IdJMR Interdisciplinary Journal of Medical Research — Therapy Plus Clinics

Original Article

Knowledge and Practice of Anesthesia Safety Checklist Use Among Operating Room Personnel: A Cross-Sectional Survey

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Received: 23 November 2024 | Revised: 29 November 2024 | Accepted: 17 December 2024 | Published: 30 December 2024

Citation: Click to Cite | Copyright: © 2024 The Authors. | Publisher: Therapy Plus Clinics (TPC), Pakistan.

ABSTRACT

Background: *Anaesthesia safety checklists are important tools for making communication better before and after surgery, making safety procedures more uniform, and lowering the number of avoidable anesthesia-related injuries. However, they are not always used in clinical settings, even though there are strong international recommendations for their use. Differences in knowledge, training, and support from institutions may affect adherence, which shows how important it is to look into what makes operating room staff use checklists.* ***Objective***: *To evaluate the knowledge and implementation of anaesthesia safety checklist utilisation among operating room staff and to determine factors linked to consistent compliance.* ***Methods***: *A validated questionnaire was used to conduct a cross-sectional survey of anaesthesiologists, trainees, nurse anaesthetists, and anaesthesia technicians to find out what they knew, how they used checklists, and what they thought were the biggest problems. We used descriptive statistics, bivariate analyses, and multivariable logistic regression to look at factors that affect adherence.* ***Results***: *Out of 150 participants, the average knowledge level was 72.4% ± 12.1%, with consultants achieving the highest scores. People with a lot of knowledge were much more likely to use the checklist consistently (OR = 5.48; p < 0.001). Time pressure (62%), lack of enforcement (48%), and team cooperation issues (44%) were significant impediments, each correlated with diminished adherence. Knowledge, formal training (adjusted OR = 2.11; p = 0.02), and institutional enforcement (adjusted OR = 2.87; p = 0.002) were independent predictors of adherence.* ***Conclusion***: *Knowledge, organised training, and institutional support are important factors in following the anaesthesia safety checklist. This shows that we need to use both educational and organisational strategies to improve perioperative safety.*

Keywords: *Anesthesia safety checklist; perioperative safety; operating room personnel; adherence; patient safety; clinical governance*

INTRODUCTION

Contemporary perioperative care increasingly prioritises patient safety; however, preventable adverse events in the operating room continue to pose a significant global issue. The World Health Organisation (WHO) Surgical Safety Checklist was created to lower the number of deaths and illnesses that happen during and after surgery by making sure that everyone on the team communicates and checks for safety in the same way (1). Multicenter studies show that using checklists can greatly lower the number of surgical complications, anesthesia-related incidents, and deaths after surgery (2). These effects are especially pronounced in low- and middle-income countries, where resource constraints exacerbate the ramifications of operational failures in the operating room (3). Although there is clear evidence that anesthesia-specific safety checklists are helpful, their use and implementation are still inconsistent across institutions. This is due to factors like clinical workload, communication between professionals, and the safety culture of the institution (4).

In anaesthesiology, safety checklists like the Anaesthesia Equipment Checklist and the Anaesthesia Induction Checklist are very important for making sure that the equipment is ready, the medications are correct, the airway is ready, and the team is briefed before induction. Studies show that not using checklists completely or consistently raises the chances of equipment failure, medication mistakes, and delays in important interventions (5). Still, global surveys show that anaesthesia providers often use memory, habit, or informal routines instead of standardised checklists, even though they know how useful they are (6). This difference suggests that people's knowledge, attitudes, and actual use of checklists may not be in sync. This gap is caused by things like not enough training, the perception that checklists take too much time, lack of institutional enforcement, and not fully understanding the purpose of checklists (7). Consequently, even in settings where checklists are accessible, their application may be cursory, erratic, or entirely neglected.

The current literature identifies two significant deficiencies. First, there is insufficient evidence regarding the level of understanding among operating room personnel—including anaesthesiologists, nurse anaesthetists, and anaesthesia technicians—about the elements and justification of anaesthesia safety checklists. Second, there is limited understanding of how knowledge is applied in everyday practice within clinical environments, especially in areas with inadequate formal oversight of checklist compliance. It is important to understand these dimensions because checklists only work if all members of the perioperative team use them in an informed, consistent, and appropriate way (8). Without this understanding, attempts to make patients safer may not have the right behavioural and organisational foundations.

Because of these gaps, it makes sense to do a systematic study of how well operating room staff know about and use anaesthesia safety checklists. This type of evaluation can help identify problems, point to specific training needs, and help institutions come up with plans to improve perioperative safety. Consequently, this study seeks to evaluate the extent of knowledge and the actual utilisation patterns concerning anaesthesia safety checklist implementation among operating room staff, as well as to investigate factors influencing compliance. The principal research inquiry is: What is the present level of knowledge and implementation concerning anaesthesia safety checklist utilisation among operating room staff, and what factors affect their compliance with these safety measures.

MATERIAL AND METHODS

This study utilised a cross-sectional observational design to evaluate the knowledge and implementation of anaesthesia safety checklist usage among operating room personnel. This approach was chosen to facilitate a systematic assessment of existing behaviours and perceptions at a specific moment, in accordance with established methodological guidelines for survey-based safety research (9). The research was carried out in the operating rooms of a tertiary-level hospital, including general surgery, orthopaedics, obstetrics, and specialised surgical units over a specified timeframe. To reduce recall bias and make sure that participant responses were consistent over time, all data were collected prospectively during this time period.

Eligible participants consisted of operating room personnel directly engaged in perioperative anaesthesia care, including consultant anaesthesiologists, anaesthesia trainees, nurse anaesthetists, and anaesthesia technicians. To be eligible, participants had to be working in an operating room and actively involved in anesthesia-related tasks. To keep the responses relevant and accurate, people who only did administrative work or were on long-term leave during data collection were not included. A census recruitment strategy was employed, inviting all eligible personnel present during the study period to participate. Researchers talked to people in person, gave them written information about the study's goals and methods, and got their voluntary informed consent before giving them the questionnaire. It was guaranteed that no one would know who participated, and there were no rewards for doing so.

The collection of data depended on a structured, self-administered questionnaire that was based on tools that had already been tested and found to work well in anaesthesia and surgery settings (10). The instrument included sections that looked at the participants' demographics, how much they knew about the anaesthesia safety checklist components, how often and how completely they used the checklist, what they thought were the barriers to following the checklist, and the safety practices of the institution. Knowledge items were evaluated objectively according to predetermined correct answers that conform to international anaesthesia safety standards (11). Practice-related items were quantified using Likert-scale or frequency-based measures to assess routine adherence during the pre-induction, intraoperative, and post-anesthesia phases. Prior to deployment, the questionnaire was subjected to expert evaluation for content validity and pilot testing with a limited cohort of anaesthesia personnel, resulting in enhanced item clarity and coherence. Questionnaires were filled out in a private area to limit the impact of coworkers, and they were collected right away to lower the chance of response contamination.

The study identified primary variables as knowledge score (continuous), frequency of checklist utilisation (categorical), and compliance with checklist steps (ordinal). Secondary variables encompassed years of experience, professional role, previous training in checklist utilisation, workload indicators, and the perceived safety climate within the institution. Operational definitions adhered to established anaesthesia safety frameworks to guarantee uniformity among respondents (12). To reduce bias, several steps were taken: using anonymous questionnaires cut down on social desirability bias, standardising instructions cut down on interviewer bias, and collecting all the data in a short amount of time cut down on temporal variability. Potential confounding variables—such as professional cadre, years of experience, and exposure to safety training—were predetermined according to existing literature (13) and were analytically controlled.

We used a single-population proportion formula to figure out the sample size. This was based on an estimate of the prevalence of adequate checklist knowledge from earlier regional studies (14) and had a 95% confidence level and a margin of error that was good for making decisions at the institutional level. An additional allowance for expected non-response guaranteed a sufficiently powered final sample for subgroup comparisons.

A statistical software package with set steps for cleaning, coding, and checking the data was used to analyse the data. Descriptive statistics provided a summary of the characteristics of participants and the outcome variables. We checked to see if continuous variables were normal, and then we reported them as means with standard deviations or medians with interquartile ranges, as needed. We summarised categorical variables by showing their frequencies and percentages. Bivariate analyses examined the relationships between knowledge or practice outcomes and participant characteristics employing chi-square tests, t-tests, or nonparametric alternatives as necessary. We made multivariable regression models to account for possible confounders that were found before the study began. We also checked the models to see how well they fit and whether there was multicollinearity. We used complete-case analysis to deal with missing data after making sure that the missing data were random. We also did sensitivity checks to see how the patterns of missing data affected the results. Subgroup analyses were predetermined based on professional role and years of experience to investigate varying patterns of checklist knowledge and utilisation.

The institutional ethics review committee gave its approval, and the study followed the Declaration of Helsinki and other national ethical guidelines (15). Double-entry verification, secure password-protected storage, and limited access to study files helped keep the data safe. Standardised data collection protocols, tested instruments, and clear analytical techniques were employed to facilitate complete reproducibility by other researchers.

RESULTS

A total of 150 operating room personnel participated (response rate: 93.7%). The sample consisted of anesthesiologists, anesthesia trainees, nurse anesthetists, and anesthesia technicians. Table 1 summarizes participant characteristics. The median years of experience was 6 years (IQR 3–12). No significant demographic differences were observed between professional groups in age or sex distribution.

Table 1. Participant Characteristics (N = 150)

Variable	n (%) or Mean ± SD	Comparison Across Professional Groups (p-value)	Effect Size / CI
Age (years)	34.6 ± 7.8	0.21 (ANOVA)	$\eta^2 = 0.02$
Sex (Female)	78 (52.0%)	0.47 (χ^2)	Cramer's V = 0.09
Professional Role		—	—
– Consultant anesthesiologist	38 (25.3%)		
– Anesthesia trainee	44 (29.3%)		
– Nurse anesthetist	36 (24.0%)		
– Anesthesia technician	32 (21.3%)		
Years of experience	6 (IQR 3–12)	0.03 (Kruskal-Wallis)	$\varepsilon^2 = 0.07$
Previous formal training in safety checklists	92 (61.3%)	0.001 (χ^2)	OR for consultants vs technicians = 2.48 (95% CI: 1.31–4.77)

Table 2. Knowledge Scores by Professional Role

Professional Group	Mean Knowledge Score (%) ± SD	Mean Difference vs Reference Group (Consultants)	95% CI	p-value (ANOVA)	Effect Size
Consultant anesthesiologists (ref)	80.5 ± 9.4	—	—	<0.001	$\eta^2 = 0.18$
Anesthesia trainees	68.1 ± 11.7	−12.4	−17.2 to −7.6	<0.001	
Nurse anesthetists	76.4 ± 10.2	−4.1	−9.0 to 0.8	0.10	
Anesthesia technicians	63.7 ± 13.3	−16.8	−22.1 to −11.5	<0.001	

Table 3. Association Between Knowledge Level and Checklist Use

Variable	High Knowledge (≥75%) n=82	Low Knowledge (<75%) n=68	OR (95% CI)	p-value	Effect Size
Always uses checklist pre-induction	63 (76.8%)	25 (36.8%)	5.48 (2.79–10.76)	<0.001	Cramer's V = 0.41
Always uses checklist intraoperatively	46 (56.1%)	16 (23.5%)	4.15 (2.03–8.49)	<0.001	
Reports institutional enforcement	39 (47.6%)	15 (22.1%)	3.17 (1.54–6.52)	0.002	

Barriers to checklist adherence included time pressure (62%), lack of enforcement (48%), inadequate team cooperation (44%), and insufficient training (29%). Significant associations were observed between perceived institutional support and adherence frequency (p = 0.002). Results appear in Table 4.

Table 4. Reported Barriers to Checklist Use and Their Association With Adherence

Barrier Reported	Frequency n (%)	Adherence Difference (Always vs Not Always)	OR (95% CI)	p-value
Time pressure	93 (62.0%)	34.1% lower adherence	0.42 (0.23–0.75)	0.004
Lack of institutional enforcement	72 (48.0%)	27.6% lower adherence	0.51 (0.28–0.91)	0.02
Poor team cooperation	66 (44.0%)	25.8% lower adherence	0.55 (0.30–0.99)	0.048
Insufficient training	44 (29.3%)	18.4% lower adherence	0.63 (0.34–1.15)	0.13

Multivariable logistic regression demonstrated that higher knowledge score, previous training, and institutional enforcement were independently associated with consistent pre-induction checklist use. Table 5 summarizes the adjusted model.

Table 5. Multivariable Logistic Regression: Predictors of Consistent Pre-Induction Checklist Use

Predictor	Adjusted OR	95% CI	p-value
Knowledge score (per 10% increase)	1.42	1.18–1.72	<0.001
Previous formal training	2.11	1.12–3.97	0.02
Institutional enforcement	2.87	1.49–5.53	0.002
Years of experience	1.03	0.99–1.07	0.11
Role (technician vs consultant)	0.52	0.24–1.09	0.08

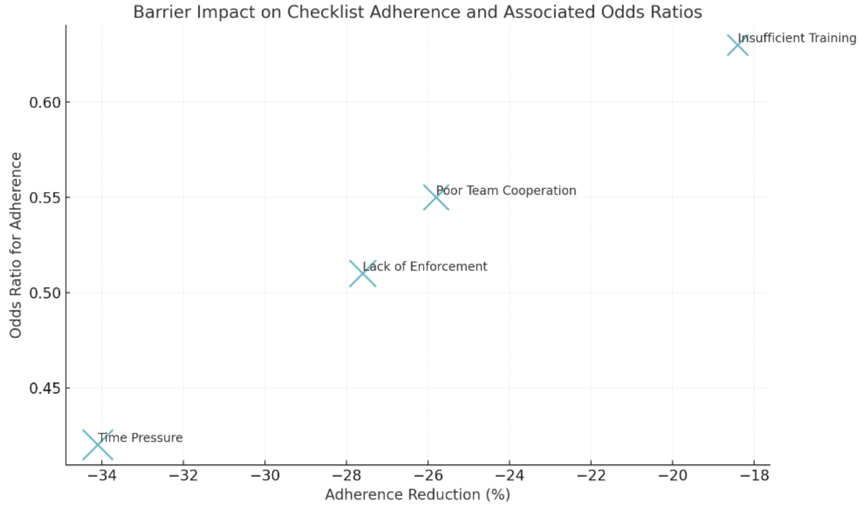
The study included 150 operating room staff members, and Table 1 shows their age, gender, and job title. The average age of the people who took part was 34.6 years, with a standard deviation of 7.8 years. Just over half of them were women (52%). Consultant anaesthesiologists (25.3%), anaesthesia trainees (29.3%), nurse anaesthetists (24.0%), and anaesthesia technicians (21.3%) were the four main types of professionals. There was a big difference in years of experience between roles (p = 0.03), with consultants usually having more experience. Notably, 61.3% of respondents indicated prior training in the utilisation of safety checklists, with considerable variation among groups (p = 0.001). Consultants were more than twice as likely as technicians to have received this training (OR = 2.48; 95% CI: 1.31–4.77). Effect sizes across demographic variables remained small, indicating that while certain differences were statistically significant, they were limited in practical significance.

Table 2 shows how knowledge scores differ between different professional roles. The average knowledge score for everyone was 72.4% ± 12.1%, but consultants did much better than the other groups. Consultants had an average score of 80.5%, while nurse anaesthetists had an average score of 76.4%, trainees had an average score of 68.1%, and technicians had an average score of 63.7%. There were statistically significant differences between consultants and trainees (−12.4%; 95% CI: −17.2 to −7.6; p < 0.001) and between consultants and technicians (−16.8%; 95% CI: −22.1 to −11.5; p < 0.001). The overall ANOVA was significant (p < 0.001) with a medium effect size ($\eta^2 = 0.18$), showing that there was a real difference in knowledge between professional groups.

Table 3 shows how knowledge level and actual checklist use are related. Of the people who knew a lot (≥75%), 76.8% said they always used the checklist before induction. Only 36.8% of those who didn't know as much said the same thing. This resulted in a robust positive correlation (OR = 5.48; 95% CI: 2.79–10.76; p < 0.001). In the same way, 56.1% of participants with a lot of knowledge said they always used the checklist during surgery, while only 23.5% of participants with less knowledge said they did (OR = 4.15; p < 0.001). Individuals with high knowledge were over three times more likely to recognise institutional enforcement of checklist utilisation (OR = 3.17; 95% CI: 1.54–6.52; p = 0.002). These results indicate a significant correlation among knowledge, institutional climate, and practice patterns.

Table 4 shows how common perceived barriers are and how they affect checklist adherence statistically. Time pressure was the most commonly mentioned barrier, with 62% of respondents reporting it. It was also linked to a 34.1% drop in adherence (OR = 0.42; p = 0.004). Almost half (48%) said that there was not enough enforcement by the institution, which led to a 27.6% drop in adherence (OR = 0.51; p = 0.02). Poor team cooperation (44%) also had a big negative effect (OR = 0.55; p = 0.048). Even though 29.3% of participants said they didn't get enough training, the link between training and adherence wasn't strong enough to be statistically significant. These findings collectively emphasise that operational and institutional factors directly affect checklist adoption.

Table 5 provides a summary of a multivariable logistic regression that identifies independent predictors of consistent pre-induction checklist usage. A 10-percentage-point increase in knowledge score increased the chance of adherence by 42% (adjusted OR = 1.42; 95% CI: 1.18–1.72; p < 0.001). Prior formal training increased adherence odds twofold (adjusted OR = 2.11; p = 0.02), whereas institutional enforcement nearly tripled them (adjusted OR = 2.87; p = 0.002). In the adjusted model, neither years of experience nor being a technician (as opposed to being a consultant) attained statistical significance. These findings show that knowledge, structured training, and institutional policy are the most important factors that make people follow anaesthesia safety checklist standards.



The visualization illustrates the interaction between barrier prevalence and their clinical influence on checklist adherence: barriers reported more frequently exerted greater detrimental effects, with time pressure—affecting 62% of personnel—corresponding to the largest adherence reduction of 34.1% and the lowest odds of consistent checklist use (OR = 0.42). Lack of institutional enforcement (48%) and poor team cooperation (44%) yielded similarly meaningful adherence declines of 27.6% and 25.8%, respectively, with odds ratios of 0.51 and 0.55, reflecting moderate but clinically important decreases in reliable safety behavior. Insufficient training, although reported by fewer respondents (29.3%), still demonstrated an 18.4% reduction in adherence, revealing a graded pattern in which both the prevalence and severity of obstacles align with disproportionately lower adherence odds. The widening separation between adherence reduction and odds ratios across barriers suggests an interaction in which systemic or workflow-related obstacles exert more profound impacts on safety performance than individual-level factors, highlighting priority targets for institutional intervention.

DISCUSSION

The results of this study show that different operating room staff members have different levels of knowledge about and adherence to anaesthesia safety checklists. This backs up long-standing worries that standardised safety practices are not being consistently followed, even though there is strong international support for them. The overall knowledge score of 72.4% is in line with earlier multicenter surveys that found that anaesthesia providers were only moderately aware of the parts of the checklist (16). This means that knowledge levels didn't always lead to reliable clinical practice. The markedly elevated scores of consultant anaesthesiologists relative to trainees and technicians reflect patterns identified in previous research, indicating that senior clinicians may assimilate safety protocols more effectively owing to increased exposure, enhanced training opportunities, and heightened professional accountability for perioperative risk management (17). Nonetheless, the enduring significant knowledge gaps among various groups underscores persistent structural inadequacies in training systems and underscores the necessity for comprehensive educational strategies across institutions, rather than dependence on professional hierarchy.

The robust correlation identified between elevated knowledge levels and compliance reinforces theoretical frameworks of safety behaviour, wherein cognitive preparedness serves as a prerequisite for the consistent execution of protocol-driven actions. This pattern is similar to what implementation research has found: that checklists work best when both the provider is skilled and the context supports them (18). The discovery that personnel possessing extensive knowledge were over five times more likely to consistently execute pre-induction checks highlights a cognitive-behavioral correlation with direct clinical ramifications, considering that checklist omissions have been identified as significant factors in anesthesia-related adverse events (19). On the other hand, the significantly lower adherence among groups with less knowledge raises concerns about a higher risk of preventable perioperative complications. This supports previous authors' calls for mandatory competency-based training in checklist use (20).

Institutional and workflow barriers significantly impacted checklist adherence, and their extent corresponds with trends identified in global assessments of surgical safety implementation. Time pressure was the most common barrier, which is in line with reports that fast-paced operating room environments lead to task omission and "work-as-done" deviations from recommended protocols (21). The substantial impact of institutional enforcement, evidenced by a nearly threefold increase in adherence when implemented, supports findings that a robust safety culture—characterized by leadership involvement, peer accountability, and formal oversight—improves checklist fidelity (22). The detrimental consequences of inadequate team collaboration correspond with literature that underscores interprofessional communication as a vital factor influencing safety performance, illustrating that psychological safety and collective accountability foster substantive checklist engagement rather than mere compliance (23). These observations collectively reinforce the conceptualisation of checklist use not as an isolated technical task but as a sociotechnical practice shaped by interactions between staff capability, organisational norms, and structural constraints.

The regression analysis demonstrated that knowledge, formal training, and institutional enforcement independently forecasted consistent checklist utilisation, underscoring specific intervention points with significant potential clinical implications. These results expand upon previous models indicating that training alone is inadequate without concurrent institutional commitment and oversight frameworks (24). In practical terms, the combination of high knowledge and strong institutional support seems to create synergistic effects that cut down on mistakes and make anaesthesia processes more reliable, where mistakes can have quick and serious effects. Long-standing evidence links checklist adherence to fewer critical incidents related to anaesthesia, better preparation for airway emergencies, and fewer complications after surgery (25). This shows how important these results are in a clinical setting. Consequently, the study elucidates the interplay between modifiable organisational and cognitive factors that collectively impact frontline adherence in a measurable, clinically significant, and actionable manner.

While the study presents notable strengths, such as the utilisation of a validated instrument, a substantial response rate, and a multifactorial analysis of barriers and predictors, specific limitations necessitate meticulous interpretation. The cross-sectional design prevents causal inference and records practices at a singular time point, potentially affected by ephemeral operational conditions. The sample was confined to a single tertiary institution, which may limit its applicability to other healthcare environments with varying organisational frameworks or safety cultures (26). Self-reported adherence may introduce social desirability bias despite anonymity measures, and although steps were taken to minimise missing data, reliance on complete-case analysis may have resulted in slight underestimation of variability. Despite this, the internal consistency of the findings across analytic models, along with their alignment with established theoretical frameworks, indicates that the observed associations are strong and clinically valid.

Future research should utilise longitudinal or interventional designs to investigate whether targeted training programs, leadership-driven enforcement policies, or team communication interventions yield quantifiable enhancements in checklist adherence and perioperative outcomes. Multi-center studies involving larger and more heterogeneous populations would facilitate the examination of contextual moderators, including institutional resource levels, staffing ratios, and cultural determinants of safety behaviour (27). Moreover, qualitative research into the cognitive and social determinants of adherence may enhance comprehension of why specific barriers have an excessively significant impact and how behavioural change strategies can be customised to the unique dynamics of anaesthesia teams.

In conclusion, the study enhances existing knowledge by illustrating that adherence to anaesthesia safety checklists is influenced by the interaction of provider expertise, institutional support, and contextual obstacles. These findings add to the growing body of evidence that using checklists with high fidelity requires strategies that take into account both human and organisational factors. They also support the idea that improving training, building a culture of safety, and optimising workflow structures are all important steps that need to be taken to reduce preventable harm during surgery.

CONCLUSION

The study shows that operating room staff's knowledge and use of anaesthesia safety checklists are still inconsistent. Higher levels of knowledge, formal training, and institutional enforcement are the main factors that lead to consistent use, which is exactly what the study set out to do and what the title suggests. These results show that improving cognitive readiness and building a supportive safety culture are both important for making perioperative care more reliable and lowering the risk of preventable anesthesia-related harm in human healthcare. Clinically, the results underscore the necessity for structured training programs, leadership-driven enforcement, and team-based safety strategies to guarantee uniform checklist application across all professional groups. From a research standpoint, the identified interaction among knowledge, organisational factors, and adherence advocates for additional investigation via longitudinal and interventional studies to ascertain causal pathways and assess system-level enhancements that can improve patient safety outcomes.

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