A QUALITY IMPROVEMENT INITIATIVE TO REDUCE ADVERSE EFFECTS OF TRANSITIONS OF ANESTHESIA CARE ON POSTOPERATIVE OUTCOMES: A REVIEW ARTICLE

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Abstract
Handovers in healthcare are becoming more frequent in university hospitals due to duty-hour restrictions. As a result, critical information can be lost during these handovers, leading to delays, inefficiencies, and potential harm to patients. The Joint Commission on Hospital Accreditation and the World Health Organization consider standardized communication during patient care handover a top priority for patient safety. Patients often experience various transitional phases during surgery, such as Analgesia or Disorientation, Excitement or Delirium, Surgical Anesthesia, and Overdose, which are crucial vulnerabilities in the healthcare system and can result in poor patient outcomes. These poor transitions are linked to missed care, adverse events, and increased morbidity and mortality. The involvement of patients in their own care plans is recommended by the WHO to enhance transitions and improve safety. Handover events occur frequently, with reported frequencies ranging from less than 2% to nearly 40%. Despite efforts to standardize handover processes, concerns about the loss of critical information persist. Standardized protocols like SBAR and I-PASS have been developed to improve communication during handovers, demonstrating potential to reduce medical errors and adverse events. However, the effectiveness of these protocols remains modest, as many studies lack systematic approaches or poor designs. In conclusion, while standardized handover protocols have shown promise in improving communication and process metrics, further investigation is needed to understand their impact on patient outcomes. Continuous efforts to refine these protocols and ensure their consistent application are crucial to improving patient safety during transitions in anesthesia care.
Keywords: Transitions of Anesthesia, Patient care handover, Perioperative medicine, Patient safety outcomes.

Overview of anesthesia care transitions in surgical settings

The care of an individual generally spans shifts, and occasionally even days or weeks. As a result, "handovers," or transfers of patient care and responsibility among carers, are unavoidable. Duty-hour restrictions have led to an increase in handovers, at least at university hospitals **(Baenziger et al., 2020)**. Important information could be misplaced during handovers, which could lead to delays, inefficiencies, poor treatment, or even injury to patients. As a result, "implementing a standardised approach to handoff communications including the opportunity to ask and respond to questions" was identified as a national patient safety priority by the Joint Commission on Hospital Accreditation in 2006. Additionally, they found that "communication failure" accounted for 65% of sentinel occurrences in 2006. Similar to this, one of the World Health Organization's "High five" categories was "communication during patient care handover." **(Meersch et al., 2022).**

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that "communication failure" accounted for 65% of sentinel occurrences in 2006. In a similar vein, one of the World Health Organization's "High five" patient safety priorities is "communication during patient care handover." Several studies have assessed different systems and techniques for improving communication and information transmission, as well as issues related to handovers. Studies assessing malpractice cases and anecdotal complications also exist. Surprisingly, however, not much evidence suggests that changes in care negatively impact patient outcomes.. **(Hu et al., 2020).**

- **Importance of seamless transitions in anesthesia care**

Whether the surgery is scheduled or not, the patient will go through several transitional phases in their care. Transitions of care are "a set of actions designed to ensure the coordination and continuity of healthcare as patients transfer between different locations or different levels of care within the same location," according to the American Geriatrics Society. A patient may go through at least seven care transitions during a straightforward elective surgery procedure; for more difficult patients requiring critical care, interhospital transfers, and rehabilitation stays, this number can reach fifteen. The transitional points of care are weak areas in our system that contribute to poor patient and carer experiences as well as higher rates of morbidity, mortality, adverse events, and treatment delays.. **(Saager et al., 2021).**

The perioperative medicine clinic offers a chance to compile patient data from a medical, physiological, psychological, and social perspective, including preoperative assessment. An extended appointment is available as part of perioperative treatment in many UK hospitals, typically with an anaesthesiologist but also increasingly with a geriatrician. Here, a more thorough examination of the patient is performed, possibly involving objective physiological evaluation by cardiopulmonary exercise testing.. **(Pisano et al., 2021).**

- **Definitions and types of transitions in anesthesia care (e.g., intraoperative, postoperative)**

- Stage 1 -Analgesia or disorientation: The patient receives medication in a preoperative anaesthesiology holding area, where they may start to feel its effects but are not yet unconscious. This is when the stage can begin. Typically, this phase is referred to as the "induction stage." Despite being anaesthetised, patients can converse. Breathing occurs steadily and slowly. At this point, the patient moves from analgesia without amnesia to analgesia and amnesia at the same time. The loss of consciousness marks the conclusion of this phase.. **(Suh et al., 2020)**

- Stage 2 - Excitement or Delirium: Disinhibition, delirium, erratic movements, lack of the eyelid reflex, hypertension, and tachycardia are characteristics of this stage. During this stage, airway reflexes are still functional but frequently overly sensitive to stimuli. It is best to refrain from doing any airway manipulation while under anaesthesia, including deep suctioning techniques and the insertion and removal of endotracheal tubes. **(Pisano et al., 2021).**At this point, laryngospasm—the involuntary tonic closure of the vocal cords—is more likely to occur, and any airway manipulation could make it worse. As a result, the patient's airway may be compromised by the confluence of spastic movements, vomiting, and rapid, irregular breathing. Fast-acting drugs make it easier to enter stage 3 and assist minimise the amount of time spent in stage 2.. **(Sauro et al., 2020)**

- Stage 3 –For treatments requiring general anaesthesia, the targeted anaesthetic level is surgical anaesthesia. This stage is characterised by reduced respiratory depression and relaxed eye movements. At this point, manipulating the airways is safe. For this step, four "planes" are detailed. Constricted pupils, centred gaze, and regular spontaneous respiration are all present during plane 1. On the other hand, in this plane, swallow, conjunctival, and eyelid reflexes typically vanish. There are sporadic respiratory arrests throughout plane 2, and the laryngeal and corneal reflexes are lost. There may also be an increase in lacrimation and halted ocular movements. The lack of the pupillary light reaction and total relaxation of the abdominal and intercostal muscles characterise plane 3. "True surgical anaesthesia" is the name given to this level because it is. **(Burns et al., 2022)**

- Stage 4 -Overdose: An already severe brain or medullary depression gets worse in this stage when an anaesthetic agent is administered in excess of what is necessary in relation to the amount of surgical stimulation. This phase lasts from the loss of breathing until the possibility of death. **(Pisano et al., 2021).**At this point, the pupils are fixed and dilated, and the skeletal muscles are flaccid. Because to the inhibition of the cardiac pump and peripheral circulation

vasodilation, blood pressure is usually much lower than normal, with weak and thready pulses. This stage is fatal without circulatory and respiratory care. Because of this, the anesthetist's objective is to get the patient into stage 3 of anaesthesia as quickly as possible and keep them there during the procedure.. **(Baenziger et al., 2020).**

Information transfers in high-consequence, high-reliability organisations are analogous to patient care handoffs. 21 distinct information-sharing systems were recognised by Patterson et al. as being used by several high-risk industries, such as nuclear power plants and NASA. **(Baenziger et al., 2020).** In these situations, scripted methods for communication include exchanging information face-to-face, establishing a space free from interruptions, and explaining the background and anticipated modifications to the strategy going ahead. Catchpole et al. worked with Formula-1 racing pit-stop crews to develop a handoff tool for the paediatric surgery-to-ICU transition of care that utilised many of these elements, drawing on lessons learnt from another high-risk profession.. **(Kannampallil et al., 2021).**

- **Impact of transitions on patient safety and postoperative outcomes**

In Europe, hospital stays have gotten shorter on average. A shorter hospital stay means more transfers between different healthcare settings—both in terms of level and location—for patients who still require care. As a result, a single patient may receive care from healthcare experts from several healthcare service domains, increasing the fragmentation of patient care. **(Pisano et al., 2021).**Patients' health and well-being are greatly dependent on the smooth transitions between various healthcare settings when they are critically ill and require sophisticated, specialised medical care. The danger of missing patient care is correlated with moving from one healthcare setting to another. A summary of reviews reveals that information exchange and communication at the discharge. **(Lazzara et al., 2020).**

To enhance patient transition, the WHO advises patients to be involved in creating their own care plans. Patients' safety levels may rise and gaps between various care levels may be filled in by include their opinions in the transfer of care. Research indicates that individuals lack awareness of critical steps in managing their conditions, are ill-prepared for their duties in the next healthcare environment, and are unaware of how to get in touch with the right professionals for help.. **(Ludbrook et al., 2021).**

- **Statistics on adverse effects related to transitions in anesthesia care**

In many circumstances, a handover or handoff—also known as an intraoperative transfer of care from one anaesthesia provider to another—occurs often. However, reported frequencies of these events vary widely, ranging from less than 2% to nearly 40%. Although there are many different reasons why handovers happen, they are typically related to efforts to prevent provider burnout or excessive work hours, or to provide a new point of view on a difficult, ongoing case. **(Baenziger et al., 2020).** Important patient data is passed from one provider to another during a handover in order to ensure continuity of care; nevertheless, worries about the loss of important facts during this transfer have persisted for decades. **(Hannan et al., 2020).**

Patient safety organisations have traditionally prioritised improving the quality of handovers. The Joint Commission (Oakbrook Terrace, IL) established better and structured handover processes as a national patient safety goal in 2006, and by 2010, it was common practice. A plethora of articles have detailed several investigator-developed instruments for general handovers and, in certain instances, for intra- and postoperative results. Process metrics including better information transmission, clinician satisfaction, and greater documentation have all been linked to structured handovers. However, there is insufficient data to demonstrate an improvement in actual patient outcomes.. **(Güven et al., 2024).**

Purpose of the Review

- To analyze existing quality improvement initiatives aimed at reducing adverse effects

- To identify key strategies and their effectiveness

Adverse Effects of Transitions in Anesthesia Care

1.Types of Adverse Effects

- **Immediate postoperative complications (e.g., respiratory issues, cardiovascular instability)**

When it comes to surgical patients, respiratory complications are the leading cause of death—up to 77%. Acute respiratory distress syndrome (ARDS), fat embolism, atelectasis, aspiration, pneumonia, pulmonary oedema, and pulmonary embolism are the several postoperative respiratory problems. The two most frequent respiratory problems during the postoperative phase are pneumonia andatelectasis. The patient reports having a cough, purulent sputum, and respiratory

difficulties. Aspiration during the healing phase has the potential to result in chemical pneumonitis and ultimately lead to bacterial infection. The stomach contents reach the respiratory system during aspiration. It may happen as a result of vomiting during anaesthesia or during the recovery period.. **(Baenziger et al., 2020).** Due to the calibre and straight course of the right bronchus, aspiration usually affects the right middle and lower lobes; however, in the prone position, it may also damage the right upper lobe. Reduced breath sounds and aberrant breath sounds, such as wheezes and crepitations, together with a fever, active cough, and one-sided opacity on a chest X-ray are all signs of pneumonia. Breathlessness and hypoxaemia are brought on by pulmonary oedema. The mechanism is aberrant fluid transport across the alveolar–capillary membrane, which causes fluid to accumulate in the alveolar and interstitial spaces and reduces the capacity for diffusion. **(Pisano et al., 2021).**Even in patients with a normal ejection fraction, pulmonary oedema can result from excessive fluid intake. The major causes of acute respiratory distress syndrome (ARDS) are sepsis, pneumonia,. The Berlin criteria used to clinically define ARDS includes acute onset of lung injury within a week, bilateral opacities on chest imaging, decrease PaO_2/FiO_2 ratio (categorised as mild, moderate and severe; <300, <200 and < 100, respectively), without heart failure or fluid overload. **(Turcotte et al., 2020).**

Hypotension is defined as a blood pressure reading below 90/60 mm Hg or a main arterial pressure (MAP) reading below 65 mm Hg. The common symptoms of hypoperfusion and shock brought on by hypotension include tachycardia, pale appearance, chilly skin, decreased urine production, and lactic acidemia. An serious cause of haemorrhage, infection, adrenal insufficiency, or maybe cardiac reasons, is postoperative hypotension. Hypovolemia is the most frequent cause of hypotension during the postpartum phase. Hypovolemia can result from insensible losses, medication reactions to opioids and sedatives, epidural anaesthesia, post-operative haemorrhage, inadequate haemostasis during surgery, and coagulopathy.. **(Sun et al., 2022).**

- Long-term postoperative outcomes (e.g., prolonged hospital stay, increased readmission rates)

Patients treated by female surgeons had considerably lower long-term (90-day and 1-year) rates of poor postoperative outcomes than patients treated by male surgeons, according to this large population-based interdisciplinary cohort study. These are the first data that, as far as we know, evaluate the relationship between the sex of the surgeon and results that go beyond 30 days after surgery. The relationship between the sex of the surgeon and the immediate surgical results has been evaluated in numerous research. The study that most closely resembles ours used a cohort from Ontario and found that patients treated by female doctors had lower rates of unfavourable 30-day postoperative outcomes, including death. This result was mostly observed in cases of elective surgery (AOR, 0.94; 95% CI, 0.89-0.98), and there was no proof that the sex of the surgeon affected the outcome of emergent procedures. (AOR, 1.01; 95% CI, 0.96-1.08). In comparable analyses of the US health care system, an association between female surgeon sex and patient outcomes was seen among elective operations but not emergent operations. In the present analysis, the effect size of surgeon sex was larger among elective surgeries (AOR, 1.05; 95% CI, 0.99-1.11) than emergent surgeons (AOR, 1.02; 95% CI, 0.98-1.06), with evidence of statistically significant heterogeneity (P = .04). **(Alvis et al., 2021).**

Longer-term perioperative outcomes are gaining attention and focus, despite the fact that surgical outcome assessment has traditionally concentrated on the immediate postoperative period. This admits in part that the results of surgical therapy may put patients on new health trajectories and have long-term effects. In surgical outcomes, extrapolating short-term results to long-term outcomes has not always proven reliable. A 30-day risk of problems was linked to video-based technical skill assessment in a seminal study that looked at patients having gastric bypass surgery. Longer-term monitoring of these patients, however, revealed that patient outcomes at one year after surgery were unrelated to peer-judged surgical performance. While technical skill is linked to short-term surgical outcomes, other factors, such as patient selection, may more significantly influence longer-term patient outcomes. These findings offer potential underlying explanations for observations regarding surgeon sex and patient outcomes. Previous research has documented variations between male and female physicians' communication styles, practices, and patient relationships.. . **(Zemedkun et al., 2022).**

2. Causes of Adverse Effects

- Communication breakdowns between anesthesia providers

For medical professionals to provide safe and effective treatment, communication with patients and other members of the healthcare team is essential. Ineffective communication can put patients' safety in danger. Research using observational and video methods in surgery has revealed a high frequency of communication breakdowns: 30% of procedurally significant communications were recorded, they happened every few minutes during the procedure, and they were a contributing factor to events that jeopardised patient

safety. These research concentrated on surgery rather than anaesthesia, and it is still unknown how communication breakdowns affect patient damage directly.. **(Österlind et al., 2020).**

Patient harm studies from malpractice claims are a useful resource for identifying anaesthetic safety issues. Rather than team performance or human factors, the majority of these investigations concentrated on clinical management**(Zemedkun et al., 2022).**. An analysis of 444 surgical malpractice lawsuits revealed 60 cases (13.5%) involving 81 instances of poor communication leading to patient harm. There is a dearth of analysis on how poor anaesthesia communication contributes to patient harm. In 910 cases of anaesthesia misconduct examined, perioperative communication errors resulted in patient damage in 43% of cases; in 13% of cases, these errors occurred more than once. The most frequent instances of poor communication were between a member of the anaesthesia team or an anaesthesiologist and a surgeon or other member of the surgical team. But there were also missteps made in relation to the patient/family. **(Weingarten et al., 2022).**

- Inadequate handoff procedures

A higher proportion of communication failures resulting in patient injury occurred in outpatient settings (34% of claims with failures vs. 26% of claims without failures), despite the fact that the majority of communication failures in both our anaesthesia claims (89%) and surgery claims (64%) occurred during elective surgery due to the overall higher numbers of elective cases. **(Zemedkun et al., 2022).** In contrast to inpatient settings, when the majority of the patient's healthcare providers are part of the same hospital system, communication between all of the patient's care providers, including other physicians, may be more difficult in outpatient settings. The increased percentage of closely monitored anaesthesia care in claims involving communication breakdowns is indicative of inadequate communication regarding intraoperative oxygen–cautery fire risk and mitigation.. **(Gruss et al., 2023).**

More than half (60%) of the communication breakdowns in anaesthesia claims that resulted in patient damage were caused by content failures, of which half (51%) happened during surgery. The remainder happened either before surgery (medical history, for example) or after surgery (intraoperative concerns/patient management plans). Reducing content failures could be greatly aided by checklists, automated prompts, and communications integrated with patient monitoring and electronic medical records.. **(Jaulin et al., 2021).**

- Lack of standardized protocols

Many times, standardisation is thought to be an intuitively clear answer to problems pertaining to the safety and quality of healthcare. Standards are, in general, lists of requirements, norms, or features for creating goods or performing tasks. In healthcare encounters, standardisation holds promise for lowering uncertainty, eliminating needless variation, and reducing mistake. Even with the growing adoption of guidelines and other established practices in the healthcare industry, a great deal of commonplace items, patient routes, workflows, and work tools are still very setting-specific and highly localised. **(Zemedkun et al., 2022).** Variability can be appropriate in some situations, but it can also present hazards and inefficiencies that are better addressed by standardising or harmonisation.. An instance of this was the persistence of crash call numbers entropy within the National Health Service (NHS) until 2004 when the standard 2222 number was implemented. Standardisation, however, is rarely an easy process. **(Zemedkun et al., 2022).** For instance, difficulties can occur because standards are defined and put into practice through intricate sociotechnical processes involving individuals, customs, protocols, and technology, necessitating various types of deliberate effort throughout the stages of development, implementation, and maintenance. To ensure the success of standards, it is necessary to comprehend the current system into which they are to be introduced or improved (i.e., for their uptake by stakeholders). However, the difficulties involved in standardising commonplace items have not received much attention from researchers.. **(Rao et al., 2021).**

Quality Improvement Initiatives

Implementation of Standardized Handoff Protocols

- Description of various handoff protocols (e.g., SBAR, I-PASS)

Although there is disagreement over the annual number of patient deaths attributable to medical errors, experts concur that this is a serious issue in healthcare. According to the Joint Commission, most sentinel occurrences are caused by a breakdown in communication. These communication breakdowns, which are common in today's healthcare systems, happen during patient handoffs in around half of the cases. Research conducted in educational hospitals has recorded four thousand patient handoffs daily. All professions of clinicians routinely take part in patient handoffs or care transitions in one way or another. It is necessary to routinely teach doctors effective handoff communication skills, although few of them receive formal handoff education throughout training.. **(Sauro et al., 2020).**

Processes for transferring patients that are organised can enhance communication fidelity. Prior research demonstrated that teaching medical professionals how to conduct organised patient handoffs improved clinician comfort and patient memory. more lately, handoff standardisation has led to improvements in patient safety. Their study employed a rigorous approach to show that among resident physicians at nine paediatric hospitals, the implementation of an organised handoff communication tool, called I-PASS, resulted in a reduction of medical errors of 23% and avoidable adverse events (AEs) of 30%.. **(Dahlberg et al., 2022).**

I-PASS is a thorough handoff program that teaches medical professionals how to communicate and quickly summarise relevant patient data. In order for every clinician involved in the patient's care to make decisions that are in line with overarching objectives, I-PASS seeks to assist doctors in creating a shared mental model of each patient. the curriculum of the I-PASS program, which addressed cultures that are resistant to change through effective strategies. The acronym for the I-PASS program, which stands for "illness severity (I), patient summary (P), action list (A), situational awareness and contingency plans (S), and synthesis by the recipient (S), is essential to the program. **(Sokas et al., 2022).**

- Evidence of effectiveness in reducing adverse effects

Increasing patient safety is a constant concern for managers, policymakers, and healthcare professionals. About 10% of hospitalised patients worldwide experience patient damage or mortality as a result of adverse events. Of these negative outcomes, half are thought to be preventable. Patient safety is not improving even with the extensive use of measures to lessen patient harm.. **(Suh et al., 2020).**

A great deal of work has gone into creating and executing safety enhancements. The term "practices, strategies, structures, procedures, behaviour, or actions to prevent or mitigate unintentional patient harm, resulting from the healthcare process across a range of diseases and procedures" refers to patient-safety improvement efforts. the characteristics and efficacy of numerous patient-safety initiatives. **(Zemedkun et al., 2022).** Nonetheless, it is important to consider a number of limitations when interpreting the results of these evaluations. Studies that lacked a systematic approach, had poor designs, or were carried out more than ten years ago were included in the reviews. Most notably, no research evaluated or ranked patient-safety treatments according to how they affected the rates of adverse events and fatalities. **(Zemedkun et al., 2022).** The effectiveness of patient safety interventions has not yet been evaluated or given priority. To help managers and healthcare providers carefully choose patient-safety interventions based on available evidence and to disseminate successful patient-safety improvement interventions into routine practice, a better understanding of the efficacy of interventions aimed at reducing adverse events and preventable deaths within hospitals is required... **(Elsalamony et al., 2024).**

2. Training and Education Programs

- Programs aimed at improving communication skills among anesthesia providers

The interchange of ideas, feelings, and information is known as communication. In addition to being a management tool, it imparts knowledge, builds relationships, creates consistent behavioural patterns, and keeps focus on the work at hand.[1] It is claimed that effective communication between a doctor and patient can lower errors, misunderstandings, discomfort, and malpractice claims while also improving patient satisfaction or health results. **(Zemedkun et al., 2022).** After analysing the underlying causes of sentinel events reported from 2004 to the first quarter of 2012, the Joint Commission on Accreditation of Healthcare Organisations discovered that communication errors were a factor in 51.7% of adverse events related to anaesthesia, 54.7% of operative and postoperative complication events, 59.6% of adverse events related to medical equipment, 71.3% of medication error events, and 80% of events related to treatment delays..Most respondents felt that good communication skill is vital to improve patient care and outcome and can prevent potentially avoidable medical errors. **(Moffitt et al., 2021).**

- Impact of simulation-based training on reducing errors

The cognitive theory, which states that work-related activities are based on action-oriented mental models, is the source of error management training. A person's comprehension of how a machine or system works is called an action-oriented mental model; the more detailed and accurate the mental model, the more successful performance will be. Errors serve as a form of feedback, pointing out the areas where one's mental model falls short. Errors are not only seen by EMT as a sign of a poor performance; rather, they are seen as a catalyst for active learning and investigation to enhance one's mental model.. **(Hu et al., 2020).**

Learners are "given only minimal guidance and otherwise, are encouraged to actively explore and experiment on their own," and 2) "EMT creates a learning environment in which errors are likely to occur," according to the two main components of error

management training-based learning. **(Zemedkun et al., 2022).** Students are told from away that mistakes will be made, and the idea is for them to think back on their mistakes and see them as opportunities for growth. EMT differs from procedure-based training methods or purely exploratory training methods in that it places more emphasis on error avoidance and positive framing of errors, which are primarily focused on correct task answers. **(Bell et al., 2023).**

The majority of research on error management training in medical simulation has been conducted in procedural specialities, such as intensive care and surgery. Students can actively explore the simulation models, make procedural errors, come up with solutions to reduce those problems, and evaluate their success by putting the trainees in a simulation-based environment. It is essential to comprehend the process being carried out and the possible mistakes that could happen in order to develop an EMT-focused training curriculum. Seeking professional advice or doing a systematic needs assessment are two ways to go about this process. When it comes to obtaining crucial procedural information, such as preferred methods and most frequent mistakes, expert opinion can be of great use. Needs analyses can also assist in highlighting areas of particular knowledge and skill deficiencies that can be remedied with EMT.. **(Palla et al., 2022).**

3. Use of Technology

- Electronic health records and handoff tools

Errors during patient handoffs, such as the deletion of pertinent information, are very common and can result in patient injury and medical mistakes.1. Physical handoff reports, which are often free-text documents created by the providers by hand, are given with verbal handoffs. The manual entry of data carries a considerable risk of transcriptional mistakes, particularly in teaching hospitals with trainees at all levels.. **(Suh et al., 2020).**

Hospital systems have put in place a number of measures to lower errors and enhance patient outcomes. One such strategy is the application of work-hour constraints, which help to minimise provider weariness and burnout. The number of handoffs increased as a result of the reduced work hours, even if resident well-being appeared to improve. Additionally, there was no discernible change in patient outcomes. Patients receiving care from a covering physician may have avoidable complications more frequently, indicating that higher handoffs and care discontinuity may be contributing factors to unfavourable outcomes.. **(Campos et al., 2022).**

Standardising verbal handoffs using procedures like the "IPASS" system (illness severity, patient summary, action items, situation awareness and contingency planning, and synthesis by the receiver) is another way to lessen handoff errors. Providers are reminded to incorporate all necessary components in their handoff by the IPASS acronym. Adverse events and medical errors were greatly decreased when the IPASS system was used. Standardised processes, like the IPASS, can increase the efficacy of handoffs; yet, when providers rely on verbal or written transcription, handoffs are still susceptible to communication failures.. **(Meersch et al., 2022).**

Therefore, adding more handoff tools to normal verbal protocols could help to further reduce errors. The electronic health record (EHR) is one such instrument that could lower errors. Data from the EHR is automatically filled in 15 times on a handoff printout. It lowers transcribing errors, such as those pertaining to active medicine, dosages, and crucial patient demographics.. **(Abraham et al., 2021).**

- Role of checklists and decision support systems

Hospital nurse resource planning is a complicated process that involves a few components. Four phases of nurse planning were proposed by Punnakitikashem: (1) budgeting; (2) scheduling; (3) staffing; and (4) assignment. The procedure of assigning a nurse to a particular patient for a predetermined amount of time is known as nurse-patient assignment (NPA). Prior study has not given the NPA stage enough attention in comparison to other phases. An essential component of healthcare delivery, effective nurse-to-patient matching has a direct bearing on both nursing workloads and patient outcomes. **(Zemedkun et al., 2022).**According to earlier studies, nurses' perceptions of the quality of patient care, their intention to stay, and their job satisfaction are all positively impacted by adequate NPAs.. Another researcher also found a positive correlation between positive perception of patient assignment and nurses' perceived nursing performance. In contrast, when nurses perceive that their assignments are not appropriate, it could lead to a negative effect on nursing care and nurses' job satisfaction. **(Muhly et al., 2020).**

Generally speaking, the charge nurse from the previous shift makes decisions for each shift, and the NPA procedure is completed at the start of each shift. Because there are a lot of aspects to take into account, this procedure is very complex and requires critical thinking competency. Allen3 conducted interviews with charge nurses in a non-profit hospital in order to identify these elements of the NPA procedure. Three primary areas

were delineated, namely: patient variables, which encompassed demographics, acuity, and duration of stay; environmental factors, which included nurse-patient ratio, location, and staffing; and nurse factors, which included nurses' competence, relationships, demographics, and preferences. Six criteria were also discovered by a different team of researchers: administrative procedures, work design and technology, physical resources, patient severity, and patient turnover.. Furthermore, the NPA process is made considerably more complex by the fact that the relative relevance of the various elements varies according on the parameters. While a home care setting prioritises nursing continuity when assigning patients, emergency department triage nurses base their decisions mostly on patient status, patient flow, and the nurses' experience. Similar to this, the NPA's decision-making process is quite intricate, but it is entirely dependent on the charge nurse's discretion. The charge nurse must sort through several choice factors in a constrained length of time throughout the manual NPA process.. **(Laporta et al., 2021).**

4. Multidisciplinary Approaches

- Involvement of surgical teams, nurses, and other healthcare professionals

Due to the frequent breakdown of communication between doctors and nurses, sentinel events in the operating room were primarily caused by communication breakdowns. Enhancing interprofessional collaboration (IPC) may be crucial to achieving safety and quality objectives in healthcare environments. IPC brings together a range of health and social care experts to solve issues and guarantee the well-being of patients by fostering clinical competence, accountability, and effective communication. **(Abraham et al., 2021).**Furthermore, with time, mutual regard, trust, and the recognition of complementing knowledge all grow. Numerous studies indicate that in order to deliver care, healthcare personnel must work together. IPC has enhanced patient safety and quality in a range of healthcare environments.. In order to achieve optimal patient safety, health practitioners working in surgical settings have a shared concern. Due to the complexity of patient needs and the surgical procedure, few studies on interprofessional collaboration have been done, despite the fact that the perioperative context demands highly skilled surgical teams. The way in which surgeons, anaesthesiologists, and perioperative nurses collaborate is not well understood. **(Admiraal et al., 2023).**

IPC has been examined in a few systematic reviews that aim to gather data from studies to assess its contributions and effects. Only quantitative research findings and randomised trial (RCT) designs were included in these evaluations; nevertheless, there is not enough data from intervention studies to draw firm conclusions. Although this variable is always standardised or controlled in these designs, the results of multiple systematic reviews of IPC interventions revealed that their effects may differ depending on the healthcare setting.. **(Massa et al., 2021).**

- Case studies of successful multidisciplinary initiatives

One of the essential abilities for health care professionals, according to the Institute of Medicine (IOM), is the capacity to operate in multidisciplinary teams. It is also advised that members of the health care team have a clear grasp of one another's duties and responsibilities. In contemporary health care, the necessity for interdisciplinary teams has grown due to changes in mortality and morbidity brought about by demographic shifts. found a number of significant factors that contribute to its importance in contemporary health care. **(Abraham et al., 2021).**The ageing population is the first factor, as it is linked to a rise in patients with chronic illnesses that need extensive care from several medical specialists. Second, in order to give patients with the care they require, health care providers must acquire sophisticated skills and knowledge.. **(Zemedkun et al., 2022).** Third, it is very hard for a single health care expert to offer a comprehensive approach due to the growing specialisation within the field. Fourth, it is thought that multidisciplinary collaboration is essential to ongoing quality improvement and care continuity. However, health care organisations face unique difficulties when it comes to multidisciplinary teamwork. Although health care providers work in particular positions (e.g., surgeon, surgical nurse, anaesthesiologist) and execute interdependent duties (e.g., a surgeon needs to anaesthetise a patient), the majority of clinical units still operate as distinct and independent groups of experts.. **(Cline et al., 2020).**

Case Studies and Real-World Applications

Examples of Successful Quality Improvement Initiatives

- Detailed case studies from various hospitals or healthcare systems

It has taken a while for the patient safety and quality improvement (QI) movements in healthcare to gain traction in terms of bettering patient outcomes. Almost two thirds of projects in healthcare institutions fail during execution. Healthcare reforms are typically project-based and systemic, acknowledging the interdependence of socio-technical variables rather than the exception. Furthermore, it can be challenging to generalise changes

to a larger scale and maintain them beyond the project lifecycle.. **(Lane et al., 2022).**

Sleek Six Sigma is a potent methodology that minimises waste and variance inside a company, which in turn maximises customer happiness, maximises productivity, and minimises operational expenses. LSS is the result of combining two process improvement techniques. Lean is a methodology that was developed in Toyota auto plants and emphasises process improvement and elimination of non-value-added (NVA) activities. Motorola implemented Six Sigma to improve its manufacturing processes by lowering variability via the strict application of statistical analysis and process metrics gathering. **(Zemedkun et al., 2022).**LSS thinking has been applied to healthcare since the early 2000s with the aim of enhancing patient satisfaction, performance, efficiency, quality of care, and safety.. **(Lane-Fall et al., 2021).**

Globally, healthcare providers—both publicly and privately funded—face comparable difficulties in providing care for an ageing population with a finite amount of staff and financial resources. As a result, there is an increasing need to find ways to increase efficiency while still offering high-caliber, safe services. Numerous healthcare organisations have deployed Lean Six Sigma (LSS), yielding positive effects on a wide range of clinical and administrative workflows. Although specific case studies show positive correlations between LSS adoption and performance measures, the total body of research on LSS effectiveness is conflicting. **(Abraham et al., 2021).** For LSS to be linked to improvements in hospital performance, a significant amount of time and energy must be invested in its implementation. The system maturity, leadership commitment, daily management system use, and training all influence how much money is invested. The significance of enhancing the healthcare experiences of patients and staff and using person-centred approaches is also becoming more widely acknowledged. A large number of political and policy players have argued that the core of the health system should be person-centred care. Person-centeredness is the term used to describe ingrained behaviours in a certain kind of culture that support and facilitate the provision of person-centred care. The provision of person-centred care is seen to require person-centred cultures. Person-centred care explicitly places the client or patient at the centre of the provision of care and is concerned with all those who are connected to the patient... **(Aquino et al., 2022).**

- Analysis of key factors contributing to their success

The healthcare industry has been significantly impacted by the fourth industrial revolution, which has led to notable changes in the ways that healthcare services are provided through technology. 3D printing has emerged as a viable tool for providing patients with innovative solutions, to name a few instances of how the adoption of technologies has significantly transformed the healthcare industry. According to references, 3D printing technology have made it possible to create surgical instruments, prosthetic limbs, and personalised models of bones, organs, and other anatomical systems. Similarly, teleconferencing, medical education and training, cognitive rehabilitation, dentistry, psychiatry, surgery, and telemedicine have all made use of virtual reality technologies. In the field of healthcare, robotics has also been extremely important, especially in the areas of surgery and minimally invasive surgery. To increase treatment success rates, technology has also been included into engineered tissue models, regenerative medicine, anatomical models, and medication formulations. **(Zemedkun et al., 2022).**These developments in technology have the power to drastically change the healthcare sector and enhance patient outcomes. As a result, the healthcare system is evolving into a sophisticated, integrated system that offers more individualised treatment, excellent service quality, enhanced customer satisfaction, better results, and reduced costs. Healthcare systems have undergone a paradigm shift as a result: (1) moving away from disease treatment and towards health management; (2) emphasising clinical outcomes and quality; (3) moving towards outpatient services (i.e., the retailization of health services); (4) with patients who are knowledgeable and informed; and (5) emphasising accountability and a values-based approach. Moreover, the COVID-19 outbreak.. **(Prasad et al., 2020).**

Challenges and Barriers

- Common obstacles faced during implementation

Though they clarified that a lack of clarity and knowledge has contributed to a lack of understanding and interest in program management, there are signs that organisations are becoming more aware of and interested in the discipline. It is necessary to provide an overview of the phrase "programme management" in order to completely understand. The phrase "programme management" has many definitions, but they all emphasise the same characteristics of choosing, organising, and overseeing a portfolio of projects in order to meet a number of organisational goals. Furthermore, several definitions additionally mention the effective implementation of the portfolio of projects in a regulated setting to maximise the benefits for the ensuing business operations.. Stated differently, program management is

the administration of significant capital projects. **(Zemedkun et al., 2022).**The integration and administration of a collection of connected projects with the goal of realising benefits that would not have been possible if the projects had been managed separately is known as program management. Although related, this is not the same as portfolio management, which is defined as the administration of a portfolio of projects that share resources and focus on the next phase of development; it entails planning and resource allocation for each individual project. Put differently, programs entail overseeing a portfolio of projects, managing several large-scale projects (mega projects), and overseeing a number of projects for the same client that gain from a unified approach.. **(Rao et al., 2021).**

Implications for Practice and Future Directions

- Recommendations for anesthesia providers and healthcare institutions

Competent anaesthesiologists can successfully manage complex and high-risk patients. Anaesthesia providers may have quite different professional growth and educational backgrounds in LMICs. While some anaesthesiologists might have had significant training, others might have had little resources available to them for skill development. To deliver safe anaesthesia, anaesthesiologists need to possess a thorough knowledge foundation and the appropriate attitude towards patient care. Insufficient instruction could lead to dangerous consequences for patients and even death.. **(Meco et al., 2024).**

Patient care is jeopardised in many LMIC institutions due to stark differences in availability to high-quality anaesthesia equipment. The budgetary constraints that the formation of LMICs faces is one of the main factors contributing to the difference in anaesthesia equipment. Modern anaesthesia machines, patient monitors, and other equipment require more funding. **(Abraham et al., 2021).** Consequently, the use of antiquated or badly maintained equipment by anaesthesia services puts patient safety and the standard of care at risk. The recent economic crisis in Sri Lanka also had an effect on quality and safety, as evidenced by the rise in medicine and instrument reuse. When a centre in Cambodia looked back on the difficulties, it found that the absence of basic medications, supplies, and oversight posed serious risks to the proper administration of anaesthesia. **(Zemedkun et al., 2022).**Hospital administrations in LMICs should give anaesthesia departments more consideration when allocating resources. A cycle of discrimination and indifference towards the anaesthesia department may result from a lack of support from hospital administration and insufficient possibilities for professional development. Anaesthesia services may require additional attention and assistance as a result of administrators giving other departments or medical specialities priority. Anaesthesia teams require assistance in order to deliver safe and effective care as a result of this negligence, which further widens the gap... **(Stuart et al., 2020).**

- Potential impact on patient outcomes and healthcare costs

A health system's agents can also include politicians, administrators, pharmaceutical corporations, insurance companies, and device manufacturers in addition to health professionals and support staff. The initial set of "inputs" into the system are people who require improved health. Resources such as fresh knowledge, technology, money, medications, and technical equipment, among others, are also significant inputs. "People with improved health" are the emergent "outputs" that are produced by the CAS as a whole.The driver of a healthcare system "focusses or directs" the agents' actions. It favours influences that align with its stated objectives, beliefs, and purpose. As a result, it permits the development of suitable structures and functions required for its overall operation.. Therefore, the driver of a health system may permit structural modifications, such as the creation of a new health services division or the application of a new service delivery strategy (functional change). Since the "current successful drivers" of a CAS typically aggressively reject top-down "instructions" that contradict, constrain, or impair the status quo, bottom-up acceptance is necessary for success.. **(Ehrlich et al., 2023).**

Conclusion

Complex adaptive organisations that are socially formed are healthcare systems. Their three main motivators are their clearly stated purpose, their goals, and their values, just like other complex adaptive systems. The Buurtzorg ambulatory nursing, NUKA, and EDARP health systems are the first instances of CAS. These organisations achieve their goals by fostering bottom-up emergent behaviours that allow their personnel to adapt to changing patient requirements and financial restrictions. This is known as "loose enough constraints.". **(Cheung etal., 2022).**

Delivering a safe and high-quality service for safe surgery is a major problem for anaesthesia services in low- and middle-income countries. Numerous issues, including a lack of qualified staff, insufficient funding, few opportunities for training, and little administrative influence, serve as weak links in the chain that ensures

the safe delivery of surgery. The importance of anaesthesia services often underestimated, despite the fact that they provide a life-saving measure for many. The anaesthesia workforce should be strengthened, appropriate compensation and incentives should be offered, anaesthesia autonomy should be promoted, and access to continuing medical education should be made easier in order to address these problems. However, to manage these issues and prioritise the health of anaesthesia providers and patients, governments, healthcare organisations, and international stakeholders must work together to establish lasting solutions.. **(Mercado et al., 2023).**

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