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(REVIEW ARTICLE)

Unintentional consequences nurses experienced while using the electronic health record; Systematic review

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Abstract

Background: Nurses are important users of EHRs, but little is known about their experiences or if they think that EHRs contribute to high-quality care and patient safety. Examining published articles that address nurses' experiences with unexpected EHR outcomes is the goal of this review.

Method: we searched for papers published between 2009 and 2024 using the keywords "nurse" and "unintended consequences" in the CINAHL and PubMed databases. 98 references were found. Three more were added following a "hand" search. After duplication removal and assessment of full text we included 7 articles in our systematic review.

Result: Seven publications describing nurses' experiences with unintentional results in EHR were included. Six of the investigations used qualitative methods, and one used mixed approaches. Several study teams wrote the seven reports. In six of the studies, the population of interest was nurses who directly care for patients at the bedside in acute care settings. Small-sample qualitative methodology and content analysis techniques were the most widely used approaches.

Conclusion: The findings demonstrated many of the unanticipated outcomes that have been reported in studies focused on the EHR—workflow time, communication, a learning curve during deployment, system problems, patient safety, nurse satisfaction, interruptions in documentation, efficiency, and functionality—were revealed.

Keywords: Electronic Health records; Unintentional Consequences; Nurses; Barriers

1. Introduction

The electronic health record (HER), was heralded as a significant advancement in the openness and accountability of healthcare. Every developed country digitalized its health records, which were designed to be accessible whenever needed and to be safe and secure. It was meant to be advantageous to all parties involved. If the EHR has been worthwhile, the verdict is still out. Despite cybersecurity precautions, there have been cases of data breaches and manipulation that jeopardize the safety of patients and the integrity of professionals. EHRs have also been held accountable for physician burnout by placing an excessive amount of preventable administrative work on them (Kataria & Ravindran, 2020; Baughman, 2024; Tajirian et al., 2020).

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Workflow isn't going smoothly because different EHR software systems aren't compatible with one another. The EHR's shortcomings are now being addressed via artificial intelligence. New information gathered from EHR use in the real world is offering helpful inputs that could improve the system. This assessment offers a critical evaluation of the EHR's current state and problems as well as an outline of the major technologies being used to improve the system's efficiency and lessen the administrative load on healthcare workers (Kataria & Ravindran, 2020; Tajirian et al., 2020).

EHR can provides healthcare workers including nurses with data gathering and integration capabilities. Nurse Information Systems possess the capability to enhance patient history and care planning procedures, as well as boost the accuracy, accessibility, and completeness of nursing documentation. Additionally, it offer a way to reduce redundant documentation and help ensure that legal documentation requirements are more precisely followed (Ammenwerth et al., 2011). A recent systematic evaluation, however, did not find any proof that nursing record systems had a quantifiable effect on nurse practice or patient outcomes.

Relatively little is known about the barriers experienced by nurses when using EHR in hospitals because there are few studies on this topic. The body of research on EHRs is more extensive. The systems arrange clinical information about patients in a chronological order. These consist of pharmaceutical administration systems as well as order entry and results reporting systems for lab, pharmacy, and radiology settings. Despite being the last users of EHRs, nurses are not well understood in terms of their experiences or if they believe that EHRs are related to patient safety and high-quality treatment (Kutney, 2011). This review's objective is to look at published works that discuss nurses' experiences with unexpected outcomes related to EHR.

2. Method

A search for papers published between 2009 and 2024 using the keywords "nurse" and "unintended consequences" in the CINAHL and PubMed databases. This study was conducted according to PRISMA guidelines. We added the terms "work-around and barrier to electronic health record, consequences, unintended" and "electronic medical record" to PubMed and CINAHL plus full text queries in order to broaden the search. With this method, 98 references were found. Three more were added following a "hand" search. Seventy-two of the 101 article titles that were reviewed were deemed irrelevant to the research issue and hence excluded. 29 full texts with a primary focus on the RN in acute care were examined to see if any of them specifically addressed unintended consequences or patient safety. After putting aside reviews and editorials, 22 papers were eliminated for not having a primary focus on registered nurses (RNs). A systematic review of seven articles was conducted (Fig 1).

Data was extracted by all authors in a predesigned form. Information extracted include; study sample size, setting, country, year of publication, design, method, aim and in intentional consequences.

3. Result

We included 7 publications summarized in Tables 1 and 2 summarize about the experience of nurses with unexpected outcomes in EHR. Out of the six investigations, one employed mixed methods, and 6 used qualitative methods (Carrington et al., 2011; Sockolow et al., 2014; Schoville et al., 2009; Stevenson et al., 2011; Sharifian et al., 2014; Samadbeik et al., 2017). The seven reports were written by several study teams. The nurses who provide direct patient care at the bedside in acute care settings were the population of interest in 6 of the research. The most popular techniques were content analysis techniques and small-sample qualitative methodologies.

Schoville et al., (2009) looked at the workarounds and artifacts that nurses employed when switching from paper order entry to EHR. The study looked at how nurses used artifacts to adjust to their changes in workflow as a result of CPOE adoption, enabling adjustments to be made by addressing these specific themes and resolving unintended consequences. In order to find workarounds, information was gathered via email asking clinical leaders to list any workarounds and artifacts they had seen; they also conducted conducting open-ended follow-up interviews with leaders.

Carrington and Effken (2011) investigated how well nurses thought the EHR communicated a clinical event or an abrupt and unplanned change in a patient's clinical status. They conducted 37 interviews with nurses, including receiving nurses (who continued to care for the patient after a shift change) and documenting nurses (who provided care during the change in status). Five categories emerged from the transcript analysis and content analysis: usability, legibility, communication, work-around, and collaboration.

In specifically, the usage of the optional free-text comments as part of a local EHR that has been in use since 2005 was one of the workarounds utilized by nurses that Collins et al. (2021) analyzed using a mixed-methods approach. In this instance, clinical events were not connected to nursing flow sheet data by the EHR design. A nurse workaround to establish such relationship was the use of free-text comments.

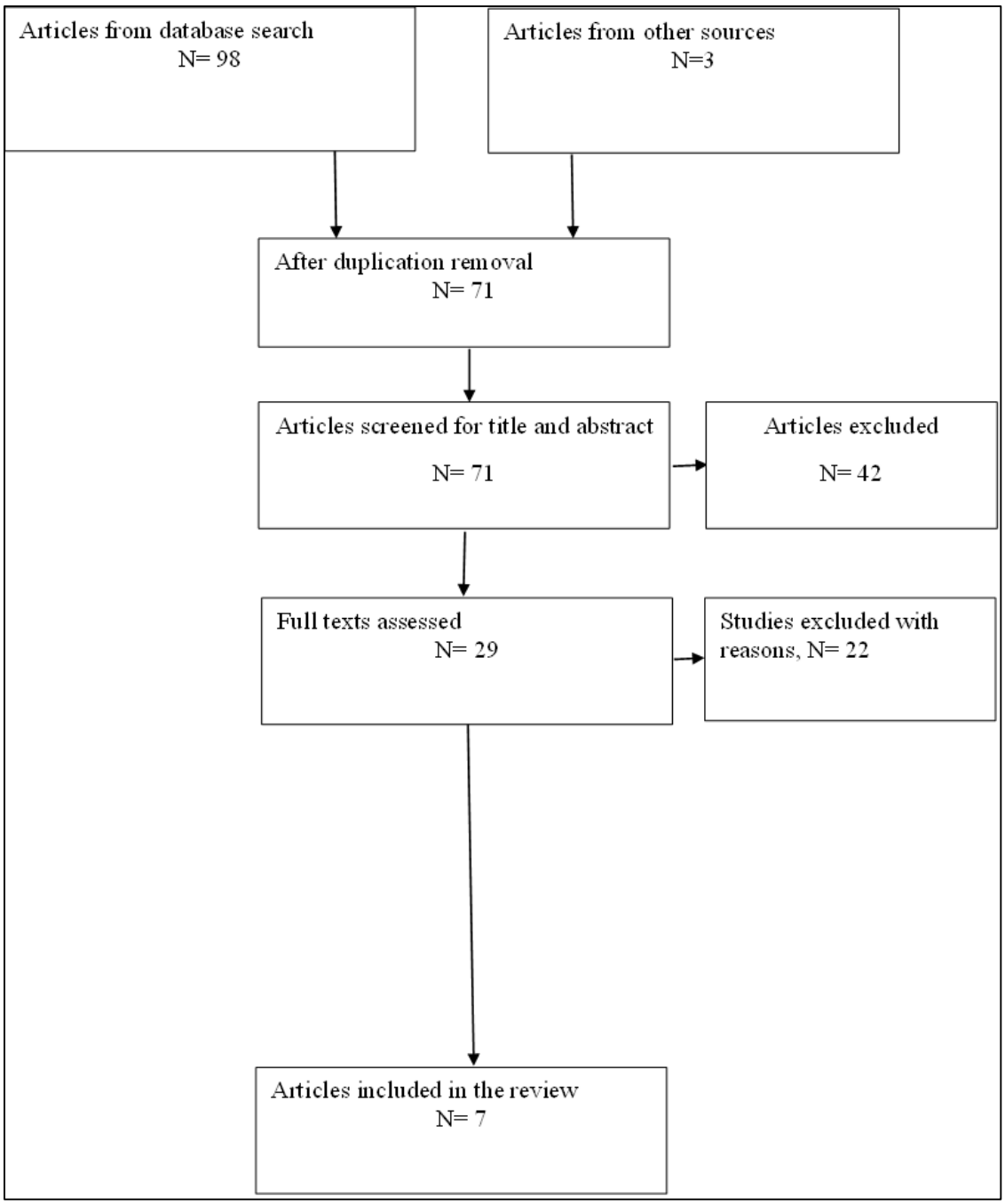

Figure 1 PRISMA consort chart of studies selected

When using the EHR as part of routine practice in a general ward context, nurses' views of patient safety were investigated by Stevenson and Nilsson, (2012). The EHR system was used by twenty-one nurses for whom focus group interviews were performed after a year. Through content analysis, the category "documentation in everyday practice" was identified. This category included three aspects: patient overview, drug module management, and vital sign documentation. Nurses said that redundant and duplicate EHR data caused confusion and increased their mental burden while trying to locate the information they required.

The influence of a Nursing Information System (NIS) and the ensuing health care outcomes connected with NISs were evaluated in 2014 by Sockolow et al. (24). Nurses may plan and make informed decisions about patient care by using evidence-based guidelines through the NIS program, which is part of the EHR. Twelve nurses who were chosen at random for interviews. They were required to "think aloud" in order to respond to questions concerning the EHR while they were recording a patient's fall during the scenario-based testing portion of the interview. To evaluate the interview transcripts for the simulation, content analysis was employed. The advantages and disadvantages of NIS usability were determined through thematic analysis. They expressed dissatisfaction with the frequent disruptions they encountered when documenting at the patient's bedside, their inability to offer feedback on the NIS design, and the inadequate flowsheet design, which made it more difficult for them to create a clear clinical picture of the patient's condition. Poor usability, the need to duplicate patient information, delays in between orders, physician evaluation of the NISs documentation, missing data, the requirement for duplicate documentation, and insufficient training during implementation were among the design elements that could have an impact on patient safety. When adopting NIS on their unit, the authors advised nurse administrators to push for better training and implementation assistance. The findings of the study by Sharifian et al. (2014) showed that effort expectancy, performance expectancy, social influence, and conducive factors all predicted the nurses' behavioral intention to use hospital information systems.

Table 1 Characteristics of the included studies

Citation	Sample size	Method	Study setting	Country
Schoville et al., 2009	12	Observation, sources of data, interviews and emails.	Two large hospitals employing1000 RNs.	USA
Carrington & Effken, 2011	37	Interviews with registered nurses who are documenting and receiving care for patients following a clinical occurrence.	Medical-surgical unit	USA
Stevenson & Nilsson, 2011	21	Nurses were split up and subjected to unstructured interviews in groups before thematic analysis was carried out.	Acute care unit	Sweden
Collins et al., 2012	5 nurses and data from 201 patients	Hybrid approach. content analysis of RN interviews regarding free-text records pertaining to cardiac arrest.	One unit from a large medical center	USA
Sockolow et al., 2014	12	qualitative, using observation and a think-aloud approach	Two hospitals with a total of 1060 beds	USA
Sharifian et al., 2014	303	The adoption and usage of EHR by nurses was investigated using a descriptive-analytical research approach. A cross-sectional survey of nurses was used to gather data.	One teaching hospital	Iran
Samadbeik et al., 2017	71	Cross sectional study	5 teaching hospitals	Iran

Table 2 Studies aim and Un-intentional consequences

Citation	Study aim	Un-intentional consequences
Schoville et al., 2009	list the WAs and artifacts that RNs used once CPOE was adopted.	There were found to be 40 WAs and 18 artifacts; 80% of the WAs were employed to enhance patient care coordination, with many of them being a response to CPOE design flaws (48%–78%). The timing of workflow events, communication modifications, system issues like care delays and provider incoordination, and learning curve WAs (such as avoiding charts, receiving unnecessary training, and manually "double-checking" computer computations) were all handled by WAs.

Carrington & Effken, 2011	To identify communication themes amongst nurses during a clinical incident and contrast them with EHR records	RNs reported a wish to identify obstacles related to EHRs and be involved in hospital decisions related to EHRs.
Stevenson & Nilsson, 2011	determining how acute care nurses view their everyday use of the EHR and how that affects patient safety	Multiple locations for documentation, which causes confusion and makes it harder or takes longer to find crucial information. Hard to navigate complex design. Knowledge that is easily "missed." Easy to log medications at the incorrect time or day. unclear drug changes.
Collins et al., 2012	To investigate the usage of free text by nurses in clinical settings and the perceived clinical value of such use.	Legal protection, simplicity in taking notes, precise time and date, and patient security. Physicians were supposed to review the notes.
Sockolow et al., 2014	Evaluate the performance of NIS, an EHR module created with nurses' documentation requirements and care plans in mind.	Usability issues, duplicate patient data, delays in orders, the necessity for duplicate documentation due to doctors' ignorance of the NIS, training and implementation issues, strange admission questions, and inadequate nursing training
Sharifian et al., 2014	To investigate the elements influencing nurses' acceptance of EHR	The findings showed that performance expectations, effort expectations, social influence, and enabling factors all impacted the nurses' behavioral intention to use hospital information systems. Seventy-two.8% of the variance in the behavioural intention to use EHR was explained by the impact of the antecedents of the behaviour intention listed above. By offering complete support, including training sessions and improved hardware and software, the majority of the obstacles to utilizing hospital information systems were eliminated.
Samadbeik et al., 2017	To assess NISs data processing	The study's findings showed that the nurses who took part in it did not make the most of digital and paper information processing tools when carrying out nursing duties. Furthermore, nurses use computer tools more to process patient discharge information the less job experience they have. The participating nurses identified the most significant expectations and issues with the HIS as "readability of patient information" and "repetitive and time-consuming documentation," respectively.

4. Discussion

The current status of research on nurses' experiences with unexpected repercussions when utilizing EHRs is reflected in the publications that make up this systematic review. There were seven articles found. One used a mixed-methods design, and all included a qualitative component. Out of the seven, only one discussed the study's theoretical framework and used information theory to define terms and explain the significance of the findings. The remaining authors did not identify the idea that served as the basis for their investigation. The concepts of human factors, which guide the development and enhancement of user-technology interfaces—in this example, the nurse-EHR interface—likely influenced each, though.

The findings of this study indicate that nurses deal with shifting work processes, uneven information accessibility, and mismatched flow sheet designs. Furthermore, it doesn't seem that EHRs change the way other medical professionals choose not to review the patient data recorded in nurse documentation. The authors suggest some key tactics to reduce the impact of EHRs unintentional consequences, to foresee modifications to the workflow, obstacles, and workarounds. Nurse administrators can advocate for nursing while decreasing the number of known EHRs unintentional consequences by being informed and participating in the implementation process, according to one recommended strategy. For example, nurse leaders should examine the present workflow and promote education for the projected future workflow post implementation with the entire nursing team during the construction process. In order for nurses to offer feedback while learning the system, they should assist the educational process during system testing. The "super

user" model, in which nurses from all care areas become the unit "expert" on system use, is another one that nurse administrators can encourage.

A recent cross sectional survey conducted by Kinnunen et al. (2023), involving 3610 nurses that are employed in Finland, to describe nurses' perceptions of their informatics competencies regarding EHR usage, their result indicate that nurses are extremely skilled users of EHR. However, nurses are facing challenges due to the skill requirements brought about by the fast rising digitalization. The competency categories of "ethics and data protection" and "digital environment" were clearly scored highest and lowest, respectively, out of the three that were studied. This alludes to pertinent nursing curriculum material on ethical guidelines and data security and protection principles in day-to-day patient care when utilizing digital services (Silén et al., 2020). This finding indicates that nurses are highly competent in ethical matters, which is significant since digitalization is shifting the nature of the patient-nurse relationship from in-person to virtual. As a result, nurses must determine the patient's needs for care from a distance, provide instruction and guidance in accordance with those needs, and evaluate the patient's progress. The preservation of patient autonomy, privacy, confidentiality, and integrity should all be upheld in digital health care procedures (Dhingra & Dabas, 2020; Konttila et al., 2018; Hübner et al., 2018).

Abbreviations

- COPE, computerized provider order entry;
- EHR, electronic health record;
- NIS, Nursing Information System;
- RN, registered nurse;
- WA, work-around

5. Conclusion

The results showed that many of the unexpected consequences—workflow time, communication, a learning curve during deployment, system issues, patient safety, nurse satisfaction, interruptions in documentation, efficiency and functionality—that have been documented in studies that have concentrated on the EHR were also disclosed. Raising awareness and preparing for the unanticipated might be the last mile of prevention needed to ensure the long-term success of EHR deployment and, ultimately, enhance patient safety.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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