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Original Article

Compliance of the WHO Surgical Safety Checklist Across Surgical Specialties: A Cross-Sectional Study in a Tertiary Care Hospital

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ABSTRACT

Background: The World Health Organization Surgical Safety Checklist is a standardized perioperative safety tool designed to reduce preventable surgical errors through structured communication and verification. Objective: To assess compliance with the WHO Surgical Safety Checklist across surgical specialties and identify staff-related and organizational predictors of perceived intraoperative outcome improvement. Methods: A descriptive cross-sectional study was conducted among 185 surgical team members working in selected operating rooms of a tertiary care hospital in Lahore, Pakistan. Data were collected using a structured self-administered questionnaire assessing demographics, checklist compliance, confidence, perceptions, barriers, and perceived outcomes. Descriptive statistics, cross-tabulation, chi-square testing, and multiple linear regression were used for analysis. Results: General Surgery was the largest specialty group (22.7%), and surgeons comprised 25.9% of participants. Most participants agreed that the checklist improves patient safety (76.8%), while 80.5% reported that proper use reduces intraoperative errors or near misses. Time Out was the most frequently skipped or rushed phase (33.0%). Confidence was significantly associated with compliance (χ^2=17.42, p=0.0016). Regression analysis showed that SSC compliance score (β=0.45, p<0.001), staff confidence (β=0.32, p=0.004), perception score (β=0.27, p=0.008), years of experience (β=0.18, p=0.026), and organizational support (β=0.22, p=0.029) positively predicted outcome improvement, while workload showed a negative association (β=–0.15, p=0.035). Conclusion: SSC compliance was influenced by staff confidence, perception, experience, organizational support, and workload. Structured training, leadership reinforcement, and workflow optimization are needed to improve checklist adherence. Keywords: Surgical Safety Checklist, WHO Checklist, Compliance, Patient Safety, Operating Room, Intraoperative Outcomes.

INTRODUCTION

Patient safety remains a central indicator of healthcare quality because preventable adverse events continue to contribute substantially to avoidable morbidity, mortality, prolonged hospitalization, and increased healthcare costs in surgical care. Surgery is a high-risk clinical process involving multiple professionals, sequential decision points, anesthesia-related risks, technical procedural demands, and postoperative transition planning; therefore, failures in communication, patient identification, site confirmation, equipment readiness, antibiotic timing, and team coordination may directly compromise patient outcomes. To address these risks, the World Health Organization introduced the Surgical Safety Checklist as part of the Safe Surgery Saves Lives initiative, providing a structured perioperative communication and verification tool intended to standardize essential safety practices before anesthesia induction, before skin incision, and before the patient leaves the operating room (1–4).

The WHO Surgical Safety Checklist is organized into three sequential phases: Sign In, Time Out, and Sign Out. These phases require confirmation of patient identity, procedure, consent, surgical site, anesthesia safety, anticipated critical events, sterility indicators, instrument and sponge counts, specimen labeling, and postoperative recovery plans. Previous studies and systematic reviews have reported that

effective checklist implementation can improve team communication, reduce preventable intraoperative errors, and contribute to better postoperative outcomes, although the magnitude of benefit depends heavily on the quality of implementation rather than checklist availability alone (5–9). Evidence increasingly suggests that superficial, incomplete, or mechanically performed checklist use may limit its safety value, whereas active multidisciplinary participation and institutional reinforcement improve adherence and clinical usefulness (10–12).

Despite global endorsement, compliance with the Surgical Safety Checklist remains inconsistent across hospitals, professional roles, and surgical specialties. Variability may arise from differences in operative urgency, workload, procedure complexity, team hierarchy, leadership support, perceived checklist relevance, staff training, and local safety culture. Emergency-driven and high-turnover specialties may experience greater time pressure, whereas specialties with more predictable operating workflows may demonstrate better checklist integration. These specialty-specific differences are important because each surgical discipline carries distinct risks, communication demands, and procedural pathways; therefore, a single hospital-wide compliance estimate may conceal clinically meaningful gaps in implementation (13–18).

In low- and middle-income tertiary care settings, evidence on specialty-wise compliance with the WHO Surgical Safety Checklist remains limited, particularly where staffing pressures, high patient volume, variable training exposure, and hierarchical team structures may influence checklist completion. Most existing work emphasizes overall checklist adoption, while fewer studies examine how compliance differs across surgical specialties and how staff confidence, perceptions, organizational support, workload, and experience jointly influence perceived intraoperative outcomes. Addressing this gap is essential for designing practical quality-improvement strategies that move beyond simple checklist availability toward consistent, team-based, and specialty-sensitive implementation.

Therefore, this study was conducted to assess compliance with the WHO Surgical Safety Checklist across different surgical specialties in a tertiary care hospital and to evaluate staff perceptions, confidence, barriers, and predictors associated with improved intraoperative safety outcomes. The study specifically sought to determine whether checklist adherence varied across clinical roles and specialty contexts and whether staff confidence, positive perception, experience, organizational support, and workload influenced perceived outcome improvement among surgical team members.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted to assess compliance with the World Health Organization Surgical Safety Checklist among operating room personnel working across selected surgical specialties in a tertiary care teaching hospital. A cross-sectional design was selected because it allowed measurement of current checklist adherence, staff perceptions, implementation barriers, and perceived outcome improvement at a defined point in time without manipulating clinical practice. The study was carried out at Services Hospital, Lahore, Pakistan, over a four-month period in operating rooms serving ENT, General Surgery, Orthopaedics, Plastic Surgery, Neurosurgery, Thoracic Surgery, and Gynecology and Obstetrics departments.

The study population comprised members of surgical teams directly involved in operating room care. Eligible participants included surgeons, anesthetists, scrub nurses, circulating nurses, operating theatre technicians, and other operating room staff who had worked continuously in the selected operating rooms for at least six months. Personnel with less than six months of operating room experience, staff from departments outside the selected surgical units, and individuals who declined informed consent were excluded. Participants were recruited using a convenience sampling technique based on availability during the study period and willingness to participate. Although this sampling method was practical for operating room settings, eligibility criteria were applied consistently across departments to reduce selection inconsistency.

The sample size was calculated using the OpenEpi formula for estimating a single proportion, using an anticipated frequency of implementation barriers of 16%, a 95% confidence level, a 5% margin of error, and a design effect appropriate for the study setting. The final calculated sample size was 185 participants. Recruitment was conducted through face-to-face contact during non-operative hours or scheduled breaks to avoid disruption of patient care. The study purpose, voluntary nature of participation, confidentiality protections, and expected questionnaire completion time were explained to each eligible participant before written informed consent was obtained.

Data were collected using a structured, self-administered Surgical Safety Checklist compliance questionnaire. The questionnaire included items on demographic and professional characteristics, including surgical specialty, role in the surgical team, and years of experience; checklist familiarity and phase-wise compliance; staff confidence in checklist use; perceptions regarding patient safety and delays; team acceptance; perceived barriers to implementation; and observed outcomes or near misses that could have been prevented by proper checklist use. Before full data collection, the questionnaire was pre-tested on a small group of operating room personnel to assess clarity, relevance, and comprehensibility. Completed questionnaires were reviewed at the time of collection to identify missing or incomplete responses and to maintain data completeness.

The main study variables included Surgical Safety Checklist compliance, staff confidence, perception of checklist usefulness, organizational support, workload influence, years of experience, surgical role, specialty, and perceived improvement in intraoperative outcomes. Checklist compliance was assessed across the three WHO checklist phases: Sign In, Time Out, and Sign Out. For analysis, compliance responses were categorized into high, moderate, and low compliance according to reported completion patterns. Staff confidence was classified as very confident, somewhat confident, or not confident. Perception was assessed using responses related to whether the checklist improves patient safety and whether it causes unnecessary delays. Barriers were recorded as multiple-response items, including time constraints, lack of training, staff resistance, lack of leadership support, and other reported barriers. The outcome enhancement index was treated as the dependent outcome in regression analysis, reflecting perceived improvement in intraoperative safety outcomes associated with checklist use.

Several steps were used to minimize bias and improve data integrity. Participants were assured that responses would remain anonymous and would not affect their employment or professional evaluation, reducing social desirability pressure. No personal identifiers, employee numbers, or names were collected. Questionnaires were distributed during breaks or non-operative periods to reduce hurried responses caused by clinical workload. Data were checked for completeness immediately after submission and again during data entry. Because the study relied on self-reported practices, the possibility of recall bias and over-reporting of compliance was recognized; however, standardized questionnaire administration and anonymous response collection were used to limit this risk. Potential confounding variables considered in analysis included years of experience, role in the surgical team, organizational support, workload influence, staff confidence, and perception of checklist usefulness.

Data were entered into Microsoft Excel for preliminary cleaning and coding, then exported to SPSS version 26 and R version 4.3.1 for statistical analysis. Categorical variables were summarized using frequencies and percentages, while continuous or score-based variables were summarized using appropriate descriptive statistics. Cross-tabulations were used to examine relationships between confidence level and compliance category. Multiple linear regression analysis was performed to identify predictors of perceived outcome improvement, with SSC compliance score, staff confidence, perception score, years of experience, surgical role, organizational support, and workload influence included as independent variables. Regression coefficients, standard errors, t-values, 95% confidence intervals, and p-values were reported. Statistical significance was set at $p < 0.05$. Missing or incomplete responses were checked during data cleaning, and analyses were conducted using available complete data for the relevant variables.

Ethical approval was obtained from the Institutional Review Board of the tertiary care hospital before data collection. All participants provided written informed consent after receiving information about study objectives, procedures, voluntary participation, confidentiality, and the right to withdraw at any stage without consequence. The study involved no clinical intervention and posed minimal risk to participants. All completed questionnaires were stored securely and accessed only by the research team. Data were analyzed and reported in aggregate form to preserve participant anonymity and ensure reproducibility, transparency, and confidentiality throughout the research process.

RESULTS

A total of 185 surgical team members were included. General Surgery represented the largest specialty group (n=42, 22.7%), followed by Orthopedics (n=38, 20.5%), OBGYN (n=32, 17.3%), Neurosurgery (n=30, 16.2%), ENT (n=28, 15.1%), and other specialties (n=15, 8.1%). Surgeons comprised 25.9% of participants, followed by scrub nurses (23.8%), circulating nurses (22.2%), anesthetists (20.0%), and other operating room personnel (8.1%). Most participants had 1–5 years of operating room experience (41.6%), while 29.2% had 6–10 years, 17.3% had more than 10 years, and 11.9% had less than one year of experience.

Table 1. Demographic Characteristics of Participants (n=185)

Variable	Category	n	%
Specialty	General Surgery	42	22.7
	Orthopedics	38	20.5
	ENT	28	15.1
	Neurosurgery	30	16.2
	OBGYN	32	17.3
	Other	15	8.1
Role	Surgeon	48	25.9
	Anesthetist	37	20.0
	Scrub Nurse	44	23.8
	Circulating Nurse	41	22.2
	Other	15	8.1
Experience	<1 year	22	11.9
	1–5 years	77	41.6
	6–10 years	54	29.2
	>10 years	32	17.3

Most participants expressed favorable perceptions of the WHO Surgical Safety Checklist. Overall, 142 participants (76.8%) either strongly agreed or agreed that the checklist improves patient safety. Confidence in checklist use was also high, with 72 participants (38.9%) reporting that they were very confident and 92 (49.7%) somewhat confident. However, implementation concerns remained evident: 48 participants (25.9%) believed that the checklist causes unnecessary delays, while 55 (29.7%) reported that delays occur sometimes. The most frequently reported implementation barriers were time constraints (38.9%), lack of training (34.6%), staff resistance (31.4%), and lack of leadership support (23.8%).

Table 2. Attitudes, Confidence, Acceptance, and Barriers Related to WHO SSC Use (n=185)

Variable	Category	n	%
Belief that checklist improves patient safety	Strongly agree	78	42.2
	Agree	64	34.6
	Neutral	26	14.1
	Disagree	12	6.5
	Strongly disagree	5	2.7
Confidence in using checklist	Very confident	72	38.9
	Somewhat confident	92	49.7
	Not confident	21	11.4
Checklist causes unnecessary delays	Yes	48	25.9
	No	82	44.3
	Sometimes	55	29.7
Team acceptance	Fully accepted	60	32.4
	Partially accepted	85	45.9

Variable	Category	n	%
	Poorly accepted	30	16.2
	Not used at all	10	5.4
Barriers*	Time constraints	72	38.9
	Lack of training	64	34.6
	Staff resistance	58	31.4
	Lack of leadership support	44	23.8
	Other barriers	15	8.1

*Multiple responses were allowed.

Regarding perceived outcomes, 149 participants (80.5%) reported that proper SSC use reduces intraoperative errors or near misses. However, 58 participants (31.4%) had witnessed adverse events or near misses that could potentially have been prevented by proper checklist use. The checklist phase most frequently reported as skipped or rushed was Time Out (n=61, 33.0%), followed by Sign In (n=52, 28.1%) and Sign Out (n=48, 25.9%). Only 24 participants (13.0%) reported that no phase was skipped or rushed.

Table 3. SSC Use Outcomes and Frequently Missed Checklist Phases (n=185)

Variable	Category	n	%
Proper SSC use reduces intraoperative errors or near misses	Yes	149	80.5
	No	36	19.5
Witnessed preventable adverse events or near misses	Yes	58	31.4
	No	127	68.6
Phase most often skipped or rushed	Sign In	52	28.1
	Time Out	61	33.0
	Sign Out	48	25.9
	None	24	13.0

A significant association was observed between confidence in checklist use and compliance category (χ^2=17.42, df=4, p=0.0016; Cramer's V=0.217), indicating a small-to-moderate relationship. High compliance was reported by 69.4% of very confident participants and 65.2% of somewhat confident participants, compared with only 23.8% of participants who were not confident. Conversely, low compliance was highest among those who were not confident (28.6%), compared with 11.0% among very confident and 10.9% among somewhat confident participants.

Table 4. Association Between Staff Confidence and SSC Compliance

Confidence Level	High Compliance n (%)	Moderate Compliance n (%)	Low Compliance n (%)	Total	χ^2	p-value	Cramer's V
Very confident	50 (69.4)	18 (19.6)	4 (11.0)	72	17.42	0.0016	0.217
Somewhat confident	60 (65.2)	22 (23.9)	10 (10.9)	92			
Not confident	5 (23.8)	10 (47.6)	6 (28.6)	21			

Multiple linear regression showed that SSC compliance score was the strongest positive predictor of improved outcome index (β=0.45, 95% CI: 0.21–0.69, p<0.001). Staff confidence (β=0.32, 95% CI: 0.10–0.54, p=0.004), positive perception score (β=0.27, 95% CI: 0.07–0.47, p=0.008), years of experience (β=0.18, 95% CI: 0.03–0.33, p=0.026), and organizational support (β=0.22, 95% CI: 0.03–0.41, p=0.029) were also significant positive predictors. Workload influence showed a significant negative association with improved outcomes (β=–0.15, 95% CI: –0.29 to –0.01, p=0.035). Compared with surgeons, circulating nurses showed significantly lower outcome enhancement scores (β=–0.19, 95% CI: –0.36 to –0.02, p=0.038), while anesthetists, scrub nurses, and other personnel did not differ significantly.

Table 5. Multiple Linear Regression Predicting Outcome Enhancement Index (n=185)

Predictor Variable	β Coefficient	SE	t-value	95% CI	p-value
SSC Compliance Score	0.45	0.12	3.75	0.21 to 0.69	<0.001
Staff Confidence	0.32	0.11	2.91	0.10 to 0.54	0.004
Perception Score	0.27	0.10	2.70	0.07 to 0.47	0.008
Years of Experience	0.18	0.08	2.25	0.03 to 0.33	0.026
Role: Anesthetist	0.11	0.09	1.22	–0.06 to 0.28	0.224
Role: Scrub Nurse	–0.14	0.08	–1.75	–0.29 to 0.01	0.083
Role: Circulating Nurse	–0.19	0.09	–2.11	–0.36 to –0.02	0.038
Role: Other	–0.08	0.12	–0.67	–0.31 to 0.15	0.505
Organizational Support Score	0.22	0.10	2.20	0.03 to 0.41	0.029
Workload Influence Score	–0.15	0.07	–2.14	–0.29 to –0.01	0.035

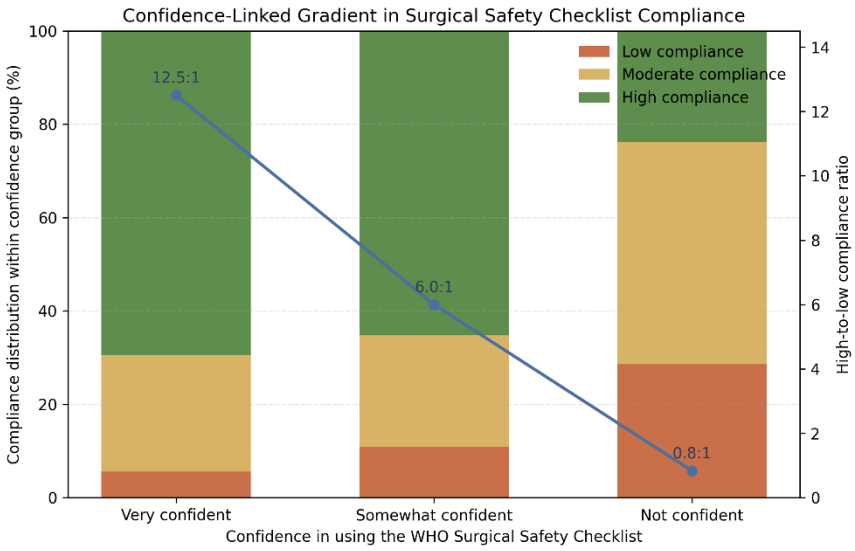

Figure 1 demonstrates a clear confidence-linked compliance gradient. High compliance was present in 69.4% of very confident staff and 65.2% of somewhat confident staff, but dropped sharply to 23.8% among participants who were not confident. The high-to-low compliance ratio decreased from 12.5:1 among very confident participants to 6.0:1 among somewhat confident participants and 0.8:1 among those who were not confident, indicating that low confidence was associated with a marked shift toward moderate and low compliance categories. This association was statistically significant (χ^2=17.42, p=0.0016), supporting staff confidence as an important behavioral factor in consistent SSC implementation.

DISCUSSION

The present study demonstrates that compliance with the WHO Surgical Safety Checklist remains inconsistent across operating room practice, despite generally favorable perceptions among surgical team members. Most participants believed that proper checklist use reduces intraoperative errors or near misses, yet only partial acceptance and variable completion of checklist phases were observed. This finding indicates that positive attitudes alone are insufficient to ensure reliable implementation; instead, checklist effectiveness depends on active team participation, consistent workflow integration, and institutional reinforcement. The finding that Time Out was the most frequently skipped or rushed phase is clinically important because this phase represents the final shared verification before incision and is central to preventing wrong-site surgery, communication failure, equipment omission, and avoidable intraoperative risk.

A key finding was the significant association between staff confidence and checklist compliance. Participants who were very confident or somewhat confident in checklist use reported substantially higher compliance than those who were not confident, and the association was statistically significant. This suggests that checklist adherence is strongly influenced by behavioral readiness and practical familiarity rather than simple awareness. Training programs should therefore move beyond passive instruction and include simulation-based rehearsal, role-specific responsibilities, structured team communication, and periodic competency reinforcement. Similar implementation-focused literature

emphasizes that checklist success depends on team culture, communication, and repeated institutional engagement rather than checklist availability alone (19).

The regression analysis further supports the importance of both human and organizational determinants. SSC compliance score, staff confidence, positive perception, years of experience, and organizational support were significant positive predictors of improved intraoperative outcome index, while workload showed a negative association. These findings suggest that checklist performance improves when staff understand its value, feel competent using it, and work in an environment where leadership supports safety routines. Conversely, workload pressure may reduce checklist fidelity by increasing time constraints, cognitive burden, and task prioritization conflicts. The lower outcome enhancement score among circulating nurses compared with surgeons may reflect role-specific workload, documentation burden, or limited authority in checklist leadership, and this requires targeted institutional attention rather than individual blame.

The reported barriers—time constraints, lack of training, staff resistance, and limited leadership support—are consistent with implementation challenges observed in surgical safety literature. These barriers show that inconsistent SSC use is not merely a compliance failure but a systems-level issue involving workflow design, team hierarchy, operating room culture, and accountability mechanisms. Checklist implementation may be improved through specialty-specific adaptations that preserve the core WHO safety elements while making the process more relevant to different operative contexts. For example, emergency or high-turnover specialties may require brief but mandatory verbal confirmation models, whereas complex specialties may benefit from expanded anticipation of critical events and equipment needs.

This study has practical implications for perioperative quality improvement. First, routine checklist audits should evaluate the quality of verbal engagement, not only whether a checklist box was marked as completed. Second, departments should introduce refresher training for all surgical team roles, especially staff with lower confidence. Third, leadership should assign clear responsibility for initiating and completing each checklist phase. Fourth, workload-related noncompliance should be addressed through workflow redesign rather than expecting staff to perform safety steps under unrealistic time pressure. The study also highlights the need for direct observational audits in future research because self-reported compliance may overestimate actual practice.

This study has limitations. The cross-sectional design prevents causal inference, and convenience sampling may limit generalizability beyond the selected tertiary care hospital. Because data were self-reported, responses may have been affected by recall bias or social desirability bias. The absence of direct observation also limits the ability to distinguish between checklist completion and meaningful checklist engagement. Future multicenter studies should combine questionnaire-based assessment with direct operating room observation, specialty-wise comparative analysis, and outcome-linked clinical audit data to better quantify the effect of checklist fidelity on preventable surgical complications and near misses (20,21).

CONCLUSION

Compliance with the WHO Surgical Safety Checklist among surgical team members was variable, with important gaps in phase-wise completion and team participation despite generally positive perceptions of its value for patient safety. Staff confidence, checklist compliance, positive perception, years of experience, and organizational support were significant positive predictors of perceived intraoperative outcome improvement, whereas workload negatively influenced outcomes. Time constraints, lack of training, staff resistance, and limited leadership support were the main barriers to consistent checklist implementation. Strengthening structured training, leadership accountability, specialty-sensitive workflow integration, and routine audit-feedback mechanisms may improve checklist adherence, reduce preventable intraoperative risks, and promote a stronger culture of surgical safety.

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