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Taking action to improve health for all

The Influence of Electronic Health Record Design on Usability and Medication Safety: Systematic Review

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INTRODUCTION

- Usability and medication safety = challenges associated with EHRs.[1 - 4]
- **Usability** is “the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” according to the International Organization for Standardization (ISO).[5]
- The definition of **medication safety** varies widely depending on the data source used. In this study, medication safety is related to the risk of drug-related problems, including adverse drug events and medication errors, within an EHR context.[6, 7]

INTRODUCTION

- Usability and medication safety = challenges associated with electronic health records (EHRs).[1 - 4]
- Linked to each other:

Usability [8]

Can influence

Medication safety [9]

- Also linked to EHR design:

Usability [9, 10]

Can influence

EHR design

Medication safety [11, 12]

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INTRODUCTION

Existing review studies have:

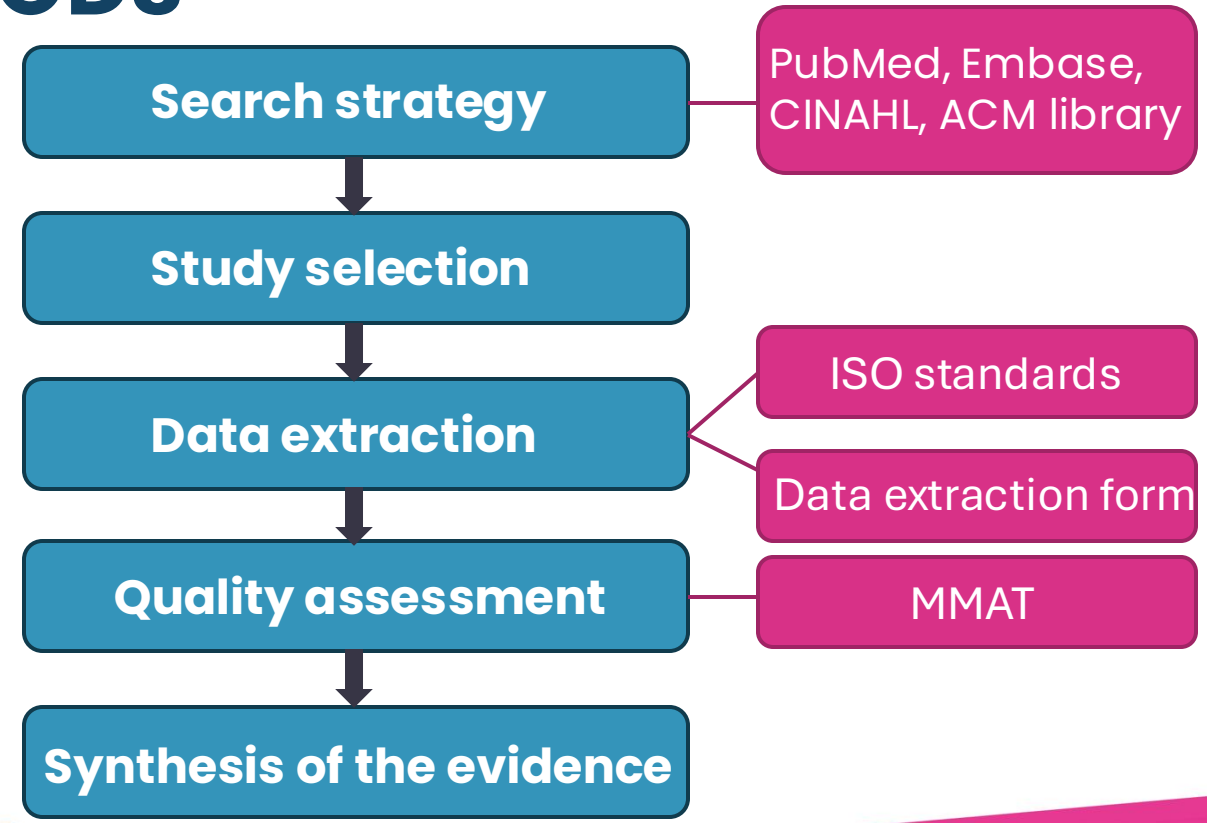
- Examined the impact of individual EHR elements (e.g. infobuttons) on usability and safety;[13-18]
- Evaluated the impact of EHRs, as a whole, on medication errors and usability.[19-29]

No systematic review has focused on how EHR design, specifically, influences both usability and medication safety

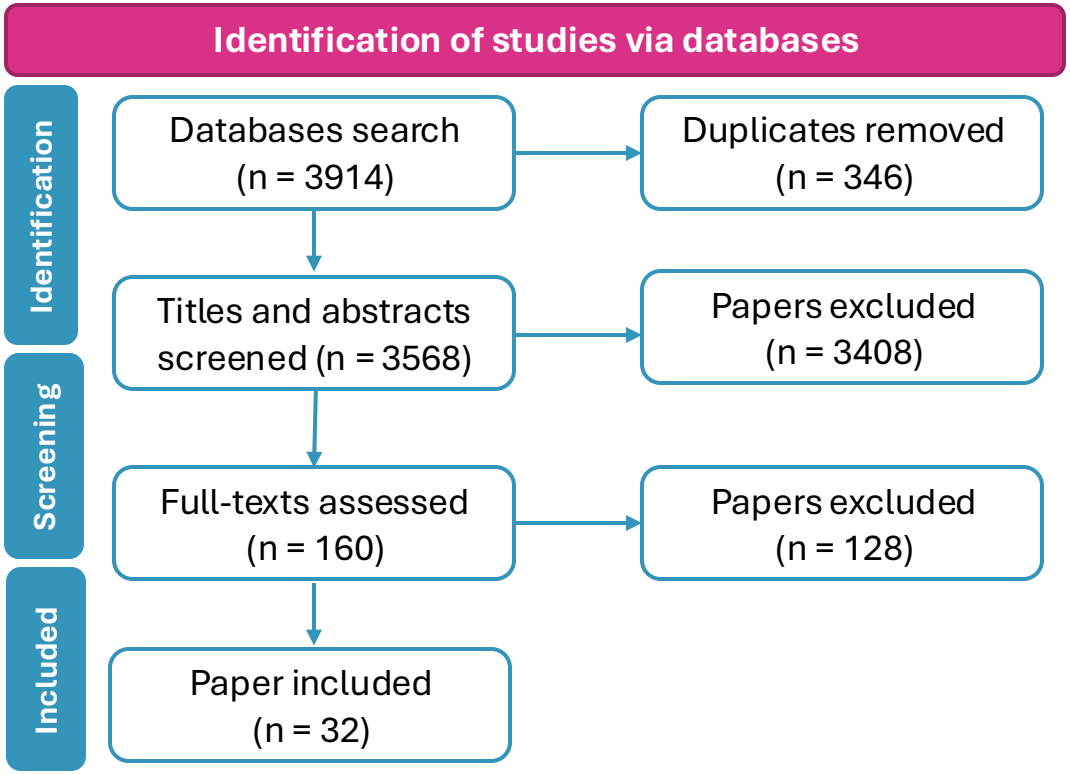
METHODS

Inclusion criteria	
(i)	Reports on the impact of EHR design elements on user satisfaction, effectiveness, efficiency and/or medication safety;
(ii)	Experimental or observational design;
(iii)	Secondary, tertiary or quaternary care setting;
(iv)	Involves healthcare professionals.
Exclusion criteria	
(i)	Involves personal health record or patient health record;
(ii)	Reports on the design features desired by users, but not the actual features present in their current EHR;
(iii)	Simulations;
(iv)	Presence of multiple confounding factors (i.e. other changes were made that were unrelated to EHR design).

METHODS


Search strategy
PubMed, Embase, CINAHL, ACM library
Study selection
Data extraction
ISO standards
Data extraction form
Quality assessment
MMAT
Synthesis of the evidence

RESULTS


Identification of studies via databases
Identification
Screening
Included
Databases search (n = 3914)
Duplicates removed (n = 346)
Titles and abstracts screened (n = 3568)
Papers excluded (n = 3408)
Full-texts assessed (n = 160)
Papers excluded (n = 128)
Paper included (n = 32)

RESULTS

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Design themes	Example of Impact on...	
	Usability	Medication safety
1. **Searchability**	A "limited group" of metadata and a computer system that intelligently "hides" low-yield data is preferrable for clinicians.	Hard to find/confusing information displays can contribute to safety events.
2. **Customisation**	Customised medication alerts are associated with a reduced alert burden on users.	Customised medication alerts can decrease medication serious safety event rates.
3. **Automation**	Incorrect field auto-population is a source of user dissatisfaction.	Automation or conversion with no clear feedback can contribute to safety events.
4. **Data entry**	EHR-embedded care pathways with structured data recording increase an EHR's ease of use.	Adding an "as directed" option to a frequency drop-down decreases prescription discrepancies.
5. **Workflow**	Numerous log-ins disrupt user workflows and present a challenge to clinicians.	The absence of information regarding alternative therapies in an EHR presents a medication safety risk.
6. **User guidance**	Compliance with pop-up alerts is higher than other types of user guidance.	A non-interruptive alert can decrease prescription discrepancies.
7. **Interoperability**	EHR applications that can pull specific disease-related data (for example, regarding asthma and cancer) are associated with satisfied users.	Smart infusion pump/EHR interoperability can reduce the rate of alerts.

RESULTS

- Three of the studies included in our review found that **attending physicians** rated EHR design more positively, versus other physicians and health care professionals.[30-32]

- Seven studies provided participant information regarding EHR experience, with the **number of years of experience** varying between studies.

- One paper found that participants who had used a smartphone-based EHR for **> 1 year** had a more **positive** perception of mobile EHR usage.[33]

- Another paper reported that the highest rating for a documentation method was given by physicians who had the most experience with the method in question.[34]

DISCUSSION

- A number of the themes explored in our review have also appeared in studies conducted by Zahabi and Kaber and Ratwani et al.
- However, important design themes, such as automation, were not included in the aforementioned papers.

- Limitations inherent in narrative syntheses:
  - Data extraction process relies on the reviewers' interpretation of the literature,
  - Can create bias.

- Future research:
  - Development of guidance regarding what exactly constitutes a design element within an EHR context.

THANK YOU

LET'S CONNECT

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