Audit of a surgical booking system for non-elective cases in a tertiary hospital

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A research report submitted to the Faculty of Health Sciences,
University of the Witwatersrand, Johannesburg,
in the partial fulfilment of the requirements for the degree of
Master of Medicine in the branch of Anaesthesiology

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Declaration

I, Natalie Jean van Wyk, herewith declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

_____

Signed

On this_____25th____day of_____October_____2023

Dedication

This MMed is dedicated to my wonderful husband Chad and our truly beautiful daughter Anna.

Abstract

Background

South Africa has a particularly large burden of emergency surgical disease, coupled with resource constraints as evidenced by fewer theatres per 100 000 population than the global average. The World Society of Emergency Surgery Study Group Initiative on Timing of Acute Care Surgery (TACS) Classification suggested application of a colour-coded triage system for acute surgical emergencies. TACS developed a ratio of Actual Time to Surgery (aTTS) to Ideal Time to Surgery (iTTS), based on expert opinion for each triage level. It is suggested that each institution examine its aTTS/iTTS ratio as a quality assessment tool, with a target ratio of ≤ 1.

Objectives

The primary objectives of this study were to describe the time between booking of non-elective operating theatre (OT) cases to the aTTS, denoted by the surrogate of time to theatre, at Chris Hani Baragwanath Academic Hospital and compare it to the iTTS for each colour-coded triage level. The secondary objectives included a description of the total number of non-elective cases per surgical discipline, identification of time differences in preoperative delays between surgical disciplines and age subgroups, and a comparison of preoperative delays for trauma patients against published data from Groote Schuur Hospital.

Methods

A retrospective clinical audit was conducted in the four dedicated 24-hour theatres of the JD Allen emergency operating theatres (JDA EOTs) over a period of one month. A colour code was added to each booking, at the discretion of the booking surgeon, according to the CHBAH operating theatre triage system (COTTS). The COTTS defined five categories, each with a corresponding iTTS, namely red (immediate), orange (2 hours), yellow (2 to 6 hours), green (24 hours) and blue (72 hours). The aTTS/iTTS ratio was calculated for each triage level.

Results

The sample size was 435 cases, comprised mostly of general surgery cases (29.7%), followed by orthopaedic surgery (20.1%) and trauma surgery cases (19.5%), respectively. The median aTTS for the red category (with target of immediate aTTS) was 2.1 hours (IQR 1.0 – 4.1 hours). The aTTS/iTTS ratio was 2.75 for the orange category and 2 for the yellow category. The aTTS/iTTS ratio was compliant for the green and blue groups, both with ratios of 0.7. The geriatric group showed the longest aTTS in each triage group and overall. The aTTS for trauma patients at CHBAH was longer for all triage categories than that reported from GSH in 2018.

Conclusions

This study shows a pattern of prolonged aTTs/iTTs ratios for higher urgency patients and acceptable ratios for lower urgency patients at CHBAH. The geriatric age group showed a longer aTTS for each triage level and overall. Further investigation into reasons for delays and optimal OT utilisation are necessary.

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List of Abbreviations

ACS	Acute care surgery
aTTS	Actual Time to Surgery (denoted by the surrogate of time to theatre)
CHBAH	Chris Hani Baragwanath Academic Hospital
COTTS	CHBAH Operating Theatre Triage System
DKA	Diabetic ketoacidosis
ENT	Otorhinolaryngology
GIT	Gastrointestinal
GSEST	Groote Schuur Emergency Triage System
GSH	Groote Schuur Hospital
HIV	Human immunodeficiency virus
iTTS	Ideal Time to Surgery
IQR	Inter quartile range
JDA EOT	JD Allen emergency operating theatre
MFOS	Maxillofacial and Oral Surgery
OT	Operating theatre
SA	South Africa
SAMJ	South African Medical Journal
SASOS	South African Surgical Outcomes Study
SSG	Split skin graft
TACS	Timing of Acute Care Surgery
TTT	Time to theatre

Statement

The research report consists of a draft article and appendices. A literature review and the study proposal are included as appendices for background reference and are not for examination.

The formatting of the 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 research report in order to comply with the author guidelines of the South African Medical Journal (SAMJ), the journal to which it is intended to be submitted.

Draft Article

Audit of a surgical booking system for non-elective cases in a tertiary hospital

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This study shows a pattern of prolonged aTTs/iTTs ratios for higher urgency patients and acceptable ratios for lower urgency patients at CHBAH. The geriatric age group showed a longer aTTS for each triage level and overall. Further investigation into reasons for delays and optimal OT utilisation are necessary.

Introduction

The global surgical caseload is large, with an estimated 234.2 million major surgical procedures performed annually.[1] In South Africa (SA), the burden of surgical disease is increased by high levels of trauma and conditions arising from HIV.[2] The South African Surgical Outcomes Study (SASOS)[3] found that 54.2% of surgical procedures performed in SA were non-elective. This is in contract to high income countries, where general surgery emergencies comprise only 10% of the surgical caseload. [1] Despite the large burden of emergency surgical disease, SA has significantly fewer operating theatres (OTs) per 100 000 population than the global average [4] and there are reports of OT utilisation time being below international standards.[5] This combination could be expected to result in preoperative delays which have significant cost implications and may increase morbidity and mortality.[6]

The World society of emergency surgery study group initiative on Timing of Acute Care Surgery classification (TACS) suggested application of a colour-coded triage system for acute surgical emergencies.[7] TACS developed a ratio of Actual Time to Surgery (aTTS) to Ideal Time to Surgery (iTTS), based on expert opinion for each triage level, and suggested that each institution examine its aTTS/iTTS ratio as a quality assessment tool. Chowdhury et al [8] compared delays to the OT for trauma patients at Groote Schuur Hospital (GSH) but such a study has not been conducted at the JD Allen Emergency OT (JDA EOT) complex at Chris Hani Baragwanath Academic Hospital (CHBAH).

The primary objectives of this study were to describe the time between booking of non-elective operating theatre (OT) cases to the aTTS, denoted by the surrogate of time to theatre, and compare it to the iTTS for each colour-coded triage level. The secondary objectives included a description of the total number of non-elective cases per surgical discipline, identification of time differences in preoperative delays between surgical disciplines and age subgroups, and a comparison of preoperative delays for trauma patients against published data from GSH.

Methods

The JDA EOT complex at CHBAH comprises four dedicated 24-hour emergency OTs. The complex is shared by multiple surgical disciplines including the acute care surgery (ACS) unit, trauma surgery, otorhinolaryngology (ENT), paediatric surgery, maxillofacial and oral surgery (MFOS), orthopaedic surgery, urology, plastic surgery, vascular surgery and neurosurgery. Although there is a separate obstetric and gynaecological OT complex, occasionally it is necessary for obstetric and gynaecological cases to be performed in the JDA EOT.

The surgical booking system was a paper-based system recording the patient details, procedure and time of booking. A colour code was added to record the urgency level of each case booked. The colour code was determined, at the discretion of the booking surgeon, according to the CHBAH Operating Theatre Triage System (COTTS), shown in Table 1. The COTTS is modified from the Groote Schuur Emergency Triage System (GSEST)[8] and the 2009 New South Wales Health Emergency Surgery Guidelines.[9]

Table 1: CHBAH Operating Theatre Triage System (COTTS)

Colour code	Urgency category	Parameters
Red		1) Immediate threat to life 2) Shocked or moribund, no physiological response to resuscitation 3) Surgery is a component of resuscitation 4) E.g. massive upper GIT bleed, ruptured aortic aneurysm, threatened airway
Orange	Urgent (within 2 hours)	1) Life or limb threatening 2) Physiological response to resuscitation 3) Surgery as soon as possible after resuscitation 4) E.g. intrabdominal hypertension, bowel ischaemia, leaking aortic aneurysm, significantly raised intracranial pressure, acute limb ischaemia
Yellow	Expedited (within 2 – 6 hours)	1) Physiological derangement but stable 2) Likely to significantly deteriorate if surgery not performed 3) E.g. complicated appendicitis, hollow viscus perforation, incarcerated hernia, bowel obstruction, sepsis with DKA, necrotising fasciitis
Green	Emergent (within 24 hours)	1) Physiologically stable, deterioration not expected but possible 2) E.g. abscess drainage, bleeding haemorrhoids, wet gangrene without DKA
Blue	Scheduled (within 72 hours)	1) Semi-urgent, deterioration unlikely 2) Surgery during day shift, on available elective list if possible 3) E.g. revision amputation stump, SSG fasciotomy wound

GIT: gastrointestinal, DKA: diabetic ketoacidosis, SSG: split skin graft

A retrospective clinical audit was conducted. Approval to conduct the study was obtained from the Human Research Ethics Committee (Medical) (M210410) of the University of the Witwatersrand and other relevant authorities.

Data were collected over a period of 30 days from 1 April 2022 to 30 April 2022 by a single data collector using a consecutive convenience sampling method. All non-elective cases booked on the paper-based surgical booking system of the JDA EOT complex at CHBAH were captured using Microsoft® Excel® data collection spreadsheet. The following data points were extracted from the surgical booking system, departmental and theatre records:

1. Case Number
2. Time period and time of booking
3. Procedure
4. Surgical discipline
5. Triage level at the discretion of the surgeon as defined by the COTTS
6. Patient age
7. Time period procedure performed
8. Time of start of anaesthesia (time in the OT)
9. Time out of the OT

Cases which were excluded were those for which the procedure was performed in an alternative OT complex, those who tested positive for SARS-CoV-2 while awaiting the OT, those with an unrecorded COTTS triage level and those for which the triage level changed as the time of triage change was not recorded in the booking system.

Data were analysed with Stata version 16 (StataCorp USA). Categorical variables were described using median values with interquartile ranges as all data sets were non-parametrically distributed. Age was analysed as a continuous variable, and further divided into paediatric (< 18 years of age), adult (18 – 65 years of age) and geriatric (> 65 years of age) subgroups for analysis. Surgical disciplines were divided into trauma surgery, general surgery, orthopaedic surgery and all other disciplines were combined as ‘other’. The Mann Whitney rank sum test was used to compare the aTTS for trauma patients to all other patients for each triage level. A p-value of < 0.05 was considered statistically significant. Duration of time in theatre per COTTS category was compared using the Kruskal-Wallis equality-of-populations rank test as post hoc analysis.

Results

A total of 660 cases were recorded in the booking system during April 2022. Of these, 124 were excluded as the surgery was not performed in the JDA EOT. The group not performed in the JDA OT, and unaccounted for, was comprised mostly of patients triaged to the green (29%), yellow (21%) and orange (15%) COTTS categories with only 2 patients each, from the blue and red categories. A further 12 tested positive for SARS-CoV-2 while awaiting theatre and 80 cases did not have a recorded COTTS classification. The cases excluded for unrecorded COTTS classification were comprised of general surgery (41%), orthopaedic surgery (26%), trauma surgery (18%) and other surgical disciplines (15%). A further nine cases were excluded due to a change of triage score with unrecorded time. The sample size was 435 cases. The aTTS variable had 27 missing data points with 408 cases remaining for the aTTS analysis.

The median age of the sample was 32 (IQR 23 – 48). The paediatric subgroup accounted for 16%, the adult subgroup 78%, and the geriatric subgroup 6%, of the sample. The sample is described by surgical discipline in Table 2.

Table 2: Total number of non-elective cases per surgical discipline

Surgical group	Surgical discipline	n (%)
Trauma		85 (19.5%)
Surgery	ACS	129 (29.7%)
	General surgery	5 (1.2%)
	Subtotal: 134 (31.9%)	
Orthopaedics		91 (20.1%)
Other	Neurosurgery	32 (7.4%)
	Paediatric surgery	25 (5.8%)
	ENT	17 (3.9%)
	Urology	16 (3.7%)
	Gynaecology	13 (3.0%)
	MFOS	7 (1.6%)
	Vascular surgery	7 (1.6%)
	Plastic surgery	6 (1.4%)
	Combined neurosurgery and ENT	2 (0.5%)
	Subtotal: 125 (28.7%)	
Total		435 (100%)

ACS (Acute Care Surgery), ENT (Otorhinolaryngology), MFOS (Maxillofacial Surgery)

The ratio of aTTs/iTTS exceeded the recommended ratio of ≤ 1 for the red, orange and yellow categories. However, the ratio was ≤ 1 and compliant with TACS guidelines for the green and blue categories (Table 3).

Table 3: Comparison of the actual and ideal Time to Surgery per triage level

Triage	iTTS	Number	Median time in hours (IQR)	aTTS/iTTS
Red	Immediate	31 (7.5%)	2.1 (1.0 – 4.1)	
Orange	<2 hours	87 (21.3%)	5.5 (2.5 – 10.0)	2.75
Yellow	<6 hours	148 (36.2%)	12 (6.8 – 19.9)	2
Green	<24 hours	137 (33.6%)	16.3 (9.8 – 33.4)	0.7
Blue	<72 hours	5 (1.2%)	48.7(36.3 – 77.5)	0.7
Total		408 (100%)		

Adult patients had the shortest aTTS in the red, orange and yellow groups. Geriatric patients had the longest aTTS in all groups and overall, as shown in Table 4.

Table 4: Differences in actual Time to Surgery between paediatric, adult and geriatric subgroups

COTTS category	Actual Time to Surgery in hours Median (IQR)					
	Paediatric	n	Adult	n	Geriatric	n
Red	4.7 (4.7 – 4.7)	1	1.7 (1.0 – 3.2)	29	5.7 (5.7 – 5.7)	1
Orange	7.3 (2.5 – 11.2)	11	4.9 (2.5 – 9.9)	72	8.0 (4.1 – 20.9)	4
Yellow	12.0 (9.3 – 21.6)	29	11.8 (6.5 – 18.8)	109	13.0 (5.1 – 22.1)	10
Green	13.6 (8.7 – 24.5)	24	16.7 (10.3 – 35.8)	103	30.5 (12.2 – 47.1)	10
Blue		0	48.7 (36.3 – 77.5)	5		0
Overall	11.2 (7.3 – 20.4)	65	10.4 (4.25 – 20.9)	318	13.4 (5.7 – 32.6)	25

COTTS (Chris Hani Baragwanath Academic Hospital Operating Theatre Triage System)

Time differences in preoperative delays between surgical disciplines are shown in table 5.

Table 5: Comparison of median actual Time to Surgery in hours per triage category by surgical discipline

	aTTS in hours (IQR)									
Discipline	Red		Orange		Yellow		Green		Blue	
		n		n		n		n		n
Trauma	1.3 (0.8 – 2.7)	20	2.7 (1.4 – 9.7)	22	11.4 (6.0 – 17.6)	26	22.1 (12.6 – 49.2)	14		0
Surgery	0.4	1	5.6 (2.8 – 10.0)	41	12.5 (6.2 – 22.1)	69	14.9 (9.1 – 29.1)	66	5.8	1
Orthopaedics		0	6.8 (5.2 – 7.3)	3	13.3 (10.5 – 17.5)	23	21.9 (11.0 – 35.1)	46	77.5 (36.3 – 168.5)	3
Other	4.0 (2.3 – 6.1)	10	6.5 (3.2 – 10.5)	21	9.8 (6.0 – 22.0)	30	19.4 (13.1 – 36.5)	11	48.7	1

When compared to all other surgical disciplines collectively using the Mann-Whitney rank sum test, the aTTS for trauma patients in the red category was significantly less than for all other surgical discipline categories combined (p=0.02). In the orange category, trauma patients showed a shorter aTTS which was non-significant (p=0.07). There was no statistical difference between trauma and other patients with respect to aTTS in the yellow and green categories (p=0.36 and p=0.26, respectively).

The aTTS for trauma patients at CHBAH was longer for all triage categories than that reported from GSH in 2018 (Table 6). As the data sets are non-parametric, statistical comparison was not possible.

Table 6: Comparison of preoperative delays for trauma patients against data published from Groote Schuur Hospital.[8]

Triage	Expected time (hours)	CHBAH aTTS (hours)	Number of cases (n)	GSH aTTS (hours)	Number of cases (n)
Red	Immediate	1.3 (0.79 – 2.7)	20	0.8 (0.6 – 1)	6
Orange	<2 hours	2.7 (1.4 – 9.7)	22	2.0 (0.9 – 3.1)	47
Yellow	< 6 hours	11.4 (6.0 – 17.6)	26	3.6 (1.9 – 5)	40
Green	< 24 hours	22.4 (12.6 – 49)	14	1.8 (1.1 – 4.4)	13
Blue	<72 hours		0		

*The GSH data was reported in minutes but has been converted into hours for the purpose of comparison.

The time in theatre was longest overall for the red category (3.7 hours, IQR 2.8 – 5.7) (p=0.0001), followed in order by orange (2.7 hours, IQR 1.7 – 3.5), yellow (2 hours, IQR 1.4 – 2.8), green (1.4 hours, IQR 1.1 – 2.0) and blue (1.4 hours, IQR 1.2 – 1.6).

Discussion

The sample was comprised mostly of general surgery cases followed by orthopaedic surgery and trauma surgery cases, respectively. A similar majority of general surgical emergencies has been reported from other low to middle income countries.[1] Large proportions of orthopaedic and trauma surgery cases are consistent with the large local burden of trauma.[10]

The aTTS/iTTS ratio was ≥ 1 and non-compliant with TACS guidelines for red, orange and yellow COTTS categories. The ratio was well within targets for the green and blue COTTS categories. Patients triaged as red were also unexpectedly delayed at GSH showing a similar pattern of poorer performance in meeting targets for triage groups of increased urgency. This could partly be explained by periods identified as peaks of trauma presentation[10] exceeding demand on OT services, blocking all available OTs and delaying surgical intervention regardless of triage category.

There are multiple possible reasons for the poor performance. CHBAH serves an immediate population of ≥ 1.5 million people and a population of ≥ 5.1 million people as a referral centre.[11] This equates to a ratio of between 0.5 – 1.7 theatres per 100 000 population, well below the global average of 6.2.[4] The burden on the four emergency OTs is arguably higher as 70% of all admissions are emergencies, including approximately 160 gunshot wound injuries per month.[11]

OT utilisation or efficiency could also be a contributing factor. SA studies in both the private and public healthcare systems have shown OT utilisation (measured as time in the OT over total OT time available) to be significantly lower than the goal utilisation of 80%.[5,12] A recent study investigating OT utilisation of specifically the paediatric surgery OTs at CHBAH showed a utilisation rate of 59.8% which was in keeping with results reported from the United States of America.[13] This is in contrast to the international benchmark of 80%[13], indicating that OT utilisation is a widespread problem.

However, with respect to emergency OTs, over utilisation results in reduced access to patients with urgent levels of triage. Paradoxically, high levels of emergency OT utilisation indicate the need for increased emergency OT capacity.[14] The high demand to resource ratio for emergency OT services at CHBAH precludes holding OTs open as a contingency for urgent cases. The likelihood of an open OT at the time of a red COTTS level case is diminished. The pattern of unacceptable delays for more urgent COTTS levels coupled with compliant aTTS/iTTS ratios for less urgent COTTS levels is consistent with the need for increased emergency OT capacity.

The results could have been confounded by the timing of the study. The study took place during the Covid-19 pandemic which had increased pressure on resources in an already strained healthcare system.[15] The month of April had three public holidays which could have reduced the staffing resources available. There was a regional linen shortage which had slowed OT services for a day, thus creating a backlog. April has also been associated with an increased burden of trauma in the SA setting[10] and could have increased the demand for OT time and further prolonged the aTTS.

Adult patients showed a shorter aTTS for red, orange and yellow COTTS levels when compared to other age-based groups. Paediatric patients only had a shorter aTTS for the

green level. At CHBAH, operating on paediatric patients is avoided after midnight unless deemed life or limb threatening due to evidence suggesting worse outcomes from night-time operating.[16, 17] This could possibly explain the counterintuitive finding of longer aTTS for paediatric patients of the higher triage levels. Geriatric patients had a consistently longer aTTS for each triage level. Possible reasons for this could include more preoperative optimisation and workup required, a reluctance to operate on physiologically frail patients after hours or a prognostic bias. A disproportionally prolonged aTTS for geriatric patients was also reported by O'Leary[6] in keeping with the suboptimal care of geriatric surgical patients described in the United Kingdom.[18]

When comparing only the trauma patients from this study to the data published from GSH trauma patients in 2018[8], the aTTS is longer for all triage categories. This could be accounted for by the challenges mentioned above, for the poor performance of the aTTS/iTTS ratio in general, as well as institutional differences. Prioritisation of another emergency, unavailability of an OT and delays in moving patients to the OT, were cited as the main reasons for delay at GSH.[8]

Trauma patients had a significantly shorter aTTS overall. This indicates a preference for prioritisation of trauma patients above those of the same COTTS triage level of other surgical disciplines. Similar patterns have not been reported, largely due to the paucity of mention of trauma patients, in emergency OT utilisation reports.[1,6,19] This is likely due to differences in local trauma caseloads, with notably high levels of trauma in the CHBAH referral population.[10]

The time spent in the OT for the red COTTS level was significantly longer than for other triage levels. In the era of damage control surgery, it could be expected to see reduced surgical procedure times for the red COTTS level. However, the increased time in the OT could partially be explained by delayed transfer to postoperative intensive care unit (ICU). The ratio of adult ICU beds to total beds is ≤ 1% and paediatric ICU beds make up approximately 2% of total paediatric beds at CHBAH, excluding the neonatal unit. These ratios are considerably lower than those reported by European high-income countries.[20] This results in a demand for ICU beds which exceeds the available resources[20] and increases post-surgical time in theatre while provision is made for appropriate postoperative care. The

longer time in the OT could be expected to further impact theatre efficiency and prolong aTTS for pending cases.

The study is limited by the short duration of data collection. The study took place over a single month and was thus likely skewed by resource availability and surgical demand peculiar to the specific month and thus not generalisable to other time periods. The retrospective nature of the study led to high numbers of exclusion for incomplete data. Following up only those cases performed in the JDA EOT further limited the data. The study did not include investigation into reasons for delays and effects thereof, nor did it measure delays between time of patient presentation, diagnosis and booking.

The strengths of this study include measurement of an important perioperative parameter, not previously reported in our institution. The recording of data for multiple surgical disciplines and comparison of times for each discipline and age subgroup could address possible bias in patient prioritisation. Importantly, it was shown that the targets for aTTS/iTTS are not being reached at CHBAH. This could encourage further investigation into reasons for delays, OT utilisation audits and motivation for increased resources allocation.

Conclusion

The aTTS/iTTS ratio is non-compliant with TACS guidelines for red, orange and yellow COTTS levels at CHBAH for the month of April 2022. This contrasts with the green and blue COTTS levels, for which the aTTS/iTTs ratios were acceptable. The aTTS for trauma patients is also below par when compared to local data.

The pattern of prolonged aTTs/iTTs ratios for higher urgency patients and acceptable ratios for lower urgency patients could indicate a need for increased emergency OT capacity. As the sample was comprised of a higher proportion of green and blue categories (35.8% vs 12.3% reported from GSH), an additional dedicated emergency elective list could be beneficial to offload the main emergency theatres. Red COTTS level patients were shown to spend longer in the OT than their counterparts, bringing into question the effect of limited ICU resources on OT delays.

A longer aTTS was demonstrated for geriatric patients than paediatric and adult patients per COTTS category. This is not an isolated finding and identifies the vulnerable geriatric age group as a target for improvement.

Further research is required to measure emergency OT utilisation and efficiency to optimise utilisation rates and better match resources to demand. Investigation into reasons for and the effects of delays is also necessary.

Conflict of interest

The authors declare no conflict of interest.

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Appendix 1: Journal guideline to authors

Author Guidelines

The *SAMJ* has launched a new submission and tracking system. Authors will be required to register a profile on the in order to submit a manuscript.
To submit a manuscript, please proceed to: https://samajournals.co.za/index.php/samj

To access and submit an article already in production, please see the guidelines here.

Author Guidelines

Please watch the Author Tutorial for guidance on how to submit.

Please take the time to familiarise yourself with the policies and processes below. If you still have any questions, please do not hesitate to ask our editorial staff (tel.: +27 (0)21 532 1281, email: publishing@samedical.org).

SAMJ policies

- Types of articles considered by the SAMJ
- Article Processing Charges
- Authorship
- Conflict of interest
- Research ethics committee approval
- Clinical trials
- Protection of patient's rights to privacy
- Copyright notice
- Privacy statement
- Ethnic classification
- CPD

Manuscript preparation

- Preparing an article for anonymous review
- General article format/layout
- Preparation notes by article type
- Illustrations
- Tables

- References

From submission to acceptance

- Submission and peer-review
- Production process
- Changing contact details or authorship

Publication

- Online versus print
- Errata and retractions
- Indexing

SAMJ Policies

Type of articles considered by the SAMJ

The *SAMJ* will no longer limit the articles accepted to those that have 'general medical content', but is intending to capture the spectrum of medical and health sciences, grouped by relevance to the country's burdens of disease. This content will include research in the social sciences and economics that is relevant to the medical issues around our burden of disease. Please see 'A new vision for the *SAMJ* – and a call for papers' for a full discussion of the new directions for the *SAMJ*.

We accept the following types of articles:

- Research
- Reviews
- Clinical trials
- Editorials
- In Practice (Previously Forum incl. Case Reports)
- Correspondence
- Obituaries
- Book reviews
- Ad hoc supplements e.g. guidelines, conference/congress abstracts, Festschrifts*

The following articles are by invitation only:

- Guest editorial
- Continuing Medical Education (CME)

*Contact claudian@hmpg.co.za for information on submitting ad hoc/commissioned supplements, including guidelines, conference/congress abstracts, Festschrifts, etc.

Publication Fees

All articles published in the *South African Medical Journa*l are open access and freely available online upon publication. This is made possible by applying a business model to offset the costs of peer review management, copyediting, design and production, by charging a publication fee of
R7 000 (vat incl.) for each research and In Practice article published. The publication fee is standard and does not vary based on length, colour, figures, or other elements.

The publication fee is payable when your manuscript is editorially accepted and before production commences for publication. The submitting author will be notified that payment is due and given details on the available methods of payment. Prompt payment is advised; the article will not enter into production until payment is received.

Authorship

Named authors must consent to publication. Authorship should be based on: (*i*) substantial contribution to conceptualisation, design, analysis and interpretation of data; (*ii*) drafting or critical revision of important scientific content; or (*iii*) approval of the version to be published. These conditions must all be met (uniform requirements for manuscripts submitted to biomedical journals; refer to www.icmje.org)

If authors' names are added or deleted after submission of an article, or the order of the names is changed, all authors must agree to this in writing.

Please note that co-authors will be requested to verify their contribution upon submission. Non-verification may lead to delays in the processing of submissions.
Author contributions should be listed/described in the manuscript.

Conflicts of interest

Conflicts of interest can derive from any kind of relationship or association that may influence authors' or reviewers' opinions about the subject matter of a paper. The existence of a conflict – whether actual, perceived or potential – does not preclude publication of an article. However, we aim to ensure that, in such cases, readers have all the information they need to enable them to make an informed assessment about a publication's message and conclusions. We require that both authors and reviewers declare all sources of support for their research, any personal or financial relationships (including honoraria, speaking fees, gifts received, etc) with relevant individuals or organisations connected to the topic of the paper, and any association with a product or subject that may constitute a real, perceived or potential conflict of interest. If you are unsure whether a specific relationship constitutes a conflict, please contact the editorial team for advice. If a conflict remains undisclosed and is later brought to the attention of the editorial team, it will be considered a serious issue prompting an investigation with the possibility of retraction.

Research ethics committee approval

Authors must provide evidence of Research Ethics Committee approval of the research where relevant. Ensure the correct, full ethics committee name and reference number is included in the manuscript.

If the study was carried out using data from provincial healthcare facilities, or required active data collection through facility visits or staff interviews, approval should be sought from the relevant provincial authorities. For South African authors, please refer to the guidelines for submission to the National Health Research Database. Research involving human subjects must be conducted according to the principles outlined in the Declaration of Helsinki. Please refer to the National Department of Health's guideline on Ethics in Health research: principles, processes and structuresto ensure that the appropriate requirements for conducting research have been met, and that the HPCSA's General Ethical Guidelines for Health Researchers have been adhered to.

Clinical trials

As per the recommendations published by the International Committee of Medical Journal Editors (ICMJE), clinical trial research is any research that assigns individuals to an intervention, with or without a concurrent comparison/control group to study the cause-and-

effect relationship between the intervention and health outcomes. All clinical trials should be registered with the appropriate national clinical trial registry (or any international primary register, if relevant), and the trial registration number should be cited at the end of the abstract. All clinical trial reports must also contain a data sharing statement as per the recommendations of the ICMJE. Statements are to indicate:

- whether individual deidentified participant data will be shared;
- what data in particular will be shared; whether additional, related documents will be available;
- when the data will become available and for how long; by what access criteria data will be shared.

Please see the ICJME announcement for further details and illustrative examples of data sharing statements: ICMJE Data Sharing Statements for Clinical Trials

Since 1st December 2005, all clinical trials conducted in South Africa have been required to be registered in the South African National Clinical Trials Register. The SAMJ therefore requires that clinical trials be registered in the relevant public trials registry at or before the time of first patient enrollment as a condition for publication. The trial registry name and registration number must be included in the manuscript.

Please refer to the general guidelines for all papers at the top of this article for additional requirements with respect to ethics approval, funding, author contributions, etc. The format of original research articles should be followed for reporting of clinical trial results.

Patient Consent

Information that would enable identification of individual patients should not be published in written descriptions, photographs, and pedigrees unless the information is essential for scientific purposes and the patient (or parent or guardian) has given informed written consent for publication and distribution. We further recommend that the published article is disseminated not only to the involved researchers but also to the patients/participants from whom the data was drawn. Refer to Protection of Research Participants. The signed consent form should be submitted with the manuscript to enable verification by the editorial team.

Other individuals

Any individual who is identifiable in an image must provide written agreement that the image may be used in that context in the *SAMJ.*

Copyright notice

Material submitted for publication in the *SAMJ* is accepted provided it has not been published or submitted for publication elsewhere. Please inform the editorial team if the main findings of your paper have been presented at a conference and published in abstract form, to avoid copyright infringement. All research already published as 'Conference proceedings' needs to be substantially re-written, with a new title, a new abstract and new and important results to back up any study before it will be considered for a new publication. The *SAMJ* does not hold itself responsible for statements made by the authors.

Previously published images

If an image/figure has been previously published, permission to reproduce or alter it must be obtained by the authors from the original publisher and the figure legend must give full credit to the original source. This credit should be accompanied by a letter indicating that permission to reproduce the image has been granted to the author/s. This letter should be uploaded as a supplementary file during submission.

Privacy statement

The *SAMJ* is committed to protecting the privacy of its website and submission system users. The names, personal particulars and email addresses entered in the website or submission system will not be made available to third parties without the user's permission or due process. By registering to use the website or submission system, users consent to receive communication from the *SAMJ* or its publisher SAMA on matters relating to the journal or associated publications. Queries with regard to privacy may be directed to publishing@hmpg.co.za.

Ethnic/race classification

Use of racial or ethnicity classifications in research is fraught with problems. If you choose to use a research design that involves classification of participants based on race or ethnicity, or discuss issues with reference to such classifications, please ensure that you include a detailed rationale for doing so, ensure that the categories you describe are carefully defined, and that socioeconomic, cultural and lifestyle variables that may underlie perceived racial disparities are appropriately controlled for. Please also clearly specify whether race or ethnicity is classified as reported by the patient (self-identifying) or as perceived by the investigators. Please note that is not appropriate to use self-reported or investigator-assigned racial or ethnic categories for genetic studies.

Continuing Professional Development (CPD)

SAMJ is an HPCSA-accredited service provider of CPD materials. Principal authors can earn up to 15 CPD continuing education units (CEUs) for publishing an article; co-authors are eligible to earn up to 5 CEUs; and reviewers of articles can earn 3 CEUs. Each month, *SAMJ* also publishes a CPD-accredited questionnaire relating to the academic content of the journal. Successful completion of the questionnaire with a pass rate of 70% will earn the reader 3 CEUs. Administration of our CPD programme is managed by Medical Practice Consulting. To complete questionnaires and obtain certificates, please visit MRP Consulting

Manuscript preparation

Preparing an article for anonymous review

To ensure a fair and unbiased review process, all submissions are to include an anonymised version of the manuscript. The exceptions to this are Correspondence, Book reviews and Obituary submissions.

Submitting a manuscript that needs additional blinding can slow down your review process, so please be sure to follow these simple guidelines as much as possible:

- An anonymous version should not contain any author, affiliation or particular institutional details that will enable identification.
- Please remove title page, acknowledgements, contact details, funding grants to a named person, and any running headers of author names.
- Mask self-citations by referring to your own work in third person.

General article format/layout

Accepted manuscripts that are not in the correct format specified in these guidelines will be returned to the author(s) for correction, which will delay publication.

General:

- Manuscripts must be written in UK English.
- The manuscript must be in Microsoft Word format. Text must be single-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes).
- Please make your article concise, even if it is below the word limit.
- Qualifications, ***full*** affiliation (department, school/faculty, institution, city, country) and contact details of ALL authors must be provided in the manuscript and in the online submission process.
- Abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'intravenous (IV)' or 'Department of Health (DoH)'.
- Include sections on Acknowledgements, Conflict of Interest, Author Contributions and Funding sources. If none is applicable, please state 'none'.
- Scientific measurements must be expressed in SI units except: blood pressure (mmHg) and haemoglobin (g/dL).
- Litres is denoted with an uppercase L e.g. 'mL' for millilitres).
- Units should be preceded by a space (except for % and ºC), e.g. '40 kg' and '20 cm' but '50%' and '19ºC'.
- Please be sure to insert proper symbols e.g. µ not u for micro, a not a for alpha, b not B for beta, etc.
- Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160.
- Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
- Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.
- If you wish material to be in a box, simply indicate this in the text. You may use the table format –this is the *only* exception. Please DO NOT use fill, format lines and so on.

SAMJ is a generalist medical journal, therefore for articles covering genetics, it is the responsibility of authors to apply the following:

- Please ensure that all genes are in italics, and proteins/enzymes/hormones are not.
- Ensure that all genes are presented in the correct case e.g. TP53 not Tp53.
**NB: Copyeditors cannot be expected to pick up and correct errors wrt the above, although they will raise queries where concerned.
- Define all genes, proteins and related shorthand terms at first mention, e.g. '188del11' can be glossed as 'an 11 bp deletion at nucleotide 188.'
- Use the latest approved gene or protein symbol as appropriate:

- Human Gene Mapping Workshop (HGMW): genetic notations and symbols
- HUGO Gene Nomenclature Committee: approved gene symbols and nomenclature
- OMIM: Online Mendelian Inheritance in Man (MIM) nomenclature and instructions
- Bennet et al. Standardized human pedigree nomenclature: Update and assessment of the recommendations of the National Society of Genetic Counselors. J Genet Counsel 2008;17:424-433: standard human pedigree nomenclature.

Preparation notes by article type

- Research
- Editorials
- CME
- In Practice and Case reports
- Reviews
- Clinical trials
- Correspondence
- Obituaries
- Book reviews
- Guidelines

Research

Guideline word limit: 4 000 words

Research articles describe the background, methods, results and conclusions of an original research study. The article should contain the following sections: introduction, methods, results, discussion and conclusion, and should include a structured abstract (see below). The introduction should be concise – no more than three paragraphs – on the background to the research question, and must include references to other relevant published studies that clearly

lay out the rationale for conducting the study. Some common reasons for conducting a study are: to fill a gap in the literature, a logical extension of previous work, or to answer an important clinical question. If other papers related to the same study have been published previously, please make sure to refer to them specifically. Describe the study methods in as much detail as possible so that others would be able to replicate the study should they need to. Results should describe the study sample as well as the findings from the study itself, but all interpretation of findings must be kept in the discussion section, which should consider primary outcomes first before any secondary or tertiary findings or post-hoc analyses. The conclusion should briefly summarise the main message of the paper and provide recommendations for further study.

Select figures and tables for your paper carefully and sparingly. Use only those figures that provided added value to the paper, over and above what is written in the text.
Do not replicate data in tables and in text .

Structured abstract

- This should be 250-400 words, with the following recommended headings:

o **Background:** why the study is being done and how it relates to other published work.

o **Objectives:** what the study intends to find out

o **Methods:** must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.

o **Results:** first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.

o **Conclusion:** must be supported by the data, include recommendations for further study/actions.

- Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors.
- Do not include any references in the abstracts.

Here is an example of a good abstract.

Main article

All articles are to include the following main sections: Introduction/Background, Methods, Results, Discussion, Conclusions.

The following are additional heading or section options that may appear within these:

- Objectives (within Introduction/Background): a clear statement of the main aim of the study and the major hypothesis tested or research question posed
- Design (within Methods): including factors such as prospective, randomisation, blinding, placebo control, case control, crossover, criterion standards for diagnostic tests, etc.
- Setting (within Methods): level of care, e.g. primary, secondary, number of participating centres.
- Participants (instead of patients or subjects; within Methods): numbers entering and completing the study, sex, age and any other biological, behavioural, social or cultural factors (e.g. smoking status, socioeconomic group, educational attainment, co-existing disease indicators, etc)that may have an impact on the study results. Clearly define how participants were enrolled, and describe selection and exclusion criteria.
- Interventions (within Methods): what, how, when and for how long. Typically for randomised controlled trials, crossover trials, and before and after studies.
- Main outcome measures (within Methods): those as planned in the protocol, and those ultimately measured. Explain differences, if any.

Results

- Start with description of the population and sample. Include key characteristics of comparison groups.
- Main results with (for quantitative studies) 95% confidence intervals and, where appropriate, the exact level of statistical significance and the number need to treat/harm. Whenever possible, state absolute rather than relative risks.
- Do not replicate data in tables and in text.
- If presenting mean and standard deviations, specify this clearly. Our house style is to present this as follows:
- E.g.: The mean (SD) birth weight was 2 500 (1 210) g. Do not use the ± symbol for mean (SD).

- Leave interpretation to the Discussion section. The Results section should just report the findings as per the Methods section.

Discussion

Please ensure that the discussion is concise and follows this overall structure – sub-headings are not needed:

- Statement of principal findings
- Strengths and weaknesses of the study
- Contribution to the body of knowledge
- Strengths and weaknesses in relation to other studies
- The meaning of the study – e.g. what this study means to clinicians and policymakers
- Unanswered questions and recommendations for future research

Conclusions

This may be the only section readers look at, therefore write it carefully. Include primary conclusions and their implications, suggesting areas for further research if appropriate. Do not go beyond the data in the article.

Editorials

Guideline word limit: 1 000 words

These opinion or comment articles are usually commissioned but we are happy to consider and peer review unsolicited editorials. Editorials should be accessible and interesting to readers without specialist knowledge of the subject under discussion and should have an element of topicality (why is a comment on this issue relevant now?) There should be a clear message to the piece, supported by evidence.

Please make clear the type of evidence that supports each key statement, e.g.:

- expert opinion
- personal clinical experience
- observational studies
- trials
- systematic reviews.

CME (by invite only)

CME is intended to provide readers with practical, up-to-date information on medical and related matters. It is aimed at those who are not specialists in the field.

From January 2016, all CME articles will be printed in full in the *SAMJ*. Please try to adhere strictly to the guidelines on word count as we have a page limit for the print issue of the *SAMJ*. We reserve the right to place some tables and reference lists online if this is necessary for space.

In practice, this means that each CME topic usually covers two issues of the print issue of the *SAMJ*.

The guest editor, in consultation with the editor, is responsible for convening a team of authors, deciding on the subjects to be covered and for reviewing the manuscripts submitted. The suggestion is for 4 - 5 articles, although there is some room for flexibility contingent on discussions with the editor.

For queries about these guidelines please feel free to contact the CME editor, Dr Bridget Farham, by email (ugqirha@iafrica.com) or telephone (+27 (0)82 452 2860)

Review process

The guest editor reviews the articles and returns them to the CME editor for review and final approval.

Guest editorials

Guideline word limit: 1 000 words

- Include the guest editor's personal details (qualifications, positions, affiliation, e-mail address, and a short personal profile (50words)).
- If possible, include a photograph of the author(s) at high enough resolution for print. It is preferable to provide two guest editorials, one for each issue, so that the content of the articles in each issue is covered.

Articles

Guideline word limit: 2 000 - 3 000 words

- Each article requires an abstract of ±200 words.
- The editor reserves the right to shorten articles but will send a substantially shortened article back for author approval.

Personal details

Please supply: Your qualifications, position and affiliations and MP number (used for CPD points); Address, telephone number and fax number, and your e-mail address; and a short personal profile (50words)and a few words about your current fields of interest.

In Practice

Guideline word limit: 2 000 - 3 000words

This section includes articles that would previously have been accepted into the Forum section, and case reports.

In practice articles are those that draw attention to specific issues of clinical, economic or political interest regarding medicine and healthcare in southern Africa. They are assigned to a topic:

- Case report
- Clinical practice
- Clinical alert
- Issues in medicine
- Issues in public health
- Healthcare delivery
- Medicine and the environment
- Medicine and the law
- Cochrane corner

An In Practice article should follow the following format – sub-headings are not necessary, but may be used for clarity:

- Author affiliations and qualifications: to be the same as for Research. Provide all authors' names and initials, qualifications and full affiliations, and corresponding author.

- Short abstract: does not need to be structured, but should capture the essential features of the article
- Introduction: the reason for the article and the issue being addressed
- Recent research, discussion, local policy around the issue – include your own research where appropriate
- All statements should be referenced and, if opinion only, this should be stated
- Discussion: how this article adds to the discussion around a particular topic
- If a clinical practice or policy point is at issue, this needs to be emphasised, using a box with highlights if appropriate.

Essentially In practice is an opportunity for a more discursive approach to topics of clinical, economic or political importance in southern African health systems. It is not an opportunity to put forward unsubstantiated opinions!

Case reports

The *SAMJ* has recently started to accept case reports. The cases must come from Africa, preferably southern Africa unless the condition is common to all African countries, and must be either a completely new description of a clinical condition or result (use Google!) or a case that highlights important practice or management issues.

Please use the following format for case reports:

- Title of case: do not include the words 'a case report' in the title
- Summary/abstract: up to 150 words summarising the case presentation and outcome
- Background: why is this case important and why did you write it up?
- Case presentation: presenting features, medical, social, family history as appropriate
- Case management: should be according to best practice, and if not, please explain why
- Investigations, if relevant: save space by simply saying 'normal' if, for example, renal function was completely normal, rather than listing normal results, highlight the abnormal – or indeed the normal if this is clinically significant
- Differential diagnosis, if relevant
- Treatment, if relevant
- Outcome and follow-up
- Discussion – a VERY BRIEF review of similar published cases

- Teaching points: 3 - 5 bullet points
- References: as per the *SAMJ* house style
- Tables and figures: keep to a minimum. Use clinical images where relevant – we need hi-res versions for print, and identifiable persons must have a consent form
- Patient consent: please include a statement about patient consent to a written case report. This should be uploaded as a supplementary file.

Clinical trials

Guideline word limit: 4000 words

As per the recommendations published by the International Committee of Medical Journal Editors (ICMJE), clinical trial research is any research that assigns individuals to an intervention, with or without a concurrent comparison/control group to study the cause-and-effect relationship between the intervention and health outcomes. All clinical trials should be registered with the appropriate national clinical trial registry (or any international primary register, if relevant), and the trial registration number should be cited at the end of the abstract. Since 1st December 2005, all clinical trials conducted in South Africa have been required to be registered in the South African National Clinical Trials Register.
The *SAMJ* therefore requires that clinical trials be registered in the relevant public trials registry at or before the time of first patient enrollment as a condition for publication. The trial registry name and registration number must be included in the manuscript.

Please refer to the general guidelines for all papers at the top of this article for additional requirements with respect to ethics approval, funding, author contributions, etc. The format of original research articles should be followed for reporting of clinical trial results.

Review articles

Guideline word limit: 4 000 words

These are welcome, but should be either commissioned or discussed with the Editor before submission. A review article should provide a clear, up-to-date account of the topic and be aimed at non-specialist hospital doctors and general practitioners.

Please ensure that your article includes:

- Abstract: unstructured, of about 100-150 words, explaining the review and why it is important
- Methods: Outline the sources and selection methods, including search strategy and keywords used for identifying references from online bibliographic databases. Discuss the quality of evidence.
- When writing: clarify the evidence you used for key statements and the strength of the evidence. Do not present statements or opinions without such evidence, or if you have to, say that there is little or no evidence and that this is opinion. Avoid specialist jargon and abbreviations, and provide advice specific to southern Africa.
- Personal details: Please supply your qualifications, position and affiliations and MP number (used for CPD points); address, telephone number and fax number, and your e-mail address; and a short personal profile (50 words) and a few words about your current fields of interest.

Correspondence (Letters to the Editor)

Guideline word limit: 500 words

Letters to the editor should relate either to a paper or article published by the SAMJ or to a topical issue of particular relevance to the journal's readership

- May include only one illustration or table
- Must include a correspondence address.

Book reviews

Guideline word limit: 400 words

Should be about 400 words and must be accompanied by the publication details of the book. Provide a hi-res image of the cover if possible (with permission from the copyright holder).

Obituaries

Guideline word limit: 400 words

Should be offered within the first year of the practitioner's death, and may be accompanied by a photograph.

Guidelines

Guidelines should always be discussed with the Editor prior to submission.

Because of the intensive review process required to ensure Guidelines are independent, evidence-based and free from commercial bias, they are usually published as a supplement to the *SAMJ*, the costs of which must be covered by sponsorship, advertising or payment by the guideline authors/association. We will provide a quote based on the expected length of the guideline and whether it is to appear online only, or in print, which must be accepted by the body putting the guidelines together before submitting the work to the SAMJ.

The Editor reserves the right to determine the scheduling of supplements. Understandably, a delay in publication must be anticipated dependent upon editorial workflow.
All guidelines should include a clear, transparent statement about all sources of funding and an explicit, clear statement of conflicts of interest of any of the participants in the guidelines about industry funding for lectures, research, conference participation etc.
All guidelines should be structured according to Agree II.
Please access this website before putting the guidelines together, download the Agree 11 instrument and use this to put the guidelines together.
All submitted guidelines will be sent to the local Agree II appraisal committee for review and must be endorsed by an appropriate body prior to consideration and all conflicts of interest expressed.

A structured abstract not exceeding 400 words (recommended sub-headings: *Background, Recommendations, Conclusion*) is required. Sections and sub-sections must be numbered consecutively (e.g. 1. Introduction; 1.1 Definitions; 2.etc.) and summarised in a Table of Contents.

Illustrations/photos/scans

- If illustrations submitted have been published elsewhere, the author(s) should provide consent to republication obtained from the copyright holder.
- Figures must be numbered in Arabic numerals and referred to in the text e.g. '(Fig. 1)'.
- Each figure must have a caption/legend: Fig. 1. Description (any abbreviations in full).
- All images must be of high enough resolution/quality for print.

- All illustrations (graphs, diagrams, charts, etc.) must be in PDF or jpeg form.
- Ensure all graph axes are labelled appropriately, with a heading/description and units (as necessary) indicated. Do not include decimal places if not necessary e.g. 0; 1.0; 2.0; 3.0; 4.0 etc.
- Scans/photos showing a specific feature e.g. *Intermediate magnification micrograph of a low malignant potential (LMP) mucinous ovarian tumour. (H&E stain).* –include an arrow to show the tumour.
- Each image must be attached individually as a 'supplementary file' upon submission (not solely embedded in the accompanying manuscript) and named Fig. 1, Fig. 2, etc.

Tables

- Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged.
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- *Internet references:* World Health Organization. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002. http://www.who.int/whr/2002 (accessed 16 January 2010).
- Legal references

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• Acts:

South Africa. National Health Act No. 61 of 2003.

• Regulations to an Act:

South Africa. National Health Act of 2003. Regulations: Rendering of clinical forensic medicine services. Government Gazette No. 35099, 2012. (Published under Government Notice R176).

• Bills:

South Africa. Traditional Health Practitioners Bill, No. B66B-2003, 2006.

• Green/white papers:

South Africa. Department of Health Green Paper: National Health Insurance in South Africa. 2011.

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Appendix 2: Literature review

The global surgical caseload is large, with an estimated 234.2 million major surgical procedures performed annually. Emergency surgery, unplanned or non-elective surgery, comprises a large portion of the workload of operating theatres and contributes to the global burden of disease (1, 2). Eighty percent of the global emergency conditions requiring surgery are performed in low to middle income countries (1). The South African Surgical Outcomes Study (SASOS) (3) found that 54.2% of surgical procedures performed were non-elective. In South Africa, the burden of surgical disease is increased by high levels of trauma, over 33%, and conditions arising from HIV; with more than 80% of acute trauma cases presenting after-hours and affecting the predictability of theatre demand (4).

Despite the large burden of emergency surgical disease, South Africa has significantly fewer operating theatres per 100 000 population than the global average; with 3.95 operating theatres per 100 000 compared to the global average of 6.2 (5). Asmal et al (6), in a South African study, found operating theatre utilisation to be non-compliant with international standards. Optimal theatre utilisation is important to match fewer resources with a larger burden of disease. Reduced theatre availability per hospital bed has been associated with higher mortality rates (10).

Prolonged preoperative delays have multiple implications and may increase morbidity and mortality (7). Various recommendations have been published to assist with prioritisation of emergency cases and to guide targets of Time to Theatre (TTT) (8) or Time to Surgery (TTS) (9) to minimise morbidity and mortality associated with delays. Reasons for delay are classified as organisational, medical and patient-related (10). Table 1 indicates possible explanations for preoperative delays.

Table 1 Reasons for preoperative delays (10)

Organisational factors	• Prioritisation of a patient with a higher urgency category • Unanticipated increased length of ongoing procedure • Inadequate preoperative preparation • Incomplete booking details • Postoperative hospital bed shortage • Staff shortages • Involvement of additional surgical disciplines
Medical factors	• Inadequate patient optimisation or resuscitation • Ongoing or progressive infection not directly causing surgical disease
Patient-related factors	• Patient refusal for surgery at available time slot • Non-arrival of patient • Patient death

Preoperative delays also have considerable cost implications. O'Leary et al (7) found a significant cost increase associated with preoperative delays when calculating costs involved per hospital bed per day awaiting surgery. The running costs of an additional emergency theatre were found to be less than the costs of patients awaiting theatre (7).

Acute care surgical units (ACSUs) have been introduced into many centres, including Chris Hani Baragwanath Academic Hospital (CHBAH), in recent years to improve perioperative outcomes for patients requiring urgent general surgical procedures (11). ACSUs have resulted in improved day-time emergency theatre efficiency, reduced TTT, reduced after-hours operating, reduced hospital admission duration and improved perioperative outcomes. ACSUs are however, dependent on the provision of a dedicated emergency theatre (11).

Dedicated emergency theatres fare well in the literature when compared to interruption of elective theatres for emergency cases (12). Dedicated emergency theatres increase access to operating theatres for emergency cases, reduce after-hours operating and reduce cancellation of elective cases (12, 13). Dedicated emergency theatres have been shown to reduce the cost of cancelled elective cases in a South African setting (14). Triage systems

are a useful tool for prioritising cases (15) and optimising the utilisation of dedicated emergency theatres (16).

Triage is the process of determining the priority of patient care based on the severity of disease or injury (9). Triage is most important when resources are limited and multiple patients with diverse needs require care. In 2013, the World Society for Emergency Surgery study group initiative on Timing of Acute Care Surgery classification (TACS) (9) suggested application of a colour coded triage system for acute surgical emergencies. TACS developed a ratio of actual Time to Surgery (aTTS) to ideal Time to Surgery (iTTS) and a ratio of less than or equal to one complies with the iTTS (9). The iTTS is based on expert opinion for each colour coded triage level.

TACS recommended that each medical institution should assess its aTTS and compare it to the iTTS as a quality assessment tool (9). Based on the TACS recommendations, Coelho et al (17) implemented a colour coded surgical screening system in a tertiary hospital and reported an improvement in the aTTS in the yellow triage group. Leppäniemi et al (2) also suggested a colour coded system to classify urgency of emergency procedures uniformly across surgical disciplines. Day-time emergency theatre utilisation improved, preoperative delays were reduced and after-hours operating decreased (2).

Chowdhury et al (16) compared delays from the time of booking trauma theatre cases to the time of operation based on the operative triage levels from the Groote Schuur Hospital emergency triage system. The median delay for patients prioritised as red (requiring immediate surgery) was longer than expected, but the median delay for cases triaged as orange, yellow and green, fell within the recommended time frame (16).

The emergency theatre should provide access, in a triage prioritised order, to different surgical disciplines. O'Leary et al (7) reported differences in the TTT for the various surgical disciplines. Urology was found to have the longest and plastic surgery the shortest preoperative delay at 43 hours and 56 minutes and 20 hours and 8 minutes, respectively. Differences were also observed between TTT for paediatric and geriatric age groups, with the geriatric group waiting disproportionately long; 23 hours and 41 minutes compared to 6 hours and 34 minutes (7).

The Covid-19 pandemic is increasing the demand of healthcare resources worldwide (18). Resources are being diverted from surgical departments to increase intensive care unit and ward capacity and resulting in increased strain on the provision of essential surgical services in many regions. There are reports of increased rates of complicated surgical disease in paediatric patients, such as complicated acute appendicitis, during the Covid-19 pandemic (19). The additional time taken to don and doff personal protective equipment and additional theatre cleaning required, could be expected to reduce theatre efficiency and increase delays.

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Appendix 3: Study proposal

Audit of a surgical booking system for non-elective cases in a tertiary hospital

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1. Introduction

The global surgical caseload is large, with an estimated 234.2 million major surgical procedures performed annually. Emergency surgery, unplanned or non- elective surgery, comprises a large portion of the workload of operating theatres and contributes to the global burden of disease (1, 2). Eighty percent of the global emergency conditions requiring surgery are performed in low to middle income countries (1). The South African Surgical Outcomes Study (SASOS) (3) found that 54.2% of surgical procedures performed were non-elective. In South Africa, the burden of surgical disease is increased by high levels of trauma, over 33%, and conditions arising from HIV; with more than 80% of acute trauma cases presentingafter-hours and affecting the predictability of theatre demand (4).

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The JD Allen theatre complex at CHBAH comprises four dedicated 24-hour emergency theatres. The complex is shared by multiple surgical disciplines including the ACSU, trauma surgery, otorhinolaryngology, paediatric surgery, maxillofacial surgery, orthopaedic surgery, urology, plastic surgery, vascular surgery and neurosurgery. Although there is a separate obstetric and gynaecological theatre complex, occasionally it is necessary for obstetric and gynaecological cases to be done in the JD Allen theatres. The surgical booking system is currently a paper-based system recording the patient details, procedure and time of booking. A colour code has been added to record the urgency level of each case booked.

2. Problem Statement

Delays to theatre for non-elective procedures have an economic impact and are associated with increased morbidity and mortality (7, 12). There is a demand for emergency theatre operating time at CHBAH and frequently there are a large number of cases awaiting non-elective surgery. Implementation of the colour code to the booking system aims to reduce waiting times and create a standardisation level against which international and local data can be compared.

3. Aims

The aim of this study is to conduct an audit of the surgical booking system for non-elective cases at the JD Allen theatres at CHBAH.

4. Objectives

The primary objectives of this study are to:

- describe the time period between booking non-elective theatre cases to the timeof start of anaesthesia (TTT)
- describe the ratio of aTTS to iTTS for each colour-coded triage level
- describe and compare the TTT per triage category with published time frame guidelines.

The secondary objectives of this study are to:

- describe the total number of non-elective theatre cases per surgical discipline
- identify time differences in preoperative delays between surgical disciplines
- identify time differences in preoperative delays between paediatric, adult and geriatric sub-groups
- compare preoperative delays for trauma patients against local published data.

5. Research assumptions

The following definitions will be used in this study.

Non elective surgery: Surgery which is either emergent or urgent, cannot bescheduled in advance and should occur within 24 hours (20).

Time to theatre (TTT): is the time period elapsed between the time of patient entry into the emergency booking system and the anaesthesia start time. TTT willbe synonymous with aTTS for the purpose of this study.

Ideal Time to Surgery (iTTS): is the acceptable waiting time period assigned for each triage category as defined by the CHBAH operating triage system (Table 1).

Day shift: will be from 07:30 to 16:00.

Night shift: will be from 16:00 to 07:30.

Paediatric patient: is a patient less than 18 completed years of age.

Adult patient: is a patient between 18 and 65 years of age.

Geriatric patient: is a patient greater than 65 completed years of age.

Triage levels of urgency: Table 1 outlines the CHBAH operating theatre system (COTTS) as modified by the Acute Care Surgical unit from the Groote Schuur Emergency Surgery Triage System (GSEST) (16) and Emergency Surgery Guidelines of New South Wales Health of 2009 (8).

Table 1: CHBAH operating theatre triage system (COTTS)

Colour code	Urgency category	Parameters
Red		5) Immediate threat to life 6) Shocked or moribund, no physiological response to resuscitation 7) Surgery is a component of resuscitation 8) E.g. massive upper GIT bleed, ruptured aortic aneurysm, threatened airway
Orange	Urgent (within 2 hours)	5) Life or limb threatening 6) Physiological response to resuscitation 7) Surgery as soon as possible after resuscitation 8) E.g. intrabdominal hypertension, bowel ischaemia, leaking aortic aneurysm, significantly raised intracranial pressure, acute limb ischaemia
Yellow	Expedited (within 2 – 6 hours)	4) Physiological derangement but stable 5) Likely to significantly deteriorate if surgery not performed 6) E.g. complicated appendicitis, hollow viscus perforation, incarcerated hernia, bowel obstruction, sepsis with DKA, necrotising fasciitis
Green	Emergent (within 24 hours)	3) Physiologically stable, deterioration not expected but possible 4) E.g. abscess drainage, bleeding haemorrhoids, wet gangrene without DKA
Blue	Scheduled (within 72 hours)	4) Semi-urgent, deterioration unlikely 5) Surgery during day shift, on available elective list if possible 6) E.g. revision amputation stump, SSG fasciotomy wound

GIT: gastrointestinal, DKA: diabetic ketoacidosis, SSG: split skin graft

6. Demarcation of study field

The study will be conducted in the JD Allen Emergency Theatre complex of the CHBAH which is affiliated to the Faculty of Health Sciences of the University of the Witwatersrand. CHBAH is a 2888 bed central hospital. The hospital has 25 theatres of which four are predominantly non-obstetric emergency theatres. On average 65 000 cases are done annually.

7. Ethical considerations

Application to the Human Research Ethics Committee (Medical) and the Post Graduate Committee of the University of the Witwatersrand will be submitted forthe clearance of this study.

Application to the Medical Advisory Committee of the CHBAH will be submitted for approval of this study (Appendix 1).

Application to the Clinical Head of the CHBAH Department of Anaesthesiology (Appendix 2) and the Head of the Department of Surgery will be submitted for approval of this study (Appendix 3). A letter requesting the addition of a colour code according to the COTTs to all cases added to the booking system will be sent to the departmental heads of the surgical disciplines at CHBAH (Appendix 4).

All data collected will remain anonymous. No identifying features such as name or hospital number will be collected. Data collected will include type of surgical procedure, surgical discipline, date and time of booking, date and time of surgery, and triage level. The data will be stored securely, in a password protected format, for six years after the completion of the study.

The study will be conducted in accordance with the Declaration of Helsinki (21)and the South African Guidelines for Good Clinical Practice (22).

8. Data collection

8.1 Research design

A retrospective clinical audit and quality improvement project will be conducted. A clinical audit, as defined by the National Institute for Health and Care Excellence, is "a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change" (23). Audits are one of the seven pillars of clinical governance allowing health care facilities to identify areas of concern and implement changes to improve patient outcomes.

A clinical audit consists of six steps, these are shown in Figure 1 (24).

Figure 1: The steps of a clinical audit cycle

The steps are defined as follows, in the context of this study:

1. Identify a problem: prolonged waiting times for non-elective surgery.
2. Define standards or criteria: use of the COTTS to determine acceptable waiting times for various triage levels.
3. Collect data: data will be collected over a 30-day period from the surgical booking system.
4. Analysis: to identify target areas for improvement.
5. Implement change: provide recommendations and actions to obtain targets.
6. Reaudit; repeat steps 1 – 5 after implementation of change.

8.2 Study sample

Sample method

In this study a consecutive convenience sampling method will be used. Convenience sampling encompasses the use of participants who are easily accessible to the researcher and is a technique in which every subject meeting theinclusion criteria until the required sample size is reached (25). This study will use records from the surgical booking system for the JD Allen emergency operating theatre complex, theatre registers and records encompassing time and date of non-elective cases done from the CHBAH Department of Anaesthesiology.

Study period

Data will be collected over a period of 30 consecutive days.

8.3 Inclusion and exclusion criteria

The inclusion criterion for this study is:

- all cases booked on the surgical booking system for non-elective surgery at JD Allen operating theatre at CHBAH over the study period.

The exclusion criterion for this study is:

- all patients confirmed to be infected with SARS-CoV-2.

8.4 Collection of data

A single data collector will collect the data. Data will be recorded from the surgical booking system, theatre registers and departmental records after the 30 day period.

The following information will extracted from the surgical booking system summary (Appendices 6 and 7):

- case number
- Time period and time case booked
- procedure
- surgical discipline
- triage level (COTTS level)
- patient age
- date procedure performed
- time of start of anaesthesia/time in theatre
- time out of theatre.

9. Data analysis

Using Microsoft Excel™ data will be captured onto spread sheets. The statistical program, GraphPad InStat™, will be used to analyse data in consultation with a biostatistician. Categorical variables will be described using percentages and continuous variables using means and standard deviations or medians and rangesdepending on the distribution of data. Chi square and Fisher's exact tests will be used to compare variables. A p value of < 0.05 will be considered statistically significant.

10. Significance of the study

There is a large burden of non-elective surgical disease in the South African setting. In view of the resource constraints, optimal theatre utilisation is important to reduce TTT as preoperative delays have been associated with increased morbidity and mortality and increased hospital costs. Emergency theatre utilisationis yet to be investigated in the JD Allen theatre complex. Results from this study may be used as a comparison to international emergency theatre service standards and function as a quality improvement project.

11. Validity and reliability of the study

Botma et al (26) has defined validity as the "degree to which a measurement represents a true value." It reflects the accuracy of a measurement. A greater validity is indicative of fewer errors in the study process. Reliability refers to thereproducibility or consistency of a measurement (26).

The following measures will ensure validity and reliability of the study:

- An appropriate study design will be used.
- A single researcher will collect all of the study data.
- A standardised data collection sheet will be used.
- Every tenth data entry point will be checked.
- The data will be analysed in conjunction with a biostatistician.

12. Potential limitations of the study

Limitations to a study are problems that restrict the conclusions that can be drawnfrom the finding of a study (27).

Convenience sampling can be a limitation as participants may be missed. In this study data will be collected from the surgical booking system once a week at the convenience of the researcher. Consecutive convenience sampling will be used inthis study and is the strongest form of convenience sampling.

A further limitation is the reliance on complete and accurate records within the surgical booking system. The opinion of the booking surgeon regarding the triagelevel according to the COTTs could be subject to bias. Bias has been defined by Brink et al (27) as “an influence that produces an error or distortion, which can affect the quality of evidence”.

13. Project outline

Activity	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	June 2022
Proposal preparation						
Proposal submission						
Ethics approval						
Graduate studies committee approval						
Data collection						
Data analysis						
Article preparation						
Submission						

14. Financial plan

The Department of Anaesthesiology will bear the cost of printing and paper for theproposal, ethics and postgraduate approvals.

Item	**Price per page**	**Numberof pages**	**Copies**	**Total (Rands)**
Proposal	1	15	10	R 150
Ethics	1	10	25	R 250
Postgraduate form	1	2	6	R 12
Final MMed submission	1	100	4	R 400
Grand total				**R 812**

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Appendix 4: Clearance from Human Research Ethics Committee

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R49 Dr N van Wyk

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M210410

NAME: (Principal Investigator)	Dr N van Wyk
DEPARTMENT:	School of Clinical Medicine Department of Anaesthesiology Medical School University
PROJECT TITLE:	*Audit of a surgical booking system for non-elective cases in a tertiary hospital*
DATE CONSIDERED:	2021/04/30
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 M Fourtounas, K Pegu and R Moore
APPROVED BY:	CB Penny Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2022/05/31

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 **April** and therefore reports and re-certification will be due in the month of **April** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator _____ Date _____

Appendix 5: Approval from Graduate Studies Committee

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

28 April 2022
Person No: 0201431H
TAA

Dr NJ Van Wyk
61 Scott Street
Berario
Ruiterhof Ext 2
2194
South Africa

Dear Dr Natalie Van Wyk

Master of Medicine in Anaesthesia: Change of title of research

I am pleased to inform you that the following change in the title of your Research Report for the degree of **Master of Medicine in Anaesthesia** has been approved:

From:	**Audit of a newly implemented electronic surgical booking system for non-elective cases in a tertiary hospital**
To:	**Audit of a surgical booking system for non-elective cases in a tertiary hospital**

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 6: Permission from Medical Advisory Committee

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 30 July 2021

TITLE OF PROJECT:

Audit of a newly implemented electronic surgical booking system for non-elective cases in a tertiary hospital

UNIVERSITY: Witwatersrand

Principal Investigator: Dr Natalie Jean van Wyk

Department: Anaesthesiology

Supervisor/s : Dr M Fourtounas / Dr R Moore

Permission Head Department (where research conducted): Yes

NHRD No: GP_202107_058

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Academic Hospital. The CEO / management of Chris Hani Baragwanath Academic Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Committee for Research on Human Subjects of the University of the Witwatersrand.
- The Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- The MAC will be informed of any serious adverse events as soon as they occur
- Permission is granted for the duration of the Ethics Committee Approval.

Recommended
(On behalf of the MAC)
2021/07/30

Approved/~~Not Approved~~
Hospital Management Date:
Date: 04/08/2021

Appendix 7: Permission from Department of Anaesthesiology

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
FACULTY OF HEALTH SCIENCES
WITS SCHOOL OF CLINICAL MEDICINE
DEPARTMENT OF ANAESTHESIOLOGY
Tel.(011)488 4344

Department of Anaesthesiology
School of Clinical Medicine
Faculty of Health Sciences
University of the Witwatersrand
11th April 2022

To Whom It May Concern

RE: MMED STUDY BY DR NATALIE VAN WYK (0201431H)

The MMed proposal, which is titled: AUDIT OF SURGICAL BOOKING SYSTEM FOR NON-ELECTIVE CASES IN A TERTIARY HOSPITAL, has been reviewed. I am happy for Dr Natalie van Wyk to perform the study within the department.

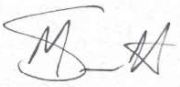
I wish her all of the best in this regard.

Yours sincerely.

Dr Palesa Mogane
Clinical Head of Department
Department of Anaesthesiology
Chris Hani Baragwanath Academic Hospital
Palesa.Mogane@wits.ac.za

Appendix 8: Permission from Department of Surgery

Approved 12/04/2022



Dr Natalie van Wyk
Department of Anaesthesiology
University of the Witwatersrand
natalievnwyk@yahoo.com
12 April 2022

Head of Department of Surgery
Chris Hani Baragwanath Academic Hospital

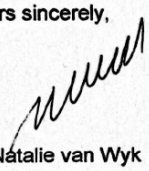
Dear Prof M Smith

I, Dr Natalie van Wyk, a registrar in the Department of Anaesthesiology, would like to request your permission to conduct a study as part of my research project for my Masters in Medicine. The study is titled: "Audit of a surgical booking system for non-elective cases in a tertiary hospital". This will be a retrospective audit and no personal patient information will be collected. Approval from the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of the University of the Witwatersrand will be sought prior to the start of the project.

There will be no financial implications to the department and a copy of the final report will be made available to you upon request.

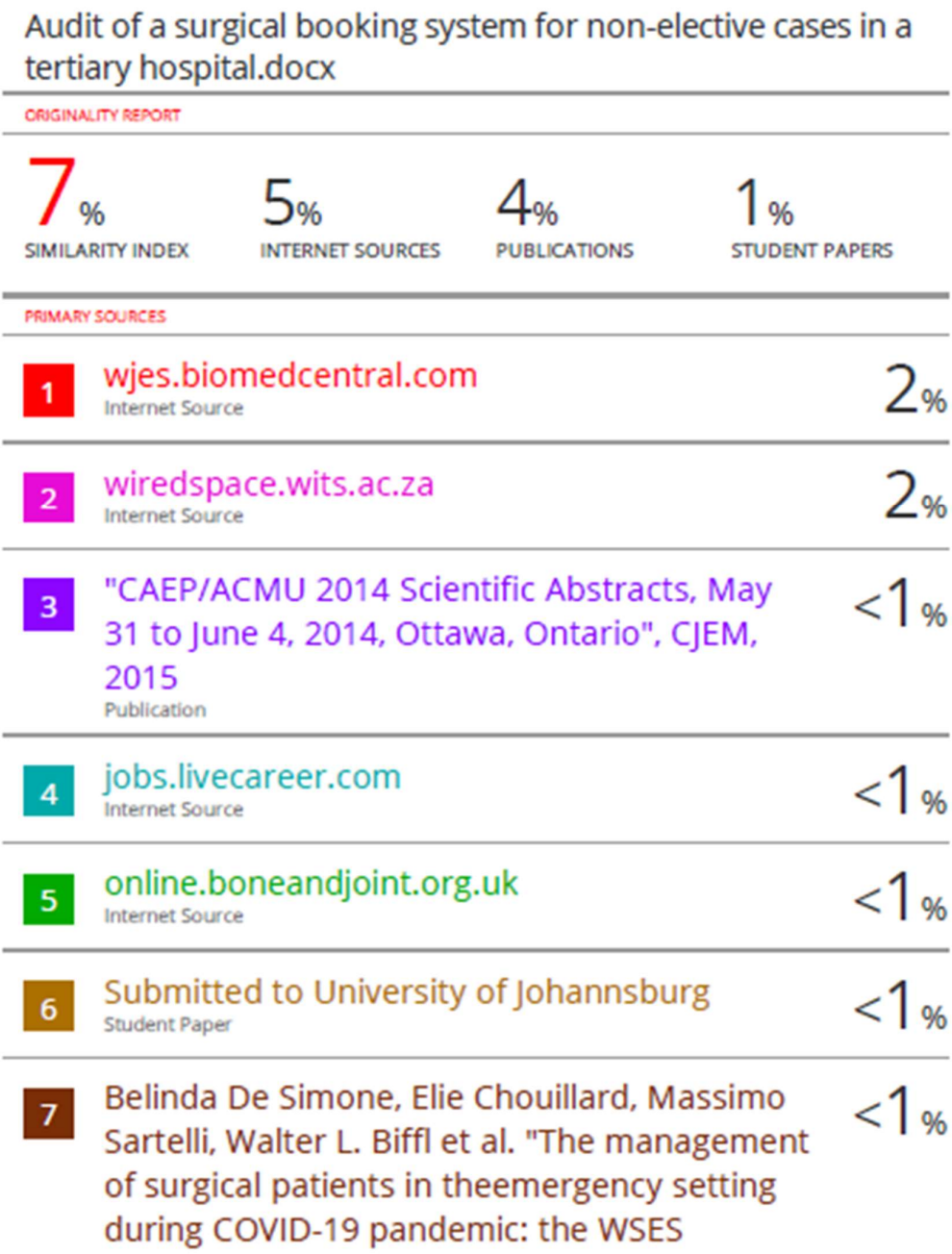
Your assistance in this regard is appreciated.

Yours sincerely,



Dr Natalie van Wyk
Email: natalievnwyk@yahoo.com
Cell: 079 529 0891

Appendix 9: Turnitin Report



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