System Changes Needed to Reduce Medical Errors

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ABSTRACT

Medical errors represent a critical challenge in healthcare, posing significant risks to patient safety and overall healthcare quality. These errors, ranging from medication mishaps to diagnostic inaccuracies, have become a matter of urgent concern in the medical community. Various studies and reports highlight the prevalence and gravity of medical errors. This research paper aims to delve into the various dimensions of medical errors and explore systematic changes that can be implemented to mitigate these errors. By examining the current efforts and challenges in addressing these errors, including the implementation of critical incident reporting systems and the creation of comprehensive training programs for healthcare professionals, the paper aims to provide actionable insights and recommendations.

Keywords: medical error, patient safety, healthcare quality

INTRODUCTION

Medical errors in hospitals represent a critical challenge in healthcare, posing significant risks to patient safety as well as overall healthcare quality. These errors, ranging from medication mishaps to diagnostic inaccuracies, have become a matter of urgent concern in the medical community. Various studies and reports highlight the prevalence and gravity of medical errors. For instance, a report by Excel Medical has emphasized that hospital errors are among the leading causes of death in the United States, underscoring the severe implications these mistakes can have. Similarly, Kounang (2022) reveals that over seven million incorrect diagnoses are made annually in United States emergency rooms, illustrating the widespread nature of this issue. Osmani et al., 2023 noted that preventable medication errors account for about 100,000 United States deaths annually, with medication errors affecting about one in ten hospitalized.

Addressing medical errors is not merely a matter of reducing the frequency of these incidents; it is fundamentally about enhancing the quality of healthcare and safeguarding the well-being of patients. Medical errors can lead to severe physical, emotional, and financial consequences for patients, undermining people's trust and reliability in healthcare systems. Beyond the direct impact on patients, medical errors also carry a significant economic burden, leading to higher healthcare costs because of additional treatments, prolonged hospital stays, and legal implications. Furthermore, these errors can cause emotional and psychological distress among healthcare professionals, leading to job dissatisfaction, burnout, and a high turnover rate, affecting the quality of patient care.

This research paper aims to delve into the various dimensions of medical errors in hospital settings and explore systematic changes that can be implemented to mitigate these errors. This exploration will include an analysis of the issues contributing to medical errors, such as the challenges in establishing a nursing-specific patient safety definition (Chatzi & Malliarou, 2023) and the role of patient safety culture in emergency nursing (Aydemir & Koç, 2023). By examining the current efforts and challenges in addressing these errors, including the implementation of critical incident reporting systems and the creation of comprehensive training programs for healthcare professionals, the paper aims to provide actionable insights and recommendations.

The scope of this research paper extends beyond merely identifying the types of medical mistakes that occur in hospitals. It also examines the systemic issues contributing to these errors, such as organizational culture, communication breakdowns, and the requirement for more effective safety protocols. The paper will explore the broader implications of medical errors on healthcare systems and patient populations. It will consider how different healthcare settings, from small clinics to large hospitals, are affected by and respond to the challenge of medical errors. Including case studies and comparative analyses will offer a diverse perspective on the issue, highlighting successful strategies and interventions implemented worldwide.

BACKGROUND AND SIGNIFICANCE

The historical perspective on medical errors in healthcare reveals a long-standing challenge that has evolved with the complexities of modern medicine. Historically, medical errors were often unrecognized or underreported, primarily due to a lack of systematic surveillance and a culture that needed to be more conducive to acknowledging mistakes. However, over the past several decades, there has been a significant shift in this perspective. The

realization that medical errors may be a leading source of death and disability prompted a global movement towards improving patient safety. For the last few decades, healthcare systems worldwide have increasingly focused on understanding and mitigating medical errors, especially those caused by human error or deficiencies in healthcare structures and systems.

Recent facts on medical errors highlight their prevalence and the urgency with which they must be addressed. For instance, Excel Medical's (2022) report has identified hospital errors as a significant contributor to America's deaths, indicating a severe public health issue. This is further underscored by the reports that more than seven million incorrect diagnoses are made annually in America's emergency rooms (Kounang, 2022). These statistics are not just numbers; they represent individuals suffering from preventable mistakes, highlighting the critical need for systemic changes in healthcare practices and policies. The consequence of medical errors on the safety of patients and healthcare outcomes can be fatal. Medical mistakes also can cause a range of adverse effects, from minor complications to severe injury. They can prolong hospital stays, necessitate additional treatments or surgeries, and, in some cases, lead to long-term disability. The emotional and psychological toll on patients and supporting relatives can be profound, often resulting in a loss of trust in the system. Medical errors also have a ripple effect on healthcare providers, who may experience guilt, anxiety, and professional burnout, further affecting the quality of provided care.

Beyond the direct impact on individuals, medical errors have significant implications for healthcare systems and society at large. They lead to increased costs due to the need for additional treatments and the potential for legal action. This financial burden is not limited to the healthcare system alone; it also affects patients and supporting family members, who may face unexpected medical bills and lost income. The societal impact extends even further, as society's trust in the healthcare total system can be eroded by high rates of medical errors, leading to decreased utilization of necessary healthcare services and poorer overall health outcomes.

The significance of addressing medical errors lies in reducing their occurrence and improving the whole quality of healthcare. A healthcare system that effectively manages and reduces medical errors is more efficient, cost-effective, and patient-centered. It fosters a safety culture where healthcare providers are encouraged to report errors and near-misses, leading to a continuous cycle of learning and improvement. Such a system also prioritizes communication and collaboration among healthcare professionals, ensuring that patient care is coordinated and holistic.

Factors Adding to Medical Errors

The incidence of healthcare errors is a multifaceted issue influenced by various factors, some of which become particularly pronounced under specific circumstances, such as during a pandemic. AlMeslamani (2023) discusses how the pandemic exacerbated medication errors. Healthcare systems are often overwhelmed during such periods, increasing stress and workload for healthcare professionals. This heightened pressure can result in lapses in standard procedures, oversight of patient history, or confusion due to rapidly changing treatment protocols. The disruption of supply chains can also be a part, leading to shortages of medication or substitution with less familiar alternatives, further increasing the error risk. Additionally, handling personal protective equipment (PPE) and the requirement of infection control measures can hinder communication among healthcare staff, making it more challenging to verify and cross-check medication orders.

In the United States, the development and implementation of testing protocols remain in a state of evolution. Confirmatory testing for the typical COVID-19 presentation, characterized by a febrile respiratory illness, is crucial. However, the availability of testing may be limited, and false-negative results can occur, leading to potential errors. The consequences of false negatives or the absence of testing include delayed diagnoses and the ongoing spread of the virus. (Gandhi & Singh, 2020) Hence, medical personnel must have access to standardized and optimized testing protocols during pandemics and as part of routine operations. The role of patient safety culture, particularly in emergency nursing (Aydemir & Koç, 2023), is another crucial factor. In emergency departments, where decisions must be made swiftly and often under high-stress conditions, the culture surrounding patient safety can significantly influence the incidence of medical errors. A culture encouraging open communication, reporting errors and near-misses, and collaborative problem-solving can help identify potential risks and implement preventive measures. Conversely, a culture where staff members feel unable to express concerns or where reporting errors is stigmatized can lead to underreporting and missed opportunities for improvement. In such environments, systemic issues contributing to errors may remain unaddressed, perpetuating a cycle of preventable mistakes.

Challenges in establishing nursing-specific patient safety practices also contribute to medical errors (Chatzi & Malliarou, 2023). A universally accepted description of patient safety within the nursing profession can lead to consistency in prioritizing and managing safety across different healthcare settings. This ambiguity can result in varied interpretations of what constitutes a safe practice, leading to discrepancies in implementing safety protocols and measures. Additionally, with a clear, nursing-specific framework for patient safety, nurses may be adequately equipped to identify and address potential hazards in their unique role within the patient care continuum.

The impact of misdiagnoses in emergency rooms is another significant factor (Kounang, 2022). Misdiagnoses can arise from various sources, including insufficient patient history, inadequate time for thorough examination, or the complexity of presenting symptoms that may mimic other conditions. In emergency settings, where time is often limited and the pressure is high, the likelihood of misdiagnosis increases. Such errors affect the patient's immediate care and can have long-term consequences if the correct diagnosis is significantly delayed, leading to inappropriate treatments and potentially worsening health outcomes.

Medication errors in children's hospitals represent a specific subset of medical errors with unique contributing factors (Liu et al., 2023). Children are particularly in danger of medication errors due to differences in pharmacokinetics and pharmacodynamics, the need for weight-based dosing, and the use of formulations and concentrations that differ from adult medications. In children's hospitals, where specialized pediatric care is provided, the medication error risks can be exacerbated by issues such as the availability of appropriately trained staff, the complexity of calculating individualized doses, and the challenges in communication with young patients who may not be able to articulate their symptoms or concerns effectively. Such errors can also stem from systemic issues within the hospitals. For example, while designed to reduce errors, EHR techniques can sometimes contribute to them if they are not user-friendly or lead to alert fatigue among healthcare professionals. Inadequate staffing and high nurse-to-patient ratios can also increase the chances of errors, as nurses may be overburdened and unable to devote adequate time to each patient. There is no substantial evidence to determine that computerized order entry can prevent all errors but that it is reduced. However, that long-term use of computerized order entry by providers still resulted in system-related errors, though when and what have still not

been substantiated. More studies and information are needed to understand how system-related errors can change over time and can be targeted (Kinlay et al., 2021).

Furthermore, the lack of standardized protocols for medication administration in pediatric settings, variability in medication formulations, and the need for compounding drugs can all contribute to the possibility of errors. Hospitals must implement strategies specific to the pediatric context to address these challenges. This includes investing in specialized training for healthcare providers, improving communication strategies to engage with children and their relatives effectively, and ensuring that EHR systems and medication delivery processes are tailored to the unique needs of pediatric patients. Additionally, promoting a safety culture that encourages reporting and learning from errors is crucial in pediatric settings, as it can lead to developing more effective policies and practices for medication safety.

CURRENT EFFORTS, BARRIERS, AND CHALLENGES

Efforts to improve patient safety and reduce hospital medical errors have been ongoing, with various strategies and interventions being implemented. However, these efforts often need help with their effectiveness. Understanding both the efforts and the obstacles is crucial in the pursuit of safer healthcare environments. Goekcimen et al. (2023) discuss how hospitals address patient safety hazards. One of the key strategies has been implementing critical incident reporting systems (Goekcimen et al., 2023). Such systems allow healthcare professionals to report incidents that could have led to or did lead to patient harm. These reports aim not to assign fault but to identify systemic issues and learn from these incidents. Hospitals have also focused on training and education programs to improve healthcare workers' safety skills (Goekcimen et al., 2023). Such programs often include simulations and drills to prepare staff for potential safety hazards. Despite these efforts, hospitals face challenges in establishing a culture that supports the reporting and analysis of critical occurrences.

Sometimes, the fear of blame or retribution discourages staff from reporting incidents. Additionally, the effectiveness of incident reporting systems can be hampered by underreporting or incomplete reporting. Another challenge is the integration of lessons learned from incident reports into daily practice, which requires a commitment to continuous improvement and allocating necessary resources.

Sivasamy et al. (2023) evaluate interventions to lower medication errors, particularly among older adults. This demographic is at a higher risk due to factors such as polypharmacy (the use of multiple medications), age-related physiological changes, and the existence of multiple comorbidities. Interventions include using technology, such as electronic prescribing and medication reconciliation tools, to ensure accuracy in medication orders (Sivasamy et al., 2023). Educational programs for both healthcare providers and patients have also been developed, focusing on the safe use of medications. However, these interventions are challenging. Technology solutions can be costly and require substantial training for effective utilization (Sivasamy et al., 2023). There is also the risk of technological failures or errors, which can cause new medication errors. Educating older adults about medication safety can also be challenging due to factors such as cognitive decline, sensory impairments, and varying levels of health literacy (Sivasamy et al., 2023).

Woodier et al. (2023) focus on the analysis of near-miss incidents and their value in enhancing patient safety. Near-miss incidents, which are actions that can result in harm to patients but do not, are a rich source of information for understanding potential safety hazards.

Hospitals increasingly recognize the importance of analyzing these incidents to avoid future errors. By studying near-misses, healthcare organizations can identify and mitigate risks before they result in harm (Woodier et al., 2023). The challenge with near-miss incidents lies in their identification and reporting. Often, these incidents go unnoticed or need to be deemed significant enough to report (Woodier et al., 2023). This underreporting means that valuable opportunities for learning and improvement are missed. Encouraging a culture where all healthcare group members feel empowered to report near-misses is critical but challenging.

Vikan et al. (2023) explore the connection between patient safety and adverse events, highlighting the importance of organizational culture in patient safety. A positive safety culture—one where safety is prioritized, communication is open, and errors are used as learning opportunities—can significantly reduce the occurrence of adverse events (Vikan et al., 2023). Hospitals that foster such a culture tend to see better patient outcomes and improved staff satisfaction. Creating and maintaining a positive safety culture is a complex endeavor. It requires buy-in from all institution levels, from frontline staff to senior leadership. Resistance to change can be a significant barrier, especially in well-established institutions. Additionally, measuring the effect of cultural changes on patient outcomes can be challenging, as the effects may not be immediately apparent (Vikan et al., 2023).

SYSTEMATIC CHANGES FOR REDUCING MEDICAL ERRORS

Reducing medical errors is a multifaceted challenge that requires a systemic approach (Vikan et al., 2023). This section explores strategies and recommendations for minimizing these errors and improving safety. A positive patient safety culture is fundamental to reducing medical errors. This culture is characterized by open communication, a no-blame approach to error reporting, and a commitment to continuous improvement. To cultivate such a culture, healthcare organizations must encourage staff at all levels to actively participate in safety initiatives. Leadership should demonstrate a commitment to safety by allocating resources, supporting safety education programs, and being involved in safety committees or rounds. Regular staff training on safety, error prevention strategies, and the psychological safety necessary for reporting errors is crucial. Recognizing and rewarding staff for safety improvements can reinforce a culture prioritizing patient safety.

Implementing critical case reporting systems is critical in identifying and learning from errors (Goekcimen et al., 2023). These systems should be easily accessible and user-friendly to encourage reporting. It is essential that these systems are non-punitive; staff should feel safe to report incidents without concern of retribution. Analyzing data from these reports can help identify patterns and risk areas, leading to targeted interventions. Hospitals should regularly give employees feedback about changes made due to incident reports, reinforcing the value of their contributions, and closing the loop in the reporting process. Developing comprehensive training programs is critical for providing healthcare professionals with the skills and knowledge to minimize errors (Goekcimen et al., 2023). Such programs should cover various topics, including patient safety principles, error prevention strategies, effective communication, and team collaboration. Simulation-based training can be efficient, allowing staff to practice skills in a realistic but controlled environment. Training should also be tailored to the specific needs of different departments or units, recognizing that the challenges and risks can vary across different areas of healthcare. Ongoing education and refresher courses can ensure that staff stay updated on best practices and new developments in patient safety.

Technology and digital tools are increasingly pivotal in the healthcare sector, particularly in their capacity to lower medical errors (Goekcimen et al., 2023). The implementation of EHRs is a prime example of how technology can enhance patient care. When used effectively, EHRs improve the precision of medical documentation and facilitate smoother communication among healthcare providers. This enhanced communication is crucial for ensuring that all healthcare group members have up-to-date and accurate information about patient's medical histories, current treatments, and overall health status. EHRs also have a vital role in providing critical alerts and reminders, which can be instrumental in avoiding medication errors and ensuring timely medical interventions.

Additionally, decision support systems in healthcare are invaluable tools that aid clinicians in diagnosing illnesses and managing medications (Goekcimen et al., 2023). These systems analyze patient data to provide healthcare providers with evidence-based recommendations, thereby reducing the likelihood of diagnostic errors and ensuring that prescribed medications are appropriate for the patient's condition. Integrating such systems into healthcare workflows can significantly diminish the chances of human error, often contributing to medical mistakes.

However, the effectiveness of these technologies is contingent upon their user-friendliness and seamless integration into existing clinical workflows (Goekcimen et al., 2023). If technology is simple and intuitive, it can burden healthcare staff, potentially leading to errors rather than preventing them. Therefore, these systems need to be designed with the end-user in mind, ensuring they complement and enhance clinical processes rather than complicate them. Regular training and support for healthcare staff are essential to maximize the benefits of these technological tools. Training programs should cover the basic functionalities of these systems and educate healthcare providers on how to leverage these tools in clinical decision-making effectively. Support systems, such as IT helpdesks and user manuals, should be readily accessible to address any technical issues promptly. This ongoing training and support will ensure that all healthcare staff are proficient in employing these technologies and can fully utilize their capabilities to enhance patient care.

Moreover, the landscape of healthcare technology is constantly evolving, and EHRs and decision support systems must be continuously monitored and updated. This ongoing maintenance is needed to ensure these systems stay relevant and effective in changing healthcare practices and emerging medical knowledge. Updates may include new features that address emerging healthcare challenges, improvements in user interfaces, or enhancements in data security measures to protect patient information. Regular updates also ensure that the systems remain compatible with other technological tools used in healthcare settings, maintaining a cohesive and efficient digital infrastructure.

Policy interventions are pivotal in establishing a robust framework for enhancing patient safety. Metelski et al. (2023) and Weintraub (2023) underscore the value of developing national and institutional policies that articulate clear goals and standards for patient safety. Such policies are fundamental in setting a baseline for safe practices within healthcare facilities. They should encompass mandates for regular safety audits, which are instrumental in identifying potential risk areas and applying corrective measures. Additionally, the policies should require the systematic reporting of harmful events, ensuring that healthcare organizations maintain transparency in their operations and learn from past mistakes.

As part of these policy interventions, regulations are crucial in maintaining specific critical standards in healthcare settings (Metelski et al., 2023). For instance, regulations can

dictate adequate staffing levels, ensuring that healthcare facilities have sufficient personnel to provide quality care without overburdening the staff. This aspect is vital because understaffing can lead to increased workloads and stress, known contributors to medical errors. Regulations can also stipulate the required training and qualifications for healthcare professionals, guaranteeing that individuals providing care have the requisite knowledge and skills (Metelski et al., 2023). To incentivize compliance with these standards, financial mechanisms can be employed. Hospitals and healthcare facilities that demonstrate adherence to high safety standards could be rewarded with financial incentives.

Conversely, penalties for non-compliance should be established to dissuade healthcare providers from neglecting patient safety guidelines. These financial motivators can significantly influence healthcare organizations to prioritize patient safety. Policymakers should acknowledge the importance of engaging patients and their relatives in safety initiatives (Metelski et al., 2023). Engaging them in discussions about care plans, safety protocols, and decision-making processes can foster a more transparent and inclusive healthcare environment. Such involvement enhances the patient's experience and provides healthcare providers with valuable insights from the patient's perspective, which can contribute to safer and added effective care.

In addition to strategies focused on policy and regulation, a holistic approach that includes the broader healthcare environment is necessary. This approach should address factors such as staff burnout, which can profoundly impact patient safety. Burnout among healthcare professionals can lead to reduced attention to detail, increased risk of errors, and lower overall quality of care. Therefore, policies and strategies should be in place to support healthcare professionals' well-being, providing them with the essential resources, support systems, and work-life balance. Collaboration across various sectors is essential in developing and implementing effective strategies to lower medical errors. This collaboration should include government agencies, healthcare organizations, professional bodies, and patient advocacy groups. By working together, these entities can share knowledge, resources, and best practices, leading to more comprehensive and practical solutions.

THE ROLE OF DATA ANALYSIS AND ACCURACY

Data accuracy and data management are essential in healthcare operations, directly impacting patient health and treatment outcomes (Dash et al., 2019). High-quality data enable the discovery of new treatment methods based on patient experiences, enhancing individualized care approaches (Dash et al., 2019). However, integrating technological advancements into healthcare systems, vital for improving data quality, presents operational and administrative challenges (Batko & Siezak, 2022). Patient data privacy and security are also crucial concerns. While healthcare organizations implement various strategies to protect patient data, issues like data mismatches or duplications persist. For instance, approximately 7 out of 100 healthcare documents are duplicated or mismatched (Senthikumar et al., 2018). Such data quality problems, stemming from poorly integrated IT systems, can lead to misuse of EHRs and the propagation of misinformation (Ismail et al., 2020). Despite over 90% of U.S. hospitals using EHRs, over half of patient records are not managed electronically (Kriegova et al., 2021). Data quality is thus a critical concern, impacting all stakeholders, including patients, medical staff, and government entities. Poor data quality can result in mistreatment of patients, flawed decision-making, employee frustration, and heightened bottlenecks in healthcare operations (Ismail et al., 2020).

Each healthcare organization's unique structure necessitates tailored data systems to support healthcare data quality (Sieck et al., 2022). Effective healthcare management relies on systematic approaches that verify data sources, ensure data quality, and minimize errors in healthcare data (Uslu & Stausberg, 2021). This process, recognized as data quality management, is essential for obtaining accurate, valid, and reliable health data from various sources, including EHRs, patient registries, and clinical trials (Bossen et al., 2019). High-quality healthcare data are crucial for informed decision-making, increased patient-physician relations, more straightforward implementation, and increased organizational profitability (Schopf et al., 2019). Accurate data allow healthcare workers to spend less time checking and correcting records, thus streamlining hospital operations. Precise data improve healthcare services, allowing targeted patient care and more effective marketing and operational strategies (Fanelli et al., 2022).

Good patient relations and efficient organizational operations hinge on high-quality data. Time spent rectifying inconsistent or incomplete data hinders the utilization of insights gained from data analysis. Enhanced patient relationships, informed decisions, and effective marketing campaigns increase profitability. Data collection also helps optimize resources, making healthcare operations cost-effective (Chen et al., 2020). Accurate health data are essential for providing high-quality patient care, enabling the mitigation of diseases, and focusing attention on patient needs rather than data searching. Accurate data prevents the prescription of ineffective or harmful medications (Tapuria et al., 2021). Thus, avoiding potentially harmful treatments is achievable through precise health data. To maintain high data quality, attention to correct data entry at the initial stage is crucial, especially given the rapid updates in IT systems. This precaution prevents the use of incorrect data by healthcare providers from different organizations, which can result in erroneous treatments (Fanelli et al., 2022).

Healthcare data quality is a critical measure determining the success of various functions such as supporting EHRs, diagnosing diseases, formulating medical policies, and maintaining public health records (Westphal & Seitz, 2021). The significance of data quality lies in its direct impact on patient care; poor-quality data can result in mistreatment or misdiagnosis, fostering mistrust between patients and providers of healtcare. EHR, a central component of healthcare data, houses crucial information about patient diseases, treatments, and conditions. However, record duplication can hinder obtaining a comprehensive patient profile, potentially complicating care (Zhang et al., 2022). Implementing patient-matching algorithms can mitigate these issues, ensuring accurate and complete patient records.

Furthermore, EHRs facilitate research and analytics, aiding in the discovery of disease trends and new treatments. High-quality data underpin clinical decision-making and the advancement of new medications. The use of standardized systems like the ICD-10 classification in EHRs minimizes errors in interpreting patient information (Wang et al., 2019). This standardization improves data accuracy, lowers healthcare costs, and supports fair reimbursement policies, strengthening the trust between healthcare suppliers and patients. Organizations investing in quality healthcare data are more prone to deliver superior services and foster patient loyalty.

Data quality is also integral to complying with standards such as HIPAA, which mandates secure and accessible patient data while upholding principles of transparency and confidentiality (Honavar, 2020). Non-compliance can result in legal outcomes, emphasizing the need for rigorous data management. Effective data management is more than just EHRs; it encompasses patient health records, treatment efficacy, medical tool logs, and operational and financial records. Properly managed health data can reduce healthcare costs by streamlining data

administration and eliminating duplicate records (Uslu & Stausberg, 2021). This management also facilitates research by providing reliable information on diseases and symptoms, which can inform preventive public health measures (Jabali et al., 2022).

For patients, high-quality health data management means less redundancy in filling out forms or undergoing tests. Patient access to their records can augment the accuracy of these records. Interoperability, a key benefit of effective data management, allows for the efficient transfer and interpretation of information across healthcare organizations, reducing repeat testing, miscommunication, and inappropriate treatment circumstances (Westphal & Seitz, 2021). This interoperability extends to integrating patient health activities with mobile applications, offering convenient access.

Healthcare data quality is crucial, as poor data quality decreases effectiveness and potential mistreatment of patients. Essential metrics for assessing healthcare data quality include accuracy, validity, reliability, precision, cohesiveness, availability, completeness, identifiability, usability, security, and uniqueness. Consistency is a crucial feature of data quality, as inaccurate or misleading data can result in severe complications (Schopf et al., 2019). The validity of healthcare data pertains to the suitability of the data for its intended use. Each hospital typically has a department that sets rules to determine the suitability of data, ensuring that the collected data meet these established criteria (Rudin et al., 2020). Additionally, the cohesiveness of information is vital. Incomplete or inaccurate data can cause incorrect patient care decisions, potentially endangering patient safety. Attention to detail in data collection is imperative to avoid such risks.

Data must be readily available to healthcare providers, with metrics like completeness ensuring that all necessary information, such as prescriptions, is fully detailed (Kriegova et al., 2021). Additionally, the uniqueness of data, avoiding duplicates, is essential for accurate treatment and analytics. Data security and confidentiality are paramount, with access typically restricted to authorized healthcare providers (Tapuria et al., 2021). Standards like HL7 are integral to healthcare data quality, providing frameworks for data exchange and storage and encompassing structures, types, and language of data (Alami et al., 2022). Programs like ICD-10, MDS, and RxNorm help healthcare providers prioritize and organize the collection and storage of patient data, enhancing interoperability and the services quality (Wang et al., 2019). Quality advancement tools in healthcare focus on patient-centered processes and teamwork, aiming to enhance patient satisfaction and system efficiency (Dash et al., 2019). Data profiling assesses current data to uncover hidden issues and identify cleansing opportunities. It involves checking for data completeness, duplication, incorrect patterns, and measurement inaccuracies (Khairat et al., 2021). Data cleansing and standardizing involve removing invalid data to view a patient comprehensively from various sources. This process includes eliminating empty values, unifying similar columns, and ensuring data consistency (Bossen et al., 2019). Patient data matching is crucial in addressing EHR duplication issues, comparing data to ascertain if they belong to an identical patient. This process utilizes exact matches or matching algorithms in the non-existence of unique identifiers (Westphal & Seitz, 2021; Ismail et al., 2020).

THE IMPACT OF LOW DATA QUALITY AND STRATEGIES FOR IMPROVEMENT

Low data quality, particularly within electronic health systems, can have dangerous consequences. The U.S. government identified patient misidentification, often due to duplicate records, as a primary cause of death. Such errors mean that 10% of incoming patients may not

receive comprehensive treatment (Uslu & Stausberg, 2021). Data inaccuracies can also hamper the ability of healthcare organizations to achieve informed decisions, as evidenced by the case of Ohio Health, which struggled with data kept in silos. The Network for Excellence in Health Innovation noted that mistaken prescriptions, primarily due to data errors, lead to significant financial losses and thousands of deaths yearly (Upadhyay & Hu, 2022).

EHRs are crucial in modern healthcare, providing easy access to patient health histories and enabling effective service delivery. These electronic versions of patient records include comprehensive information on illnesses and treatment histories (Ismail et al., 2020; Dash et al., 2019). EHRs assist in managing patient-specific care programs, guidelines, and protocols, streamlining healthcare service provision. However, EHRs are also vulnerable to issues like data breaches, particularly in Brazil and Mexico, where cyberattacks are common (Fanelli et al., 2022).

Healthcare data management, a rapidly growing market, faces challenges like integrating reliable sources and establishing accurate analytics (Hoover, 2017). Privacy concerns are paramount, as breaches can lead to misdiagnosis or incorrect treatment (Rudin et al., 2020). Data security is enforced through regular software support, multi-factor authorization, and adherence to HIPAA regulations (Chen et al., 2020). Integrated data analytics are essential for high-quality data in healthcare. This includes receiving, formatting, and transferring data effectively. Systematic management of data quality is critical for verifying and correcting information before storing it in destination resources. Ensuring data security, organized storage, and verification of data origins are vital practices. Regular audits help identify existing challenges and improvement areas (Khairat et al., 2021; Wang et al., 2019).

Health data managers ensure data accuracy, confidentiality, and up-to-date patient records. They oversee data analysts and technologists, contributing to data accuracy and management. Their responsibilities extend to maintaining security against hacker attacks and facilitating data visualization for decision-making (Senthikumar et al., 2018). Training healthcare teams in data literacy ensures they can effectively read, comprehend, and analyze data. Investing in technological systems can also mitigate information errors, with automation potentially saving significant costs in administrative operations (Batko & Siezak, 2022). The impact of low data quality is profound, affecting patient treatment and the efficiency of healthcare systems. Improving data quality requires integrated data analytics, systematic management, secure and organized data storage, and regular audits. The role of health data managers and the value of continuous training and technology updates must be addressed to ensure healthcare data accuracy and security.

ARTIFICIAL INTELLIGENCE (AI) IN HEALTHCARE SYSTEMS

To safeguard patient well-being and improve healthcare quality, hospitals are integrating AI into their daily operations. AI, a prevalent term in various aspects of our lives, is pivotal in transforming healthcare and evolving intelligent care systems. Hospitals need to utilize AI in their daily operations to lower the risk of misdiagnoses and ensure more precise treatment decisions. AI technologies, including medical robots, AI-driven genetic data, and AI-powered stethoscopes, can streamline administrative tasks, enhance patient care, speed up diagnostic decisions, and simplify data management. (Shaheen, 2021)

AI can swiftly and effectively analyze patterns in large and complex datasets. However, the quality of available health data poses a possible challenge for AI users. Inconsistencies in

data availability and quality can limit the potential of AI. To address these issues, doctors must be comfortable digitally sharing personal health data, ensure consistency in digitizing medical records, standardizing these records, and maintaining digital record keeping and data labeling. While the benefits of AI in healthcare are immense, it is crucial to be mindful of potential bias and fairness issues throughout the AI development lifecycle. This could stem from historical data that includes biased information about patients' medical conditions among different ethnic groups or underrepresentation in clinical trials and research data, such as those involving Black, Asian, and minority ethnic populations (Nuffield Council on Bioethics, 2018). For example, racial bias is often prevalent during AI training due to the racial representation included in the dataset. A case in point is the IJB-A dataset constructed by the National Institute of Standards and Technology (NIST), which was created explicitly for geographical diversity: most face images are of lighter skin tones. (Buolamwini J., Gebru T., 2018) Considering diversity and inclusion during AI development and training is crucial to avoid any disparity and misdiagnoses. This process requires careful data collection from various sources representing the target population's demographics, characteristics, healthcare needs, and potential health issues. (Ueda et al., 2023).

RECOMMENDATIONS FOR CHANGES

Implementing Advanced Data Quality Management Systems

One of the primary recommendations for reducing medical errors is the implementation of advanced data quality management systems. These systems ensure the accuracy, entirety, and reliability of patient data. Given that errors in patient identification and record duplications are significant contributors to medical errors, a robust data management system can mitigate these risks. This system should incorporate features like patient-matching algorithms to eliminate duplicate records and ensure that each patient's data is unique and comprehensive (Uslu & Stausberg, 2021). Furthermore, integrating data from numerous sources should be managed precisely, ensuring not only accurate information but also consistent and up-to-date data. Automated tools for data quality can aid in identifying and rectifying real-time errors, significantly reducing the chances of medical errors arising from misinformation.

Enhancing Electronic Health Record (EHR) Systems

Enhancing EHR systems is another vital recommendation. EHRs are instrumental in maintaining detailed patient histories, care plans, and medication records. However, the effectiveness of EHRs is contingent on their ability to provide accurate and accessible information to healthcare providers. EHR systems should be user-friendly to decrease medical errors, allowing for easy navigation and retrieval of patient information. Including decision support tools within EHRs can guide clinicians in making informed treatment decisions, reducing the chances of errors such as medication mishaps (Ismail et al., 2020). Additionally, EHR systems should be designed to integrate seamlessly with other hospital systems and databases, ensuring a holistic analysis of patient data. Regular training for professionals on the latest updates and functionalities of EHR systems is also crucial to maximize their potential to lower medical errors.

Fostering a Safety Culture and Reporting

Creating a culture prioritizing safety and encouraging the reporting of errors and near-misses is fundamental to reducing medical errors. In such a culture, healthcare workers feel empowered and obligated to report incidents that could compromise patient safety. This approach not only includes the frontline healthcare workers but also requires strong leadership promise for patient safety. Regular workshops and training sessions should strengthen the importance of a safety-first approach and educate staff on identifying and reporting potential risks (Sieck et al., 2022). Encouraging openness and transparency in discussing medical errors without fear of punitive actions can improve patient care quality. Additionally, learning from described incidents and near-misses and implementing corrective actions can prevent the recurrence of similar errors.

Integrating Interoperability and Standardization

Interoperability and standardization across various healthcare information systems are crucial for reducing medical errors. Interoperability ensures that the data of patients is seamlessly shared and accessed across various programs and departments within a hospital. This seamless data flow is essential for providing comprehensive and coordinated patient care. Standardization, particularly in data entry and retrieval, is equally important. Adopting standard coding systems like ICD-10 and HL7 can enhance the clarity and consistency of health records, aiding healthcare providers in accurately interpreting patient information (Alami et al., 2022). These standards also facilitate more accurate billing and reimbursement processes, reducing administrative errors. Hospitals should invest in technologies and protocols that support interoperability and adhere to recognized data specifications to ensure patient information is accurate, comprehensive, and accessible when needed.

Continuous Training and Education

Continuous training and education for healthcare professionals are pivotal in reducing errors. Regular training programs can keep healthcare workers updated on the newest medical practices, technologies, and data management systems. Such educational initiatives should cover various topics, including patient safety principles, error prevention strategies, and technological tools in healthcare (Batko & Siezak, 2022). Simulation-based training can efficiently prepare staff for real-life scenarios and enhance their skills in managing complex patient cases. Education programs should also focus on data literacy, enabling healthcare professionals to understand, interpret, and utilize patient data effectively. By investing in continuous training and education, hospitals can ensure their staff are well-equipped to provide safe, efficient, and high-quality patient care.

CONCLUSION

The current work has explored the multifaceted issue of medical errors, highlighting their prevalence, contributing factors, current efforts to mitigate them, and systematic changes required for reduction. Key findings include the recognition that medical mistakes are a major trigger of mortality and morbidity, with various factors contributing to their occurrence. These

factors range from systemic issues like overwhelmed healthcare systems during pandemics, as Al Meslamani (2023) noted, to specific challenges like medication mistakes in pediatric populations, as suggested by Liu et al. Efforts to address these errors are diverse and evolving. Implementing essential incident reporting systems (Goekcimen et al., 2023) and enhancing patient safety culture, particularly in emergency settings (Aydemir & Koç, 2023), represent significant strides in acknowledging and learning from errors. However, challenges persist, including the underreporting of near-miss incidents and the difficulty in fostering a non-punitive culture for error reporting. Adopting technology and digital tools has been labeled as a crucial strategy in error reduction. EHRs and decision support methods can significantly reduce medication-related errors when effectively integrated into healthcare workflows. However, challenges such as ensuring user-friendliness and avoiding alert fatigue remain. Policy interventions and recommendations have been underscored as essential in creating an enabling environment for increasing patient safety. The recommendations of Metelski et al. and Weintraub emphasize the need for clear safety standards and regulations that mandate safety audits and the recording of adverse events.

Future research should concentrate on several key areas to continue advancing the understanding and mitigation of hospital medical errors. First, longitudinal studies are required to assess the long-term effectiveness of current interventions and strategies. Understanding how these interventions impact patient safety over time can provide valuable insights into their sustainability and improvement areas. Second, research should explore the integration of technology in healthcare settings more deeply, especially the impact of emerging technologies such as machine learning and artificial intelligence on patient safety. Studies examining the efficacy of these technologies in real-world settings, their user acceptance, and their impact on clinical workflows would be valuable. Third, further research is necessary to explore the psychological and organizational factors contributing to a positive safety culture. Studies that investigate the impact of leadership, communication, and team dynamics on the incidence of medical misakes can provide deeper insights into how to advance a culture that prioritizes patient safety. Finally, there needs to be more research focusing on patients and relative engagement in patient safety. Understanding how patients and their relatives can be effectively involved in safety initiatives could open new avenues for reducing medical errors.

Reducing hospital medical errors is not just a clinical imperative but a moral one. Every medical error has the possibility of harming patients who trust healthcare systems with their lives and well-being. The importance of reducing these errors cannot be overstated, as it directly affects patient safety, the value of care, and the overall efficacy of the healthcare system. Medical errors also have broader implications beyond individual patients. They contribute to increased healthcare costs, erode people's trust in healthcare systems, and can result in significant emotional and professional repercussions for healthcare workers. Addressing these errors is thus essential for the system sustainability of healthcare and maintaining the confidence and trust of the public they serve. The journey towards reducing medical mistakes in hospitals is ongoing and requires a concerted effort from all stakeholders. It calls for a continuous commitment to learning, improvement, and innovation. By focusing on systematic changes, embracing technology, fostering a safety culture, and prioritizing patient-centered care, significant strides can be made in enhancing patient safety and reducing medical errors. This endeavor is a professional responsibility for healthcare professionals and a fundamental characteristic of providing compassionate and valuable patient care.

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