

# Utilization and Completeness of Surgical Safety Checklist with Associated Factors in Surgical Units of Jimma University Medical Center, Ethiopia

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**Introduction:** Surgical safety checklist is used for every patient undergoing a surgical procedure and is now employed by a majority of surgical providers around the world, but the utilization and completion of surgical safety checklists were low in lower- and middle-income countries.

**Objective:** The objective of this study was to evaluate the utilization and completeness of the surgical safety checklist in surgical units of Jimma University Medical Center, Ethiopia.

**Methods:** Hospital-based prospective cross-sectional study was conducted from October 1 to 30, 2020. A total of 384 surgical cases were included in the study. Checklists were kept as part of each patient's medical record, and consecutive post-operative patient charts were included in the study. The data were collected using the modified version of the WHO checklist constituted of 27 items. The collected data were cleaned, coded, and entered into EpiData version 3.1 and exported to SPSS version 20 for analysis. Binary and multiple logistic regression analyses were computed, and the level of statistical significance was determined at  $p < 0.05$ .

**Results:** The use of a surgical safety checklist was 93.5%. The checklist was completed 17.3% of the time, with sign-in, time-out, and sign-out being completed 83%, 25%, and 35% of the time, respectively. Utilization of the surgical safety checklist was 87.4%, which is lower in elective surgeries (AOR = 0.126 95% CI (0.039–0.414)) compared with the emergency procedure. Once more, the completeness of the safety checklist was 63.3%, which is lower in elective surgery (AOR = 0.367 95% CI (0.208–0.65)) than in emergency procedures.

**Conclusion:** The use of a surgical safety checklist was promising, while the completeness of the checklist was poor that demands further improvement. Time-out was the least completed section of the checklist. Completion of the checklist was high in the first case on the positions of the theatre list.

**Keywords:** surgical safety checklist, compliance, completeness, Ethiopia

## Introduction

Surgery is an essential element of health care with an estimated 313 million surgical procedures performed each year in the world. In 2008, the World Health Organization (WHO) introduced a surgical safety checklist applicable to all surgical teams.<sup>1</sup> The checklist can be implemented in developing countries under different patterns.<sup>2</sup> The correct implementation of the checklist plays a central role in the effectiveness of the checklist.<sup>3</sup> It improves patient safety and protects the operator, but it could not substitute other defensive medical practices.<sup>4</sup> The checklist has pointed out a significant reduction in both morbidity and mortality and is now employed by a majority of surgical providers around the world.<sup>5</sup> The surgical safety checklist has three distinct sections: sign-in, time-out, and sign-out. It is designed to reinforce clinical practice,<sup>6</sup> while the checklist alone is not sufficient to enhance patient safety.<sup>7</sup> Still, the checklists have significantly increased patient satisfaction, benefiting the organization, and reducing adverse events.<sup>8</sup> The initial result of the implementation of the checklist showed a decrease in surgical site infection from 6.25% to 3.4% and a decrease in the death rate from 1.5% to 0.8%.<sup>9</sup> The surgical safety checklist has greater importance in low- and

middle-income countries compared to high-income countries.<sup>10</sup> However, in lower- and middle-income countries the implementation rate of the surgical safety checklist was low due to a lack of infrastructure and resources,<sup>10,11</sup> so implementing surgical safety in low-income countries brought significant improvements.<sup>12</sup> Checklist compliance can be improved through education and enforcement. In Thailand, surgical sites were rarely marked during the sign-in period. Sterility was confirmed by the operating room nurses for every patient. Surgeons, anesthesiologists, and nurses were responsible for the major activities of patient recovery and management.<sup>2</sup> One-center study in Pakistan showed that compliance with the checklist increased from 20.4% to 89.9% within four years with a reduction of surgical site infection by 56.9%, while no near-miss complication with the wrong site as well as no difference in mortality rate. In Romania, none of the checklists were completed fully, with 55% of the average items number under checkup.<sup>13</sup> A study in Brazil showed that utilization of surgical safety checklist and completeness was 61% and 4%, respectively.<sup>14</sup> Another study in Nigeria revealed that the major barriers to utilization of surgical safety checklists were lack of training (58.2%), lack of assertiveness (58.2%), lack of time (34.5%), and requirement for signature (20%).<sup>15</sup> A study conducted in Ethiopia showed that the overall compliance of the checklist was 39.7%, and the completeness rate was 63.4%. Sign-in phase steps were missed by 30.5% and the least performed task was drug allergy assessment (38.4%). The main reasons for the non-compliance with the checklist were lack of training (45.1%) and lack of cooperation among team members.<sup>12</sup> On the other hand, there was much enthusiasm for use of the checklist and appreciation of the benefit gained in using it, whereas the greatest challenges in completing the checklist were communication difficulties between teams and high staff turnover.<sup>16</sup> Therefore, this study aimed to evaluate the utilization and completeness of the surgical safety checklist with associated factors in surgical units of Jimma University Medical Center, Ethiopia.

## Methods

### Study Area and Period

This study was conducted from October 1 to 30, 2020 in Jimma University Medical Center, which is located in Jimma, Southwest Ethiopia 346 kilometers away from the capital Addis Ababa. Currently, it is one of the teaching and referral hospitals in the southwestern part of the country; the hospital is providing services for around 18,000 inpatients and 200,000 outpatient attendees per year out of the catchment population of 15–20 million people. The hospital has been giving surgical care since its establishment in 1930. The Department of Surgery gives services of emergency and elective surgery with 209 beds, 8 major operation rooms, and 6 intensive care unit beds. The average number of surgeries per year at the hospital is about 15,250 cases, in a total of 15 operating rooms, including 12 major surgeries and 2 minor surgeries.

### Study Design and Study Populations

A hospital-based prospective cross-sectional study was conducted to evaluate the utilization of a surgical safety checklist and its associated factors among surgical patients. Selected surgical cases and consecutive post-operative patient charts were considered as study populations.

### Eligibility Criteria

This study included the available records of postoperative surgical cases, excluding minor surgical procedures.

### Sample Size and Sampling Process

A total of 384 surgical cases were included in the study with a 50% prevalence of using the surgical checklist and  $\alpha < 0.05$  at a confidence interval of 95%. A total of 384 surgical cases were included in the study. Checklists were kept as part of each patient's medical record and a convenient sampling technique was used for immediate availability of data to include the total of 384 surgical cases with corresponding post-operative patient records. The patient profiles were identified early and selected patient records were reviewed to reach the total number of post-operative cases as soon as the patient was transferred to the post-anesthesia care unit.

## Data Collection Procedures

The data were collected using the modified version of the WHO checklist constituted of 27 items. Operating room nurses are responsible for documentation of surgical safety checklists at Jimma University Medical Center (JUMC). Necessary data were collected by three clinical nurses who were working in the operating room of JUMC after half-day training was provided. Post-operative patient charts were reviewed immediately after the patient was transferred to the post-anesthesia care unit. State of surgery, surgeon, type of anesthesia, number of surgical staff, specialty, and position on the theatre list data were collected from the patient chart. Position of patients on theatre list was reviewed from daily operation theatre lists.

## Data Quality Assurance

Data were collected by clinical nurses who took a half-day training using a standard checklist through close supervision.

## Data Processing and Analysis

The collected data were cleaned, coded, entered into EpiData software 3.5.1, and exported to SPSS version 20 for analysis. Descriptive statistics like frequency, mean, median, standard deviation and percentage were determined. Bivariate and multivariate logistic regression results were computed statistically significant at  $p < 0.05$ . Finally, the results were reported using graphs and tables.

## Operational Definition

Completeness: the checklist is considered to be completed if the safety range is 80–100%.<sup>4</sup>

## Results

### Utilization of Surgical Safety Checklist

This study showed that a surgical safety checklist was utilized in 359 (93.5%) surgical interventions. Most of the surgical interventions were elective surgeries 252 (70.2%). Senior surgeons 267 (74.4%) used the surgical safety checklist than residents 92 (25.6%) (Table 1).

### Completeness of Safety Checklist

Sixty-two (17.3%) of the checklists were fully complete and the rest were partially complete. The name of the patient, card number, patient diagnosis, and correct consent was the most completed component of the checklist (Figure 1). As per the position on the theatre list, the completeness of the checklist for the first 34 (54.8%), second 23 (37.1%), and third 5 (8.1%) surgical positions was different.

### Factors Affecting Utilization of Surgical Safety Checklist

Bivariate logistic regression analysis was done to see factors associated with the utilization of a surgical safety checklist. Utilization of a surgical safety checklist is 87.4% lower in elective surgeries (AOR=0.126, 95% CI (0.039–0.414)) than in emergency procedures. When the number of staff during surgery was six, utilization of the surgical safety checklist is 95.4% lower (AOR=0.046, 95% CI (0.004–0.547)) (Table 2).

### Factors Affecting the Completeness of Surgical Safety Checklist

Bivariate logistic regression analysis was determined to see factors associated with the completeness of the surgical safety checklist. Thus, the completeness of the checklist was 63.3% lower in elective surgeries (AOR=0.367, 95% CI (0.208–0.65)) than in emergency procedures. Compared to RA the completeness of the checklist is 76.6% lower in SA (AOR=0.234, 95% CI (0.062–0.876)) (Table 3).

**Table I** The Utilization of Surgical Safety Checklist in Jimma University Medical Center, 2020

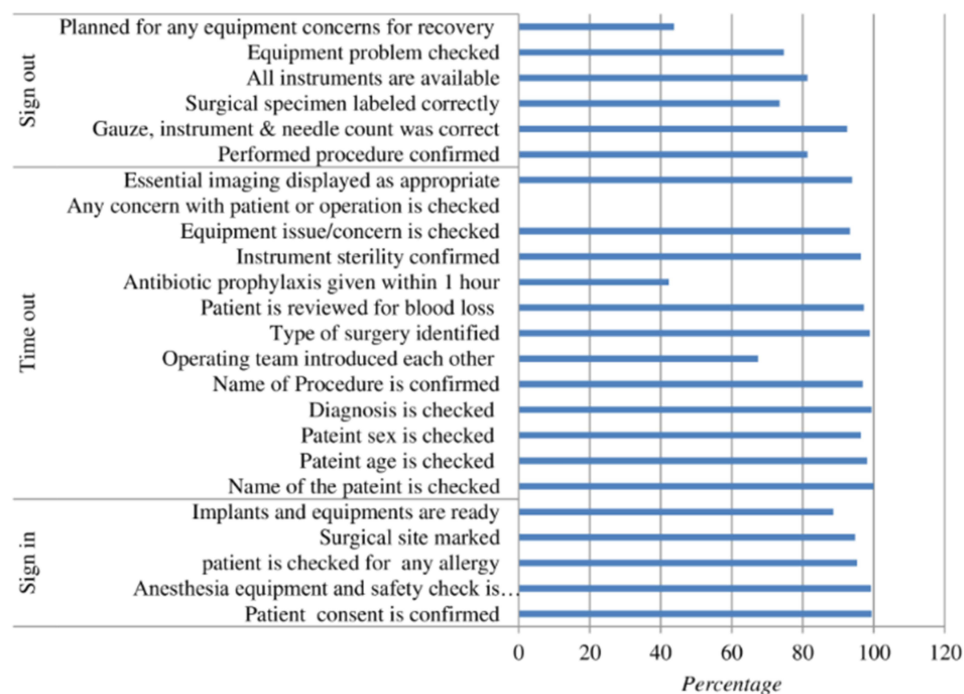
| Variables                    | Category                           | Utilization of Checklist |           |
|------------------------------|------------------------------------|--------------------------|-----------|
|                              |                                    | Yes (n=359)              | No (n=25) |
|                              |                                    | n (%)                    | n (%)     |
| State of surgery             | Elective                           | 252 (70)                 | 7 (28)    |
|                              | Emergency                          | 107 (30)                 | 18 (72)   |
| Type of anesthesia           | GA                                 | 286 (80)                 | 21 (84)   |
|                              | SA                                 | 55 (15.3)                | 4 (16)    |
|                              | RA                                 | 18 (5)                   | –         |
| Number of staff              | Five                               | 185 (52)                 | 22 (88)   |
|                              | Six                                | 157 (44)                 | 1 (4)     |
|                              | Seven                              | 17 (5)                   | 2 (8)     |
| Specialty                    | General surgery                    | 129 (36)                 | 15 (6)    |
|                              | Pediatric surgery                  | 125 (35)                 | –         |
|                              | Orthopedic surgery                 | 68 (19)                  | 8 (32)    |
|                              | Plastic and reconstructive surgery | 37 (10.3)                | 2 (8)     |
| Position on the theatre list | First                              | 152 (42.3)               | 11 (44.4) |
|                              | Second                             | 130 (36.2)               | 11 (44.4) |
|                              | Third                              | 63 (19)                  | 3 (11)    |
|                              | Fourth                             | 10 (3)                   | –         |
| Surgeon                      | Senior                             | 267 (74.4)               | 13 (52)   |
|                              | Resident                           | 92 (26)                  | 12 (48)   |

**Abbreviations:** GA, general anesthesia; SA, spinal anesthesia; RA, regional anesthesia.

## Discussion

Implementing a checklist helps to deliver standardized critical healthcare services which improve communication during handover and prevent medical errors.<sup>17</sup> Accordingly, the surgical safety checklist encourages procedural compliance with basic safety processes which reduces the gap between best practice and actual patient care.<sup>18,19</sup> This is realized through the effective use of the WHO surgical safety checklist. In practice, Jimma University Medical Center introduced WHO surgical safety checklist 10 years back. The current finding indicated that the utilization of a surgical safety checklist was 93.5%, which is higher than a similar study conducted at the University of Gondar that a checklist was utilized in 39.7% of the surgical cases.<sup>12</sup> Another study conducted in Madagascar indicated that 74% of the participants reported a nationwide sustained use of a safety checklist.<sup>20</sup> In essence, there is a need for further improvement<sup>21</sup> to reduce mortality and hospital complications.<sup>22</sup> Although the effective utilization of the surgical safety checklist varies with the type of surgery,<sup>23</sup> it reduces surgical site infections and complications and saves patient's life from avertable mortality.<sup>24,25</sup>

Regarding completeness of the surgical safety checklist, the overall completeness of the checklist was 17.3%, which is much lower than that of the finding from Yekatit 12 hospital at 84%.<sup>26</sup> Time-out was the least completed (25%) section of this checklist which is lower than studies conducted in Felegehiwot hospital at 50%<sup>16</sup> and Brasov's children hospital at 55%.<sup>27</sup> On the other hand, sign-in was the highest completed (83%) component of this checklist and also higher than studies conducted in England at 61%,<sup>28</sup> New Zealand at 69%,<sup>29</sup> the University of Gondar at 63.4%,<sup>12</sup> and Yekatit 12



**Figure 1** Completeness of surgical safety checklist in Jimma University Medical Center, 2020.

hospital (80%),<sup>26</sup> but lower than that of a study conducted in Felegehiwot hospital at 90%. Besides, sign-out was a 35% completed component of this checklist and lower than studies conducted in Felegehiwot (80%) and Yekatit 12 hospitals (79%).

**Table 2** Associated Factors of the Utilization of Surgical Safety in Jimma University Medical Center, 2020

| Variables         | Category    | Utilization |    | COR   | AOR   | 95% CI      | P-value |
|-------------------|-------------|-------------|----|-------|-------|-------------|---------|
|                   |             | Yes         | No |       |       |             |         |
| Type of procedure | Emergency   | 107         | 18 | 0.155 | 0.126 | 0.039–0.414 | 0.001*  |
|                   | Elective    | 252         | 7  | 1     | 1     |             | 1       |
| Number of staff   | Six         | 157         | 1  | 0.054 | 0.046 | 0.004–0.547 | 0.015*  |
|                   | Seven/above | 17          | 2  | 1     | 1     |             |         |

**Note:** \*Variables with a significant association at p-value <0.05.

**Abbreviations:** COR, crude odds ratio; AOR, adjusted odds ratio.

**Table 3** Associated Factors of the Completeness of Surgical Safety Checklist in Jimma University Medical Center, 2020

| Variables          | Category  | Completeness |            | COR   | AOR   | 95% CI      | P-value |
|--------------------|-----------|--------------|------------|-------|-------|-------------|---------|
|                    |           | Complete     | Incomplete |       |       |             |         |
| Type of procedure  | Emergency | 30 (28)      | 77 (72)    | 0.373 | 0.367 | 0.208–0.65  | 0.001*  |
|                    | Elective  | 32 (12.7)    | 220 (87.3) | 1     | 1     |             |         |
| Type of anesthesia | GA        | 50 (17.5)    | 236 (82.5) | 0.424 | 0.367 | 0.128–1.053 | 0.062   |
|                    | SA        | 6 (10.9)     | 49 (89.1)  | 0.245 | 0.234 | 0.062–0.876 | 0.031*  |
|                    | RA        | 6 (33.3)     | 12 (66.7)  | 1     | 1     |             |         |

**Note:** \*Variables with a significant association at p-value <0.05.

**Abbreviations:** COR, crude odds ratio; AOR, adjusted odds ratio; GA, general anesthesia; SA, spinal anesthesia; RA, regional anesthesia.

Completeness of the checklist in elective surgery was 0.63 lower than in emergency surgery might be due to operating room nurses including surgeons focusing on urgent situations than non-urgent cases and it was different among positions on the theatre list. The first case on the theatre list was the highest completed. The completion of the checklist for spinal anesthesia was lower by 0.77 than that of regional anesthesia. This might be caused by communication failures and lack of compliance with the surgical safety checklist that should be understood not as a list of items to be checked off but as an instrument for the improvement of communication, and teamwork and it should be complete.<sup>30</sup> The success of checklists is dependent on compliance with all listed items and an effective rollout strategy. This study identified that the compliance rate was higher than the completeness of the safety checklist, possibly due to some operating room nurses missing some list of checklist items over a certain time. The most poorly checked checklist item was prophylactic antibiotics given like that of the highest incomplete time-out item on the checklist at the University of Gondar hospital.<sup>12</sup> It is also a global challenge that the development of surgical and anesthetic care has been consistently reported as inadequate.<sup>31</sup> It is testified, but the checklist has a growing body of evidence supporting its ability to assist in the delivery of safe anesthesia and surgical care, wide-scale implementation of the checklist has been difficult globally and has significant challenges in lower-income and middle-income countries.<sup>20</sup> The use and completion of a paper surgical safety checklist may not represent actual practice and does not guarantee that the expected steps have been followed in which theatre's team attitude contributes most<sup>32</sup> and facilitated by education of surgeons.<sup>24,33</sup> This study was limited to a checklist review, physical observations deprived of the surgical team, and some potential factors were unnoticed.

## Conclusion

Despite the utilization of the surgical safety checklist being satisfactory, the overall completeness of the surgical safety checklist was poor. The use of a surgical safety checklist was promising, while the completeness of the checklist was poor. Time-out was the least completed section of the checklist. Completion of the checklist was high in the first case on the positions of the theatre list. Completion of the surgical safety checklist was vastly lower in elective surgeries than in emergency procedures. More staff would improve the use of safety checklists, while extra effort is required in elective procedures and regional anesthesia to improve utilization and completeness of the safety checklists. We recommended further study that considers the surgical team and remaining factors that could affect the compliance and completeness of the surgical safety checklist.

## Ethical Consideration

The study was conducted after ethical clearance was obtained from the institution of the Ethical review board of Jimma University. The study was conducted according to the ethical standard criteria set by the Declaration of Helsinki. Both verbal and written informed consent were obtained from the participants before study commencement. Confidentiality of information was respected and only used for this study purpose.

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## Disclosure

The authors declare there is no conflict of interest regarding this article.

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