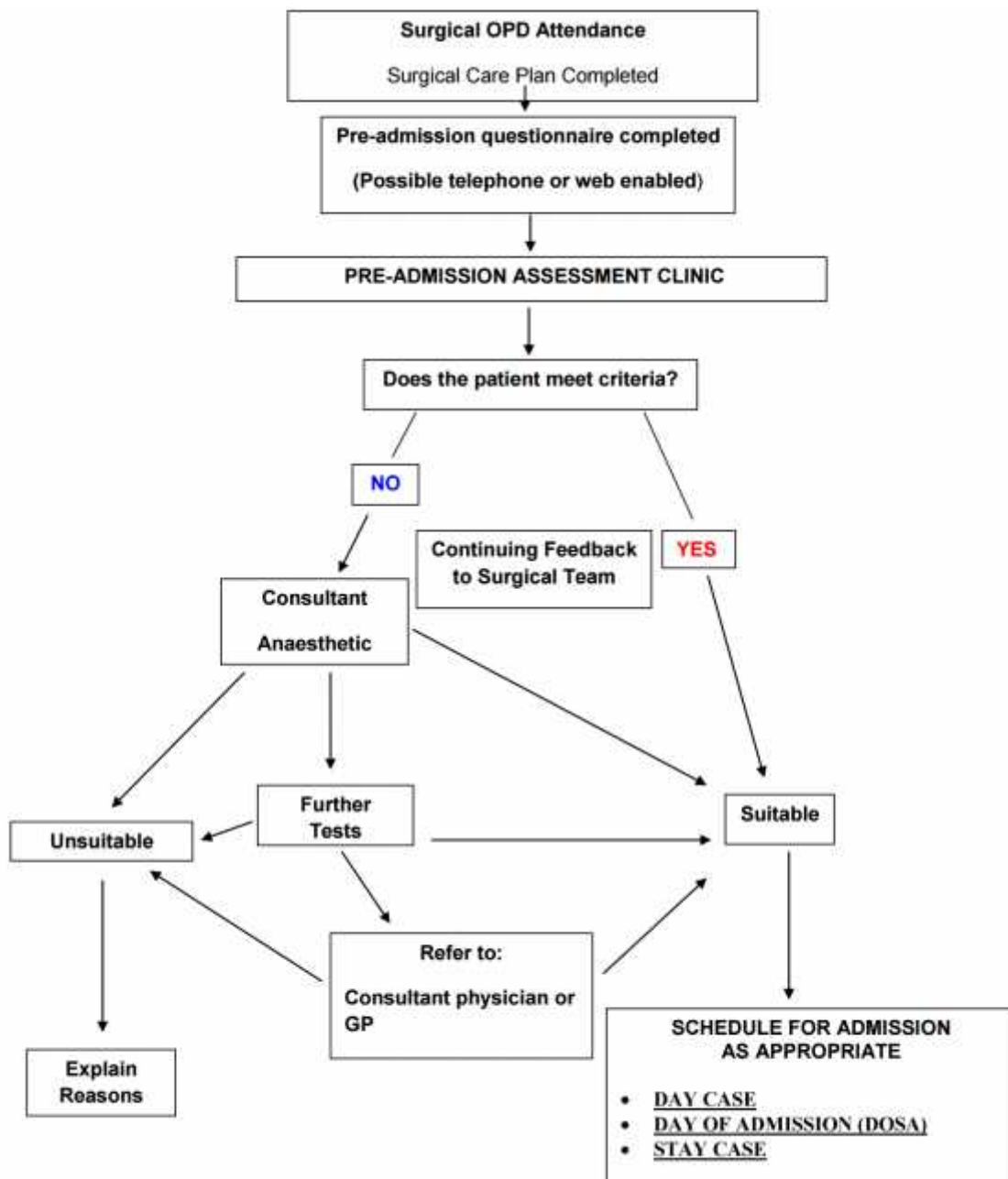


Figure 2.3: Flow of Patient Through the Pre-admission Assessment Clinic

Source: [algorithmhttps://www.hse.ie/eng/about/Who/clinical/.../modelofcare.pdf](https://www.hse.ie/eng/about/Who/clinical/.../modelofcare.pdf)

2.12 Impact of Preoperative Assessment on Day Surgery Cancellations

This section of the literature review covers the studies most closely related to the study presented in this dissertation. It presents and compares four studies which evaluated the impact of preoperative assessment clinics on the cancellation rates for day surgery.

The first of these studies by McKendrick et al., (2014) categorised cancellations into those that were affected by preoperative assessment and those that were not. They conducted an observational study of cancellations pre and post introduction of a preoperative assessment clinic in August 2007 in a 194 bedded District General Hospital in the United Kingdom. This clinic was nurse-led. In 2006, only patients scheduled for joint replacement surgeries underwent preoperative preparation. An initial audit revealed that preoperative preparation across all specialities could possibly reduce cancellations on the day of surgery by up to 77%. Patients who were scheduled for minor surgeries were reviewed only by the nurse. All benefits and risks were discussed and information leaflets were given.

The cancellations were divided into two groups, the ones that were affected by preoperative assessment and the ones that were not. 42,082 patients were scheduled for operation during the 5 year study period. 28,982 cases fulfilled the inclusion criteria (the remaining patients did not require POA services or anaesthetic services). 2,689 (9.3%) of these patients were cancelled on the day of surgery. The cancellation rate prior to the introduction of the POA was 9.7%; this was reduced to 8.6% after the POA clinic was introduced. The cancellations which were affected by POA were categorised into the following three groups:

- DNA (did not arrive) cancellations were reduced from 39.2% to 13.6% ($P < 0.001$)
- Medical reasons for cancellations were reduced from 32.6% to 19.9% ($P < 0.001$)
- Cancellations by patients themselves increased from 4.6% to 8% ($P = 0.002$)

Their study concluded that the introduction of preoperative assessment clinics had significantly reduced cancellations due to DNA and medical reasons. However, the number of cancellations by patients themselves on the day of the surgery had increased. This study also found unsurprisingly that the cancellations due to reasons that cannot be affected by

POA such as no theatre time due to over running of theatre lists, equipment failure, personnel not available as expected did not show a significant reduction (McKendrick et al., 2014).

Knox et al., (2009) compared surgical cancellations pre and post establishment of a preoperative assessment clinic in an Irish hospital in 2003. January 2002 to December 2002 was the control group prior to establishing the POA clinic and July 2003 to June 2004 was the study group, consequent to the establishment of the clinic. There were 1,421 cases in the study group and 1,405 cases in the control group. The number of cases preoperatively assessed was 721 in the study group and 669 in the control group. There was a notable difference in day of surgery cancellations between the study and control groups, (114 and 256 respectively, $P < 0.001$). The reasons for cancellation were classified as hospital related, patient related, medical and other reasons for cancellation:

- Cancellation for hospital reasons (49 vs 132, $P < 0.001$)
- Cancellation due to medical reasons (10 vs 31, $P = 0.013$)
- Cancellation due to patient related reasons (20 vs 51, $P > 0.05$)
- Cancellation due to other reasons (35 vs 42)

Interestingly, in contrast to McKendrick et al.,(2014) in this study cancellation due to patient related reasons reduced significantly. Knox et al.(2009), suggest that patients are less inclined to cancel their operation after undergoing preoperative assessment. This study has demonstrated that preoperative assessment can significantly reduce the cancellations due to medical reasons (Knox et al., 2009).

Freschl et al., (2005) retrospectively reviewed the charts of all surgical patients over a six month period at The University of Chicago Hospitals. 6,254 fulfilled the inclusion criteria for the study between 1st July and 31st December 2003. These patients were divided into two groups: cases that were performed in the same day surgical suite and those that were performed in the general operating rooms. The charts of all of these patients were cross-referenced with those of the patients who attended the POA clinic during the same period. Data was extracted from the POA clinic database.

98 of 1,164 (8.4%) of preoperatively evaluated cases were cancelled as compared to 366 of 2,552 (14.34%) of cases that were not evaluated preoperatively. The rate of cancellation between the two groups was compared using a chi-square test. These results were significant enough to infer that POA clinic visits can reduce cancellations on the day of surgery and were strong enough to recommend POA clinic visits to all who are to undergo surgery.

The last study by Pollard and Olson (1999) focussed on the timing of the preoperative assessment clinic visit. 529 patients were examined during the study period of three months. 166 (31%) of these patients underwent POA within 24 hours of the surgery (standard group) and 363 (69%) attended POA clinics 2-30 days before the day of surgery (early group). The cancellation rates were 13.3% and 13.2% for the early and standard groups respectively. The reasons for cancellation were insufficient operating room time in 15 cases (21%), acute patient illness in 13 cases (19%), surgeons' decisions in 11 cases (16%) and patients' decisions in 10 cases (14%). This study concluded that early POA was not directly related to reduction in cancellations but there are other benefits such as patients who have been preoperatively assessed at an early stage can be called for when a cancellation arises, thus preventing underutilisation of a theatre. An optimal time for POA was hard to define and, until adequate evidence is established, POAs can be performed at a time that best suits the patient and also will make the clinic resourceful (Pollard and Olson, 1999).

Table 2.4 summarise the results of the four studies described above. All four studies show a significant reduction in the cancellations after implementation of the POA clinics.

Table 2.4: Comparison of Studies Which Have Shown That Preoperative Assessment Can Reduce Cancellations.

Authors and year of study	McKendrick et al., (2014)	Knox et al., (2009)	Freschl et al., (2005)	Pollard & Olson (1999)
Preoperatively assessed	Yes	Yes	Yes	Yes
Anaesthetist / Nurse led	Nurse led	Anaesthetist led	Anaesthetist led	Anaesthetist & Nurse led
Time of preoperative assessment	Not available	Not available	Not available	24 hours prior to surgery (standard group)
				2-30 days prior to surgery (early group)
Duration of study	5 years	2 years	6 months	3 months
Rate of cancellation pre-intervention	9.7% - 1,771 cancellations out of 18,288 procedures	38.26% - 256 cancellations out of 669 procedures	16.2% - 366 cancellations out of 2,252 procedures	Not applicable to this study
Rate of cancellation post-intervention	8.6% 918 cancellations out of 10,640 procedures	15.81% 114 cancellations out of 721 procedures	8.4% 98 cancellations out of 1,164 procedures	13.3% (standard group)
				13.2% (early group)

Nurse-led clinics have demonstrated reductions similar to clinics led by anaesthetists, which implies that protocol-led clinics are efficient.

The shortest study period was three months and the longest 5 years. Regardless of the duration of the study, the implementation of POA clinics has lessened cancellations.

Except for Pollord and Olson, none of the other authors have stipulated the ideal time for carrying out POA.

Starsnic et al., (1997) evaluated the rate of cancellations on patients undergoing day surgery. 454 patients were evaluated over a period of one year. 66 cancellations were reported, none of these would have been prevented by further preoperative testing or specialist consultations. This study concluded that a preoperative assessment clinic where the anaesthetists evaluate patients and order tests is cost-effective and equally efficient.

The remainder of this chapter covers other observations of the preoperative assessment clinics. Firstly, patient satisfaction with preoperative assessment and financial benefits of preoperative assessment are reviewed. These areas are not evaluated in the current study but are indispensable. Finally, it looks at the impact of preoperative assessment on operating room efficiency which relates to the current study.

2.13 Patient Satisfaction with Preoperative Assessment

Hepner et al., (2004) studied patient satisfaction during the preoperative period, especially regarding the setup of the clinic. Patients presenting to the POA were given a questionnaire with a total of 18 questions which covered the following areas; general, anaesthesia, nurse, lab and overall experience. A Likert scale was used for rating the experience. Free text option was available to portray patients' contentment. 855 questionnaires were completed. The Cronbach coefficient alpha for the 18 question was 0.96, thus confirming the tool was reliable. Mean calculations were carried out to ascertain overall patient satisfaction. Patients had expressed dissatisfaction in the following three areas; ease of locating the POA clinic, time taken to be seen after arrival to the clinic, and surgeons'

explanations regarding the clinic. These were non-clinical aspects, yet essential to patients. The study concluded that the practitioner and functional aspects of the preoperative visits have a considerable influence on patient satisfaction. Information and communication from all service providers remain the most important positive elements and the total amount of time spent represents the most negative component of patient satisfaction in a PATC (Hepner et al., 2004a). The patients' perceptions of these clinics have not been sufficiently examined. Using patient contentment as a corollary helps to gain a better understanding of the effectiveness of these clinics (Fung and Cohen, 1998).

2.14 Financial Benefits of Preoperative Assessment

POA is a crucial component of perioperative care and stipulates an estimation of resources that may be essential for the surgery. Risk factors are identified during the POA through history collection, physical examination, relevant clinical data, laboratory and other radiological tests. Evidence based guidelines are available to justify preoperative testing (Dimpel, 2014). Using guidelines has demonstrated a reduction in the number of preoperative tests ordered without compromising patient safety (Roizen, 1994). Realisation of cost benefits have been quantified at individual hospital level (Nardella et al., 1995, Mancuso, 1999) and for a whole health system (France and Lefebvre, 1997).

Ferrando et al., (2005) conducted a survey on all patients undergoing elective surgery in Turin, Italy, to forecast the economic impact when preoperative assessment guidelines are implemented. An average of 20 laboratory tests and 1.9 instrumental tests were performed preoperatively on each patient. The anaesthetists considered 52% of the tests useful for clinical and medicolegal reasons. ECG was performed on 128 (19.2%) of the patients. This was not required by the guidelines and there were no relevant findings which might have required changes in the anaesthetic plan. 182 (27.8%) of patients had chest X-ray, which the guideline had stated as inappropriate. The findings of the X-ray changed the surgical risk on two occasions, but this did not require change in the plan of anaesthesia.

On considering the cost per patient for preoperative testing, costs could have been reduced by 63% by adhering to guidelines and by 36% by excluding tests considered unwarranted by the anaesthetists, which parallels to €43 and €25, respectively. In addition

to the reduction in the cost of preoperative tests, Ferrando et al., found that comprehensive use of guidelines will reduce cost of length of preoperative hospital admission and eliminate cost due to postponement of surgery by 50%. In this study setting where 10,000 patients are hospitalised annually for elective surgery, it was estimated that the potential annual savings could be €3 million (Ferrando et al., 2005).

Boothe et al., (1995) conducted a study to compare the cost of inpatient elective surgery to that of outpatient same day surgery in patients undergoing laparoscopic cholecystectomy. 53 patients underwent POA in the outpatient setting and were admitted to the hospital on the day of surgery (group 1) and 11 patients were admitted the day before the surgery and underwent POA as inpatients (group 2). The cost incurred per case in group 1 was \$360 less than in group 2. There was a cost advantage of 18% per patient. During the study period, though the number of surgical beds had declined by 15.7% the volume of surgeries performed had declined only by 5.4%, which highlights an increase in day case surgery (Boothe and Finegan, 1995).

In a study conducted by Starsnic et al., (1997) to evaluate the 'efficacy and financial benefit of an anaesthesiologist-directed university preadmission evaluation centre', the cost of preoperative testing was measured on two sets of patients undergoing day surgery. 3,062 patients over a period of eight months were included in the study. 1,519 patients (group S) had preoperative tests ordered by surgeons and supplemented by the anaesthetists. 1,543 patients (group A) had tests ordered predominantly by anaesthetists. Surgeons were also allowed to order tests they deemed necessary. The study indicated that 28.63% lesser tests were ordered in group A. A statement by the hospital financial department showed that the testing costs were \$20.89 less for each patient in group A. No alteration in the anaesthetic plan was required due to fewer tests being ordered nor were additional tests required on the day of the operation.

2.15 Impact of Preoperative Assessment on Operating Room Efficiency

This section reviews studies on the impact of preoperative assessment on operating room efficiency. The visit to the preoperative assessment clinic prepares the patient adequately for surgery. The patients' questions are answered and they are aware of what to expect

when they arrive for the operation. It curtails the unnecessary delay caused by preparing the patient on the day of surgery. Therefore, surgeries can be started on time and turn-around times are quicker.

Jonnalagadda et al., (2005) studied the reasons for cancellations and delays of surgical procedures. The study was conducted in a 650 bedded tertiary hospital in Barbados for a period of six weeks in 1999. Audit forms were devised to record delays and cancellations. Scheduled start time, time of arrival of patient into the theatre department, actual start time of the procedure, finishing time of the procedure, the scheduled start time of the next procedure and the reasons for cancellations or delays were recorded. 840 procedures were scheduled. 594 forms were returned, 98 of these were incomplete and had to be excluded. 496 forms were available for analysis.

There were 118 (24%) cancellations and 350 (71%) delays. There was a delay in start time of the procedure in 93% of the patients. These delays ranged from half an hour to 9 hours. There was an average delay of one hour in 67% of the cases. Only 4% of the cases started on time. 17% of the delay was due to the time taken to transfer patients from the ward to the theatre. 10% of the procedures were cancelled due to improper and inadequate preoperative preparation. There was no reason recorded in 15% of the cancellations.

The study concluded that delays in start time render valuable theatre time to be wasted. Efficient use of resources and understanding the causes for delays will help anticipate the problems and identify solutions. As described earlier in the present study, theatre is the single most expensive department in the hospital, therefore, its maximum utilisation is pivotal to increase productivity (Jonnalagadda et al., 2005).

Correll et al., (2006) studied the 'Value of Preoperative Clinic Visits in Identifying Issues with Potential Impact on Operating Room Efficiency'. Though the title of the study is to identify 'issues which have impacted on operating efficiency', the authors have only described identification and management of 'medical issues' in the preoperative clinic. One of the major reasons for cancellations on the day of surgery is the patient's medical condition. These cancellations, when avoided, have a positive economic impact. Thus the

role of preoperative clinics in decreasing operating room delays and cancellations cannot be disputed.

A retrospective study was conducted on patients' charts that were seen in the preoperative assessment clinic over a period of three months. Data was collected in relation to the type of medical issue identified, information needed to resolve the issues, time taken to retrieve such information, rates of cancellations and delays and the effect on management. During the 3-month study period, 5,083 patients were seen in the preoperative clinic. 647 patients (12.7%) had 680 medical issues requiring further information or management. 565 (83%) of these required further information regarding known medical problems ('old problems') and 115 (17%) were medical problems first identified in the clinic ('new problems'). New problems were associated with a greater chance of delay 10.7% or cancellation 6.8% than old problems. The authors were able to identify all outstanding medical issues and obtain the required information in 93% and 96.1% of patients with old and new medical problems, respectively. This study concluded that a preoperative centre can identify medical issues that could potentially cause delays or cancellations on the day of surgery because of incomplete information, thereby confirming the hypothesis by the authors. "The cost savings to the hospital, as a direct result of the work of the clinic, is significant" (Correll et al., 2006).

2.16 Conclusion

Hart (1998) described that a literature review can help to:

- Distinguish what has been done from what needs to be done.
- Identify important variables relevant to the topic.
- Synthesise earlier results and ideas and gain a new perspective.
- Rationalise the significance of the problem.
- Identify the main methodologies and research techniques that have been used.
- Place the research in context with state-of-art developments (Hart, 1998).

This section included a review of literature in relation to preoperative assessment and preoperative assessment clinics. It provided an overview on day of surgery admissions and elective surgery cancellations on the day of surgery. It has summarised the impact of preoperative assessment on day surgery cancellations, patient satisfaction with preoperative assessments and financial benefits of preoperative assessment.

Research has shown that preoperative assessment clinics can help reduce cancellations on the day of the operation. Day surgery is widely being accepted in many health care systems, as this does not require admission on the previous day of surgery. All patients scheduled for day surgery are referred to the preoperative assessment clinic where underlying medical problems are identified and treated. Blood tests and investigations are done before the day of the operation with a view to avoiding delays on the morning of the operation. Cancellations and delays have an enormous impact on the finances of the hospital. The theatre is the most expensive department in the hospital and hence it needs to be productive.

CHAPTER 3 CONTEXT

3.1 Introduction

This dissertation is a study of the impact of preoperative assessment clinics on surgical cancellations and operating theatre efficiency. The preoperative assessment clinic under study was implemented in the study setting in February 2016. The author of this dissertation initiated the new protocol guided nurse-led preoperative assessment clinic. This chapter describes the setting and practice prior to implementation of the new clinic. It then describes the motivation for the design and introduction of the new preoperative assessment clinic and tool and the patient pathway after implementation.

3.2 The Problem

Up until mid-2012 both elective and emergency surgeries were performed in the study setting, thus surgeons, anaesthetists and doctors of other specialities were available in the hospital at all times. Therefore, patients who needed optimisation were identified and treated without delay. Moreover, the availability of surgical in-patient beds permitted the admission of patients where necessary. Customarily, preoperative assessments of day surgery patients were done on the morning of the operation. If the anaesthetists felt the need for deferring the operation owing to underlying medical conditions, patients were allocated an in-patient bed and treated appropriately.

Since the reconfiguration of the hospital, day surgery has taken precedence. There are no surgical in-patient beds available. All surgeries are performed as day cases where patients are admitted through the day ward on the day of the operation and discharged later during the day after they have fully recovered from the effects of anaesthesia. Staff rosters, particularly those of the anaesthetists, were rearranged where they rotated between the three hospitals in the group. This arrangement had an enormous implication on preoperative assessment as there was a different anaesthetist every morning and regrettably this would be their first encounter with the patient. Any medical problems identified at this first meeting necessitated further laboratory investigations, ECG's, chest X-rays, ultrasounds and/or referral to other specialities. Some of these laboratory

investigations would be performed on the same day and the decision might be made to proceed with the operation subject to blood test results. Unfortunately, some interventions could not possibly be organised on the same day, consequently forcing the surgery to be cancelled and re-scheduled for a later date. Arrangements had to be made for patients to be followed up with the necessary preoperative testing. These cancellations led to valuable theatre time being wasted and underutilisation of human resources i.e. surgeons, anaesthetists, nurses and technicians. This glitch continued to an extent that there were at least one or even more cancellations each day. This array of cancellations rendered the staff to be frustrated and both the patients and their families to be unhappy.

3.2.1 The existing preoperative assessment clinic

The problem seems to have originated owing to the ineffective use of the existing preoperative assessment clinic. Very few day surgery patients, approximately 10%, were referred to the existing clinic from any of the out-patient clinics. These referrals were not governed by protocols and neither was the clinic. The subjective decision by doctors in the out-patient department often had the tendency to neglect patients who categorically needed POA and there was no definitive referral pathway. Often patients were not referred on to the clinic even if they had pre-existing medical conditions. Lack of accepted protocols and guidelines was an area of concern.

The preoperative assessment clinic that originally existed ran a half a day session on the first Monday of every month with a throughput of 8-10 patients per session. The new preoperative assessment clinic has two full day sessions per week, led by nurses and driven by definitive protocols. All patients are first seen by the nurses. If any patient requires further review e.g. for an ASA physical status score <3 (ASA physical status score has been discussed in Section 2.8.2 and in Table 2.2) or for any underlying conditions like epilepsy they are referred onto the anaesthetist who then schedules the patient for surgery after the appropriate work up. The table below presents the percentage of patients pre-assessed during the pre and post-interventional period.

3.3 Motivation

The reason for the author to initiate a preoperative assessment clinic was that the cancellation of day case surgeries occurred on a daily basis. As stated earlier, these cancellations led to the underutilisation of the nurses and other personnel which caused frustration among the staff. Delaying or cancelling the operation with short notice is unsolicited as the efficiency and productivity of the department is reduced (Gupta and Gupta, 2010). Visits to the preoperative clinics have shown to improve patient satisfaction (Hepner et al., 2004a).

Cancellations are also inconvenient to the patients and their relatives (Garg et al., 2009), as their daily life is interrupted and it costs the patient in terms of losing working days (Schofield et al., 2005). Schofield et al have also stated that this experience could perhaps be stressful and disappointing for the patients. Foreseeing the complexities of this perplexing situation, the author engaged in discussions with the anaesthetic department, day ward and the out-patients department of the hospital to devise a solution to this ongoing problem.

Effective preoperative assessment of elective surgical patients in an out-patient setting would greatly enhance the care of patients during the perioperative period. This practice has demonstrated efficiency and cost effectiveness (García-Miguel et al., 2003). Although there is an existing POA clinic in the study setting, its operation and utilisation needed to be reconsidered. However, in the other two hospitals in the group, POA clinics have successfully been implemented. These clinics appear to be functioning well with substantial throughput of patients. The medical personnel working between the three hospitals affirm that a series of minor modifications to the existing POA clinic can help accomplish its objectives and realise its true potential.

With a view to restructuring the existing clinic the author, along with the anaesthetists, surgeons, nurses from the day ward, theatre department and outpatients department held frequent meetings to ensure that the process of restructuring adhered to international and national guidelines and also with local policies, procedures and guidelines. The author took

a lead role in this process under the direct supervision of the Head of the Department of Anaesthesiology.

The enthusiasm to partake in this process was from Prof. Lucy Hederman, who indicated that this would be an ideal topic for dissertation. After careful consideration, the author derived a mind map to steer through the project in such a manner that both the author and the hospital would benefit from. The hospital management embraced this project with great zeal. All of these constructive progresses motivated the author to work on this project with the:

- Vision of providing holistic care to all patients undergoing surgery in the study setting.
- Better understanding the role of preoperative assessment in elective surgery.
- Effective utilisation of allocated resources towards the POA clinic in SCH.
- Potential for improving the flow of patients through the surgical clinic.
- Possibility of serving as paradigm for POA clinics in model 2 hospitals in Ireland.

3.4 The Study Setting

The study was conducted in a 106 bedded model 2 hospital, which serves a population of 160,000 across Dublin and Wicklow. General surgery, vascular surgery, dental surgery, urological surgery, gynaecology surgery and chronic pain procedures are carried out in the theatre department as day case procedures. The POA clinic is run in the out-patients department and is led by a consultant anaesthetist. Anaesthetic registrars and nurses from the day ward are involved in the functioning of the clinic. These clinics were customarily run on the first Monday of every month. Being a model 2 hospital, there is no inpatient facility for surgical patients. All surgical patients are treated as day cases hence the category of patients suitable for day surgery had to be carefully chosen. Some of the surgeries performed in the theatre department are hernia repair, laparoscopic hernia repair, laparoscopic cholecystectomy, laparoscopic Nissen's fundoplication, excision of lipomas, haemorrhoidectomy, varicose vein surgery, cystoscopy, ureteroscopy, vasectomy, circumcision, hysteroscopy, dilatation and curettage, nerve root blocks,

rhizotomy and pulsed radiofrequency for chronic pain, dental examination under anaesthesia and dental extractions.

3.5 Patient Referral Pathway – Pre-Intervention Period

Patients are referred to the surgical outpatient clinic from the other departments within the hospital or from the general practitioners. Following the initial review by the surgeon the patients are scheduled for the operation. Approximately 10% of the day surgery patients were referred to the POA clinic. Laboratory and radiological tests were ordered by the surgeon with no definitive protocols. Results of these tests were seldom followed up prior to the date of the operation. However, patients who were referred to the POA clinic were thoroughly assessed by the anaesthetist and all necessary testing was performed. Special- needs dental patients are directly referred to the POA from the Dublin Dental Hospital.

3.5.1 Scheduling for the operation

All patients scheduled for operation arrive to the day ward at 08:00 hours irrespective of the order of surgery. Patients with existing comorbidities were operated on earlier during the day, while the other patients waited for their turn. On occasions patients had to wait until 15:00 hours to be transferred to the theatre department. This lengthy waiting time added to patients' anxiety and caused frustration. Some patients have refused to undergo surgery due to the anxiety which increased during the delay.

According to local hospital policy, a patient whose surgery is cancelled by the anaesthetist or the surgeon needs to be notified by the consultant surgeon. Although the surgery would usually have been cancelled very early in the day, there have been instances where the consultant surgeon was busy with other operations and unable to communicate to the patient until 13:00 hours. The patient would have been left unaware of the cancellation and remained fasting until they were eventually notified of the cancellation. This type of situation causes undue anxiety for the patient and their family.

3.6 The Preoperative Assessment Tool

The Association of Anaesthetists of Great Britain and Ireland (AAGBI) recommends using a protocol guided assessment tool for use in the preoperative assessment clinics (Guideline, 2010). The author, in consultation with the hospital management and department of anaesthesiology, proposed to adopt the tool that is successfully being used in one of the other hospitals in the group. The tool was reviewed by a team of consultant anaesthetists and modified to suit local policies and guidelines. It is a comprehensive care pathway with sections to be completed at various stages from the initial visit to the clinic until discharge from the hospital after the operation. The nursing staff involved was trained to use the tool. The tool is presented in full in Appendix A.

Table 3.1: Sections of the Preoperative Assessment Tool

SECTIONS OF THE PREOPERATIVE ASSESSMENT TOOL		
SECTIONS	COMPLETED BY	TIME OF COMPLETION
Preoperative visit	Preoperative nurse	Initial visit to clinic
Preoperative visit	Anaesthetist	Initial visit to clinic
Day of Surgery	Day ward nurse	On arrival to day ward
Day of Surgery	Theatre nurse	On arrival to theatre
Day of Surgery	Discharge nurse	On discharge from the day ward

The patients go through four different areas of care. Using one care pathway for the entire perioperative period can ensure continuity of care and enhance patient safety.

3.7 The New Preoperative Assessment Clinic

The new protocol guided nurse-led POA clinic runs twice a week. It is being staffed by the nurses on the day ward who willingly took up the role to pre-assess patients. Patients requiring review by the anaesthetist are seen by the anaesthetist on-duty on the same day where possible. There were very few occasions where a second appointment to be seen by the anaesthetist was necessary. This arrangement of staffing by the existing nurses and anaesthetists has eliminated the need for a new complement of staff for the clinic. Training is being provided on an ongoing basis to ensure staff competence. Currently patients are being reviewed approximately ten days before their surgery.

If a patient is deemed unfit for surgery or anaesthesia by the surgeon or the anaesthetist, the patients are directly referred to the University hospital attached to the group for further evaluation and their GP is notified.

The introduction of the clinic has allowed for staggered admission times throughout the morning, so that the waiting time in the day ward prior to transfer to the theatre department is reduced, thereby reducing patients' anxiety and stress levels. The scheduling system has also improved by assigning surgical block times.

Surgical Block Times: The hospital assigns a specific operating room on a specific day to a surgeon or surgical group. The surgeon or group then schedule its cases for that room and day. This arrangement has allowed surgeons to plan their theatre list based on the length of time they need for each operation, thus over booking of surgeries is prevented (Miller et al., 2014).

3.8 Conclusion

The chapter firstly presented the problem and the motivation for the study. It then described the study setting and the patient referral pathway prior to the introduction of the new clinic. It also included an overview of the new preoperative assessment clinic and

the tool. The author's role was immense in the restructuring of the existing POA clinic and implementation of the tool. However, the clinic gained momentum with the support from all parties involved. The next chapter illustrates how a methodology was chosen to assist the author to carry out the research to meet the aims and objectives of the study.

Chapter 4 **METHODOLOGY**

4.1 Introduction

This chapter delineates the research design and the methodology depicting how data will be collected and analysed to answer the research question. The primary aim of the study was to ascertain the impact of a preoperative assessment on surgical cancellations and operating theatre efficiency in the study setting.

4.2 Research Approach

There are various approaches to research. Discerning and setting a research paradigm can help the researchers to explain their set of beliefs. Paradigms also influence the way in which the research is done. This can often be complex and hard to conceptualise. "Research paradigm is a perspective that is based on the set of shared assumptions, values, concepts and practices" (Johnson and Christensen, 2008).

Paradigm: "a theory or a group of ideas about how something should be done, made or thought about" (Dictionaries). A good understanding of the paradigms guides the researcher through the research process and helps in identifying the method that will best answer the research question. Some of the research paradigms are:

) *Postpositivist (and Positivist) Paradigm*

Positivism refers to '*scientific methods*' or '*scientific research*'. Positivist and postpositivist research associates with quantitative methods of data collection and analysis (Mertens, 2005).

) *Interpretivist/Constructivist Paradigm*

This approach of research intends to understand "the world of human experience" (Cohen et al., 2013). The interpretivist/constructivist researcher relies upon "participants' views of the situation being studied" (Creswell, 2013). The researcher depends upon qualitative methods of data collection and analysis and in some studies both quantitative and qualitative methods (mixed methods) can be used.

) ***Transformative Paradigm***

The researchers "believe that enquiry needs to be intertwined with politics and a political agenda" and contain an action agenda for reform "that may change the lives of the participants, the institutions in which individuals work or live, and the researcher's life" (Creswell, 2013). Quantitative and qualitative methods of data collection and analysis are used by transformative researchers.

) ***Pragmatic Paradigm***

The researchers' focus is on the 'what' and 'how' of the research problem. Here the research problem is considered central. The potential method which will answer the research question and provides an understanding of the problem is chosen for data collection and analysis, which could be quantitative, qualitative or mixed methods.

4.3 Research Design and Methods

A research design is a "set of advance decisions that make up the master plan specifying the methods and procedures for collecting and analysing the needed information" (Denscombe, 2010). Selecting the appropriate research design is influenced by the research question, personal experiences of the researcher and the observers of the study (Creswell, 2013).

There are three main types of research methods:

) ***The Qualitative Research Method*** interprets data through observations and interviews (Kawulich, 2005). This method is subjective and can be biased at times. The decisions are personal choices made by the participants (Jamshed, 2014).

Types of Qualitative Research:

- © Case study
- © Grounded theory
- © Phenomenology
- © Ethnography
- © Phenomenology

) **The Quantitative Research Method** tests objective theories by examining the relationship among the variables. This method is objective and independent. It is a statistical research which is a derivative of numbers that are mathematically measured (Creswell, 2013).

Types of Quantitative Research:

- ❖ Descriptive
- ❖ Correlational
- ❖ Quasi experimental
- ❖ Experimental

) **The Mixed Methods Research** is an enquiry that combines quantitative and qualitative forms. It applies philosophical assumptions of pragmatism and uses both quantitative and qualitative approaches, thus the effectiveness of the study is superior to studies that either use quantitative or qualitative methods (Creswell and Clark, 2007).

There are contradictory opinions regarding quantitative and qualitative methods. Some researchers claim that qualitative researchers are subjectivist (Little, 2013) while many researchers consider the quantitative method as a positive approach (Garbarino and Holland, 2009). Conversely the quantitative method could be biased if the response rate is low (Driscoll et al., 2007).

4.4 Statement of the Problem

There is a need to determine the impact of preoperative assessment on surgical cancellations and operating theatre efficiency.

POA clinics were initially established to optimise a patient before anaesthesia and surgery (Kopp, 2000). The patients' needs are carefully considered and a thorough assessment of the patient is carried out in the POA clinic. This has demonstrated an increase in patient satisfaction (Hepner et al., 2004) and improved patient safety (Parker et al., 2000). These visits also minimise preoperative consults and unnecessary laboratory testing, thereby

increasing hospital resource utilisation (Starsnic et al., 1997). These benefits of a POA clinic visit are well known, but whether or not the visit influences the reduction in the number of cancellations on the day of surgery is still being studied (Ferschl et al., 2005).

4.5 Research Question

What is the impact of preoperative assessment on surgical cancellations and operating theatre efficiency?

In order to answer the research question the reasons for cancellation had to be categorised, therefore the following question had to be answered:

What are the reasons for surgical cancellations?

4.6 Purpose of the Study

The purpose of this study is to examine the impact of a preoperative assessment clinic on surgical cancellations and operating theatre efficiency in the study setting. It will evaluate if there has been a reduction in the number of surgical cancellations and if the operating room efficiency improved due to the implementation of a preoperative assessment clinic. The author also aspires to:

- ❖ Classify the reasons for cancellation.
- ❖ Enumerate cancellation rates pre and post implementation of the clinic.
- ❖ Compare theatre efficiency pre and post implementation of the clinic.
- ❖ Identify reasons for surgical cancellations post implementation of the clinic.

4.7 Research Design of this Study and Justification of Choice

Unlike a true experimental study which includes all of the following design elements: pre-test/post-test design, a treatment group and a control group, and a random selection of participants, this study lacks some of the elements, hence it can be categorised as a quasi-experimental study.

4.8 Research Methods

Creswell (2013) states that each research proffers various forms of data collection, analysis and interpretation; these together are called research methods. The initial literature review helped the author to understand preoperative assessment. Similarly the review helped to understand how surgical cancellations and operating theatre efficiency are quantified and measured.

4.8.1 Study duration

This is a hospital based study, conducted over a period of 11 months in a model 2 hospital from July 2015 to May 2016. The new protocol guided preoperative assessment clinic started functioning in February 2016. The study setting has been described in Chapter 3, Section 3.4. The study necessitated two parts:

- ❖ Pre-interventional period
- ❖ Post-interventional period

Pre-interventional Period

The period of study prior to implementation of the preoperative assessment clinic is the pre-interventional period. The duration of the pre-interventional phase was 7 months, from July 2015 to January 2016.

Post-interventional Period

The period of study after the implementation of the preoperative assessment clinic is the post-interventional period. The duration of the post-interventional phase was 4 months from February 2016 to May 2016.

4.8.2 Data collection

Sampling – pre-interventional phase

Data collection for this study relied upon three sources; the medical notes, theatre register and the theatre list. These sources of data are described in this section. A retrospective

review of medical notes of all patients that were cancelled was conducted to describe the reasons for cancellations on the day of surgery. The cancelled cases were identified by cross checking the theatre list against the theatre register. The theatre register holds details of all patients who were listed for and underwent surgery. Any patient who was listed for surgery but whose name did not appear on the theatre register was considered as a cancelled case.

The medical notes

The medical notes are a comprehensive record of all patient care. In this instance the author used the medical notes to learn the reasons for cancellations on the day of surgery. The reasons were usually documented in the clinical notes section, however, they were also sometimes documented in the other sections such as the surgical notes section and the anaesthetic section.

The theatre register

The theatre register serves as a valuable source of information. In the study setting the theatre register is a manual record. Details entered in the theatre register are summarised in the following table.

Table 4.1 Details of Information Entered in the Theatre Register

DETAILS OF INFORMATION ENTERED IN THE THEATRE REGISTER				
TIME	Time in: (Time of patient's arrival into theatre)	Start time: (Actual start time of the procedure)	End time: (End time of the procedure)	Time out: (Time of patient's discharge from the theatre)
PATIENT DETAILS (DEMOGRAPHICS)	Name:	Date of birth: Sex:	Hospital number:	Address:
PERSONNEL DETAILS	Surgeon(s):	Anaesthetist(s):	Nurse(s):	
PROCEDURE DETAILS	Name of the procedure(s) carried out:			

The theatre list

The theatre list provides information on the procedures that are to be performed in a given day. In the study setting the list is printed and circulated to the operating theatre department, the day ward and the administration department. The list for the following day is available by 3pm every afternoon. The theatre list provides details of the patient, surgeon, type of anaesthetic and the proposed procedure.

4.8.3 Data collection – pre-intervention phase

Cancelled cases

The number of cancelled cases prior to the implementation of the clinic was calculated utilising the theatre register and the theatre list. Schofield et al (2005) defined cancelled

cases as “any operation that was scheduled on the final theatre list generated at 3pm the previous day and that was not performed on that day”. The same definition was adopted in this study as the methodologies of the two studies were similar. The theatre list and the theatre register were cross checked to establish if all the names on the theatre list appeared on the theatre register. Any name that did not appear on the register was considered as cancelled.

Reasons for cancellation

A retrospective review of medical notes of surgeries that were cancelled was performed to classify and categorise the reasons for cancellation. McKendrick et al., (2014) grouped the cancellations into two; those that were affected by preoperative assessment and those that were not. Fayed et al., (2016) classified the reasons of cancellation as patient related, preoperative preparation related and hospital related. Garg et al., (2009) broadly classified the reasons for cancellation into; lack of operating room time, medical reasons, patient did not arrive, change in surgical plan, administrative reasons and miscellaneous reasons.

Based on the above studies, the author of this study categorised cancellations as either potentially hospital related or patient related reasons. These were further classified as avoidable and unavoidable cancellations.

During the retrospective chart review the author found that the reasons were poorly documented. In some charts there was no record of cancellation. In such cases the author had to profoundly investigate all sections of the chart such as the radiology and laboratory investigation sections to verify if any results were abnormal and further examine correspondence letters to other departments or GPs to establish whether reasons for cancellation were documented in these letters.

Section 5.3 summarises the reasons for surgical cancellations in the study setting.

Operating Theatre efficiency

A retrospective review of the theatre register was carried out to track the first case start times. Ferschl et al., (2005) chose the first case start time to identify delays; for these delays

are probably due to problems with the scheduled first patient themselves rather than a delay caused by the previous case in the theatre. Delay in starting the first case signifies problems with patient preparation for surgery. The author adopted the same method to capture the first case start time in the study setting. Cases usually begin between 8.15am and 8.30am. Any case that started after this time was considered a delayed start.

An average of the total number of surgeries that were performed each day was obtained by totalling the number of surgeries carried out per day. The theatre register was used as a data source.

4.8.4 Implementation of preoperative assessment clinic and tool

The present preoperative assessment clinic started functioning in February 2016. The clinic setup and tool were described in sections 3.5 and 3.6 respectively. Since February 2016, **all** patients scheduled for surgery are referred to the preoperative assessment clinic in order to evaluate the impact of the preoperative assessment on surgery cancellations and theatre utilisation. During the pre-interventional period referral to the clinic was the subjective decision of the surgeon. Approximately 9.61% of patients were preoperatively assessed in the pre-intervention period.

4.8.5 Data collection - post-interventional phase

Cancelled cases

Since the implementation of the new preoperative assessment regime cancelled cases are logged in a register kept in the theatre department. The senior nurse on duty records the cancellations. The author reviewed the register at the end of each day to ensure that all cancellations are documented. Any patient who was listed for an operation and did not arrive to the theatre department was considered as a cancelled case.

Reasons for cancellation

The reasons for cancellation are recorded in a register kept on the day ward. In their study, Schofield et al. (2005) recorded cancellations in a form which had a column for

'classification and comment'. The author designed a similar register to record the reasons for cancellations. The details included were 'patient demographics', 'proposed surgery', 'reason for cancellation', 'cancelled by' and 'comments'. The reasons for cancellation were categorised as those that were potentially avoidable and those that were not, and also as cancellations affected by preoperative preparation and those that were not. A follow up of cancelled cases through a review of medical notes was carried out by the author to ensure that the reasons for cancellation were recorded appropriately. Any inconsistencies were further investigated and tracked. Chart reviews were carried out where necessary.

Operating Theatre efficiency

A weekly review of the theatre register was performed by the author to ascertain the first case start time. The theatre department had always maintained a record of delays in start times. The reasons for delay in starting the cases were obtained from this register. Cases that over ran the allocated time were also recorded to observe the implications they had on the daily functioning of the theatre department. Theatre efficiency i.e. the number of surgeries performed per day were measured by comparing the throughput of patients through the department during the pre and post intervention period.

4.9 Categorisation of the Reasons for Cancellation

As stated in section 4.8.5, the reasons for cancellations during the post-interventional phase were documented by nurses in the register kept in the day ward. This register was kept on the day ward rather than the theatre department because the nurses on the day ward had more access to information regarding the patient and the plan of action if a cancellation occurred. The theatre nurses were often only informed that the cancellations had been made, the reasons may or may not have been communicated to them. The reasons were recorded in text format. Interpreting this data to categorise them into reasons was an exhaustive task as data was sometimes incomplete and, from time to time, needed further in-depth investigation and follow up with surgeons, anaesthetists and clerical staff to obtain clearance and clarification. Section 5.3 gives examples of the text entered by staff and how it was categorised.

4.10 Data Analysis

Data analysis begins after carrying out preliminary observation (Strauss and Corbin, 1990) and is conducted to condense, systematise and give meaning to the data (Polit and Beck, 2008). Descriptive statistics are used to arrange, understand and present data (Weiss and Weiss, 2012). The use of descriptive statistics measures the relationship between two or more sets of data (De Vaus and de Vaus, 2001).

Microsoft Excel offered ease of use for analysis and comparison of data. The results are presented in statistical tables, pie charts and bar charts to illustrate the relationship between the two groups.

The *z-score test for two population proportions* and the *Chi-square test* were used to compare the difference in the various categories of cancellations i.e. avoidable vs unavoidable and hospital related vs patient related during the pre and post intervention period.

4.10.1 Hypothesis testing

A hypothesis is described as a statistical procedure intended to test a claim (Dures et al., 2011).

Marshall et al., (2014) have described the null hypothesis (H_0) as where the researcher tries to contradict or nullify. The alternative is (H_1) which is opposite to null hypothesis.

The null hypothesis for this study is:

H_0 - There is no significant difference between pre-implementation and post-implementation of the preoperative assessment clinic.

The alternative is:

H_1 - There is a significant difference between pre-implementation and post-implementation of the preoperative assessment clinic.

A p-value of < 0.05 was considered significant.

4.11 Ethics Approval

A research proposal was submitted to the hospital clinical governance committee. The committee deemed ethical approval not to be necessary.

4.12 Conclusion

This chapter has given an overview of the research design and approach used to answer the research question. This study used the quasi-experimental study design, descriptive statistics and Z-score testing for two population proportions for analysis of the data. Data collection methods during the pre and post implementation phase have also been described. The next chapter presents the results.

CHAPTER 5 DATA ANALYSIS AND RESULTS

5.1 Introduction

The purpose of this study was to evaluate the impact of preoperative assessment clinics on surgical cancellations and operating theatre efficiency. This chapter will outline the reasons for cancellations and how they were categorised. This will be followed by examining the rates of cancellation which are presented through a comparative analysis of data that was collected during the pre and post interventional period. Operating theatre efficiency is examined towards the end of this chapter. Appropriate tables and figures are used to enhance the understanding of all who read this chapter.

5.2 Number of Patients

During the 11 month period of the study from July 2015 to May 2016, a total of 1,422 patients were scheduled for elective surgery. 728 of those were during the pre-intervention period from July 2015 to January 2016 and 694 were during the post implementation period from February 2016 to May 2016. Of the 728 patients 70 (9.61%) underwent preoperative assessment during the pre-implementation period. Of the 694 patients 679 (97.83%) patients underwent preoperative assessment during the post implementation period.

5.3 Preoperative Assessment Rates – Pre and Post Intervention Period

In the course of the 11 months from July 2015 to May 2016 a total of 1,422 patients were scheduled for elective surgery, 728 during the pre-interventional period from July 2015 to January 2016, and 694 during the post interventional period from February to May 2016. The number of patients preoperatively assessed during the pre-interventional period were 9.61% ($n = 70/728$) and in the post-interventional period was 97.83% ($n = 679/694$). An 88.22% increase in the number of patients being preoperatively assessed has been demonstrated. Change of hospital protocol to preoperatively assess every patient scheduled for surgery from February 2016 accounts for this notable increase in patients being pre assessed.

The preoperative assessment clinic that originally existed ran a half a day session on the first Monday of every month with a throughput of 8-10 patients per session. The new preoperative assessment clinic has two full day sessions per week, led by nurses and driven by definitive protocols. All patients are first seen by the nurses. If any patient requires further review e.g. for an ASA physical status score <3 (ASA physical status score has been discussed in Section 2.8.2 and in Table 2.2) or for any underlying conditions like epilepsy they are referred onto the anaesthetist who then schedules the patient for surgery after the appropriate work up. The table below presents the percentage of patients pre-assessed during the pre and post-interventional period.

Table 5.1 Pre-operative Assessment Rates - Pre and Post Intervention Period

Pre/Post Intervention	Total Number of Patients	Number of Patients Pre-assessed	% of Patients Pre-assessed
Pre-intervention period	728	70	9.61%
Post-intervention period	694	679	97.83%

5.4 Cancellation Rates Pre and Post Intervention Period

The cancellation rate during the pre-intervention period was 16.2% (n = 118/728) and during the post intervention period was 6.48% (n = 45/694). There has been a notable 9.36% reduction in the number of cancellations. This was confirmed using the Z score calculator for two population proportions. The proportion of cancellations (Z value) during the pre-intervention period was 6.169 and Z value during the post-intervention period was 1.066. The P value is 0.001, the result is significant at P <0.05.

Table 5.2 Cancellation Rates Pre and Post Intervention Period

Pre/Post Intervention	Total Number of Patients	Number of Patients Cancelled	% of Patients	Chi - Square
Pre-intervention period	728	118	16.20 %	33.107 Df = 1 P<.005
Post-intervention period	694	45	6.48%	

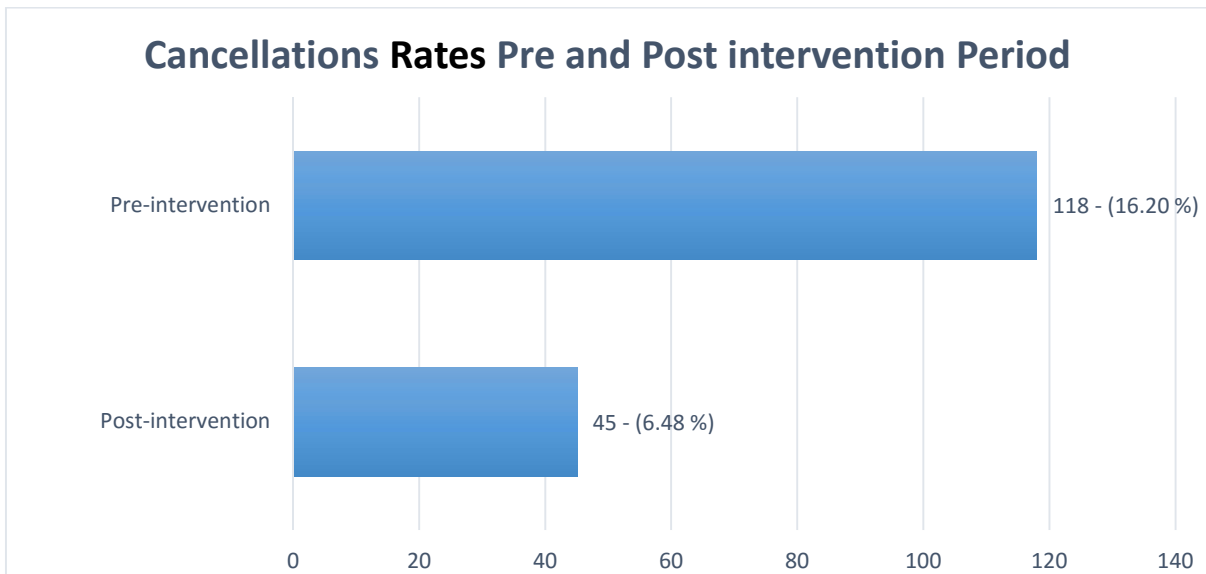


Figure 5.1: Cancellation Rates Pre and Post Intervention Period

5.5 Classification of Reasons for Cancellation

One of the aims of this study was to understand the reasons for surgical cancellations in the study setting. The reasons for cancellation during the pre-intervention period were obtained through a retrospective chart review and during the post-intervention period from a register maintained in the day ward (Appendix B).

The following tables show some of the reasons entered in the patients' notes by the doctors. The tables also show what category the author grouped them into. Table 5.3 demonstrates the pre-intervention period and Table 5.4 demonstrates the post intervention period.

Table 5.3 Data Obtained for Reasons of Cancellations – Pre-Intervention Period

Data from Medical Notes	Interpretation by Author
1. “Needs cardiology review”	Incomplete medical evaluation - Here the patients needed to be reviewed by a cardiologist in view of conditions such as Atrial Fibrillation, presence of cardiac implants such pace maker, valvular heart disease and other cardiac conditions.
2. “Needs medical review”	Incomplete medical evaluation - Here the patients needed to be reviewed by medical doctors for reasons such as sleep apnoea, morbid obesity and acute respiratory infections.
3. “Cancelled – BSL 13.4”	Abnormal blood test results - The Blood Sugar Level of the patient was 13.4 mmol/L (millimols/litre). The normal blood sugar levels are 4-7 mmol/L. The blood sugar levels have to be within the normal range for the surgery to be performed without any complications.
4. “Cancelled DNA”	Patient did not arrive - The patient did not arrive to the hospital on the morning of the operation.
5. “Bloods unavailable”	Needs further investigation - Some patients require certain blood tests to be carried out prior to surgery. These blood tests were not performed.

Table 5.4 Data Obtained for Reasons of Cancellations – Post-Intervention Period

Data from Cancellation Register	Interpretation by Author
1 “Cancelled ↑ blood pressure”	<p>Needs further optimisation</p> <p>The blood pressure needs to be within the normal range for proceeding safely with the surgery. Here the patient’s blood pressure was considered high and unsafe to undergo the operation.</p>
2 “Cancelled – needs further work up”	<p>Incomplete surgical evaluation</p> <p>Some surgeries e.g. Varicose vein removal might need duplex scanning (ultrasound) of the limb to be operated on. In this instance the scan was not performed prior to the date of the operation, therefore the surgery had to be cancelled.</p>
3 “Rescheduled”	<p>Change in treatment plan</p> <p>The patient here needed two surgical procedures that required two different consultant surgeons. One of the surgeons’ was not available on that day. Therefore the surgery was cancelled to avoid the patient undergoing anaesthesia twice.</p>
4 “Consultant not available – Patient refused procedure”	<p>Patient refused procedure</p> <p>Here the patient refused to be operated on by the other surgeons on the team. The consultant was busy at that time operating on a different patient.</p>
5 “Cancelled, X-ray machine broken”	<p>Equipment failure</p> <p>Some procedures require the use of ‘X-ray’ during the procedure.</p>

5.6 Categorisation of the Reasons for Cancellation

The author classified the reasons into the following main categories, those that were potentially avoidable or unavoidable and then those that were hospital related or patient related.

Table 5.5 Categorisation of Reasons for Cancellation

Hospital Related	Patient Related
Avoidable	
Change in Treatment Plan	Did Not Arrive
Incomplete Medical Evaluation	Patient Changed Mind
Incomplete Surgical Evaluation	Patient Refused Procedure
Needs Further Investigation	
Needs further Optimisation	
No Operating Theatre Time Available	
Unavoidable	
Equipment Failure	Change in Medical Status
No Surgeon Available	Abnormal Blood Test Results
	Change in Medical Status

5.7 Chi-square Test on Cancellations

The contingency table below provides the following information: the number of cancellations in each category during the pre and post intervention period and the chi-square statistic for each category.

Results: The Chi-square statistic is 36.4056. The P-value is < 0.00001. The result is significant at $P < .05$.

Table 5.6 Chi-square Test on Cancellations

Chi-square Test on Cancellations						
	Total Number of Cancellations	Hospital Related	Patient Related	Avoidable Reasons	Unavoidable Reasons	Row Totals
Pre-intervention period	118 (118.00) [0.00]	79 (81.80) [0.10]	39 (36.20) [0.22]	106 (91.94) [2.15]	5 (26.06) [7.59]	354
Post-intervention period	45 (45.00) [0.00]	34 (31.20) [0.25]	11 (13.80) [0.57]	21 (35.06) [5.64]	24 (9.94) [19.89]	135
Column Totals	163	113	50	127	36	489 (Grand Total)

5.8 Reasons and Rates of Cancellation – Pre-Intervention Period

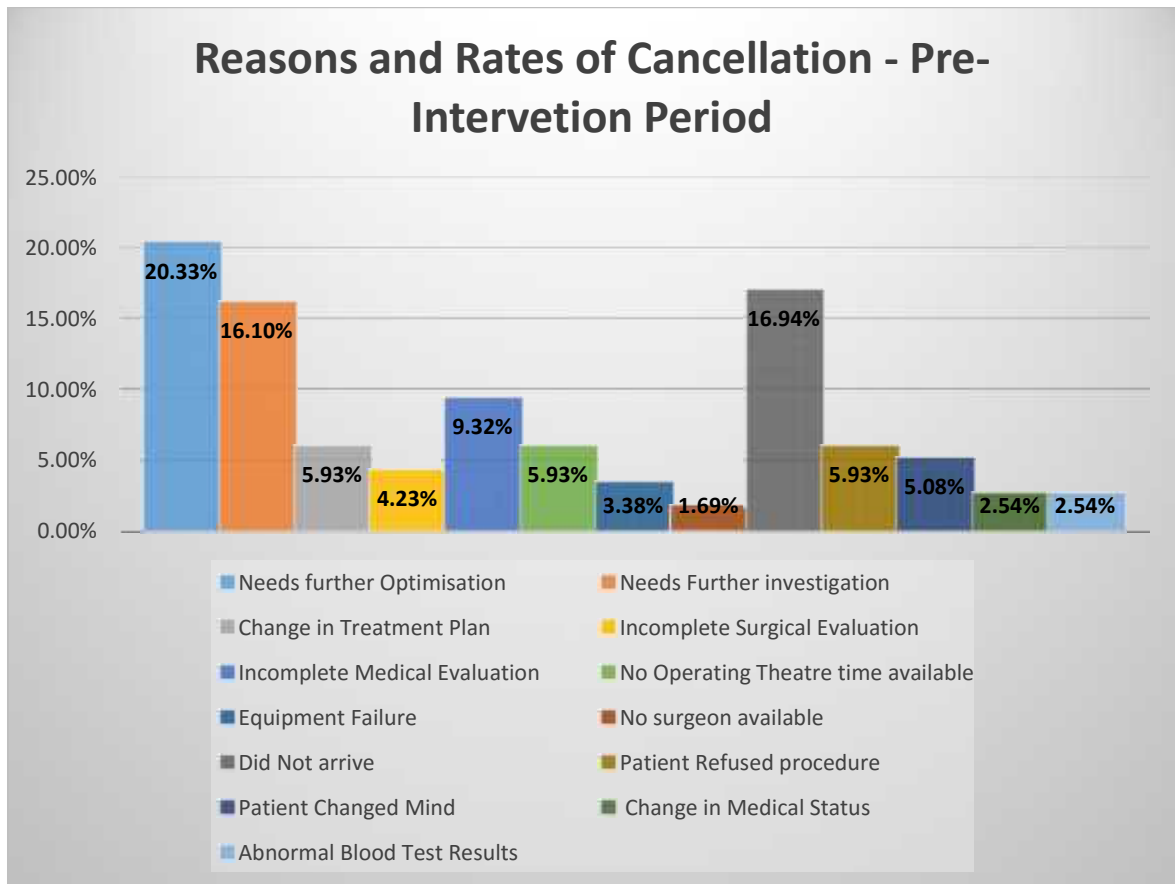


Figure 5.2 Reasons and Rates of Cancellation Pre-Intervention Period

Of the 118 cancellations during the pre-intervention period, patients requiring further optimisation accounted for the highest number of cancellations (20.33%). The second highest reason for cancellation was due to patients who did not arrive for the operation (16.94%), followed by 16.10% of patients who needed further investigations. 9.32% of the cancellations were due to incomplete medical evaluation. Figure 5.2 graphs the reasons and rates of cancellation during the pre-interventional period.

5.9 Reasons and Rates of Cancellation Post-intervention Period

Of the 43 cancellations during the post intervention period, equipment failure accounted for the highest number of cancellations at 44.44%. This was due to the breakdown of the X-ray machine, which resulted in the cancellation of two theatre sessions of ten patients each in the month of April. 8.88% of cancellations were due to patients needing further optimisation and a further 8.88% was due to patients not arriving for the operation. Approximately, 6.66% of the cancellations were due to patients requiring further investigations. Mandatory preoperative assessment of all surgical patients from February 2016 has demonstrated a 9.72% reduction in cancellations compared to the pre-interventional period. Figure 5.3 graphs the reasons and rates of cancellation during the post-intervention period.

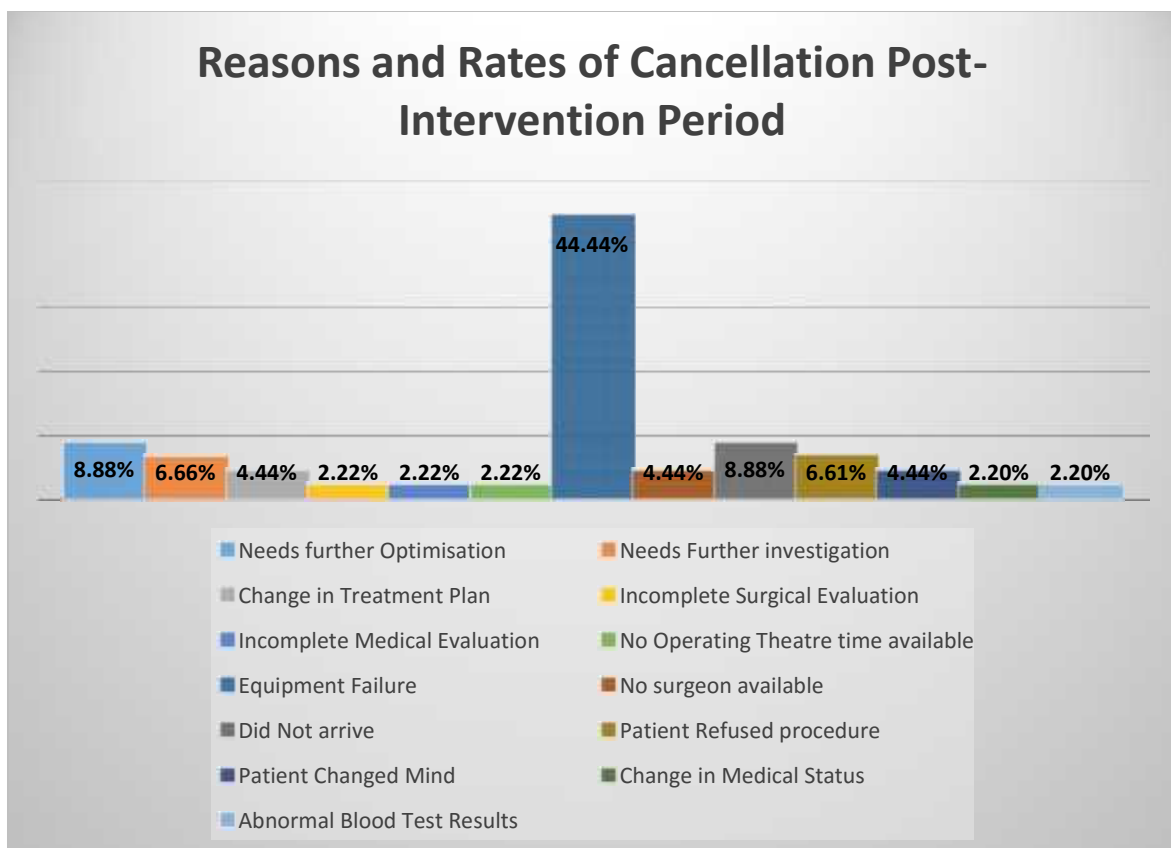


Figure 5.3 Reasons and Rates of Cancellation Post-Intervention Period

5.10 Comparison of Cancellation Rates Pre and Post-Intervention Period

A remarkable reduction in cancellations during the post-intervention period can be witnessed, especially in reasons for cancellation associated with preoperative assessment such as needs optimisation with approximately 11.45% of a reduction and a 9.45% reduction in patients requiring further investigations. A high percentage (44.44%) of patients was cancelled during the post-implementation period due to equipment failure. Table 5.7 presents the comparison of the percentage of cancellations during the pre and post-interventional period.

Table 5.7 Comparison of Cancellation Rates Pre and Post-Intervention Period

Comparison of Cancellation Rates Pre and Post-Intervention Period				
Reasons for Cancellation	Cancellations Pre-intervention Period		Cancellations Post-intervention Period	
	Number	(%)	Number	(%)
Needs further Optimisation	24	20.33%	4	8.88%
Needs further Investigation	19	16.10%	3	6.66%
Change in Treatment Plan	7	5.93%	2	4.44%
Incomplete Surgical Evaluation	5	4.23%	1	2.22%
Incomplete Medical Evaluation	11	9.32%	1	2.22%
No Operating Theatre Time Available	7	5.93%	1	2.22%
Equipment Failure	4	3.38%	20	44.44%
No Surgeon Available	2	1.69%	2	4.44%
Did Not Arrive	20	16.94%	4	8.88%
Patient Refused Procedure	7	5.93%	3	6.61%
Patient Changed Mind	6	5.08%	2	4.44%
Change in Medical Status	3	2.54%	1	2.20%
Abnormal Blood Test Results	3	2.54%	1	2.20%

The figure below graphs the comparison of cancellation rates during the pre and post-intervention phase.

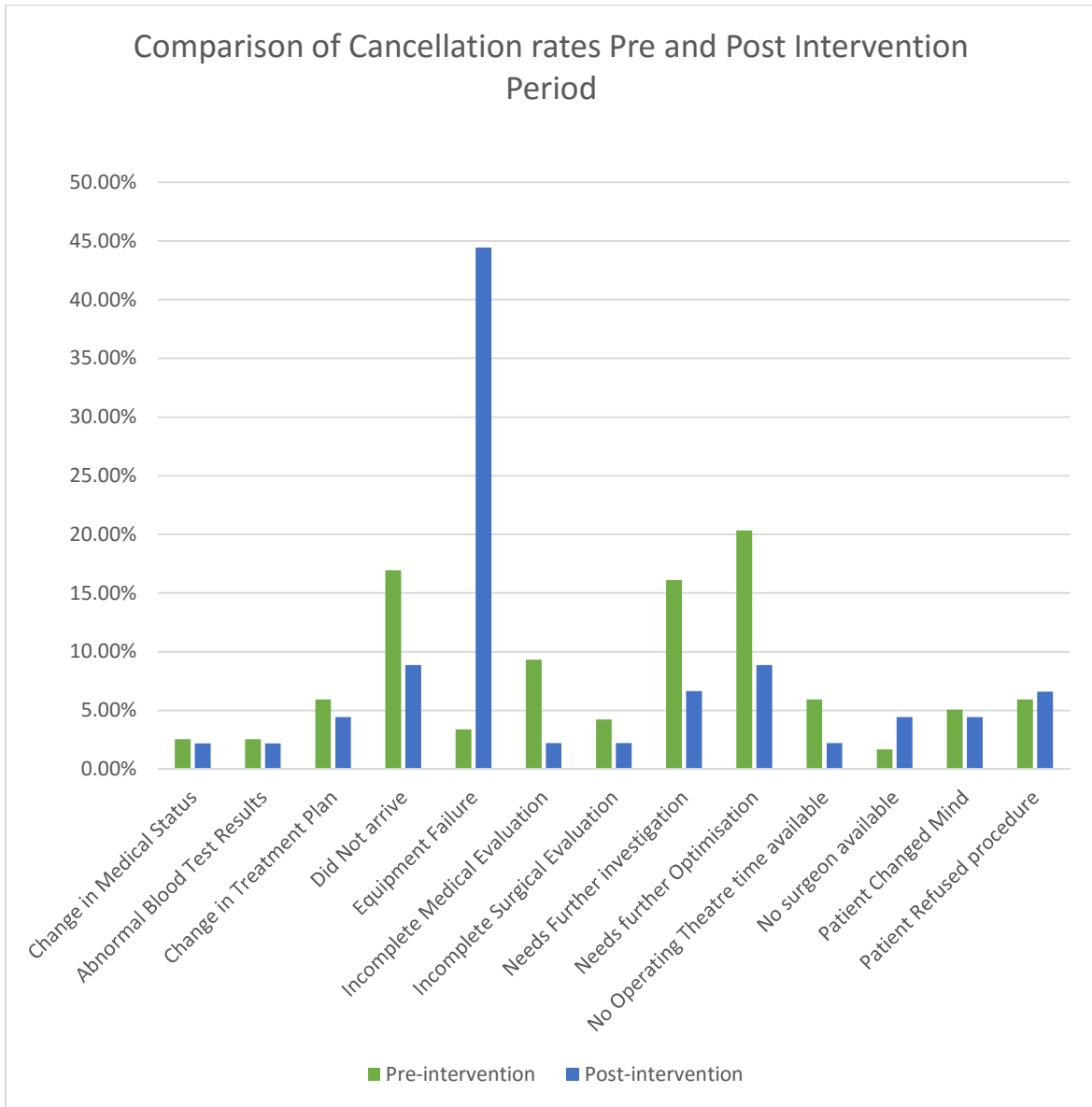


Figure 5.4 Comparison of Cancellation Rates Pre and Post-Intervention Period

Excluding equipment failure, it is evident that during the post-intervention period, cancellations due to ‘need of further optimisation’ were reduced by 11.45%, ‘needing further investigation’ by 9.44%, ‘incomplete medical evaluation’ by 8.06% and ‘non-arrival of patients’ by 7.10%. Cancellations due to the same reasons were considerably high during the pre-intervention phase.

A significant reduction in cancellations due to other reasons is also evident during the post-intervention phase. The Chi-square test confirms the statistical significance - the P-value is < 0.00001. The result is significant at P<.05. (Calculations shown in Table 5.6)

5.11 Operating Theatre Efficiency Pre and Post-Intervention Period

A total of 1,422 patients were scheduled for surgery during the 11 month study period, 728 and 694 patients during the pre and post intervention period respectively. The actual number of surgeries performed excluding cancellations during the pre-intervention period (July 2015 to January 2016) was 610 and the number of surgeries performed during the post intervention period (February 2016 to May 2016) was 651.

Table 5.8 Operating Theatre Efficiency Pre and Post-Intervention Period

Operating Theatre Efficiency Pre and Post-Intervention Period			
Pre/Post Intervention	Total Number of Surgeries Scheduled	Total Number of Surgeries Performed	% of Scheduled Surgeries Performed
Pre-intervention Period	728	610	83.79%
Post-intervention Period	694	651	93.80%

Statistical significance was calculated using Z score for two population proportions, the Z-score is -5.9564, P value is 0.0001, the result is significant at P<0.05.

There was an average of 19 cases performed each week during the pre-intervention period, and 38 cases during the post intervention period. The number of cases performed per day had effectively doubled i.e. from 3.8 per day during the pre-intervention period to 7.6 per day during the post-intervention period. The mandatory preoperative assessment of all surgical patients has facilitated an efficient scheduling system by assigning surgical block times (discussed in section 3.7) which resulted in an increase of throughput of patients to

the theatre department during the post interventional period. The staff complement of the theatre remained the same during the pre and post intervention period but the efficiency doubled using the same resources.

Table 5.9 Chi-square Calculation for Operating Theatre Efficiency

	Number of Weeks	Number of Surgeries Performed per Week	Marginal Row Totals
Pre-intervention Period	31 (22.86) [2.9]	19 (27.14) [2.44]	50
Post-intervention Period	17 (25.14) [2.64]	38 (29.86) [2.22]	55
Marginal Column Totals	48	59	105 (Grand Total)

The chi-square statistic is 10.2017. The p-value is .001403. This result is significant at $p < .05$.

A review of the theatre register was carried out to examine the arrival time of the first patient into the theatre department. The median arrival time during the pre-intervention phase was 08:43 hours (interquartile range, 08:33 – 08:53), whereas during the post-intervention phase the median first patient arrival time was 08:27 hours (interquartile range, 08:17 – 08:37).

5.12 Conclusion

In summary, the findings of this study show that the introduction of the mandatory preoperative assessment of all patients in the protocol-led preoperative assessment clinic has reduced the number of cancellations. There has been a significant (9.72%) reduction in cancellations in the post-intervention period. The reasons for cancellation have been categorised and a comparison made between the rates of cancellation during the pre and post-intervention period.

Theatre efficiency has also improved, the throughput of patients through the department has almost doubled, the number of cases performed per week during the post-intervention

period improved to 93.80% from 84.95% during the post-intervention period. The first patient arrived to the theatre department ten minutes earlier during the post-interventional period. In conclusion the introduction of mandatory pre-operative assessment has reduced the overall cancellations on the morning of the operation. However, operating theatre efficiency could be further improved by implementing effective scheduling by assigning surgical block times.

CHAPTER 6 DISCUSSION

6.1 Introduction

This chapter presents a review of the findings of this research from the data analysis undertaken in the previous chapter and associates it with the secondary data obtained through the literature review in the second chapter. It then presents a comprehensive discussion on the findings and its effects. The results in relation to each objective of this study i.e. the reasons for the cancellations, the rates of cancellation and the operating theatre efficiency are discussed in detail, consistent with international literature. The implications of this research to the study setting such as what happens to the cancelled patients and staff morale are discussed. Finally, the prospects of an electronic preoperative assessment tool are also discussed.

6.2 The Research Question

What is the impact of preoperative assessment on surgical cancellations and operating theatre efficiency?

This question was answered by initially examining and categorising the reasons for surgical cancellations in the study setting and then by comparing the rates of cancellation during the pre and post-interventional period. Operating theatre efficiency has also been compared.

6.3 Classification of Reasons for Surgical Cancellations

This section discusses how the cancellations were classified by the author in the present study and how other authors of similar studies have classified the reasons for cancellation. This study has broadly categorised the reasons for cancellations into hospital related and patient related. These were further classified into potentially avoidable reasons and unavoidable reasons. It was realised that preoperative assessment had an influence on all hospital related and patient related avoidable reasons for cancellation. Trentman et al., (2012) in their study had used a similar type of classification.

Many studies have classified reasons for surgical cancellations based on the nature of surgeries performed, facilities available such as number of theatres available and if preoperative assessment was carried out or not. In this current study it was necessary that comparisons be made between the pre and the post-intervention period. The data for the pre-intervention period was collected through retrospective chart reviews as there was no approved or agreed means of recording cancellations. Therefore the classifications were primarily based on hospital related reasons or patient related reasons.

Fayed et al., (2016) in their study, specified 'need for further optimisation', 'need for further investigation', 'abnormal blood test results' and 'change in treatment plan' as reasons for cancellations related to preoperative preparation. But this current study has grouped abnormal blood test results under patient related unavoidable reasons, as those patients who were cancelled due to abnormal blood test results were on anti-coagulant medications. Despite discontinuing these medications for the specified time according to the hospital protocol, these patients had abnormal test results on the morning of the operation. Hence, this could not be attributed as a preoperative preparation related reason for cancellation.

The McKendrick et al., (2014) classification process was based on those affected by preoperative preparation and those that were not. Those who were affected by preoperative preparation were very broadly classified into patient did not arrive, medical cancellations and patient cancellations. The present study has fragmented medical reasons for cancellation into ones such as 'needs further optimisation', 'needs further investigation' and 'incomplete medical evaluation'. This has helped in the follow up of cancelled patients i.e. referring them back to the appropriate clinics, surgeons or physicians etc. McKendrick et al., (2014) classified the reasons for cancellation unaffected by preoperative preparation into 'emergency', 'no bed', 'no time' and 'other reasons'. However, in this present study setting there are no emergency or inpatient surgeries being performed, therefore these reasons were inapplicable to the current study. Knox et al., (2009) classified hospital related reasons for cancellation into 'no bed', 'no intensive care bed' and 'emergency workload'. Yet again these reasons do not apply to the current study as there are no emergency or inpatient surgeries being performed. Whereas their patient related reasons

of cancellation such as 'did not arrive', 'patient refused procedure' and 'change of mind regarding surgery' were very similar to the present study.

6.4 Overall Cancellation Rates

This section discusses the overall rates of cancellation during the pre and post interventional period. One of the aims of this study was to examine the impact of preoperative assessment clinics on surgical cancellations. 'Does a visit to the preoperative assessment clinic reduce day of surgery cancellations?' is the question that many studies of this nature wish to answer. A number of studies have desired to record the impact of POA clinics on surgical cancellations (Pollard and Olson, 1999, van Klei et al., 2002, Correll et al., 2006).

This present study has shown a significant (9.72%) reduction in the number of surgical cancellations after the introduction of the new preoperative assessment clinic where the visit to the clinic was mandatory for all patients scheduled for elective surgery. The cancellations were reduced from 16.2% during the pre-intervention period to 6.48% during the post-intervention period. This result is consistent to that obtained by Freschl et al., (2005) where the cancellation rate was 16.2% for patients who were not preoperatively assessed. The cancellation rate was reduced to 8.4% when patients were preoperatively assessed. The results of the present study is also comparable to results demonstrated by McKendrick et al., (2014) where the cancellation rate was 9.7% prior to the introduction of the clinic and which was reduced to 8.6% after the introduction of the preoperative assessment clinic.

6.5 Reasons and Rates of Cancellation

This section discusses the cancellation rates and reasons in the study setting and what the reasons and rates of cancellation were in other similar studies. Preoperative assessment clinics appear to directly improve patient safety and satisfaction, however, their impact on surgical cancellations has only been briefly studied (Hepner et al., 2004a, Parker et al., 2000).

6.5.1 Cancellation due to hospital related avoidable reasons

This present study has found that the cancellations due to hospital related avoidable reasons have significantly reduced since the implementation of the new preoperative assessment clinic. Of the hospital related avoidable reasons the highest cancellations that had occurred were due to patients requiring further optimisation and patients requiring further investigations. These cancellations were reduced to 11.45% and 9.44% respectively. This finding is similar to the finding by Fayed et al., (2016) and Jonnalagadda et al., (2005). Knox et al., (2009) have also demonstrated a significant reduction in the number of cancellations due to patients requiring further optimisation, further investigations and specialist consultations.

Incomplete medical evaluation and incomplete surgical evaluation contributed to 11.54% of cancellations during the pre-intervention period and 4.44% during the post-intervention period. During the pre-intervention period, patients who were initially seen by surgeons in the out-patients clinic and required evaluation by other consultants were referred onto the appropriate team, but at many instances the appointments to see those doctors were scheduled for after the original date of operation. This apparently led to the patient being cancelled.

'No operating theatre time available' has been reported by Schofield et al., (2005), Trentman et al., (2012), Fayed et al., (2016) and various other studies. This current study found that 5.93% of cancellations during the pre-intervention period and 2.22% of the cancellations during the post-intervention period were due to 'no theatre time available'. This was mainly due to over running of time during the previous operations.

6.5.2 Cancellations due to hospital related unavoidable reasons

A remarkably high number of cancellations (44.44%) occurred during the post-interventional period due to equipment failure. This was due to an unexpected breakdown of the X-ray machine where two surgical lists of 10 patients each were cancelled. Equipment failure is an unusual happening but studies by Garg et al., (2009) and Chalya et al., (2011) have reported cancellations due to unavailability of instruments, lack of

availability of essential theatre supplies, lack of drugs etc. Interrupted power supply has been reported as a reason for cancellations in third world countries (Mpyet, 2002).

This present study found that unavailability of surgeons accounted for 4.44% of cancellations during the post-intervention period. This was slightly higher in comparison to the pre-intervention period rate of 1.69%. These cancellations were due to surgeons being on sick leave. Garg et al., (2009) have classified 'unavailability of surgeon' under 'miscellaneous' reasons which accounted for 4.2% of cancellations. Windokun et al., (2002) reported a 62% cancellation rate due to 'surgeon did not show up'.

6.5.3 Patient related avoidable reasons for cancellation

The reason 'patient no show' or 'patient did not arrive' has been reported in numerous studies. Fayed et al., (2016) have reported a rate of 27% cancellations due to non-arrival of patients. McKendrick et al., (2014) have found significant reductions (39.3% to 13.6%) in the rate of cancellations due to non-arrival of patients since the introduction of preoperative assessment clinics. Likewise this present study has demonstrated a 50% (16.96% to 8.88%) reduction in the rate of cancellation reason 'patient did not arrive'. Patients being unaware of the date of surgery, acute respiratory tract infections and social and economic reasons have been reported as some of the reasons for non-arrival of patients for surgery (Paschoal and Gatto, 2006).

Preoperative assessments provide an excellent opportunity to impart valuable information about the operation to the patients (Offiah and Grimley, 1997). Reed et al., (1997) have demonstrated that patients are unlikely to cancel elective surgery after preoperative assessment. However, they found that there was a negligible (less than 1%) reduction in the cancellations due to 'patients change of mind' and 'patients refusing procedure'. Similarly, Fayed et al., (2016) have reported that cancellations remained at 8.8%.

On an attempt by the author of this study to find out the reasons behind the 'patient did not arrive' it was evident that invariably patients who did not turn up for preoperative assessments did not arrive for the procedure. Telephone or mail reminders to patients to remind them about the appointments would be helpful (Grover et al., 1983).

'Patients refusing procedure' on the morning of the operation was most likely due to anxiety related reasons. Such patients might benefit from additional consultations and comprehensive discussions about their operation. (Parhiscar and Rosenfeld, 2002) have stated that such consultations would be able to elucidate patients concerns and worries and help in better decision making, and hence a better compliance with the scheduled procedure. Patients in this present study have refused to undergo procedure if operated upon by any surgeon other than the consultant they were familiar with and whom they were expecting to perform the operation. This finding has not been reported in any other study.

6.5.4 Patient related unavoidable reasons for cancellation

Though one can argue that 'abnormal blood test results' is an avoidable reason of cancellation, in this study such cancellation reason accounted for 2.54% during the pre-intervention period and 2.20% during the post intervention period and were due to patients who were on anti-coagulant medications. Though these patients were reviewed in the preoperative assessment clinics and their anti-coagulant medications were held prior to surgery according to hospital protocol, blood results immediately prior to the operation were in a range which was unsafe to proceed with the operation. Trentman et al., (2012) reported a higher rate of cancellation (7.17%) due to abnormal blood test results in comparison to this present study.

Cancellations due to 'change in patients' medical status' were minor (2.54%) during the pre-intervention period and 2.20% during the post-intervention period. Most of these patients presented with acute respiratory tract infections and febrile illnesses. Some patients had uncontrolled atrial fibrillation, the reason for which is perhaps attributed to anxiety. Knox et al., (2009) have classified these cancellations as 'other patient related minor illnesses' which accounted for 9.52% of cancellations in the control period and a higher rate of 20% cancellations during the study period. It can be inferred that preoperative assessment has no effect on patient related unavoidable reasons for cancellation.

6.6 Operating Theatre Efficiency

One of the aims of this study was to evaluate the impact of preoperative assessment on the operating theatre efficiency. The post-intervention period in the study has seen an enormous increase in the number of surgeries being performed. During the 31 week pre-intervention period the number of surgeries performed were on average 19 per week. This doubled during the 17 week post-intervention period where the number of cases rose to an average of 38 per week. Although the duration of the post-intervention period was shorter, it was demonstrated that a higher number of cases can be performed by adopting effective scheduling techniques. Preoperative assessment clinics have shown to facilitate effective scheduling. Trentman et al., (2012) in their study used scheduling based on assigned block time that was flexible. In addition to thorough preoperative assessment, a shared medical record and judicious communication process were recorded as reasons for precise surgical scheduling. Though paper based medical records are in use in the current study setting, thorough preoperative assessment and appropriate communication has helped to improve scheduling and thus has produced quantifiable results relating to operating theatre efficiency.

The start time for the first case of the day is crucial in improving the efficiency of the theatre. Weinbroum et al., (2003) reported that inadequate preoperative preparation of patients accounted for 15% of operating room time being wasted (Weinbroum et al., 2003). Inadequately prepared first cases cause delays in starting the list, thereby wasting valuable theatre time. An audit of the theatre register to determine first case start times was performed. During the pre-intervention period the approximate start time was 08:43 hours and during the post intervention phase the start time was 08:27 hours. The cases are now starting 13 minutes earlier which denotes that patients are well prepared prior to admission to the day ward and there is no need for further preparation in the day ward. The patients just need to change into hospital gowns, they are then ready to be transferred to theatre. Freschl et al., (2005) conducted a similar audit. They chose first case start time delays because these delays are likely to be caused by a problem related to the patient rather than a delay due to over running of the previous surgery. Their study found that the start time of preoperatively evaluated patients was 2 minutes earlier than the patients who were not evaluated preoperatively.

Avoiding delays alone might not allow to add extra cases to the theatre schedule (Dexter et al., 2005, Abouleish et al., 2004) nonetheless, decreasing these delays could possibly influence staffing costs when operating theatres are running at full capacity (Dexter et al., 2005, Epstein and Dexter, 2002, Dexter et al., 2003). Quantifying staffing costs was not possible within the scope of the present study.

6.7 What Happens to the Cancelled Patient?

The local policy in the study setting is that, when a cancellation occurred during the pre-intervention period this was communicated to the patient or the family only by the consultant surgeon. There have been occasions where the decision to cancel the patient's surgery would have been made earlier in the day (e.g. 10am) when the anaesthetic assessment took place. Regrettably patients were often only made aware of the cancellation after midday, as the consultant would have had a busy schedule in the theatre department before then. This has put patients under undue stress, anxiety and delay. Had the patient been notified about the cancellation at an earlier stage it would at least have prevented the patient from fasting unnecessarily. Numerous studies have discussed the negative impact of cancellations on patients (Ferschl et al., 2005) but delay in communicating cancellations has not been widely studied.

During the post-intervention period new methods were identified to notify patients immediately if a cancellation occurred. The nurse in-charge of the day ward or any junior doctor is able to notify the patient regarding the cancellation. Necessary arrangements are made for the patient to be swiftly followed up and re-scheduled for surgery. Unlike during the pre-intervention period where all patients arrived at 08:00 hours regardless of the time of the operation, admission of patients are now being staggered, so that they only arrive nearer to the time of the operation, thereby reducing long waiting times.

6.8 Staff Satisfaction

Copious studies have been undertaken to evaluate patient satisfaction (Pakdil and Harwood, 2005, Hepner et al., 2004b, Thomas et al., 1998). Surgical cancellations have a negative impact on staff morale (Ferschl et al., 2005). Discussions about the positive impact

of preoperative assessment clinics on staff morale are not common. However, in the current study setting though not formally studied, the introduction of the new preoperative assessment clinic has greatly improved staff morale. The high number of cancellations during the pre-intervention period rendered the staff to feel under-worked. As the patients flow through the clinic, activity in the day ward and the theatre department has increased significantly. The whole team participates enthusiastically in providing patient care.

6.9 Why Might an Electronic Preoperative Assessment Tool be Better?

One cannot deny the process change brought about by the paper based tool in the current study setting. It would be worthwhile considering an electronic preoperative assessment tool which can be linked to the patient administration system, laboratory information system and radiology information system. Multiple paper records are created at each visit to the hospital (Bouamrane and Mair, 2013, Bouamrane and Mair, 2014). This leads to difficulty in data entry, data duplication, errors during data transfer and mismanagement of information. Due to the intricacy of information interpretation tasks in preoperative assessment and the importance of performing patient-centred screening, risk assessment and managing patient care, electronic preoperative assessment tools are desirable (Bouamrane et al., 2008, Bouamrane and Mair, 2014).

The NHS has developed an online preoperative medical assessment tool which the patients complete prior to their visit to the clinic (networks.nhs.uk).

Scope of Online Preoperative Assessment:

- ❖ Patients can be triaged prior to attending the clinic.
- ❖ Patients requiring further assessment are identified prior to arrival in the clinic.
- ❖ Appointments can be re-booked or cancelled in advance.

6.10 Conclusion

This chapter has identified and discussed the key findings of this study. Consistent with the research literature this study has demonstrated a significant reduction in surgical cancellations after the introduction of the new protocol guided nurse led preoperative assessment clinic. The overall rate of surgical cancellations, the various reasons for cancellation, operating theatre efficiency and uses of an electronic preoperative assessment tool have been discussed.

CHAPTER 7 CONCLUSION AND FUTURE WORK

7.1 Introduction

The aim of this study was to evaluate the impact of preoperative assessment on surgical cancellations and operating theatre efficiency. This chapter firstly presents a summary and the key findings of the research. It then acknowledges the limitations of the present study and makes recommendations for future work. In conclusion, the author reflects on the experience gained by conducting this study.

7.2 Research Summary

Having recognised the need for a protocol governed mandatory preoperative assessment of all patients scheduled for elective surgery in the study setting, the author embraced this opportunity to partake in and contribute to the introduction and evaluation of the new preoperative assessment clinic. The study setting is a recently reconfigured model 2 hospital which provides day surgery facilities. A literature review identified numerous studies which address the same topic through different approaches. Based on the literature review a methodology was drawn up to answer the research question:

What is the impact of preoperative assessment clinics on surgical cancellations and operating theatre efficiency?

The main focus of this study was to examine the reasons for surgical cancellations on the day of surgery and evaluate the cancellation rates and operating theatre efficiency, prior to and after the introduction of the new protocol led preoperative assessment clinic. It was mandatory for all patients scheduled for elective surgery to undergo preoperative assessment.

A preoperative assessment tool was adopted and implemented for use in the clinic. This tool served as a comprehensive care pathway and followed the patient right from the first visit to the preoperative assessment clinic to the time of discharge after the procedure. Though this was a paper document, it contained all of the essential information for this episode of care.

7.3 Key Findings

Noteworthy findings have emerged out of this study. The empirical findings of this study are presented in detail in chapter 5.

7.3.1 Surgical cancellations

This study has demonstrated a significant reduction in the number of surgical cancellations that occur due to hospital related reasons such as:

- ❖ Requiring further optimisation of pre-existing medical conditions.
- ❖ Requiring further laboratory or radiological investigations.
- ❖ Incomplete medical or surgical evaluations.

There have also been significant reductions in the number of cancellations that occur due to patient related reasons such as:

- ❖ Non arrival of patients for the surgery.
- ❖ Patients refusing the surgical procedure.

This study has shown that patients are less inclined to cancel their surgery or fail to arrive on the day of the operation after having already had a visit to the preoperative assessment clinic.

7.3.2 Operating Theatre efficiency

After the introduction of the new preoperative assessment clinic the efficiency of the operating theatre has remarkably increased. This was demonstrated by the number of surgeries performed per week. The throughput of patients through the theatre department has doubled. First case start times have also improved as they are now starting approximately thirteen minutes earlier.

7.4 Implications of the Study

The findings of this study are having various positive implications in the study setting. Staff morale has improved because all surgeons, anaesthetists and nurses are able to visualise real-time results. This study has motivated my colleagues to undertake small projects and audits which are aimed at improving various areas of patient care.

The overall positive impact of the study has motivated the hospital management to expand the clinic and introduce more efficient scheduling and referral to the clinic.

7.5 Limitations of the Study

Like any other research, this study had a few limitations which are outlined below:

- ❖ Data regarding the nature and rate of surgical cancellations for the pre-intervention period had to be collected retrospectively. There was no structured format of recording cancellations during the pre-intervention period. These cancellations were categorised by the author. The data could have been biased due to the subjective nature.
- ❖ The optimal time to conduct the preoperative assessment could not be identified. The convenience of the patient takes priority while booking appointments. It would be ideal to specify a time that is best suitable to identify and treat medical conditions.
- ❖ The financial gains attained through decreased cancellations and improved theatre utilisation was not quantifiable. Access to financial information was not possible.

7.6 Recommendations for Future Work

The recommendations proposed as a result of this study are:

- ❖ Future studies on the cancellation of surgeries should be of prospective nature. This will help to define and categorise the reasons for cancellation. This will greatly enhance data collection and avoid bias.
- ❖ Electronic preoperative assessment tools should be adopted or developed and integrated with the hospital IT system. When in use this will serve as a clinical decision support tool.

- ❖ A web enabled preoperative assessment tool can be developed. This will aid in involving the patient in all areas of decision making.

7.6.1 Recommendation to the Ireland East Hospital Group

The author wishes to strongly recommend that a single preoperative assessment tool be developed for use across all model 2 hospitals in the group. This will provide uniformity and improve perioperative care processes in accordance with The National Clinical Programme for Surgery in Ireland.

7.7 Dissemination of the Findings

Dissemination of the findings is vital to any research study as it helps academicians and practitioners use the valuable results in future research and practice.

The author has already presented the abstract of this study in the 1st Nursing and Midwifery symposium of the Ireland East Hospital Group. The idea of preoperative assessment for smaller hospitals was widely accepted by representatives from each of the 11 hospitals.

Furthermore, the author plans to publish the study in national nursing and anaesthesia journals. The author also wishes to present these findings at the Annual Operating Room Nurses Conference organised by the Irish Nurses and Midwives Organisation.

7.8 Reflection on the Study

The author was initially very apprehensive about carrying out this research project. Ongoing support from the academic supervisor of this project served as a motivation to complete it. Lectures from the college helped to understand the research process and apply it in practice. The involvement in introducing the new preoperative assessment clinic was challenging at the initial stages but turned out to be worthwhile.

The entire process of conducting this research study was enlightening. It has demanded enormous input in terms of time and commitment. The author believes that the knowledge

gained from conducting this research will be helpful for participating in future studies. The author also feels that he has gained the competency to partake in other research projects.

7.9 Conclusion

The aim of this study was to evaluate the impact of preoperative assessment clinics on surgical cancellations and operating theatre efficiency. The objectives were to categorise cancellations, to evaluate cancellation rates and operating theatre efficiency prior to and after the introduction of the new preoperative assessment clinic.

In conclusion, it can be said that all of the study objectives were met and that the study demonstrated a positive impact by reducing the number of surgical cancellations and improving operating theatre efficiency.

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Appendix A - Preoperative Assessment Tool

Appendix A

Full Name:
D.O.B:
Address
Hospital No.:

PRE-OPERATIVE ASSESSMENT & ADMISSION FORM FOR GENERAL ANAESTHESIA- DAY CASE PROCEDURES

Consultant: Planned procedure:

GP: Date of Assessment:

Planned Date for Surgery:

N.B. PLEASE ANSWER YES/NO TO THE FOLLOWING AND CIRCLE AS APPROPRIATE

YES NO

		YES	NO
Q1	Will you have a responsible person to take you home? (Specific to the day case)		
Q2	Will you have a responsible person at home capable of looking after you for the remainder of the day and night following the surgery? (Specific to the day case)		
Q3	Do you have a telephone number at home? Phone No.: _____ or Contact No.: _____		
Q4	Do you get chest pain? (1) on exercise (2) at rest		
Q5	Do you have? (1) Heart disease (2) heart murmur		
	Have you ever had a heart attack? If Yes, When?		
	Have you ever had previous cardiology review? If Yes, When?		
	Have you ever had a? (1) Stress test (2) Echo (3) Angio If Yes, When?		
Q6	Do you get breathless? (1) Walking (2) Climbing stairs (3) Lying flat		
Q7	Do you have? (1) Asthma (2) Bronchitis (3) Chest disease (e.g. T.B.)		
Q8	Do you smoke? If Yes, How many a day?		
Q9	Do you have high blood pressure?		
Q10	Are you diabetic? If yes, (1) Type I (2) Type II		

Full Name:

D.O.B:

Address

Hospital No.:

		YES	NO
Q11	Have you ever had a fit/seizure? If Yes, How long since the last one?		
Q12	Do you have kidney disease?		
Q13	Have you ever been jaundiced? (yellow)		
Q14	Do you? (1) bleed easily (2) bruise without cause		
Q15	Do you have? (1) anaemia (2) other blood disease (specify): (3) History of DVT or PE (clots in legs or lung) (specify):		
Q16	Do you have arthritis?		
Q17	Do you have any restrictions in the movement of (1) neck (2) joints? If Yes, please specify:		
Q18	Do you or any of your family have any diseases affecting your muscles?		
Q19	Do you have (1) indigestion (2) heartburn (3) stomach ulcers?		
Q20	Do you drink alcohol? If Yes, How much per week?		
Q21	Have you ever had an anaesthetic? (1) General (2) Spinal		
	If Yes, How long since your last one?		
	Where there any anaesthetic problems? If Yes, please specify:		
Q22	Have any of your family ever had a problem with an anaesthetic? If yes please specify:		
	Have you ever had an operation before?		
	If Yes, please specify (what/ when):		
		
		

Full name:

D.O.B:

Address

Hospital No.:

		YES	NO
Q23	Do you have a family history of sickle cell disease		
Q24	Have you ever had a serious illness or other health problems?		
Q25	Are you taking any medication? (e.g. tablets, patches, inhalers, steroids,...?) If Yes, please list: _____ _____ _____ _____ _____ _____ _____		
Q26	Are you taking any other recreational drugs?		
Q27	Have you any allergies?		
Q28	Are you? (1) Pregnant (2) taking the "pill" (3) on H.R.T.		
Q29	Dental history: Have you had any recent tooth extractions/dental problems? Have you any dentures, loose teeth, caps or crowns? If Yes, specify:		

Signature of Patient: _____

Baseline observations:	Additional Comments:
B.P.	_____
Pulse	_____
Weight	_____
Height	_____
B.M.I	_____
Peak Flow	_____
B.S.L	_____
Patient Information leaflet given <input type="checkbox"/> Date: _____ Time: _____	

Full name:

D.O.B.:

Address

Hospital No.:

INVESTIGATIONS ORDERED/CARRIED OUT

To be completed by Nursing and Medical staff

DATE	BLOODS	ORDERED/TAKEN		DATE	INVESTIGATION	ORDERED/TAKEN	
		YES	NO			YES	NO
	FBC				MRSA Screen		
	Renal/liver profile				Urinalysis		
	COAG				MSU/Direct		
	CRP/ESR				Sensitivity Test		
	PSA				ECG		
	BLOOD GROUP				Chest X-Ray		
	Other investigations/test:						

Suitable for Day Case procedure YES NO Not Applicable

Accepted subject to investigation YES NO

Referred to Anaesthetist YES NO

Other (e.g. referred to waiting list)

MEDICATION INSTRUCTION as per SCH Pre-op Assessment Guidelines

Is the patient on medication/s that need to be discontinued prior to surgery? YES NO

Medication to be discontinued	Dose	Date to be discontinued-instructions

Signature of R.G.N.: _____

ANAESTHETIC/DOCTOR REVIEW

Signature: _____ Date: _____ Time: _____

Full Name:
D.O.B:
Address
Hospital No.:

DAY OF SURGERY- NURSING

Consultant:		
Record patients understanding of procedure:		
Has there been any change in health and social circumstances since pre assessment? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, please record changes and action taken:		
Mobility: Fully Independent <input type="checkbox"/> Needs some assistance <input type="checkbox"/> Completely dependent/unpredictable <input type="checkbox"/> Mobility aids:		
Falls Risk Assessment Score: ____ If score is 2 or more, the care plan is carried out as per falls risk care plan YES <input type="checkbox"/> NO <input type="checkbox"/>		
MEDICATIONS: (Please refer to preassessment page to see medications)		
Additional information: (e.g. date & time of medication taken last, fasting)		
Admission Day Observations: (please see Early Warning Score- EWS attached)		
Urinalysis required? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, record results:	Weight: kgs BMI:	Height: m B.S.L: mmol/L at N/A <input type="checkbox"/>
HCG required? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, Positive <input type="checkbox"/> Negative <input type="checkbox"/>	LMP: or N/A <input type="checkbox"/>	Total EWS:
Type of Anaesthetic:		
Additional information:		

St.Columcille's Hospital

Full Name:

D.O.B:

Address

Hospital No.:

Rationale of Preoperative care: to maintain the patient's well being ad safe physical environment during the transfer to the Operating Theatre.

Ward: _____

Date of surgery: _____

PERIOPERATVIE NURSING RECORD

Consented surgical procedure: _____

Infection control notifications: _____

Premedication/regular medication given- details: _____

Patient clean and dressed in a theatre gown: _____ Religious considerations if any: _____

Attended preoperative assessment clinic: Yes/No (if yes refer to assessment document for special pre-op instructions)

Preoperative Checks:	Ward	Patient Reception	Theatre
Patient identification (arm and leg bands legible, secure & not on operative limb)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Allergies:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fasting since: Food: _____ Fluids: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Surgical consent signed and understood.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Surgical site marked.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anaesthetist review complete	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Addressographs present.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dental: Dentures removed/broken or loose teeth/caps or crowns.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prosthesis or implants: Yes / No. Location	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Jewellery: Jewellery & piercings removed.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TED stockings: Yes / No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lab reports: Yes / No.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blood availability: Group &hold/Group & cross match/ not requested.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ECG in chart: Yes / No.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other relevant information (e.g. necessary pre-op interventions, communication difficulties, movement limitations, etc.): _____			

Nurses name and Signature: _____

Day Ward Theatre reception Theatre

Full Name:

D.O.B:

Address

Hospital No.:

St.Columcille's Hospital

NURSING DISCHARGE PLAN

TOTAL EWS Pre Discharge:

Discharge criteria		Post Anaesthetic Discharge Scoring System	
<p>1. Vital signs – must be stable and consistent with preoperative level. 2 = within 20% of pre op value 1 = within 20%-40% of pre op value 0 = >40% of pre op value</p>	<input type="checkbox"/>	<p>2. Ambulation – must be able to ambulate at preoperative level. 2 = Steady gait/ no dizziness 1= With assistance 0 = None, dizziness</p>	<input type="checkbox"/>
<p>3. Nausea/Vomiting – should have minimal nausea and vomiting prior to discharge. 2 = Minimal – successfully treated with oral anti-emetic. 1 = Moderate – successfully treated with intramuscular injection 0 = Severe – continues after repeated treatment</p>	<input type="checkbox"/>	<p>4. Pain – the location, type and intensity of pain should be consistent with the anticipated postoperative discomfort. 2 = Minimal/ none 1 = Moderate 0 = Severe</p>	<input type="checkbox"/>
<p>5. Surgical bleeding – postoperative bleeding should be consistent with expected blood loss for the procedure 2 = Minimal/none –no dressing change required 1 = Moderate –up to 2 dressing changes 0 = Severe –more than 3 dressing changes</p>	<input type="checkbox"/>	<p>TOTAL SCORE Patients with score of 9 or greater are fit for discharge</p>	<input type="checkbox"/>

Patient Education

Patient and carer have received written/verbal instructions for the following (please tick):

- | | |
|--|-------------------|
| -Post anaesthetic advice | -Pain management |
| -Advice re: driving/alcohol/use of machinery | -Wound management |
| -Prescription and medication advice given | -Other: |

Discharge Checklist	Yes	No	N/A	Nurses Initials	Time	Comments
Patient is cooperative, oriented and tranquil						
Light diet and fluids tolerated well						
Has passed urine						
IV cannula removed. Site inspected +dressing applied						
Dressing given						
Medical certificate given						
GP letter given/faxed/sent to GP						
Follow up appointments						
Personal belongings returned						
Accompanied by Escort						

Discharge Details:	If variance enter reason and action taken:
Discharge time:	
RGN Print Name:	
RGN Signature:	

Appendix B - Record of Cancellations

Case No. -

Pre-intervention Post-intervention

Q1. Is the surgery performed or cancelled?

1. Performed 2. Not performed
(End) (Answer Q3 to Q5)

Q2. Is the cause of cancellation hospital related or patient related?

1. Hospital Related 2. Patient Related

Q3. Is the cause of the cancellation is avoidable or unavoidable?

1. Avoidable 2. Unavoidable

Q4. What was the cause of cancellation?

- 1. Needs further Optimisation
- 2. Needs further Investigation
- 3. Change in Treatment Plan
- 4. Incomplete Surgical Evaluation

- 5. Incomplete Medical Evaluation
- 6. No Operating Theatre Time Available
- 7. Equipment Failure
- 8. No Surgeon Available
- 9. Did Not Arrive
- 10. Patient Refused Procedure
- 11. Patient Changed Mind
- 12. Change in Medical Status
- 13. Abnormal Blood Test Results

