Barriers and facilitators to implementing electronic prescription: a systematic review of user groups’ perceptions

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ABSTRACT

Objective We conducted a systematic review identifying users’ groups’ perceptions of barriers and facilitators to implementing electronic prescription (e-prescribing) in primary care.

Methods We included studies following these criteria: presence of an empirical design, focus on the users’ experience of e-prescribing implementation, conducted in primary care, and providing data on barriers and facilitators to e-prescribing implementation. We used the Donabedian logical model of healthcare quality (adapted by Barber et al) to analyze our findings.

Results We found 34 publications (related to 28 individual studies) eligible to be included in this review. These studies identified a total of 594 elements as barriers or facilitators to e-prescribing implementation. Most user groups perceived that e-prescribing was facilitated by design and technical concerns, interoperability, content appropriate for the users, attitude towards e-prescribing, productivity, and available resources.

Discussion This review highlights the importance of technical and organizational support for the successful implementation of e-prescribing systems. It also shows that the same factor can be seen as a barrier or a facilitator depending on the project’s own circumstances. Moreover, a factor can change in nature, from a barrier to a facilitator and vice versa, in the process of e-prescribing implementation.

Conclusions This review summarizes current knowledge on factors related to e-prescribing implementation in primary care that could support decision makers in their design of effective implementation strategies. Finally, future studies should emphasize on the perceptions of other user groups, such as pharmacists, managers, vendors, and patients, who remain neglected in the literature.

INTRODUCTION

Prescription and renewal of patient drugs are among the most commonly used treatments in primary care. The prescription process is a major concern for public health policies and efforts are required to promote the continuous improvement of optimal and adequate prescription in primary healthcare. Studies have shown that errors related to drug prescription are common and avoidable; they are also the cause of a high level of morbidity and mortality recorded among populations. Taking into account the increased complexity of health conditions caused by an aging population and multi-morbidity, patients’ exposure to iatrogenic damage caused by drug misuse and interactions is likely to grow in proportion to these changes. It is therefore essential to improve the quality and safety of prescribing, as well as to optimize the use of medicines, making it a priority for current health policies.

In this context, the computerization of prescriptions based on modern information and communication technologies (ICT) is supported in many developed countries. Electronic prescription (e-prescribing) is intended to be an inter-operational platform which facilitates the exchange of patients’ drug therapy information between health professionals and organizations in primary care and community pharmacies. E-prescribing can improve the drug prescription process by responding to specific user needs as well as reducing inconsistencies. E-prescribing is a promising technology that has the potential to improve the quality of drug use especially in ambulatory and primary care, where treatments for chronic diseases are used for extended periods.

Motulsky et al9 indicate that stakeholders in many countries have made considerable efforts in order to promote the widespread use of e-prescribing by health professionals. However, despite major investments and widespread availability of e-prescribing systems, health providers do not always make use of this technology for prescribing and renewal of treatments.

Cresswell et al2 assert that e-prescribing management computer systems implemented in medical clinics vary considerably in terms of functionality, level of interoperability, cost, and involvement of stakeholders in the strategic choices related to the implementation of these technologies. Problems such as a predetermined deficit in norms governing the attribution of public contracts, a lack of functional specifications for choices that stakeholders have adopted, and a lack of harmonization in the systems implementation strategies may also accentuate the degree of implementation of e-prescribing.

As main users of e-prescribing systems, healthcare professionals are best positioned to identify the barriers and facilitators they face in their work environment that could affect the success of these systems. However, most studies related to e-prescribing implementation in primary care are fairly recent and few have addressed end-users’ perceptions of barriers and facilitators in the implementation process. Considering users’ perceptions of barriers and facilitators to the implementation of e-prescribing systems could help reveal which implementation strategy could be successful.
In order to expose these barriers and facilitators, we conducted an exploratory systematic review on the implementation of e-prescribing in the daily work setting of primary healthcare providers. This review sought to answer this question: What are users’ perceptions of barriers and facilitators to e-prescribing implementation in primary care?

METHODS

Search strategy

An information specialist developed the literature search strategy from the research question. We searched PubMed to identify applicable articles published within a period of 10 years (from January 1, 2002 to December 11, 2012), in order to focus on more contemporary systems. See online supplementary appendix 1 for search parameters used.

Selection criteria

We included studies with an empirical design, either qualitative, quantitative, or mixed-methods. These studies should present a clearly stated data collection process as well as research methods and measurement tools used. As such, editorials, comments, position papers, and unstructured observations were excluded from this review.

Included studies focused on the users’ experience of e-prescribing implementation. User groups considered included: physicians, clinical staff (including nurses), pharmacists, pharmacy staff, and others (patients, IT staff, and managers). We included studies that took place in primary care (including ambulatory or community healthcare settings). However, studies involving secondary and tertiary care levels could also be included, as long as there was a linkage of the e-prescribing system with primary care settings.

Also, studies had to provide data on barriers and facilitators to e-prescribing implementation in their results or discussion sections to be included. These barriers or facilitators had to be based on empirical evidence.

If a study was reported in more than one publication and presented the same data, we only included the most recent publication. However, if new data were presented in multiple publications describing the same study, all were included. Publications were not excluded based on language used.

Screening, data extraction, and presentation

Two authors (ENS and SG) independently reviewed all titles and abstracts and reached consensus on included studies. A third author (MPG) confirmed included and excluded studies. Full text review of the selected studies was done by three authors (JPG, ENS, and SG).

We used a validated data extraction grid from previous research on the classification of barriers and facilitators to ICT implementation in healthcare settings. The data extraction grid developed used both inductive and deductive methods, following established theoretical concepts, particularly the technology acceptance model and the diffusion of innovations theory.

We developed the data extraction grid in Microsoft Excel 2010. We took all included publications, and three reviewers (ENS, JPG, and SG) independently read and identified sections of the publications that presented a relevant barrier or facilitator to the implementation of e-prescribing from the users’ perspective. ENS and JPG coded these selected sections in the program. We also extracted data regarding: year of publication, country, study design (quantitative, qualitative, or mixed-methods), theoretical framework (present or absent), type of participants, care setting, technology used, objectives of the study, data collection methods, and main findings.

We used the logical model of healthcare quality proposed by Donabedian, coupled to the themes proposed by Barber et al. as the analytical framework for summarizing our findings. We transposed extracted data into this framework using thematic analysis. This framework highlights e-prescribing users’ perceptions under the dimensions of system functionality, human perspectives, and organizational factors defined by Barber et al. which are classified according to the structure, process, and outcomes categories from the Donabedian’s model, thus providing a 3×3 thematic classification matrix.

Study quality assessment

We used the mixed methods appraisal tool (MMAT)—a scoring system which presents evaluation criteria for quantitative, qualitative, and mixed-methods studies—proposed by Pluye et al. for appraising the quality of included studies. Two authors (ENS and JPG) independently screened each study and gave it a quality score. No studies were excluded based on their scores (results for quality assessment available on request).

RESULTS

Included studies

In total, we identified 230 references from bibliographic databases, of which we retained 44 publications for full-text review. After applying the inclusion criteria, we excluded 10 of these publications: four were not about e-prescribing, two did not mention barriers or facilitators, two did not possess an empirical design, and two did not concern primary care. The review therefore included 34 publications, corresponding to 28 individual studies, because paired publications by Abramson, Crosson, Grossman, Lapan and Goldman, Weingart, and Tamblyn were considered as one study. The number of studies included at various stages of the review process is described in a study selection flow diagram (figure 1).

Characteristics of included studies

The characteristics of included studies are summarized in online supplementary appendix 2. The most frequent types of technology covered were: e-prescribing system (n=20 studies), electronic health records (EHR) with e-prescribing system (n=4), and the personal digital assistant (PDA) with prescribing software and drug information. Computerized physician (or prescription, or provider) order entry systems (CPOE) were considered in the search, but not included since they are traditionally used in secondary and tertiary care and are confined within hospital settings, which are not the focus of this review.

The majority of studies took place in North America (n=22, 78.6%). Of those, 20 are from the USA and two are from Canada. A smaller number of studies (n=5, 17.9%) were conducted in European countries: Sweden (n=3), and the UK (n=2). All studies were published since 2005 and more than half of the included articles were published since 2010 (n=20, 58.8%).

Twelve studies (42.9%) exclusively involved physicians, while another two studies targeted exclusively pharmacists (7.1%). Six studies included physicians and their staff (21.4%), three studies involved pharmacists and their staff
and five studies (17.9%) include more than one of these groups and/or other types of users.7 9 29 33 46 51

Twelve of the studies (42.9%) were quantitative, primarily using surveys.13 27 31 35 40 43 45 46 48 49 53 54 Eleven studies (39.3%) had a qualitative research approach, using one or more of the following data collection methods: interviews, focus groups, questionnaires, observations, and document analysis.17 9 13 26 30 32 33 39 41 50–52 Five studies (17.9%) used a mix of both approaches.28 29 34 37 38 42 44 47 More than one third of the studies (35.7%) included a theoretical framework.9 26 31 32 35 36 39 40 53 54

Results presentation
We grouped factors representing barriers and facilitators to e-prescribing implementation into the nine broad themes of the analytical framework. Each theme is divided into factors representing the content extracted from the publications (explanation for each term used can be found in figure 2). Nearly all factors were perceived both as a facilitator and as a barrier, depending on the context. It is worthwhile to mention that overall more facilitators (332) than barriers (264) were mentioned. The majority of factors were common to all user groups. A summary of extracted data is presented in table 1 (see online
supplementary appendix 3 for full classification). Results regarding each of the nine themes from our analytical framework are presented below.

System functions

Structure

Design and technical concern aspects of e-prescribing implementation was the most frequently mentioned factor, extracted 82 times over the 90 elements of that theme. This factor was mostly considered as a barrier to e-prescribing implementation by all user groups. The most frequently mentioned barriers were the limitations related to software or hardware, and system problems (ie, prescriber had to manually replace data, complexity of the commercial system, or inadequacies of current e-prescribing product).33 49 52 Moreover, physicians reported that e-prescribing would increase the quality of care.7 9 13 26 34 37 40 41 43 48 51 54

Other factors belonging to this theme were reported by physicians and pharmacists who had concerns about the system reliability or dependability7 30 31 45 51 as well as quality standard1.38 Alerts (17) were reported as barriers due to their frequency and their lack of relevance,27 28 39 47 51 52 but were considered useful when prescribing an unfamiliar medication to avoid harmful interactions, to look something up in a drug or medical reference, or to change the way they monitored a patient28 34 44 46 47 51 Lack of generic substitution options (5) or lack of its flexible options was also reported as a barrier.9 27 33 53

Outcome

Overall, the perception that e-prescribing would improve patient security (21 elements) was a facilitator to its implementation.7 13 25 34 35 37 40 41 43 48 51 54 Moreover, physicians reported that e-prescribing would increase the quality of care.7 9 13 26 34 37 40 41 43 48 51 54

Human perspective

Structure

Agreement with e-prescribing was the most cited factor of this theme (31 elements). Resistance to change was observed among physicians, particularly when they did not see an added value of e-prescribing9 13 36 or when they perceived inadequate decision support.49 52 Also, they did not want to solve implementation problems and believed this should be done by clinical staff41 50 51 Practice using both prescribing systems (traditional and electronic) at the same time generally discontinued the implementation process of e-prescribing until the expected final adoption.7 7 50 51 However, physicians and pharmacists who were voluntarily enrolled in the program had more favorable opinions and positive attitudes about the technology.7 30 37 45 47 50 53 54 Clinical staff considering the e-prescribing benefits welcomed the opportunity to expand their job responsibilities.1 39 51 Pharmacy owners were resistant to e-prescribing implementation when it involved a top down decision from pharmacy chains and preferred to trust their

Table 1

<table>
<thead>
<tr>
<th>Themes</th>
<th>System function</th>
<th>Factor raised by:</th>
<th>Human perspectives</th>
<th>Organizational factors</th>
<th>Factor raised by:</th>
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<td>P</td>
<td>CS</td>
<td>PhS</td>
<td>O</td>
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<tr>
<td>Structure</td>
<td>Design and technical concern</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td>Familiarity and ability with IT</td>
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<td>Perceived ease of use</td>
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<td>Perceived usefulness</td>
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<td>Process</td>
<td>Interoperability</td>
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<td>X</td>
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<td></td>
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<td>Productivity (efficiency)</td>
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<td></td>
<td>Content appropriate for user</td>
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<td></td>
<td>Alerts</td>
<td>X</td>
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<tr>
<td>Outcome</td>
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<td>X</td>
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<td>Satisfaction about content available</td>
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<tr>
<td></td>
<td>Data accuracy and legibility</td>
<td>X</td>
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</tbody>
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CS, clinical staff (nurses, practice staff); O, others (managers, patients, IT staff); P, physicians; Ph, pharmacists; PhS, pharmacy staff.
Factors specific to the e-prescribing structure also included perceived usefulness (12), ease of use (13), Familiarity with technology in general or with e-prescribing (14), patients’ attitudes and preferences towards e-prescribing (7), and self-efficacy (belief in one’s competence to use the e-prescribing) (4), standing for half of the elements of this theme.

We found eight other factors related to human perspective linked to the structure (representing a total of 38 elements), but these were less cited in the studies (e.g., socio-demographic characteristics like age, gender, and experience, and support and promotion of e-prescribing by colleagues).

Outcomes

Time issues represented 16 of the 35 extracted elements for that theme. Physicians and pharmacists have reported gains in time at post-implementation stage, but this was not the case at the pre-implementation or transition phases, where they believe that it was not the best use of their time. However, as an outcome expectancy (8), physicians and clinical staff expected the system to be useful to improve patient care with multiple, complex problems. Observability (8) was seen as a facilitator since physicians were able to view the medication traceability compliance of patients. Finally, impact on professional security was also mentioned.

Organizational context

Structure

The resources factor, including information technology support, training, as well as material and human resources, accounted for 29 of the elements of that theme. Factors related to implementation strategies—such as a strategic plan to implement e-prescribing, the participation of end-users in the implementation, organisational readiness, as well as incentive and innovation structures—stood for 17 of the extracted elements.

Characteristics of the health system factors, referring to setting of care, practice size, status, physician salary structure, and workforce shortage accounted for seven elements extracted. Staff skills such as the influence of leadership were mentioned three times. Fifteen macro organizational elements were extracted and are mainly related to financial support and healthcare policies.

Organizational context

Process

Work process was the most important factor of this theme (24 elements). When e-prescribing was integrated, work process was facilitated and workflow was improved. However, these are reported as barriers in the transition phase.
accepting more and more e-prescriptions. Also, time and efficiency can be gained with e-prescribing in the later stages, whereas the opposite is observed during the beginning of implementation. On the other hand, some features may seem interesting to the users at first glance but can cause some serious problems when used: errors may arise using default settings, and some information may be unreliable or even superficial. Furthermore, the feature may not work.

Studies on e-prescribing implementation are quite recent. Indeed, the majority of studies were published since 2010. This technology gained interest recently due to its promises for improving patient care in a context of increased healthcare complexity. Moreover, one third of the studies include a theoretical framework, which is superior to the 21% reported in a systematic review on EHR implementation by McGinn et al.

It is worth mentioning that there is a change in users’ perceptions between the different phases of e-prescribing implementation. This is most apparent between the pre-implementation phase, where non-users and future users have a less favorable opinion of e-prescribing, and the transition and post-implementation phases, where the opinion on e-prescribing becomes more favorable with more frequent use of the technology. More importantly, attitudes also have an important influence on the adoption of e-prescribing. Indeed, a positive attitude towards e-prescribing contributes to its successful adoption. Conversely, users who believe that e-prescribing has no value are less inclined to use the technology when it is implemented. This attitude can also change during the transition process, depending on the evolution of users’ perceptions regarding e-prescribing.

The transition process is decisive in the full adoption of e-prescribing by an organization: a negative attitude can potentially lead to the abandonment of the technology, whereas a positive attitude is more likely to lead to a favorable adoption of e-prescribing.

Even though the importance of health managers and public involvement in innovative technology implementation and diffusion is recognized, their perceptions remain under-studied. In this review, physicians’ perceptions were addressed in 75% of included studies (21.4% for clinical staff), whereas those of pharmacists (and their staff) appeared in 28.6% of studies. Perceptions from other user groups (managers, IT staff, and patients) are almost absent from the reviewed literature, accounting for 7% of studies, making it difficult to consider their perspectives, even if they could influence the success of e-prescribing implementation.

Our results must be interpreted with some caution due to the limitations of this review. First, we only used one bibliographic database (PubMed) in the literature search. Thus, it is possible that relevant studies published in journals that are not indexed in PubMed are not included, but due to the explorative nature of our review and the percentage of duplicates reported between multiple databases, we think that we retrieved most current work related to e-prescribing implementation. Second, since we based the analysis of our findings on a pre-determined framework, the use of other theoretical or analytical frameworks could reveal different perspectives. Nonetheless, we deem that the chosen framework answers adequately the question of our systematic review and provides a logical and useful model of factors affecting e-prescribing implementation. Finally, the findings that are presented only relate to the content that has been published. We did not contact authors of included studies for supplementary information. We think that the editing policies applied in the scientific press ensure that we had access to sufficient content to meet our objectives. In the end, we were able to conduct this exploratory review following the standards of mixed-methods systematic reviews.

CONCLUSION

The findings reported in this review provide evidence that design and technical concerns, interoperability, relevance of the data, attitude towards e-prescribing, productivity, and available resources are important factors to the implementation of e-prescribing for the users. Implementation strategies should focus on these factors in order to facilitate the adoption of this technology. It is interesting to note that some factors can be perceived as barriers or as facilitators depending on the implementation phase of e-prescribing, and can change in nature (changing to a barrier or a facilitator) during the process of implementation. Moreover, attitudes users and future users have in relation to e-prescribing and its implementation may have an influence on the success of the adoption of the technology. Finally, future studies should put the emphasis on the perceptions of other user groups, such as pharmacists, managers, vendors, and patients, whose perspectives remain overlooked in the literature.

Contributors C5 and MPG conceived the study. SG searched the database. ENS and SG reviewed all titles and abstracts. MPG confirmed included studies. ENS, JGP, and SG completed the full text review of selected studies. ENS, JGP, and SG drafted the manuscript. All authors revised the manuscript critically for important intellectual content and gave final approval of the version to be published.

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