



Review Article

A review of the literature and proposed classification on e-prescribing: Functions, assimilation stages, benefits, concerns, and risks

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Abstract

Background: Evidence from the literature indicates that besides its benefits, e-prescribing also generates new types of unintended medication errors that have the potential to harm patient safety. Analyzing both the benefits and risks of e-prescribing can give health care organizations a better understanding of the improvements gained and errors generated by this technology.

Objectives: To review the primary functions of e-prescribing and its assimilation stages in the health care context. This review also aims to classify the potential benefits, risks and concerns associated with e-prescribing along with factors contributing to e-prescribing errors.

Methods: A literature review was conducted primarily in Web of Sciences electronic databases. The online databases were searched for both peer-reviewed quantitative and qualitative research papers written in English and published between January 2008 and December 2014 (i.e., the last seven years). Several additional studies were also accessed through Google Scholar and the citations of the selected articles. A total of 73 publications met the study's inclusion criteria.

Results: The key benefits of e-prescribing were identified as improving the quality of health care services, increasing the efficiency and effectiveness of prescribing and dispensing medications, reducing medication errors, and health care cost savings. Failure to properly implement e-prescribing systems can also result in new types of errors that reduce workflow efficiency, increase medication cost, and threaten patient safety. In this study, factors contributing to potential errors were categorized into four primary groups (human, technical, interaction and organizational errors).

Conclusions: This review identified the primary benefits and risks of e-prescribing services. The study contributes to the body of knowledge related to the design, adoption and use of e-prescribing by providing a clear reflection on its potential gains and risks. Based on the findings of this review, conducting research in several areas is quite promising as future work. This review also

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has practical implications for health care providers, e-prescribing software vendors and policy makers.

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Introduction

E-prescribing is a system that facilitates the interaction between physicians and pharmacies by enabling physicians to create and pass on prescriptions electronically to pharmacies.^{1,2} The growth of the e-prescribing adoption rate demonstrates that almost 34% of all US office-based prescribers used computers to generate and transmit prescriptions to pharmacies electronically by 2010.³ Due to the allocation of funds aimed at encouraging the adoption and implementation of e-prescribing systems, the number of e-prescription receipts in US pharmacies grew by 72% between 2009 and 2010.⁴ According to the US national progress report on e-prescribing, the total number of transmitted e-prescriptions to community pharmacies increased by 27% from 2007 to 2012 in the United States.⁴

Medical errors are capable of creating severe harm that injures one million patients and result in 44,000 deaths yearly just in the US.⁵ Medical errors have a number of subcategories; one of these is medication errors, which are considered to be the main reason for approximately 7000 deaths yearly.⁵ These types of errors can affect care planning as well as the length of treatment, which in turn leads to higher priced health care services.⁶ Medication errors have several dimensions, one of which is classified as prescription errors.^{7,8} E-prescribing enables direct communication between physicians' offices and pharmacies via computers to increase efficiency and reduce errors.⁹ Although a well-implemented e-prescribing system can reduce errors related to illegible handwriting, the technology itself can introduce new types of e-prescribing errors such as the incorrect entry of dosing directions, drug quantity or patient's information.¹⁰ E-prescribing services are mainly used to improve patient safety and prevent medication errors, but they can also generate some additional errors and unintended consequences for pharmacies and patients. The occurrence of some unintended e-prescribing errors is inevitable; however, evidence shows that 9% of e-prescriptions contain medication errors.⁴ Therefore, despite the potential benefits of e-prescribing in improving the

quality of health care and large investments in the development of this project, e-prescribing systems have not been adopted as expected.¹¹ More research is required to provide insights into health care providers' decisions to adopt and use e-prescribing in their practices.¹²

The literature reflects that little is known about the unintended consequences of e-prescribing technology in community pharmacies and further research is required to understand the true benefits and risks of e-prescribing in the context of community pharmacies and hospitals.¹³ Furthermore, e-prescribing errors and potential benefits are not classified in prior reviews on e-prescribing. For instance, a systematic review by Ammenwerth et al¹⁴ describes the general effect of e-prescribing on medication errors and concludes that e-prescribing can reduce the risk of medication errors. A review by Clyne et al¹⁵ examines the current evidence related to the use and gains of e-prescribing to reduce inappropriate prescribing for older people. Kannry¹⁶ shows that although e-prescribing can reduce medication errors, it also can be a source of new type of errors. Johnson et al¹⁷ discuss some of the limitations and potential benefits of e-prescribing systems in pediatrics and Papshev and Peterson¹⁸ examine advantages and obstacles to e-prescribing in the ambulatory care setting. Caldwell and Power¹⁹ explain the benefits and concerns related to the use of e-prescribing in the pediatric setting. They indicate that more study is required to identify and optimize the benefits and minimize the unintended consequences of e-prescribing. Odukoya et al²⁰ explain e-prescribing errors and their potential consequences in community pharmacies. Consistent with their study, there is a significant need to apply a national reporting and learning system to better understand e-prescribing functions, errors, concerns, benefits and safety. Therefore, additional research is needed to address the main functionality, benefits and risks of e-prescribing services to better utilize the system and prevent e-prescribing errors from reaching patients. It is the aim of this review study to examine the current literature relating to the function and assimilation steps of e-prescribing

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