Assessing the Influence of Electronic Health Records (EHR) Implementation on Medication Errors and Patient Safety in Hospital Settings: A Multi-dimensional Evaluation

Original Article

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Abstract
Background: The implementation of Electronic Health Records (EHRs) in healthcare settings is pivotal for enhancing patient safety and reducing medication errors. However, the diverse experiences of healthcare professionals with EHR systems suggest a complex interplay of factors influencing their effectiveness and acceptance.

Objective: To evaluate the impact of EHR implementation on medication errors and patient safety in hospitals and assess healthcare professionals' perceptions of EHR systems and their effectiveness in improving clinical outcomes.

Methods: A structured survey was employed, involving three distinct groups: clinicians (n=12), physicians (n=12), and nurses (n=12). Participants responded to Likert-scale and open-ended questions assessing the daily use of EHRs and the challenges encountered. Statistical analysis included descriptive statistics and chi-square tests to compare differences among groups, with p-values determining significance.

Results: Clinicians reported the highest positive perception of EHRs in daily use with a mean Likert score of 4.2, compared to physicians (4.0) and nurses (3.8). Challenges associated with EHRs were noted with mean scores of 2.5 for clinicians, 2.8 for physicians, and the highest, 3.1, for nurses. The p-values indicated significant differences among groups (p=0.034 for clinicians, p=0.045 for physicians, and p=0.050 for nurses).

Conclusion: The findings suggest that while EHRs are generally viewed positively for enhancing daily medical practice, significant challenges persist, particularly among nurses. Tailored strategies addressing the specific needs of different healthcare provider groups are necessary to optimize the effectiveness of EHR systems.

Keywords: Clinical outcomes, Electronic Health Records, Healthcare professionals, Medication errors, Patient safety, Perceptions, Physicians, Nurses, Survey analysis.

INTRODUCTION

In the landscape of modern healthcare, the integration of Electronic Health Records (EHRs) marks a pivotal evolution from traditional paper-based methods, aiming to enhance the quality and safety of patient care (1). The promise of EHRs lies in their ability to streamline the management of health information, ensuring that patient data is accessible and accurate across diverse medical settings (2). This systemic shift towards digital records is expected to foster significant improvements in medical practice, including reducing medication errors, facilitating effective treatment plans, and bolstering preventive care by providing clinicians a comprehensive overview of patient histories (3).

However, the transition from paper-based systems to EHRs is not without challenges (4). While the theoretical benefits are compelling, the actual implementation of these systems has presented a complex mix of outcomes (5). On the positive side, studies have demonstrated that EHRs can effectively reduce the incidence of medication errors—one of the critical metrics for patient safety. For instance, EHRs help in automating the drug prescribing and monitoring process, thus minimizing human errors attributable to manual data entry and interpretation (6). This automation also extends to enhanced drug allergy checks and drug-drug interaction alerts, which are crucial for patient safety (7).

Yet, the implementation of EHRs has also unveiled limitations that temper their efficacy (8). The complexity and variability of EHR software can lead to a steep learning curve for healthcare providers (9). There are also concerns about the overload of alerts, which can lead to 'alert fatigue' wherein the frequency and number of alerts cause clinicians to inadvertently disregard critical safety warnings (10). Moreover, the very feature of accessibility can be a double-edged sword, as improper access controls can lead to breaches in patient confidentiality—a cornerstone of medical ethics (11).

The debate surrounding the adoption of EHRs also includes the consideration of their impact on clinical workflows (12). Some practitioners report enhanced efficiency and communication within and across healthcare settings, which fundamentally supports the continuum of care (13). Conversely, others feel that EHR systems can be intrusive, detracting from patient interaction and contributing to clinical burnout (14). This dichotomy illustrates the critical need for EHR systems to be intuitive and supportive rather than obstructive (15).

Importantly, the evolution of EHRs must be viewed through a lens that balances technological advancement with human factors (16). The design and functionality of EHR systems should prioritize user-friendliness and be adaptable to the nuanced needs of different medical specialties (17). Moreover, ongoing training and support are essential in maximizing the benefits of EHRs while mitigating the risks associated with their use (18).

While EHRs represent a significant advancement in healthcare technology, their deployment must be meticulously managed to fully realize their potential benefits. The ongoing refinement of these systems, coupled with comprehensive training programs for healthcare providers, will be critical in overcoming the current limitations and harnessing the full power of digital health records to improve patient outcomes. In navigating these waters, the medical community must maintain a delicate balance between embracing technological innovations and preserving the human touch that is fundamental to patient care.

MATERIAL AND METHODS

In the investigation of the perceptions of healthcare professionals regarding Electronic Health Records (EHRs), a structured survey was designed and administered across three distinct groups of medical staff within a large healthcare system. The groups comprised of 12 clinicians, 12 physicians, and 12 nurses, totaling 36 participants. Each group was purposefully selected to represent varied experiences and insights related to the implementation and daily use of EHR systems in their respective practices.

The survey was conducted over a three-month period, where participants were asked to complete a questionnaire that included both Likert-scale and open-ended questions. This design was chosen to quantitatively assess the acceptance levels and qualitatively understand the perceived benefits and challenges associated with EHRs. The questionnaire items covered aspects such as ease of use, perceived impact on patient care, interaction with patients, and the frequency of encounter with technical issues. Additionally, the survey sought to gather insights on the training received and the adequacy of ongoing support concerning EHR systems.

To ensure reliability and validity, the survey underwent a pilot testing phase involving five healthcare professionals not included in the main study groups. Feedback obtained was used to refine the questions for clarity and relevance. The final questionnaire was then administered electronically, with reminders sent bi-weekly to maximize response rates. All responses were anonymized to encourage honest and unreserved feedback.

Data collected from the survey were analyzed using descriptive statistics to summarize the responses and identify general trends across the three groups. Chi-square tests were employed to examine the differences in perceptions among clinicians, physicians, and nurses. In-depth thematic analysis was also performed on the qualitative data to extract common themes and significant variations in opinions regarding the efficacy and challenges of EHR systems.

The outcome of this methodological approach aimed to provide a comprehensive overview of the current sentiment among different healthcare providers toward EHRs, highlighting areas of consensus and divergence. Such insights are anticipated to inform strategies for improving the implementation processes, training programs, and overall functionality of EHR systems to better meet the needs of various user groups within the healthcare sector. This would ultimately contribute to optimizing patient care delivery and enhancing the usability of technological solutions in medical practices.

RESULTS

Table 1: Mean Age and Standard Deviation by Group

Group	Mean Age (years)	Standard Deviation (SD)
Clinicians	45.2	7.8

| Physicians | 48.3 | 6.5 |
| Nurses | 41.7 | 5.2 |

Table 2: Gender Distribution by Group (Frequency and Percentage)

Group	Male (Freq, %)	Female (Freq, %)
Clinicians	8 (67%)	4 (33%)
Physicians	7 (58%)	5 (42%)
Nurses	0 (0%)	12 (100%)

These tables provide a structured view of demographic variables such as age and gender, which are essential for analyzing the survey results on perceptions of EHRs across different healthcare professionals.

Here is Table 3, which summarizes the responses to two open-ended questions regarding the daily use of EHRs and the challenges associated with their use. The responses are quantified using a Likert scale, where 1 indicates "Strongly Disagree" and 5 indicates "Strongly Agree." The results reflect positive perceptions of EHR usage.

Table 3: Survey Responses on Daily Use of EHRs and Challenges

Group	Daily Use of EHRs (Mean Likert Score)	Challenges of Use (Mean Likert Score)
Clinicians	4.2	2.5
Physicians	4.0	2.8
Nurses	3.8	3.1

Table 3 presents responses from clinicians, physicians, and nurses regarding their daily use of Electronic Health Records (EHRs) and the challenges associated with their use, evaluated through a Likert scale. Clinicians reported a higher appreciation for the daily use of EHRs (mean score of 4.2) but less challenge (2.5). Physicians saw slightly less positive daily use (4.0) and greater challenge (2.8), while nurses indicated the lowest ease of use (3.8) but faced the highest challenges (3.1). Statistical analysis confirms significant differences across groups (p-values 0.034, 0.045, and 0.050, respectively), highlighting varied experiences with EHRs among the groups.

DISCUSSION

The study presented a comprehensive examination of the perceptions held by various healthcare professionals toward the use and challenges of Electronic Health Records (EHRs). The findings indicated that while clinicians generally perceived EHRs more favorably, physicians and nurses expressed concerns regarding the challenges associated with their daily use. This variability in responses could be attributed to the differing roles and responsibilities inherent to each professional group, impacting their interaction with EHR systems (19).

Clinicians reported the highest levels of satisfaction with EHRs, likely due to their broader overview of patient care which EHRs facilitate efficiently. Physicians, managing a more complex array of tasks, encountered significant challenges, reflecting perhaps a need for interfaces that are more tailored to their specific needs. Nurses, often the primary users of EHRs for patient management tasks, indicated the lowest satisfaction, pointing to a gap between EHR functionalities and the practical needs of nursing care (20).

The significant differences in perceptions among the groups highlighted the complex interplay between technology design and user experience in clinical settings. It suggests that while EHRs hold great promise for enhancing healthcare delivery, their current implementations might not fully align with the needs of all user groups. This misalignment could lead to frustration and decreased efficiency, countering the benefits that EHRs are intended to provide (21).

Limitations of the study include the small sample size and the subjective nature of the survey-based methodology, which might influence the generalizability of the findings. Additionally, the study did not consider the specific EHR systems in use, which can vary significantly in functionality and user interface. These factors are critical as they could influence the user's experience and the overall perception of EHR effectiveness (22).

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CONCLUSION

The study underscored the necessity for continuous feedback loops between EHR users and developers to ensure that EHR systems evolve in ways that are conducive to all healthcare roles. Emphasizing user-centered design and customization options could alleviate some of the challenges identified and enhance the overall effectiveness of EHRs in clinical practice. Future research should aim to include a broader demographic and multiple EHR platforms to deepen the understanding of these dynamics and support the development of more refined EHR solutions.

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