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IMPACT OF INTRAOPERATIVE TEAM COMMUNICATION ON SURGICAL OUTCOME AND ERROR PREVENTION IN TERTIARY CARE OF MULTAN HOSPITALS

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ABSTRACT

Communication at the surgical team level is important in the safety of patients and the delivery of the best surgical results. This research was aimed at evaluation of intraoperative communication practices, and their impact on the prevention of errors and the general surgery performance. Also, it aimed at determining the major obstacles that prevent proper communication in the operating theatre (OT). The existing literature has linked communication breakdowns at the surgical location with the higher rates of medical errors, after-effect of surgeries, and poor patient outcomes. To explore all these variables, a quantitative cross-sectional study was designed, aiming at 120 OT professionals, such as technicians, nurses, and surgeons. The structured questionnaire was utilized to gather the data based on the earlier-validated tools of study touching on surgical communication. The questionnaire involved five large areas of interest, including demographic characteristics, intraoperative communication practices, communication barriers, communication outcomes, and a contribution of communication to prevent the occurrence of errors. Analysis of the data has been done with the SPSS version 26. The descriptive statistics were used to describe the characteristics of the participants and patterns of communication. Relationships among variables were investigated by use of the inferential statistical techniques, such as the Pearons correlation, Chi-square tests, and linear regression analysis. The statistical significance was stipulated $p < 0.05$. The results showed that most of the communication practices in the operating theatre were usually favorable especially in areas touching on the practices of teamwork and verbal clarity. The degree of communication and the prevention of error had a moderate positive correlation ($r = 0.32$, $p < 0.001$), whereas the quality of communication and its outcome in surgery were connected with a very strong positive correlation ($r = 0.87$, $p < 0.001$). Moreover, Chi-square analysis revealed statistically significant correlations in 21 of 25 combinations of variables, and it supports the relationship between effective communication and the low occurrence of surgical errors. According to the results, effective intraoperative communication not only helps to increase positive surgical outcomes but is also vital in reducing preventable errors. Nevertheless, even now, a number of nagging issues are still experienced when it comes to team communication such as time crunch, hierarchies within surgical teams, lack of formal training in communication, and distractions in the environment. The research suggests reinforcement of the structured communication systems including the WHO Surgical Safety Checklist and SBAR (Situation-Background-Assessment-Recommendation) protocol as well as their regular training as a multidisciplinary team and a culture of respectful open communication. The

findings are maintaining collaborative information to the current international literature and make the way of effective local evidence in support of communication-oriented safety interventions in surgery practice.
Keywords: *Surgical outcomes, Patient safety, Error prevention in Operation Theatre, Intraoperative team communication, Teamwork.*

Chapter 1
INTRODUCTION
1.1. Background

Intra-operative communication is a process in which there is verbal and non-verbal sharing of information among surgical team members during a surgery. It forms one of the core elements of work as a team, patient safety, and effective surgery. Timely and accurate information flow is central to effective coordination of team performance; otherwise, there is no way to provide the efficient and safe surgical care. Nurses that directly engage with the circumstances of every member of the surgical team have a key and independent role of protecting the patient, even though their tasks are either technical, non-technical, or collaborative (*(Nasiri et al., 2021).* The surgeons are the main ones who ensure patient safety throughout the operation, especially due to the fact that the patient has been put under anesthesia and cannot detect or rectify wrongful actions. This fact draws importance to the need to take proactive measures to reduce the number of errors in the operating room setting *(Skramm et al., 2021).*

The motivation of surgical teams is maintained by both monetary rewards, including additional pay, and emotional one. Positive criticism by the managers, physicians, and colleagues also enhances the performance and integration of the team. Surgical personnel need to communicate clearly, in an organized, and efficient way in order to minimize risks, adverse events, and provide patients with the best results. The importance of investigating the interrelation between the practice of communication and clinical outcomes is, therefore, essential to promoting the quality and safety levels of surgical care. Due to operating room staff's workload based on shift schedule, scrub and circulating staff might be required to be substituted during long procedures. The time of handover in an ongoing surgery is very crucial, and failure to communicate effectively during such a time could cause fatal or critical mistakes. *(Torabizadeh et al., 2021).*

Complete transfer of information must incorporate patient identification and medical history, intraoperative vitality, and equipment details like implant position, tourniquet time and pressure exerted. Besides this, proper documentation of instruments and sponge counts, specimen labeling, drugs at the sterile field, and other pertinent clinical information is required. This communication of information can put the life of the patient and, possibly, his or her life at grave risk in the event of any incorrectness or oversight in this communication. Despite the several safety measures that have been enacted toward the security of patients undergoing surgery, the existing checklists and regulatory measures are not effective enough, so as to avoid preventable (preventable) harm effectively. Despite the recent introduction of modern procedures safety check-lists, a recent investigation in California has recorded that the incidence of the so-called never events, such as wrong-site and wrong-patient procedures, still persists, albeit to a small extent. In the past, the safety of surgical practice has not had the extent of standardized high-reliability operations that exist in other high-risk fields, which have led to the continued susceptibility to error and poor surgery outcomes *(Kristoffersen et al., 2022).*

The human error is a normal feature of behavior, but the outcomes are important within a high-level risk situation like surgery. Although any healthcare field is vulnerable to errors, surgical practice is more vulnerable given that it is complex and time-performed. To comprehend surgical errors, this multi-layered system, all the factors that can cause errors along the patient pathway, theoretical approaches to the theory of error causation, techniques of assessing technical errors, and prevention and mitigation strategies all

demand consideration of these factors. This kind of examination is part of enhancing patient care and clinical outcomes (Stahel et al., 2022). Surgical competence is a combination of technical ability as well as good cooperation and interaction of the surgeons, anesthetists, nurses, and other critical staff and making of good decisions prior, during, and after surgery. Such integrated competencies are linked to a decreased morbidity and mortality level. However, it is unrealistic to assume that the error will be eliminated completely even in simple cases. The surgeons implement documentation review constantly, remodel the clinical situation, test the work environment, and track the progress of the procedure, but errors are always possible. This is why standardized procedures, specifically those aimed at wrong-site surgery, have been actively encouraged in order to minimize potential errors *(Yeganeh et al., 2022).*

Team communication allows the team members work together more smoothly and the fulfillment of common objectives. Good and uniform communication enhances coordination, performance of tasks on time, and discussion of ideas. Effective workplace communication in healthcare ensures that roles and functions are defined, professional relationships are reinforced, staff remain engaged and productive which leads to organizational performance and a positive effect on patient care outcomes *(Armstrong et al., 2022).*

Operating theatres can be considered high stakes settings where complex surgery operations are going on by a multidisciplinary team which are the surgeons, anesthesiologists, nurses and operating theatres technologists. The role of every member is specified and their communication skills in pressure situations are extremely important to coordinate and respond quickly to changes or emergencies in the middle of the operation *(Robinson & Beaumont, 2023).*

There is evidence to suggest that non-technical skills deficiency occurs more frequently as factors associated with poor surgical outcomes than technical competence of surgeons does. Non-technical skills include cognitive and social skills used by the surgeons to decide, possess situational awareness, and lead the support staff in an adept manner. The modern safety theory aims to remind people that it is more efficient to pay attention to the successful processes-what works well- than just discussing the mistakes post factum Poor communication during surgery has been identified as one of the main causes of preventable adverse occurrences, surgical mistakes, and near misses. World Health Organization lists the failure of communication as major contributors to the worst events in the world as they happen in such areas as retained surgical instruments, misplaced location, and other complications on anesthesia. It has been identified that out of all the adverse events at the hospital, communication breakdowns have led to up to 70% of the events, in part due to handovers, and intraoperative processes *(Tamoor et al., 2024).*

Several factors do present a challenge to effective communication in the modern surgical practice and they include complex procedure, time, hierarchical barriers, and differences in culture between team members. These difficulties are further aggravated in nations such as Pakistan and, particularly, in the tertiary care hospitals whose number of patients are higher and resources are few. The communication lapses present in these environments have the potential to add to the surgical complications, delays, staff stress, and patient dissatisfaction *(Bethune et al., 2024).*

The efficiency of the operating rooms, collaboration, and relationship with others are frequently the levels lower than optimal, and poor communication was found to be the critical cause of medical errors. Lapses in communication may lead to the severe errors in the high-stress environment of the OR. The central role of cooperation in the OR nursing is because coordinated performance of surgical tasks presupposes the joint work of several team members *(Alsadoun et al., 2024).*

Technology has also had an impact of effectiveness of OR team work. The readiness of nurses to implement accountability and active team behavior was facilitated by clear protocols in the working with equipment and task orientation, especially during emergencies. Collaboration was also influenced by environmental factors including the physical size of the OR and the number of staff. It was also challenging to build

and sustain coherent teams in bigger ORs since it took considerable time to pick all the required staff (Pasquer, Ducarroz, et al., 2024).

The smaller OR teams were more flexible, easily communicating, and making decisions than large units. Well-coordinated OR teams were characterized by effective assignment of patients and workflow planning. Constant communication between the anesthesiologists and other OR staff members made sure that overall collaboration was promoted through mutual decision making. OR managers ensured well-structured teamwork by not allocating too little experienced staff to a team. The clashes have also been caused by a lack of alignment between the expectations or values, i. e. the need to have highly skilled surgeons and the training requirements of the less experienced nurses *(van der Meijden et al., 2024).*

A patient care team that works well is based on teamwork, collaboration, situational awareness, and communication. A deliberate team led by a transparent leader and involving the patient in decision-making processes helps to build a good working collaboration since every member will be responsible and work towards attaining common goals. Communication is a key factor in all healthcare environments to maximize patient and maintain care teams updated. In contrast, communication breakdowns and related issues may result in subpar healthcare work and seriously impair the patient safety *(Tale et al., 2024).*

Prevention of mistakes in the operating room (OR) is important in ensuring the safety of patients and achieving positive outcomes in the surgical process. This necessitates the surgical team teamwork, standard ways of doing things, and a well-organized communication. The use of tools like the WHO Surgical Safety Checklist and other precautionary measures support the confirmation of the application of surgical procedures, identification of patients as well as accurate sites of operations. The risks of infections are reduced by means of authentic sterilization of instruments, utilization of personal protection equipment (PPE), and compliance to aseptic measures. There is less error during critical situations due to clear communication in the operation room where regular eyeglass checkups and adequate record documentation limit technical errors. Preparedness exercises, simulations, and training help the team to cope with the unexpected. Also, the continual improvement is supported by systematic reporting and analysis of errors. In general, it is important to establish a culture of safety, continuous observation, and observance of the standard operating procedures in order to reduce errors in the OR *(Aseeri et al., 2024).*

Surgery is a risky and complicated process that will require high-level methods, equipment, and, above all, a team of professional skills (surgeons, nurses, and technologists) under pressure. To ensure a high level of practical efficiency, as well as patient safety and the best possible surgical outcomes, communication within this team is required to be effective *(Jang and Lee, 2024).*

A number of reasons inform the achievement of research on the effect of communication during surgery. Very high risks are associated with surgical operations that can be infectious and can cause damage to the tissues, organ damage, and complications during anesthesia. The growth in the complexity of a procedure requires a high level of accuracy in coordination and the application of advanced technology. Also, the OR is a very unpredictable space, and there are numerous chances to make an error given time constraints, unexpected conditions during the work, and the evolving conditions of patients *(Scheiterle et al., 2024).*

Previous studies such as the Harvard Hospital Use Study showed that there was a substantial occurrence of preventable patient harms, and, the majority of harms were incurred in the surgical stage. Later research has found communication failures as one of the key causes of surgical errors and near misses. The effects of these mistakes are severe patient injuries (morbidity and mortality), higher healthcare expenses, longer hospitalization, and psychological trauma of patients, families, and the healthcare staff *(Ryan et al., 2024).*

The OR group is diverse and, in most cases, includes unstable members who differ in their degree of experience and rank especially in the conventional surgeon-based systems. Surgical planning, patient status, changes in the surgical proceeding, instrumentation, medication

administration, and other critical information including possible risks should be communicated in an understandable and timely fashion. The most common causes of errors include incomplete or inaccurate handovers, the absence of constant communication, the unwillingness to raise the matter (particularly, among junior staff or non-physician staff), vague instructions, language barrier, assumptions, distractions, or unresolved conflicts *(Armellini et al., 2024)*.

It has been proven that the process of standardizing communication at critical points, i.e., at sign-in, time-out and sign-out exhausts, can help not only to minimize flaws but also to minimize mortality. This practice has been verified by such campaigns as "Safe Surgery Saves Lives" and the introduction of WHO Surgical Safety Checklists, which create an obvious correlation between the improved teamwork, the established order of communication and improvement of life-saving results, in the end contributing to the global changes in the surgical practice Laparoscopic, robot-assisted, and endoscopic surgeries augment information tasks and chances of equipment malfunction attributable to the requirement of high accuracy of hand-eye co-ordination, cognitive, and dependence on the advanced technology*(Sutkin et al., 2024)*.

Extricate surgeries that may include major oncological or cardiovascular surgeries usually have several specialists who work one or in concurrence to one another; hence effective communication and sharing of information is the norm. Abnormal conditions detected during the operation, including concealed tumors or hyperthermia, demand a quick well-organized measure in the conditions of severe stress *(Dirie et al., 2024)*.

The interference of procedures may affect the staff daily activities, schedule, and even patient outcomes. Catch-up efforts can result in hasty lifestyles and insecure practices. Surgical teams often have to be assisting in various activities at the same time: anesthesiologists, nurses, technicians are working with tools, counts, equipment, and surgeons are operating. This split attention exposes them to lapse in concentration and mental mistakes. Errors are more likely to occur when team members handle a lot of information at once and it contains such issues as patient history, real-time organs alteration, procedure status, equipment status and group activities *(Luo et al., 2024)*.

Variations in professional orientation and vocabulary may also make communication more difficult. Physiological and pharmacological data are taken into account by anesthesiologists, anatomy and procedural steps are valued by surgeons, sterilization and instruments, and counts are prioritized by nurses *(Pasquer, Cordier, et al., 2024)*. Equipment (robotics, sensors), practices, and humans go hand in hand in a surgical practice, and communication failures are not usually caused by personal mistakes but by the systemic factors. Human error is two-pronged which takes the individualistic approach and the systems-oriented approach. Both sides of the coin give a different explanation of the errors and guide the various approaches to managing errors. Knowing these differences will help resolve the issue of ongoing risk factors of adverse events in health care environments *(Sagua et al., 2024)*.

The existing literature suggests that more than 70 percent of sentinel surgical events are associated with communication failures, and 43 percent of operative errors lead to coordination failures, including handoffs or lack of clarity *(Brennan & Jarvis, 2024)*.

Although the use of checklists is evidently important, some of the staff at nine study sites stated that it was time consuming and did not get much value attached to it. Some of the surgeons were said to have worried that the use of the checklists might slow down the procedures or create tension. Staff turnover especially among the nurses was also reported as a hindrance to the implementation of the checklists on a regular basis. Checklist elements were not fitting with the usual operations of operating rooms (like needles being counted after being thrown away or not counting them at appropriate times) of particular hospitals, which diminished their usefulness *(Sutkin et al., 2024)*.

As much as robotic surgery is related to increased operative time, it is safe to apply with proper backup of hospital management and nursing

leadership. Even though the communication between the surgeon and the team can be complicated during the physical separation of the two, the problems can be addressed with the help of the standardized communication procedures. Robotic surgery also leads to an ergonomic benefit in the form of improvement in fatigue and decision-making, whereupon it turns out to be any better to the performance of the surgeons despite the changed situational awareness. This review has identified measures of aiding the implementation of robotic surgery, as well as situational details that should be successful *(Aydin Akbuga et al., 2023).*

Although surgeons mainly use verbal communication, as it has been found out, studies on open and laparoscopic surgeries show that nonverbal signals, including body language, eye contact, and gestures among others, significantly predominated in coordination of the surgical staff. The complexity of communication can only be understood by appreciating it as a complex process in which speech, physical cues and use of tools should be involved. During open and minimal invasive surgeries, surgeons communicate with the team using verbal and nonverbal signals together; an example would be a surgeon requesting a tool by not only holding the hand at some point outstretched, but also waving the hand signals *Popov et al., 2024).*

(Human Factors and Ergonomics (HFE) has become a field that has found its application in healthcare. HFE strives to create environments, work, equipment and systems in line with human capabilities and constraints to minimize chances of mistakes. This is critical in the operating theatre (OT) because cognition load, fatigue, disruptions in workflow, and the usability of the device have become critical issues of safety concern. Surgical practice is a high-risk area in itself, with landmark reports including To Err Is Human and other reports bringing it to the fore. This changed the trend of individual blame and focused on the issues of system-level quality which could be corrected, and identified team work and communication failures were occurring to be among the crucial contributors. *(Bates et al., 2023).* The ideas of other high-risk sectors were borrowed, and standardized instruments such as WHO Surgical Safety Checklist were worked out and verified to achieve better outcomes Though a lot has been done, research financed by Office of Inspections and Evaluations of the Secretary of Health and Social Services, where national estimates of harm in the Medicare institution have been conducted, has been unable to effectively gauge the improvement of patient safety. Though the rate of healthcare-associated infections has been decreasing slowly, there are several areas of safety where organizations cannot measure indicators that assess the adverse events and track improvement. An instance here is that SLEs, such as injuries associated with the use of medication, are not always recorded, and it is challenging to identify trends over time *(Felinska et al., 2023).*

Recent experience shows that length of stay in the operating room is a non-dependent and possibly manipulable risk factor of complications. Elongated operating periods have a very high correlation with bleeding, formation of hematoma, necrosis of tissues, and surgical site infections. An extensive literature review was performed to integrate the available studies on the correlation of the duration of surgery and the negative outcome in different surgical specialties and types of procedures. This was to educate decision-making, preoperative planning, and management approaches since complications are sources of deteriorated clinical conditions, increased healthcare expenses, and psychological and financial costs, which patients and their families bear. In the range of specialties, the longer duration of operations was expected to be the predictable effective key of growing the number of complications*(H. Liu et al., 2024).*

Healthcare organizations in the world acknowledge the need of quality of care and patient safety. However, in-depth study on North American and European regions has demonstrated that there is high risk of adverse outcome implying that healthcare systems are still susceptible to errors. Medical errors that cause the patient to have an unpleasant experience, such as unexpected injuries or complications caused by the medical treatment and not the underlying illness, can result in excessively long hospitalization, disability, or even death. It is

estimated that the number of medical errors that could be avoided results in up to 98,000 deaths and more than one million injuries every year in the United States *(Monetta et al., 2024).*

This has been the recognition in the medical profession in the recent years that medical interventions have the power to harm. Undesirable drug reactions, e.g., take up a considerable share of hospitalization and cause a substantial amount of patient injury in the healthcare facilities. The prolonged hospitalization and high healthcare expenses are linked to preventable drug adverse reaction which can be caused by medication errors. A majority of medication errors happen on prescription and administration, and a recent systemic review has tried to concentrate on medication administration mistakes as one of the significant components to enhance patient safety*(Alqenae et al., 2020).*

Despite the extensive records of medication-related safety concerns in the hospital setting, they may also emerge soon after the discharge. Immediate post-hospital period can be a difficult one as patients may feel anxious, have functional weaknesses, and be vulnerable to risky situations. In most instances, hospitalization leads to major modifications in medication regimens such as discontinuations, replacement, introduction of new drugs, and alterations in dosage or frequency. A lack of communication, including poor discharge plans, wrong assessment, or late or absent discharge summaries, may also increase the risk of medication errors *(Huang et al., 2024).*

In short- and long-term care environments, nurses serve at the core of the safety and prevention of harm of the patients. Nurses are using organizational strategies to recognize risks and limit harm through patient assessment, care planning, follow up, support provision, and interdisciplinary teamwork. Effectiveness of the interventions, designed to decrease the number of errors and provide safer clinical settings, is determined by compliance of the nurses with safety measures, effective policies, supportive leadership, evidence-based interventions, professional education, and patient engagement *(Jalali et al., 2024).*

Active errors are those involved that the healthcare staff directly harms the patient within a clinical procedure like in wrong-eye surgery. Latent errors, conversely, are the errors that are inherent in the processes of healthcare such as a malfunctioning machine, inefficient organization, and poorly structured system. Traditionally, patient safety was targeted at the outcomes that need to be avoided. Research however has pointed out that in order to prevent such errors it is necessary to know the weak areas of an organization that are the root cause of medical errors. Medical professionals should be conversant with the common terms to detect the nature of errors accurately, evaluate their rate of occurrence, and learn possible triggers *(Vaismoradi et al., 2020).*

Latent errors can take many years to be noticed and with no real-time effect, hence identified as accidents waiting to occur. As an illustration, a faulty ventilator is a latent error, but not verifying equipment before providing a service is an active error of a physician *(Vacheron et al., 2023).*

Surgical mistakes are the most dangerous that may result in severe injury or fatalities of patients. Approximates suggest that a majority of physician malpractice claims are intraoperative errors as the major problem. Not all surgical errors are caused by inappropriate technique, patient factors, and location. Usually, medical record errors, miscommunication, organizational (transfer on call, dropping of specimens that are not labeled, etc.) or staffing problems, clinical (fatigue or distraction), and cognitive (lapses) factors are common contributors *(Sameera et al., 2021).*

Some of the most common preventive measures are checklists, counting instruments, administration of antithrombotic drugs to avoid deep vein thrombosis, and the application of radiofrequency-tagged sponges. Another commonly used technique of minimizing errors is surgical time-outs. Andrew, a surgical resident, goes on to conduct a time out with the surgical team with whom they confirm that the patient is who they are, that they have permission to perform the surgery, the details of the surgery, and that the location of the surgery is defined. The time-outs are to be carried out between the various surgeries, or when the teams are mixed, and all them,

including surgeons should be involved. The differences must be managed as soon as possible and to guarantee the safety of patients (Gray et al., 2021).

The five most frequently misdiagnosed ones consist of neurological issues, cardiovascular issues, urological issues, perioperative issues and malignancies. Such mistakes are usually caused by information gaps, which causes insufficient clinical reasoning and bedside evaluation (*Kinlay et al., 2024*). Errors made in diagnosis are mainly cognitive and not system based. Some of the contributing factors encompass clinician fatigue, distraction, lack of consideration about different diagnoses, and non-follow-up on diagnostic tests, among other factors in addition to lack of clinical knowledge (*Ahsani-Estahbanati et al., 2022*).

The error rate in diagnoses is a complicated problem, and the method to solve it takes a multidimensional approach of various interventions. System-based checks as well as cognitive aids are usually suggested. Mental aids are checklists to eliminate overlooked steps, electronic health record prompting an evaluation of potential differential diagnosis of a misdiagnosed condition, and automated decision support through use of algorithms. The studies show that these tools have the ability of minimizing diagnostic mistakes. There are also extended specialist consultation, training with simulations, and decision support with the help of a device (*Singh et al., 2022*).

There are several phases of medication management, i.e. prescription, dispensing, taking medication, and administration, all of which can be subjected to error. A lot of medication errors, however, can be avoided. Such errors as neglecting safety checks, using outdated medication, or prescribing medications with alike names are common mistakes Computerized physician order entry (CPOE), barcode-based patient and drug identification, standard units of measurements, weight-based dosing, and pharmacist assistance in computing the doses are examples of system-based interventions that can reduce errors. Drug names and dosage should also be verified prior to administration to avoid avoidable mistakes in medication (*Hines et al., 2018*).

Although most healthcare specialists find that technology may help to enhance efficiency, lower expenses, clinical outcomes, and improve patient safety, new threats and mistakes emerge as a result of such innovations. Malfunctions associated with equipment are unavoidable considering the fact medical devices of more than 5,000 types are used by thousands of people working in healthcare facilities around the world. The errors usually take place due to the device malfunctioning, operator, mishandling, or design flaws. Factors related to different manufacturers, inadequate testing, excessive or misuse, ineffective design, and poor maintenance are some of the factors. Cases of misconnection between catheters and feeding tubes are also common like: accidental insertion of nutrition tubes into the lungs, catheter use on non-purpose use or that such lines are incorrectly connected using the infusion pumps. These mistakes might be fatal in case they are not corrected in time (*Ruskin et al., 2020*).

To increase the safety of devices, the healthcare professionals ought to be involved in formulating and testing institutional and organizational plans. This involves setting up a system of equipment handling, personnel training, monitoring, and reporting of the undesirable events in technology (*Kirkendall et al., 2020*). The clinicians should be trained on how to deal with faults and to be alert even in instances of care being aided by technology. Errors in the connection can be greatly decreased with the use of special connectors whereby feeding tube and anesthetic lines are fed. Alongside, the staff must be able to trace every connection to its source before beginning infusions, labeling at-risk catheters, and plugging/unplugging equipment (*Singh et al., 2024*).

Pharmacy-led antimicrobial stewardship programs should be implemented to enroll all admitted patients in aiming to reduce healthcare-associated infections risk (*Ugwoke et al., 2024*).

Equally, wound care teams ought to conduct routine skin assessment, offer specific nurse training and apply evidence-based practices. In the case of surgical site care, research indicates the provision of chlorhexidine impregnated dressings

RJNMSR
Review Journal of Neurological & Medical Sciences Review

to aid in lowering the risks of infections *(Ruskin et al., 2020).*

Even though the individuals are expected to be responsible about personal errors, health care system and environment should be streamlined to ensure that error reporting results in systematic improvement and not punitive measures. The errors can be reduced by redesigning the processes using unsafe practices more challenging such as implementing electronic tools on different issues of patient care. Nevertheless, there can be no systemic enhancements without problem identification. Reporting system, root cause analysis, and outcome monitoring can assist in identifying pattern of errors and solve organizational weakness. Employees might be reluctant to disclose mistakes under the conviction of being punished or prosecuted *(Ratwani et al., 2024).*

Thus, institutional culture dedicated to education, constant improvement, and interventions based on the system where staff members are not afraid of retaliation can improve patient safety. Healthcare provision involves effective involvement of all the healthcare team members (*Frederick, 2024).*

1.2. Problem Statement

One of the main causes of surgical errors and unfavorable outcomes in operating rooms is still intraoperative miscommunication. In healthcare settings, including tertiary care hospitals in Multan, problems with communication continue to jeopardise the safety of patients and surgery efficiency despite the introduction of protocols like the WHO Surgical Patient Safety Checklist.

1.3. Research Objectives

I. To determine the association between intraoperative team communication and surgical outcomes.

II. To evaluate the role of intra operative communication in preventing intraoperative errors.

III. To assess the quality of intraoperative team communication in tertiary care hospitals of Multan.

1.4. Research Questions

I. How does intraoperative team communication effect surgical outcomes and error prevention?

II. What kinds of errors in intraoperative team communication are most common during surgery and lead to intraoperative error?

III. What is the current standing of intraoperative team communication among surgical teams in Multan's tertiary care hospitals?

Chapter 2
REVIEW OF LITERATURE

2.1. Literature Review

Surgical teams present healthcare providers with serious time constraints and pressures to work as a unit. Collaboration with colleagues is the key to the provision of high-quality care and patient safety. According to Domek et al (2011), the concept of coordination, defined as communicating and relating with the aim of integrating tasks has demonstrated to create a better care delivery and patient safety. Besides, well-managed interpersonal coordination helps staff members to feel well and encourage the learning capabilities of errors. Relational coordination has been studied regarding different contexts such as surgery (*Weldon et al., 2019).*

The effectiveness of collaborative training was evaluated by a comprehensive review that can help to determine the effects on clinical outcomes and effectiveness of healthcare team, including non-technical and technical skills. The analysis of various training strategies utilized in the clinical settings revealed that the structured collaboration training had a profound positive effect on the team interactions, communication, and decision making. These measures were linked to increased overall patient clinical outcomes, less medical errors, and quantifiable patient safety improvements. The review revealed the necessity of incorporating team training in the continuation of professional training and medical education. It further stated that repetitive training with a focus on context-specific training is more likely to have long-term positive effects, which is why teamwork is particularly important in improving patient care and healthcare provision *(Torring et al., 2019).*

The Joint Commission has distinguished ineffective communication as one of the major causes of sentinel events in health care. Morbidity and mortality due to the use of briefings, time-outs, and debriefing have been reduced by the introduction of structured communication tools, including the WHO Surgical Safety Checklist *(Barimani et al., 2020).*

Current studies have surpassed earlier interests of advocate of standardized tools such as WHO Checklist to attend to their implementation. Research indicates that the use of checklists may be restrictive at times, shifting to the use of tick-box activities. Another well-known failure mode (largely referred to as the checklist fatigue) is the recitation of items without any interactive process. The success of these tools does not come naturally; it is possible only when the team communicated in good faith, and their usage was accompanied by the feeling of psychological safety *(Cramer et al., 2020).*

Leadership is a significant aspect in changing procedural compliance in checklist adoptions into a long-term cultural incorporation. It has been indicated that healthcare leaders can have a significant impact on structure more than just rules by setting an example through open communication, seeking feedback, establishing an atmosphere where an individual feels comfortable sharing their thoughts. Meaningful change is the process that should occur continuously and be associated with re-establishing values, learning on near-miss, and encouraging open communication instead of single interventions *(Nicoara et al., 2020).*

The concept of human factors engineering (HFE) can also improve patient safety in a high-risk setting like a cardiovascular operating room (CVORs). HFE analysis can be applied to spot systemic sources of error, such as poor communications, inefficient workflows and flaws in environmental design. Through application of concepts like ergonomics, collaboration among teams, user centricity, procedures and tools may be streamlined to enhance and support surgical teams, minimize risk, and achieve better results. The present study justifies the implementation of the HFE principles into the surgical safety plans in the complicated, high-risk environments such as CVORs *(O'Donovan and McAuliffe, 2020).*

Adverse events are unfortunate events that happen when medical care is rendered to a patient inadvertently. Incidents like intraoperative awareness, fatalities during surgeries, or undetected meningitis may be disastrous to patients and healthcare givers and lead to lawsuits and complaints. Studies are often interested in the behaviors of individual clinicians, but not in those of the overall context in which they take place. Indicatively, in one instance when a patient suffered a perforation of his colon in surgery, when his medical records were examined first, the doctor was criticized. As it turned out, the operation was conducted under almost the darkness, because of equipment and power problems. The adverse events are normally associated with interactions of a set of systemic factors in different levels such as personal responsibilities, and interactions in a team, as well as the work environment *(Vaismoradi et al., 2020).*

Relative care structure plans to come up with evidence-based patient safety frameworks to ensure effective care mechanisms that reduce cases and effects of adverse events and enhance recovery. Such frameworks include risk management, infection control, medication safety, safe instruments and surroundings, patient education and self-care involvement, injury prevention, nutritional optimization, collaboration, leadership, evidence-based learning, responsibility, and reporting of surgical errors. In any care environment, nurses have a key role in ensuring safety of patients and avoiding damage. They will comply with organizational risk and hazard identification steps by assessing patients, care planning and/or monitoring, and cooperation with other medical workers (*Rodziewicz and Hipskind, 2020*).

Studies have indicated the huge effect of efficient communication and cooperation on the efficiency and patient results of the surgery. Lack of communication and especially during high pressure or crisis is a significant source of surgical error. Collaboration and clarity have been demonstrated to improve, using preparation briefings and checklists. Increased surgical safety

has been linked to interdisciplinary collaboration, respect, and common mental model. The significance of interactive training as the means of development of non-technical skills is also discussed, and team relationships and leadership play a crucial role in predetermined or unusual situations. The culture of open communication and providing feedback continuously should be promoted to minimize the risks of errors and guarantee high-quality surgery care (Earl, 2020).

The use of well-organized communication tools in the handoff process and any other critical clinical interaction has proven to diminish postoperative complications. The use of standardized communication protocol enhances information transfer amongst the surgical team members involved in reducing miscommunication and clinical errors. In hospitals that chose these tools, the postoperative complications, such as infection, late diagnosis, and errors on prescribed medication, were reduced. These findings support the other research results which indicate that effective communication at the team level directly relates to patient outcomes and surgical safety, and that formal communication tools are an important quality improvement approach *(Espin et al., 2020).* Moreover, publications that investigate the connection between patient results and surgical team behaviours underscore the role of teamwork, preparation, and communication in the operating theatre. Teams that proved to be timely in exchanging information, understanding their roles, and having respect among themselves had much lower rates of surgical complications. On the other hand, the teams that were characterized by low communication or interpersonal conflicts were attributed to more mistakes as well as negative results. Such observations underscore the fact that non-technical skills and expertise are just as important in the achievement of surgical success as the clinical competence. Team training and changes in behavior are hence critical towards providing effective teamwork, patient safety, and improved surgical outcomes *(Etherington et al., 2021).*

A systematic review proved that team training interventions such as the Crew Resource Management intervention and Team STEPPS intervention have established positive results by enhancing communication, errors reduction, and team consistency during surgeries. The programs focus on situational awareness, confidence, mutual support and leadership in the team members of the teams *(Hardie et al., 2020).* Interpersonal communication between colleagues would be critical in providing quality and safe medical care. Researchers have investigated the contribution of communication failures to patient harm using the data provided by the Anesthesia Limited Claims Project *(Douglas et al., 2021).*

The need of surgical services continues to increase around the world. To guarantee that quality surgical procedures are always administered, there is a need to have a wider perception of how complicated the operating room is, and how the rising number of requirements in the surgical team are pushing the bounds of its operations. Surgical safety checklist is part of the standard of operation procedures in England, but the overall effect on patient safety is still under research all over the world. In the last ten years, the research has focused on advantages as well as constraints of the checklists, where different obstacles and facilitators that can be used to enhance the application have been pointed out. There have also been studies done on the variations in team performance and compliance. At the moment, there is no evidence that can be reliable to sustain or halt the usage of surgical checklists *(Lorkowski et al., 2021).*

Communication in education has two functions, organizing work (doing) and nurturing trainees (teaching). These functions can come into conflict sometimes. The recent studies address how supervising surgeons can ensure patient safety and workflow and balance instructional and directive communication, including the commands such as, Lords, hand me a scalpel *(Cohen et al., 2021).*

The human error is considered in the following sense: there is an individual approach and the systemic approach. Both views give an avenue through which mistakes can happen and enlighten various approaches on how to deal with mistakes. Awareness of such differences is the key to presenting the current threat of clinical practice mistakes (Yang et al., 2021).

An approach to human factors system has an important role in enhancing safety and quality of healthcare. The model that has found a wide application is the SEIPS (Systems Engineering Initiative for Patient Safety) model and this has been successfully applied within research and practice in health care. SEIPS model focuses on systems and human roles of the workplace, which provide critical information on redesigning the healthcare processes and health care setting. Its fundamental tenets emphasize the need to balance system structure but encourage active and adaptive roles of healthcare workers in order to provide patient safety and care excellence *(Perez-Guzman et al., 2021*).

According to a current research, these risks were 60 in cardiac surgery; they comprised variability in cardiac surgery practice, overwork, non-compliance with clinical standards, and lack of physician participating in the choice of medical equipment. The results imply that these risks are common issues that should be controlled to enhance patient safety in cardiac operating rooms. It has been proposed to adopt the culture of safety, adopt effective infection-preventing measures, improve collaboration and communication, and work with all stakeholders to maximize medical equipment and technology (Widana et al., 2021).

Communication is especially a concern in case of patient handoff, especially when relevant information is not properly transferred, these situations may lead to medical errors or sentinel events. Specifically, the perioperative setting is particularly prone to the influence of rapid turnover of patients and physicians of different specialties. To combat this, unit-specific handoff tools would be required to have proper and accurate communication. The application of a common communication protocol, like Situation-Background-Assessment-Recommendation (SBAR), in a perioperative environment, both in the operating room and the preoperative area, has been reported to improve information flow in surgical teams (Abraham, 2021).

The operating room (OR) requires communication and cooperation, which are crucial to the safety of surgery and the avoidance of errors, and robot surgery integration impacts them greatly. Robotics technologies can modify the conventional relationship within the team by physically isolating the surgeon amongst other members of a surgical team, to which verbal and visual messages are reduced. The mentioned disconnect can lead to more mistakes especially when there is an unforeseen event in operations since it can hinder the timely coordination. The research states that these risks can be addressed by preoperative briefings, well-developed communication technologies, and developed communication protocols. Improvement of the team situational awareness and purposeful and clear communication are as important to the successful robotic surgery as technical skills in working with the equipment *(Miller et al., 2022).*

In orthopedic surgeries, it is also important that communication is effective in enhancing patient safety, and minimizing the number of complications. Inadequate interaction between the surgical teams has been considered as one of the main factors contributing to errors, delays, and negative results. Shared understanding, increased clarity, and less uncertainty between the team members are achieved with the help of strategies like checklists, structured handoff tools, preoperative briefings, and postoperative debriefing. The paper highlights the necessity to promote the culture of safety where open communication and cooperation are encouraged, and ongoing assessment is done to promote the development of more organized communication patterns, which help to provide safer and more benevolent orthopedic surgical care *(Gillespie et al., 2021).*

Cardiac surgical OR is also a very intricate setting where nurse subspecialists work under the guidance of state-of-the-art equipment to provide care to patients with severe cardiac pathology and considerable comorbid conditions. Modern cardiac surgical technique has sharply cut down morbidity as well as mortality after its introduction. Nevertheless, research has reported that collaboration failures are frequent which brings about surgical flow disruptions. Even in situations where the occurrence of such minor interruptions is not predictable, their presence adds up and predisposes the presence of adverse

events, technical errors, and near-miss situations. The data show that most problems leading to intraoperative circulation are based on failures of collaboration that are good predictors of surgical errors, complications, and deaths *(Mu et al., 2023).* The reduction of surgical complications and mortality has been hypothesized to be achieved by structured communication interventions such as administering a 19-item surgical safety checklist to enhance communication in the team and standardize care. Their success however, is usually undermined by irregular application of implementation and the culture of teamwork that prevails in institutions. In addition to the conventional surgery, the practice of occupational therapy (OT) practice is not deprived of mistakes, and they are a relatively recent topic of strictly conducted research. Errors of the OT practitioners, especially those related to geriatric and physical rehabilitation units, have also been found to have systematic and individual issues that led to poor outcomes, and it is necessary to implement systematic safety measures and improved communication activities across all areas of surgical and therapeutic practice *(Bucoy, 2022).*
Occupational therapists (OTs) just like other practitioners in the healthcare field are not exempt of making errors in clinical practice. Mistakes within OT practice have been hard to research only recently. A recent study examined five instances of OT practitioner errors during geriatric and physical rehabilitation and found that there were systemic and individual factors that led to these errors *(Lackie et al., 2023*).
Healthy culture of safety in hospitals values patient safety and inculcates it in the day-to-day activities of the person as well as groups of individuals. These cultures cultivate psychological safety, which puts the staff in a position to take interpersonal risks, diagnose and solve problems, and learn by experience as a team facing the frontline of the care delivery *(Mu et al., 2023).* This psychological safety in surgical setting suffers to allow team members to engage in interpersonal risk-taking, which is relevant to safer patient care. Nevertheless, limited research has explored the mental or psychological safety in the operating room through the view of highly competent team members. In one study, the researchers examined these perceptions and interviewed the members of the operational team at a Category 1 trauma center of Central Texas and identified factors affecting mental safety in the OR *(Calderwood et al., 2023).*
In OR technology is increasingly being created to facilitate communication, and situational awareness. The use of systems that provide real-time data (e.g. vital signs, surgical progress) also available to the whole staff, enhance common ground. The use of recording technologies enables post-operative debriefing and transform the OR into a learning laboratory, in which the interpersonal communication can be scrutinized and returned to better *(Lin et al., 2023).* Although the importance of communication in enhancing surgical outcomes is openly accepted, it is necessary to understand the human factors and cognitive subject to ensure that the operational communication is made successful or not. The recent literature examined the reasons behind communication failures, implicit communication, shared mental model, cognitive workload, and changing roles of team members in the OR *(Shah et al., 2023).*
One of the best methods of minimizing surgical errors is through improving situational awareness (SA). SA is the perception of pertinent information, the interpretation of these data in context, and predicting the future to handle high-risk dynamic surgical situations. Studies show that a great number of intraoperative mistakes happen due to preoccupation or lack of good preconception or intrusion as opposed to technical breakdown. Virtual training programs that focus on real-time decision-making can be used to enhance individual and team SA to strengthen collaboration, minimize miscommunication, and prepare surgical teams to respond to the unexpected event, which holds a significant role in human life. Integration of SA training in surgical training also equips non-technical competencies that are necessary in enhancing patient safety in complicated operating conditions and preventing the occurrence of errors that can be avoided *(Kwon et al., 2023).*
Poor communication does not only play a role in direct harm to a patient, but it also adversely

affects the functionality of ORs and the use of resources. Lack of efficient communication may lead to delays, unnecessary requests of instruments, misunderstanding of the procedures, and the lack of questions answered. Such inefficiencies cause longer surgery times, which may result into more risks of complications including healthcare infection of the surgical sites. Research indicated that the teams that obtained specific communication and teamwork training achieve superior OR results (fewer non-operative time and high on-time commencement of the next cases). The gains help to improve patient flow and decrease operating costs, reduce staff stress and burnout *(Arad et al., 2023).*

The most serious, avoidable surgical incidences, including retained equipment or wrong surgery site, are key patient safety issues. Strong communication practices, following surgical safety checklists, proper team briefing documentation, and accountability culture have been singled out as predictive factor of preventing the above incidents by predictive modeling of large datasets *(Domenghino et al., 2023).*

Although almost ten years of intervention by some of the largest healthcare organizations had been conducted, wrong-site surgery is still a patient safety issue of great concern. Despite the introduction of surgical safety checklists and other preventive tools to curb such incidences, cases of such mistakes continue to be reported. In the recent past, there has been research on the effectiveness of these tools, the perceptions of the personnel who are supposed to use the tools and institutional compliance. The results show that overall patient safety has increased and operating room employees tend to have a positive attitude toward these programs, but it is still not clear how checklists and other materials have a direct effect on preventing wrong-site surgeries *(Sparling & Cooper, 2024).*

Team communication during the intraoperative case is vital in ensuring the surgical outcome is at its best and preventable errors are reduced. With time pressure, surgical teams that are multidisciplinary such as surgeons, anesthesiologists, nurses, technologists, and technicians, structured and clear communication is fundamental to patient safety as well as time efficiency of the team. Intraoperative communication with nurses in Canadian hospitals, as reported in observational studies, had a failure rate of about 30%. The most frequent errors were insufficient information, unclear guidelines and time-latency, which were some of the factors that led to delays and increment in the risk of patient harm *(Morohashi et al., 2023).*

Communication dynamics are also influenced greatly by environmental elements like noise in the environment. In the context of abdominal surgeries, the loud environment failed to lower the level of communication between patients and doctors, but lowered the level of communication between patients and surgical technologists, which indicates that the large noises can disrupt the efficiency of coordination among employees*(Y. Liu et al., 2024).* implying that some special procedures are necessary to coordinate both the surgery and the imaging process *(Ding et al., 2024).*

Extensive studies of intraoperative communication reveal that there are a number of obstacles to effective teamwork in communication such as time limitations, noise, role ambiguity, and hierarchies. Ineffective communication is often a common cause of events and mistakes during surgery. Some things that would be utilized to enhance communication are held staff briefing, constant information flow, interactive training among team members, and building a psychologically safe environment. The authors also note the need to conduct additional research to investigate the main features of real-time communication behaviors and interventions, which would positively influence the process of interprofessional collaboration in the high-stress OR setting *(Shin & Baek, 2024).*

The effectiveness in communication is also a critical factor that involves team structure and team dynamics. Based on social network analysis, it has been shown that healthcare teams with a well-linked system and a free channel of communication are more coordinated, achieve excellent patient safety, and make fewer errors. Rigid hierarchies and lack of or limited exchange of information, on the other hand, are related to high levels of breakdowns in communication.

Such results justify the adjustment of the team organization and specific communication interventions to increase the information flow within the team and improve patient outcomes *(Hargestam et al., 2024).*

The American Heart Association has worked out a thorough review to provide the summary of what existent literature says and what can be done to minimize the risks of perioperative and human errors in cardiac surgery. Although a large body of knowledge is available on the procedures, approaches to cardiopulmonary bypass, ways of reducing retained objects or infections, in this instance, more focus was placed to social, personal, and systemic factors affecting cooperation, in this case, the communication between cardiac surgery OR personnel and other unit crews. The results revealed the relevance of intra- and inter-team communication to improve surgery outcomes *(Hargestam et al., 2024).*

Communication breakdowns may happen at any point in the patient care process but frequent breakdowns do happen because the surgical attendants and other caregivers fail to communicate effectively which is regularly complicated by role definitions. Standardized read-backs, structured handover methods, arranged exchanges and clearly defined triggers that necessitate contact with an assisting surgeon all are some of the mitigation measures that can be employed. The issue of limited space, time, cognitive load, attention on sensory information, and the use of equipment is strengthened even more than in the currently studied open-heart surgery. Any delay in operation at the critical stages of surgery may lead to an irreversible injury in the essential organs of the body, which highlights the importance of programming and achieving the overall duration of the procedure took in general. Teamwork, smoothness of the interaction between the staff, and maximum efficiency in the use of tools and machines are thus required. It is essential to predetermine intraoperative events and provide the team-members with an ability to react accordingly to attain the goals of the surgery *(Liu et al., 2025).*

Collaboration is also becoming a known indicator of effective outcomes in surgery and a principle of quality care. Nevertheless, the absence of standard and reliable measures in measuring performance of teamwork poses a great challenge to research and training. The input-process-output (IPO) model facilitates the investigation of surgical team dynamics because it is a fundamental model, but it is essential to confirm the measurement tools further to be able to measure the multidisciplinary team performance and influence interventions (*Emara and Eissa, 2025).*

Although it is acknowledged that communication is very vital, the underlying factors behind most surgical mishaps are not well known. One of the suggested ways to systematically gather the information on errors is incident reporting. Secondly, there has been an emergence of studies involving the use of audio and video surveillance to examine the communication habits, such as frequency, flow, and content, aiming at associating particular behaviors of communication with the outcome of surgery. These methods will seek to offer objective data, which is used to design interventions that enhance collaboration intraoperatively and patient safety *(Rezaei et al., 2025).*

Breaks in the surgical flow have a considerable impact on the error rates and the use of time in the operating room (OR) on an individual basis. An inquiry into disturbances caused during surgery found out that it was caused by various factors disrupting successful operation processes that included failures of equipment, time wastage during the operation and breakdown of communication. These disturbances were linked to the long working hours and significant rise in number of surgical errors. Notably, most of these interruptions were avoidable and in most cases it was caused by either poor preparation before surgery or lack of team work. The paper has stressed out that unnecessary breakages and improving preoperative communication are significant to maintain the flow of the surgery. In general, the results justify the use of team training and with guidelines in order to enhance the productivity of OR operations and mitigate the risk during intraoperation *(Hussain et al., 2021).*

Communication and collaboration also have an impact on patient safety in the OR. It has been

identified that ineffective communication, equipment failure and lack of adherence to laid down procedures are the leading causes of the intraoperative errors and near misses. Such safety hazards are often caused by the delegation of tasks, absence of teamwork, and distraction with the environment instead of technical incompetence. The research indicated that defining tasks, use of checklists, and team briefings are very effective in enhancing efficiency and minimization of risks. These results confirm the significance of the systematic communication, active precaution of safety, and ethos of the collective responsibility in surgical care and include the advocacy of system-wide planning to avoid preventable harm *(Silver et al., 2020).*

According to further research, the majority of surgical errors are caused by teamwork, communication, and procedural system failure but not by the technological shortage. Some of the common causes have been identified as poor exchange of information, poor definition of roles to be filled and poor communication amongst members of the team. Organizational and human factors are essential predictors of patient safety since many of these errors are only avoidable in routine operations. The research has provided an opportunity to consider that proper preoperative planning, disorganized communication, and systemic interventions are crucial to error reduction, which exploits the definition of successful collaboration and communication and its significance in high-stakes clinical settings *(Wheeler and Acord-Vira, 2023).*

The review of malpractice claims and adverse event data also show that communication failures most commonly happen during intraoperative management, preoperative preparation, and handoffs of a patient. Common issues encompass inaccurate delegation, unfinished information transmissions and un-checking of important activities. Such problems are usually caused by structural issues and ineffective communication habits as opposed to incompetence in the clinical setting. The study established that a number of adverse events could be prevented by using interventions like checklists, standardized handoff and continuous communication. It also emphasized that institutional measures are necessary to facilitate cooperation and interaction, which eventually leads to improved patient safety and minimizes harm that can be prevented *(Hijazi et al., 2025).*

Training on simulation has become an effective method of trainers to develop pivotal non-technical skills, such as decision-making, coordination, leadership, and communication skills. Best practices in designing realistic training scenarios mean that the participants of the process receive important educational experiences. The review made a significant point in the use of structured debriefing and evaluation tools in order to reinforce the lessons learned and note errors. In diverse fields of medicine, simulation has been demonstrated as a tool of enhancing the quality of collaboration and safety outcomes in the patients. Simulation that is integrated into regular training programs is a proactive way to train healthcare professionals on the high-pressure clinical environment, which reduces the risk of making mistakes in practice *(Latella, 2024).*

The teams which got through an organized training showed enhanced cooperation, reduced mistakes in communication, and got to perform their tasks more efficiently in the procedure. Interactive training involving multidisciplinary trainers that focused more on team behaviors as opposed to individual skills proved to be the most successful. The results indicate the need to incorporate whole team-based teaching in the process of training surgical educational approaches in order to enhance patient safety, decrease the number of mistakes during operations, and develop collaboration within high-stress surgical settings *(Berryman et al., 2020).*

poor communication, poor monitoring, flawed decision-making and complexity in the organization- more than technical incompetence were more likely to lead to errors. This paper has shown how cardiac surgery teams are prone to human losses owing to dependence on complex machinery and coordination that cut across disciplines *(Herriott and McNulty, 2022).*

The importance of non-technical skills (NTS) lies in the probability of promoting efficiency and safety in surgery. The main ones are leadership,

collaboration, interpersonal communication, situational awareness, and decision making. Their interpersonal skills and cognitive skills have been shown to have a strong presence in determining the outcomes of the surgical procedures and especially in situations that are dynamic or high pressure. Technical skills are required, but the overall performance of the surgery is usually determined by non-technical skills. It was noted in the study that NTS should be taught and evaluated in surgical education and certification programs. Virtual education and organized methods of behavioral evaluation were suggested to be the part of an effective approach to optimize team performance and reduce human error in the OR *(Askari et al., 2020).*

Inability to perceive, comprehend or react to the alterations in the operating room is one of the central causes of intraoperative errors. It is observed that situational awareness (SA) training programs can increase the perception level, decision-making, and future prediction of diseases. The learning concepts developed through simulation enable the surgical staff to train where the cues and the distractions are to be avoided and the events that are unfamiliar so to react in real time. Better situational awareness will decrease chances of human error and enhance collaboration, communication and better performance of a task. Training of cognitive skills during surgical education helps to improve concentration and alertness and collaborative learning, which eventually contributes to safer patient care *(Yunus et al., 2024).*

Mistakes in the OR regarding medication administration through wrong dosage, mislabeled materials or miss placement as well is common but not incurable and can lead to serious harm in a patient. The methods of minimizing such errors are color coded syringes, standard labeling, the utilization of two checks, and the utilization of pre-loaded medications. Also, one should promote the non-punitive culture based on mistake reporting and learning. Training on medication safety and use of technological tools like bar codes scanning is also done on a regular basis to enhance accuracy. Strict administration protocols and practices allow OR staff to improve patient outcomes and decrease medication risks *(van Dalen et al., 2022).*

An operating room (OR) should be organized to reduce any surgical complications and improve the performance. Research shows that poor process efficiency, lack of effective equipment system, ambiguity in personnel roles and improper layouts are among the factors that add to interruptions and avoidable errors. Religion This method of teamwork, task distribution, and frequent use of preoperative safety checklists are essential steps to be taken to minimize errors. Focus, communication, and situational awareness are also the factors, which depend on environmental factors such as comfort, noise control, and adequate lighting. Team briefings and debriefings and scheduling and monitoring technology enhance efficiency in the workflow and cognitive load, which contribute to safer surgical environments *(Ghobadian et al., 2021).*

Hurdles to the communication of mistakes in high-stakes environments like intensive care units and OR units have been described in detail. The lack of anonymity in reporting, fear of punishment, and organizational support, as well as blameful culture, represent major challenges. Reporting is also discouraged by time constraints, as well as poor feedback mechanisms. The studies highlight that providing those with the support of leadership, psychological safety, and education regarding the necessity of reporting mistakes is necessary to establish the culture that would encourage those to see the mistakes as factors of the learning process rather than personal failures. It has been revealed that such structural changes minimize frequent errors and enhance patient outcomes, which confirms the role of transparency and accountability in healthcare *(Pasquer, Ducarroz, et al., 2024).*

The strategies that have been developed to decrease the number of surgical errors are based on the improvement of both technical and non-technical skills. Principles encompass group training, reflective learning, practising with deliberation, immediate feedback and simulation-based training. These measures enhance communication, situational awareness, decision-making and coordination, the skills required in

high-risk settings such as the OR. It has been indicated that one should not rely on conventional training since systematized evidence-based team training proves to be more effective as it enhances anticipation skills, good response, and avoidance of mistakes, which develops a culture of safety and continuous enhancement The efficiency and error rates are also direct results of the organization of operating rooms. Inadequate working environments, lack of role definition and interruptions in the workflow cause time wastage and high levels of error repetition. On the contrary, considerate planning of OR space such as prioritization of ergonomics, specific role, lighting, and minimization of noise aids crew concentration, sense of context, and continuity in surgery. Multilevel strategies such as integration of technology, reorganization of the organization, systematic communication terms and non-technical skills development, have proved very beneficial in minimizing the avoidable harm. Patient safety is further reinforced through simulation-based training and the creation of a culture that is not punitive when it comes to errors made. It is necessary to have regular institutional commitment so that the safety practices are adhered to, tracked, and enhanced continuously *(Eva et al., 2024).*

In Third World countries like Pakistan, there are a few studies on the topic of intraoperative communication. Nevertheless, communication-related errors are starting to be identified by local studies and literature as a significant source of wrong-site surgery and retained surgical items. Reports of tertiary hospitals in Lahore investigated poor communication as a major cause of negative surgical outcomes. Barriers and facilitators to effective interdisciplinary communication have been charted out by narrative studies, and the importance of this communication in patient safety during surgeries was demonstrated as highly important and necessary, and the strategies which can be used to enhance daily processes of communication have been identified. The results of this study highlight the importance of having a research agenda to guide standards of OR communication in these situations *(Elhoseny et al., 2025).*

On the same note, a multi-centric study conducted in Egypt found that there were significant differences in attitudes of doctors and nurses towards safety which depended on leadership support, organizational culture, workload and quality of communication. Issues of failing to report errors as a result of fear of repercussions or lack of any feedback was widespread. The presented research noted that it is crucial to develop a successful safety culture, foster the participation in safety programs, and offer specific training to minimize the number of errors and enhance patient outcomes. It was suggested to promote care quality on the critical and high pressurizing settings by a system-wide intervention that promotes open responsive and transparent safety cultures *(Danback et al., 2025).*

2.1. Research Gap

Effective team communication is a critical non-technical skill that directly influences patient safety and surgical outcomes in the high-pressure, complex environment of the operating theatre (OT). Globally, over 60% of warning signs and preventable adverse events—such as wrong-site surgery, retained surgical instruments, medication errors, and surgical site infections—are attributed to communication breakdowns *(Bokhari et al., 2025).*This issue is particularly acute in resource-limited settings such as Multan, Pakistan. As a major healthcare center, Nishtar Hospital faces a unique combination of logistical, interpersonal, and systemic challenges that impede effective intraoperative communication. Among these challenges is a deeply ingrained institutional culture that discourages junior staff from voicing concerns, further compromising team dynamics and patient safety *(Weigl et al., 2020).*

Poor communication in the OT is directly linked to severe negative patient outcomes, including medication errors, incorrect surgical procedures, and delays in handling surgical instruments (Gardner, 2023). all of which contribute to morbidity and mortality Inadequate communication also correlates with longer surgery durations, increased surgical complications, higher rates of infection, and unplanned returns to the operating room *(Alayande et al., 2024)*

RJNMSR Review Journal of Neurological & Medical Sciences Review

The OR requires coordinated effort among surgeons, anesthesiologists, nurses, and support staff to ensure patient safety and successful surgical outcomes. Despite technological advancements in surgical techniques, preventable adverse events remain a significant problem in hospitals worldwide. Research indicates that these incidents are often the result of team inefficiencies and non-technical skill deficiencies rather than a lack of professional expertise *(Atinga et al., 2024).* Ineffective communication disrupts workflow, increases the likelihood of procedural errors, prolongs operating times, and contributes to staff dissatisfaction, fatigue, and a weakened safety culture. *(Gardner, 2023).*

Understanding the relationship between intraoperative team communication, surgical errors, and patient outcomes is essential for developing targeted interventions *(Minehart & Foldy, 2025).* This study aims to evaluate existing communication practices in tertiary hospitals in Multan and their impact on surgical performance. The findings will inform the development of structured communication training programs, refinement of surgical safety protocols, and promotion of a collaborative culture in operating theatres *(Watanabe et al., 2023).*

Chapter 3
RESEARCH METHODOLOGY
3.1. Research Design
Methodology

To determine the relationship between intraoperative communication between the operating room (OT) personnel and how it impacts the outcomes of the surgery and can eliminate intraoperative errors, a quantitative cross-sectional survey design was selected. Quantitative approach has been chosen due to the possibility to check the variables (team collaboration, communication strategies and patient safety outcomes) objectively and have statistical analysis. The cross-sectional design was suitable because it ensured 16 OT personnel took part in data collection solely at one instance in time so that a group of the OT personnel could be considered as a snapshot of the current communication practices and the linkage of such practices with surgical performance.

A standardized, self-administered questionnaire, which was modified based on validated tools that have been used in such studies on the communication and collaboration in surgical teams in the pastas *(Lingard et al., 2005).*

used to gather the data. Every question in the questionnaire was evaluated by a three-point Likert scale, with 1 expressing close to agreements, 2 neutral and close to disagreements and 3 disagreements. This form allowed the participants to respond with the extent of their agreement with each statement and allowed to make a quantitative comparison of the perceptions among various professional groups. The Likert scales are popular in medical and social scientific studies because they enable measurement of the subjective attitudes and perceptions to be arranged in a systematic manner *(Sexton et al., 2006).*

3.2. Study Setting

The study was carried out in the operation theatres of Nishtar Hospital, Multan, and Al Khaliq Hospital, Multan, that are large tertiary care facilities in the area.

3.3. Target Population

The study was carried out in the theatres of operation departments of Nishtar Hospital, Multan, and Alkhaliq Hospital, Multan, both of which are large tertiary care units in the region. The target population was to include surgeons, anesthesiologists, scrub nurses, circulating nurses, operation theatre technologists and technicians employed in the operation theatres in the selected hospitals. The participants were selected to reflect all the important intraoperative care positions, and therefore a full picture of communication dynamics among the surgical team members should be obtained.

3.4. Study Duration

The proposed research took place within a duration of 4 months and this is enough time to collect and analyses data and follow up.

3.5. Sample Size

The sample size was set at 120 participants, depending on the practicality and number of employees in the sampled hospitals. The sample was determined based on a standard formula that is typically a cross-sectional study when the population size is large or unknown, which is given below (Tamoor et al., 2024)

The sample size of 120 participants was rounded-up to give sufficient representation and cover possible non-respondents.

3.6. Sampling Technique

To recruit a group of participants, a non-probability purposive sampling approach was used. Participants that took part in the study were limited to those participating who were willing to give informed consent and qualified as participants who met all the inclusion criteria.

Inclusion Criteria

The professionals who deal directly with surgical operations are operating theatre (OT) specialists such as surgeons, anesthesiologists, nurses, OT technologists, and technicians. At least six months working experience in an operating room. Available at the time when data was collected and volunteered to take part in the data collection.

Exclusion Criteria

Non-surgical or administration staff which is not directly involved in surgery. OT employees of less than six months of experience in surgery. People who failed or did not want to be included in the data collection process.

3.7. Data Collection Tool

The questionnaire was structured that incorporated: Communication Assessment Tool (CAT): It is a tool to assess the quality of intraoperative communication between members of the OT staff (Lingard et al., 2004).Surgical Safety Error Checklist: It is used to document the observed or reported surgical mistakes during operations (Lingard et al., 2004).Demographic and Professional Background Sheet: Collected some personal, professional, and work-related data about the participants.

3.8. Data Collection Procedure

The questionnaires were administered to qualified members of OT staff after they had agreed to the study. To guarantee truthful and sincere answers, the researcher ensured the confidentiality of participants and gave proper guidelines. Also, intraoperative practices were directly observed with a standardized surgical safety error checklist on live surgeries, which was allowed by the ethical review board.

3.9. Plan of Data Analysis

The SPSS version 26 was used to input and analyze the obtained data. Frequencies, percentages, and mean were used as descriptive statistics to describe the characteristics of the participators in terms of demographics and the intraoperative communication scores. Chi-square and correlation analyses were conducted to investigate the links between quality of communication and the outcomes or error rates in surgery operations. Any p-value below 0.05 was regarded as being statistically significant.

3.10. Ethical Consideration

The Times Institution Institutional Ethical Review Board admitted the study. The informed consent was given by all the participants before they were collected. All the research procedures were conducted with the high expectations of secrecy and anonymity of every participant. The participation was voluntary and the participants could pull out anytime without repercussions.

Chapter 4

RESULTS AND DISCUSSION

Results

4.1. Total number of staff member

In this questionnaire-based study, a total of 120 operating theatre staff members participated.

Table 4.1: Age distribution among all staff member

Age Group	Frequency	Percentage (%)
20–24	21	17.6%
25–29	33	27.7%
30–34	25	21.0%
35–39	19	16.0%
40–44	15	12.6%
45–49	4	3.4%
50–54	1	0.8%
55–59	1	0.8%
Total	**120**	**100%**

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& Medical Sciences Review

4.2. Age distribution among all staff member

The average age of the 120 operating room staff members in this survey-based study is displayed in Table 4.1 (Figure 4.1). Of those interviewed, 21 (17.6%) were between the ages of 20 and 24; 33 (20.7%) were between the ages of 25 and 29; 25 (21.0%) were between the ages of 30 and 34; 19 (16.0%) were between the ages of 35 and 39; 15 (12.6%) were between the ages of 40 and 44; 4 (3.4%) were between the ages of 45 and 49; and 1 (0.8%) was in each of the 50– 54 and 55–59 age groups.

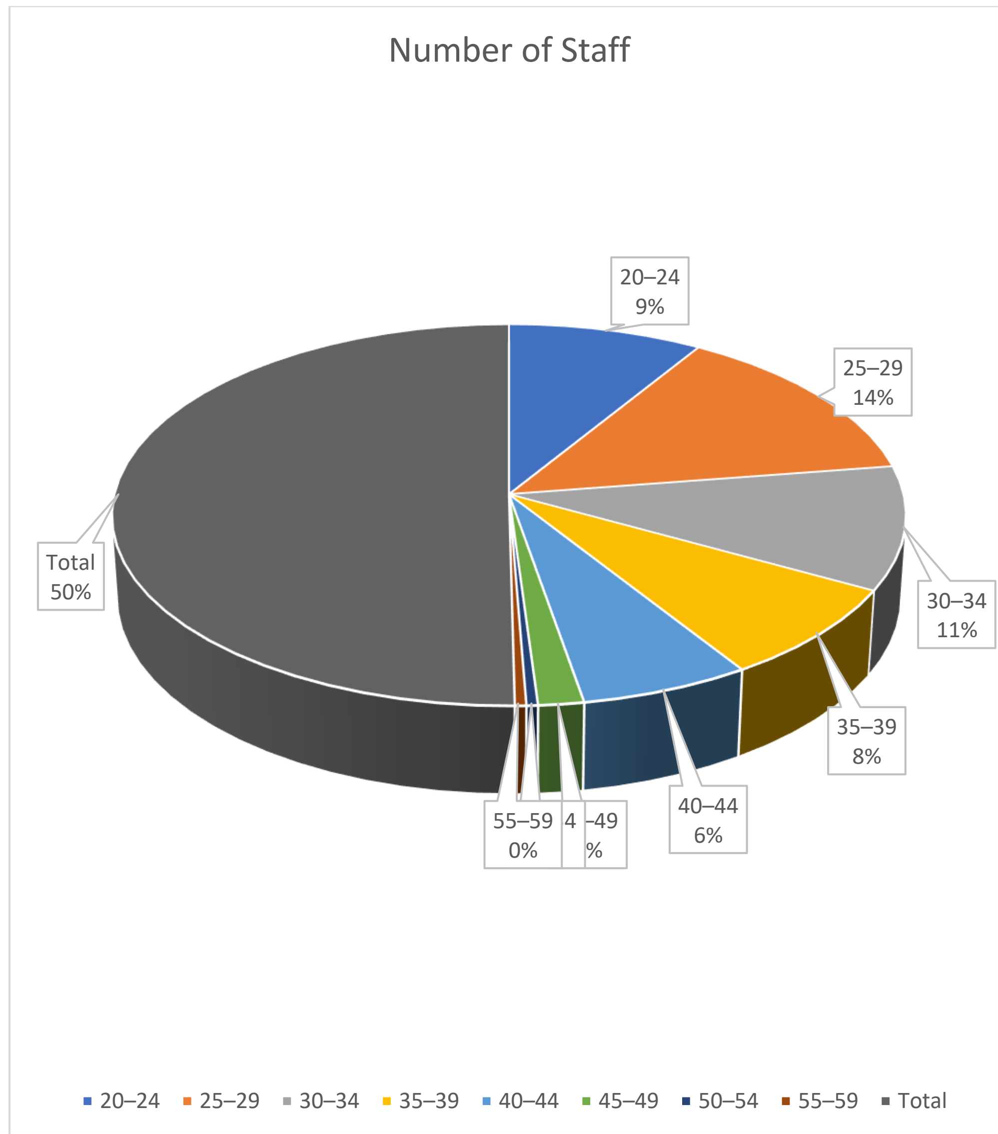

Figure 4.1: A pie chart graph displays age distribution among all OT Staff member

Table 4.2: Gender distribution among all staff member

Profession	Female	Male	Total	Female %	Male %
Nurses	66	0	66	55.0%	0.0%
OT Technicians	17	17	34	14.2%	14.2%
OT Technologists	0	5	5	0.0%	4.2%
Surgeons	1	14	15	0.8%	11.7%
Total	84	36	120	70.0%	30.0%

4.3. Gender distribution among all staff member

Table 4.2 (Figure 4.2) shows the gender and professional breakdown of the 120 operating room employees in this survey-based study. 66 (55.0%) female nurses, 34 (28.3%) OT technicians (17 males and 17 females), 5 (4.2%) male OT technologists, and 15 (12.5%) surgeons (14 males and 1 female) were included in the sample.

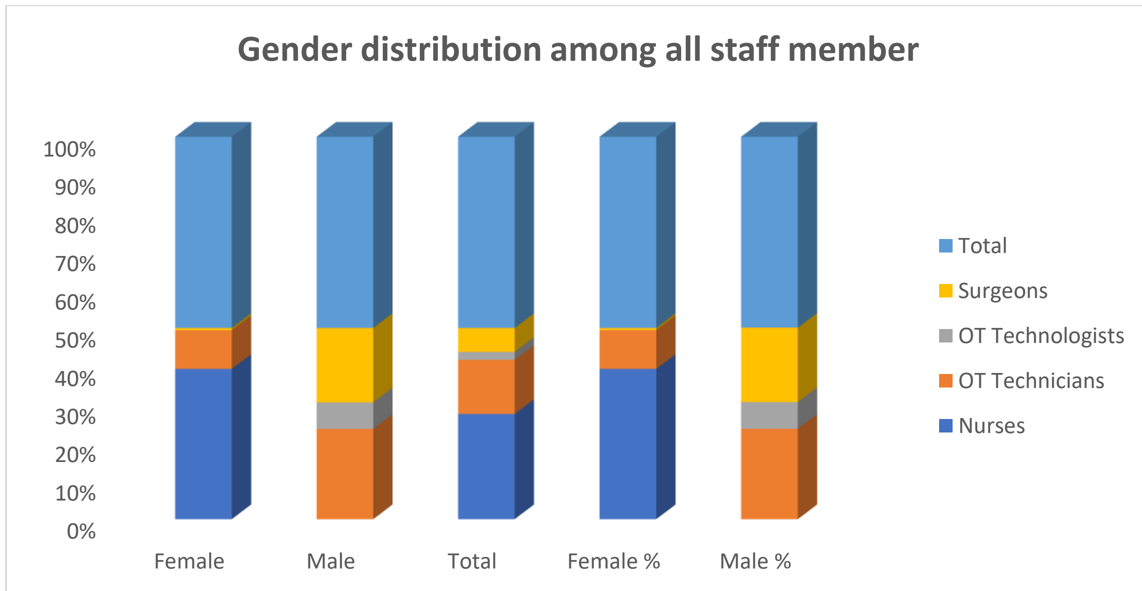

Figure 4.2: A pie chart graph displays gender distribution among all OT Staff member

Table 4.3: Distribution of Participants by Years of Experience in OT (n = 120)

Years of Experience	Frequency	Percentage (%)
< 1 year	10	8.3%
1–3 years	35	29.2%
4–6 years	42	35.0%
> 6 years	33	27.5%
Total	120	100.0%

4.3. Distribution of Participants by Years of Experience in OT

35% of surgical theatre (OT) staff members had four to six years of experience, which was followed by 29.2% with one to three years and 27.5% with a minimum of six years of experience, according to Table 4.3 (Figure 4.3) from this survey-based study. The percentage of respondents with less than a year's experience was just 8.3%. According to these results, most participants had moderate to high degree of experience, so their answers are likely to be representative of actual intraoperative procedures.

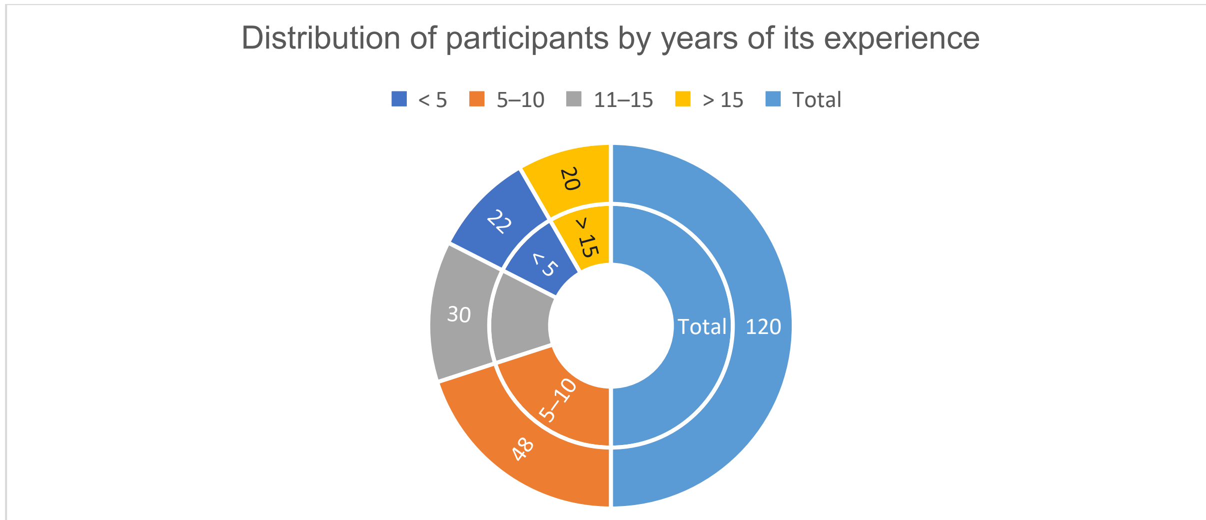

Figure 4.3: Pie chart illustrating the distribution of participants according to years of experience.

4.3: Number of Surgeries Participated in per Week

The total amount of surgeries that participants performed each week is shown in Table 4.4 (Figure 4.4). According to the results, 16.7% of participants assisted in more than 15 surgeries per week, 25% helped in 11–15 surgeries, and 40% took part in 5–10 surgeries per week. According to these findings, the majority of participants had regular and significant exposure to surgical procedures, which strengthened the validity and dependability of their opinions on during-operation communication techniques.

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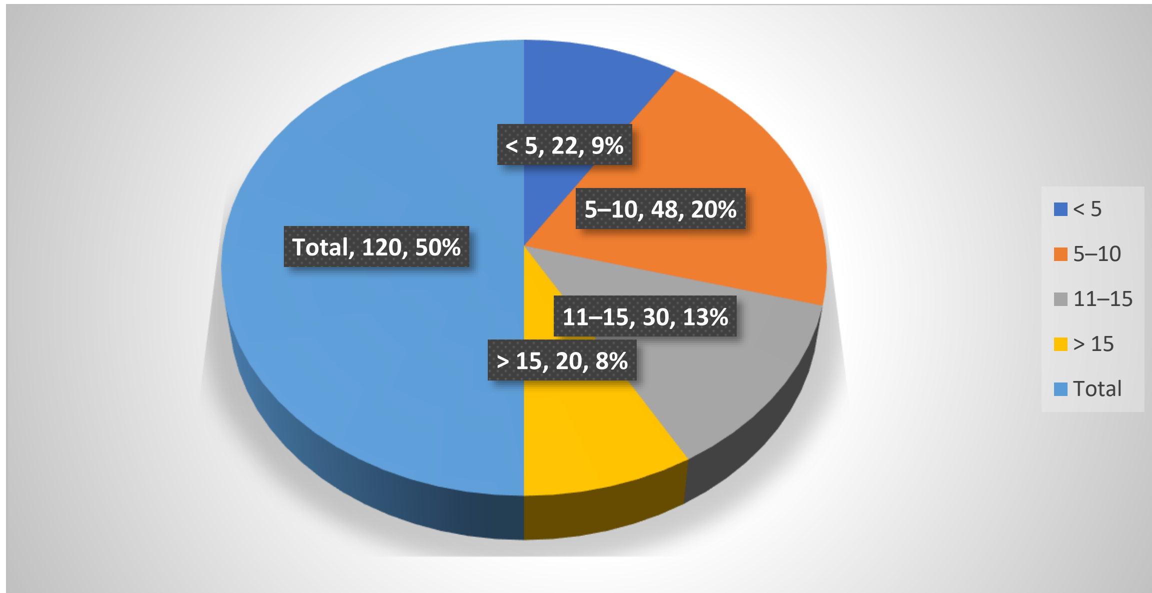
Table 4.4: Number of Surgeries Participated in per Week (n = 120)

Surgeries per Week	Frequency	Percentage (%)
< 5	22	18.3%
5–10	48	40.0%
11–15	30	25.0%
> 15	20	16.7%
Total	120	100.0%



4.4: A pie chart graph displays Number of Surgeries Participated in per Week

4.5. Intraoperative Team Communication Practices

The descriptive analysis of the intraoperative team communication practices in the operating theatre (OT) is presented in Table 4.5 (Figure 4.5).

This research employed a three points Likert scale, with 1 = Agree, 2 = Neutral and 3 = Disagree. The average rating measures the general inclination of the responses of the participants. Higher values of a means that are nearer to 1 would represent a greater degree of agreement and an overall positive attitude when it comes to the communication practice. Having a mean closer to 2 indicates a neutrality whereas having a mean closer to 3 indicates greater disagreement. Consequently, less mean score in this analysis shows greater congruency in effective intraoperative communication practices.

The results indicate different degrees of team communication efficacies among OT employees. A mean score of 1.77 was recorded on clear verbal communication with 53 percent of the respondents agreeing that there is verbal consistency in the procedures. Non-verbal communication was felt to be better as 64 percent agreed with it and only 14 percent disagreed meaning that there was a strong appreciation of body language and use of gestures in coordination in the unit.

The exchange of information was also facilitated in time where 55 percent of the participants agreed that information is shared within a reasonable time during surgical operations. Preoperative briefings were moderately supported (51% approval), but 22 per cent still disapproved, implying the unreliability in the regular practice of preoperative briefing.

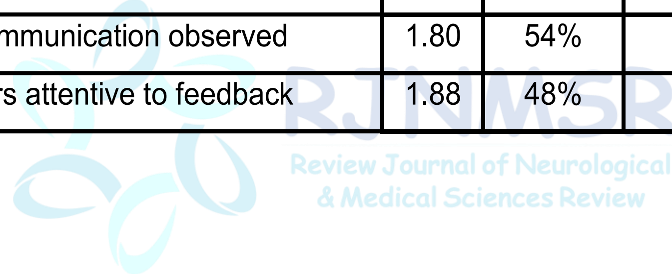
There was relatively low support in terms of standardized communication protocols where only 46 per cent of those surveyed agreed and 22 per cent disagreed showing dissimilarity in following standard guidelines of communication. Likewise, 50% of participants reported that unadopting a structured documentation method, such as written documents (like notes and checklists) were also resourcefully used, with a significant level of participants being either neutral or opposed, with.

Transparent communication between hierarchic levels showed the least level of agreement (42 percent agree, 29 percent disagree), showing that the hierarchical barriers which might prevent transparent flow of information still persist. On the other hand, respectful communication received a better perception, with only the majority of 54 in agreement and minority of 18 in disagreement which may signify that the working

environment is generally professional and cooperative.
Sensitivity to feedback was moderately supported (48% agree, 20% disagree), so it is possible to enhance the creation of the culture that prioritizes feedback continuously and positive dialogue.

Table 4.5: Intraoperative Team Communication Practices in OT

Item	Mean	Agree %	Neutral %	Disagree %
Clear verbal communication is maintained	1.77	53%	31%	16%
Non-verbal cues are understood	1.72	64%	22%	14%
Information shared timely among OT staff	1.79	55%	29%	16%
Pre-op briefings improve preparedness	1.85	51%	27%	22%
Standardized communication protocols are followed	1.90	46%	32%	22%
Written notes/checklists used effectively	1.83	50%	28%	22%
Communication across hierarchy is open	1.96	42%	29%	29%
Respectful communication observed	1.80	54%	28%	18%
Team members attentive to feedback	1.88	48%	32%	20%



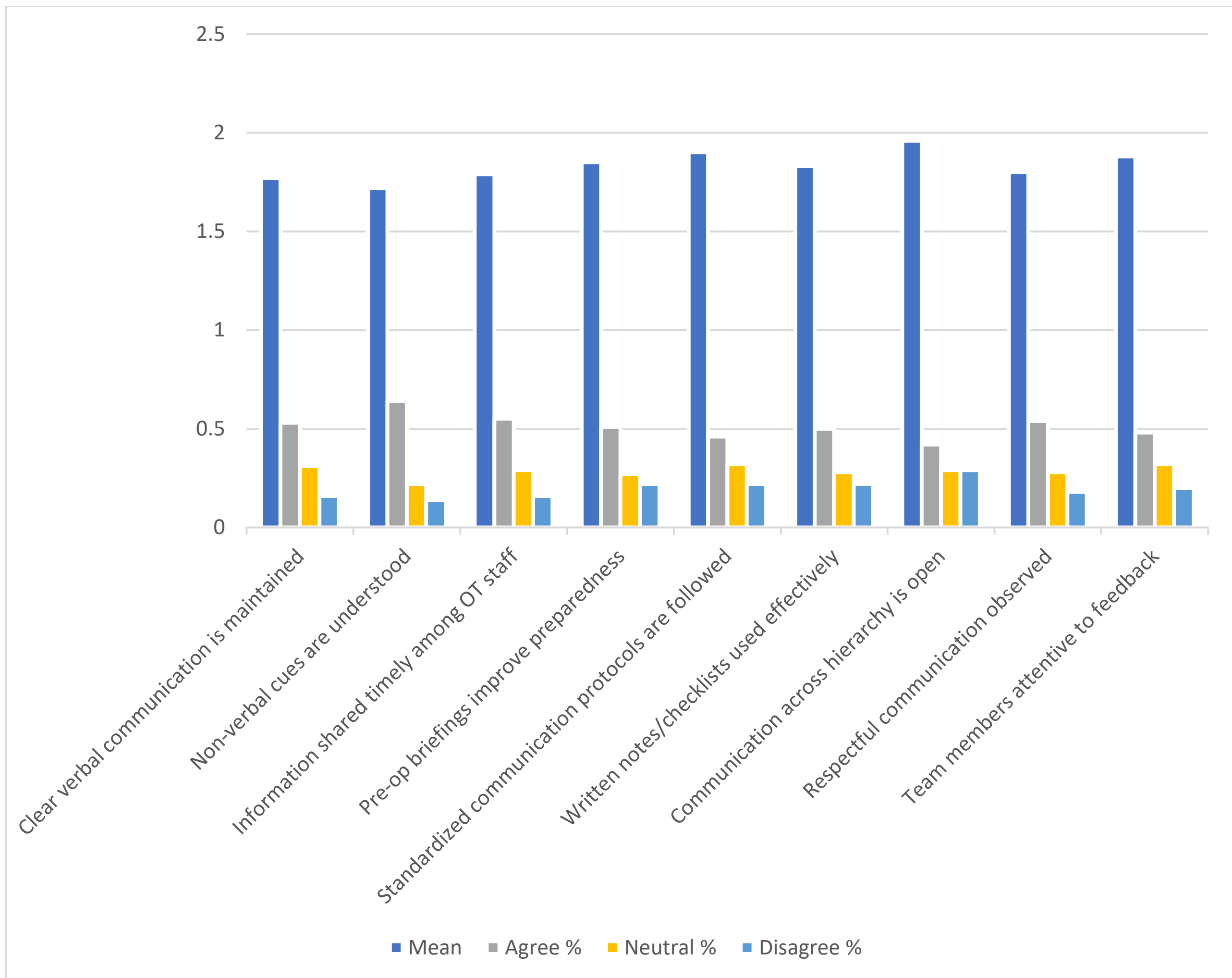


Figure 4.5: A pie chart graph displays intraoperative team communication practices

4.6. Impact of intraoperative team communication on Surgical Outcomes

Table 4.6 (Figure 4.6) demonstrates the perceived effect of the intraoperative communication of the team on the outcomes of surgery. The quote "Effective communication results in less smooth operations has been supported by 49 percent of the respondents with the mean of 1.78. Given that the mean values are lower to indicate the stronger agreement, the results may indicate that almost half of the participants are aware of efficient communication being one of the key factors of workflow efficiency during surgery.

Attitudes to whether communication mistakes are connected to post-operative complication were split. Although 41% of the respondents said that communication errors led to complications, 33% of them said otherwise. The average (1.93) is the measure of this inconsistency in opinions, as the staff appeared to be more or less in agreement concerning the role of bad communication in the negative consequences of surgical events.

Equally, there was a mixed perception as presented by the statement that communications instill more coordination between surgeons, anesthetists, and nursing staff. The percentage that agreed was only 41 but disagreed was 37 and the average score was 1.96. This is an indication that despite the fact that numerous respondents recognize the significance of communication in interdisciplinary coordination, a significant percentage may not always realize the benefits of communication in its daily application.

The importance of teamwork in the decrease of intraoperative delays received more positive perception. The agreement rating of 46% and the mean score of 1.83 indicate that most respondents tend to believe that collaborative communication can help to provide an easy transition during the intraoperative process. Nonetheless, the percentage of disagreement (29) shows that the state of delays is not always ascribed to the lack of communication and is sometimes determined by the logistical or systemic effects as well.

Table 4.6. Impact of intraoperative team communication on Surgical Outcomes

Item	Mean	Agree %	Neutral %	Disagree %
Effective communication → smoother procedures	1.78	49%	24%	27%
Communication errors → complications	1.93	41%	26%	33%
Communication enhances coordination	1.96	41%	23%	37%
Teamwork reduces intraoperative delays	1.83	46%	25%	29%

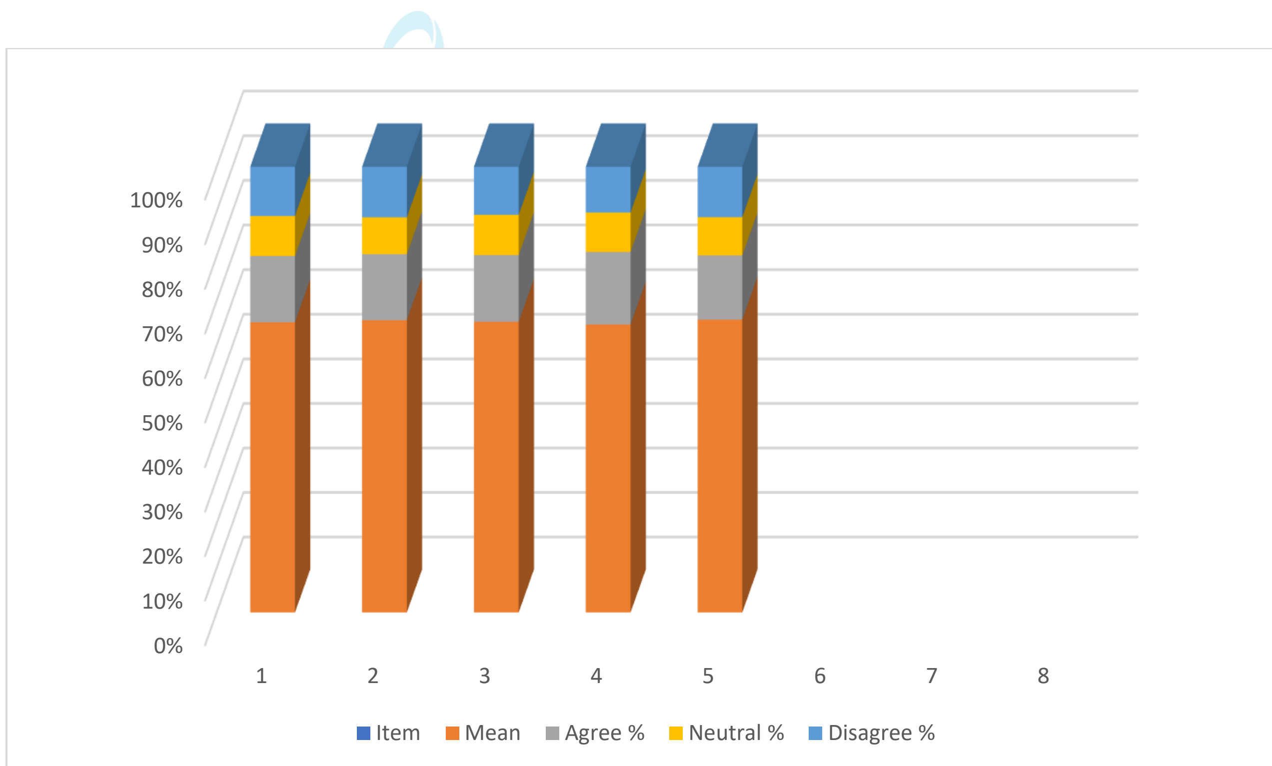


Figure 4.6: A pie chart graph displays impact of intraoperative team communication on surgical outcomes

4.7: Error Prevention through Communication

Figure 4.7 (Table 4. 7) summarizes the perception of the participants on the issue of error prevention by communication. Speaking of the phrase that the errors in communication often lead to errors, 43 percent of the interviewees accepted this claim

with an average of 1.89. Nevertheless, a third of people did not agree, which proves that despite the fact that relatively significant percentage of employees acknowledge errors caused by communication malfunction, other people believe that the mistakes are caused by other factors, e.g., technical problems or system limitations. In the case of the item that concerns timely communication and avoidance of wrong-site or wrong-procedure events, 43% of the people encountered agreed, whereas 33% disagreed with the item producing a mean score of 1.91. This is an expression of inconsistency in opinion and implies uncertainties among staff on whether communication is effective in the prevention of major surgical errors. The fact that teamwork lowers the risk of infection was agreed to by 43% and had a mean of 1.88. However, 31 percent of the respondents differed, which means that there are divided opinions that collaborative communication can have direct effect on postoperative complications, including surgical site infections. The statement about the structured communication and the necessity of reducing re-interventions was considered more positively with 46% of agreement and lower mean score of 1.83. Nevertheless, 29% of them said they did not agree, which means that even though structured briefing and standardized practices are deemed to be useful, their applicability will not necessarily be uniform among all teams. Lastly, postoperative debriefings to prevent repeating the same errors caused varied effects as 42% believed that they should be the same or disagree with 33% and the mean score was 1.92. This shows that reflective team discussions, despite being seen as moderately important, have uncertainly good results in practice.

On balance, the results indicate a moderate recognition of communication as an important element in preventing errors, with also much room to enhance the perceptions, which is a significant indication of the necessity to enhance and standardize communication practices in the operating theatres.

Table 4.7: Error Prevention through Communication

Item	Mean	Agree %	Neutral %	Disagree %
Failures in comm. lead to errors	1.89	43%	26%	32%
Timely communication prevents wrong site/procedure	1.91	43%	24%	33%
Teamwork reduces infection risk	1.88	43%	26%	31%
Structured communication → fewer re-interventions	1.83	46%	25%	29%
Post-op debriefings prevent recurrence	1.92	42%	25%	33%

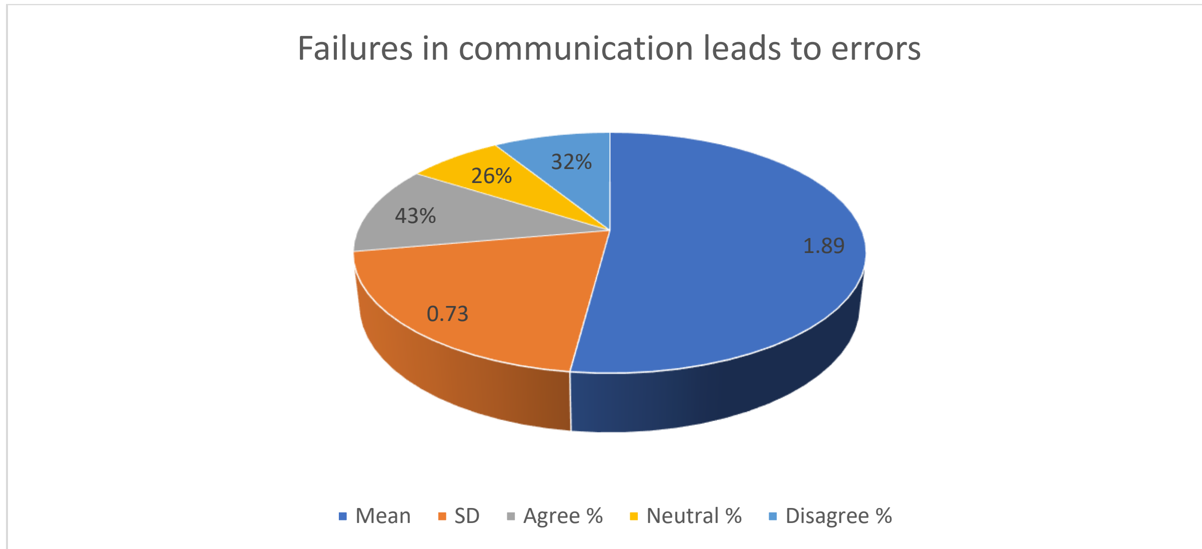


Figure 4.7: A pie chart graph displays Error Prevention through Communication

4.8: Barriers to Effective Communication

The curves regarding the perception of the participants on what hinders effective intraoperative communication are shown in Table 4.8 (Figure 4.8).

The fourth communication barrier that was found as a barrier of seniority and hierarchy by the respondents making 42 percent of the total meaning and a mean score of 1.90. Though, 32% were opposed to that, meaning that although hierarchical culture still can play a role in communication processes within the operating theatre, its perception differs across the staff members.

Time pressure showed the same pattern and had 42 percent agreement and 32 percent disagreement(M=1.90). These results indicate that time pressure at work during surgical practice is commonly discussed as one of the current impediments to free and effective dialogue. Many of the participants (43 percent) approved high workload and understaffing with the mean score slightly lower (1.88). However, 31% of the respondents said they disagreed on this, indicating that their experience varied with staffing rates, complexity of cases, and workload distribution. It implies that the resource constraints can also be a factor to consider regarding communication failure, even though the perceived effect is not equal among all members of staff. The 43 percent of the respondents also supported inadequate training (M = 1.88) though, 31 percent disagreed. This indicates that the quality of intraoperative contact can be hindered in case of the deficiency of the formal communication training or team-based education, but 32-percent of the respondents disagreed (M = 1.90). It means that the environmental factors like ambient noise, equipment alarms, and mobility in the OT are taken into consideration as able to affect the quality of communication, and the disruptive influence does not necessarily have an equal effect on all of them.

Table4.8: Barriers to Effective Communication

Item	Mean	Agree %	Neutral %	Disagree %
Hierarchy/seniority	1.90	42%	27%	32%
Time pressure	1.90	42%	27%	32%
High workload/understaffing	1.88	43%	26%	31%
Inadequate training	1.93	42%	23%	35%
Distractions/noise in OT	1.90	42%	27%	32%

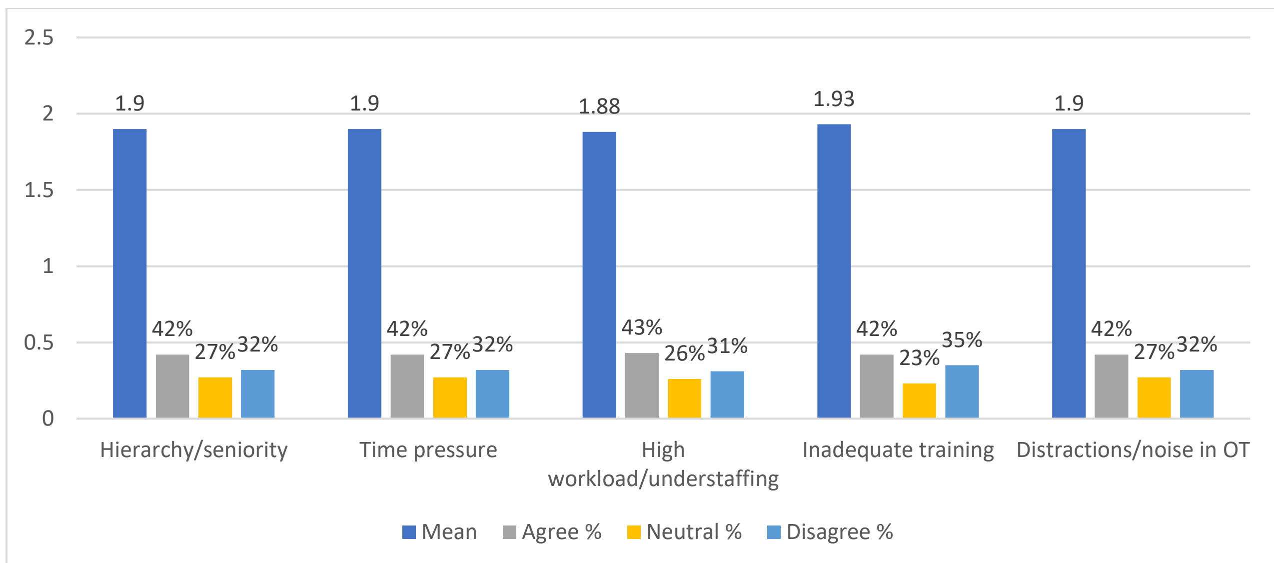


Figure 4.8: A pie chart graph displays barriers to effective communication

4.9: correlation of surgical outcomes and intraoperative team communication practices

The correlation analysis, which determines the links between the practices in intraoperative team communication and surgical outcomes and error prevention, are presented in Table 4.9. The impact of team communication practices intraoperatively on a surgical outcome was found to have a high significant positive correlation ($r = 0.87$, $p < 0.001$). This means that there is a strong correlation of increased successful communication in the operation theatre with improved surgical performance in terms of better working flow, greater coordination, and less surgical delays. The team communication practices in terms of intraoperative error prevention had a moderate positive relationship ($r = 0.32$, $p < 0.001$). It is of lesser strength than the association with surgical outcomes; this statistically significant relationship is enough to indicate that the broader better communication is, the more significance is attached to this subject as concerns the reduction of intraoperative errors.

On the same note, the moderate positive correlation in the outcomes of surgical procedures and error prevention ($r = 0.32$, $p = 0.001$) was recorded. This observation means that the lower the error rate, the better the surgery results, which supports the interdependence of communication

in promoting both operational and patient efficiency. safety.

Table4.8: correlation of surgical outcomes and Intraoperative team communication practices

Relationship	r	p-value	Interpretation
Intraoperative Team Communication Practices ↔: Impact on Surgical Outcomes	0.87	<0.001	Very strong positive correlation
Intraoperative Team Communication Practices ↔ Error Prevention through Communication	0.32	<0.001	Moderate positive correlation
Impact on Surgical Outcomes ↔ Error Prevention through Communication	0.32	<0.001	Moderate positive correlation

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4.10: series of Chi-Square tests were conducted error prevention and evaluate the association between items measuring surgical outcomes.

Table 4.10 shows the findings of Chi-square tests performed to consider the relationship between variables of surgical outcome and preventive measure of errors associated with the procedure of intraoperative communication. The results showed that successful communication resulting in a smoother operating process was greatly related to the majority of the error prevention items such as communication failures being one of the most prominent causes of the error during surgery (kh2 = 15.7, p = 0.003), timely communication as a way of avoiding wrong site/procedure errors (kh2 = 12.3, p = 0.015), team work as a way of preventing infection (kh2 = 10.3, p = 0.036) and structured communication as a way to avoid But the communication in the process of debriefing assisting in avoiding the repetition of errors was not statistically significant (kh2 = 8.5, p = 0.076).In the analysis of the role of communication errors as causes of complications, it was noted that there were significant associations between communication failures and surgical errors (kh2 = 11.9, p = 0.018), timely communication and wrong site errors (kh2 = 9.8, p = 0.043) and structured communication and re-intervention errors (kh2 = 12.6, p = 0.013) and debriefing errors (kh2 = 15.2, p = 0.004). Nevertheless, there was no substantial association between the occurrence of communication errors and team work mitigating the risk of infection (kh2 = 7.2, p = 0.124). In addition, the communication that improves coordination had a significant relationship with the prevention of wrong site errors (kh2 = 16.8, p = 0.002) and errors due to communication failures (kh2 = 13.6, p = 0.009), but the relationship with re-interventions was marginally insignificant (kh2 = 9.4, p = 0.051). On a similar note, teamwork that minimized the delays intraoperative fell apart with substantial correlations with surgical errors (kh2 = 14.5, p = 0.006), timely communication (kh2 = 10.9, p = 0.028), and reduction in risk of infection (kh2 = 12.1, p = 0.017; kh2 = 13.8, p = 0.008), but not with re-interventions (kh2 = 9.0, Lastly, communication affecting recovery and surgical outcome had statistically significant relationships

with all key error prevention problems strengthening the belief that intraoperative communication is key in reducing surgical errors which in effect enhance patient outcomes.

Table4.10: Chi-Square Test Results summary.

Communicating Item	Error Prevention Item	χ² (Chi-square)	p-value	Significance
Smoother operations	Failure errors	15.7	0.003	Significant
Smoother procedures	Avoiding wrong site	12.3	0.015	Significant
Fewer procedures	Smaller infections	10.3	0.036	Significant
Smoother procedures	Re-interventions	8.5	0.076	Not Significant
Smoother procedures	Debriefing averts repetition	14.1	0.007	Significant
Post-operative complications	Failure-related errors	11.9	0.018	Significant
Post-operative complications	Avoiding wrong side	9.8	0.043	Significant
Post-operative complications	Decreased infections	7.2	0.124	Not Significant
Post-operative complications	Re-interventions	12.6	0.013	Significant
Post-operative complications	Debriefing avoids repetition	15.2	0.004	Significant
Coordination	Failure coordination errors	13.6	0.009	Significant
Coordination	Avoiding wrong site	16.8	0.002	Significant
Coordination	Reduced infections	11.2	0.024	Significant
Coordination	Re-interventions	9.4	0.051	Marginal
Coordination prevention	Debriefing	12.9	0.012	Significant
Teamwork	Failure errors	14.5	0.006	Significant
Teamwork	Avoiding wrong site	10.9	0.028	Significant
Teamwork	Less infections	12.1	0.017	Significant
Teamwork	Re-interventions	9.0	0.061	Not Significant
Teamwork	Debriefing prevents recurrence	13.8	0.008	Significant

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Discussion

The present research examined how the role of intraoperative communication among operating room (OT) personnel affects the outcome of surgery and avoidance of intraoperative errors, which adds to the accumulating evidence that

communication is one of the key factors in determining the efficiency of a surgical process and patient safety. This discussion places this study in the context of the research of surgical safety by comparing its findings with the literature available on the subject. Generally, descriptive analysis revealed that intraoperative communication was generally positive. Respondents expressed a high degree of consensus with respect to effective verbal communication, use of non-verbal communication and exchange of information in time during procedures. The findings are in line with other studies that have highlighted that effective collaborative teamwork in highly stakes setting like the operating room requires timely and accurate communication (Lingard et al., 2004). It is interesting to note that 64 percent of employees appreciated the role of non-verbal communication, which supports the claims by Manser (2009) that gestures, eye contact, and body positioning can support verbal communication, especially in busy or noisy surgery rooms.In spite of these advantages, the study presented the gaps in organizational support and compliance on standardized communication protocols. Only some half respondents said that they were guided by formal standards of communication and a short 42 per cent said that there was open communication across hierarchies. This is consistent with the results of Sexton et al. (2006), who emphasize that strict hierarchies in healthcare may prevent subordinates in the health sector to speak and thus may prevent critical safety data. These conflicting trends highlight the two-sided nature of the role of communication in surgical teams as it is assumed that communication is vital, but structural and cultural impediments can undermine such processes, in line with Flin et al. (2006) who noted that leadership, teamwork culture, and organizational norms are equally vital to provide safe surgical care as the technical skills.

One of the most important conclusions of the study was that there was a strong positive correlation between intraoperative communication practices and the outcomes of surgery ($r = 0.87$, $p < 0.001$). This means that improved coordination, reduced delays and efficient surgical processes are synonymous with effective communication. High-quality reporting communication was also reported to have better surgical outcomes by staff. This is supported by the previous studies, such as Makary et al. (2006) and Lingard et al. (2004), which have found communication failures to be a key cause of surgical errors, time loss, and inefficiency in processes. In the same vein, Nagpal et al. (2010) observed that only about 43 percent of technical errors during surgery were associated with communication breakdown, and in this respect, we need to conceptualize communication as a technical skill and not only as a soft interpersonal quality, since it directly influenced the coordination, predictability of surgical requirement and continuity of operations.

Intraoperative communication was also discussed in preventing errors. The degree of correlation was moderate and statistically significant between communication and error prevention ($r = 0.32$, $p < 0.001$). Analyses by chi-square also showed that 21 of 25 item-pair relationships between communication and error-prevention scales were significant, meaning that positive attitudes towards communication are related to greater appreciation of its contribution to avoidance of surgical errors. These findings are in line with World Health Organization initiative; Safe Surgery Saves Lives (Haynes et al., 2009), which supported the claim that communication-based checklists lead to lower mortality and significant postoperative complications. Similarly, Greenberg et al. (2007) discovered that poor communication was a key driving factor in malpractice suits related to neglect of retained instruments or wrong-site surgeries, which also explains why structured communication, as an error prevention tool, is important.

Nevertheless, the fact that the association is moderate indicates that communication does not have the ability to eradicate surgical errors. Systemic influences including organizational policy, technical expertise and staffing are also important as has been observed by Catchpole et al. (2007) who observed that communication failures tend to interact with larger structural inadequacies to result in negative events. In general, the

research supports the idea that the intraoperative communication is a key to the successful surgical implementation and patient safety, yet it should be combined with systemic, technical, and organizational factors to gain the highest effect.

The study indicates that ineffective intraoperative communication is being undermined by various factors which include hierarchy, time, excessive workload, lack of training and distractions in the environment such as noise. All these obstacles have been reliably reported by the previous research. Seniority and hierarchy were mentioned by 42% of the respondents. According to Sexton, there are scenarios in which patient safety is under threat; however, young staff members do not feel comfortable to approach senior surgeons because of the environment that harsh hierarchies are setting. On the same note, Leonard et al. (2004) emphasized that hierarchy is among the greatest barriers to open communication in the medical profession.

Time pressure, workload also came up as frequent references in this survey. This is similar to what Reader et al. (2009) found out when they found out an excessive work load reduces the cognitive resources to be used in communication leading to omitted safety precaution and shortcut. The other identified barrier was noise and distraction in the operation room, which corroborated findings of Healey et al. (2007).

Only 42 percent of the respondents opposed poor training meaning that there is no formal training on communication skills. This is consistent with the views of Yule et al. (2006) who argued that in the past, more focus was placed on technical capabilities in surgical training than non-technical ones such as teamwork and communication.

Chapter 5

CONCLUSIONS AND RECOMMENDATION

5.1. Conclusion

This research was done to assess the impact of intraoperative communication between the operating room (OT) staff on the outcomes of the surgical process and the causes of intraoperative errors. The results explicitly show that communication is a pivotal factor of patient safety and not an ancillary factor. In most cases, the intraoperative communication practices have been found to be of relatively good quality especially with regard to sharing of timely information, verbal clarity and interpretation of nonverbal messages.

The relationship between communication and surgical outcomes showed a very high positive correlation ($r = 0.87$, $p < 0.001$), which implied an active association between successful communication and outcome of teamwork, reduction in intraoperative delays, and successful surgical procedures. It was also found that there is a moderately positive correlation between communication and error prevention ($r = 0.32$, $p < 0.001$), and chi-square tests have confirmed that significantly different variables exist in 21/25 pairs ($p=0.001$-0.004). These findings indicate that the effective and efficient workflow and team efficiency, along with the major contribution of decreasing the number of surgical errors, is supported by structured communication practices. Although these positive results were found, the research findings reported a few enduring obstacles to effective communication such as hierarchical frameworks, excessive workloads, time constraints, insufficient training, and distractions such as the environment. Such hindrances are indicative of organizational and cultural wider issues and depict the fact that any intervention that addressing communication needs should not be limited to the growth and development of individual skills, but rather the way the system and structure is structured.

5.2: Recommendations

The recommendations provided below will refer to the cultural issues (hierarchy, attitudes) and structural problems (procedures, staffing, training) to improve intraoperative communication and patient safety.Hospitals need to establish standardized communication tools, e.g. WHO Surgical Safety Checklist, and make them obeyed strictly. Team roles and expectations should be properly spelled out during preoperative briefings and postoperative debriefings are to be undertaken to assess what has been learnt and how to avoid making the same mistakes. Application of these standard procedures would ensure clarity,

responsibility, and training Simulation-based processes would be given priority in order to simulate the high-stress operating rooms, where staff members can acquire technical and non-technical skills such as communication, coordination, and teamwork. The interprofessional training that unites surgeons, anesthetists, nurses and OT technicians in the understanding of their roles will decrease the hierarchy between everyone and build rapport. In addition, communication as a core competency must be incorporated in surgical and nursing curriculum formally and that evaluation criteria must assess collaborative as well as communicative competence in addition to technical performance. The hospital management must consider and streamline the staffing levels in order to minimize the communication breakdown due to the shortages in the staffing. Protected time related to preoperative briefings and postoperative debriefings must be listed in surgical schedules because research indicates that the methods take only a few minutes but enormously lower the number of errors. Unnecessary communication has to be reduced during critical surgical stages so that concentration can be given.
The operating rooms must also put up measures to minimize noise and distraction including restricting unnecessary discussion, regulating foot traffic, and unnecessary entries. A relaxed and well-structured atmosphere helps to focus the attention, increase situational awareness and make verbal and nonverbal interaction between the team mates possible.

5.2.1: Future Research Directions

The difference between perceptions and observed behavioral communication usually results in observational methods being adopted in the next research to supplement the self-reported data.
Longitudinal studies would help researchers to determine the impact of communication training treatments on surgical outcomes and error rates.
The comparative research of multiple organizations and countries could demonstrate the issue that is peculiar to a particular environment and underline the best practices that could be tailored to the specific healthcare system.

LIMITATIONS

Although this research presents important actions on how intraoperative communication can be utilized to enhance the outcome of a surgery and minimize errors, a number of limitations can be admitted. To begin with, the cross-sectional design fails to identify causal relations between communication practices and patient outcomes because it will only measure associations at a specific time. Second, subjective perceptions collected by self-administered questionnaire collected data, which was susceptible to the biases produced by the subjective perception of the participants, presenting the communication behaviors in a more positive light. Third, the sample consisted of 120 staff in the operating rooms of selected hospitals, which may have restricted the generalizability of the results to other health care facilities with different organizational cultures, staffing, and resources. Also, the research was not based on a direct observation, which did not allow objective evaluation of the communication practices and real-time observation of surgical error. Lastly, unmeasured confounders (leadership style, task complexity, and individual level of experience) might have contributed to perceptions of participants of communication and safety.