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A Literature Review: Development of Electronic Medical Records In Hospital Management Information Systems

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Abstract: Introduction: Health technology today is developing very quickly from the initially conventional using paper to being computerized. This literature review aims to map and critically summarize the scientific evidence on the cost-effectiveness and acceptability of Computerized Physician Order Entry (CPOE) and Electronic Health Reports. This Journal have Question that need to be answered how does the development of CPOE in medical records affect cost-effectiveness improvement so that it can be accepted by many parties? Method used in this journal is literature review is conducted on journal articles related to costs and receipts in CPOE. The systematic search was conducted from 5 databases namely PubMed, Science Direct, ProQuest, DOAJ and Ebscohost. Journal articles are selected and selected following PRISMA guidelines. Twenty-five journal articles qualified based on predetermined criteria. At the end as result, Cost-effectiveness with CPOE is more likely to be found that it is easier to reach compared to conventional methods. In addition, the acceptance of patients and health workers is also high. These factors can have a positive or negative influence on the hospital management system because developing countries still need adequate resources so that they can run these methods. Discussion and conclusion CPOE systems can improve patient safety by detecting drug interactions and actions. It is necessary to develop medical records in order to provide effective financing and acceptance.

Keywords: cost-effectiveness; Acceptance; Hospital Information System; and Computerized Physician Order Entry

INTRODUCTION

Technological development is accelerating in the pandemic era, the lack of opportunities for in-person interaction poses new challenges to stay connected (Nguyen et al., 2020). The benefits of technology have been proven in various sectors, including in the health sector. Continuous monitoring of the development of hospital information system technology, including medical records, is important considering the role of hospitals as health care providers that must be equipped with adequate infrastructure. The development of electronic medical records aims to facilitate use for health workers, improve accurate reporting, and overall, improve service quality (Raut et al., 2017). The use of good technology can reduce errors in clinical services, as seen in the study of the use of Computerized Physician Order Entry (CPOE), which succeeded in reducing cases of clinical errors by 29% (Sethuraman et al., 2015). In addition, the adoption of e-prescribing systems has also been shown to increase patient satisfaction by improving the safety and accessibility of prescription information (Lau et al., 2019). CPOE, with the support of the Clinical Decision Support System (CDSS) feature, can improve patient safety and reduce errors in medical terminology (Cho et al., 2015). In addition, CPOE and CDSS also facilitate uninterrupted electronic communication, speed up workflow, save staff time, and limit disruptions (Pontefract et al., 2018). To comprehensively explore the historical acceptance of CPOE in healthcare services, a focused literature review within the context of cost-effectiveness is warranted.

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RESEARCH OBJECTIVE

A li The primary objective of this comprehensive literature review is to critically synthesize scientific evidence pertaining to the development and implementation of electronic medical records within hospital management information systems. To achieve this, we employ the Population, Content, Context (PCC) framework, meticulously crafted by the Joanna Briggs Institute. By utilizing the PCC framework, we establish a robust analytical structure, define meaningful research goals, and set appropriate criteria for conducting our review (Pollock et al., 2023).

Topic: Development of CPOE in medical records to increase cost effectiveness
Key question: How does the development of CPOE in medical records affect cost-effectiveness improvement so that it can be accepted by many parties?

Table 1 Research Objectives using the Population, Content, Context (PCC) framework (University of South Australia, 2024)

PCC Elements	Definition	Answer
Population	*Participant characteristics such as age, or other qualities (11.2.4) You may not need to include this element unless your question focuses on a specific condition or cohort.*	Hospital
Concept	*The core concepts examined by the coverage review should be clearly explained to guide the scope and depth of the investigation. This may include details relating to elements to be described in a systematic review of the standard, such as "interventions" and/or "phenomena of interest" and/or "outcomes" (11.2.4).)*	CPOE
Context	*"May include cultural factors such as geographic location and/or interests based on a particular race or gender. In some cases, context may also include details about specific settings."*	Cost-effectiveness

METHOD

Search Strategy

Our study systematically retrieved journal articles from four reputable databases: PubMed, Science Direct, ProQuest, DOAJ, and Ebscohost. The focus of this search was on the development of electronic medical records within hospital management information systems. Commencing in June 2023, we employed the following keywords: “Hospital Information System,” “Electronic Medical Records,” and “Computerized Physician Order Entry (CPOE).” These terms were combined using logical conjunctions (i.e., OR or AND). Notably, our search was conducted exclusively in English.

Article Selection and Restriction Criteria

Our inclusion criteria encompassed both qualitative and quantitative research articles. We meticulously considered population characteristics, conceptual frameworks, and contextual relevance. Adhering to PRISMA guidelines, our research specifically explored the evolution of electronic medical records within hospital management information systems. The screening process involved evaluating each publication based on its title and abstract. To be eligible for review, articles had to meet the following criteria:1) the relevant population is hospital management with the CPOE system; 2) interventions including the use of CPOE-related questionnaires and interviews; 3) research results related to the development of electronic medical records in hospital management information systems; 4) The research design includes cross-sectional approaches and cohort studies. Exclusions were applied to articles that did not meet these criteria. Specifically, we excluded publications with unclear language, non-research content, articles published over 30 years ago, and titles diverging from the literature review’s central theme.

Data Collection and Data Analysis

Data collection occurs systematically, with meticulous attention to relevant keywords. The process is facilitated by the Mendeley reference management software. Each database is meticulously searched, and duplicate files are effectively managed using Mendeley.Software.

Screening and Data Extraction

Journal articles corresponding to keywords are filtered and extracted information to be synthesized narratively, focusing on the development of electronic medical records in hospital management information systems. The information extracted includes the author, year of study, population, study variables, key findings (such as 95% confidence interval and P value <0.05), as well as implications and conclusions. Article extraction is done by considering four main domains: 1) author and year published; 2) identification of studies (article title, journal title,

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impact of CPOE, etc.); 3) the location of study; 4) methodological characteristics (study design, objectives, etc.); 5) key findings and their implications; and 6) conclusions.

Research Ethics

A characteristic of this study design is a systematic review. Evaluation of research ethics is not required. However, the availability of research ethics in journal articles is a consideration for the use of publications for the literature review process.

RESULT

Table 2 Study Characteristics

Variable Analysis Results	N
Cost Effectiveness	15
Patient Reception	10
Data sources	
Cross Sectional Studies	19
Cohort Study	6

Article Selection

Before starting the article review, a duplication extraction process is carried out. The process of reviewing selected articles is carried out in 3 stages: title review, abstract review, and review of the entire article content. Of the total 1,983,042 articles obtained, as many as 896,585 articles were excluded due to duplication. After that, a full text selection was carried out on 256 articles that were considered feasible. Of these, 231 articles were excluded because they focused on a specific group in the population, constituting reviews, preprints, qualitative research, or retrospective studies. After a complete screening, 25 research articles were found that fit the inclusion criteria for literature review.

Research Characteristics

A sample size of 25 journal articles was used with the total number of participants reaching 778,288 respondents, with the most respondents in one article reaching 401,896 people. The ages of participants ranged from 1 year to 85 years. The study consisted of 19 cross-sectional designs and 6 cohort studies, involving 22 countries and Discuss. However, due to research limitations, the literature review focuses on only two factors in the development of electronic medical records, namely cost-effectiveness and acceptability.

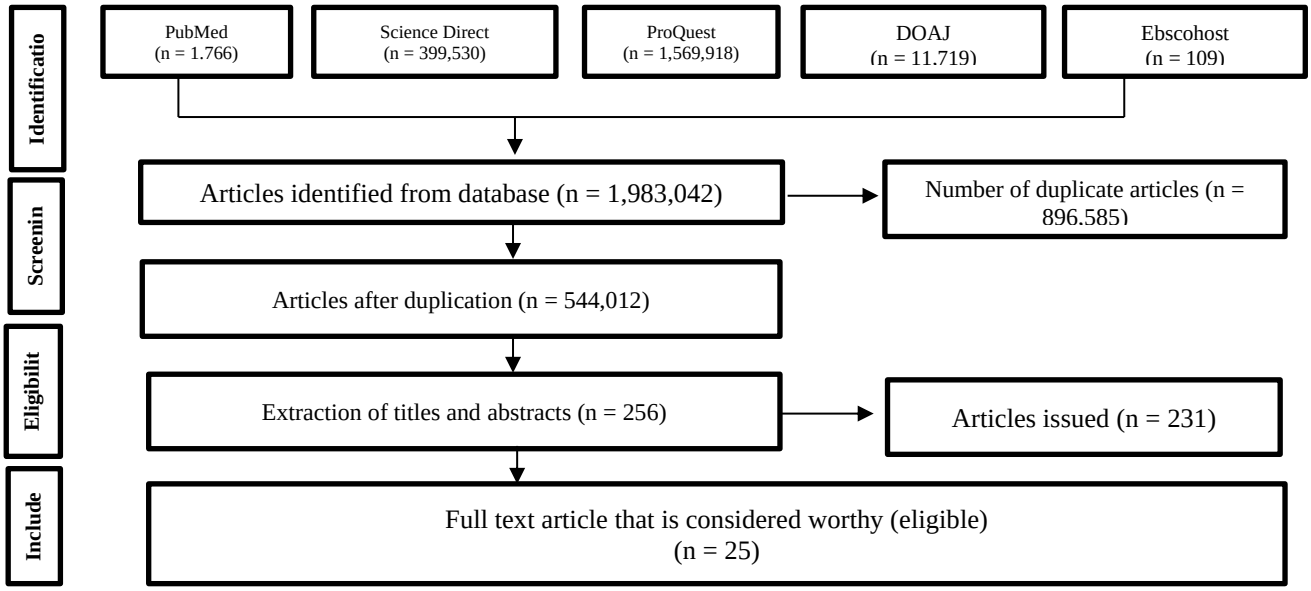

Figure 1. PRISMA Flow Chat Diagram

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No	Author name	Year of Publication	Heading	Database	Country	Research Type	Content
1	James Gallagher, David O'Sullivan, Suzanne McCarthy, Paddy Gillespie, Noel Woods, Denis O'Mahony, Stephen Byrne	2016	Structured Pharmacist Review of Medication in Older Hospitalised Patients: A Cost-Effectiveness Analysis	Pubmed	Irish	Cohort studies	Electronic medical records are more economical than conventional. In comparison to standard care, there was a decrease in average healthcare costs of €807 and the number of ADR events per patient decreased by −0.064. (Gallagher et al., 2016).
2	Ruth Webster, Tim Sherwood, Rohina Joshi, Bandana Saini, Carol Armour, Sue Critchley, Gian Luca Di Tanna, Shane Galgey, Charlotte M Hespe, Stephen Jan, Ajay Karia, Baldeep Kaur, Ines Krass, Tracey-Lea Laba, Qiang Li, Serigne Lo, David P Peiris, Christopher Reid, Anthony Rodgers, Louise Shiel, Jessica Strathdee, Nuria Zamora, Anushka Patel	2021	An electronic decision support-based complex intervention to improve management of cardiovascular risk in primary health care: a cluster randomised trial (INTEGRATE)	Pubmed	Australia	Cohort Studies	The reduced cost of electronic medical records can affect compliance. a fee equivalent to one co-payment to each patient, as determined by Pharmaceutical Benefits Scheme (Webster et al., 2021).
3	Marc Mitchell, Bethany L Hedt-Gauthier, Daniel Msellemu, Melania Nkaka, Neal Lesh	2013	Using electronic technology to improve clinical care - results from a before-after cluster trial to evaluate assessment and classification of sick children according to Integrated Management of Childhood Illness (IMCI) protocol in Tanzania	Pubmed	East Africa	Cohort studies	Computerized Physician Order Entry can improve compliance with the MTBS protocol compared to the current paper-based protocol in Tanzania (Mitchell et al., 2013).
4	Demah Alsalman, Arwa Alumran, Just Alrayes, Arwa Althumairi, Sama'a Almubarak, Sumaiah Alrawiai, Zahraa Alakrawi, Beyan Hariri, Alanzi Turkey	2021	Implementation status of health information systems in hospitals in the eastern province of Saudi Arabia	Science Direct	Arabic	Cohort Studies	Hospital information systems provide benefits in speeding up operations, increasing efficiency, and reducing costs, especially in managing electronic health records (Alsalman et al., 2021).

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5	E. Kağan Atikeler, Ahmad Nader fasseeh, aukje k mantel-teeuwisse, zafer çalışkan, z. gülşen öner, harun kızılay, Zoltan Kalo, Wim Goettsch	2023	Health technology assessment in Türkiye: Current status and perspectives on future implementation	Science Direct	Turkish	Cross Sectional Study	The majority of participants suggested HTA for all health technologies to be listed as a threshold for financing effectiveness in the next 10 years (Atikeler et al., 2023).
6	Tarandeep Anand, Chattiya Nitpolprasert, Stephen J Kerr, Tanakorn Apornpong, Jintanat Ananworanich, Praphan Phanuphak and Nittaya Phanuphak, on behalf of the Adam's Love study team	2017	Implementation of an online HIV prevention and treatment cascade in Thai men who have sex with men and transgender women using Adam's Love Electronic Health Record system	Science Direct	Thailand	Cross Sectional Study	The electronic medical record model can be adopted by unreachable and vulnerable groups. With the capacity to support 1,000 users more efficiently with an initial investment cost of 130,000 USD and an annual maintenance cost of 21,100 USD (Anand et al., 2017).
7	Anant Raut, Chase Yarbrough, Vivek Singh, Bikash Gauchan, David Citrin, Varun Verma, Jessica Hawley, Dan Schwarz, Alex Harsha Bangura, Biplav Shrestha, Ryan Schwarz, Mukesh Adhikari	2017	Design and implementation of an affordable, public sector electronic medical record in rural Nepal	DOAJ	Nepal	Cross Sectional Study	Key needs in developing EMR include easy use, mid-level service providers, improved reporting to the government, and medical cost efficiency (Raut et al., 2017)
8	Lucas M. OKUMURA , Jezeland VERONEZE, Celia I. BURGARDT, Marta F. FRAGOSO	2016	Effects of a computerized provider order entry and a clinical decision support system to improve cefazolin use in surgical prophylaxis: a cost saving analysis	DOAJ	Brazil	Cross Sectional Studies	The successful implementation of a hospital's CDSS system is strongly influenced by two main problems. First, there is a need to improve the allocation of human and financial resources. Secondly, collaboration between many professionals is required in the development and implementation of CPOE/CDSS (Okumura et al., 2016).
9	Valéria Castilho , Antônio Fernandes Costa Lima, Fernanda Maria Togeiro Fugulin, Heloisa Helena Ciqueto Peres, Raquel Rapone Gaidzinski	2014	Total staff costs to implement a decision support system in nursing	Pubmed	Brazil	Cross Sectional Studies	Staff financing is dominated by professional computer staff financing of 71.78% and 28.22% is used to pay for Hospital and University resources. the amount paid refers to the complete execution of CDSS (Castilho et al., 2014).

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10	Faisal Sultan, Muhammad Tahir Aziz, Idrees Khokhar, Hussain Qadri, Manzar Abbas, Amir Mukhtar, Waqar Manzoor, Muhammed Aasim Yusuf	2014	Development of an in-house hospital information system in a hospital in Pakistan	Ebscohost	Pakistan	Cross Sectional Studies	HIS implementation resulted in a total savings of US$ 5.1 million, with net savings of US$ 3.5 million during the period 2001-2011, This HIS implementation project shows a short payback period, signifying greater liquidity in the HIS project (Sultan et al., 2014).
11	Kamal G Shah, Tara Lyn Slough, Ping Teresa Yeh, Suave Gombwa, Athanase Kiromera, Z Maria Oden and Rebecca R Richards-Kortum	2013	Novel open-source electronic medical records system for palliative care in low-resource settings	Ebscohost	Malawi	Cross Sectional Studies	ERM generates customizable reports, generates comprehensive patient records and reports on provider activities, and minimal training, saving costs (Shah et al., 2013).
12	L Rossi, E Materia, A Hourani, H Yousef, V Racalbuto, C Venier, M Osman	2009	Hospital information system for the Palestine Red Crescent Society in Lebanon	Pubmed	Lebanon	Cross Sectional Studies	This system facilitates the retrieval of collected information that is ready for analysis, with this kind of system, cost analysis and management, implementation of quality standard protocols, patient referral system can be carried out efficiently (Rossi et al., 2009).
13	Sophie Relph ,Maria Elstad ,Bolaji Coker,Matias C Vieira,Natalie Moitt,Walter Muruet Gutierrez,Asma Khalil,Jane Sandall,Andrew Copas,Deborah A Lawlor,Dharmintra Pasupathy	2021	Using electronic patient records to assess the effect of a complex antenatal intervention in a cluster randomised controlled trial-data management experience from the DESIGN Trial team	Pubmed	Brazil	Cross Sectional Studies	Conducting clinical trials that use electronic patient records to assess outcomes can save time and cost but still requires the right time and resources to maximize data quality (Relph et al., 2021).
14	K Herbst, P Littlejohns, J Rawlinson, M Collinson, J C Wyatt	1999	Evaluating Computerized Health Information Systems: hardware, software and human ware: experiences from the Northern Province, South Africa	Pubmed	South Africa	Cross Sectional Studies	The cost of replacing hardware and software added to an existing system is about $10,000. takes about 16 weeks, however, for future implementation, the time required will be much less (Herbst et al., 1999).

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15	K Priya, Mary Sreshta, Sonin Philip	2021	Cost-saving medication therapy management for outpatients	Pubmed	India	Cross Sectional Studies	Development of clinical pharmacy practices with ERM in outpatient hospitals can reduce prescribing errors and healthcare costs (Priya et al., 2021).
16	Mohammad Khammarnia , Roxana Sharifian, Farid Zand , Omid Barati, Ali Keshtkaran, Golnar Sabetian, Nasim Shahrokh, Fatemeh Setoodezadeh	2017	The impact of computerized physician order entry on prescription orders: A quasi-experimental study in Iran	PubMed	Southern Iran	Cohort Studies	CPOE significantly 19% to 3% (p = 0.001) CPOE reduces two types of errors, illegible commands and lack of writing drug acceptance forms (Khammarnia et al., 2017).
17	Aaron Kundi, Nazim Coskun, Metin Yesiltepe	2021	Association of entirely claims-based frailty indices with long-term outcomes in patients with acute myocardial infarction, heart failure, or pneumonia: a nationwide cohort study in Turkey	Science Direct	Turkish	Cohort Studies	ERM has been shown to increase recovery rates and reduce death rates for heart attacks, heart failure, and pneumonia. The use of ERM in managing patient admissions is a significant factor in better evaluation of hospital performance (Kundi et al., 2021).
18	Nasriah Zakariaa, Shafiz Affendi Mohd Yusof	2016	Understanding Technology and People Issues in Hospital Information System (HIS) Adoption: Case study of a tertiary hospital in Malaysia	Science Direct	Malaysia	Cross Sectional	There has been a positive response from the new system that improves workflow efficiency and saves time, decreases redundancy and improves communication between medical teams (Zakaria &; Mohd Yusof, 2016).
19	Tsai Min-Fang, Hung Shin-Yuan, Yu Wen-Ju, Chen C. C, Yen David C.	2019	Understanding physicians' adoption of electronic medical records: Healthcare technology self-efficacy, service level and risk perspectives	Science Direct	Thailand	Cross Sectional Studies	The results of the Structural Equation Modeling (SEM) analysis show that self-efficacy, risk perception, and patient acceptance rates are significant factors. (Tsai et al., 2019).
20	Ali, Mohammad; Canh Gia o; Clemens, John D; et al.	2005	The use of a computerized database to monitor vaccine safety in Viet Nam	ProQuest	Vietnamese	Cross Sectional Studies	The construction of computerized health information systems can provide reliable data in developing countries to improve the efficient use of resources. (Ali et al., 2005).

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21	Roopalekha Jathanna	2017	Awareness And Perception Of Nurses Towards E – Health Records: A Hospital Study	DOAJ	India	Cross Sectional Studies	There is a change in positive views about E-Health Record, especially in improving the quality of decision making, patient care acceptance, and efficiency and productivity. (Jathanna, 2017).
22	Alireza Kazemi, Johan Ellenius, Shahram Tofighi, Aref Salehi, Fatemeh Eghbalian, Uno G Fors	2009	CPOE in Iran—A viable prospect? Physicians' opinions on using CPOE in an Iranian teaching hospital	Pubmed	Iran	Cross Sectional Studies	Physicians generally show disapproval of computerized systems because social expectations for prescribing drugs in paper. Concerns also raised regarding possibility in professional deterioration, errors in databases and technical problems deemed potentially dangerous for patients(Kazemi et al., 2009).
23	Alireza Kazemi, Uno GH Fors, Shahram Tofigh, Mesfin K Tessma, Johan Ellenius	2010	Physician Order Entry Or Nurse Order Entry? Comparison of Two Implementation Strategies for a Computerized Order Entry System Aimed at Reducing Dosing Medication Errors	DOAJ	Iran	Cross Sectional Studies	CPOE may improve physician compliance with recommended dosage and frequency warnings. Nurses are also willing to participate in order entry and could do so, so it can be considered a beneficial alternative order entry method (Kazemi et al., 2010).
24	Mahdieh Montazeri, Reza Khajouei, Ehsan Mohajeri, Leila Ahmadian	2021	Development of a Minimum Data Set for Drug Module of Computerized Physician Order Entry System	DOAJ	Iran	Cross Sectional Studies	More than 90% of participants considered five data items, (Drug Name, Dosage, Frequency, Start Date, and Patient Treatment History) as important components in the cardiovascular CPOE system so that they can be used as models for CPOE system designers for the development of new systems or updates to existing systems in patient admission (Montazeri et al., 2021).
25	Dang, Thu Ha, Nguyen, Tuan Anh, Hoang Van, Minh, Santin, Olinda, Tran, Oanh Mai Thi, Schofield, Penelope	2021	Patient-Centered Care: Transforming the Health Care System in Vietnam With Support of Digital Health Technology	DOAJ	Vietnamese	Cross Sectional Studies	To meet healthcare needs, reduce the burden on healthcare systems, improve healthcare delivery, and promote health equity, a digital health system is needed (Dang et al., 2021).

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DISCUSSIONS

This literature review focuses on the two most common factors found in research journals. These factors are cost-effectiveness and acceptability in the development of electronic medical records. Therefore, in this review can not include other factors such as time effectiveness, minimum errors, resources, and others. In addition, in some journals there is no definite sample with sociodemographic. In journals there are also some that do not include the gender and age of the sample not listed in the journal.

Analyses of the relationships or mechanisms of influence among different variables in research have been based on limited available evidence. In addition, the titles that come out of the journal are very complex and many are not appropriate from the theme raised. Not all relationships were found between variables in this literature review. In addition, there is still a lack of use of CPOE in developing countries so that research journals are still minimally found. Still, researchers have sought to build a more comprehensive look at the relationships between variables by synthesizing evidence from quantitative and qualitative studies.

CONCLUSION

The integration of Computerized Physician Order Entry (CPOE) with the Clinical Decision Support System (CDSS) can improve patient safety and financing efficiency by detecting drug interactions and multiple actions. Although it requires a large initial investment, changing from conventional to electronic medical records can save costs in the long run. Medical record development today is standardized by state policy, often carried out by vendors or IT service providers. It is important to develop medical records with effective financing so that they are accepted by various parties.

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