Knowledge of the WHO surgical safety checklist in an anaesthesiology department

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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 branch of Anaesthesiology.

Johannesburg, 2021

Declaration

I, Yolwando Nyathela-Nthai, declare that this research report is my own unaided work. It is being submitted for the Degree of Master of Medicine in the branch of Anaesthesiology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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08 December 2021

Abstract

Background

The WHO checklist has the potential to decrease surgical mortality and morbidity if implemented and used correctly. It is not known if the WHO checklist is widely used in the Department of Anaesthesiology at the University of the Witwatersrand (Wits) and if it is used correctly. The aim of this study was to describe knowledge of the WHO checklist among anaesthetists in the Department of Anaesthesiology at Wits.

Methods

A cross-sectional design was followed in this study using a self-administered questionnaire. The study population consisted of all anaesthetists working in the Department of Anaesthesiology. A convenience sampling method was used, and completion of the questionnaire implied consent. The Angoff Method was used to determine the pass mark of 70% or more.

Results

The median (IQR) overall score for the questionnaire was 57.9% (52.6 – 63.2%). Only 19 (12.7%) anaesthetists obtained a pass mark. There was no significant difference between the median (IQR) score of the junior anaesthetists, 57.9% (52.6 – 63.2%) and 57.9% (52.6 – 68.4%) for the seniors (p=0.080) or between the scores of those who used the WHO checklist less than daily, 60.0% (52.6 – 63.2%) or daily 57.9% (52.6 – 63.2%) (p=0.133). Significantly more senior anaesthetists achieved a pass score than juniors.

Conclusion

The anaesthetists' knowledge regarding the WHO checklist at Wits was inadequate, despite two-thirds of the participants indicating that they used it daily. There was no significant difference in knowledge between those who used the WHO checklist daily and those who did not or the scores of junior and senior anaesthetists. Significantly, more seniors obtained a pass score; however, the practical relevance of this is questionable.

Acknowledgements

Many thanks to my supervisors, Helen Perrie, Juan Scribante and Meg Wellbeloved, for the hard work in completing this work. I would also like to thank the Wits Department of Anaesthesia, without which the research would not have been possible.

Special mention to my husband Rendani and my children for their support and patience throughout this process.

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Abbreviations

WHO	World Health Organization
Wits	University of the Witwatersrand
WHO checklist	WHO surgical safety checklist

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 Southern African Journal of Anaesthesia and Analgesia, 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

Medico-legal claims for negligence in South Africa have more than tripled from 2016 – 2019, amounting to R104.5 billion in 2019 (1). The World Health Organization (WHO) Surgical Safety Checklist (WHO checklist) has the potential to decrease surgical mortality and morbidity if implemented and used correctly (2).

In this section, the background, the development, application and implementation of the WHO checklist will be briefly discussed. Lastly, the operating theatre staff's knowledge of the WHO checklist will be presented.

1.2 The background to the WHO checklist

Human error in healthcare has been noted and has led to the release of the landmark report "To err is human: building a safer health system by the Institute of Medicine" (3). In the report, it was stated that between 44 000 and 98 000 patients die every year because of medical errors in the United States of America (3). To ensure the safety of surgical patients, the WHO in 2008 published guidelines identifying multiple recommended practices (2). From these guidelines, a 19-item WHO checklist was developed by the WHO Patient Safety Program called "Safe Surgery Saves Lives" (2). The intention was that the WHO checklist could be used worldwide to decrease mortality and morbidity related to surgery (2).

The development of the WHO checklist was influenced by the aviation industry (4). A Boeing aircraft crashed after take-off during testing by the United States of America Army Air Corps in 1934. The investigation following the crash concluded that human error was the cause of the disaster. The pilots assigned to this new flight realised that the new model was a complex aircraft and may have been ''too much for one man to fly''. Subsequently, the aviation industry developed a checklist to improve aviation safety (4).

1.3 The development of the WHO checklist

The development of the WHO checklist consisted of the following steps, content and format development, timing, formal testing and evaluation and local modification (5).

The aviation industry makes use of a short one-page checklist that uses ticks and the WHO followed this example (5). To identify the content to be included in the WHO checklist, documents on patient safety in surgery were collected to determine problems and set targets. This was then reviewed by experts, and the relevance of the content in different countries with different economic backgrounds was noted (5).

Appropriate timing of checkpoints to identifying potential mistakes and correcting them before they cause harm is essential (5). Three time points were identified, namely before induction of anaesthesia, before skin incision and before the patient leaves the operating theatre. The draft WHO checklist was trialled by the multidisciplinary panel involved in the development of the WHO checklist in eight countries. Areas for improvement, such as the language or actions that were confusing, were highlighted. These eight countries then proceeded with the formal testing and evaluation to determine the impact of the WHO checklist on surgical patient outcomes. The last step was the local modification to the contexts of the different countries. The elimination of any of the steps in the WHO checklist was not encouraged (5).

1.4 The application of the WHO checklist

A single coordinator should be responsible for performing the safety checks on the WHO checklist. It is usually the responsibility of the circulating nurse, but it can be performed by any clinician in the operating theatre (6).

Before induction of anaesthesia, the identity of the patient, the operation site and the consent are confirmed verbally by the checklist coordinator (6). If a child or patient who does not have the mental capacity to confirm this, a guardian or family member can do so on their behalf. Secondly, the checklist coordinator ensures that the site is marked by the operating surgeon, especially if the operation

involves left or right and multiple sites. Thirdly, the checklist coordinator verbally confirms that the pulse oximeter is on the patient and is functioning. The pulse oximeter needs to be visible and ideally audible to alert the operating theatre staff to heart rate or saturation changes. If the pulse oximeter is not available, the anaesthetist and the surgeon should decide if the operation should be postponed. In an emergency, the anaesthetist and the surgeon must be in agreement about the urgency of the case and if it should continue without a pulse oximeter (6).

The checklist coordinator verbally confirms the patient's allergies, aspiration and blood loss risk. If the patient is suspected of having a difficult airway, the anaesthetic team should have emergency equipment for a difficult airway and an assistant available to help with induction (6). If the risk of blood loss exceeding 500 ml exists, blood products should be available and two large intravenous lines inserted (6).

The application of the WHO checklist before skin incision requires the whole team to pause (6). The first step is for the team to introduce themselves and their roles, followed by confirmation of the patient's name, procedure and the incision site. In the next step, the anaesthetist must confirm that the patient has received prophylactic antibiotics in the past 60 minutes if necessary. Depending on the time the prophylactic antibiotics were given, adjustments must be made. If prophylactic antibiotics were given more than 60 minutes ago, they must be re-administered. If prophylactic antibiotics are not applicable, this must be verbally stated and the not applicable box ticked. In this step, the surgeon should be asked about any critical steps necessary, the duration of the operation and estimated blood loss. The anaesthetic team must communicate any concerns such as rapid blood loss and hemodynamic instability. The scrub nurse must confirm sterility, equipment issues and that essential imaging is displayed (6).

Before the patient leaves the operating theatre, the name of the completed procedure must be confirmed as the operation might have changed or expanded (6). Sponges, instruments and needles must be counted before the patient leaves to avoid accidental retention. The circulating nurse must confirm the specimen labelling. Lastly, the surgeon, anaesthetist and scrub nurse must review the post-operative recovery and management plan for the patient (6).

1.5 The implementation of the WHO checklist

After publishing the checklist, the WHO conducted a pilot study in the eight countries with different socio-economic backgrounds involved in the development of the WHO checklist (2). In this study, the authors hypothesised that the implementation of the WHO checklist would change the culture in the operating theatre that would decrease the mortality rate and major complications after surgery. The study consisted of pre and post-intervention periods. Baseline data were collected prior to the introduction of the WHO checklist. Afterwards, the WHO checklist was introduced in the operating theatres and patients were followed up for 30 days or until discharge post-surgery for complications or death. The results of the study showed a significant decrease in major complications from 11 – 7% and the rate of mortality from 1.5 – 0.8% (2). These findings were confirmed by a similar study that was done on urgent cases, which was conducted in the same hospitals using the same protocols (7). Results showed a decrease in complications from 18.4 – 11.7% and a decrease in the death rate from 3.7 – 1.4% (7).

Vats et al. (8), in the United Kingdom, found no significant changes in post-operative surgical complications and death rate when the WHO checklist was implemented. However, the authors showed a noticeable improvement in safety measures such as appropriate use of prophylactic antibiotics, which increased from 57 – 77% of operations. It was found that the WHO checklists were incomplete, completed in a hurry and without all the team members present. Barriers and challenges to the WHO checklist included existing hierarchy in the operating theatre, the timing of checks, duplication and lack of enthusiasm from surgeons. In the interviews held during this study, some participants commented that the WHO checklist needed local modification; for example, a pulse oximeter is almost always used in the United Kingdom, and this check was therefore not necessary (8).

Epiu et al. (9) determined the utilisation of the WHO checklist in the main referral hospitals in east Africa. Results showed that 58% of the anaesthetists knew of the

WHO checklist, but only 25% of the anaesthetists who were interviewed used it. The main reason for not using the WHO checklist by 78 % of the participants was that it was unavailable. Other reasons given were that it is not clear, too long and some did not understand its purpose (9).

In South Africa, a randomised control trial on the effect of a modified WHO Surgical Safety Checklist for Maternity Care on incidence rate ratios of adverse incidents associated with surgery was conducted in 18 hospitals (10). The study commenced with training the staff, followed by months of implementation. A reduction in post-operative sepsis, referral to higher levels of care, unscheduled return to the operating theatre and maternal mortality were found (10). Another South African study surveyed the perceptions of 51 nurses, 54 anaesthetists and 79 surgeons regarding the barriers and reasons for poor compliance with the WHO checklist (11). This study found that lack of training, lack of time and no cooperation from other staff members as barriers and reasons for poor compliance (11).

1.6 Knowledge of the WHO checklist

Mascherek et al. (12), in 2013 in Switzerland, conducted a national study of the knowledge of 1 378 operating theatre doctors, nurses and surgical technicians regarding the WHO checklist and its frequency of use. The questionnaire consisted of three parts. The first part evaluated the general use of the WHO checklist, the frequency of use and satisfaction with its use. The second part assessed objective and subjective knowledge. The last part assessed attitudes, norms and behavioural control towards the WHO checklist. The results showed that 79.1% of respondents used surgical checklists, with 25.1% using the WHO checklist. The doctors that used the WHO checklist obtained a mean score of 76%, compared to 74% for those who did not use it. The authors stated that this difference was statistically significant. This study also found that doctors scored higher than nurses. The authors concluded that these differences in scores, although statistically significant, had no practical relevance (12).

Sendlhofler et al. (13), in 2015, comprehensively evaluated the use of the WHO checklist in the operating theatres of a university hospital in Austria. Included in the

evaluation was the frequency of use and knowledge of the WHO checklist using the Mascherek et al. (12) questionnaire. Of the 160 healthcare professionals completing the questionnaire, 91.3% used the WHO checklist and 80.6% used it in more than 90% of surgeries. The median score was 80%, with no significant differences found between professional groups. As the WHO checklist had been in use for more than three years and was frequently used, the authors concluded that the knowledge needed to improve (13).

Patil and Mythreyee. (14) conducted a study on knowledge and attitudes regarding the WHO checklist among 100 operating theatre staff nurses in Tumkur, India in 2018. The authors developed a self-administered questionnaire after an extensive review of the literature that was validated by subject experts. The questionnaire consists of three sections: demographics, 30 multiple-choice questions on knowledge and an attitude scale. The results of the study showed that 78 (78.0%) theatre staff nurses had inadequate knowledge, 20 (20.0%) had moderately adequate, and 2 (2.0%) had adequate knowledge regarding the WHO checklist. The mean score was 39.9%. The authors concluded that the results were an indication of a need for an interventional programme for theatre staff nurses to improve their knowledge as this could result in a reduction of surgery-related complications (14).

Sharma et al. (15) conducted a study on knowledge, attitudes and practices regarding the WHO surgical safety checklist and the challenges with its use in north India in 2020. The authors distributed a self-administered questionnaire to all theatre staff. The participants were asked if they knew of the WHO checklist, and those who did (n=96) were asked to complete six knowledge questions regarding content, utilisation and application. The results of this study showed 52 (54.2%) had good knowledge regarding the WHO checklist, 35 (36.8%) had average, while 9 (9.3%) had poor knowledge (15).

Weber-Sanchez et al. (16), in Mexico in 2018, conducted a study among 69 surgical staff including surgeons, anaesthetists and nurses, to determine the knowledge of and attitude towards a surgical checklist. The authors did not specify which surgical checklist was evaluated. A questionnaire with 15 questions on knowledge, usefulness, impact on mortality and morbidity and attitudes towards

the checklist was used. The results showed that 53.6% of the participants knew the phases of the checklist. Of the participants, 76.8% knew that the surgical site had to be marked, 82.6% knew in which cases surgical marking applied and 94.2% knew who is responsible for marking the surgical site. Concerning when time out should be performed, 55% of the participants answered correctly. The ideal time for prophylactic antibiotics to be administered was correctly answered by 65.2% of the participants (16).

1.7 Summary

In this section, the background, the development, application and implementation of the WHO checklist were briefly discussed. Lastly, the operating theatre staff's knowledge of the WHO checklist was presented.

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Acknowledgements

In a separate section, acknowledge any financial support received or possible conflict of interest. This section may also be used to acknowledge substantial contributions to the research or preparation of the manuscript made by persons other than the authors.

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Cite references in numerical order in the text, in superscript format (Format> Font> Click superscript). Please do not use brackets or do not use the foot note function of MS Word.

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The following are sample references:

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10. All numbers below ten, without percentages or units, must be written in words.
11. Figure numbers: Arabic, table numbers: Roman

Section 3: Draft article

Knowledge of the WHO surgical safety checklist in an anaesthesiology department

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Key words: WHO surgical safety checklist, anaesthetist, knowledge

Abstract

Background

The WHO checklist has the potential to decrease surgical mortality and morbidity if implemented and used correctly. It is not known if the WHO checklist is widely used in the Department of Anaesthesiology at the University of the Witwatersrand (Wits) and if it is used correctly. The aim of this study was to describe knowledge of the WHO checklist among anaesthetists in the Department of Anaesthesiology at Wits.

Methods

A cross-sectional design was followed in this study using a self-administered questionnaire. The study population consisted of all anaesthetists working in the Department of Anaesthesiology. A convenience sampling method was used, and completion of the questionnaire implied consent. The Angoff Method was used to determine the pass mark of 70% or more.

Results

The median (IQR) overall score for the questionnaire was 57.9% (52.6 – 63.2%). Only 19 (12.7%) anaesthetists obtained a pass mark. There was no significant difference between the median (IQR) score of the junior anaesthetists, 57.9% (52.6 – 63.2%) and 57.9% (52.6 – 68.4%) for the seniors (p=0.080) or between the scores of those who used the WHO checklist less than daily, 60.0% (52.6 – 63.2%) or daily 57.9% (52.6 – 63.2%) (p=0.133). Significantly more senior anaesthetists achieved a pass score than juniors.

Conclusion

The anaesthetists' knowledge regarding the WHO checklist at Wits was inadequate, despite two-thirds of the participants indicating that they used it daily. There was no significant difference in knowledge between those who used the WHO checklist daily and those who did not or the scores of junior and senior anaesthetists. Significantly, more seniors obtained a pass score; however, the practical relevance of this is questionable.

Introduction

Human error in healthcare has been noted and led to the release of the Institute of Medicine's landmark report "To err is human: building a safer health system" (1). In the report, it was highlighted that between 44 000 and 98 000 patients die in the United States of America every year due to medical errors (1). To ensure the safety of surgical patients, the World Health Organization (WHO), in 2008, published guidelines identifying multiple recommended practices (2). From these guidelines, a 19-item WHO Surgical Safety Checklist (WHO checklist) was developed for worldwide use with the intention of decreasing mortality and morbidity related to surgery (2).

The development of the WHO checklist was influenced by the aviation industry (3). A Boeing aircraft crashed after take-off during testing by the United States of America Army Air Corps in 1934. The investigation following the crash concluded that human error was the cause of the disaster. The pilots assigned to the testing of the Boeing realised that this new model was a complex aircraft and may have been ''too much for one man to fly''. Subsequently, the aviation industry developed a checklist to improve aviation safety (3).

The reported impact of the WHO checklist on surgical patient safety varies. The WHO conducted a study in 2009 in elective patients in the eight countries with different socio-economic status that took part in the development of the WHO checklist (2). After the implementation of the WHO checklist, it was noted that major complications decreased from 11% – 7% and the death rate decreased from 1.5% – 0.8%, both of which were significant (2). A follow-up study in urgent patients was conducted in the same hospitals using the same protocols. The results also showed a significant decrease in complications from 18.4% – 11.7%, and in the death rate from 3.7% – 1.4% (2). However, no significant decrease in mortality and morbidity was reported in a United Kingdom study (4). Taylor et al. (5) stated that there had been an improvement in communication, respect and teamwork after implementation of the WHO checklist. Improvement in safety processes such as timely use of prophylactic antibiotics has also been noted (4).

The use of the WHO checklist is, however, not without challenges. Vats et al. (4) found that the WHO checklists were incomplete, completed in a hurry and without all the team members present. Barriers and challenges to using the WHO checklist included existing hierarchy in the operating theatre, timing of checks, duplication and lack of enthusiasm from surgeons. In the interviews held during this study, some participants commented that the WHO checklist needed local modification (4).

Medico-legal claims for negligence in South Africa have more than tripled from 2016 – 2019, amounting to R104.5 billion in 2019 (6). The WHO checklist has the potential to decrease surgical mortality and morbidity if implemented and used correctly (2). It is not known if the WHO checklist is widely used in the Department of Anaesthesiology at the University of the Witwatersrand (Wits) and if it is used correctly. The aim of this study was to describe knowledge of the WHO checklist among anaesthetists in the Department of Anaesthesiology at Wits.

Methods

A cross-sectional design was followed in this study. Approval to conduct the study was obtained from the Wits Human Research Ethics Committee (Medical) (M200272) and other relevant authorities.

The study population consisted of all anaesthetists working in the Department of Anaesthesiology. The department consists of 239 anaesthetists: 90 consultants, 111 registrars and 38 medical officers. A minimum response rate of 60% (143) was considered acceptable (7). A convenience sampling method was used. Anaesthetists who decline participation, interns and questionnaires returned blank were excluded from the study.

The draft questionnaire was developed after an extensive review of the literature and the WHO checklist guidelines, ensuring content validity. The draft questionnaire was reviewed by three senior anaesthesiologists, ensuring face and content validity. The comments from the reviewers were incorporated into the final draft. The questionnaire consisted of 23 questions, six demographic and 18 single best answer knowledge questions.

One author (YN) approached the prospective anaesthetists at departmental academic meetings where the study was explained and invited them to participate. Those who agreed received an information letter and a questionnaire. Completed questionnaires were folded and placed in a sealed box by the anaesthetists at the meeting room door. This author was present during data collection to address queries and to prevent data contamination. Questions not answered were regarded as incorrect. The Angoff Method was used to determine the pass mark of 70% or more (8).

Data were analysed in consultation with a statistician using the statistical program STATA® version 15 (StatCorp, USA). One question was discarded as it erroneously had no correct options. Categorical variables were described using numbers and percentages and compared using a Chi-square or Fisher's exact test. Continuous variables were compared using the Mann-Whitney U test and and independent t-test. A p-value of 0.05 or less was considered statistically significant.

Results

Of the 160 questionnaires distributed, 150 (93.8%) were returned. This represents 68.5% of anaesthetists in the department. Of these 42 (28.0%) were consultants, 73 (48.7%) were registrars and 35 (23.3%) were medical officers. There were 87 (58.0%) junior and 63 (42.0%) senior anaesthetists. The frequency of use of the WHO checklist and the training received are shown in Table 1. Three anaesthetists reported two sources of training on the WHO checklist and, therefore, the numbers add up to more than the number of participants.

Table 1: WHO checklist frequency of use and training received

	Number	Percent
Frequency of WHO checklist use		
• Never	1	0.7
• Daily	100	66.7
• Weekly	35	23.3
• Monthly	14	9.3
WHO checklist training		
• Lecture	48	32.0
• Tutorial	41	27.3
• Simulation	10	6.7
• Other	2	1.3
• None	52	34.7

The median (IQR) overall score for the questionnaire was 57.9% (52.6 – 63.2%). There was no significant difference between the median (IQR) score of the junior anaesthetists, 57.9% (52.6 – 63.2%) and 57.9% (52.6 – 68.4%) for the seniors (p=0.080) or between the scores of those who used the WHO checklist less than daily, 60.0% (52.6 – 63.2%) or daily 57.9% (52.6 – 63.2%) (p=0.133).

The WHO checklist was used by 149 (99.3%) anaesthetists. The anaesthetist who had never used the WHO checklist was excluded from the analysis of the frequency of use. The association between passing and seniority of the anaesthetists and between passing and the frequency of use of the WHO checklist is shown in Table 2. Significantly more senior anaesthetists achieved a pass score than juniors.

Table 2: Comparison between passing or failing and seniority and frequency of use

	Score <70% n=130 n (%)	**Score ≥70%** n=19 n (%)	**P-value**
Seniority			
• Junior	80 (92.0)	7 (8.0)	0.046
• Senior	51 (81.0)	12 (19.0)	
Frequency of use			
• Less than daily	39 (79.6)	10 (20.4)	0.089
• Daily	91 (91.0)	9 (9.0)	

The mean (SD) score of anaesthetists that received WHO Checklist training was 59.8% (11.2%) and those with no training, 55.0% (11.9%). Although this difference was statistically significant (p=0.016), it was as small and of no clinical significance.

A description of the questions and the number of correct responses per question is shown in Table 3.

Table 3: Correct answers per question

Question description	Correct answers		
	Overall n = 150 n (%)	Juniors n = 87 n (%)	Seniors n=63 n (%)
Different parts of WHO checklist	30 (20.0)	15 (17.2)	15 (23.8)
Surgeon mark site of operation	111 (74.0)	61 (70.1)	50 (79.4)
Theatre staff present before induction	15 (10.0)	8 (9.2)	7 (11.1)
Questions directed to patient before induction	125 (83.3)	70 (80.5)	55 (87.3)
Action taken if pulse oximeter not working	78 (52.0)	51 (58.6)	27 (42.9)
Steps taken difficult airway patient before induction	92 (61.3)	47 (54.0)	45 (71.4)
Appropriate action if >500 ml blood loss anticipated (a)	128 (85.3)	73 (83.9)	55 (87.3)
Appropriate action if >500 ml blood loss anticipated (b)	130 (86.7)	74 (85.1)	56 (88.9)
Information confirmed before skin incision	125 (83.3)	75 (86.2)	50 (79.4)
Action if inappropriate antibiotic prophylaxis	105 (70.0)	59 (67.8)	46 (73.0)
Questions for surgeon before skin incision	128 (85.3)	74 (85.1)	54 (85.7)
Questions for anaesthetist before skin incision	129 (86.0)	73 (83.9)	56 (88.9)
Questions to scrub nurse before skin incision	76 (50.8)	39 (44.8)	37 (58.7)
Action if imaging needed but not available	89 (59.3)	54 (62.1)	35 (55.6)
Questions for surgeon before patient leaves theatre	40 (26.7)	21 (24.1)	19 (30.2)
Questions for anaesthetist before patient leaves theatre	102 (68.0)	60 (70.0)	42 (66.7)
Questions for scrub nurse before patient leaves theatre	22 (14.7)	10 (11.5)	12 (19.1)
According to WHO, purpose of checklist	130 (86.7)	74 (85.1)	56 (88.9)

Discussion

WHO checklist, published in 2009, has the potential to decrease surgical mortality and morbidity if implemented and used correctly (2). In this study, 99.3% of the anaesthetists reported having used the WHO checklist and two-thirds of those used it daily. Sendlhofler et al. (9) in Austria reported that 91.3% of healthcare professionals in their study used the WHO checklist, and 80.6% used it in more than 90% of surgeries. In a study done in Switzerland, Mascherek et al. (10) reported that 79.1% of operating theatre staff used surgical checklists, with 25.1% using the WHO checklist. The high frequency of use reported in this study is unexpected. Anecdotally it is known that the WHO checklist is not used formally at one of the large Wits-affiliated hospitals and is used sporadically at the other large

hospital. However, aspects of the WHO checklist are used informally at these hospitals, and this may have been confused with formal checklist use.

It was difficult to compare our results to those of other studies. Some authors did not state what they considered adequate or inadequate knowledge (10-12). Knowledge studies identified often assessed awareness rather than knowledge of the WHO checklist (9, 10, 13).

There was inadequate knowledge of the WHO checklist among anaesthetists in this study, as a median score of 57.9% was obtained. Only 12.7% of anaesthetists obtained a pass mark of 70% or more. This is similar to 78.0% of operating room nurses who had inadequate knowledge in Tumkur, India (11). In another study in north India, Sharma et al. (12) reported that 9.3% of operating theatre staff had poor knowledge, 36.8% had average knowledge and 54.2% had good knowledge. Sendlhofer et al. (9) reported a median score of 80%, and the authors regarded this as inadequate knowledge as the WHO checklist had been used in their hospital for more than three years.

This study found no significant difference in knowledge between anaesthetists who used the checklist daily (57.9%) and those who used it less than daily (60.0%). Mascherek et al (10) also found that the doctors who used the WHO checklist had a higher mean score, 76%, compared to 74% for those who did not use it. The authors reported this difference as statically significant but of no practical relevance. The small difference found in our study could be attributed to the informal use of the WHO checklist being reported as formal WHO checklist use.

Although there was no significant difference between the knowledge scores of junior and senior anaesthetists, with both scoring 57.9%, significantly more senior anaesthetists obtained a pass score. However, the practical relevance of only 19% of seniors versus 8% of juniors passing is questionable as the seniors should teach the junior anaesthetists and set an example.

The questions in which the participants achieved the highest scores, such as the appropriate action to be taken when blood loss of more than 500 mls is anticipated, do not necessarily show knowledge of the WHO checklist as they are routine daily practice in most theatres. That participants did not score well on the

questions, such as the different parts of the WHO checklist, which staff needs to be present before induction of anaesthesia and that the entire team should be concerned about the post-operative recovery and management of the patient. This indicates unfamiliarity with the WHO checklist and may show that it is mainly used informally.

Limitations of this study include that it being done contextually in the Department of Anaesthesiology at Wits, and therefore, the results may not be generalisable to other contexts. The correct use of a checklist is influenced by multiple factors such as perceptions and attitudes of the users and not only the knowledge of the checklist. This study only assessed the knowledge of anaesthetists in the department. However, a parallel qualitative study is currently exploring the perceptions of anaesthetists regarding the use of the WHO checklist in the department. The WHO checklist has the potential to decrease surgical mortality and morbidity if implemented and used correctly (2). It is recommended that further research should be conducted to determine if the WHO checklist is implemented and used correctly in other settings.

Conclusion

The anaesthetists' knowledge regarding the WHO checklist at Wits was inadequate, despite two-thirds of the participants indicating that they used it daily. There was no significant difference in knowledge between those who used it daily and those who did not or between the scores of junior and senior anaesthetists. Significantly, more seniors obtained a pass score; however, the practical relevance of this is questionable.

Conflict of interest

The authors declare that we have no financial or personal relationships, which may have inappropriately influenced us in writing this paper.

Acknowledgement

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Section 4: Proposal

Knowledge of the WHO surgical safety checklist in an anaesthesiology department

Yolwando Nyathela-Nthai

0204955h

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4.1 Introduction and problem statement

Human error in healthcare has also been noted and lead to the release of the landmark report “To Err is Human” by The Institute of Medicine Committee on Quality of Health Care in America (1). In the report, it was stated that between 44 000 and 98 000 patients died in the United States of America every year due to medical errors. To ensure the safety of surgical patients, the World Health Organization (WHO) in 2008 published guidelines identifying multiple recommended practices (2). From these guidelines, a 19-item WHO Surgical Safety Checklist (WHO checklist) was developed (2). The intention was that the WHO checklist could be used worldwide to decrease mortality and morbidity related to surgery (2)

Muller and Hiten (3) noted that after Boeing submitted an aircraft to the United States of America army for testing, the aircraft crashed after take-off. Investigations showed that the crash was a result of human error. Pilots, after learning the cause of the accident, discussed means of “making sure everything is done and nothing is overlooked” (3). The WHO checklist was adapted from the aviation industry.

The WHO conducted a study in 2009 in which the authors hypothesised that implementation of the WHO checklist would reduce major surgical complications and the death rate (2). The study was conducted in eight different socio-economic status countries, with a pre-intervention and implementation period (2). After the implementation of the checklist, it was noted that major complications decreased from 11% – 7%, and the death rate decreased from 1.5% – 0.8%, both of which were significant (2). A similar study, for urgent cases, was conducted in the same hospitals using the same protocols (2). These results also showed a significant decrease in complications from 18.4% – 11.7%, and in the death rate from 3.7% – 1.4% (2). However, no significant decrease in mortality and morbidity was reported in a United Kingdom study (4).

Taylor et al (5) stated that there has been an improvement in communication, respect and teamwork after implementation of the WHO checklist. Improvement in safety processes such as timely use of prophylactic antibiotics has also been noted (4). The use of the WHO checklist is, however, not without challenges. Vats et al (4) concluded that poor completion of checklists could be attributed to factors such as hurried completion of checklists when checklists were seen as a disturbance to workflow and checklists completed when key members of the team were missing. Hierarchy was observed to be a barrier, with surgeons found not to be very enthusiastic about the checklist (4).

Medico-legal claims for negligence in South Africa have more than tripled from 2016 – 2019, amounting to R104.5 billion in 2019 (6). The WHO checklist has the potential to decrease surgical mortality and morbidity if implemented and used correctly. Anecdotally, it is known that the WHO checklist is not widely used in the Department of Anaesthesiology at the University of the Witwatersrand and when it is used, it is not always correctly used. Many factors, such as knowledge and attitudes, may influence correct use. The knowledge of the anaesthetists in the Department of Anaesthesiology regarding the WHO checklist is not known.

4.2 Aim and objectives

4.2.1 Aim

The aim of this study is to describe knowledge of the WHO checklist among anaesthetists in the Department of Anaesthesiology at the University of the Witwatersrand.

4.2.2 Objectives

The primary objective of this study is to determine the knowledge of anaesthetists of the WHO checklist.

The secondary objectives of this study are to compare:

- the knowledge of junior and senior anaesthetists
- the knowledge of those who use the checklist daily versus those who use it less frequently

- compare the adequacy of knowledge (pass mark) between juniors and seniors and between those who use it daily versus those who use it less frequently.

4.3 Research assumptions

The following definitions will be used in this study.

Anaesthetist: is any qualified doctor working in the Department of Anaesthesiology including medical officers, registrars and consultants.

Medical officer: is a qualified doctor who is practising in the Department of Anaesthesiology under specialist supervision. A medical officer with more than 10 years of experience is regarded as a career medical officer.

Registrar: is a qualified doctor who is registered with the Health Professions Council of South Africa as a trainee anaesthetist.

Specialist anaesthetist: is a qualified doctor who is registered with the Health Professions Council of South Africa as a specialist anaesthetist.

Consultant: is a specialist anaesthetist or a career medical officer.

Junior anaesthetist: in this study refers to a medical officer or a registrar with three or less years of experience.

Senior anaesthetist: in this study refers to a registrar with more than three years of experience or consultant.

Adequate knowledge: in this study will be determined by using the modified Angoff method (7).

4.4 Demarcation of study field

The study will be conducted in the Department of Anaesthesiology, affiliated to the University of the Witwatersrand. The staff complement of the department is 90 consultants, 111 registrars and 38 medical officers. The following core hospitals are affiliated to the department's training platform.

- Charlotte Maxeke Johannesburg Academic Hospital, a 1200-bed central hospital.
- Chris Hani Baragwanath Academic Hospital, a 2888-bed central hospital.
- Helen Joseph Hospital, a 500-bed regional hospital.
- Rahima Moosa Mother and Child Hospital, a 338-bed regional hospital.
- Wits Donald Gordon Medical Centre, a public-private hospital with 190 beds.

4.5 Ethical considerations

Approval to conduct the study will be obtained from the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of the University of the Witwatersrand. Approval to conduct this study was obtained from the Head of Department of Anaesthesiology (Appendix 1).

This study uses an anonymous self-administered questionnaire (Appendix 2) with consent implied by the return of a completed questionnaire. The researcher will approach the prospective anaesthetists at departmental academic meetings where the study will be explained and invite them to take part. Those who agree will receive an information letter (Appendix 3) and a questionnaire (Appendix 2).

Anonymity will be maintained by not using identifying information and assigning a study number to the questionnaire. Completed questionnaires will be folded and placed in a sealed box by the anaesthetists at the door of the meeting room. Only the researcher and supervisors will have access to the raw data; therefore confidentiality will be maintained. Raw data will be stored securely in a locked cupboard for six years.

If the results of the study show that the knowledge of the WHO checklist is poor, the researcher will report the results to the Head of Department. A recommendation for the appropriate introduction of the checklist in the daily routine of the operating theatres will be made.

The study will be conducted according to the principles of the Declaration of Helsinki (8) and the South African Guidelines for Good Clinical Practice (9).

4.6 Research methodology

4.6.1 Research design

A cross-sectional design was followed in this study. Cross-sectional studies are used for describing phenomena or relationships between phenomena at a fixed point in time (10). This study will describe the knowledge of the anaesthetists in the department.

4.6.2 Study population

The study population consists of all anaesthetists working in the Department of Anaesthesiology, University of the Witwatersrand.

Sample size

The department consists of 239 anaesthetists: 90 consultants, 111 registrars and 38 medical officers. Questionnaires will be administered to the entire accessible population. A minimum response rate of 60% (143) will be considered acceptable (11).

Sampling method

A convenience sampling method will be used in this study. Convenience sampling is when a researcher uses participants that happen to be available at the time of sampling (12). This study will sample anaesthetists working in the Department of Anaesthesiology who attend departmental academic meetings

Inclusion and exclusion criteria

The inclusion criteria for this study will be all the anaesthetists attending the departmental academic meetings at the time of data collection.

The exclusion criteria for this study will be:

- anaesthetists who decline participation
- interns
- blank questionnaires.

4.6.3 Data collection

Questionnaire development

The draft questionnaire was developed after an extensive review of the literature and the WHO checklist guidelines, ensuring content validity. The draft questionnaire was reviewed by three senior anaesthesiologists, ensuring face and content validity. The comments from the reviewers were incorporated into the final draft. The questionnaire (Appendix 2) consists of 23 questions;

- six demographic questions
- 18 knowledge questions
    - before induction of anaesthesia – seven questions
    - before skin incision – seven questions
    - before the patient leaves the operating room – three questions.

Data collection

The researcher will approach the prospective anaesthetists at departmental academic meetings where the study will be explained and invite them to take part. Those who agree will receive an information letter (Appendix 3) and a questionnaire (Appendix 2). Completed questionnaires will be folded and placed in a sealed box by the anaesthetists at the door of the meeting room. The researcher will be present during data collection to address queries and to prevent data contamination. Questions not answered will be regarded as incorrect. There is one single best answer per question. The Angoff Method will be used to determine the pass mark.

4.6.4 Data analysis

A Microsoft Excel® spreadsheet will be used to capture data. Data will be analysed in consultation with a statistician using the statistical program STATA® version 15 (StatCorp, USA). Categorical variables will be described using numbers and percentages and compared using a Chi-square or Fisher's exact test. Continuous

variables will be reported using means and standard deviations or medians and interquartile ranges and compared using an independent t-test or Mann-Whitney test depending on the distribution of the data. A p-value of 0.05 or less will be considered statistically significant.

4.7 Significance of the study

To ensure the safety of surgical patients, the WHO, in 2008, published guidelines identifying multiple recommended practices (2). From these guidelines, a 19-item WHO checklist was developed (2). The WHO checklist has the potential to decrease surgical mortality and morbidity if implemented and used correctly.

Many factors, such as knowledge and attitudes, may influence correct use. The results of this study will give insight into the knowledge of the anaesthetists in the Department of Anaesthesiology regarding the WHO checklist. If the knowledge is found to be poor, a recommendation will be made to the Head of Department for formal lectures at academic meetings. This may contribute to improved patient safety.

4.8 Validity and reliability of the study

Validity is defined as the “degree to which study conclusions are justified based on the study design” (13), and reliability refers to the consistency of results (14).

Validity and reliability of this study will be ensured through:

- using an appropriate study design
- using a questionnaire based on an extensive literature review (content validity) reviewed by three senior anaesthesiologists (content and face validity)
- the researcher being present during completion of the questionnaire to assist with queries and to prevent data contamination
- creating a non-threatening environment by placing completed questionnaires into a sealed box to ensure anonymity
- analysing data will be done in consultation with a statistician.

4.9 Potential limitations

The study will be done contextually in the Department of Anaesthesiology at the University of the Witwatersrand and, therefore, the results of this study may not be generalizable to other departments. The use of convenience sampling may result in bias, as the participants included may not be representative of the whole department.

4.10 Project outline

4.10.1 Time frame

Activity	Year 2020									
	Feb	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Proposal preparation										
Literature review										
Proposal submission										
Ethics approval										
Postgraduate approval										
Data collection										
Data analysis										
Draft article										
Submission										

4.10.2 Budget

Item	Number	Cost	Total
Printing	1200	R1 per page	R1200
Binding	3	R150	R450
Total			R1650

The Department of Anaesthesiology will incur the costs of paper and printing for the proposal, ethics and postgraduate approvals.

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4.12 Appendices

Appendix 1: Request to HOD of Anaesthesiology at the University of the Witwatersrand

4 February 2020

Attention: The Head of Department of Anaesthesiology

Dear Dr Motshabi

Re: Knowledge of the WHO surgical safety checklist in an anaesthesiology department

For the research component of my M Med, I would like to describe knowledge of the WHO checklist amongst anaesthetists in the Department of Anaesthesiology at the University of the Witwatersrand. Data will be collected through a self-administered questionnaire. The questionnaires will be handed out at several departmental academic meetings with permission from the chairperson

Data collection will only start once permission to do the study has been received from the Graduate Studies Committee and the Human Research Ethics Committee. There will be no cost to the department. A copy of the final report will be made available to you should you wish.

I hereby request permission to conduct this study.

Yours sincerely

Yolwande Nyathela-Nthai

Dr Motshabi

Head of Department

Appendix 2: Questionnaire

Knowledge of the WHO surgical safety checklist in an anaesthesiology department

Please mark appropriate boxes with an X

Demographics

Question 1

Professional designation

Consultant	
Registrar	
Medical officer	

Question 2

Registrar

First-year	
Second-year	
Third-year	
Fourth-year and more	

Question 3

Number of years of experience in anaesthesia

< 1 year	
1 – 5 years	
6 – 10 years	
>10 years	

Question 4

Have you used the WHO surgical safety checklist?

Yes	
No	

Question 5

If yes, how often do you use the WHO checklist?

Daily	
Weekly	
Monthly	
Never	

Question 6

Have you received any training in the use of the WHO checklist?

Lecture	
Tutorial	
Simulation	
Other	

If other, please specify.

WHO surgical safety checklist questions

Please answer the following questions according to the WHO surgical safety checklist guidelines

There is one single best answer per question

Question 7

What are the different parts of the WHO checklist?

Check in, sign in, check out	
Sign in, time out, sign out	
Time in, sign out, time out	
Do not know	

Question 8

Where should the surgeon mark the site of operation?

Mark on imaging	
Mark on consent form	
Mark on patient	
Do not know	

Question 9

Before induction of anaesthesia, which of the theatre staff must be present?

Scrub nurse, surgeon, anaesthetist	
Scrub nurse, anaesthetist, floor nurse	
Anaesthetic nurse, surgeon, floor nurse	
Do not know	

Please answer the following questions according to the WHO surgical safety checklist guidelines

Question 10

Before induction of anaesthesia, what questions are normally directed to the patient by the checklist coordinator?

Age, consent, identity	
Identity, site, consent	
Comorbidities, consent, identity	
Do not know	

Question 11

The checklist coordinator will ask the anaesthesia team if the pulse oximeter is on the patient and functioning. What is the appropriate action if it is not working?

Cancel the case	
Continue without pulse oximeter	
Operating team must have a discussion whether to continue or not	
Do not know	

Question 12

The checklist coordinator will ask the anaesthesia team if the patient has a difficult airway. If the patient is recognised to have a difficult airway, what steps must the anaesthesia team take before induction of anaesthesia?

Have a fibre optic in theatre	
Cancel the case	
Have a capable assistant in theatre	
Do not know	

Please answer the following questions according to the WHO surgical safety checklist guidelines

Question 13 (a)

The checklist coordinator will ask the anaesthesia team if the patient has a risk of losing more than 500 ml of blood (7 ml/kg for a child). If the patient has a risk of losing more than 500 ml of blood, what appropriate steps must the anaesthesia team take before induction of anaesthesia?

Have a cell saver in theatre	
Have blood ready in theatre	
Have access to blood	
Do not know	

Question 13 (b)

The checklist coordinator will ask the anaesthesia team if the patient has a risk of losing more than 500 ml of blood (7 ml/kg for a child). If the patient has a risk of losing more than 500 ml of blood, what appropriate steps must the anaesthesia team take before induction of anaesthesia?

Insert an arterial line and central a venous catheter	
Insert two large-bore lines	
Have inotropes ready	
Do not know	

Question 14

Before skin incision, the checklist coordinator will ask the team to pause briefly to introduce themselves and confirm again certain information pertaining to the patient and operation. What information must be confirmed at this point?

Identity, procedure, site	
Procedure, allergies, position	
Age, comorbidities, procedure	
Do not know	

Please answer the following questions according to the WHO surgical safety checklist guidelines

Question 15

Antibiotic prophylaxis should be given 60 minutes before:

Inflating the tourniquet	
Induction of anaesthesia	
Arrival in theatre	
Do not know	

Question 16

What is the appropriate action if antibiotic prophylaxis was administered longer than this period or if it was never given?

Repeat dose	
Give half the dose	
No need to repeat dose	
Do not know	

Question 17

Before skin incision, the checklist coordinator will ask specific questions of the team. What question is directed to the surgeon?

Estimated blood loss	
Position	
Allergies	
Do not know	

Please answer the following questions according to the WHO surgical safety checklist guidelines

Question 18

Before skin incision, the checklist coordinator will ask specific questions of the team. What question is directed to the anaesthetist?

Patient-specific concerns	
Allergies	
Estimated blood loss	
Do not know	

Question 19

Before skin incision, the checklist coordinator will ask specific questions of the team. What question is directed to the scrub nurse?

Equipment issues	
Allergies	
Swabs and instruments count	
Do not know	

Question 20

The checklist coordinator will ask the surgeon if imaging is necessary for the operation. What is the appropriate action if imaging is not available but needed?

Cancel the case	
Request new imaging and postpone the case	
Surgeon can decide	
Do not know	

Please answer the following questions according to the WHO surgical safety checklist guidelines

Question 21

Before the patient leaves the operating room, there are safety checks that should be completed by directing certain questions to the surgeon, anaesthetist, and scrub nurse. What question is directed to the surgeon?

Concerns for recovery and management of the patient	
Concerns for procedure performed	
Concerns for equipment failure	
Do not know	

Question 22

Before the patient leaves the operating room, there are safety checks that should be completed by directing certain questions to the surgeon, anaesthetist and scrub nurse. What question is directed to the anaesthetist?

Estimated blood loss	
Concerns for recovery and management of the patient	
Swabs and instrument count	
Do not know	

Question 23

Before the patient leaves the operating room, there are safety checks that should be completed by directing certain questions to the surgeon, anaesthetist and scrub nurse. What question is directed to the scrub nurse?

Concerns for equipment failure	
Concerns for specimen labelling	
Concerns for recovery and management of the patient	
Do not know	

Please answer the following questions according to the WHO surgical safety checklist guidelines

Question 24

According to the WHO, the purpose of the checklist is to?

Increase communication	
Strengthen the relationship between surgeon and anaesthetist	
Dissolve hierarchy in theatre	
Do not know	

Thank you for your time

Appendix 3: Information sheet

Hello, my name is Yolwando Nyathela-Nthai. I am a registrar in the Department of Anaesthesiology, and I am currently busy with my M Med. I would like to invite you to participate in my study: Knowledge of the WHO surgical safety checklist in an anaesthesiology department. The aim of this study is to describe anaesthetists knowledge of the WHO surgical safety checklist. The WHO checklist has been proven to decrease the rate of surgical complications. Knowledge of the WHO checklist has not been assessed in Anaesthetists in South Africa

Should you agree to participate in my study, I will ask you to complete a written questionnaire. Completing the questionnaire should take approximately 15 minutes. Your participation is voluntary, and consent will be implied by your completion and return of the questionnaire. You will remain anonymous as there is no identifying information requested on the questionnaire. Please fold and place the questionnaire, completed or not, in the sealed collection box at the door of the meeting room. There will be no incentive for completing the questionnaire. There is no penalty for not participating in the study, and you may withdraw at any time before returning the questionnaire. Confidentiality will be ensured as my supervisors and I will have access to the raw data. This study has been approved by the Human Research Ethics Committee (Medical) (Professor CB Penny) and the Graduate Studies Committee of the University of the Witwatersrand and your health care institution. Should you require more information on the study, please contact me on 0725267605 or the Chair of Human Research Ethics Committee (Medical) on 011 7171234.

Thank you for taking the time to read this letter.

Yours sincerely

Yolwando Nyathela-Nthai

Section 5: Annexures

5.1 Ethics approval

5.2 Graduate studies approval

5.3 Turnitin report