

SAFE SURGERY AND SAFE ANAESTHESIA IN AFRICA: A CROSS-SECTIONAL STUDY TO ASSESS THE KNOWLEDGE, ATTITUDE AND AVAILABILITY OF THE WHO SAFE SURGERY CHECKLIST TO THE MEMBERS OF THE SURGICAL TEAM

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ABSTRACT

Background: Access to safe surgery and anaesthesia remains a challenge, particularly in low-middle income countries. Lack of anaesthetic and surgical safety causes significant burdens on the healthcare systems, leading to high morbidity and mortality. To address these issues, the WHO introduced the Surgical Safety Checklist (SSC) in 2009. This study aims to investigate the knowledge, attitude, and availability of the SSC to members of the surgical team in Africa.

Methodology: A cross-sectional study design was used to sample members of the surgical team across tertiary hospitals in 6 African countries. A p-value less than 0.05 was considered significant for associations between dependent and independent variables.

Results: Of the 227 respondents, 55% are male and 45% are female. Students (Medical and Nursing) accounted for 30% while the remaining 70% comprised other professionals in the surgical team. Overall, 74% of the participants were aware of the WHO SSC with Anaesthetists and Surgeons having the highest awareness and medical and nursing students reporting the least awareness. Of the respondents aware, 93% had good knowledge and 88% had a positive attitude towards the WHO SSC. Of those who primarily use the WHO SSC, 82% said it was readily available. Awareness, Knowledge, Attitude and Availability of the WHO SSC were all associated with the university hospital of the respondents.

Conclusion: The result of the study calls for increased training and education on the WHO SSC should be provided to all members of the surgical team, regardless of their professional roles and training levels.

Keywords: WHO checklist, Surgery, Surgical procedures, Operative, Patient safety

INTRODUCTION

Safe surgery and anaesthesia are essential components of global health, yet access to safe surgical procedures remains a challenge, particularly in low-middle income countries (LMICs), amid a constant increase in the number of hospital admissions due to surgical pathology thus weighting on healthcare systems.¹ The burden of surgical conditions has been estimated to be up to 30% worldwide,¹ with one study reporting it

as high as 57.5% of hospital admissions and referrals in Mozambique.² The WHO has declared that unsafe procedures can cause complications in a quarter of patients, leading to complications in 7 million patients annually, of which 1 million will die during or immediately after the surgery.³ Others will be impacted physically, mentally, and economically, thus impacting their healthcare systems.

Throughout the world, about 5 billion people do not have access to safe surgery and anaesthesia when needed.¹ Patients living in LMICs are much more affected by this issue. Some studies have reported the anaesthesia-related death rates to be 100 to 1000 times more in LMICs than in high-income countries (HICs).^{4,5} Other studies have reported up to 10 times more operating theatres and up to 100 times as many surgeons in HICs.⁶ A recent study also demonstrated unacceptable disparities in survival rates for common paediatric surgical conditions in LMICs compared to HICs, particularly for neonates. For example, gastroschisis mortality was found to be up to 75% in LMICs vs 2% in HICs.⁷

To address these issues, the WHO introduced the Surgical Safety Checklist (SSC) in 2009, as part of the “Safe Surgery Saves Lives” project, with the aim of reducing surgical deaths and complications by promoting compliance with best practices in operating rooms and improving team communication.⁸ The checklist is based on a core set of 19 safety checks covering anaesthetic practice, surgical practice, scrub team and nursing routines.

The WHO SSC is a simple and effective tool that reminds the surgical team members of the important tasks to be performed before, during and after the surgery.⁹ Studies have highlighted the significant improvement in results observed by this small but effective intervention. It has been shown to reduce surgical mortality and morbidity by up to 45%.¹⁰ Haynes *et al.* reported a 65% and 50% improvement in compliance with standards of care and reduction in death rate, respectively, after implementing the WHO SSC.¹¹ A study conducted by White *et al.* on the implementation of the WHO SSC reported that, thanks to the checklist itself, 87% of the study participants reported improved understanding of patient safety and 83% increased job satisfaction.¹² Many countries have adopted the use of this checklist, with studies reporting its use in over 4000 hospitals around the world.¹³ There is less literature on the WHO SSC in LMICs¹⁴ and despite its effectiveness, there has been low implementation of the Checklist in region or country-wide studies in Africa.^{15,16}

To our knowledge, there has not been any continent-wide study done to investigate the knowledge, attitude and availability of surgical checklists to the members of the surgical team in the African continent. This, therefore, is the main aim of our study with the overall intention to improve patient safety throughout the continent.

METHODS

Study design, sampling technique and study setting

A descriptive cross-sectional study using convenience sampling techniques was conducted across 6 university hospitals across different regions of Africa, including Alexandria Main University Hospital from Egypt, Tikur Anbessa Specialized Hospital from Ethiopia, Korle Bu Teaching Hospital from Ghana, University College Hospital from Nigeria, Inkosi Albert Luthuli Central Hospital from South Africa, and Kilimanjaro Christian Medical Centre from Tanzania.

Ethical approval was obtained by the Institutional Review Board of Alexandria University, Faculty of Medicine in Egypt with IRB no. 00012098 and FWA no. 00018699, The University of KwaZulu-Natal Biomedical Research Ethics Committee with Protocol reference number: BREC/00004352/2022 and the Korle Bu Teaching Hospital Institutional Review Board with Reference Number: KBTH/MD/G3/27.

Study participants, inclusion and exclusion criteria

Study participants included members of the surgical teams in the study locations. These included Clinical Nursing students and Clinical Medical students and professionals including Nurses, Resident Surgeons, Resident Anesthesiologists, Surgeons, and Anesthesiologists.

Participation in the study was voluntary and anonymous. Informed consent was explicitly explained and obtained from the participants through the online Google form.

Pilot study:

A pilot study was carried out among 15 members of the surgical team at the Kenyatta National Hospital, Kenya. The results were analyzed, and based on feedback, the study instrument was improved. This data is not included in the report.

Data collection:

Data collection across all 6 sites was conducted using an online questionnaire created via Google Forms. The form was divided into 5 main sections (A-D). Section A collected demographic information. Section B obtained participants' knowledge about WHO SCC. Section C explored participants' attitudes whereas Section D explored the availability of the WHO SCC at the participants' respective University hospitals.

Members of the surgical team were contacted using emails, messaging platforms and printed hardcopies. The study was explained to the participants in detail, consent was obtained and all questions were addressed appropriately. The response rate was 100%.

Data analysis

Categorical variables were presented in frequencies and percentages. The association between awareness, level of knowledge, WHO SSC availability vs sex, and university hospital were tested using Chi-square at a p-value less than 0.05 as statistically significant.

For Section B, the responses regarding “Knowledge” about WHO SCC were scored. One point was given to each correctly answered question while 0 points were given to incorrect answers. Having a total of 5 and above points out of 8 was deemed as having good knowledge while a score of 4 points or below was regarded as having poor knowledge.

For Section C, the responses regarding “Attitude” towards WHO SCC were scored using the Likert scale. Each question answered positively was given one point while each question answered negatively was given 0 points. Five points or above was regarded as having a positive attitude; a score of 4 points or below was regarded as having a negative attitude towards the WHO SCC.

Definition of terms

Clinical Students: medical or nursing students who have started clinical rotations as part of their training in medical or nursing school. They include Clinical Medical Students and Clinical Nursing Students

Professional role in surgical team: The different roles of members of the surgical team. These roles include Clinical Medical Student, Clinical Nurse Student, Nurse, Resident Anaesthetist, Resident Surgeon, Anaesthetist and Surgeon.

Training level: These divided all the participants into two groups

- Clinical Student: undergraduate students i.e Clinical Medical Students and Clinical Nursing Student
- Professional Surgical Workers: Those who have gotten a degree already- Nurse, Resident Anaesthetist, Resident Surgeon, Anaesthetist and Surgeon

University hospitals: Tertiary healthcare institutions. These are the study sites.

RESULTS

A total of 227 responses were collected and analyzed. Of the 227 participants, 125 (55%) were male and 102 (45%) were female. Medical and Nursing students accounted for 30% (69) of the respondents while other professionals in the surgical team (Resident doctors, qualified Nurses, qualified Surgeons and Anaesthetists) accounted for the remaining 70% (158).

Table 1: General information about participants (N=227).

Characteristics of respondents	Frequencies (n)	Frequencies (%)
Sex		
Male	125	55.1
Female	102	44.9
Training level		
Clinical student	69	20.4
Professional surgical worker	158	69.6
Professional roles in surgical team		
Clinical medical student	43	18.9
Clinical nursing student	26	11.5
Nurse	32	14.1
Resident Anaesthetist	35	15.4
Resident surgeon	28	12.3
Anaesthetist	32	14.1
Surgeon	31	13.7

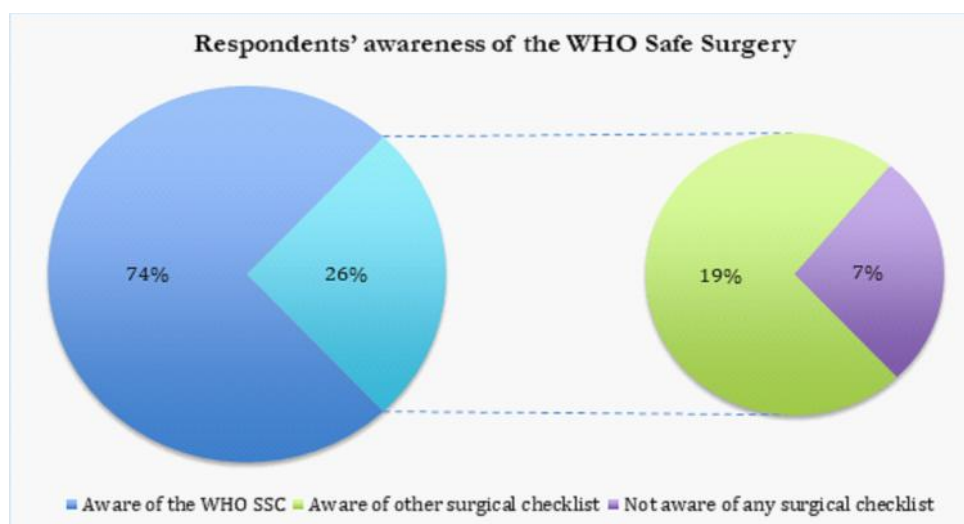


Figure 1: Respondents' awareness of the WHO safe surgery checklist (n=227)

Table 1 gives more details of the sociodemographic characteristics of the respondents.

Figure 1 below shows the response of the participants when asked if they are aware of the WHO SSC while Figure 2 shows the respondents' sources of awareness of the WHO SSC. Of the 227 participants, 168 (74%) are aware of the WHO SSC, while 59 (26%) are not aware of the WHO SSC. Of these 26% not aware of the WHO SSC, 19% are aware of other surgical

checklists and 7% are not aware of any surgical checklist.

Table 2 shows that being aware of the WHO safe surgery checklist is statistically significant with training level, professional roles in the surgical team and the university hospital. Anaesthetists and Surgeons were aware of the WHO SSC (96.9% and 96.8% respectively) the most while students were least aware of the WHO SSC (37.2% and 38.5% respectively).

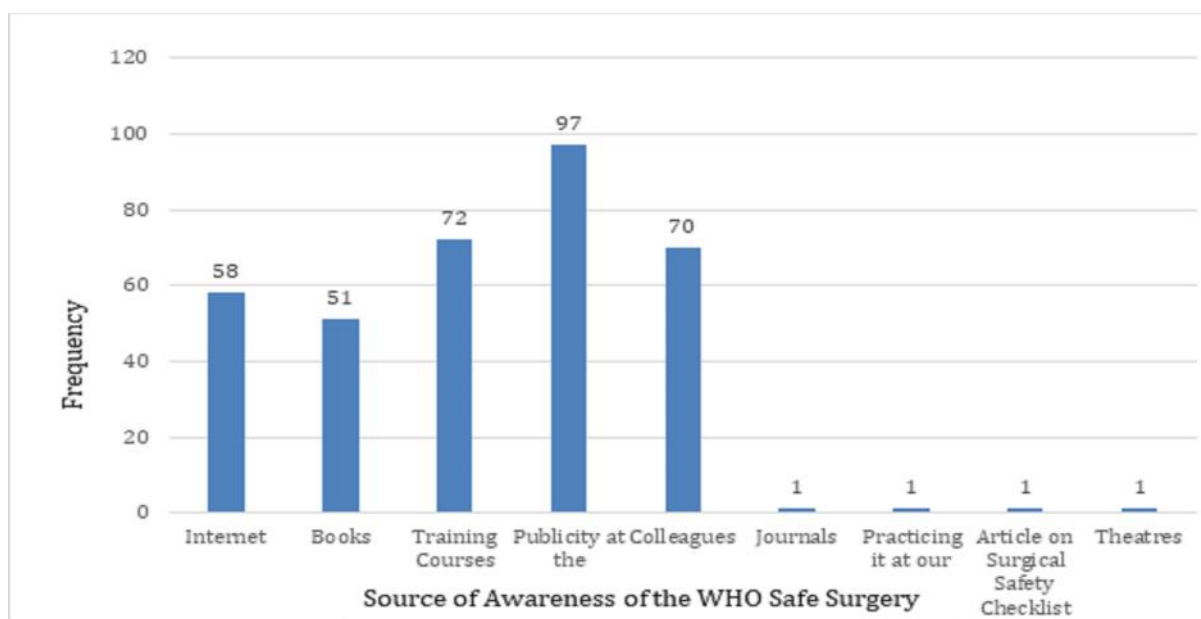


Figure 2: Respondents' sources of awareness of the WHO safe surgery checklist (n=168)

Table 2: Awareness of the WHO safe surgery checklist (N=227)

	Frequencies of Yes (%)	Frequencies of No (%)	p-value
Sex			
Male	91(72.8)	34(27.2)	0.758
Female	77(75.5)	25(24.5)	
Training level			
Clinical student	26(37.7)	43(62.3)	<0.001
Professional surgical worker	142(89.9)	16(10.1)	
Professional roles in surgical team			
Clinical medical student	16(37.2)	27(62.8)	<0.001
Clinical nursing student	10(38.5)	16(61.5)	
Nurse	24(75.0)	8(25.0)	
Resident Anaesthetist	33(94.3)	2(5.7)	
Resident surgeon	24(85.7)	4(14.3)	
Anaesthetist	31(96.9)	1(3.1)	
Surgeon	30(96.8)	1(3.2)	
University hospital			
University College Hospital, Nigeria	33(84.6)	6(15.4)	0.002
Kilimanjaro Christian Medical Centre, Tanzania	28(80.0)	7(20.0)	
Tikur Anbessa Specialized Hospital, Ethiopia	26(57.8)	19(42.2)	
Alexandria Main University Hospital, Egypt	22(59.5)	15(40.5)	
Korlebu Teaching Hospital, Ghana	34(91.9)	3(8.1)	
Inkosi Albert Luthuli Central Hospital, South Africa	25(73.5)	9(26.5)	

Table 3: Knowledge of the WHO safe surgery checklist (N=168).

	Frequencies of Good Knowledge (%)	Frequencies of Poor Knowledge (%)	p-value
Sex			
Male	87(95.6)	4(4.4)	0.229
Female	69(89.6)	8(10.4)	
Training level			
Clinical student	24(92.3)	2(7.7)	1.000
Professional surgical worker	132(93.0)	10(7.0)	
Professional roles in surgical team			
Clinical medical student	16(100.0)	0(0.0)	0.034
Clinical nursing student	8(80.0)	2(20.0)	
Nurse	19(79.2)	5(20.8)	
Resident Anaesthetist	31(94.0)	2(6.0)	
Resident surgeon	22(91.7)	2(8.3)	
Anaesthetist	31(100.0)	0(0.0)	
Surgeon	29(96.7)	1(3.3)	
University hospital			
University College Hospital, Nigeria	30(90.9)	3(9.1)	0.042
Kilimanjaro Christian Medical Centre, Tanzania	26(92.9)	2(7.1)	
Tikur Anbessa Specialized Hospital, Ethiopia	26(100.0)	0(0.0)	
Alexandria Main University Hospital, Egypt	17(77.3)	5(22.7)	
Korlebu Teaching Hospital, Ghana	33(97.1)	1(2.9)	
Inkosi Albert Luthuli Central Hospital, South Africa	24(96.0)	1(4.0)	

The level of knowledge of the 168 respondents who were aware of the WHO safe surgery checklist was further assessed. A total of 156 (93%) respondents had good knowledge, while 12 (7%) demonstrated poor knowledge. Having good knowledge was statistically significant with a professional role in the surgical team and university hospital as shown in Table 3.

Table 4 shows the frequency of the respondents that show the correct response to each of the “Knowledge” questions.

The attitude of the 168 respondents aware of the WHO safe surgery checklist was assessed with a total of 147 (87.5%) respondents having a positive attitude towards the WHO safe surgery checklist while 21 (12.5%) had a negative attitude towards it (Table 5). The frequency of the respondents showing positive attitude to each question is shown in Table 6.

Of the 168 respondents aware of the WHO safe Surgery Checklist, 112 of respondents reported that the WHO safe surgery checklist was the primary

Table 4: Correct responses to questions on knowledge of the WHO safe surgery checklist (N=168)

	Frequencies (n)	Frequencies (%)
The WHO Safe Surgery Checklist exclusively addresses the surgeons?	149	89
The WHO Safe Surgery Checklist is a tool used to attribute errors and adverse events to specific people?	120	71
The WHO Safe Surgery Checklist aims to prevent accidental omissions within routine procedures?	165	98
The WHO Safe Surgery Checklist aims to improve team communication?	166	99
How many safety checkpoints (time points where safety procedures are assessed) does the WHO Safe Surgery Checklist consist of?	121	72
The last safety checkpoint in the WHO Safe Surgery Checklist occurs?	138	82
The WHO Safe Surgery Checklist recommends an antibiotic prophylaxis within 60 minutes before the surgery?	144	86
The WHO Safe Surgery Checklist have to be signed by every member of the team (surgeon, anaesthesiologist, etc.)?	123	73

Table 5: Respondents' attitude towards WHO safe surgery checklist (n=168).

	Frequencies of Positive Attitude (%)	Frequencies of Negative Attitude (%)	p-value
Sex			
Male	82(90.1)	9(9.9)	0.380
Female	65(84.4)	12(15.6)	
Training level			
Clinical student	23(88.5)	3(11.5)	1.000
Professional surgical worker	124(87.3)	18(12.7)	
Professional roles in surgical team			
Clinical medical student	14(87.5)	2(12.5)	0.100
Clinical nursing student	9(90.0)	1(10.0)	
Nurse	21(87.5)	3(12.5)	
Resident Anaesthetist	29(87.9)	4(12.1)	
Resident surgeon	21(87.5)	3(12.5)	
Anaesthetist	26(83.9)	5(16.1)	
Surgeon	27(90.0)	3(10.0)	
University Hospital			
University College Hospital, Nigeria	30(90.9)	3(9.1)	0.002
Kilimanjaro Christian Medical Centre, Tanzania	26(92.9)	2(7.1)	
Tikur Anbessa Specialized Hospital, Ethiopia	23(85.2)	4(14.8)	
Alexandria Main University Hospital, Egypt	13(61.9)	8(38.1)	
Korlebu Teaching Hospital, Ghana	34(100.0)	0(0.0)	
Inkosi Albert Luthuli Central Hospital, South Africa	21(84.0)	4(16.0)	

surgical safety checklist used during surgery as shown in Figure 3.

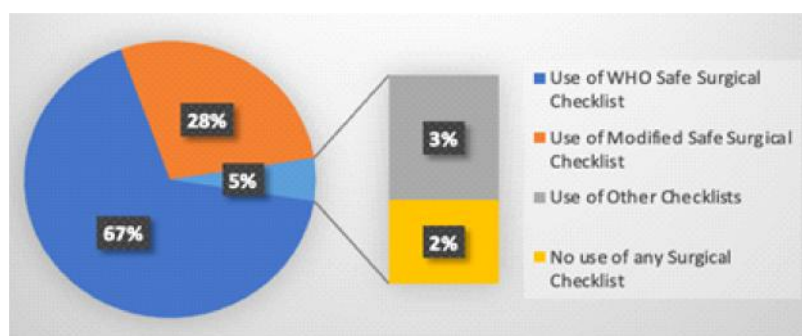
readily available, 92 (82%) said Yes while 20 (18%) said No.

A total of 112 respondents who had stated that the WHO SSC was the primary surgical safety checklist used during surgery were asked if the checklist was

In Table 7 the statistical significance of the availability of the WHO surgical checklist across the sociodemographic variables was assessed. It is shown

Table 6: Positive responses to questions on attitude of the WHO safe surgery checklist (n=168).

	Frequencies (n)	Frequencies (%)
The WHO Safe Surgery Checklist should be used for all procedures in this facility	149	89
The WHO Safe Surgery Checklist seems like an unnecessary checkbox	143	85
The WHO Safe Surgery Checklist improves the efficiency of our operating theatres	154	92
The WHO Safe Surgery Checklist wastes time and causes unnecessary delays	128	76
The WHO Safe Surgery Checklist causes irritation amongst the staff members	105	63
The WHO Safe Surgery Checklist improves communication and collaboration between staff in the operating room	153	91
The WHO Safe Surgery Checklist does not make a difference in improving patient safety	147	88
The WHO Safe Surgery Checklist is easy to use	146	87

**Figure 3:** Surgical checklist used by the respondents.

from the table that the availability of the WHO SSC is statistically significant being available within the university hospital.

A total of 112 respondents who had stated that the WHO SSC was the primary surgical safety checklist used during surgery were asked if the checklist was readily available, 92 (82%) said Yes while 20 (18%) said No.

In Table 7 the statistical significance of the availability of the WHO surgical checklist across the sociodemographic variables was assessed. It is shown

from the table that the availability of the WHO SSC is statistically significant being available within the university hospital.

Figure 4 and Figure 5 shows how often respondents use the WHO surgical checklist and response to making errors that could have been prevented with the use of the Checklist respectively.

Proportion of respondents from each University Hospital/Country's awareness-, having good knowledge- and having a positive attitude towards the WHO safe surgery checklist

Table 7: Assessment of the availability of the WHO safe surgery checklist (n=112).

	Frequencies of Availability (%)	Frequencies of non-Availability (%)	p-value
Sex			
Male	51(82.3)	11(17.7)	1.000
Female	41(82.0)	9(18.0)	
Training level			
Clinical student	15(78.9)	4(21.1)	0.944
Professional surgical worker	77(82.8)	16(17.2)	
Professional roles in surgical team			
Clinical medical student	9(75.0)	3(25.0)	0.178
Clinical nursing student	6(85.7)	1(14.3)	
Nurse	13(92.9)	1(7.1)	
Resident Anesthetist	21(95.5)	1(4.5)	
Resident surgeon	12(92.3)	1(7.7)	
Anesthetist	12(66.7)	6(33.3)	
Surgeon	19(86.4)	3(13.6)	
University hospital			
University College Hospital, Nigeria	17(81.0)	4(19.0)	<0.001
Kilimanjaro Christian Medical Centre, Tanzania	12(92.3)	1(7.7)	
Tikur Anbessa Specialized Hospital, Ethiopia	10(47.6)	11(52.4)	
Alexandria Main University Hospital, Egypt	10(83.3)	2(16.7)	
Korlebu Teaching Hospital, Ghana	33(100.0)	0(0.0)	
Inkosi Albert Luthuli Central Hospital, South Africa	10(83.3)	2(16.7)	

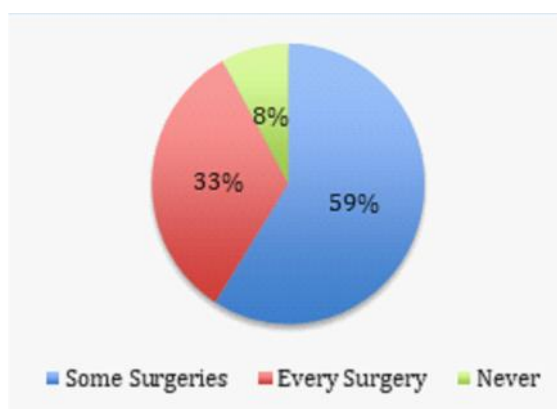


Figure 4: How often they use the WHO surgical checklist (n=112)

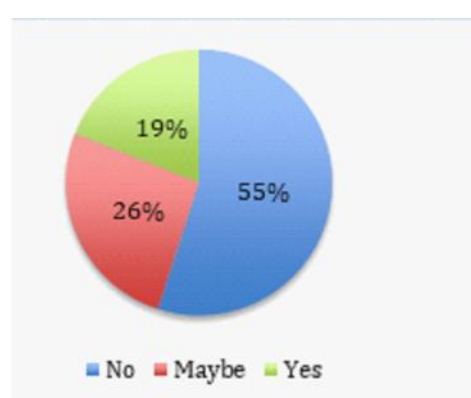


Figure 5: Have you or anyone made any error that could have been prevented with the use of the WHO SSC (n=112).

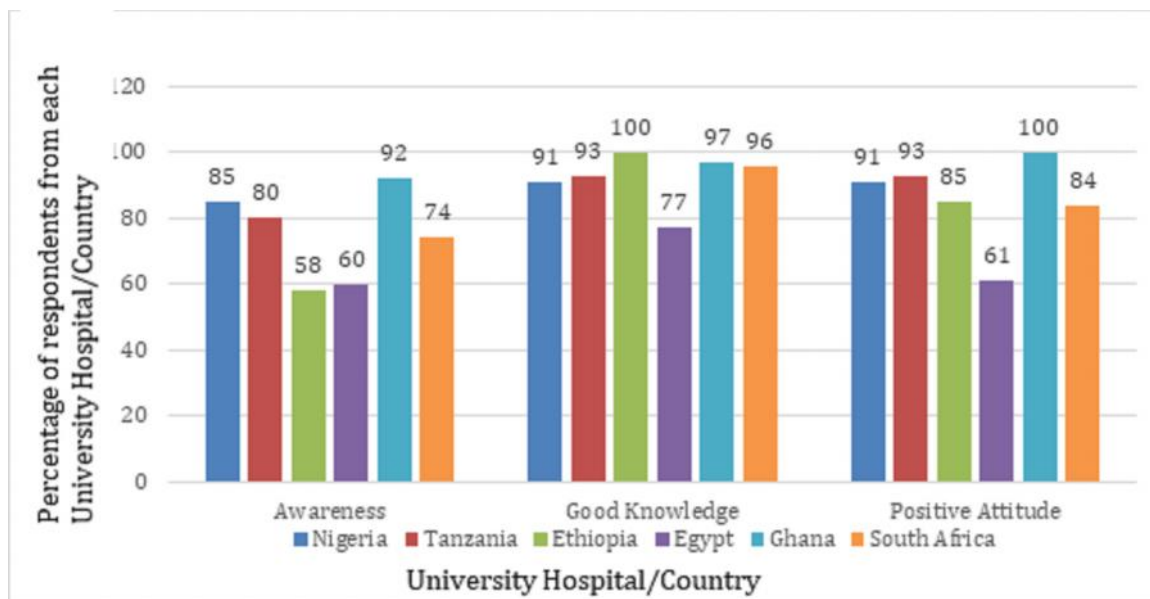


Figure 6: Summarizing the proportion of respondents from each University hospital/country's awareness, having good knowledge- and having a positive attitude towards the WHO safe surgery checklist

DISCUSSION

Our study found high overall awareness and positive attitudes toward the WHO SSC among surgical team members in Africa. The study also found out that awareness and knowledge were significantly associated with professional role and university hospital. Gaps remain among Clinical Medical and Nursing Students, and checklist availability varies widely across regions, highlighting the need for more equitable training and consistent implementation to improve surgical safety outcomes in Africa.

In our study, an impressive 74% of participants showed knowledge of the checklist, compared to only 58% in a similar study conducted among Anaesthetists in referral hospitals in East Africa.¹⁵ In our study 96.7% of the Anaesthetists are aware of the WHO SSC. This could be possibly due to the increase in studies documenting the impact of the Checklist, leading to increasing awareness of the Checklist among many healthcare professionals.

The results show that the professional role in the surgical team was significantly associated with awareness of the WHO SSC. Specifically, Surgeons (96.8%) were more likely to be aware of the WHO SSC compared to Clinical Medical (37.2%) and Nursing Students (38.5%). This suggests that the WHO SSC is more widely used and accepted by those who are more experienced in the surgical setting. This may reflect the importance of the WHO SSC in ensuring patient safety and the role of Anaesthetists and Surgeons in leading the surgical team. It is concerning that a substantial

proportion of Clinical Medical and Nursing Students were unaware of the WHO SSC (62.8% and 61.5% respectively). This suggests that there may be disparities in the teaching and implementation of the WHO SSC across different training levels and professional roles. It is crucial for medical schools to provide training on the WHO SSC to all surgical professionals, regardless of their training level, to ensure that the WHO SSC is used consistently across the surgical team.

The results also indicate that working in a university hospital was significantly associated with awareness and good knowledge of the WHO SSC, meaning that university hospitals might be implementing these international guidelines more often for safe surgical care, possibly due to their research endeavours. In university hospitals, the checklist was also more widely available.

Of the participants aware of the WHO SSC, 93% of participants aware of WHO SSC had good knowledge, while 17% had poor knowledge. Professional roles in the surgical team were statistically significant in determining good or poor knowledge, as shown in Table 3. This finding is consistent with a study by Mascherek AC et al on Swiss professional associations of invasive healthcare professionals, which found that knowledge levels differed significantly between doctors and nurses.¹⁷ Career progression comes with more knowledge and exposure to surgical practices, such as the use of the WHO SSC, which could explain this finding.

The majority (87.5%) of the participants had a positive attitude towards the WHO SSC; this is a reassuring result indicating a progression of the surgical workforce towards the right direction in terms of positive adoption of this tool. Having a positive or negative attitude was statistically significant with the university hospital only ($p < 0.001$) showing how important the University Hospitals are to influencing the attitudes of members of the surgical team to the WHO SCC. Participants responded positively that the WHO SSC should be used for all procedures in their facility (89%) and that the WHO SSC improves the efficiency of operating theaters (92%). Eighty seven percent (87%) of the participants agree that the WHO SSC is easy to use while 91% agree that it improves communication; these findings are similar to a previously published Pakistan-based study (Minhas MS *et al.*)¹⁸

Of the 168 respondents aware of the WHO SCC, 112 (67%) said it was the primary SSC used during surgery. Of these 112 respondents, 82% said it was readily available to them. This was however varied across the University hospitals as only 48% of participants in Ethiopia said the checklist was readily available while 100% of participants in Ghana said it was readily available to them. In a study in East African referral hospitals among Anaesthetists, 57 % reported that it was not generally available for use.¹⁵ This overall shows a great variety in terms of availability of the list, which impacts patient care and team communication.

When asked about the possibility of mistakes being prevented by the use of the WHO SSC, only 45% of our participants said “yes” or “maybe”; this is different from a finding by Vohra *et al.* where 64.3 % felt it prevented mistakes.¹⁹ This shows a concerning gap in the perceived effectiveness of the WHO SSC among our participants, indicating a need for enhanced education and sensitization on how the checklist contributes to preventing surgical errors and improving patient safety.

This study is of particular relevance to the African population given the results from the recent studies on surgical outcome in Africa where maternal deaths are 50-fold higher than high-income regions and where the checklist was only used in just over half of the countries in the study, with a 20% lower mortality in those hospitals.²⁰ In related work the checklist was completed for just over 70% of South African paediatric surgical patients, again with a lower morbidity rate in that part of the study cohort.²¹

CONCLUSION

Our study showed that the awareness of the WHO SSC among members of the surgical team in Africa is high (74%), with the highest awareness observed among anaesthetists and surgeons. However, there is still a knowledge gap regarding the checklist among clinical medical and nursing students, which calls for increased training and education. We also found that university hospitals play a significant role in influencing the adoption and attitudes of members of the surgical team towards the WHO SCC. Overall, the attitudes towards the WHO SCC were positive among the study participants, with most agreeing that the checklist should be used for all procedures in their facility and that it improves communication and efficiency in the operating room. Additionally, the study revealed that despite good knowledge and attitudes towards the WHO SSC, there is still a lack of implementation of the checklist in some hospitals, which suggests the need for further efforts to ensure consistent use of the WHO SSC.

Competing interests

The authors declare no competing interest.

Authors' contributions

DEA contributed to manuscript writing, reviewing, as well as data collection and analysis. MB played a key role in the project, contributing to conceptualizing the idea, manuscript writing and reviewing, data analysis, and corresponding work. ACC assisted with manuscript writing and reviewing. SXM, MAN, DSM, and NEA all contributed to data collection and manuscript writing. OK provided assistance with manuscript writing and reviewing. NP was involved in data analysis and manuscript writing. YS contributed to manuscript reviewing. MIS helped with data collection and manuscript writing. TCH assisted with data collection and obtaining local hospital approval and revising the final manuscript.

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