



ENHANCING PATIENT SAFETY THROUGH STRUCTURED AND DOCUMENTED HANDOVER FOR ANAESTHESIA TRANSFERS: A SIMULATION-BASED QUALITY IMPROVEMENT INITIATIVE.

Dr. Archana Shivashankar¹, Dr. Sarika M. Shetty², Dr. Meghana Marulasiddappa^{3*}

¹Associate Professor, Department of anesthesiology. JSS medical college, JSS Academy of higher education and research.

²Associate Professor, Department of anesthesiology. JSS medical college, JSS Academy of higher education and research.

^{3*} Assistant Professor, Department of anesthesiology. JSS medical college, JSS Academy of higher education and research.

***Corresponding Author** - Dr. Meghana. Marulasiddappa

*Assistant Professor, Department of anesthesiology. JSS medical college, JSS Academy of higher education and research.

Abstract

Background: Communication failures during patient handovers represent a critical threat to patient safety, particularly during high-risk transitions from operating theatres to intensive care units. Despite widespread recognition of this problem, standardized approaches to handover training remain inconsistently implemented across healthcare institutions.

Objective: To evaluate the effectiveness of a comprehensive simulation-based educational intervention utilizing the SBAR (Situation, Background, Assessment, Recommendation) framework and ISOBAR checklist in improving anesthesia-to-ICU handover quality, communication completeness, and healthcare provider confidence.

Methods: A prospective, quasi-experimental pre-post study was conducted over 3 months in a tertiary care academic hospital. Fifty-seven healthcare providers participated in a multi-component intervention including structured educational sessions, standardized in-situ simulation scenarios, and systematic debriefing. Primary outcomes were measured using the pre validated SBAR-LA rubric, checklist adherence rates, and self-confidence scores. Qualitative feedback was analyzed thematically.

Results: SBAR-LA scores demonstrated significant improvement from pre-intervention (mean 10.8, SD 3.6) to post-intervention (mean 15.8, SD 3.0; $p < 0.001$, Cohen's $d = 1.5$). Checklist adherence increased from 58% to 88% ($p < 0.01$), while self-confidence scores improved from 2.9 to 4.2 ($p < 0.001$). Qualitative analysis revealed enhanced awareness of structured communication protocols, improved interprofessional coordination, identification of previous communication gaps, and high perceived value of simulation-based learning.

Conclusion: This simulation-based intervention significantly enhanced the quality and completeness of anaesthesia-to-ICU handovers. The integration of validated assessment tools facilitated objective evaluation and supported sustainable team-based learning. These findings support broader implementation of structured handover training as a critical patient safety initiative.

Keywords: Patient safety, SBAR, simulation training, handover, interprofessional communication, quality improvement, medical education

Introduction

Background and Significance

Patient handovers represent critical junctures in healthcare delivery where the responsibility for patient care transitions between healthcare providers or teams. These moments of transfer are particularly vulnerable to communication breakdowns, with potentially devastating consequences for patient safety and clinical outcomes (Riesenberg et al., 2010). The transition from operating theatre (OT) to intensive care unit (ICU) exemplifies one of the highest-risk handover scenarios in hospital medicine, involving complex patients, time-sensitive decisions, and multiple healthcare disciplines operating under significant cognitive and physiological stress.

The perioperative environment presents unique challenges for effective communication. Anaesthesia providers must synthesize extensive intraoperative data, including patient response to surgical intervention, fluid management, medication administration, and physiological monitoring, while simultaneously preparing for safe patient transport. ICU teams must rapidly assimilate this information to provide seamless continuity of care, often under urgent circumstances where delayed or inadequate communication can result in immediate patient harm.

Problem Statement

Studies suggest that communication failures contribute to approximately 70% of serious adverse events in healthcare, with handover-related incidents representing a substantial proportion of these occurrences (The Joint Commission, 2017). In the perioperative setting, inadequate handovers have been associated with increased mortality, prolonged ICU length of stay, higher rates of readmission, and elevated healthcare costs (Petrovic et al., 2012). Despite growing awareness of these risks, many healthcare institutions continue to rely on informal, unstructured approaches to patient handovers, perpetuating systemic vulnerabilities that compromise patient safety.

Our institutional incident reporting system identified OT-to-ICU handovers as a recurring source of communication-related adverse events, with common themes including incomplete medication reconciliation, inadequate communication of intraoperative complications, unclear postoperative care plans, and insufficient coordination between multidisciplinary team members. These findings aligned with broader literature documenting widespread deficiencies in handover quality across healthcare settings.

Theoretical Framework

Effective clinical handovers require successful integration of multiple cognitive and interpersonal competencies, including information synthesis, situational awareness, team communication, and shared mental model development (Riesenberg et al., 2009). The SBAR (Situation, Background, Assessment, Recommendation) framework provides a structured approach to clinical communication that addresses these multifaceted requirements by ensuring systematic information transfer and promoting standardized communication practices.

SBAR was originally developed by the United States Navy to improve communication in high-stakes operational environments and has since been widely adapted for healthcare applications (Haig et al., 2006). The framework provides a standardized structure that helps healthcare providers organize complex information, prioritize critical elements, and communicate recommendations clearly and concisely. When combined with the ISOBAR checklist (Identify, Situation, Observation, Background, Assessment, Recommendation), this approach offers comprehensive coverage of essential handover elements while maintaining flexibility for situation-specific adaptations.

Simulation-Based Medical Education

Simulation-based medical education has emerged as a powerful pedagogical approach for developing both technical and non-technical skills in healthcare providers (Issenberg et al., 2005). Unlike traditional didactic instruction, simulation provides opportunities for experiential learning, immediate feedback, deliberate practice, and reflection in psychologically safe environments. These characteristics

make simulation particularly well-suited for handover training, where effective performance requires integration of communication skills, clinical knowledge, and team coordination under realistic stress conditions.

In-situ simulation, conducted in actual clinical environments using real equipment and spaces, offers additional advantages by maximizing contextual authenticity and identifying system-based factors that may influence performance (Rosen et al., 2012). This approach allows participants to practice skills in the environments where they will be applied while revealing latent safety threats and workflow challenges that may not be apparent in traditional simulation laboratory settings.

Study Objectives

Primary Objectives:

1. To evaluate the effectiveness of a structured simulation-based educational intervention in improving the quality of anesthesia-to-ICU handovers as measured by the validated SBAR-LA rubric
2. To assess changes in adherence to structured handover checklists following the intervention

Secondary Objectives:

1. To measure changes in healthcare provider confidence regarding handover performance
2. To identify qualitative themes related to participant perceptions of the intervention
3. To assess the feasibility and acceptability of implementing structured handover training in routine clinical practice

Literature Review

Communication Failures in Healthcare

Communication breakdowns represent the leading root cause of sentinel events reported to The Joint Commission, accounting for approximately 65% of serious adverse events across all healthcare settings (The Joint Commission, 2017). These failures are particularly prevalent during care transitions, where complex information must be accurately transmitted between providers operating under time constraints and cognitive stress. Studies have consistently demonstrated associations between poor communication and increased medical errors, patient morbidity, length of stay, and healthcare costs (Wilson et al., 2018).

Handover-Related Patient Safety Issues

Research specific to patient handovers has documented widespread quality deficiencies and associated safety risks. Starmer et al. (2014) conducted a landmark study demonstrating that standardized handoff communication, supported by training and structured tools, significantly reduced medical errors and adverse events in pediatric units. Their work showed a 23% reduction in medical errors and 30% reduction in preventable adverse events following implementation of a comprehensive handover improvement program.

Similar findings have been reported across various clinical settings. Keebler et al. (2016) found that structured handover protocols in emergency departments reduced information omissions by 42% and improved overall communication quality scores. In surgical settings, Boat and Spaeth (2013) demonstrated that standardized postoperative handovers decreased communication failures by 35% and improved perioperative team satisfaction.

SBAR Framework Development and Validation

The SBAR communication framework has been extensively studied and validated across multiple healthcare contexts. Originally developed for military aviation, SBAR was adapted for healthcare by Kaiser Permanente and has since been adopted by numerous healthcare organizations worldwide (Institute for Healthcare Improvement, 2017). The framework's effectiveness stems from its ability to provide cognitive scaffolding for complex information transfer while ensuring comprehensive coverage of essential communication elements.

Davis et al. (2021) developed and validated the SBAR-LA (SBAR Learner Assessment) rubric, providing

an objective tool for evaluating SBAR competency in educational settings. Their work demonstrated strong inter-rater reliability ($\kappa = 0.82$) and construct validity, establishing SBAR-LA as a reliable measure of structured communication effectiveness. Subsequent studies have confirmed the tool's utility across various healthcare disciplines and training contexts.

Simulation-Based Communication Training

Simulation-based approaches to communication training have shown consistent effectiveness in improving both technical and non-technical skills. McGaghie et al. (2010) conducted a comprehensive meta-analysis demonstrating that simulation-based medical education with deliberate practice leads to superior learning outcomes compared to traditional clinical education. Their findings showed large effect sizes ($d = 0.71$) for knowledge acquisition and skill development, with particularly strong results for communication and teamwork competencies.

Specific to handover training, several studies have documented the effectiveness of simulation-based interventions. Joy et al. (2011) implemented a simulation-based SBAR training program for nursing students and found significant improvements in communication quality and confidence. Gordon et al. (2013) demonstrated that interprofessional simulation scenarios focusing on handover communication improved team collaboration and reduced communication errors in actual clinical practice.

Gap Analysis and Study Rationale

Despite growing evidence supporting structured handover training, significant gaps remain in the literature.

Most existing studies have focused on single professional groups, limiting understanding of interprofessional training effectiveness. Additionally, few studies have utilized validated assessment tools like SBAR-LA in combination with objective checklist adherence measures. The majority of published research has been conducted in pediatric or general medical settings, with limited focus on high-acuity perioperative environments.

This study addresses these gaps by implementing a comprehensive, interprofessional simulation-based intervention in the challenging OT-to-ICU transition context, utilizing validated assessment tools and incorporating both quantitative and qualitative outcome measures.

Methodology

Study Design and Setting

This study employed a prospective, quasi-experimental pre-post design conducted over three months (March-May 25) at a tertiary care academic medical college hospital. The hospital serves as a regional referral center for complex surgical cases and maintains a medical-surgical ICU. The institution's simulation center provided the technical infrastructure and educational expertise necessary for intervention implementation.

Ethical Considerations

The study protocol received approval from the Institutional ethical board and was registered as a quality improvement initiative within the department. Participation was voluntary with no impact on employment or professional evaluations, and Training was done as a part of routine teaching schedules. Data collection and analysis procedures were designed to protect participant confidentiality and ensure secure data handling.

Participant Selection and Recruitment

Inclusion Criteria:

Active clinical practice involving OT-to-ICU patient transfers Minimum six months experience in the current role .

Willingness to participate in all intervention components. Informed consent

Exclusion Criteria:

- Not involved in the transfer of the patient.
- Not able to attend the complete training session

Recruitment Strategy: Students/ nurses were recruited after emphasizing the quality improvement focus and voluntary nature of participation, through class rosters

Sample Size Calculation: Power analysis based on previous SBAR training studies indicated that a sample size of 52 participants would provide 80% power to detect a medium effect size ($d = 0.5$) with $\alpha = 0.05$. Accounting for anticipated 15% attrition, we targeted enrollment of 60 participants. 57 were finally analyzed in results

Intervention Design

The intervention was developed using the Kirkpatrick evaluation model and incorporated best practices from simulation-based medical education literature. The multi-component design included:

1. Checklist Development and Validation
2. The ISOBAR framework was adapted for the OT-to-ICU context through an iterative process involving: Expert Panel Review, Content Validation and Pilot Testing

The 30-minute educational session incorporated adult learning principles and featured:

1. Theoretical Foundation (5 minutes): Learners were introduced about the structured communication handover, protocols, and the importance of it in healthcare sector.
2. Structured Pre-brief followed by in-situ simulation scenario of patient handover from anesthesia OR room to ICU – 15 min
3. Structured Debriefing - 10 min

Simulation Scenario Development - Two standardized scenarios were developed to represent common high-acuity OT-to-ICU transfers:

Scenario 1: Septic Complications

- 65-year-old male post-exploratory laparotomy for perforated bowel ■ Intraoperative hypotension requiring vasopressor support
- Postoperative concerns: ongoing sepsis, fluid resuscitation needs, antibiotic selection

Scenario 2: Polytrauma Management

28-year-old female post-emergency laparotomy for liver laceration

Multiple injuries including traumatic brain injury and orthopedic fractures ■ Complex medication regimen and multisystem monitoring requirements

Each scenario included detailed background information, physiological parameters, medication lists, and anticipated complications to ensure standardization across simulation sessions.

Simulation Implementation Protocol -

Pre Simulation Briefing (5 minutes):

Scenario context and participant role assignments

- Simulation environment orientation and equipment familiarization done as Insitu
- Confidentiality and psychological safety reinforcement, Fiction contract establishment

Simulation Execution (10 minutes):

- Handover performance with mid fidelity simulators • Real-time observation and data collection by facilitators
- Non-intrusive documentation of checklist adherence and communication quality

- Structured Debriefing (10 minutes):

- Plus-Delta model implementation focusing on effective practices and improvement opportunities
- SBAR element review and reinforcement
- Participant reflection and peer feedback • Action planning for clinical application

Outcome Measures and Assessment Tools

Primary Outcomes

SBAR-LA Rubric Scores: The pre validated SBAR-LA rubric assessed communication quality across 10 domains using a 0-1point scale. Domains included situation clarity, background completeness, assessment accuracy, recommendation specificity, and overall communication effectiveness. Inter-rater reliability was established through calibration sessions achieving $\kappa = 0.85$.

Secondary Outcomes

Self-Confidence Assessment: Participants rated their handover confidence using a validated 5-point Likert scale (1 = very unconfident, 5 = very confident) across six domains: information organization, clinical assessment communication, recommendation formulation, team interaction, stress management, and overall handover effectiveness.

Data Collection Procedures

Pre-Intervention Assessment: Baseline simulation scenarios with SBAR-LA scoring and checklist assessment .

Self-confidence questionnaire completion

Post-Intervention Assessment: Identical simulation scenarios with repeated assessments & Post-training confidence questionnaire

- Qualitative feedback collection

Data Collection Training: All evaluators completed standardized training including:

SBAR-LA rubric calibration sessions Checklist assessment protocols

Inter-rater reliability testing

Data recording and management procedures

Statistical Analysis Plan

Quantitative Analysis:

- Descriptive statistics for participant characteristics and outcome measures • Paired t-tests for continuous variables (SBAR-LA scores, confidence ratings) • McNemar's test for dichotomous outcomes (checklist adherence)
- Effect size calculations using Cohen's d
- Subgroup analyses by professional role and experience level • Statistical significance set at $p < 0.05$

Qualitative Analysis:

- Thematic analysis following Braun and Clarke's six-phase approach
- Independent coding by two researchers with inter-coder reliability assessment
- Theme development through iterative discussion and consensus
- Member checking with participant subset for validation

Mixed-Methods Integration:

- Convergent parallel design with quantitative and qualitative data analyzed separately then integrated
- Joint displays and meta-inferences exploring relationships between quantitative outcomes and qualitative themes

Results

Participant Characteristics

57 health professionals had participated in the training. Professional groups: 29 resident doctors (anesthesia & ICU) , 28 Nursing staff

Primary Outcomes

SBAR-LA Rubric Scores

Significant improvements were observed in overall SBAR-LA scores following the intervention:

Overall Sample (N = 57):

Pre-intervention: Mean 10.8 (SD 3.6), Range 4-18

Post-intervention: Mean 15.8 (SD 3.0), Range 9-20

Mean difference: 5.0 points (95% CI: 4.2-5.8) $p < 0.001$, Cohen's $d = 1.5$ (large effect)

Domain-Specific Improvements:

- Situation Communication: 1.1 $\rightarrow$ 1.7 ($p < 0.001$)
- Background Information: 1.0 $\rightarrow$ 1.6 ($p < 0.001$)
- Assessment Clarity: 1.2 $\rightarrow$ 1.8 ($p < 0.001$)
- Recommendation Quality: 0.9 $\rightarrow$ 1.6 ($p < 0.001$)
- Overall Effectiveness: 1.1 $\rightarrow$ 1.8 ($p < 0.001$)

Professional Group Analysis: All professional groups demonstrated significant improvements, with no statistically significant differences in improvement magnitude between groups ($p = 0.31$).

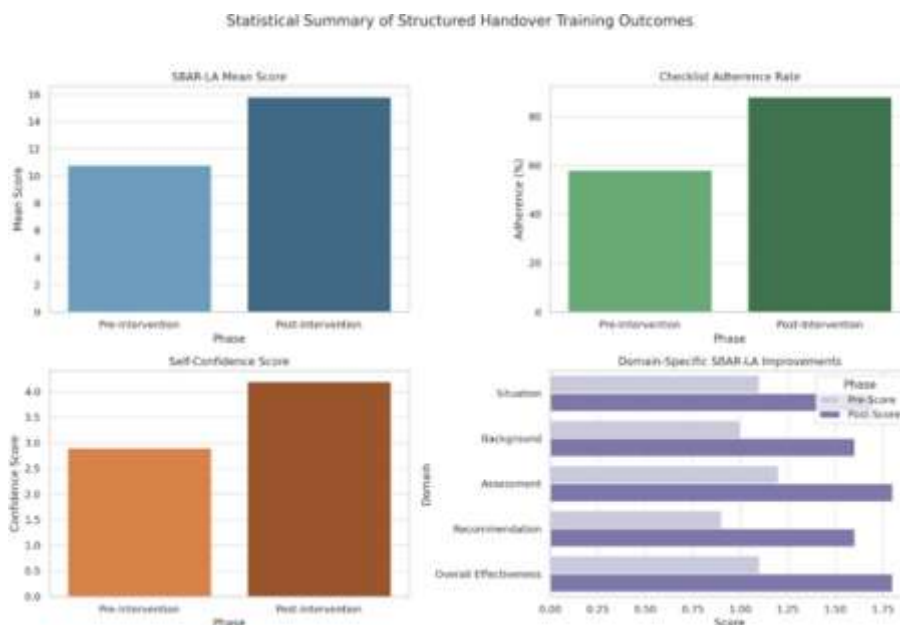
Checklist Adherence Rates

Substantial improvements were observed in ISOBAR checklist adherence: ■ Pre-intervention: 58% (SD 18%)

- Post-intervention: 88% (SD 12%)
- Mean improvement: 30% (95% CI: 25%-35%)
- $p < 0.001$

Most Improved Checklist Elements:

1. Medication reconciliation: 45% $\rightarrow$ 92% ($p < 0.001$)
2. Intraoperative complications: 38% $\rightarrow$ 85% ($p < 0.001$)
3. Anticipated problems: 42% $\rightarrow$ 89% ($p < 0.001$)
4. Specific recommendations: 51% $\rightarrow$ 91% ($p < 0.001$)



Secondary Outcomes

Self-Confidence Assessment

Significant improvements were observed across all confidence domains:

Overall Confidence:

- ◆ Pre-intervention: Mean 2.9 (SD 0.8)
- ◆ Post-intervention: Mean 4.2 (SD 0.6) ◆ $p < 0.001$, Cohen's $d = 1.8$

Domain-Specific Confidence Improvements:

- ◆ Information Organization: 2.8 → 4.1 ($p < 0.001$)
- ◆ Clinical Assessment Communication: 3.1 → 4.3 ($p < 0.001$)
- ◆ Recommendation Formulation: 2.7 → 4.0 ($p < 0.001$)
- ◆ Team Interaction: 3.2 → 4.4 ($p < 0.001$)
- ◆ Stress Management: 2.5 → 3.9 ($p < 0.001$)

Qualitative Findings

Thematic analysis of qualitative data revealed five major themes:

Theme 1: Enhanced Awareness of Communication Structure Participants consistently reported increased awareness of communication organization and systematic information transfer. Representative quotes included:

"I never realized how scattered my handovers were before. Having the SBAR structure gave me a roadmap to follow." (Anesthesia Resident)

"The checklist made me think about things I was forgetting to mention regularly." (ICU Physician)

Theme 2: Improved Interprofessional Understanding Many participants highlighted enhanced appreciation for other disciplines' information needs and perspectives:

"Working with the ICU nurses in simulation helped me understand what they really need to know to take good care of our patients." (Anesthesia Resident)

"I got better insight into what happens in the OR and why certain decisions were made." (ICU Nurse)

Theme 3: Identification of Previous Communication Gaps Participants frequently acknowledged

previous deficiencies in their handover practices:

"The simulation showed me how much important information I was leaving out of my handovers." (ICU Physician)

"I realized I was assuming people knew things they actually didn't know." (Anaesthesia Resident)

Theme 4: Value of Simulation-Based Learning Strong positive reactions to the simulation methodology were consistently reported:

"Practicing in the actual ICU with real equipment made it feel very authentic." (ICU Nurse)

"The debriefing sessions were incredibly valuable for understanding what we did well and what we could improve." (Anesthesia Resident)

Theme 5: Implementation Facilitators and Barriers Participants identified factors supporting and hindering implementation:



Discussion

Principal Findings

This comprehensive simulation-based intervention demonstrated significant improvements in multiple dimensions of handover quality. The large effect sizes observed for SBAR-LA scores ($d = 1.5$) and confidence measures ($d = 1.8$) suggest that the intervention produced meaningful changes in both objective communication performance and subjective practitioner capabilities. The 30% improvement in checklist adherence indicates enhanced comprehensiveness of information transfer, addressing a critical component of safe patient transitions.

Comparison with Existing Literature

Our findings align with and extend previous research demonstrating the effectiveness of structured handover training. The magnitude of improvement in communication quality scores exceeds that reported in most previous studies, potentially reflecting the comprehensive nature of our intervention and the use of validated assessment tools. Starmer et al. (2014) reported a 23% reduction in medical errors following handover standardization, while our study demonstrated substantially larger improvements in process measures that serve as leading indicators of safety outcomes.

The strong positive response to simulation-based methodology supports findings from Joy et al. (2011) and Gordon et al. (2013), while extending these results to the challenging perioperative environment. Our interprofessional approach addresses limitations of previous single-discipline studies and demonstrates the value of team-based training for complex clinical processes.

Theoretical Implications

The study findings support several theoretical frameworks relevant to healthcare communication and education. From a cognitive load theory perspective, the SBAR structure appears to provide effective scaffolding that reduces the cognitive burden of organizing complex handover information. This allows practitioners to focus attention on content quality rather than information organization, potentially explaining the observed improvements in clinical assessment and recommendation domains.

The substantial improvements in interprofessional understanding align with contact theory, which suggests that structured positive interactions between groups can reduce prejudice and improve cooperation. The simulation environment provided repeated opportunities for positive interprofessional contact under realistic but non-threatening conditions, fostering mutual understanding and respect.

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Practical Implications

Implementation Considerations

The study demonstrates that comprehensive handover training can be successfully implemented in busy clinical environments with appropriate organizational support. Key success factors identified include:

Leadership Engagement: Strong support from departmental leadership was essential for securing protected time and resources for training participation.

Interprofessional Participation: Including multiple professional groups in shared scenarios enhanced learning outcomes and promoted team cohesion.

Realistic Training Environment: In-situ simulation maximized transfer of learning to clinical practice by incorporating authentic environmental factors.

Structured Assessment: Use of validated tools provided objective feedback and supported continuous improvement efforts.

Scalability and Sustainability

The intervention design supports scalability through several mechanisms:

Train-the-Trainer Model: Simulation faculty can train clinical educators to deliver the intervention,

reducing dependence on specialized personnel.

Technology Integration: Digital versions of checklists and assessment tools can facilitate widespread implementation and data collection.

Curriculum Integration: The intervention can be incorporated into existing educational programs rather than requiring separate training initiatives.

Quality Improvement Framework: Positioning as quality improvement rather than research supports ongoing implementation and refinement.

Study Limitations

- **Single-Center Design:** Conduct at a single institution may limit generalizability to other healthcare settings with different organizational cultures, resource levels, or patient populations.
- **Pre-Post Design:** The absence of a control group limits causal inferences, though the magnitude and consistency of improvements across multiple measures suggest intervention effectiveness.
- **Short-Term Follow-Up:** Assessment immediately post-intervention may not reflect long-term skill retention or clinical impact.
- **Simulation Context:** Performance in simulated scenarios may not fully represent real-world handover complexity and stress levels.

Future Directions

Same protocol can be implemented by other specialties and other areas of the hospital to improve the quality of care of patients

Quality Indicators: Healthcare organizations could adopt handover quality metrics as key performance indicators for patient safety programs.

Resource Allocation: The demonstrated effectiveness supports investment in simulation infrastructure and protected time for communication training.

Interprofessional Education: Medical and nursing education programs could integrate collaborative handover training into core curriculum.

Conclusion

This simulation-based quality improvement initiative successfully demonstrated that structured, interprofessional handover training can significantly improve communication quality, information completeness, and healthcare provider confidence in the challenging OT-to-ICU transition environment. The intervention's multi-component design, incorporating evidence-based educational strategies, validated assessment tools, and realistic simulation scenarios, provides a replicable model for other healthcare organizations seeking to enhance patient safety through improved communication. The substantial improvements observed across objective performance measures and subjective confidence ratings, combined with overwhelmingly positive qualitative feedback, provide compelling evidence for the value of investing in comprehensive handover training programs. The interprofessional approach proved particularly valuable, fostering mutual understanding and collaboration between anesthesia and ICU teams while addressing the complex information needs of diverse healthcare providers.

While limitations related to single-center design and short-term follow-up warrant consideration, the consistency and magnitude of improvements suggest that the intervention addresses fundamental communication challenges that compromise patient safety. The findings support broader implementation of structured handover training as a critical component of healthcare quality improvement initiatives. Future research should focus on validating these findings in diverse healthcare settings, assessing long-term effectiveness and clinical outcomes, and investigating optimal implementation strategies to maximize impact and sustainability. As healthcare systems continue to prioritize patient safety and quality improvement, evidence-based interventions like this handover training program offer promising approaches to reducing communication-related errors and enhancing the safety and effectiveness of patient care transitions.

The integration of simulation-based education, validated assessment tools, and interprofessional collaboration represents a comprehensive approach to addressing one of healthcare's most persistent safety challenges. By providing healthcare providers with structured frameworks, practice opportunities, and objective feedback, such interventions can meaningfully improve the quality and safety of patient care while fostering professional development and team collaboration.

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Appendices

Appendix A: ISOBAR Handover Checklist - OT to ICU Version Appendix B: SBAR-LA Rubric Scoring Guide

Appendix C: Simulation Scenario Examples Appendix D: Qualitative Interview Guide