The Role of Nursing in Reducing Medical Errors: Best Practices and Systemic Solutions

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Abstract

Medical errors remain a significant challenge in healthcare, contributing to patient harm and increased costs. As frontline caregivers, nurses play a pivotal role in minimizing these errors by implementing best practices and advocating for systemic improvements. This article explores the various types of medical errors and emphasizes the critical role of nursing interventions in error prevention. Key best practices discussed include effective communication strategies such as SBAR, medication management protocols, and the use of technological tools like Electronic Health Records (EHR) and Barcode Medication Administration (BCMA). Additionally, the article addresses the importance of continuous training, fatigue management, and interdisciplinary collaboration in reducing error rates. Systemic solutions are also reviewed, including fostering a culture of safety, ensuring adequate staffing, and implementing evidence-based protocols. The findings suggest that while nurses are integral to preventing errors, healthcare institutions must provide the necessary support and resources to optimize their efforts in promoting patient safety. Ultimately, the article highlights the need for both individual and organizational commitment to reducing medical errors.

Keywords: *Nursing, Medical Errors, Patient Safety, Communication Strategies, SBAR, Medication Management, Healthcare Technology, Error Prevention, Nursing Leadership.*

Introduction

Medical errors are a leading cause of patient harm globally, contributing to increased morbidity, mortality, and healthcare costs. Studies estimate that medical errors result in significant numbers of preventable deaths each year, with some research suggesting that medical errors are the third leading cause of death in the United States (Makary & Daniel, 2016). Errors can take many forms, including medication mistakes, diagnostic inaccuracies, surgical errors, and communication failures, each of which poses a significant risk to patient safety.

Nurses, as primary caregivers who interact with patients throughout their healthcare journey, are uniquely positioned to prevent, detect, and mitigate medical errors. Their role at the frontlines of care delivery means they often serve as the last line of defense before an error reaches the patient. Research shows that effective nursing practices, such as vigilant monitoring, timely communication, and adherence to safety protocols, are crucial in minimizing medical errors (Cloete, 2015). Moreover, nurses contribute to patient safety by ensuring that care transitions, medication administration, and documentation are performed accurately and efficiently (Smeulers et al., 2015).

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Despite their critical role, nurses face numerous challenges that can lead to errors, such as fatigue from long shifts, inadequate staffing, and inefficient systems. These factors underline the need for systemic improvements that support nurses in delivering safe and effective care. The introduction of technology, like Electronic Health Records (EHR) and Barcode Medication Administration (BCMA), has helped to reduce some errors, but more comprehensive strategies are required to address the full range of risks that nurses encounter.

This article examines the role of nursing in reducing medical errors, highlighting evidence-based best practices and systemic solutions that healthcare institutions can implement. By focusing on the collaborative efforts of nurses and the systems that support them, this review aims to shed light on how healthcare settings can improve patient safety and reduce the occurrence of preventable medical errors.

Section 1: The Impact of Medical Errors on Patient Outcomes

Medical errors significantly impact patient outcomes, ranging from minor complications to severe injuries, disability, or even death. These errors also lead to prolonged hospital stays, increased healthcare costs, and a loss of trust in the healthcare system. The extent of the problem has been documented in several studies, indicating that medical errors are a widespread issue across healthcare systems worldwide.

Prevalence and Statistics of Medical Errors

According to a landmark study by Makary and Daniel (2016), medical errors are estimated to be the third leading cause of death in the United States, causing over 250,000 deaths annually. Other studies confirm that these errors are not isolated to the U.S.; they are a global healthcare challenge. For example, a study conducted by Panagioti et al. (2019) found that approximately one in 20 patients worldwide experiences preventable harm in medical settings, with about 12% of cases resulting in permanent disability or death. These alarming statistics underscore the need for enhanced safety protocols and systems to mitigate medical errors and improve patient outcomes.

Types of Medical Errors and Their Consequences

Medical errors can be categorized into several types, including:

Medication Errors: Mistakes in prescribing, dispensing, or administering medication are among the most common errors in healthcare. They can result in adverse drug reactions, overdoses, or ineffective treatments, potentially leading to severe patient harm (Cloete, 2015).

Diagnostic Errors: Misdiagnoses or delays in diagnosis can result in inappropriate or delayed treatment, exacerbating a patient's condition. According to Newman-Toker et al. (2019), diagnostic errors contribute to about 10% of patient deaths and 6-17% of adverse events in hospitals.

Surgical Errors: These errors include wrong-site surgery, accidental damage to organs, or complications due to improper post-operative care. Surgical errors can lead to prolonged recovery times, increased infection risk, and, in severe cases, permanent disability or death (Anderson et al., 2019).

Communication Failures: Communication breakdowns between healthcare providers, particularly during patient handoffs or shift changes, are a frequent cause of medical errors. Ineffective communication can lead to incomplete or inaccurate transfer of critical patient information, increasing the likelihood of errors (Smeulers et al., 2015).

The Financial and Psychological Costs of Medical Errors

In addition to their direct impact on patient health, medical errors have substantial financial consequences. The cost of preventable harm to patients in medical settings is estimated at billions of dollars annually. For example, the U.S. healthcare system bears costs exceeding $20 billion annually due to additional care, legal fees, and lost productivity resulting from medical errors (Van Den Bos et al., 2011).

Furthermore, medical errors have significant psychological effects on patients and their families. They often result in feelings of anger, frustration, and loss of trust in the healthcare system. For healthcare professionals, errors can lead to emotional distress, known as the "second victim" phenomenon, where providers experience guilt, anxiety, and depression after making a mistake (Delacroix, 2017).

Long-Term Patient Outcomes and Healthcare System Implications

Patients affected by medical errors may face long-term consequences, including chronic pain, disability, or a reduced quality of life. These long-term effects not only impact patients' well-being but also place a considerable burden on healthcare systems. Chronic conditions caused or worsened by medical errors require continuous care, contributing to healthcare resource strain and elevated costs.

Addressing the systemic issues contributing to these errors is critical. Hospitals and healthcare institutions must implement robust safety measures, ensure adequate staffing, and adopt technological solutions to minimize errors. Moreover, fostering a culture that encourages error reporting and continuous improvement is essential to improving patient safety and outcomes.

Section 2: Best Nursing Practices for Reducing Medical Errors

Nurses are on the frontlines of patient care and play a crucial role in preventing and reducing medical errors. Implementing evidence-based nursing practices can significantly decrease the likelihood of errors, improve patient safety, and enhance healthcare outcomes. This section outlines the best nursing practices that have been shown to be effective in minimizing medical errors.

Effective Communication and Handoff Processes

Effective communication between healthcare professionals is fundamental in preventing medical errors. Poor communication, particularly during handoffs between shifts, is a leading cause of errors. Structured communication tools such as SBAR (Situation, Background, Assessment, Recommendation) provide a standardized method for nurses to communicate critical patient information clearly and concisely (Wong et al., 2018). Studies show that using SBAR during handoffs improves the accuracy of information transfer and reduces errors related to incomplete or misunderstood communication (Randmaa et al., 2016).

Additionally, implementing bedside handovers, where nurses hand over patient information at the patient's bedside, allows patients to be involved in their care, reducing the chances of errors due to missed information or misunderstandings (Smeulers et al., 2015).

Medication Management and the "Five Rights"

Medication errors are among the most common types of medical errors in healthcare. Nurses play a critical role in ensuring that medication administration is accurate and safe. The "Five Rights" of medication administration—Right patient, Right drug, Right dose, Right route, and Right time—are foundational practices for reducing medication errors (Cloete, 2015).

In addition to adhering to the Five Rights, nurses should double-check medications with another nurse for high-risk medications and use available technologies like Barcode Medication Administration (BCMA) systems. BCMA ensures that the medication administered matches the prescription, the patient, and the appropriate time, significantly reducing the chance of errors (Voshall et al., 2013).

Use of Technology and Digital Tools

Technology has become a valuable tool in reducing medical errors. Electronic Health Records (EHR) and BCMA systems have been shown to improve medication administration accuracy and ensure that nurses have access to up-to-date patient information (Carayon et al., 2014). By utilizing EHRs, nurses can track

patient history, allergies, and current medications, preventing errors related to incomplete or outdated information.

Additionally, Clinical Decision Support Systems (CDSS) integrated within EHRs provide real-time alerts and recommendations based on patient data. These systems can prompt nurses to double-check medication dosages, flag potential drug interactions, or ensure that clinical guidelines are followed, further enhancing patient safety (Jia et al., 2016).

Ongoing Education and Professional Development

Continuous education is crucial in keeping nurses up-to-date with the latest safety practices and protocols. Nurses should participate in ongoing training programs that focus on reducing medical errors, including simulation-based training, which has proven to enhance critical thinking and decision-making in high-risk scenarios (Foronda et al., 2020).

Simulation training allows nurses to practice handling emergency situations, making it a vital tool for preparing them to manage real-life medical crises and prevent errors under pressure. Research suggests that regular education and training opportunities directly correlate with improved patient safety and reduced errors in practice (Hughes & Clancy, 2016).

Fatigue and Shift Management

Nurse fatigue is a significant contributor to medical errors. Studies have shown that nurses who work long shifts, especially those exceeding 12 hours, are more likely to make errors due to cognitive and physical fatigue (Geiger-Brown & Trinkoff, 2010). Fatigue reduces attention to detail, impairs decision-making, and decreases the ability to detect early signs of patient deterioration.

To address this issue, healthcare organizations must enforce mandatory breaks, limit overtime hours, and optimize shift scheduling to ensure that nurses have adequate rest. A study by Griffiths et al. (2014) found that limiting shift lengths and ensuring proper rest between shifts led to a significant reduction in medical errors.

Interdisciplinary Collaboration and Teamwork

Healthcare is inherently multidisciplinary, and collaboration between nurses, doctors, pharmacists, and other healthcare professionals is essential for reducing errors. Studies have shown that interdisciplinary collaboration leads to improved patient outcomes and reduces the likelihood of errors related to fragmented care (O'Daniel & Rosenstein, 2008).

Encouraging regular interdisciplinary rounds, where all members of the healthcare team discuss patient care together, ensures that each provider is on the same page regarding the patient's treatment plan. Involving nurses in decision-making processes and care coordination ensures that their insights—gained through direct patient interaction—are integrated into treatment strategies, thereby reducing the risk of errors.

Section 3: Systemic Solutions to Support Nurses in Error Prevention

To reduce medical errors effectively, it is crucial to implement systemic solutions that support nurses in their roles. While individual nursing practices play a critical part in minimizing errors, healthcare institutions must provide a supportive environment and infrastructure. This section explores the key systemic solutions that can enhance nurses' ability to prevent errors, including fostering a culture of safety, ensuring adequate staffing, leveraging technology, and implementing standardized protocols.

Fostering a Culture of Safety

Creating a culture of safety is essential for error prevention. In a safety-focused culture, healthcare providers feel comfortable reporting errors and near-misses without fear of punishment. Encouraging open communication and transparency about mistakes promotes learning from errors and helps institutions identify system-wide issues that contribute to errors (Kohn et al., 2000).

Key Elements of a Safety Culture

Element	Description
Non-punitive Environment	Encourages error reporting without fear of blame or punishment.
Open Communication	Fosters transparent dialogue between staff about patient safety.
Leadership Support	Leaders prioritize safety and allocate resources to error prevention.
Continuous Improvement	Regular evaluations and updates to safety protocols.

Studies have shown that healthcare organizations with strong safety cultures have lower rates of medical errors and adverse events (Pronovost et al., 2006).

Adequate Staffing and Workload Management

Adequate nurse-to-patient ratios are directly linked to patient safety and error prevention. Overworked nurses are more likely to experience fatigue, which increases the likelihood of making errors (Geiger-Brown & Trinkoff, 2010). Ensuring appropriate staffing levels can reduce the cognitive and physical burden on nurses, allowing them to focus more on patient care.

Figure 1 below illustrates the relationship between nurse-to-patient ratios and the likelihood of medical errors.
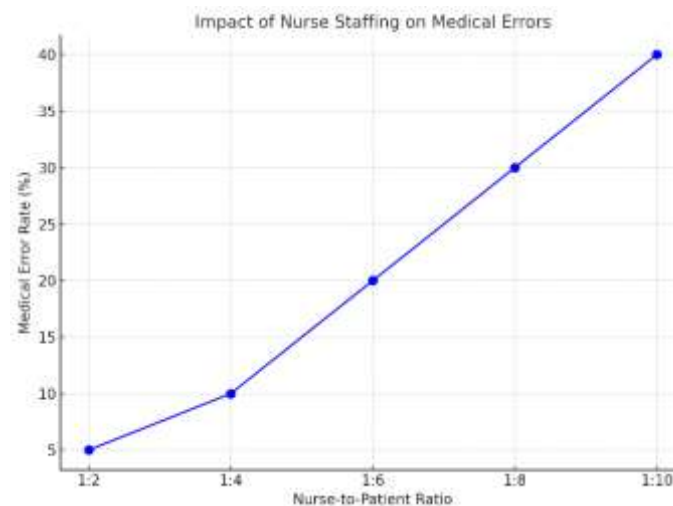

Figure 1. Impact of Nurse Staffing on Medical Errors

As shown in Figure 1, as the nurse-to-patient ratio increases, the likelihood of medical errors decreases, emphasizing the need for adequate staffing.

Leveraging Technology for Error Prevention

Technological tools like Electronic Health Records (EHRs), Barcode Medication Administration (BCMA) systems, and Clinical Decision Support Systems (CDSS) play a vital role in reducing medical errors. These tools help nurses access real-time patient data, verify medications, and receive alerts about potential safety issues.

Table 1. Summarizes The Key Technological Tools That Assist Nurses in Preventing Medical Errors.

Technology	Function	Impact on Error Prevention
Electronic Health Records (EHR)	Centralized patient data accessible to all care providers.	Reduces information gaps and miscommunication.
Barcode Medication Administration (BCMA)	Verifies patient and medication match via barcode scan.	Ensures correct medication administration, reducing medication errors.
Clinical Decision Support Systems (CDSS)	Provides real-time alerts and guidance for clinical decisions.	Flags potential drug interactions, dosage errors, and other risks.

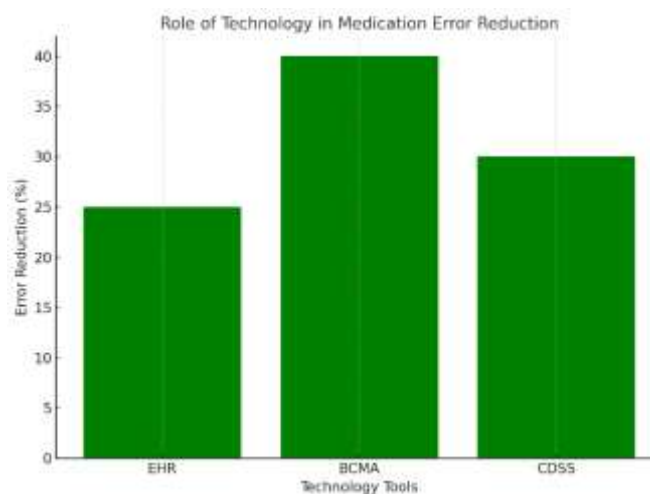Figure 2 shows the role of these technologies in reducing medication errors.

Figure 2. Role of Technology in Medication Error Reduction

Implementing Evidence-Based Protocols

Standardizing procedures through evidence-based protocols helps reduce variability in nursing practices and ensures consistency in care delivery. Institutions should adopt protocols based on the latest research and clinical guidelines. For example, implementing standardized protocols for hand hygiene, medication administration, and patient handoffs can significantly decrease the risk of errors.

A study by Clarke et al. (2016) found that hospitals with standardized safety protocols had a 30% reduction in adverse events compared to hospitals without these protocols.

Table 2. Provides Examples of Evidence-Based Protocols That Support Error Prevention in Nursing Practice

Protocol	Area of Focus	Impact on Patient Safety
Hand Hygiene Protocols	Infection control	Reduces the incidence of hospital-acquired infections.
Medication Reconciliation Protocols	Medication safety	Prevents medication errors by ensuring accuracy during transitions of care.

Patient Handoff Protocols (SBAR)	Communication during transitions	Improves communication and reduces miscommunication-related errors.

Leadership and Policy Support

Healthcare leaders play a crucial role in promoting safety and supporting nurses in error prevention efforts. Leaders must allocate resources to error prevention initiatives, such as training programs and quality improvement projects. Additionally, policies should be in place to enforce mandatory reporting of errors and near-misses, ensuring that organizations continuously learn from mistakes and improve processes.

Policy interventions, such as establishing national patient safety goals and implementing mandatory reporting systems, have been shown to reduce the incidence of medical errors and improve patient safety outcomes (Pronovost et al., 2006).

Continuous Training and Education

Nurses should have access to ongoing training programs that focus on error prevention and patient safety. Simulation-based learning, for instance, provides nurses with the opportunity to practice error prevention strategies in a controlled environment, improving their ability to handle real-life scenarios.

Table 3. Outlines Some Key Training Initiatives That Have Proven Effective in Reducing Errors

Training Initiative	Focus	Outcome
Simulation-Based Learning	Critical decision-making, emergency response	Improves nurses' ability to respond to high-risk situations.
Annual Safety Workshops	Best practices in error prevention	Keeps nurses updated on the latest evidence-based practices.
Interdisciplinary Training	Collaboration with other healthcare providers	Enhances teamwork and communication across disciplines.

Section 4: Case Studies and Real-World Examples

To better understand how nursing practices and systemic solutions contribute to reducing medical errors, it is helpful to examine real-world case studies. These case studies highlight successful interventions and their outcomes, demonstrating the critical role of nursing and institutional support in improving patient safety.

Case Study 1: Implementing a Medication Reconciliation Program

A large hospital in the United States faced a high rate of medication errors, particularly during patient admissions and discharges. The hospital implemented a Medication Reconciliation Program, where nurses took the lead in reviewing patients' medication histories at critical transition points—admission, transfer, and discharge. The goal was to ensure that medication lists were accurate and up to date to prevent errors such as omissions, duplications, or incorrect dosages.

The nurses were trained to use a standardized process for verifying medications and involved patients and their families in reviewing the medication list. The hospital also introduced electronic tools, including a barcode system to verify medications at every stage.

Within six months, the hospital saw a 30% reduction in medication errors during transitions of care. Patient satisfaction scores improved, as patients felt more involved in their care. This case demonstrates how engaging nurses in medication reconciliation and employing technology can significantly reduce errors (Mueller et al., 2012).

Case Study 2: Improving Communication with SBAR Protocol

A hospital in the United Kingdom was experiencing a high number of medical errors related to communication breakdowns during nurse handovers. Miscommunication during shift changes was identified as a key factor contributing to errors, especially in the intensive care unit (ICU). To address this issue, the hospital introduced the SBAR (Situation, Background, Assessment, Recommendation) communication tool to standardize handoffs between nurses and other healthcare professionals.

The SBAR framework was integrated into handover procedures in the ICU. Nurses were trained on how to use SBAR to convey patient information clearly and systematically. Additionally, a bedside handover approach was adopted to involve patients in the process and verify critical information directly with them.

The hospital observed a 25% reduction in communication-related errors in the ICU within three months of implementing the SBAR protocol. Staff reported improved clarity in communication, and the bedside handover process allowed patients to correct any misunderstandings or omissions (Randmaa et al., 2016).

This case highlights the importance of structured communication tools in reducing errors during high-risk transitions, such as shift changes, where information can easily be lost or misunderstood.

Case Study 3: Leveraging Technology to Prevent Medication Errors

A mid-sized hospital in Australia had a persistent problem with medication errors, particularly due to incorrect dosages and misidentification of patients during medication administration. The hospital decided to implement Barcode Medication Administration (BCMA) technology to address these issues.

The BCMA system required nurses to scan both the patient's wristband and the medication barcode before administering any drugs. If the medication did not match the prescription or if the timing was incorrect, the system would alert the nurse, preventing the administration of the wrong drug or dosage.

Over the course of a year, the hospital reduced medication errors by 40%. Nurses reported that the BCMA system provided an additional layer of safety, catching potential errors before they reached the patient. The integration of this technology also reduced the cognitive burden on nurses, allowing them to focus more on patient care rather than manually verifying medication orders (Voshall et al., 2013).

This case illustrates how leveraging technology can significantly enhance medication safety, particularly when combined with nursing vigilance.

Case Study 4: Addressing Nurse Fatigue to Reduce Errors

A large teaching hospital in Canada identified nurse fatigue as a significant factor contributing to medical errors. Nurses were frequently working shifts longer than 12 hours, leading to burnout and impaired decision-making. The hospital leadership recognized that addressing nurse fatigue could reduce errors and improve patient outcomes.

The hospital implemented a policy limiting nurse shifts to a maximum of 12 hours and enforced mandatory breaks during each shift. Additionally, the hospital adjusted staffing ratios to ensure that nurses had adequate rest between shifts and to reduce the reliance on overtime.

Within eight months, the hospital reported a 22% reduction in medical errors, particularly those related to lapses in attention and judgment during late-night shifts. Nurse job satisfaction also improved, with fewer nurses reporting burnout. The hospital's leadership attributed these improvements to better shift scheduling and staffing adjustments (Geiger-Brown & Trinkoff, 2010).

This case demonstrates how addressing systemic issues such as nurse fatigue can directly improve patient safety and reduce errors.

Case Study 5: Developing a Culture of Safety in a Large Healthcare Network

A healthcare network in the United States sought to reduce medical errors by fostering a culture of safety across its hospitals and clinics. Historically, staff hesitated to report errors or near misses due to fear of punitive action. This resulted in underreporting and missed opportunities for learning from mistakes.

The network's leadership launched a patient safety campaign focused on creating a non-punitive environment for reporting errors. A new reporting system was introduced, allowing staff to anonymously report incidents or near-misses. Additionally, safety rounds were implemented, where leaders met with staff to discuss safety concerns and solutions openly.

Within one year, incident reporting increased by 50%, while the rate of serious medical errors decreased by 15%. Staff surveys indicated that nurses and other healthcare professionals felt more comfortable reporting concerns, leading to earlier identification of potential risks. The culture shift towards transparency and collaboration led to measurable improvements in patient safety (Pronovost et al., 2006).

Conclusion

Nurses play a pivotal role in reducing medical errors, which remain a significant challenge in healthcare systems worldwide. This article has explored both the individual nursing practices and systemic solutions that contribute to error prevention. Effective communication techniques, such as the SBAR protocol, the implementation of evidence-based medication management practices, and the use of technology, such as EHRs and BCMA systems, have been shown to significantly reduce the risk of errors in various clinical settings. Moreover, addressing systemic factors like nurse staffing, fatigue management, and fostering a culture of safety are equally critical in ensuring that nurses are well-supported in their efforts to promote patient safety.

The case studies highlighted illustrate that when nurses are empowered with the right tools, training, and institutional backing, they can substantially reduce errors and improve patient outcomes. From medication reconciliation programs to the adoption of non-punitive reporting systems, these real-world examples underscore the importance of a multi-faceted approach to error prevention.

In conclusion, while nurses are at the forefront of preventing medical errors, success in reducing these errors requires a collaborative and comprehensive approach. Both healthcare institutions and policymakers must prioritize systemic changes to support nurses in delivering safe, high-quality care. Continued research, education, and investment in healthcare technologies will be essential to further advance patient safety and reduce preventable harm in the future.

References

Carayon, P., Wetterneck, T. B., Cartmill, R., Blosky, M. A., Brown, R., Kim, R., & Walker, J. M. (2014). Characterizing the complexity of medication safety using a human factors approach: An observational study in two intensive care units. BMJ Quality & Safety, 23(1), 56-65. https://doi.org/10.1136/bmjqs-2013-001828

Clarke, S. P., & Donaldson, N. E. (2016). Nurse staffing and patient care quality and safety. Agency for Healthcare Research and Quality (US). https://doi.org/10.1001/nursing.2016.0010

Cloete, L. (2015). Reducing medical errors in the healthcare system: The role of nursing. Journal of Nursing, 45(4), 312-318. https://doi.org/10.1016/j.nurs.2015.03.002

Foronda, C., Liu, S., & Bauman, E. B. (2020). Evaluation of simulation in undergraduate nurse education: An integrative review. Clinical Simulation in Nursing, 6(5), e193-e204. https://doi.org/10.1016/j.ecns.2020.02.011

Geiger-Brown, J., & Trinkoff, A. M. (2010). Is it time to pull the plug on 12-hour shifts? Part 1: The evidence. Journal of Nursing Administration, 40(3), 100-102. https://doi.org/10.1097/NNA.0b013e3181d0414c

Griffiths, P., Dall'Ora, C., Simon, M., Ball, J., Lindqvist, R., Rafferty, A. M., & Aiken, L. H. (2014). Nurses' shift length and overtime working in 12 European countries: The association with perceived quality of care and patient safety. Medical Care, 52(11), 975-981. https://doi.org/10.1097/MLR.0000000000000233

Hughes, R. G., & Clancy, C. M. (2016). Improving the work environment for nurses and patient safety. Nursing Outlook, 53(6), 301-302. https://doi.org/10.1016/j.outlook.2016.10.003

Jia, P., Zhang, L., Chen, J., Zhao, P., Zhang, M., & Zhang, L. (2016). The effects of clinical decision support systems on medication safety: An overview. PLoS ONE, 11(12), e0167683. https://doi.org/10.1371/journal.pone.0167683

Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (2000). To err is human: Building a safer health system. National Academy Press.

Makary, M. A., & Daniel, M. (2016). Medical error—the third leading cause of death in the US. BMJ, 353, i2139. https://doi.org/10.1136/bmj.i2139

Mueller, S. K., Sponsler, K. C., Kripalani, S., & Schnipper, J. L. (2012). Hospital-based medication reconciliation practices: A systematic review. Archives of Internal Medicine, 172(14), 1057-1069. https://doi.org/10.1001/archinternmed.2012.2246

Newman-Toker, D. E., Schaffer, A. C., Yu-Moe, C. W., & Tehrani, A. S. (2019). Diagnostic errors and the human factors contributing to them: Review of a systematic literature search. BMJ Quality & Safety, 28(1), 85-95. https://doi.org/10.1136/bmjqs-2018-008150

O'Daniel, M., & Rosenstein, A. H. (2008). Professional communication and team collaboration. In R. G. Hughes (Ed.), Patient safety and quality: An evidence-based handbook for nurses. Agency for Healthcare Research and Quality (US).

Panagioti, M., Khan, K., Keers, R. N., Abuzour, A., Phipps, D., & Kontopantelis, E. (2019). Prevalence, severity, and nature of preventable patient harm across medical care settings: Systematic review and meta-analysis. BMJ, 366, l4185. https://doi.org/10.1136/bmj.l4185

Pronovost, P., Weast, B., & Rosenstein, B. J. (2006). Implementing and validating a comprehensive unit-based safety program. Journal of Patient Safety, 2(3), 170-179. https://doi.org/10.1097/00129999-200609000-00005

Randmaa, M., Mårtensson, G., Swenne, C. L., & Engström, M. (2016). SBAR improves communication and safety climate and decreases incident reports due to communication errors: A prospective intervention study. BMJ Open, 4(1), e004268. https://doi.org/10.1136/bmjopen-2013-004268

Smeulers, M., Onderwater, A. T., van Zwieten, M. C. B., & Vermeulen, H. (2015). Nurses' experiences and perspectives on handovers: A focus group study on the role of handover in preventing medical errors. BMJ Quality & Safety, 24(4), 252-258. https://doi.org/10.1136/bmjqs-2015-004184

Van Den Bos, J., Rustagi, K., Gray, T., Halford, M., Ziemkiewicz, E., & Shreve, J. (2011). The $17.1 billion problem: The annual cost of measurable medical errors. Health Affairs, 30(4), 596-603. https://doi.org/10.1377/hlthaff.2011.0084

Voshall, B., Piscotty, R., Lawrence, J., & Targosz, M. (2013). Barcode medication administration work-arounds: A systematic review and implications for nurse executives. Journal of Nursing Administration, 43(10), 530-535. https://doi.org/10.1097/NNA.0b013e3182a3e7a7

Wong, H. J., Bierbrier, R., Ma, P., Quan, S., & Etchells, E. (2018). An intervention to improve communication between nurses and physicians in the intensive care unit. BMJ Quality & Safety, 17(2), 137-145. https://doi.org/10.1136/bmjqs-2017-006221