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Manganyi, Rixongile Style

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Reasons for delays in start of first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital

Rixongile Style Manganyi, (2610358)

A research report submitted to the faculty of health sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in the subspecialty of Anaesthesiology

July 2025

Declaration

I**,** Rixongile Style Manganyi, declare that this research report titled 'Reasons for delays in start of first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital' is my own unassisted work. It is being submitted for the degree of Master of Medicine in the branch of Anaesthesiology at the University of Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at any other University.



Manganyi Rixongile Style

07 July 2025

Abstract

Background

Delays in the first case start time increases scheduled theatre time wastage, overruns, and unplanned cancellations. This further causes unnecessary costs for the healthcare centres involved. Improving first-case start time is associated with higher theatre productivity. This study prospectively observed the reasons and causes of delays in starting of first elective cases in different operating theatres at a tertiary hospital in Johannesburg South Africa.

Method

A prospective study was conducted in a multi-disciplinary elective theatre suite over three months (3rd June to 8th August 2023). All adult and paediatric cases that started before or at the scheduled first case start time (in-room time, anaesthesia time, and procedure time) were deemed to be on-time cases. Cases that started after the scheduled first case start time were deemed delayed. A five-minute grace period was applied when analysing the data. Delay times were calculated using frequencies and mean with 95% confidence intervals at different stages per specialty. Similarly, reasons for delays were categorised and calculated accordingly. All the statistical analyses were performed using Stata 15 (StataCorp, USA).

Results

First-case start times were recorded in the study period. A delay prevalence of 97.5% was reported and only 2.5% started on time. The mean delay time was 47.5 minutes and a standard deviation of 53.2. The most frequent reasons for delays were surgeon-related factors accounting for 23.7%, followed by logistics-related factors at 17.7%. Most of these causative factors are preventable.

Conclusion

Over 95% of first cases are delayed and the reasons for delays are multifactorial but preventable. Multiple strategies can be employed to mitigate the causes of delays, thus improving theatre utilisation and saving costs.

Keywords: delays, scheduled, start time, elective, first case, reasons, factors, causes.

Presentations and publications from this research project

None

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Abbreviations

CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
ENT	Eyes, Nose and Throat
HOD	Head of Department
CEO	Clinical executive officer
IQR	Interquartile range
SD	Standard deviation
ICU	Intensive care unit
DMAIC	Define, measure, analysis, improvement, and control
UK	United Kingdom
HIV	Human immunodeficiency virus

Statement

The Research Report consists of a literature review, draft article, study proposal and appendices. The study proposal is included for background reference and is not for examination.

The formatting of this Research Report complies with the University of the Witwatersrand's Style Guide for Theses, Dissertations and Research Reports. The formatting of the draft article may differ from the author guidelines of the Critical Care and Resuscitation, the journal to which it is intended to be submitted, in order to comply with the university's style guide.

Section 1: Review of the literature

1.1 Introduction

Operating theatres are part of the hospital's most interactive spaces. Surgical management of patients form a third of health care costs and half of inpatient hospital expenditures.[1] For these reasons, maximizing operating theatre efficiency and utilization is of great importance. Operating theatres are complex and unpredictable environment with numerous factors contributing to a successful workflow. This makes it difficult to pinpoint source of inefficiencies and failures.[2,3] Examples of factors influencing operating theatre workflow and efficiency, include but are not limited to patient related (e.g. late presentation to the hospital, violation of fasting guidelines etc.), hospital or logistics related (e.g. electrical faults, anaesthetic machine malfunction, low main supply gas pressures etc.), staff related (e.g. surgeon, anaesthetists, nurses, porters) and procedure related (e.g. instrumentation sets).[4]

The primary goal of operating theatre management is to maximise theatre throughput or efficiency, patient care and good outcome without increasing costs.[5,6] Even the smallest improvement in operating theatre efficiency increases productivity.[7] Theatre productivity can be defined as the quantity of output produced per unit input.[8] It can be calculated by taking total costs or resources utilised and dividing it by the average output for that specific period of time.[7] Productivity can be measured for a specific single theatre, theatre unit, specific surgical discipline or multiple institutions.[8] Theatre productivity is often used synonymously with theatre efficiency.[9]

1.2 Theatre efficiency and utilisation

Theatre efficiency can be simply defined as the ability to translate available time into revenue.[10] It can be input orientated meaning that the same output is achieved using least amount of input and output- orientated which refers to achieving an increased output using the same input.[7] Various metrics can be used to measure efficiency in surgical care.[8]

First case start time measures operation theatre and patient's readiness, and it contributes to perioperative delays.[9] Improving first case start times is associated with higher theatre productivity.[7] Delays in first case start times lead to theatre time wastage, overruns and unexpected cancellations.[8] This metric measures the difference between the actual time the first patient enters theatre and theatre list scheduled start time.[8] Delays in first case start times have an inevitable negative impact on successive cases with consequent decrease in theatre efficiency.[2,11] First case start times are variables that can be entirely controlled amongst the factors affecting theatre throughput and efficiency.[12] Majority (50-80%) of cases in tertiary institutions showed an average of 30 minutes delay and preventable causes such as staff unavailability, delayed patient registration and patient transportation were implicated.[1]

Surgeon related factors were the most implicated reasons for delays in first case start times in the European, American and South African studies, with late arrival or unavailability being number one reason.[13] The above reason accounted for 30% of all the delays together with other factors including inadequate patient preparation and incomplete surgical procedure consent.[4] Sandy et al.[14] conducted a study that focused on surgeon related factors, specifically late arrival to the operating theatre. Their study implemented strategies to modify the behaviour through visual cues like posters and communicating via emails to remind them of start times and issues concerning the procedure. This showed marked improvement on first case start times from 72% to 88% which is within the international benchmark standard.[14]

In a study conducted in Durban metropolitan hospital, results showed that 18% of the delays in first case start times was attributed to anaesthesia related reasons such as unavailability of an anaesthetist and the mean delay time was 23 minutes.[13] In academic institutions delays in first case start times reflects on cost effectiveness and academic programmes rendered.[15] It can be used to assess registrar's competence in perioperative care.[15] The level of expertise that the anaesthetist possess influences the duration of induction as well as the start times.[16] Delays in large academic or tertiary hospital are attributed to the complexity of anaesthesia and surgical procedures conducted in these institutions.[16] Delays due to registrar's training affects all theatre staff and it becomes challenging to balance specialist training and maintaining an efficient theatre.[15] Anaesthesia related factors include late arrivals, late ordering of anaesthetic drugs, requesting additional investigations and preparation of equipment such anaesthetic machine.[4]

The most common patient related factors include violating fasting guidelines and patients not availing themselves to the hospital. Okeke et al.[17] conducted a study of 1170 patients undergoing a surgical procedure in Nigerian hospital and found that patient related factors were the leading reason for delays in the first case start time that accounted 43% of the delays. This is different compared to European and American studies where surgeon related factors were the leading cause of delays.[18] The reason for delays in Nigeria were attributed to poor socio-economic status and the fact that patients finance their own health care services, so patients outsource funds up to the day of the procedure.[17] Foglia et al.[4] conducted a study in USA from 2009 to 2014 on reasons for delays in first case start time and patient related factors only accounted for 10% of the overall delays which is 4 times lower than the Nigerian study findings. Other patient related factors included enquiries from family members, prolonged visiting times and additional investigations required such a haemoglucotest, clotting profile or pacemaker review.[19]

Nursing related reasons for the delays in first case start time accounted for 10% in a study conducted by Foglia et al[4]. The commonest reason is staff unavailability or late arrivals and late administration of treatment. Chen et al.[20] performed a retrospective study analysing 8700 cases in an academic hospital over a period of 4 years. He looked at the effect of staffing ratio on the first case start time and he found that when staff ratio was 1:1 and 1:2, they had more delays compared to solo staffing.[20] Staff fatigue and lack of motivation were found to contribute to delays in first case start times.[15]

There are other factors which may be internal or external to the operating theatre that influence first case start times. These include operating room preparations, procuring and checking medical and surgical supplies and patient transportation to theatre.[4] An Australian audit of 209 cases found that 39.4% of scheduled theatre time was used for procedure non-related activities and this large portion of operating theatre time used for activities not related to the surgical procedure such as prolonged turnover times is another area for improvement.[3]

1.3 Effects of first case start time delays

It costs around R14000-00 per hour to run an average theatre.[9] South Africa as a resource scarce country having an unmatched demand and supply of health care facilities. The burden of trauma and HIV infection further aggravates the situation.[9] Delays in first case start times are not cost free, it may lead to reduced operating theatre efficiency through overruns that may be direct or indirect overtime costs.[17,21] It may also cause conflicts among team members, staff fatigue and dissatisfaction from different team members including patients.[16,21] Late starts are associated with unexpected day of surgery cancellations that further prolongs surgical waiting lists.[3] This inevitably impact patient's mental health negatively.[22] Studies showed that UK wastes 2 hours of scheduled theatre time per day that increases surgical waiting list by at least 18 weeks in arthroplasty patients.[22] Delayed start times may also be detrimental to patient's health. An example is a diabetic patient who is kept nil per mouth longer due to delays, which may predispose the patient to complications such as hypoglycaemia.[23]

1.4 Recommendations for improving first case start times.

The quality of health care system in the public sector is poor and the fact that health care providers do not use the public services themselves often are not affected by the deteriorating services, making it challenging to improve efficiencies.[9] Theatre efficiency can be improved depending on whether one is clued up about how operating theatre operates, the working environment practices and the health care provider's willingness and attitude to change.[24] However, health care providers may perceive improved efficiency as an increased workload and associated work stress[9]. Usman et al.[20] did a systematic review of 209 articles and found that a third of hospital costs are utilised to run operating theatre. 280000 elective cases could have been done from the 2 hour per day wasted time in the UK.[20] These figures show how expensive operating theatres are, hence, they developed recommendations to improve first case start times.

The financial incentives method involves financially rewarding health care providers who perform better.[23] An example is when the first patient on the list arrives in theatre on time or before scheduled theatre time. This increased operating theatre first case on time from 19% to 61%.[23] Han et al.[25] implemented a mandate to pay neurosurgical registrars if they managed to ensure a complete consent and brought the patient to theatre on time or earlier than the scheduled time. This reduced first case start delays to 7.17% while patients were brought to theatre at least 30 minutes earlier than the scheduled time.[25] This method is effective however it may not be feasible in developing countries such as South Africa due to resource constraints.

Communication is another strategy proposed in improving first case start time. This involves communicating roles and expectations of theatre staff and reinforcing first case on time start.[26] Mathews et al.[27] introduced morning meetings where preoperative and post-operative surgical lists and their associated issues were discussed while reflecting back on previous meetings issues. They identified sources of delays and communicated their theatre goals to involved theatre members. They managed to improve first case start times from 33% to 68%.[27]

Education form part of the strategies which can be implanted to improve delays in first case start time. Overdyk et al.[34] implemented theatre efficiency educational strategies to staff over a period of two weeks and it entailed causes of delays, their optimal target times and strategies to improve first case on time start. They managed to improve it by 22 minutes earlier than scheduled time across surgical disciplines.[23] Developing support programmes for theatre staff can also improve start times.[9]

The golden patient method refers to allocating a well investigated, medically fit patient with a well-structured surgical plan as the first elective case.[9] Javed et al.[23] implemented this method in trauma and orthopaedics surgical lists and improved first case start times to 19 minutes earlier than the scheduled times.

The Lean and six sigma methods have been used in clinical practice to improve first case start time. These are innovations adopted from industrial sector to improve first case start time.[1] The Six sigma method involves the DMAIC process, which stands for define, measure, analyse, improvement and control. It uses statistical methods to decrease process variability.[1]

The Lean method was initially developed by Toyota to eliminate wasteful steps in order to increase efficiency. It involves 5 steps namely: identifying the value, mapping the process to eliminate steps which do not increase the value, create flow for product consumer, establish flow to flow to pull value from actions and lastly creating perfection by repeating steps.[1,28]

McNamara et al.[25] conducted a study to assess the effects of using these improvements strategies where they fast tracked patient admission, improved patient transportation to theatre and effective communication among team members. They found improved start time to be 30 minutes earlier.[23,25] Another study used perioperative joint operating council to focus on identifying causes and implement strategies to reduce delays in first case start time involving multidisciplinary team through the lean process. They had 50-60% start time in 2018 and improved to 70-77% in 2019.[18]

In a study done in rural areas, 70% of surgical cases started late in 2015 and 30% of them ended up finishing late.[26] They developed strategies to improve first case start time and discussed with all theatre staff. Their recommended solutions included modifying nursing allocations to cater for operating theatre preparations, allocating first case to a patient who will not require post-operative ward admission to decrease impact of bed unavailability, introducing electronic medical records and giving feedback to surgical department pertaining

late start. Vitez et al.[12] recommend using performance standards and heath care providers' education programmes to improve first case start times in academic institution.

1.5 First case start time as a performance indicator.

A standardised performance indicator must be simple, easy to use, applicable, objective and have standardised definitions.[12] The perceived advantage of this metric is that it is easy to measure and is comparable among different institutions.[23] However, it has multiple limitations such as the difficulty of defining anaesthesia start time versus procedure time. Veen Berky et al.[24] stated the impact of intervention implemented to decrease the first case delays in a seven year study conducted over a number of facilities. They assumed that delays in first case start times lead to overruns without indicating that short cases lasting between 60-120 minutes were booked on days when there was adequate staff available. Their calculations on financial impact were not accurate. Another limitation is that cases that started on time may develop delays with subsequent cases. It has shown to have no correlation between start and finish times.[24]

Therefore, the focus must not only be on first case start times because definitions to these times have different meanings among team members and differ across institutions.[9] It becomes insignificant if used as a sole performance metric. The focus must also be on finish times because delayed first case start may finish before or on time, thus it does not directly translate to late finish or overruns and an inefficient theatre.[12,21] An efficient theatre consists of delays of less than 45 minutes in an eight hours operational scheduled theatre time, hence finish times must be tackled before trying to optimise theatre efficiency pertaining under or over utilization.[18] A delay by 45 minutes does not translate to an inefficient theatre but the time can be used to prepare for the next patient. An example being using it for preoperative assessment or preparing surgical equipment.[21] First case start time should be analysed in conjunction with other performance metrics such as cancellation rates, utilization, estimated duration of surgical procedure, turnover over times etc.[7,12,21]

1.6 Summary

It is important to measure theatre efficiency using different standardised metrics. Each metric should be used and supported by evidence and should be balanced such that it aids in surgical list preparation and bookings.[28] The outcome of operating theatre efficiency should be good quality service rendered, patient safety and should be saving costs.[6]

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Section 2: Author's guidelines

British Medical Journal Public Health

2.1 How to submit your paper online

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2.2 Review policy and guidelines

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Editor(s) are expected to obtain a minimum of two peer reviewers for manuscripts reporting primary research or secondary analysis of primary research.

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2.3 Aims and scope

BMC Public Health is an open access, peer-reviewed journal that considers articles on the epidemiology of disease and the understanding of all aspects of public health. The journal has a special focus on the social determinants of health, the environmental, behavioral, and occupational correlates of health and disease, and the impact of health policies, practices and interventions on the community.

2.4 Articles sections and length

Abstract should not exceed 350 words.

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Present a title that includes, if appropriate, the study design, list the full names and institutional addresses for all authors and indicate the corresponding author.

2.6 Abstract

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- **Background:** the context and purpose of the study.
- **Methods:** how the study was performed and statistical tests used.
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2.7 Keywords

Three to ten keywords representing the main content of the article.

2.8 Declarations

- **Ethics approval and consent to participate**

Manuscripts reporting studies involving human participants, human data or human tissue must:

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- **Competing interests**

All financial and non-financial competing interests must be declared in this section.

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Section 3: Draft article

Reasons for delays in start of first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital

Rixongile Style Manganyi, MBChB, DA(SA)[1] (2610358)

1Department of Anaesthesiology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, Gauteng, South Africa

17 Jubilee Road Parktown 2193

http:orcid.org/0009-0002-6634-7958

Nana Yaa Fening, MBChB, DA(SA), FCA(SA) MMed(Wits)[1]

[1]Department of Anaesthesiology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, Gauteng, South Africa

17 Jubilee Road Parktown 2193

http:orcid.org/0000-0001-54653240

Amanda Nkuna, MBChB, DA(SA), FCA(SA) MMed(Wits)[1]

[1]Department of Anaesthesiology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, Gauteng, South Africa

17 Jubilee Road Parktown 2193

http:orcid.org/0000-0002-0771-4853

Corresponding Author:

Manganyi Rixongile Style, MBChB, DA(SA)[1] (2610358)

Charlotte Maxeke Johannesburg Academic Hospital

17 Jubilee Road Parktown

Johannesburg

2193

http:orcid.org/0009-0002-6634-7958

rixongilemanganyi@gmail.com

011 488 4344

3.1 Abstract

Background

Delays in the first case start time increases scheduled theatre time wastage, overruns, and unplanned cancellations. This further causes unnecessary costs for the healthcare centres involved. Improving first-case start time is associated with higher theatre productivity. This study prospectively observed the reasons and causes of delays in starting of first elective cases in different operating theatres at a tertiary hospital in Johannesburg South Africa.

Method

A prospective study was conducted in a multi-disciplinary elective theatre suite over three months (3rd June to 8th August 2023). All adult and paediatric cases that started before or at the scheduled first case start time (in-room time, anaesthesia time, and procedure time) were deemed to be on-time cases. Cases that started after the scheduled first case start time were deemed delayed. A five-minute grace period was applied when analysing the data. Delay times were calculated using frequencies and mean with 95% confidence intervals at different stages per specialty. Similarly, reasons for delays were categorised and calculated accordingly. All the statistical analyses were performed using Stata 15 (StataCorp, USA).

Results

First-case start times were recorded in the study period. A delay prevalence of 97.5% was reported and only 2.5% started on time. The mean delay time was 47.5 minutes and a standard deviation of 53.2. The most frequent reasons for delays were surgeon-related factors accounting for 23.7%, followed by logistics-related factors at 17.7%. Most of these causative factors are preventable.

Conclusion

Over 95% of first cases are delayed and the reasons for delays are multifactorial but preventable. Multiple strategies can be employed to mitigate the causes of delays, thus improving theatre utilisation and saving costs.

Keywords: delays, scheduled, start time, elective, first case, reasons, factors, causes.

3.2 Introduction

Operation theatres form part of costly components of a hospital budget, and maximising operation theatre utilisation is crucial to ensure optimum cost benefit.[1,2,3] The primary goal of improving operating theatre management is to improve theatre throughput or efficiency, patient care, and good outcomes without increasing costs.[4-7] Studies have argued that even the smallest improvement in operating theatre efficiency can increase productivity.[7-9] Theatre productivity is defined as the quantity of output produced per unit input.[8] It can be calculated by taking total costs or resources utilised and dividing it by the average output for that specific period. Theatre productivity can be measured for a specific single theatre, theatre unit, specific surgical discipline, or multiple institutions.[8]

International studies have shown that 16-24% of operating theatres' productivity and expenditure may be wasted due to the inefficient functioning of theatre complexes, contributing to limited healthcare resources.[1,4] Hospital systems are now paying increased attention to workflow efficiency and waste reduction.[4] In South Africa, public hospital theatre utilisation averages between 30-40% compared to the private sector which averages 48%.[1] One of the most current discussions in both public and private hospitals' theatre utilisation is improving operating theatre efficiency to ensure optimum cost benefit.[1-4]

Although studies have identified potential elements that can contribute to the success of operating theatre workflow efficiency and preventing unnecessary wasteful expenditure, challenges still exist in terms of implementing such elements. One of the challenges includes the difficulties in pinpointing when and where most failures to improve workflow efficiency occur.[4,5] According to Bauer et al.,[2] this makes it difficult to develop an action plan to improve efficiency and limits the success of operating theatre workflow efficiency.

The success of operating theatre workflow is dependent on multiple factors, including adherence to the scheduled start time of first surgical cases.[6-10] Adherence to the scheduled first-case start time and efficient room turnover optimises theatre utilisation.[6,7] This also reduces time wastage, overruns, and unnecessary cancellations, resulting in patients' longer hospital stays, and increased care costs such as food, medication, and hospital expenditure.[8,9] Inefficient theatre utilization prolongs the elective waiting list period, resulting in patients' dissatisfaction and to some extent compromising patients' safety.[11,12]

Studies have shown a remarkable improvement in the reduction of delays in first-case start times after implementing strategies and policies to mitigate such delays.[13,39] Over nine months there was an improvement of 6% to 60% in first case start time according to Wright et al.[40] in a Canadian study

conducted at level 1 paediatric trauma hospital between 2005 and 2007. For example, strategies such as preparation of equipment in advance, regular equipment servicing, improving inter-departmental communication and compliance, proper planning and ensuring pre-anaesthetic instructions are followed were reported to improve theatre efficiency and meaningfully reduce hospital costs.[35,37]

Given this context, the overarching aim of this study was to determine the reasons for delays in the start of the first elective case of the day at a teaching hospital and ultimately develop strategies to mitigate the causes of such delays to improve theatre workflow and productivity and ensure optimum cost benefit. Specific objectives included determining the actual first case start times, identifying preventable and non-preventable causes (modifiable and non-modifiable factors responsible for such delays), and classifying causes of delay. Five categories can be used to classify causes of delay. They include patient-related factors (e.g. violating fasting guidelines), surgeon-related factors (e.g. late or unavailable surgeon), anaesthesia-related factors (e.g. late, difficult intubation), nursing-related factors (late, drugs counting), and logistics-related factors (porters being late, equipment failure, etc.)

3.3 Methods

This was a prospective and observational study conducted over three months from 3 June 2023 to 8 August 2023 at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH). CMJAH is a 1088-bed teaching hospital affiliated with the faculty of health sciences of the University of Witwatersrand in Parktown, Johannesburg, Gauteng Province, South Africa. All qualifying adults and paediatric patients scheduled for weekday elective surgery as first cases, booked at least one day before the operation were included. Cases not requiring an anaesthetist and done after hours (before 07:00 and after 16:00), during public holidays, or on weekends were excluded. The study protocol was reviewed by the human research ethics committee of the Witwatersrand University and deemed non-human subjects' research. Approval to conduct the study at the hospital and access patients' medical files and theatre record books was granted by theatre management.

Data was collected using the data collection tool (Appendix A) and the following times were recorded: date, theatre name, surgical specialty, procedure, scheduled first case time, porter send-off time, and theatre arrival time. Upon theatre arrival, patient in-room time, anaesthesia time, and procedure times were recorded. Delay times were calculated using frequencies and mean with 95% confidence intervals at various stages per specialty. Similarly, reasons for delays were categorised and calculated accordingly. All the statistical analyses were performed using Stata 15 (StataCorp, USA).

3.4 Results

A total number of 427 cases met the inclusion criteria, of which 21 cases were cancelled. The reasons for cancellation included low theatre temperatures (8 cases), poor patient optimisation requiring further optimisation prior surgery (3 cases), unavailability of postoperative ICU beds (3 cases), patient unfit for theatre meaning that the patient is unable to tolerate surgery or anaesthesia (2 cases), equipment failure (1 case), invalid consent (1 case), patient's pathology resolved (1 case), wrong booking (1 case), and 1 case due to no available anaesthetist. The remaining 406 scheduled first cases from 14 different surgical specialties were analysed. Figure 1 shows a flow diagram of the study data.

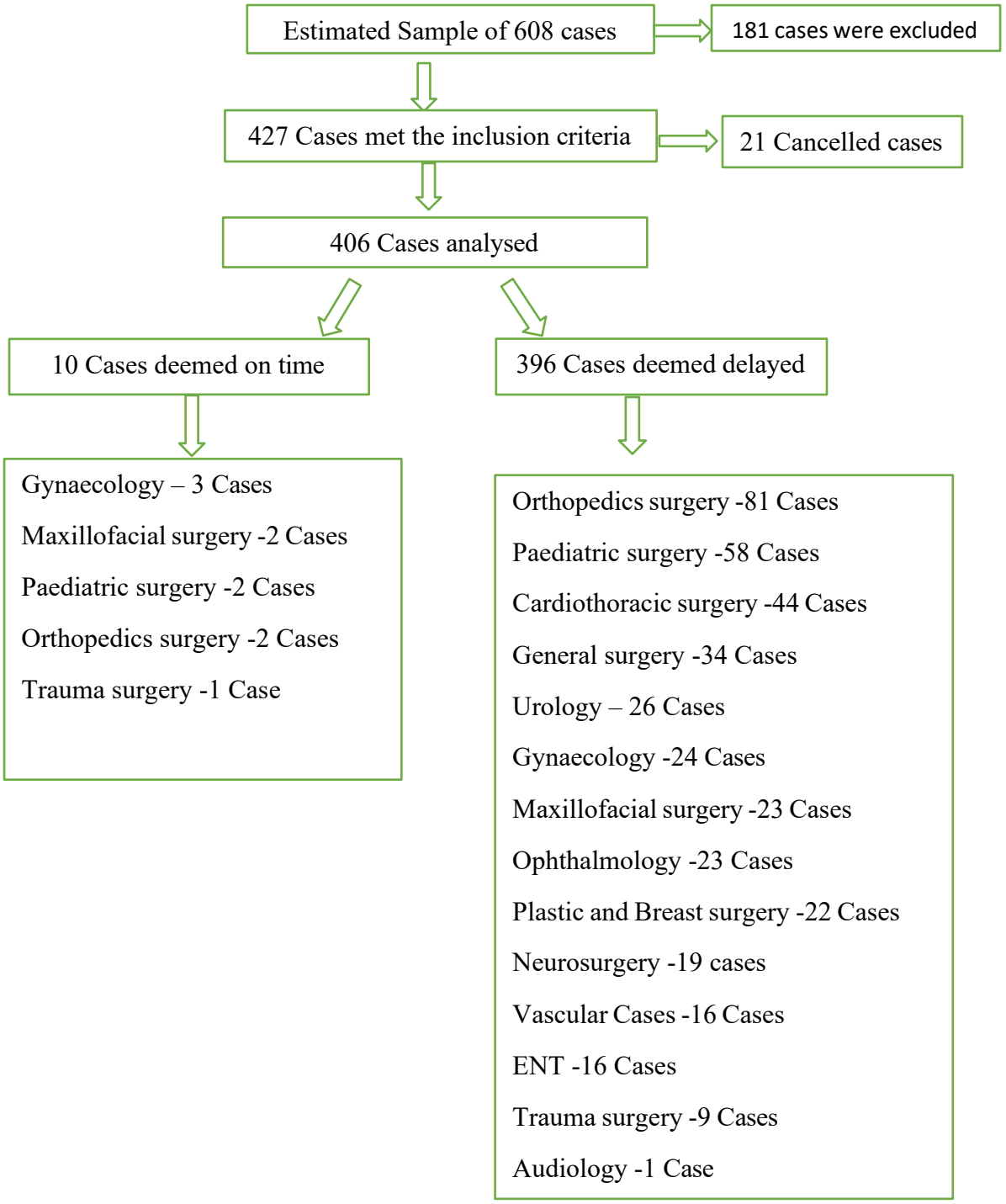


Figure 1: Flow diagram of the study data.

The following were scheduled first case start time per specialty: 07:00 for cardiac surgery, 07:30 for urology, ENT, general surgery, trauma surgery, orthopedics surgery, vascular surgery, ophthalmology, and maxillofacial surgery, and 08:00 for gynecology, plastics surgery, breast surgery, and pediatric surgery. The distribution of cases per specialty is shown in Table 1.

Table 1: Distribution of cases per specialty.

SPECIALTY	n (%)
Gynecology	28 (6.6)
Urology	28 (6.6)
ENT	19 (4.4)
Maxillofacial surgery	25 (5.9)
Ophthalmology	24 (5.6)
Plastic and breast surgery	24 (5.6)
Orthopedic surgery	86 (20.1)
Trauma surgery	11 (2.8)
General surgery	38 (8.9)
Cardiothoracic surgery	46 (10.8)
Neurosurgery	21 (4.9)
Pediatric surgery	60 (14.0)
Vascular surgery	16 (3.7)
Audiology	1 (0.2)

Of all the 406 cases studied, there was a significant delay in starting the scheduled first elective cases of the day by 97.5% (*n* 396) which is statistically significant with $p<0.001$. There was only 2.5% (*n* 10) cases that were deemed to be on time. The mean delay time for all the cases was 47.3 minutes. The mean delay time for porter send-off was 7.2 minutes (SD 23.8), in-room delay time 42.7 minutes (SD 40.1), anaesthesia delay time 50,7 minutes (SD 40.7), and procedure delay time 90 minutes (SD 69,0). There was a 19% delay during porter send-off, 40% at theatre arrival, 93% in-room delay time, 96% at anaesthesia delay time, and 97.5% at procedure delay time. The mean delay time per specialty at different time delays is shown in Table 2.

Table 2: Frequency of delays in first elective case start, Mean delay time, Standard deviation, and total delay time.

Specialty	Total number of cases analyzed	Delayed cases ***n*** (%)	Mean delay time (minutes)	Standard deviation	Total delay time: minutes (%)
Gynecology	27	24 (88.9)	23.7	34.7	1567 (4.3)
Urology	26	26 (100)	44.0	45	2185 (6.0)
ENT	16	16 (100)	36	40	1364 (3.7)
Maxillofacial surgery	25	23 (92)	50.3	38.4	2311 (6.3)
Pediatric surgery	60	58 (96.1)	30.2	31.7	3526 (9.6)
Orthopedic surgery	83	81 (96.7)	51.3	52.0	8434 (23.0)
General surgery	34	34 (100)	46.2	40	2843 (7.8)
Plastic and breast surgery	22	22 (100)	42.5	40.9	1852 (5.0)
Trauma Surgery	10	9 (90)	46.2	40.8	1108 (30)
Vascular surgery	16	16 (100)	48.6	52.3	1454 (4.0)
Neurosurgery	19	19 (95)	64.0	66.4	2444 (6.7)
Cardiothoracic surgery	44	44 (100)	70.3	63.4	5554 (15.1)
Ophthalmology	23	23 (100)	53.3	39.7	1971 (5.4)
Audiology	1	1 (100)	43.5	22.6	59 (0.2)

There were only five departments that did not have 100% delayed cases. These included Gynaecology with a delayed percentage of 88.9%, Trauma surgery (90%), Maxillofacial surgery (92%), Paediatric surgery (96.1), and Orthopedic surgery (96.7%). The rest of the specialties had 100% delayed cases. Delays at porter send-off and theatre arrival time were low compared to almost 100% of delays occurring at in-room, anaesthesia, and procedure time. The three most delayed specialties were cardiothoracic surgery, neurosurgery and ophthalmology. Delay percentages at different stages of the three most delayed specialties are shown in the table below (Table 3).

Table 3: Delay percentages at different stages of the three most delayed specialties.

Specialty	Cardiothoracic surgery	Neurosurgery	Ophthalmology
Overall delayed cases ***n*** (% of the total number of cases)	44 (100)	17 (100)	23 (100)
Delayed Porter send-off time ***n*** (% of the total number of cases)	12 (27)	8 (47)	1 (4)
Delayed theatre arrival time ***n*** (% of the total number of cases)	29 (66)	5 (29)	9 (39)
Delayed in-room time ***n*** (% of the total number of cases)	43 (98)	16 (94)	23 (100)
Delayed Anaesthesia time ***n*** (% of the total number of cases)	44 (100)	17 (100)	23 (100)
Delayed procedure time ***n*** (% of the total number of cases)	44 (100)	17 (100)	23 (100)

The were 1072 reasons for delay identified during the study. The reasons for the delay were classified into six categories namely: patient-related factors, surgeon-related factors, anaesthesia-related factors, nursing-related factors, logistics-related factors, and others, which were further classified into no reason documented and delayed cascade (meaning that further delay was due to prior delays). Surgeon-related factors accounted for the most delays at 353 (23.7%), followed by other reasons i.e., cascading delay at 339 (22.8%), logistics-related factors at 264 (17.7%), nursing-related factors at 241 (16.1%) and anaesthesia-related factors at 192 (12.9%). Patient-related factors accounted for the least reason for delays at 35 (2.3%) as

shown in figure 2.

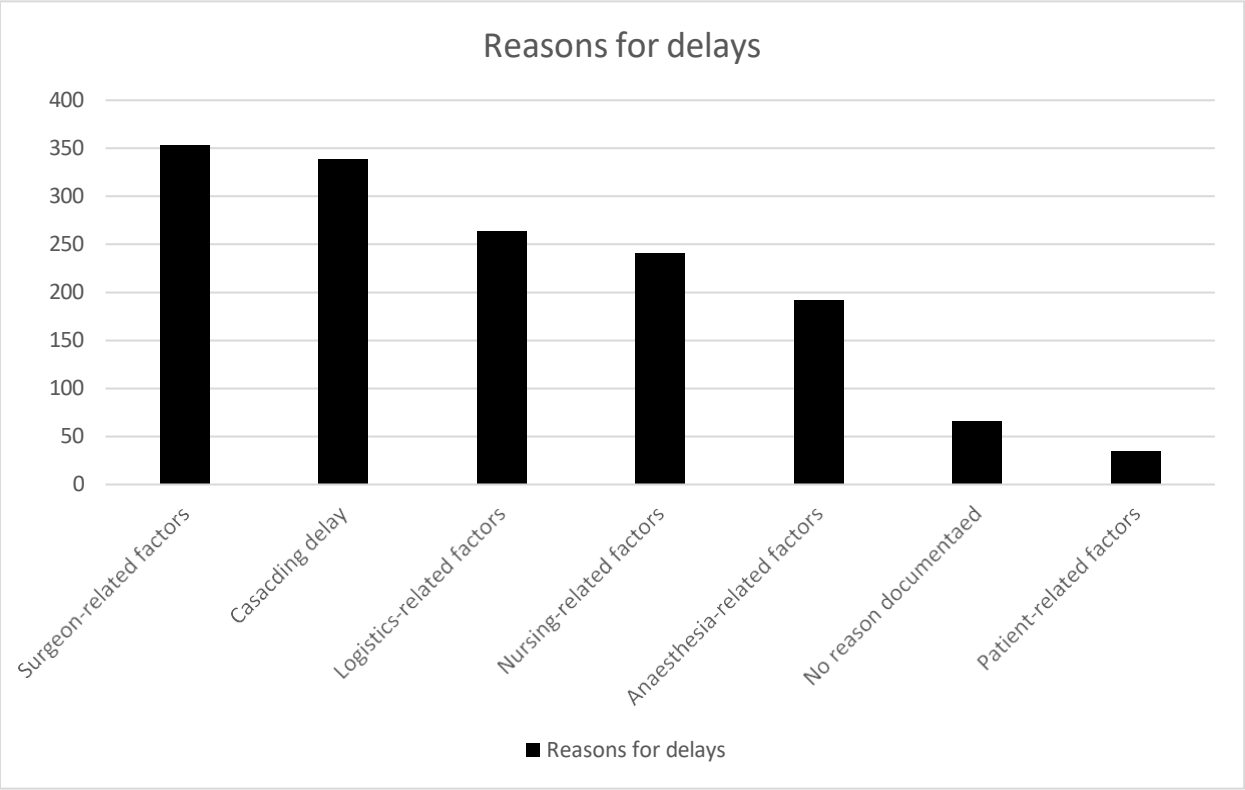


Figure 2: Reasons for delays.

The surgeon being late accounted for 58.9% of all surgeon-related causes, followed by incorrect booking of the surgical list at 14.1%. The most common reasons among other categories included outpatients being late under patient-related factors accounting for 52% and late anaesthetist at 40.2%. The ward nurses preparing patients late or presenting incomplete handover documents accounted for 30%. Late porters accounted for 30% of all logistics-related causes. Common reasons for delays are shown below in Table 4. The causes for delays in the start of the first elective case of the day are further classified into preventable and non-preventable factors. The preventable causes constitute 86% of all causes, whilst 13.4% are non-preventable.

Table 4: Common reasons for delays

Surgeon-related causes (%)	**Anaesthesia-related causes (%)**	**Nursing-related causes (%)**	**Patient-related causes (%)**	**Logistics related causes (%)**
Late arrival (58,9%)	Late arrival (40,2%)	Late arrival (56, %)	Late arrival (53%)	Late porters (30%)
Incorrect bookings (14,1%)	Changed staff (2,3%)	Anaesthetic drug delays (14%)	Violated fasting guidelines (24%)	Equipment failure (25%)
Miscommunication (2,3%)	Difficult technique (unplanned difficult airway and difficult regional techniques) (24%)	Incomplete handover documents (30%)	Refusing operation (5%)	Theatre room issues (25%)
Invalid consent (9,6%)	Invasive lines insertions (23,4%)		Unfit for surgery (10%)	No ICU bed available (8%)
Poor patient preparation (15%)	Lack of consumables (8,3%)		Patient demised (8%)	Additional investigations (7%)
				Others e.g. late representation of companies (5%)

3.5 Discussion

The study has shown the prevalence of delays in the first elective case of the day start time to be within the global standard as depicted in publications.[17] Delays in start time are a widespread problem faced by both developing and developed countries. It has a negative impact on the quality of health and reflects negatively on theatre utilisation.[21] The goal of operating theatre is to maximally use it and mitigate any form of delay. A delayed start time has invariably led to slates finishing late and unplanned cancellations. This has led to increased costs through overtime payments.[21] For this reason, first-case start times have been used as a performance indicator and to implement improvement strategies to optimise theatre utilisation.[19]

This study has indicated a considerable number of delayed cases, accounting for 97.5%. This is similar to the findings of a study by Cox Beaur et al.[2] where they studied 5598 patients across three high-volume urban hospitals between July 2012 and November 2013. They found that 98% of the cases were delayed. Similarly, a higher delayed prevalence of 99% was found in a study conducted in a Nigerian hospital comprising 1170 patients by Okeke et al.[17] These studies were conducted in both developed and developing countries, respectively. However, the findings are in contrast with a Canadian nine-year prospective study of 1531 elective cases where just over 50% (51.4%) of cases were delayed.[36] This large gap in delay prevalence may be attributed to the premise that the study setting was in a specialised neurosurgical unit as compared to a multi-specialty system at CMJAH. Another contributing factor may be resources and the capacity to cater to the operating theatre needs.

This study shows a 0.23% (21 Cases) cancellation rate. This is lower than the findings in a study by Fayed et al. [42] where they studied 1813 cases over 3.5 years. They had an 11.1% cancellation rate. [42] The numbers are similar to the Nigerian study by Okeke et al. [41], which showed a 9.1% cancelation rate of the 1296 cases studied. This difference might be accounted for by the nature of their studies, where they studied all booked elective cases in contrast to our study where only the first elective cases were studied. The commonest reasons for cancellation were low theatre temperatures (38%), poor patient preparation (14.2%), and unavailability of ICU beds (14.2%). Patient-related factors were the most common causes of cancellation by Fayed et al. [42] and Okeke et al. [41]. Majority of patients did not show up for the procedure while in Nigeria, patients were cancelled due to lack of funds. [41,42]. This study took place in the winter season which could have contributed to low theatre temperatures. Theatre thermostat devices in our hospital do not function well contributing to failure to detect or adjust low temperatures. Another contributing factor is that all theatre temperature controls are centralised, making it difficult to single out a specific theatre and adjust its temperature. The department with the

highest cancellation rate is Orthopaedics surgery with 28%. Jayed et al. [42] in a four-year retrospective study of 1813 cases in Saudi Arabia indicated that Ophthalmology had the highest cancellation rate accounting for 37% of all the cancelled cases, while Okeke et al. [41] had general surgery on top of the list with 36%. This highlights that there are multifactorial contributing factors across various institutions.

Causes of delays in our study were multifactorial, with the most common being surgeon-related factors accounting for 23.7%. This was followed by logistics-related factors at 17.7% and nursing-related factors at 16.1%. These findings are similar to a study by Overdyk et al.[34], which found surgeons' unavailability to be the most common reason for the delays accounting for more than half of the reasons. This contrasts with a Nigerian study by Okeke et al., wherein patient-related factors were the leading cause of the delays accounting for 31.1%.[17] The reason for this may be attributed to affordability as patients are required to fund their medical bills. Our study found that over half (58.9%) of the delays were due to surgeons being late. This was followed by wrong booking of surgical lists either the list was submitted late, changed on the morning of the procedure or there was a change order of patients. Issues including invalid, missing, or unsigned consent forms were also among the common causes of delays. Other causes of delays were miscommunication between team members, poor patient preparation, and poor pre-procedure preparations such as positioning, prewash, or insertion of a transurethral catheter.

Logistics-related causes were the second highest reasons for delays. Porters being late accounted for 30% of all logistics-related causes. A similar finding was revealed by Jonnalagadda et al.[38] in a six-week prospective study of 594 cases, where the most common reason for the delay was patient transportation to theatre (17%). In our study, other reasons for delays included equipment failures (25%), delayed cleaning, and awaiting ICU beds or investigations. The common nursing-related issues included late arrival of nurses, drug counting which delayed anaesthesia start time, and ward nurse late preparations. The reason for these delays accounted for 4.4%. This was lower than the 60% finding in a study conducted by Cox Beaur et al.[2] The overall mean delay time in this study was 47.3 (IQR 33-52) minutes. It is almost twice the mean delay times of 28.2 minutes and 21.6 minutes found by Cox Beaur et al. and Shuster et al.[2,39] The difference in the setting of the study by Cox Beaur et al. and our study might be the reason for this finding. Their study took place in a dedicated neurosurgical facility while our study took place in a centre catering to multiple disciplines. Factors such as equipment malfunction, theatre temperature instability, and water shortages were not part of the reasons for the delay in their study.

Specialties with the least prevalence of delays were audiology, paediatric surgery, and gynaecology. Similarly, Shuster et al.[39] studied 21357 cases across twenty-two German Hospitals over 9 months period and found Gynaecology and ENT specialties to have the least delays. The most delayed specialty in our study was cardiothoracic surgery with a mean delay time of 70.3 minutes, followed by neurosurgery with 64.0 minutes, and ophthalmology with 53.3 minutes. In a study conducted by Cox Beaur et al.,[2] Neurosurgery was the most delayed specialty. However, a study by Okeke et al.[17] found that general surgery, orthopaedic surgery, and urology had the most delays. On the other hand, Hicks et al.[19] studies of 3604 cases in a level one trauma centre in 2018 found that paediatric surgery and trauma surgery had the most delays. These findings show that there is no universal start time applicable across surgical specialties, and different institutions have different challenges affecting first-case start times across various specialties.

The main goal in trying to identify the areas of delays in the start time of the first elective cases was to mitigate these delays for better outcomes. We have found that 86% of all the reasons for delay were preventable factors and 13.4% were non-preventable. This highlights room for improvement. [7] The commonest preventable cause of delay is staff being late. Numerous strategies have been shown to improve outcomes. The financial incentives method involves financially rewarding healthcare providers who perform better. [23] Han et al [25] implemented a mandate to pay neurosurgical registrars if they managed to ensure that the patient is brought to the theatre on time or earlier. They managed to reduce the first-case start delays by 7.17% and patients were brought to the theatre 30 minutes early. Improved interdepartmental communication and frequent meetings to discuss the roles and expectations of each team member have been shown to reinforce the first case on-time start. [26] Overdyk et al [34] implemented theatre efficiency educational strategies to staff over 2 weeks and they improved first case start time by 22 minutes. [1]

Logistics-related factors involved cleaning theatre rooms late, inconducive theatre temperatures, waiting for the availability of ICU beds, and equipment failure. The theatre temperatures must be checked before and at the end of each theatre list to ensure that the temperatures are within the recommended values. Regular equipment servicing and appointing of a designated team to ensure up-to-date equipment functioning will reduce late first-case starts. Cleaning of theatres at the end of a theatre list will reduce the need for morning cleaning.

3.6 Strengths and limitations

The overarching strength of the study is that it contributes to the body of knowledge in the subdiscipline of Anaesthesiology, given that reasons for delays in first elective case start times have been identified. Strategies can be implemented accordingly to reduce such delays. The study was conducted in a single academic hospital setting. Thus, limiting the generalisation of its findings.

3.7 Conclusion

The study reported an alarmingly high rate (97.5%) of delayed cases, with surgeon-related factors being the most common cause. The majority of these causative factors are preventable and can be improved. Strategies can be put in place to mitigate these delays. In doing so, costs may be reduced, and the quality of health care may be improved.

3.8 References

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Section 4: Proposal



Reasons for delays in start of elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital.

Principal Investigator

Dr Manganyi Rixongile Style

2610358

Supervisors:

Dr Nana Fening (CMJAH Department of Anaesthesiology)

Dr Amanda Nkuna (CMJAH Department of Anaesthesiology)

4.1 Introduction and problem statement

Operation theatres form part of the costly component of hospital budget expenditures, thus maximizing operation theatre utilization ensures optimum cost-benefit.[13,29,30] International studies have shown that 16-24% of operating theatres may be wasted due to inefficient functional theatre complexes, causing significantly limited healthcare resources wastage.[2,13] In South Africa, public hospital theatre utilization averages between 30-40% compared to the private sector which averages 48%.[13]

Operating theatre delays in first-case start time increases scheduled theatre time wastage, overruns, and unplanned cancellations.[8] These factors result in increased hospital stay, increased patient care costs (including food, medications, bed, etc.), increased elective waiting list periods, patient dissatisfaction, and to some extent patient safety.[9] Conducting this study to identify the areas of delays, will assist in developing improvement strategies that may be applied and improve the first case start time in our institution as well. This study aims to determine the reasons for the delay in the first case start time of the elective cases at Charlotte Maxeke Johannesburg Academic Hospital.

4.2 Aims and objectives

4.2.1 Aim

The study aims to determine the reasons for delays in the start of the first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital.

4.2.2 Objectives

2.2.1. To determine the actual first case start times.

2.2.2. To identify preventable and non-preventable causes (modifiable and non-modifiable factors responsible for delays).

2.2.3. To classify causes of delays.

4.3 Research assumptions

- Elective case: a scheduled procedure that is not urgent or an emergency.
- Emergency case: an unplanned operation performed on patients with an acute condition that threatens the life, limb, or integrity of a body structure.
- Scheduled first case: this is the first elective case scheduled in the operating room for the day.
- Scheduled first case time: is defined as the time when the case is posted to start in the operating theatre, which differs for different specialties at CMJAH (4).

- On-time start: is the patient in-room time that occurs at or before the scheduled first case time.
- Start time delays: is defined as the patient in-room time that occurs after the scheduled first case time.
- Porter send-off time: is defined as the time the patient slip is written and handed over to the porter to collect the patient from the ward.
- Grace period: is defined as the additional period of 5 minutes added to the scheduled case start time.[4]
- Theatre arrival time: is defined as the time the patient is wheeled into the theatre reception area.[4]
- Patient in-room time: this is the time when the patient is wheeled into the operating room for an operation.[4,9]
- Anaesthetic time: this is the time when the anaesthetist or Anaesthetic nurse starts preparing the patient or attachment of monitors.[4,9]
- Procedure time: is defined as the earliest time of a specific surgical positioning or skin preparation which differs for different specialties at CMJAH.[4,9]

4.4 Demarcation of the study

The study will be done at CMJAH operating theatres which is affiliated to the faculty of health sciences of the University of Witwatersrand.

4.5 Ethical considerations

Approval to conduct the study will be submitted to the human research ethics committee of the University of Witwatersrand, hospital management, and medical advisory committee. The study will be discussed with colleagues involved in the management of the qualifying patients and the theatre management team. Consent to conduct the study will be obtained from the theatre management team.

The study audits patient medical records and theatre record books, it does not in anyhow interfere with patient management. It does not pose any harm to the patients and healthcare personnel. The data collected do not include patient identifiers that is; names, ages, or file numbers, hence formal patient consent will not be required. Each patient will be allocated a number to maintain the patient's anonymity.

Raw data will only be accessed by the researcher and the supervisors to maintain confidentiality. Data will be securely stored for six years after completion of the study. It will be locked up in a

cupboard and electronically on a password-protected database. The study will be conducted under the guidance of the principles of the Declaration of Helsinki.

4.6 Research methodology

4.6.1 Research design

The study will be conducted as a prospective, observational study. A prospective study collects data over a period from the commencement of the study. This is a prospective study as the data is collected as new patients are enrolled in the study.

4.6.2 Study population

The study population will be adults and Paediatric patients undergoing elective surgery scheduled as the first case of the day at CMJAH, in Parktown, Johannesburg.

4.6.3 Study sample

The study will include all qualifying patients who underwent elective surgery as first cases over two months. An estimated sample size of 384 cases was calculated using statistical formulae calculator.net. The sample size was calculated using a delay proportion of 50%. A total number of 424 cases will be considered adequate taking into consideration the sample errors of 10%. An average of 16 cases are done on Mondays to Wednesdays, 15 cases are done on Thursdays and 13 cases on Fridays making a total of 76 cases in a week. A total number of 608 cases are estimated at the end of two months, which is above the estimated sample size.

4.6.4 Sampling method

The sampling method describes how patients in the study are selected from the population group.[31]

The sampling method for this study will be the Convenience method which is described as a non-random selection of samples as they are in the right place at the right time.[31]

4.6.4.1 Inclusion criteria

a. All age group patients.
b. Elective cases.
c. First cases.
d. Cancelled cases.

4.6.4.2 Exclusion criteria

a. Cases not requiring an anaesthetist.
b. Cases done after scheduled elective time i.e., after 16:00.

4.6.5 Data collection

The study will be conducted as a prospective study in a 1088-bed teaching hospital elective CMJAH theatres in Johannesburg, Parktown. The elective theatres at the hospital will be utilized. It will be conducted over two months. All weekday scheduled first cases booked at least one day before the operation will be enrolled for the study. Cases not requiring an anaesthetist as well as those done after hours (before 07:00 and after 16:00), during public holidays, or weekends will not be included in the study.

Data collection will be primarily conducted by the researcher who completes the first part of the data collection tool (see Appendix 1 Table A). The researcher will be available in the hospital from 06:30 every weekday for the period of the study to observe the process and collect data. The researcher will not interfere with any of the steps of the perioperative process to minimise bias. The data collected will not include patient identifiers nor interfere with their perioperative management, hence formal patient consent will not be required. The nursing personnel who send for a patient will note and record the time on the porter send-off slip. The researcher will check the porter send-off slip and check if the time is recorded before the send-off. Should it not be recorded, the researcher will record the time on the data collection tool before sending it off.

When the patient arrives in the theatre reception area from the ward, the nursing personnel receives the patient, documents the patient's condition, and records the time in the patient's file. The time is noted as the theatre arrival time. The researcher will record this information as well. The patient is either wheeled directly into the operating room or wheeled into the waiting area. If the patient is wheeled to the waiting area, the reason for not being wheeled directly into the operating room will be documented. The attending anaesthetist will record the remaining information (see Appendix 1 Table B) and the reasons for the delay (see Appendix 1 Table C). if the patient is wheeled directly into the operating room, the attending anaesthetist must record the time on the patient slip designed for data collection as patient in-room time as not all theatres document it in the record books. They will record patient in-room time, anaesthesia time, and procedure time. If the anaesthesia time or procedure time is not documented on the slip, it will be extracted from the anaesthetic chart or redcap program.

There will be sealed collection boxes placed in all recovery areas next to the departmental anaesthetic charts drop-off box, where the completed slips must be dropped in. The boxes will only allow drop-in and not withdrawal. At the end of each day, the boxes will be opened, and the data collected on the patient slips will be transferred onto a data collection tool and analysed. The data will be kept in a sealed box placed in a locked cupboard inside a room with limited access for 6 years.

Six different times will be recorded namely scheduled first case time, porter send-off time, theatre arrival time, patient in-room time, anaesthetic time, and procedure time. For every case, the patient in-room time will be noted and compared to the scheduled first case time. If the patient's in-room time is at or before the scheduled time, the patient will be coded as an on-time case. If the patient's in-room time is after the scheduled first case time, the case is coded as a delayed case and the reason for the delay will be documented. Likewise, if the anaesthesia time or procedure time is after the scheduled anaesthesia or procedure time, the case will be coded as delayed, and the reason will be recorded. A five-minute grace period will be considered when analysing the data. The pattern of first case start time delays, frequency of delays, mean delay times, and reasons for delays will be examined. The reason for the delays will be categorised into surgeon-related, patient-related, anaesthetic-related, nursing-related, and hospital or logistics related (which will include factors such as porters, equipment, and supplies).

4.6.6 Data analysis

The information from the data collection tool will be entered into a Microsoft Excel spreadsheet and analysed as discrete data. Data analysis will occur in consultation with the biostatistician. Continuous variables will be described using central tendencies. Preventable and non-preventable causes of delays will be described using chi-square to determine the independence or association of data. The reasons for delays will be classified for easy interpretation and undergo a regression model. The p-value of 0.05 or less will be considered statistically significant.

4.7 Significance of the study

The study aims to determine the causes of delays in first case start times at CMJAH elective theatres that will aid in developing and implementing improvement strategies to reduce hospital stays that will secondarily relieve the financial burden of the hospital.

4.8 Validity and reliability of the study

Validity refers to whether the conclusions made by the study are justified according to the design and interpretation.[32]

Reliability is defined as consistency throughout a series of measurements.[33] The validity and reliability of the study will be ensured by:

a. Using appropriate study design.

b. Data collection tool.

c. Any record with insufficient information will be discarded.

d. Statistical derivation of the sample size to ensure the appropriate power of the study.

e. Analysing the data with a biostatistician.

4.9 Potential limitations

The study is limited to the first elective cases and the patient sampling method is non-random, so there may an element of being bias. The study depends on the nursing staff and medical doctors caring for the patient, so there may also be some biased information. The availability of the researcher throughout the study may cause bias and skew the results.

4.10 Project outline

4.10.1 Time frame

Table 1.

	2022			2023			2024	
	January-April	May-August	September-December	January-April	May-August	September-December	January-April	May-October
Literature Review								
Proposal Preparation								
Proposal Submission								
Postgraduate approval								
Ethics approval								
Data collection								
Data analysis								
Submission & marking								

4.10.2 Budget

The University of the Witwatersrand Department of Anaesthesiology will incur the costs of paper and printing for the postgraduate application. Any shortfall and remaining costs will be covered by the primary researcher.

Table 2.

	Per page	Number of pages	Copies	Price per patient	Total
Proposal	R2-00	12	10		R240-00
Postgraduate Form	R2-00	2	8		R32-00
Data collection Tool	R2-00	1	500	R2-00	R1000-00
Complete Report	R2-00	80	5		R800
Grand Total					R2072-00

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Appendices

Appendix 1: data collection sheet

Table A: Case details and time slip completed by the researcher

DATE	
THEATRE NAME	
SURGICAL SPECIALTY	
PROCEDURE	
SCHEDULED FIRST CASE TIME	
PORTER SEND-OFF TIME	
THEATRE ARRIVAL TIME	

Table B: Time slip completed by the attending anaesthetist

PATIENT IN-ROOM TIME	
ANAESTHESIA TIME	
PROCEDURE TIME	

Table C: Reasons for delays

REASONS FOR DELAYS	DELAYED PORTER SEND-OFF TIME	
	DELAYED THEATRE ARRIVAL TIME	
	DELAYED PATIENT IN-ROOM TIME >07:30	
	DELAYED ANAESTHESIA TIME >07:30	
	DELAYED PROCEDURE TIME >08:00	

Appendix 2: Approval letter to conduct research

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF ANAESTHESIA
Area 361
Charlotte Maxeke Johannesburg Academic Hospital

Tel: 011 488 4344
Fax: 086 765 3477

12 January 2023

Dr RS Manganyi
Registrar: Department of Anaesthesia

Dear Dr Manganyi

APPROVAL FOR MMed RESEARCH DATA COLLECTION

I fully support the participation of the Department of Anaesthesia at CMJAH in your MMed research endeavor, titled: Reasons for delays in start of first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital. The findings from this study will contribute towards improved productivity and outcomes in caesarean section patients.

The departmental support for this study is subject to the usual preconditions, namely that the study will not have any cost implications to the department / hospital and must be approved by all the relevant ethics and hospital research committees before data collection can start.

Yours sincerely,

Prof EE Oosthuizen
Clinical head: Department of Anaesthesia

Appendix 3: Final approval to conduct research at CMJAH

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG
ACADEMIC HOSPITAL
OFFICE OF THE CLINICAL DIRECTOR

Enquiries: *Ms N. Mzila*
Email: Nolwazi.Mzila@gauteng.gov.za
Tel: *011 488 3365*
Ref: *1/7/2*
Date: 04 May 2023

GP_202212_018

Dear Rixongile Style Manganyi

RE: FINAL APPROVAL OF STUDY

TITLE: REASONS FOR DELAYS IN START OF FIRST ELECTIVE CASE OF THE DAY AT CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL.

Permission is granted for you to conduct the above-mentioned study as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic Hospital will not in any way incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall always be observed.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the HOD and Unit Manager or Sister in charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Supported / ~~Not Supported~~
Signed by:Jayshina Punwasi
Signed at:2023-05-04 16:12:08 +02:00
Reason:Witnessing Jayshina Punwasi

Dr J. Punwasi
Clinical Director

Approved / ~~Not Approved~~
Signed by:Gladys Magugudi Bogoshi
Signed at:2023-05-05 08:04:01 +02:00
Reason:Witnessing Gladys Magugudi Bo

Ms G. Bogoshi
Chief Executive Officer: CMJAH

Appendix 4: Ethics approval

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

R49 Dr R Manganyi

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M221067

NAME: (Principal Investigator)	Dr R Manganyi
DEPARTMENT:	School of Clinical Medicine Department of Anaesthesiology Medical School University
PROJECT TITLE:	*Reasons for delays in start of first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital*
DATE CONSIDERED:	2022/10/28
DECISION:	Approved unconditionally
CONDITIONS:	
NOTE:	If contact information regarding student study participants is required, please contact the Registrar's office - <Nicoleen.Potgieter@wits.ac.za>
SUPERVISOR:	Drs NY Fening and A Nkuna
APPROVED BY:	CB Penny Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2023/04/11

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **October** and therefore reports and re-certification will be due in the month of **October** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator — Date: 2023/04/15

Appendix 5: Post-graduate study approval

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

22 September 2022
Person No: 2610358
PAG

Dr RS Manganyi
Unit 44 Edwards Boulevard
Heather View
0183
South Africa

Dear Dr Rixongile Manganyi

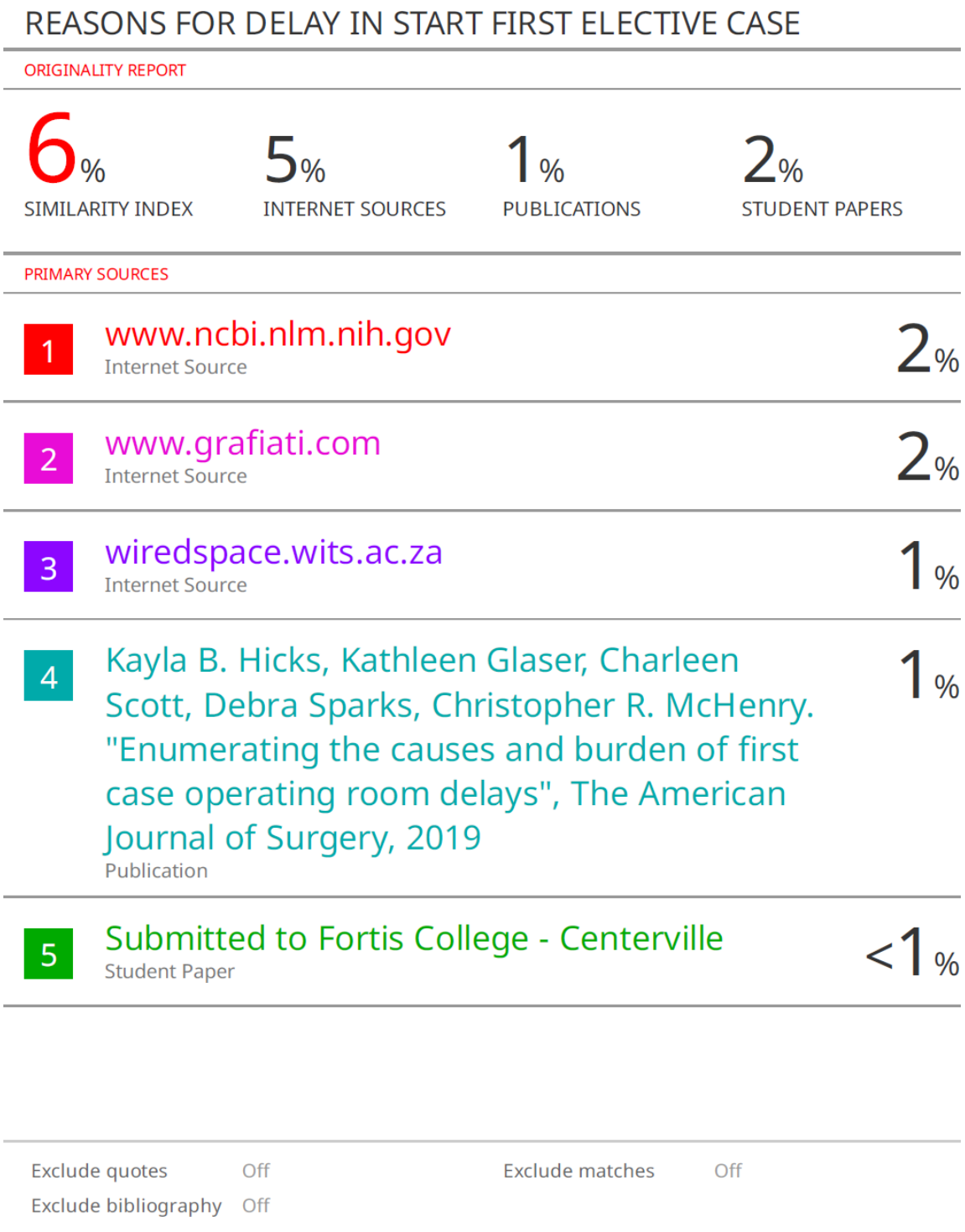
Master of Medicine in Anaesthesia: Approval of Title

We have pleasure in advising that your proposal entitled *Reasons for delays in start of first elective case of the day at Charlotte Maxeke Johannesburg Academic Hospital* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 6: Turnitin report



REASONS FOR DELAY IN START FIRST ELECTIVE CASE

ORIGINALITY REPORT

6%	5%	1%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.ncbi.nlm.nih.gov Internet Source	2%
2	www.grafiati.com Internet Source	2%
3	wiredspace.wits.ac.za Internet Source	1%
4	Kayla B. Hicks, Kathleen Glaser, Charleen Scott, Debra Sparks, Christopher R. McHenry. "Enumerating the causes and burden of first case operating room delays", The American Journal of Surgery, 2019 Publication	1%
5	Submitted to Fortis College - Centerville Student Paper	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		