

Enhancing Patient Safety: Mitigating Medical Errors in Technology-Mediated Communication

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Abstract— In contemporary healthcare systems, technology plays an increasingly important role in facilitating communication among healthcare professionals, patients, and various stakeholders. However, the potential for misinterpretation and misunderstanding in technology-mediated communication (TMC) poses a significant challenge to patient safety. As the use of computers during general practice consultations has become ubiquitous worldwide due to the growing adoption of electronic health records (EHRs) and digital documentation, this paper underscores the importance of preserving and enhancing the quality of physician-patient relationships. Such relationships are fundamental to effective healthcare delivery, improved patient satisfaction, and better health outcomes, ultimately contributing to the reduction of medical errors. Based on interdisciplinary perspectives such as linguistics, human-computer interaction, and healthcare informatics, this paper also discusses a framework for improving TMC through standardization of terminology, development of context-aware communication tools, and consideration of privacy concerns and user acceptance. By addressing the intricacies of language and meaning in technology-mediated interactions, healthcare systems can cultivate a more reliable, accurate, and patient-centered communication environment. To this end, the paper proposes a curriculum for an online course designed to enhance communication in healthcare.

Keywords: *technology-mediated communication, linguistics, medical errors*

I. INTRODUCTION

The integration of digital technologies into the healthcare system has undeniably brought about positive changes, alongside challenges. The risks in the implementation of digital technology in healthcare are specific. Many are attributed to medical errors. It should be emphasized that the risk of errors can also arise from the pressure of using digital technologies, which many healthcare professionals face as part of their care provision responsibilities. This applies to eHealth tools, electronic health records, clinical decision-making aids supported by artificial intelligence, telemedicine, digital surgical devices, and other similar technologies.

Fatal outcomes resulting from medical errors in the United States surpass other causes. Therefore, it is urgent to explore possibilities for reducing such errors. The Agency for Healthcare Research and Quality (AHRQ) identifies eight common causes of medical errors [1]. This paper focuses on communication problems and inadequate information flow, i.e.

to what extent eHealth technologies impact communication among participants in the healthcare system.

Numerous reasons and examples of errors exist. The lack of teamwork is also identified as a critical factor affecting the quality and safety of care [2]. Communication errors predominantly arise from poor data transmission, inadequate documentation, or misunderstandings between healthcare providers and recipients. Studies indicate that communication errors account for 60% of identified adverse events [3].

Data mining, ontology, semantic reasoning, clinical decision support systems, and big medical data are some areas covered by artificial intelligence [4]. Artificial intelligence techniques play a significant role in error identification and prevention. Machine learning techniques analyze structured data, including imaging, genetic, and physiological data, to find key factors for error reduction [5]. Healthcare organizations gather information on incidents, including both structured and unstructured (free text) data, to reduce errors. Natural Language Processing (NLP) facilitates extracting information from unstructured data, such as clinical notes or incident reports, by employing computer techniques to organize unstructured data. Several studies have confirmed the high efficiency of NLP in extracting structured information from unstructured free texts [6].

An essential aspect of communication lies in the physician's ability to assess the patient's comprehension of the information provided. Communication breakdowns can also lead to errors and poor outcomes [7]. Effective communication between healthcare professionals and patients significantly impacts positive health outcomes, in terms of adherence to prescribed therapy, decisions regarding medical interventions, and changes in patient health behavior. Research has shown that the complexity of communication within the healthcare system can hinder the quality of healthcare services provided [8]. Health literacy also plays a critical role in communication, indirectly contributing to medical errors [9]. However, the cause of errors may not be exclusively attributed to human factors. Within the domain of communication errors, issues arising from mismatches between communicating healthcare systems, failures in electronic data transmission, and failures in ensuring data security and privacy can be identified and categorized.

The use of telephones and EHRs in mHealth can have diverse impacts. The extent to which telephone usage facilitates

healthcare while also leading to negative outcomes was discussed in a study [10] which reviewed 32 cases involving malpractice suits related to telephone interactions between doctors and patients. The study identified major medical errors, including failed diagnosis (68%), inaccurate documentation (88%), and faulty triage (84%). The consequences of these errors were severe, resulting in high fatality rates (44%) and an average indemnity exceeding \$500,000.

II. THE INFLUENCE OF EHR INTEGRATION ON MEDICAL INTERACTIONS

EHR can contribute to “medical” errors as well, often due to inaccuracies or incompleteness caused by various issues, ranging from data entry problems to errors in copying by individual users. Furthermore, physicians sometimes overly concentrate on computers during examinations, disregarding EHR records and failing to give adequate attention to the patient.

In the typical setup of a doctor’s office, it is customary to have only one computer or screen placed directly in front of the doctor. This arrangement allows the doctor to control the exchange of information between the EHR system and the patient. However, if offices were outfitted with two screens, both the doctor and the patient could view information simultaneously, offering patients more than just verbal communication from the doctor. According to cognitive theory, utilizing both audio and visual channels concurrently contributes to better information reception and understanding. The findings of the study [11], which analyzed the behavior of participants in medical examinations in rooms with one and two screens, indicate the benefits of patients receiving information through two channels – audio and visual. In this way, patients can process EHR data according to their cognitive abilities and level of health literacy, thereby decreasing the likelihood of medical errors due to misunderstandings, while also increasing transparency of medical data, and patient trust in the treatment process. The study also points to somewhat surprising results that the presence of a second screen increases eye contact between patients and doctors, leading to greater overall patient engagement during health examinations. Such findings could help address key criticisms surrounding the implementation of EHR in primary healthcare, particularly concerns about doctors not giving sufficient attention to their patients.

Another recent study [12] examined EHR utilization during patient-physician interactions in primary healthcare settings. It identified three EHR usage patterns: active information sharing, passive information sharing, and technology withdrawal. Patient involvement varied depending on physicians’ sharing styles. The study suggests implementing a more interactive system and a simplified data entry interface to reduce physician typing time. Additionally, proposing separate patient displays could address privacy concerns and the complexity of existing EHR systems. Introducing patient portals for early data input could further streamline processes and increase physician awareness of patient concerns. The study also recommends enhancing physician training on EHR use, allowing them to adapt their sharing style based on visit purposes or patient needs,

thereby improving patient education and empathy during encounters.

III. HARNESSING LINGUISTIC ANALYSIS FOR HEALTHCARE ENHANCEMENT

Communication is a complex phenomenon, influenced by many factors, such as cognitive processes, social contexts, and linguistic diversity. Many different theories and models have been developed to better understand linguistic and discourse features of communication. The speech act theory [13] claims that by utilizing language, people perform different actions, e.g. requesting, apologizing, promising, etc. Language utterances have their own intended meaning and illocutionary force. This theory highlights the necessity of employing appropriate speech acts in different communicational settings. The relevance theory [14] has also to be taken into consideration to improve communication strategies in healthcare. This theory implies the optimization of communication by focusing on maximizing relevance and inferring intended meanings from contextual clues, enabling practitioners to enhance their cross-cultural and interprofessional communication skills effectively.

By implementing linguistic and semantic optimization strategies, healthcare organizations can improve communication effectiveness, enhance patient safety, and reduce the occurrence of medical errors.

Linguistic analysis offers immense potential as a tool for identifying at-risk individuals and offering timely interventions. During the onset of the COVID-19 pandemic, there was a concerning rise in suicidal ideation and attempts among adolescents, prompting many to seek support in online communities. The observational study [15] examined communication patterns within a large suicidal ideation support community on Reddit by deploying the LIWC 2015 (Linguistic Inquiry and Word Count) text analysis program. The program’s algorithm calculated the frequency of words that were categorized as associated with hopelessness (positive vs. negative emotions) and social disengagement (1st person singular vs. 2nd person pronouns). The findings revealed a significant shift in language style, content, and user activity since the pandemic’s spread, highlighting an increase in linguistic markers associated with hopelessness and a decrease in markers of social engagement.

The prevalence of major depressive disorders globally highlights the urgent need for effective treatments. Research suggests that mHealth apps can address these challenges and support individuals with depression, offering features ranging from psycho-education to therapeutic treatments. Sentiment analysis of the language in user reviews of depression health apps sheds light on an understanding of technology’s role in mental health care, which can lead to improving app design and facilitating guiding users to appropriate resources [16].

Psycholinguistic introspection into emergency communication can identify communication gaps often overlooked in emergency planning and provide recommendations for improving communication systems [17]. The study uncovered insights into how different languages influence understanding of emergency notifications. Five main

themes emerged: gaps in direct translation, variations in emotional impact, variations in grammatical language structure, fusion attitudes, and lack of technical terminology. Drawing upon the Sapir-Whorf hypothesis, the study also suggested that our understanding of emergencies is shaped by the language we speak, and thus, addressing psycholinguistic gaps can improve disaster risk management.

The research in psycholinguistics and sociolinguistics offers valuable insights into the complexities of communication in healthcare and provides a foundation for developing targeted interventions to enhance communication effectiveness and mitigate language barriers. Ultimately, the reduction of medical errors would consequently improve patient safety and quality of care.

IV. IMPROVING TMC IN HEALTHCARE: A STRUCTURAL FRAMEWORK

As pointed out above, communication in healthcare plays a crucial role in providing effective and efficient medical care. However, misunderstanding and misinterpretation often pose obstacles in this interaction, which can lead to unintended consequences for patients and healthcare workers. Therefore, this paper highlights the necessity to establish strategies to facilitate communication, standardize medical terminology, and develop tools that will recognize the context of communication.

First and foremost, to enhance communication in healthcare, it is imperative to ensure that healthcare workers receive adequate training in communication skills, encompassing empathy, active listening, and clear expression. The language used by healthcare professionals must be straightforward and tailored to suit the understanding of patients. Avoidance of medical jargon that would be incomprehensible to patients is essential, necessitating the clear and precise delivery of various medical instructions, therapies, and advice to prevent misinterpretation. Medical professionals should possess a heightened awareness and proficiency in discerning and interpreting nonverbal cues, which often speak volumes beyond words and serve as indicators of patients' psychological and emotional states. This capability enables healthcare workers to empathize with patients and gain deeper insights into their needs. It is widely acknowledged that trust is predominantly built upon the way of speaking and manners rather than words alone, and nonverbal communication serves as a conduit to perceive underlying emotions, attitudes, and personality traits, thereby augmenting verbal exchanges and offering valuable feedback on the reception of information. Whenever feasible, medical professionals should also utilize visual aids such as diagrams and charts to clarify medical information.

As regards medical terminology, it is necessary to establish national standards that align with international norms to ensure consistency and comprehension. The adoption and integration of electronic health records can greatly facilitate the usage of standardized terminology. Equally crucial is the ongoing training of healthcare professionals in the consistent application of these standardized terms.

To ensure the effective application of communication skills within specific contexts, the development of software tools

capable of analyzing the communication dynamics between doctors and patients would be advantageous. These tools would identify key points and potential areas of ambiguity. Each software solution should undergo rigorous testing with actual users to validate its efficacy and utility. This iterative process would enable the refinement and adaptation of these tools to keep pace with evolving practices and technological advancements.

To guarantee that the theoretical framework of a training course enhances the communication skills of medical professionals for practical applications in real clinical settings, it is crucial to direct research toward the appropriate use of language and analyze various aspects of socially adapted interaction across diverse contexts. By employing sociolinguistic methods such as conversation analysis, it is possible to identify and analyze established interactional practices in doctor-patient communication. The insights gained from this analysis can then be integrated into the training of healthcare professionals through simulations of medical examinations and role-playing scenarios. Although simulated interaction is often criticized by clinicians and sociolinguists for lacking authenticity, healthcare workers state that such training methods are very useful because they need to think and react in real time, receive feedback, and gain insight into how others approach the same task [18].

Research indicates the importance of considering various communicative objectives influenced by different social factors. For instance, when selecting communication strategies, it is essential to take into consideration the age of the interlocutor. Moreover, special attention should be paid to the psychological aspects of communication between children/adolescents and adults, as well as between doctors and the parent/legal guardian of a minor patient [19]. Furthermore, in the development of training courses, it is necessary to study the clinical communication skills needed in clinical encounters with patients who speak a different language than the doctor and require urgent medical attention [20]. Recommendations for error prevention include improving communication, education, and training efforts [21].

A. Course Curriculum

This paper introduces a curriculum for a training course titled "Effective Communication in Healthcare: Enhancing Communication Skills for Better Medical Care" that would be mandatory for all healthcare employees, aiming to raise awareness of the crucial role of communication in healthcare.

The proposed online course would provide a comprehensive training program designed for healthcare professionals seeking to refine their communication skills to deliver better medical care and foster more fruitful relationships with patients. Through a blend of theoretical lectures, interactive exercises, and case studies, participants would learn how to effectively communicate with patients and patients' families, as well as with colleagues, thereby minimizing misunderstanding and enhancing treatment outcomes.

The course would be conducted through online lectures featuring video materials and presentations, interactive

exercises, and simulations of communication scenarios. Discussion forums for sharing experiences and ideas would be available to the participants, along with continuous instructor support via the learning platform.

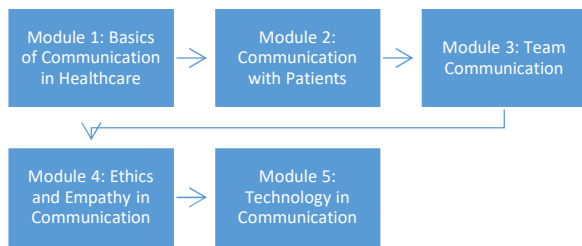


Figure 1. Curriculum for the online course “Effective Communication in Healthcare: Enhancing Communication Skills for Better Medical Care”

Course Content, as presented in Figure 1:

Module 1: Basics of Communication in Healthcare

- Understanding the significance of communication in medicine
- Incorporating emotional intelligence into communication
- Practicing active listening and effective questioning technique

Module 2: Communication with Patients

- Tailoring communication to diverse patient needs
- Recognizing and managing patients’ emotions
- Communicating medical information in plain language

Module 3: Team Communication

- Fostering collaborative communication among colleagues
- Managing conflict within the medical team
- Delegating tasks and setting goals effectively

Module 4: Ethics and Empathy in Communication

- Exploring ethical considerations in medical communication
- Developing empathy towards patients and colleagues
- Communicating with patients in challenging situations

Module 5: Technology in Communication

- Utilizing electronic health records to improve communication
- Engaging in telemedicine and virtual communication with patients
- Harnessing digital tools to support communication efforts

The course would be intended for physicians, nurses, technicians, pharmacists, and other healthcare professionals directly or indirectly involved in patient communication, and upon completion of the course, all participants would receive a certificate of successful completion of the “Effective Communication in Healthcare: Enhancing Communication Skills for Better Medical Care”.

Additionally, no specific prerequisites would be required for enrollment in the course, which would span six weeks, with

flexible scheduling options, and would be accessible via an interactive online platform, allowing access from any device and accommodating various learning methods.

V. CONCLUSION

Effective communication across all levels of the healthcare system can contribute to preventing and correcting errors, as well as devising strategies to minimize mistakes. The factors contributing to medical errors are numerous and complex, making it clear that there is no single solution to address these issues.

The market value of digital healthcare technologies, often measured in multi-billion-dollar valuations, places significant pressure on medical institutions to effectively integrate these advancements into the healthcare system.

Artificial intelligence-based technologies offer a range of solutions for improving medical intervention outcomes. Predictive analysis shows promise in preventing adverse events, as artificial intelligence algorithms can discern patterns and known risk factors linked to specific harmful events. Artificial intelligence tools should be applied with great caution, ensuring validation and avoiding the pitfalls of potential bias. In cases where the system heavily relies on artificial intelligence, a dilemma may arise: should accountability for medical errors lie with the physician or the artificial intelligence-powered decision-making system?

Undoubtedly, there is a pressing need to advance the knowledge, skills, and awareness of both healthcare professionals and patients.

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