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Physicians' opinions about the value of laboratory test recording and nursing information systems

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Abstract
Background: The implementation of Computerized Provider Order Entry (CPOE) systems has been proposed to improve healthcare quality and patient safety. These systems are designed to minimize medical errors, enhance decision-making, and streamline clinical workflows. However, their impact on healthcare professionals' workflows, particularly physicians and nurses, remains a subject of debate. This study aimed to evaluate the effects of CPOE systems on the workflows of physicians and nurses, with a focus on patient safety, interdepartmental workflows, professional relationships, and the quality of care provided to patients.
Methods: This study was conducted at a general teaching hospital, involving 145 nurses and 28 physicians. A structured questionnaire with a five-point Likert scale was distributed to assess perceptions of CPOE's impact in four key areas: patient safety, interdepartmental workflows, professional relationships between physicians and nurses, and quality of care. Data were analyzed using SPSS, with descriptive statistics and t-tests employed to compare the perspectives of physicians and nurses.
Results: The study revealed a generally positive perception of CPOE's impact on patient safety and quality of care. Nurses expressed more favorable views on the system's effects on interdepartmental workflow and professional relationships compared to physicians. Significant differences were observed between the two groups in terms of the perceived time-saving benefits of CPOE and its impact on collaboration. While both groups agreed that CPOE enhanced patient safety, physicians were less enthusiastic about its role in improving interdepartmental coordination and efficiency.
Conclusion: Both physicians and nurses recognized the positive influence of CPOE on patient safety and care quality. However, differences in opinions regarding its impact on workflows and professional relationships were noted, with nurses having more favorable views. The findings suggest that addressing workflow disruptions and enhancing collaboration between healthcare professionals is crucial for optimizing the benefits of CPOE systems. A deeper understanding of healthcare workflows and organizational dynamics is essential for the successful design and implementation of such technologies.

Introduction

The quality of healthcare services and patient safety are key priorities within healthcare organizations, and the implementation of computerized provider order entry (CPOE) systems has been proposed as a means to enhance both aspects (1). Typically integrated as components of hospital information systems, CPOE systems may include decision support functionalities that provide alerts regarding drug interactions, improper dosages, and other medication-related issues (2, 3, 4, 5, 6, 7). These systems offer various advantages, such as minimizing medical errors, standardizing care practices, aiding clinical decision-making, preserving data for research purposes, reducing expenses and hospital stays, and streamlining organizational workflows (8, 9, 10, 11, 12).

Additionally, CPOE systems can prevent task duplication and accelerate the completion of clinical processes (13). They also enhance internal communication, facilitate better coordination among medical teams, and decrease the time nurses spend verifying, reviewing, and amending clinical orders (14, 15).

Despite these benefits, some research suggests that CPOE systems may not significantly affect the morbidity and mortality rates of critically ill patients (16). Moreover, their use can introduce challenges in communication and collaboration between healthcare professionals, particularly physicians and nurses (17, 18). For example, the shift from synchronous to asynchronous communication modes may disrupt teamwork (19, 20). Other reported issues include reduced interaction between physicians and nurses, diminished focus on direct patient care, and potential negative effects on clinical workflows (21). Such workflow disruptions may stem from factors such as suboptimal human-computer interaction, altered sequencing of clinical tasks, incomplete support for clinician responsibilities, decreased situational awareness, and misalignment with organizational policies and procedures (22).

Given these mixed outcomes, exploring the experiences and perceptions of users has been strongly recommended. Understanding the perspectives of end users, such as physicians and nurses, is critical to ensuring the success of health information technologies like CPOE (23, 24). However, there remains a scarcity of studies investigating how CPOE systems influence the workflows of these key user groups (25, 26).

This study aimed to explore the views of physicians and nurses regarding the effects of CPOE systems on their workflows. At the time of the study, the system had been operational for approximately two years, but no formal evaluation had been conducted since its introduction. The findings were intended to inform future implementations of similar systems based on users' feedback. It is noteworthy that the specific CPOE system under examination did not include decision support capabilities.

Methods

This research, conducted utilized a case study approach. The target participants comprised nurses (n = 145) and physicians, including 16 specialists and 12 general practitioners, all employed at a general teaching hospital with a capacity of 199 beds. To maximize participation, the study invited all eligible individuals rather than applying a sampling method.

Tools

Data collection was facilitated through a structured questionnaire employing a five-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). The questionnaire was designed based on insights from the literature (27, 28, 29, 30, 31, 32, 33, 34) and was organized into six primary sections. These included demographic information about the participants and the perceived impact of CPOE in four key domains: patient safety (8 items), interdepartmental workflow (11 items), collaborative relationships between physicians and nurses (6 items), and quality of care provided to patients (5 items). An appendix provided detailed questions for these sections. Additionally, open-ended items invited feedback on the strengths and limitations of the CPOE system.

The instrument underwent validation through face and content validity techniques. Experts in health informatics and health information management reviewed the questionnaire to ensure its relevance and comprehensiveness. Reliability was established using internal consistency analysis, yielding a Cronbach's alpha coefficient of 0.78.

Data Analysis

Data were analyzed using SPSS software version 18.0. Descriptive statistics, including mean values and standard deviations, were calculated, and independent t-tests were employed to compare the perspectives of nurses and physicians.

Results

Out of 173 questionnaires distributed among the participants, the response rate was 65.9%, amounting to 114 completed surveys. Among these, responses came from 101 out of 145 nurses (69.7%), 3 out of 16 specialists (18.8%), and 10 out of 12 general practitioners (83.3%). Most physicians were male (n = 12, 92%), with an average age of 36.46 ± 5.66 years, while the majority of nurses were female (n = 60, 59.4%), with an average age of 31.67 ± 5.85 years. Work experience for physicians averaged 8 ± 4.22 years, while for nurses, it was 7.61 ± 5.52 years.

The study revealed a generally positive perception of the CPOE system's influence on patient safety. Among nurses, the highest average score (4.31 ± 0.48) reflected their belief that the system facilitated accurate documentation of

drug names, while the lowest (4.13 ± 0.49) concerned accurate recording of drug dosages. Physicians reported their highest mean score (4.11 ± 0.29) in recognizing the system's role in preventing misplacement of orders, with the lowest mean (3.96 ± 0.32) associated with timely documentation of orders, timely drug administration, and reducing errors in drug administration methods.

Both groups expressed positive opinions about the system's impact on interorganizational workflows. Nurses gave the highest mean score (4.31 ± 0.52) to the perception that CPOE saved time in organizational processes, while their lowest score (3.01 ± 0.99) pertained to a preference for paper-based records. Physicians rated timely access to clinical information and improved interdepartmental relationships highest (mean = 4.0 ± 0.40), but saving time through CPOE received the lowest rating (3.35 ± 0.80). This was also the area of greatest disparity between physicians and nurses, with 99% of nurses (n = 100) agreeing on the time-saving benefits versus only 46.2% of physicians (n = 6).

Regarding the working relationship between physicians and nurses, nurses gave the highest average score (4.24 ± 0.45) to the reassurance provided by complete data through CPOE. Physicians unanimously agreed that the system enhanced data legibility (mean = 4). Both groups assigned the lowest scores to the perception that CPOE complicated their working relationships (3.5 ± 1.0 for nurses, 3.23 ± 0.83 for physicians), indicating minimal concerns about inefficiency or complexity. Differences in agreement between nurses (90%, n = 91) and physicians (53.8%, n = 7) regarding the facilitation of documentation by CPOE were notable.

The system's impact on patient care quality was also rated positively. Nurses reported their highest mean score (4.6 ± 0.56) for reduced documentation time, which allowed for more patient interaction, while the lowest score (4.07 ± 0.62) pertained to the role of timely prescriptions in improving care. Physicians, in contrast, rated reducing adverse drug events, enhancing patient satisfaction, and improving care efficiency highest (mean = 3.92 ± 0.27). Their lowest score (3.46 ± 0.66) related to reduced documentation time and its effect on patient interaction.

Comparative analysis showed no significant differences between physicians and nurses in their views on patient safety (p = .156) or quality of care (p = .209). However, significant differences emerged regarding interorganizational workflows (p = .001) and professional relationships (p = .017), with nurses expressing more favorable opinions than physicians on these aspects.

Age-specific analysis revealed that physicians aged 29–34 years rated the system's impact on patient safety highest (mean = 4.09 ± 0.22), while those aged 41–47 years reported the lowest ratings for its influence on workflow (mean = 3.36 ± 0.47) and professional relationships (mean = 3.36 ± 0.16). Among nurses, those aged 23–28 years had the highest ratings for patient safety (mean = 4.66 ± 2.57), while nurses aged 29–34 years rated professional relationships lowest (mean = 3.93 ± 0.43).

Few participants responded to open-ended questions. Reported strengths of the system included cost reduction, improved care quality, and minimized duplication of efforts. Commonly noted weaknesses involved system errors that consumed time and an interface requiring refinement.

Discussion

Information technology is increasingly recognized as a valuable tool in enhancing healthcare quality and patient safety. For example, the implementation of Computerized Physician Order Entry (CPOE) systems can streamline processes like ordering medical tests, document actions, and prevent medical errors by providing accurate information (35).

The results from this study revealed that the majority of physicians and nurses believed that CPOE had a beneficial impact on patient safety. This effect is likely due to the system's ability to improve documentation quality and minimize medical errors. However, no significant difference was observed in the opinions of physicians and nurses regarding its impact on patient safety. Similarly, findings from other studies suggest that CPOE systems can significantly reduce medical errors (36, 37, 38). By addressing issues such as illegible medical documentation, CPOE ensures that records completed by healthcare providers are legible and identifiable (39, 40).

The study also indicated a notable difference between the opinions of physicians and nurses regarding CPOE's effect on interorganizational workflow. Nurses expressed a more favorable view on how CPOE influences workflow across different departments compared to physicians. This could be attributed to the broader scope of tasks that nurses handle, including more frequent documentation and daily communication with other departments. Consequently, CPOE's impact on interdepartmental workflow has a more direct influence on nurses' daily activities, while physicians typically engage with other departments indirectly, often through nursing staff. These results align with other studies that suggest both nurses and physicians recognize that CPOE can enhance productivity and operational efficiency in healthcare settings (41, 42). Additionally, research by Barakah et al. demonstrated that CPOE systems enhance information sharing among healthcare providers, which can accelerate service delivery (43).

Another key finding from this study was the difference in opinions regarding CPOE's influence on the working relationship between physicians and nurses. Nurses expressed greater satisfaction with how CPOE improved this

professional relationship. This disparity is reflected in other research, where opinions on CPOE's impact on physician-nurse collaboration varied. For instance, Rahimi et al. found that while nurses largely agreed that CPOE improved the legibility of data, physicians were less convinced (48). In contrast, a study by Pirnejad et al. revealed that CPOE disrupted the collaboration between physicians and nurses, causing communication problems (49). Niazkhani's study also highlighted both positive and negative effects, noting that while CPOE systems improved data legibility and completeness, they also created challenges in collaboration (50). These findings suggest that careful consideration of organizational workflows is essential before CPOE systems are implemented. They should be designed not merely as data repositories but as communication tools to facilitate interactions between healthcare providers (51, 52).

Interestingly, although nurses had a generally positive outlook on the impact of CPOE on interprofessional relationships, many nurses acknowledged that the system added to the workload of both physicians and nurses. Kazemi et al. suggested that an ideal system should ease the data entry load on physicians, even though it may increase transcription tasks for nurses (53). Some studies have pointed out that higher workloads can contribute to medical errors, particularly in fast-paced environments like emergency departments (54). Technical factors could contribute to increased workload, and as Avansino and Leu argued, user-friendly system design can help reduce cognitive burden (55). Despite these challenges, nurses in this study seemed to believe that the benefits of CPOE, such as improved documentation and efficiency, outweighed the drawbacks related to workload.

The study also indicated that both physicians and nurses agreed on the positive effects of CPOE on patient care quality, although no significant difference was found in their views. Similarly, Holden's research showed that physicians believed CPOE could improve care quality by enhancing data accessibility, providing reminders, and speeding up care delivery (56). However, a study by Al-Dorzi et al. found no improvement in patient outcomes even after a year of system implementation (57). Other factors, such as the duration of CPOE usage, commitment to quality improvement, and the severity of patient conditions, may influence the system's effectiveness in improving care quality (58).

While the developers of the CPOE system in this study planned to extend its implementation to other hospitals, the findings emphasized that issues such as interorganizational workflow and physician-nurse relationships need further exploration to ensure the system fits seamlessly into diverse healthcare environments. A thorough analysis of clinical workflows is crucial in the early stages of CPOE design and implementation. Furthermore, since healthcare settings vary greatly, usability testing and user feedback are essential to refine future versions of the system. Although nurses were relatively satisfied with the system, physicians expressed reservations, indicating that future versions should better address both physicians' and nurses' needs.

Conclusion

The research findings indicated that both physicians and nurses had similar views on CPOE's positive impact on patient safety and care quality. However, significant differences emerged between their opinions regarding CPOE's effect on interorganizational workflow and their professional relationship. Nurses generally had a more positive outlook on these areas. The results highlighted that interorganizational workflow and collaboration between care providers are critical aspects that require further attention. Negative impacts on workflow could ultimately affect the quality of care and patient safety. Therefore, a thorough understanding of workflow patterns and organizational structures is essential before CPOE systems are designed and implemented.

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