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ScienceDirect
Research in Social and Administrative Pharmacy 11 (2015) 339–351
RESEARCH IN SOCIAL & ADMINISTRATIVE PHARMACY

Original Research

The impacts of second generation e-prescribing usability on community pharmacists outcomes

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Abstract

Background: The results from past studies about the effects of second-generation e-prescribing systems on community pharmacists' outcomes and practices are inconclusive, and the claims of effectiveness and efficiency of such systems have not been supported in all studies. There is a strong need to study the factors that lead to positive outcomes for the users of these systems.
Objective: This paper intends to bridge the above gaps by empirically examining the impacts of user interface usability on the community pharmacists' outcomes.
Methods: A quantitative survey research method was used and the data was collected from the community pharmacists, who use an e-prescribing system. Data from 152 questionnaires collected in a national survey were used to for the study. Partial Least Squares (PLS) path modeling was used to examine scale reliability, validity and hypotheses.
Results: The scale was found to test well for reliability and validity. Examining the hypotheses illustrated that ease of use ($P < 0.01$, $t = 5.79$) and information quality ($P < 0.01$, $t = 6.24$) of an e-prescribing system improved pharmacists' outcomes (including communication, facilitation of care, reduction of workload and medical errors) while ease of use of the system was influenced by user interface consistency ($P < 0.01$, $t = 7.35$) and system error prevention ($P < 0.01$, $t = 5.29$).
Conclusion: To improve community pharmacists' outcomes and practices, the ease of use, information quality, consistency and error prevention features of e-prescribing systems should be improved. It was

Authors contributions: *Hamid Reza Peikari*: Made the conception and design of the study, collected the data, made the analysis and developed the first draft of the paper; *Mahmood Hussain Shah*: Commented on the methodology and contributed in editing and re-phrasing the paper; *Mohamad Shanudin Zakaria*: Contributed in finding the research gap and the data collection process; *Norjaya M. Yasin*: Contributed in the data analyses and commented on the discussion; *Abdelbary Elhissi*: Commented on the final version of the paper and approved the final version of the paper to be submitted.

Source of funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests: The authors declare that they have no competing interests.

Ethics: The study design and the data collection process were approved by the ethics committee of GSB and the hospitals where the data was collected.

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http://dx.doi.org/10.1016/j.sapharm.2014.08.011

found that information quality had a stronger impact on the outcomes and hence improving the quality of the generated information would have higher impacts on users' outcomes.
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Keywords: E-prescribing; Community pharmacists; Usability; Partial least squares; Outcome

Introduction and research gap

Electronic prescribing (e-prescribing) systems, as the means of communicating medicine choice and therapy of patients between doctors and pharmacists,[1] often lead to significant improvements in the delivery of care.[2,3] Examples of such improvements are rapid delivery of care, access to medical information and records of patients,[4] and increased efficiency in care work flows.[5] However, such systems are not always a source of improvement in the quality of care and in some case these may even bring about negative impacts on the care quality.[1,6–10] Past research has found unexpectedly high levels of patients' safety concerns and other consequences that may arise from e-prescribing technology. For example, Abdel-Qader et al[11] reported that the implementation of an e-prescribing system in a hospital led to an almost 44% increase in medical errors compared with the use of handwritten prescriptions. Similarly, it was found that using e-prescribing systems in hospitals can increase medication error risks.[4,12] It was also found that after the implementation of an e-prescribing system, the number of mortalities increased in the hospital intensive care unit.[13,14] Other examples of negative outcomes included: workflow and time problems, greater physical and mental workload for physicians and changes in communication patterns, often resulting in negative perceptions of the technology.[9,15–18] In a review paper, Khajouei and Jaspers[19] stated that most studies on the impacts of e-prescribing systems had reported negative impacts.

The above-mentioned research suggests that the implementation and use of e-prescribing systems have often not delivered the expected benefits. Hence, there is a strong need to study the factors which can increase the likelihood of delivering positive outcomes. One set of factors that often plays an important role is system design features. It has been speculated that if an e-prescribing system is poorly designed, it can negatively impact on the quality of care, while a properly designed system can significantly contribute to improvements.[1,17–23] One set of design factors, to improve users' outcomes, is system usability.[17,23–25] However, despite the importance of the issue, the interaction between e-prescribing design features and their outcomes has not been studied adequately.[26] It is important, therefore, to study the usability features of e-prescribing systems that could lead to positive outcomes.

Oztekin et al[27] state that there are two shortcomings associated with the usability studies. They state that the previous usability studies have either used qualitative techniques, which employ subjective perception and restrict the generalization of the findings,[28] or did not use any robust quantitative techniques to assess the usability.[28] Also, in a review paper on the impacts of CPOE and e-prescribing systems, it was found that most of the studies were qualitative and only a few quantitative research studies were available.[19] Overall, the focus of the past quantitative research in this field has been on presenting the findings and no attempts have been made to develop and test a reliable and valid instrument for robust research.[3,23]

Another gap in research is regarding the different types, or generations of the e-prescribing systems studied and the population targeted in past investigations. According to Motulsky et al,[3] there are two generations of e-prescription systems: those used to enter, modify and review prescriptions and those used to communicate the prescriptions between different care providers and health professionals. The former – as the first generation – is a stand alone technology, while the latter is the latest technology, based on communication networks and protocols.[3] Community pharmacists, who use the first generation technology, can use patients' smart cards or flash memories to open and access their prescriptions, while the users of the second generation technology access and open patients' prescriptions via the internet and an identification code. Despite the extensive amount of research conducted to study the impacts of such systems, little is known about the impacts of second generation e-prescribing systems[3] and such systems still present "new

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