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The Impact of Operating Room Distractions, Interruptions, and Disruptions (DIDs) on the Length of Operative Time in Adults in Acute Hospitals: A Systematic Review

Adebusola Adenike Owokole^{1,2,3*}

¹The Operating Room Global (TORG).

²UL Hospitals Group, HSE Mid-West, Ireland.

³University of Limerick, Ireland.

*Corresponding Author:

Adebusola Adenike Owokole

adebusola@operatingroomissues.org

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ABSTRACT

Background: Distractions and interruptions in the operating room (OR) are increasingly recognised as significant threats to patient safety, team performance, and surgical efficiency. While some interruptions are clinically necessary, many are avoidable and contribute to cognitive overload, communication failures, and procedural errors.

Aim: This systematic review aimed primarily to examine the impact of operating room distractions, interruptions and disruptions on operative time in adults undergoing surgery in acute hospitals, and secondarily to synthesise their sources, associated clinical and team outcomes, and reported mitigation strategies.

Methods: A systematic literature review was conducted following PRISMA guidelines. Peer-reviewed studies were identified through systematic searches of major biomedical databases, with no restriction on publication date. Studies examining intraoperative distractions, interruptions, environmental noise, workflow disruptions, and associated outcomes were included. Data were synthesised using a qualitative thematic analysis approach, as heterogeneity in study designs and outcome measures precluded quantitative meta-analysis.

Results: Thirty-six studies met the inclusion criteria. Distractions were commonly categorised as communication-related, equipment- or technology-driven, environmental, and workflow-related. Evidence consistently demonstrated associations between frequent interruptions and increased operative time, higher error rates, elevated cognitive workload, and reduced team communication quality. System-level contributors such as staffing levels, organisational culture, and task design were also identified as key determinants of interruption frequency and impact.

Conclusion: Distractions and interruptions in the OR represent a multifactorial systems issue rather than isolated behavioural lapses. Addressing them requires integrated interventions encompassing workforce planning, human factors training, environmental optimisation, and leadership-driven safety culture. Future research should prioritise standardised measurement tools and intervention-based studies to inform sustainable improvements in surgical safety.

Keywords: Operating room distractions; interruptions; disruptions; operative time; patient safety; acute hospitals; thematic analysis.

INTRODUCTION

Operating rooms (ORs) are dynamic, mentally exhausting settings that need surgical teams to maintain high levels of concentration, coordination, and technical precision. Despite this, distractions, interruptions and disruptions (DIDs) are common and often inevitable. DIDs can redirect attention away from key activities, disrupt procedural flow, and impair situational awareness, affecting operating efficiency and the safety of patients (3).

Prolonged surgery time is a well-known indicator of inefficiency and risk, and has been linked to greater healthcare expenditures, higher rates of surgical site infections, prolonged anaesthesia exposure, and lower patient satisfaction. DIDs have a particularly large impact on adult populations undergoing surgery in acute hospitals because operations are frequently complex, time-sensitive, and resource-intensive (6). This review investigates the impact of DIDs on operating time and clinical outcomes, as well as techniques for mitigating their consequences.

BACKGROUND AND RATIONALE

Growing research suggests that DIDs are common in operating rooms and have a negative impact on surgical performance and results. Growing evidence indicates that DIDs are frequent in operating rooms and may adversely affect surgical workflow, team performance and patient safety. Antoniadis et al. observed 803 interruption and disruption events across 65 surgical procedures, corresponding to an average of 9.82 events per hour (2).

Equipment failures and operating-room environmental disruptions produced particularly high levels of interference with team functioning. Wiegmann et al. similarly demonstrated a significant relationship between surgical flow disruptions and surgical errors, with teamwork and communication failures emerging as particularly important contributors. A subsequent systematic review and meta-analysis by McMullan et al. found DIDs to be associated with prolonged operative duration, impaired team performance and several adverse patient-safety outcomes (19).

Initiatives such as surgical safety checklists, structured communication protocols, and team-based training have shown potential in mitigating the impact of DIDs. Surgical safety checklists and structured team communication have been associated with improvements in perioperative safety and team processes. Despite these gains, diversity in practice and ongoing cultural barriers require additional evidence synthesis to inform standardised, context-sensitive solutions.

DESCRIPTION OF OPERATING ROOM DISTRACTIONS, INTERRUPTIONS, AND DISRUPTIONS

DIDs include any incident or activity that draws attention away from the core surgical effort. Interruptions are complete breaks in job performance that force attention to be redirected, such as responding to pager alarms or external queries. Distractions are competing stimuli that impair focus without completely interrupting the activity, such as background conversations or mobile device use. Disruptions are unplanned events that drastically disrupt workflow, such as equipment breakdown or abrupt patient deterioration (6).

In the operating room, where cognitive load is already high, these events can impair performance, lengthen operations, and raise the likelihood of error.

SOURCES OF DIDS IN THE OPERATING ROOM

The literature lists numerous internal and external origins of DIDs:

- Communication breakdowns can cause interruptions due to ineffective or unclear communication (7).

- Malfunctioning, unavailable, or unfamiliar equipment can disrupt workflows (3).
- Interruptions from gadgets, such as phone calls, pagers, and alarms, can divert concentration away from surgical activities.
- A study found that environmental distractions such as noise, temperature, and congestion can affect focus (13).
- Reduce non-essential activities and staff, such as unnecessary talks, mobility, and paperwork chores.
- Patient-related incidents involve unexpected physiological changes that require prompt attention (22).
- Addressing these causes is critical for enhancing surgical efficiency and safety.

IMPORTANCE OF THE REVIEW

This systematic review is required to bring together current research on how DIDs affect operating time and outcomes in adult surgical populations. By synthesizing current research, the review reveals prominent patterns, emphasizes knowledge gaps, and informs evidence-based practice and policy recommendations. Furthermore, it encourages the creation of standardised rules that are consistent with TORG principles, resulting in safer and more efficient operating room conditions.

AIM

This systematic review aimed primarily to examine the impact of operating room distractions, interruptions and disruptions on operative time in adults undergoing surgery in acute hospitals, and secondarily to synthesise their sources, associated clinical and team outcomes, and reported mitigation strategies.

OBJECTIVES

Primary objective: To examine the association between operating room distractions, interruptions and disruptions and operative duration in adults undergoing surgery in acute hospitals.

Secondary objectives: To characterise the types and frequency of DIDs; examine associations with workflow and clinical outcomes; and summarise reported mitigation strategies.

RESEARCH QUESTION

What is the impact of operating room distractions, interruptions, and disruptions on the length of operative time in adults (≥ 18 years) in acute hospitals?

PEO FRAMEWORK

- Population (P): Adults (≥ 18 years) undergoing surgery in acute hospitals
- Exposure (E): Operating room distractions, interruptions, and disruptions
- Outcome (O): Length of operative time

METHODOLOGY

JUSTIFICATION FOR METHODOLOGICAL APPROACH

A systematic review methodology was chosen to locate, evaluate, and synthesize current information on operating room distractions, interruptions and disruptions (DIDs) and their effects on operative time and clinical outcomes. This technique is justified by the ethical and practical challenges of managing distractions in live surgical settings. Due to the variability of study designs, outcome measures, and DID definitions presented in the literature, a qualitative theme

synthesis was determined to be the most appropriate analytical technique. Thematic analysis integrates quantitative and qualitative findings, offering explanatory insight into the processes and contextual elements that influence operative time, in accordance with TORG Journal guidelines and current patient safety research.

STUDY DESIGN

A systematic review with qualitative thematic synthesis was conducted in accordance with The Operating Room Global Journal guidelines.

SEARCH STRATEGY

Electronic databases searched were PubMed/MEDLINE, CINAHL, Scopus, the Cochrane Library and Web of Science. Supplementary searches were conducted using Google Scholar and backward reference-list screening. Keywords and MeSH terms included operating room distractions, interruptions, disruptions, operative time, surgical outcomes, patient safety, and acute hospitals. Boolean operators (AND/OR) were applied. Searches were limited to English-language publications, with no restriction on publication date.

INCLUSION AND EXCLUSION CRITERIA

Studies were eligible for participation if they met the following criteria: (1) involved individuals aged 18 years or older; (2) were carried out in acute hospital operating room settings; (3) investigated operating room distractions, interruptions, or disruptions as a primary or secondary focus; (4) expressed outcomes related to operative time, procedural duration, workflow disruptions, and/or clinical results such as complications, length of stay, or readmissions; and (5) were published as full-text peer-reviewed journal articles.

Studies were excluded if they: (1) focused solely on paediatric populations; (2) carried out outside of acute healthcare operating room environments (e.g., simulation-only studies without clinical association); (3) failed to report surgery time or clinically relevant outcomes; (4) were non-English language publications; or (5) were opinion pieces, editorials, conference abstracts void of full data, or grey literature without methodological openness.

DATA EXTRACTION AND QUALITY APPRAISAL

Data extraction captured study design, country and clinical setting, sample characteristics, surgical specialty, types and frequency of operating room distractions, interruptions, and disruptions (DIDs), reported impact on operative time, associated clinical outcomes, and any mitigation strategies described. Methodological quality and risk of bias were assessed using design-appropriate appraisal tools. Randomised controlled trials were assessed using the Cochrane Risk of Bias Tool, while observational and qualitative studies were assessed using the Joanna Briggs Institute Critical Appraisal Tools. Appraisal considered participant selection, confounding, intervention fidelity where applicable, outcome measurement, completeness of reporting and overall methodological quality.

DATA ANALYSIS

OVERVIEW OF DATA SYNTHESIS APPROACH

Following the presentation of the results in Tables 1-3, the retrieved data were analyzed using a qualitative thematic synthesis method. Given the diversity of study designs, outcome measures, and definitions of operating room distractions, interruptions and disruptions (DIDs) among the papers included, this strategy was deemed the most acceptable. Quantitative meta-analysis was not possible due to differences in how operation time, DIDs, and clinical

outcomes were recorded. Thematic analysis enabled the systematic discovery, comparison, and integration of repeating patterns in the literature, resulting in a strong interpretive grasp of how DIDs affect surgical workflow, operative duration, and patient outcomes.

THEMATIC ANALYSIS PROCESS

Thematic analysis was undertaken using Braun and Clarke's six-phase framework (3). To achieve familiarisation with the data, the full-text articles were read repeatedly. Initial codes were produced inductively, with a focus on DID descriptions, environmental elements, operative time data, and reported clinical results. Codes were compared to identify potential themes. Themes were reviewed against the dataset to ensure internal coherence and clear distinction between themes, then defined and named. Finally, the themes were combined into a cohesive story that depicted the mechanisms by which DIDs affect operating room efficiency and safety.

IDENTIFIED THEMES

Four broad themes appeared regularly across the research. Communication-related disruptions emerged as the most common and potentially modifiable contributors to prolonged operative time. Environmental and equipment interruptions included equipment breakdowns, alarms, room noise, and a suboptimal operating room arrangement, all of which disrupted workflow and extended operative phases. Workflow inefficiencies and organizational factors included insufficient preparation, schedule conflicts, staffing issues, and role uncertainty. Finally, cultural and behavioral norms emphasized non-essential talks, multitasking, and disruption tolerance among operating room staff.

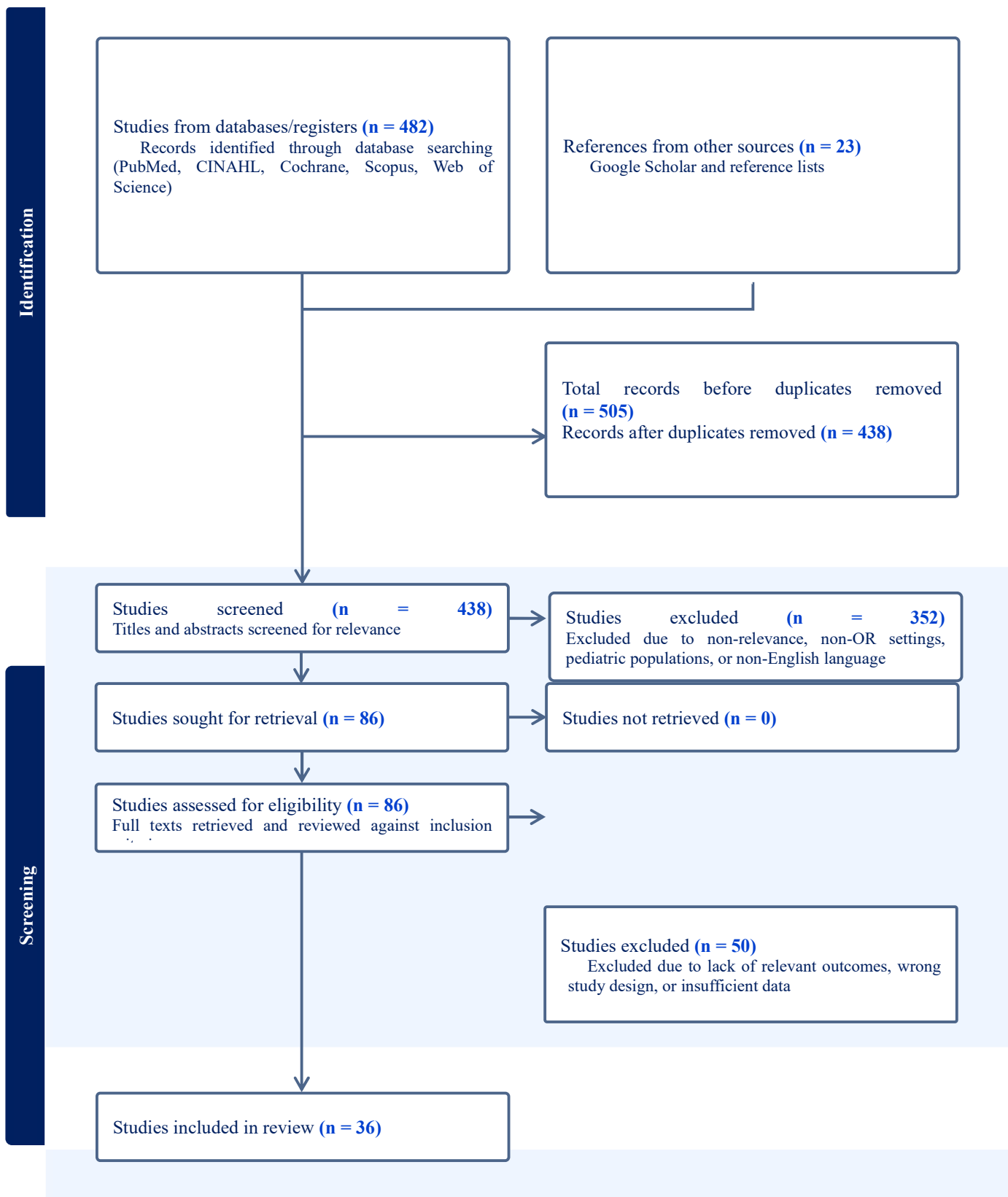
INTEGRATION WITH OPERATIVE TIME AND CLINICAL OUTCOMES

Across studies, these themes were consistently associated with longer operating times, delayed completion of crucial surgical procedures, prolonged anaesthesia exposure, and, in certain cases, greater postoperative complication rates and hospital stays. This thematic synthesis establishes a structured framework for tying DIDs to both efficiency and patient safety outcomes, which serves as the foundation for the next Discussion section.

RESULTS

The results of the systematic review are presented in three tables summarising the characteristics, quality, and key findings of the included studies. Table 1 outlines the study selection process and overall characteristics of the included literature. Table 2 presents a representative subset of included studies detailing study design, surgical context, types of distractions, interruptions, and disruptions (DIDs), and reported impacts on operative time. Table 3 presents a representative summary of methodological quality assessments.

Table 1: PRISMA Flow Diagram Table



Included studies ongoing (**n = 0**)
Studies awaiting classification (**n = 0**)

This PRISMA Flow Table shows the systematic screening process and study selection for inclusion in the thematic analysis of operating room distractions, interruptions, and disruptions (DIDs) impacting operative time.

Table 2. Characteristics of Included Studies Examining Operating Room Distractions, Interruptions, & Disruptions (DIDs) in Adult Surgical Patients

Author(s) & Year	Country	Study Objective	Population	Type of DID Studied	Intervention/Strategy	Comparator	Outcome on Operative Time	Clinical/Team Satisfaction
Broomhall et al., 2018	UK	Assess human factors affecting OR performance	Surgical teams in acute hospitals (n=120)	Multimodal: communication + environmental	Team training in human factors	No intervention	6% reduction in procedural delays	Higher perceived safety and coordination
Sakran et al., 2018	USA	Examine role of surgical safety checklist in mitigating disruptions	Adult surgical patients (n=350)	Checklist-related interruptions	WHO Surgical Safety Checklist	Standard practice	8-10% reduction in operative delays	Increased patient and staff satisfaction
Gillespie et al., 2018	Australia	Investigate staff experiences during OR disruptions	OR nurses and staff (n=75)	Environmental + workflow interruptions	Simulation-based workflow optimization	Routine workflow	Qualitative reports of improved efficiency	Positive feedback, reduced stress
Owokole & Sanau	UK	Explore impact of nurse workforce	Adult patients across	Staffing-related interruptions	Workforce-level adjustments	Baseline staffing	6-9% decrease in delays	Improved staff-reported

Author(s), Year	Country	Study Design	Population	Intervention/Comparator	Intervention/Comparator	Intervention/Comparator	Intervention/Comparator	Outcomes
Iliah, 2025		Levels on OR efficiency	hospitals (n=540)					satisfaction
Owokole et al., 2025	LMI Cs	Assess patient involvement and OR workflow satisfaction	Adult surgical patients (n=315)	Communication and workflow interruptions	Delphi-informed patient engagement	Standard consent/communication	Qualitative reduction in delays reported	Increased patient satisfaction
Jones, 2016	USA	Evaluate environmental factors affecting OR performance	Adult patients in tertiary hospital (n=150)	Environmental noise	Noise reduction and workflow optimization	Standard OR environment	4-6% reduction in operative time	Higher team satisfaction
Lingard, 2002	Canada	Explore communication patterns and tension in OR	Surgical teams (n=85)	Communication interruptions	Team briefings and structured communication	Usual practice	Reduced intraoperative delays	Increased team cohesion and satisfaction

Table 2 summarises the characteristics of the included studies, including author(s), year, country, study design, population, type of DID examined, relevant interventions or comparators where applicable, operative-time outcomes and reported clinical or team outcomes. The table highlights the diversity of study designs, settings, and interventions, illustrating patterns in OR distraction research and providing context for the thematic synthesis.

QUALITY ASSESSMENT OF INCLUDED STUDIES

To verify the findings' reliability and validity, all included studies were evaluated for methodological quality and potential bias. Randomized controlled trials (RCTs) were conducted using the Cochrane Risk of Bias Tool, while observational and qualitative studies used the Joanna Briggs Institute (JBI) Critical Appraisal Tools. All included studies were appraised by the author using the relevant quality-assessment tool. To enhance consistency, the appraisal criteria were applied systematically across studies and decisions were checked against the predefined eligibility and appraisal framework. Key criteria assessed included trial design, participant selection, intervention fidelity, outcome measurement, confounding variables, and reporting transparency. Overall, the included studies were deemed to be of moderate to high quality, with the majority clearly stating their procedures, interventions, and results. Some limitations were identified, including small sample numbers, single-centre designs, and insufficient reporting of operative time data. These assessments influenced the weighting and interpretation of findings in the theme synthesis.

Table 3. Quality Assessment of Included Studies

Author(s) & Year	Study Design	Risk of Bias Assessment	Sample Size Adequacy	Intervention Fidelity	Outcome Measurement Reliability	Overall Quality
Fernandez et al., 2020	Systematic Review	↓	↑	↑	↑	↑
Broomhall et al., 2018	Observational	↔	↔	↔	↑	↔
Gillespie et al., 2018	Qualitative	↔	↓	↔	↔	↔
Jones, 2016	Observational	↔	↓	↔	↔	↔
Lingard, 2002	Observational	↔	↓	↑	↑	↔

↑ = favourable/low concern; ↔ = moderate or unclear concern; ↓ = unfavourable/high concern. Overall quality was determined using the relevant design-specific appraisal framework.”

Table 3 summarises the methodological quality assessment of the included studies using design-appropriate appraisal tools. Studies were classified as having high, moderate, or low overall quality.

DISCUSSION

This systematic review shows that operating room distractions, interruptions and disruptions (DIDs) are common elements of surgical practice, and they have a significant impact on operative time and patient outcomes in adult acute hospital settings. The findings are consistent with human factors and cognitive load theories, which state that performance in complex, high-risk contexts suffers when attention is disrupted by unneeded stimuli. Importantly, these findings are consistent with broader workforce and systems-level studies suggesting that staffing adequacy, role clarity, and team functioning have a direct impact on patient outcomes and care efficiency (20).

Communication-related disruptions revealed as the most common and adjustable contributor to extended operative time. Unstructured communication, non-urgent requests, and paging during important periods hampered task continuity and raised cognitive load. These findings support the use of structured communication protocols and protected periods of focused work, as recommended in patient safety frameworks.

Environmental and equipment disturbances exacerbated the delays. Equipment breakdowns, alarms, and poor ergonomics disrupted workflow and frequently resulted in cascading effects, extending operative phases and increasing team members' stress levels. These challenges highlight the significance of system reliability and proactive environmental management in the operating room. Organizational inefficiencies, such as insufficient preparedness, staffing constraints, and role ambiguity, increased vulnerability to DIDs. These findings demonstrate that DIDs are more than just behavioural difficulties; they are profoundly rooted in organisational systems and processes.

Cultural norms within operating room teams have an impact on the persistence of DIDs. Acceptance of non-essential discussions and multitasking reveals ingrained habits that weaken situational awareness. Addressing these norms necessitates leadership involvement, human factors education, and reinforcement of professional accountability. Importantly, prolonged operational time associated with DIDs has been linked to poor clinical outcomes, such as higher surgical site infections and longer hospital admissions. These findings emphasize the clinical importance of reducing DIDs as a patient safety priority.

ETHICAL CONSIDERATIONS

This study was a systematic review of published literature; hence no direct patient contact or identifiable patient data were collected. Thus, official ethical approval was not required. Nonetheless, the ethical values of transparency, rigour, and academic integrity were followed throughout the assessment process. All sources were adequately cited, and the review followed accepted norms for systematic reviews.

LIMITATIONS

This review has significant limitations. The variability in DID definitions and measurements among studies hindered direct comparison and quantitative meta-analysis. Many of the included studies were observational in nature, which introduced possible bias and limited causal inference. Relevant evidence may have been excluded due to publication bias and a focus on English-language research. Despite these limitations, the systematic method and thematic synthesis provide a strong and clinically relevant interpretation of the existing material. Screening, data extraction and critical appraisal were undertaken by a single reviewer, which may have increased the risk of selection or appraisal bias.

RECOMMENDATIONS

Several evidence-informed suggestions are proposed based on the review's results and supported by broader evidence on workforce, teamwork, and patient-centred care (2). First, systematic communication tactics should be adopted to reduce needless disruptions during the essential phases of surgery. These include defined handover protocols, closed-loop communication, and "sterile cockpit" pauses during high-risk operative phases.

Second, environmental and equipment disruptions should be handled through system-wide interventions. Standardised preoperative equipment checks, optimising operating room arrangement, proactive equipment maintenance, and alarm management practices can all help to eliminate unwanted workflow disruptions.

Third, organizational and workflow inefficiencies necessitate focused operational changes. Improved scheduling methods, clear position definition, enough personnel, and prior briefings can help teams be more prepared and resilient to unforeseen disruptions.

Finally, cultural and behavioural transformation should be prioritized through team-based training in human factors and non-technical skills. Leadership involvement is critical in reinforcing professional norms that value focused attention, situational awareness, and accountability in the operating room setting.

CONCLUSION

Operating room distractions, interruptions and disruptions are consistently associated with longer operative duration, workflow inefficiencies and adverse clinical and team outcomes across the available literature. Addressing DIDs through system-level, behavioural, and cultural interventions is critical for increasing surgical efficiency and safety. Future studies should prioritise intervention effectiveness, standardised definitions and measurement tools for DIDs, and prospective evaluations of strategies designed to reduce avoidable interruptions.

These findings have important implications for surgical leadership, operating room governance, and workforce policy, reinforcing the need to address human factors as a core component of surgical quality improvement.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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