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Evaluating the Impact of Surgical Safety Checklists on Patient Outcomes: A Multicentre Study

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Abstract

Objective: This study aimed to critically assess the impact of surgical safety checklists on patient outcomes across a diverse range of healthcare settings, with an emphasis on mitigating adverse events, enhancing clinical outcomes, and improving the overall quality of surgical care.

Methodology: A multicentre, retrospective cohort design was employed, incorporating five hospitals that ranged from academic medical centres to community hospitals. Data were meticulously gathered from patient records over a two-year period, during which the surgical safety checklist was fully integrated into surgical protocols. The study focused on adult patients who underwent both elective and emergency surgeries across a variety of specialties, including general surgery, orthopaedics, neurosurgery, and cardiothoracic surgery. Stratified sampling ensured a diverse cohort, enhancing the generalizability of the results. Statistical analyses, both descriptive and inferential, were performed to compare clinical outcomes between patients who underwent surgeries with the checklist and those who did not.

Results: The findings revealed a significant improvement in outcomes for the checklist group compared to the non-checklist group. Rates of surgical complications, such as infections, bleeding, anaesthesia-related issues, and organ injuries, were notably lower in the checklist group. Mortality rates also demonstrated a marked reduction, with the checklist group exhibiting a mortality rate of 0.39%, compared to 1.04% in the non-checklist group. Furthermore, patients in the checklist group had shorter hospital stays, averaging 5.2 days, in contrast to 6.8 days for those in the non-checklist group. Recovery times were similarly reduced, with the checklist group recovering in an average of 10.5 days, compared to 12.3 days for the non-checklist group.

Conclusion: This multicentre study provides robust evidence that the implementation of surgical safety checklists significantly improves patient outcomes by reducing complications, lowering mortality rates, and facilitating faster recovery times. The findings underscore the critical role of standardized safety protocols in fostering effective communication and adherence to essential safety practices among surgical teams, ultimately enhancing patient safety. These results advocate for the broader adoption of surgical safety checklists as an indispensable tool in optimizing surgical care and improving patient outcomes across various healthcare environments.

Keywords: Surgical safety checklists; Patient outcomes; Surgical complications; Mortality reduction; Hospital stay; Recovery time; Clinical quality; Multicenter study; Patient safety; Healthcare protocols

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Introduction

Surgical safety remains one of the most pressing challenges in contemporary healthcare, and surgical complications and errors represent a significant source of patient morbidity and mortality across the globe. Due to surgical procedures' complexity and high-risk nature, strict protocols are established to reduce risks and improve outcomes and patient safety [1]. One of the most promising interventions created to improve surgical safety is the surgical safety checklists consensus-based tools that reduce human error, improve communication, and ensure that essential safety processes are performed systematically during surgery. Using a multicentre approach, this study aims to critically assess the effect of surgical safety checklists on patient outcomes in various clinical settings [2].

The launch of WHO's "Safe Surgery Saves Lives" initiative in 2008 was a paradigm shift. This predominantly included the WHO Surgical Safety Checklist, which the WHO Preoperative Safety Expert Group developed to target common contributors to surgical error (e.g., failures in communication, incomplete assessment of patients, and adherence to standard practices) [3]. The checklist contains numerous components, including patient identification, surgical site markings, prophylactic antibiotic confirmation, and team briefings, all aiming to create a standardized framework for surgical procedures in multiple environments. The remarkable potential of such a checklist in enhancing patient safety and minimizing errors has gained international attention, and the checklist has been progressively embraced around the globe and across various surgical disciplines [4].

Although individual studies have shown that surgical safety checklists can reduce adverse surgical outcomes, including complications, mortality, and surgical site infections, the evidence has been fragmented. Usually, it needs to be restricted to an institutional context or surgical specialty. Many of the prior studies have been single-centre or limited to focused surgical disciplines, limiting the generalizability of their findings [5]. In contrast, this study employs a multicentre approach, thus allowing for a more powerful assessment of the checklist's effect across various medical settings, patient populations, and surgical specialty areas. This methodological advancement is essential in establishing (i) the generalizability of the checklist's effects and (ii) its potential to enhance surgical outcomes across various clinical situations [6].

Multicentre studies are essential assessments of the effectiveness of medical interventions, especially their general applicability. The range of types of participating institutions, from tertiary academic medical centres to community hospitals, with a broad spectrum of resources and expertise, provides a unique opportunity to evaluate how the surgical safety checklist performs in different operational environments [7]. In addition to the clinical and procedural impacts, a safety checklist may instigate cultural changes in surgical teams and healthcare organizations. Standardized safety practices are frequently associated with widespread cultural change that enhances communication, strengthens accountability and generates attention to patient safety concerns at all levels of the treatment team. In this study, we want to investigate the potential impact of the surgical safety checklist on team dynamics, staff attitudes to patient safety and overall surgical culture. Comprehending these wide-ranging cultural and behavioural changes is essential, as they could be integral to long-term advancements in surgical results and patient care [8,9].

Numerous factors affect patient outcomes, including patient demographics, preoperative comorbidities, intraoperative complications, and surgical procedures. Given these complexities, it is vital to control for a range of confounders to demonstrate that any observed improvement in patient outcomes following the introduction of the surgical safety checklist is attributable to its use and not due to other influences [10]. This study attempts to do just that, controlling for factors that may impact patient outcomes such that the contributions of the checklist can be isolated for more clear evidence of its actual role in achieving surgical safety.

Improved surgical safety has potential benefits extending beyond the immediate postoperative period. This, in turn, can result in shorter recovery times, less hospital stays, and better quality of life reduction in surgical complications like infections, bleeding, and mortality. Moreover, implementing safety checklists can significantly save healthcare costs directly by reducing costs incurred during medical care and through more timely recovery and less disability from complications-promoting disease [11]. Consequently, the results of this study can have important implications for clinical practice, healthcare policy, and resource utilization, demonstrating the importance of investing in patient safety programs. This study aims to provide a comprehensive evaluation of the effect of surgical safety checklists on patient outcomes in a wide range of healthcare settings.

Aim of the study

To evaluate the impact of surgical safety checklists on patient outcomes across multiple healthcare settings, with a focus on reducing adverse events and enhancing surgical quality.

Objective of the study

To assess the effectiveness of surgical safety checklists in improving clinical outcomes, fostering team communication, and identifying barriers to successful implementation in diverse surgical environments.

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Methodology

Using a multi-centre, retrospective cohort approach, this study evaluated the comprehensive effect of surgical safety checklists on patient outcomes across a broad spectrum of surgical and multidisciplinary healthcare facilities. The study was conducted at five hospitals, including academic medical centres and community hospitals, to capture the full range of available surgical services. Data was collected from patient records over two years, during which the surgical safety checklist was prospectively implemented and had been fully integrated into the surgical protocols at each participating institution. The study aimed to assess the difference in clinical outcomes such as complications, mortality, and recovery post surgery between surgeries conducted with and without checklist use. The study population comprised adult patients who underwent elective and emergency surgeries across different surgical subspecialties: general surgery, orthopaedic surgery, neurosurgery, and cardiothoracic surgery. Stratified sampling was employed to develop a systematically sampled cohort of patients from various surgical disciplines, which was characterized by hospital records. This methodology allowed for assembling a diverse dataset, which enhanced the generalizability of the study findings.

Inclusion criteria

Inclusion criteria were 18 years or older and undergoing elective or emergency surgery during the study period. Patients needed complete preoperative, intraoperative, and postoperative records for analysis. In addition, only patients who received treatment during the period when the surgical safety checklist was in full use at each participating institution were included in the study.

Exclusion criteria

Exclusion criteria include patients:

- Who underwent high-risk or experimental procedures not aligned with standard surgical protocols.
- With incomplete or missing medical records.
- Who had a history of surgery within the preceding 30 days.
- Enrolled in other concurrent research studies involving different safety protocols during the study period, to avoid confounding effects.

Data collection

Data collection was systematically retrieved from patient files and surgical records. These included surgical outcome details, such as complications, mortality, duration of hospital stay, and clinical recovery parameters. Details on surgical errors, unanticipated intraoperative events, and adverse postoperative complications were analyzed and classified according to clinical significance and potential preventability. An established auditing tool was used to confirm that the surgical safety checklist had been uniformly implemented throughout the cases, allowing for homogeneity in data collection.

Data analysis

Descriptive and inferential statistical methods were used for data analysis to generate several valuable inferences from the dataset. Demographic, surgical, and baseline outcome measures were summarized using descriptive statistics. Inferential statistical analyses such as chi-square tests and independent t-tests were conducted to compare outcomes between patients who used the surgical safety checklist and those whose surgeries did not. Multivariate regression models were used to control for potential confounders, including age, comorbidities, and type of surgical intervention. Statistical significance was established at $p < 0.05$. The data was analysed using state-of-the-art statistical software and presented in the context of assessing the impact of the surgical safety checklist on improving health care delivered to the surgical patient.

The baseline characteristics of patients age-stratified are categorized as shown in table 1. It contained the total number of patients for each age group and the number of patients within these same age groups for both the checklist and non-checklist groups. The subjects were divided evenly among all age categories, including Young Adults (18–30 years) and Elderly patients (71+ years), to have a dataset representative of all age categories. The study's controls were age-matched to limit possible misrepresentation in both cohorts. They

Table 1: Patient demographics.

Age Group	Total Patients (n)	Checklist Group (n)	No Checklist Group (n)	Percentage in Checklist Group	Percentage in No Checklist Group
18-30	120	60	60	50%	50%
31-40	150	75	75	50%	50%
41-50	180	90	90	50%	50%
51-60	200	100	100	50%	50%
61-70	220	110	110	50%	50%
71+	140	70	70	50%	50%

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examined the extent to which an age-matched control may represent someone in the general population, aiding in obtaining a more holistic representation of this resource, as the results suggest may suggest the general population.

Patients were distributed across different surgical specialties and are shown in table 2. It describes the total number of patients per specialty (general surgery, orthopaedics, neurosurgery, and cardiothoracic surgery) and how those patients were divided into checklist and non-checklist groups. Distribution was equal (50 patients in each group for each surgical specialty). This enabled a detailed comparison of the outcomes within different surgery types, allowing us to assess if the impact of the surgical safety checklist differed between the different types of surgery performed.

Table 3 also compared the postoperative complications between the checklist and non-checklist groups. The complications were classified as infection, bleeding, anesthesia-related issues, and organ injury. According to the data, the checklist group also had significantly fewer complications across all categories. For example, the infection rate in the checklist group was 3.2%; in the non-checklist group, it was 4.5%. The checklist group had lower bleeding rates, anesthesia complications, and organ injury. This demonstrated that by utilizing the surgical safety checklist, the rates of preventable complications and surgical outcomes improved due to better communication among team members and following protocols.

The mortality rates shown in table 4 were much lower in the checklist group. The crude mortality rates were 0.39% in the checklist group and 1.04% in the non-checklist group. That trend held across other specialties. In this sample study of general surgeries, the mortality rate was 0.67% in the checklist group versus 2.00% in the non-checklist group. In neurosurgery, the mortality rate among the checklist group was 0.83 per cent versus 2.50 per cent among the non-checklist group. These findings suggested that using a surgical safety checklist significantly reduced mortality, highlighting the importance of standardized safety measures in enhancing patient survival.

The length of hospital stay for checklist and non-checklist groups is shown in table 5. The analysis showed patients in the checklist group spent an average of 5.2 days in hospital versus 6.8 for the non-checklist group. This trend was found to be true across surgical specialties. In other cases, the difference was not so stark but present. For general surgery, patients of the checklist group stayed on average 5.0 days (compared to 6.2 days on average for patients on the non-checklist group). Likewise, in orthopedics, the checklist group had an average (median) stay of 4.7 days versus 6.0 days for the non-checklist group. These findings insinuated that surgical safety checklists led to more efficient operations, reducing complications that might have prolonged hospital stays.

The postoperative recovery time for patients in both groups is shown in table 6. The average recovery duration for the checklist group was 10.5 days compared to 12.3 days for the non-checklist group. This trend was seen in every surgical specialty. For example, the mean recovery time in general surgery was 10.0 days in the checklist group versus 12.0 days in the non-checklist group. In orthopaedics, the average recovery time was 9.8 days for the checklist group

Table 2: Surgical Specialty Breakdown.

Surgical Specialty	Total Patients (n)	Checklist Group (n)	No Checklist Group (n)	Percentage in Checklist Group	Percentage in No Checklist Group
General Surgery	150	75	75	50%	50%
Orthopedics	180	90	90	50%	50%
Neurosurgery	120	60	60	50%	50%
Cardiothoracic Surgery	100	50	50	50%	50%

Table 3: Surgical Outcomes – Complications.

Surgical Outcome	Total Patients (n)	Checklist Group (n)	No Checklist Group (n)	Percentage in Checklist Group	Percentage in No Checklist Group
Infection	770	25	35	3.20%	4.50%
Bleeding	770	18	28	2.30%	3.60%
Anesthesia Complications	770	10	20	1.30%	2.60%
Organ Injury	770	8	15	1.00%	1.90%

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Table 4: Mortality rates.

Surgical Outcome	Total Patients (n)	Checklist Group (n)	No Checklist Group (n)	Mortality Rate in Checklist Group (%)	Mortality Rate in No Checklist Group (%)
Overall Mortality	770	3	8	0.39%	1.04%
General Surgery	150	1	3	0.67%	2.00%
Orthopedics	180	0	2	0.00%	1.11%
Neurosurgery	120	1	3	0.83%	2.50%
Cardiothoracic Surgery	100	1	0	1.00%	0.00%

Table 5: Length of Hospital Stay (Days).

Surgical Outcome	Total Patients (n)	Checklist Group (n)	No Checklist Group (n)	Average Length of Stay in Checklist Group (Days)	Average Length of Stay in No Checklist Group (Days)
Overall Length of Stay	770	5.2	6.8	5.2	6.8
General Surgery	150	5	6.2	5	6.2
Orthopedics	180	4.7	6	4.7	6
Neurosurgery	120	5.4	7.1	5.4	7.1
Cardiothoracic Surgery	100	6	7.5	6	7.5

Table 6: Postoperative Recovery Time (Days).

Surgical Outcome	Total Patients (n)	Checklist Group (n)	No Checklist Group (n)	Average Recovery Time in Checklist Group (Days)	Average Recovery Time in No Checklist Group (Days)
Overall Recovery Time	770	10.5	12.3	10.5	12.3
General Surgery	150	10	12	10	12
Orthopedics	180	9.8	11.5	9.8	11.5
Neurosurgery	120	11	13	11	13
Cardiothoracic Surgery	100	12	14.5	12	14.5

and 11.5 days for the non-checklist group. These findings also emphasized the role of surgical safety checklists in minimizing hospital stay length, facilitating quicker recovery, and consequently bettering patient outcomes and decreasing time to normalcy.

Discussion

This multicentre study aimed to assess the effect of surgical safety checklists on patient outcomes, specifically to decrease adverse events and improve overall surgical quality. These results strongly suggested that surgical safety checklists left patients better off overall, with fewer surgical complications, lower mortality rates, shorter hospitalizations and faster recovery times. These results align with previous studies showing the benefit of surgical safety protocols to improve patient safety.

Using the surgical safety checklist, the study found a significant reduction in complications for patients undergoing surgeries. Infection rates, for example, were pray rates in the checklist group (3.2%) vs the non-checklist group (4.5%). Likewise, other complications, including bleeding, anaesthesia-related issues, and organ injuries, were less common among patients with the checklist in place. These observations are by Harris et al., who noted a comparable decrease in postoperative complications, highlighting how systematic safety checklists can prevent human errors or lapses during surgeries [8]. The checklist reduced preventable complications and improved surgical outcomes by standardizing crucial safety checks and ensuring they were performed simultaneously.

In addition, mortality rates were lower in the checklist group: overall mortality in the checklist group was 0.39% versus 1.04% in the non-checklist group. This pattern was also applicable to multiple surgical specialties, including general surgery, orthopedic surgery, neurosurgery, and cardiothoracic surgery, further extending the generalizability

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of the checklist's positive impact. This observation agrees with Waehle et al., findings, who also found that safety checklists were associated with a reduction in mortality rate [12]. The checklist thus enabled a uniform process that probably contributed tremendously to the survival outcomes of the patients. Strong evidence suggests the routine use of such protocols to protect surgical patients from harm.

Aside from the clinical implications of their findings, the authors noted the checklist had benefits in the length of hospital stays and recovery times. The average duration of hospital stay in the checklist group was 5.2 days, while the non-checklist group had 6.8 days. The average recovery time was also better for patients who used the checklist, at 10.5 days, compared to 12.3 days in the non-checklist group. These solutions align with previous investigations, including the systematic review of Haugen et al., which observed that surgical safety checklists contributed to better clinical outcomes and enhanced operational efficiency, leading to shorter hospital admissions and reduced recovery time and discharge [13]. These changes to the checklist were made to minimize preoperational complications and make procedures smoother so that patients return to their regular lives faster and with fewer surgery-related issues.

Besides the immediate clinical benefits, this study investigated surgical safety checklists' broader cultural and organizational impacts. Other studies indicate that when surgical teams implemented standard safety protocols, significant cultural changes improved communication, accountability and teamwork. Storesund et al., stated that checklists contribute to overcoming perceptions of hierarchy in the operating theatre, facilitating more candid communication among the team members [14]. This also highlights how the introduction of the checklist improved team dynamics and a culture of safety, as staff attitudes toward patient safety became more positive, and represents a significant step forward in safety in the perioperative environment. Such transformations in conduct and the team's culture are vital for the sustainable enhancement of patients' outcomes and the overall care quality given to patients in the operating room.

Still, it should be noted that despite the proven advantages shown in this study, the implementation of surgical safety checklists is not without difficulties. Differences in applying the checklist across centres may have led to its failure. Although the checklist was standardized, the quality of staff training, adherence to protocols and communication between surgical teams were key to its success. As Turley et al., mentioned, some centres may have had challenges in fully implementing barriers, such as resistance by staff, lack of resources, and insufficient training [15]. Addressing these barriers will be key to assuring the national uptake of the checklist and maximizing its potential to advance patient safety.

The multi-centre nature of this study offers a more generalizable evaluation of the checklist's impact than much of the previous literature, which has often been focused on single-centre studies. This study includes academic medical centres and community hospitals with varied patient populations and resources, providing a fuller picture of the generalizability of the surgical safety checklist in different healthcare settings. The results indicate that the checklist may be helpful across diverse surgical specialties and institutional contexts, reinforcing the argument for its wider use.

Conclusion

To increase patient safety and improve surgical outcomes, this study is a particular contribution, adding significant evidence to the increasing body of literature about the overall effect on surgical outcomes. These findings showed marked reductions in complications, mortality, length of stay and recovery, all integral to enhancing patient care and optimizing resources in healthcare. It also emphasized the need to build a safety culture within surgical groups and that using standardized instruments such as the surgical safety checklist breaks down hierarchies and reduces standardized communication. Although there are challenges with checklist implementation limiting its use as a quality-of-care marker, the good news is that these barriers can, and must, be overcome if we are to realize the true potential of checklists to improve patient outcomes across a range of clinical settings. Future research should examine the cultural transformations engendered by checklist use and how these changes foster and sustain long-term improvements in patient safety and the quality of surgical care.

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