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Audit Reports

Audit of Compliance with the WHO Surgical Safety Checklist in the Orthopedic Operating Theatre at Benazir Bhutto Hospital

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Abstract: *The World Health Organization (WHO) Surgical Safety Checklist (SSC) has been shown to reduce peri-operative harm, but its real-world effectiveness is contingent on consistent, high-quality application. Global evidence indicates considerable variability in adherence, with the sign-out phase frequently showing the poorest compliance.* ***Objective:*** *To evaluate baseline SSC compliance in an orthopedic operating theatre, implement a targeted, low-cost intervention, and reassess compliance in a closed-loop audit.* ***Methods:*** *A closed-loop clinical audit was conducted at the Orthopedic Operating Theatre, Benazir Bhutto Hospital, Rawalpindi, Pakistan. In Cycle 1 (December 2024), 30 consecutive orthopedic surgeries were directly observed using a standardized SSC compliance tool. After the baseline assessment, a multifaceted intervention—comprising a department-wide educational session for surgeons, anesthetists, nurses, and residents; placement of laminated SSC posters at each operating table; and senior-staff verbal reinforcement and coaching—was implemented in February 2025. In Cycle 2 (June 2025), 30 new surgeries were observed by the same team using identical methods. Compliance for each SSC phase (sign-in, time-out, sign-out) was categorized as full (all items completed and verbalized), partial, or non-compliant. Descriptive statistics were applied to compare pre- and post-intervention proportions.* ***Results:*** *At baseline, full compliance was 40% for sign-in, 30% for time-out, and 20% for sign-out; overall, 30% of surgeries were fully compliant, 36% partially compliant, and 34% non-compliant. Following the intervention, full compliance increased to 80% (sign-in), 70% (time-out), and 65% (sign-out); overall, 72% of surgeries were fully compliant, 21% partially compliant, and 7% non-compliant. The most notable improvement occurred in the sign-out phase, which rose from 20% to 65% full compliance.* ***Conclusion:*** *A straightforward, low-cost intervention—combining education, visual reminders, and leadership engagement—more than doubled overall SSC full compliance in a high-volume orthopedic theatre within six months. Embedding such strategies into routine practice, alongside continuous monitoring and reinforcement, is likely essential to sustain improvements.*

Keywords: Compliance; orthopedic surgery; patient safety; Pakistan; quality improvement; Surgical Safety Checklist.

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Introduction

Surgical care is integral to modern health systems, yet the operative environment is prone to avoidable errors. Global analyses estimate that complications occur in 3–16 % of operations and that peri-operative mortality ranges from 0.4 % to 0.8 %. Many of these events are preventable. The World Health Organization (WHO) launched the Safe Surgery Saves Lives campaign in 2007. It developed the Surgical Safety Checklist (SSC) to address common problems such as inadequate anaesthetic safety, avoidable surgical infection, and poor communication(1). The checklist standardises critical safety steps and has been promoted worldwide as a mandatory intervention (2). Evidence shows that SSC implementation improves communication within the surgical team, decreases complications, and reduces mortality. However, these benefits depend on full compliance and active participation from the surgical team(1,3).

Despite its proven effectiveness, adherence to the checklist varies widely. Surveys have reported compliance rates ranging from 12 % to 100 %, often lowest for the sign-out phase(3). Factors associated with poor adherence include lack of training, inadequate awareness, workflow interruptions, and absence of supportive leadership (2,3). Educational interventions and multidisciplinary engagement have been shown to improve adherence; for example, a clinical audit at a tertiary hospital in Pakistan reported that an educational session and departmental circulars increased compliance and identified lack of awareness and training as the most common barrier(3).

This closed-loop audit was conducted at the Orthopedic Operating Theatre (OT) of Benazir Bhutto Hospital (BBH) in Rawalpindi, Pakistan, to assess baseline compliance with the WHO SSC, implement a focused intervention, and evaluate changes in adherence six months later. The study followed international reporting standards for quality improvement.

Aims and objectives

1. **Assess baseline compliance** with all three components of the WHO Surgical Safety Checklist (sign-in, time-out, and sign-out) in the orthopedic OT at BBH.
2. **Improve compliance** through a targeted educational and systems-based intervention.
3. **Re-audit** adherence six months after the intervention to measure improvement and identify persistent barriers.

Methodology

Study design and setting

This was a closed-loop clinical audit conducted in the orthopedic OT at Benazir Bhutto Hospital, Rawalpindi. BBH is a tertiary-level teaching hospital affiliated with Rawalpindi Medical University. The audit adhered to the Revised Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) guidelines (3). Ethical approval was obtained from the

hospital's surgical department, and patient confidentiality was maintained.

Timeline and sample

Two audit cycles were performed:

Audit cycle	Period	Activities	Sample
Cycle 1 (baseline)	December 2024	Random audit of 30 orthopedic surgeries to assess compliance with the WHO SSC.	30 surgeries (sign-in, time-out, and sign-out observed)
Intervention	February 2025	Educational session for surgical staff (surgeons, residents, nurses, and anaesthetists), laminated posters of the checklist displayed in each OT, and verbal reinforcement by senior staff.	18 OT staff participated
Cycle 2 (re-audit)	June 2025	Audit of 30 different surgeries using the same tool and observers to measure post-intervention compliance.	30 surgeries

Participants and audit tool

Eighteen OT staff members (consultant surgeons, residents, nurses, and anaesthetists) were involved in the audit. A WHO SSC audit form was used to record whether each of the three phases—sign-in (before induction of anaesthesia), time-out (before skin incision), and sign-out (during or immediately after wound closure)—was fully completed, partially completed, or omitted. Definitions were:

- **Fully compliant:** all checklist items in a phase were performed and verbalised.
- **Partially compliant:** some items were performed, but not all were verbalised or completed.
- **Non-compliant:** the checklist phase was ignored.

Intervention

After the baseline audit, a package of low-cost interventions was implemented. A department-wide session explained the importance of the WHO SSC, and laminated posters were displayed at each OT table to serve as visual prompts. Senior surgeons provided verbal reinforcement and coaching during procedures. These interventions targeted the root causes of poor compliance (lack of awareness and training) identified in other studies (2,3).

Data analysis

Compliance data were summarised as percentages for each component and overall. Improvement was assessed by comparing the proportions of full, partial, and non-compliance between cycles. Bar charts were generated using Python's Matplotlib library to visualise compliance before and after the intervention. No statistical hypothesis testing was performed because the audit aimed to guide local quality improvement rather than infer population-level effects.

Results

Baseline compliance (Cycle 1: December 2024)

Compliance was poor at baseline, particularly for the sign-out phase (Table 1, Figure 1). Only 40 % of cases were fully compliant with the sign-in phase. Time-out had full compliance in 30% of cases, while the sign-out phase was fully completed in just 20% of cases. One third of surgeries showed no adherence to any phase of the checklist, yielding an overall 30 % full compliance, 36 % partial compliance, and 34 % non-compliance.

Post-intervention compliance (Cycle 2: June 2025)

After the educational and systems-based intervention, compliance improved dramatically (Table 1, Figure 2). Full adherence reached 80 % for the sign-in phase, 70 % for the time-out, and 65 % for the sign-out. Overall, 72 % of surgeries were fully compliant, 21 % were partially compliant, and only 7 % were non-compliant. Improvements were observed across all components, with the most pronounced gains in the sign-out phase (from 20% to 65% full compliance).

Table 1 – Compliance with the WHO Surgical Safety Checklist

Checklist component	Cycle 1 – full compliance	Cycle 1 – partial	Cycle 1 – none	Cycle 2 – full compliance	Cycle 2 – partial	Cycle 2 – none
Sign-in	40 % (12/30)	36 %	24 %	80 % (24/30)	17 %	3 %
Time-out	30 % (9/30)	43 %	27 %	70 % (21/30)	23 %	7 %
Sign-out	20 % (6/30)	30 %	50 %	65 % (19/30)	25 %	10 %
Overall	30 %	36 %	34 %	72 %	21 %	7 %

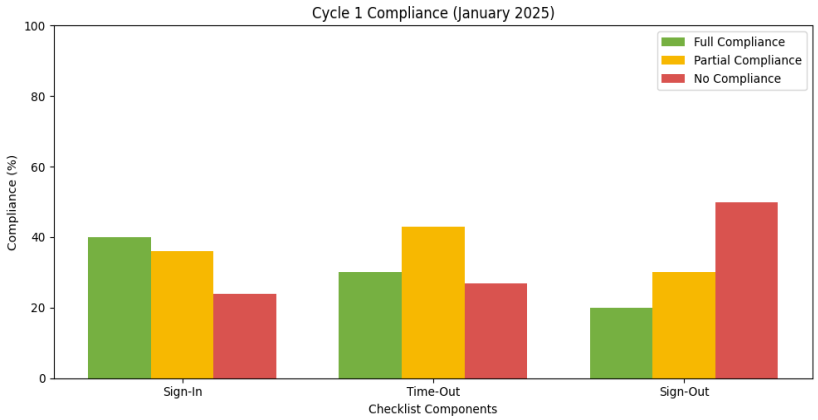

Figure 1: baseline compliance

Figure 1 illustrates baseline compliance. The sign-in phase showed the highest adherence, although less than half of the surgeries were fully compliant. Time-out compliance was lower, and sign-out had the poorest performance, with half of the cases ignoring the phase entirely.Figure 2 displays compliance after the intervention. Each phase exhibited substantial improvement, particularly the sign-out stage. Full compliance exceeded partial or non-compliance in all components.

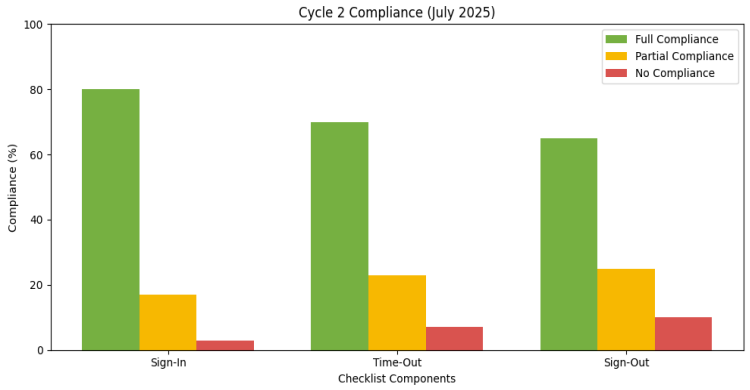

Figure 2: Compliance after the intervention

Figure 3 compares overall compliance categories across cycles. Full compliance increased from 30 % to 72 %, partial compliance decreased from 36 % to 21 %, and non-compliance dropped from 34 % to 7 %.

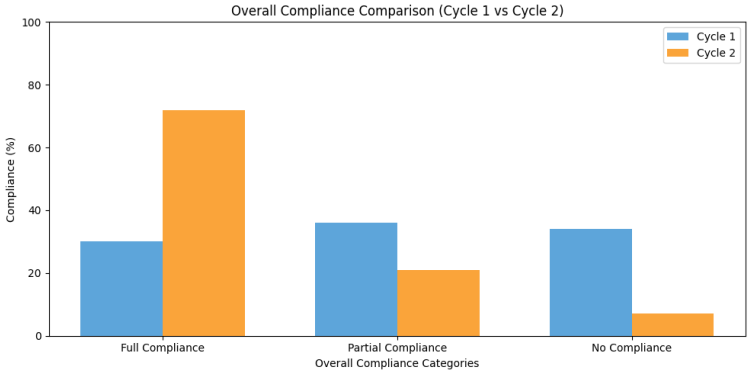

Figure 3: Overall compliance categories across cycles.

Discussion

This audit demonstrates that a simple, multifaceted intervention can substantially improve adherence to the WHO SSC in a busy orthopedic OT. Baseline compliance was consistent with reports from other low- and middle-income settings, where sign-out is often neglected(3). The dominant barriers identified in similar audits—lack of awareness, insufficient training, and workflow interruptions (2)—were also present in our OT. The intervention addressed these barriers by providing education, visual reminders, and leadership support. Consequently, full compliance increased more than twofold, and non-compliance decreased dramatically.

The sign-out phase showed the greatest improvement (from 20% to 65% full compliance), indicating that targeted reminders and senior staff reinforcement can overcome the tendency to skip check-out procedures when attention shifts to the next patient. The improvement aligns with previous reports where sign-out had the greatest relative gain after educatio.

The results mirror findings from other audits and quality improvement initiatives. For example, an audit at the same hospital in 2022 reported that educational sessions and departmental circulars improved compliance, with the highest gains observed in the sign-out step and lack of awareness being the main barrier. A quality improvement project in Ethiopia also noted that successful implementation of the SSC requires active participation, training and supportive supervision. Additionally, research from India concluded that the checklist's benefits—improved communication, reduced complications, and enhanced safety—are realised only when compliance is high (1).

This audit's strengths include its closed-loop design, adherence to SQUIRE 2.0 reporting standards, and inclusion of all key perioperative personnel. By randomising surgeries and blinding staff during data collection, observer bias was minimised. The intervention was low-cost and easily scalable. However, limitations exist: the sample size was modest, limiting the ability to perform inferential statistics; the audit was confined to a single specialty and institution; and the follow-up period was only six months. Further studies with larger samples, longer follow-up, and evaluation of patient outcomes (e.g., complication rates or surgical site infections) are warranted.

Implications for practice

The marked improvement in compliance suggests that education, visual aids, and leadership reinforcement are effective strategies to embed the SSC into routine practice. Hospitals seeking to enhance surgical safety

should prioritise continuous training, maintain visible reminders at the point of care, and integrate the checklist into standard documentation. Notably, team members must be encouraged to speak up during the checklist; active participation is critical (3).

Conclusion

The WHO Surgical Safety Checklist is a proven tool to reduce surgical complications, yet compliance varies widely. At Benazir Bhutto Hospital's orthopedic OT, baseline adherence was suboptimal, with only 30 % full compliance. Following a targeted educational intervention, full compliance increased to 72 %, demonstrating that simple, low-cost measures can dramatically improve checklist utilisation. Sustaining these gains will require ongoing education, supportive supervision, and integration of the checklist into the workflow. The findings reinforce international evidence that checklist compliance, rather than mere adoption, drives improvements in patient safety.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
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Approved
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Conflict of interest

The authors declared the absence of a conflict of interest.

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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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