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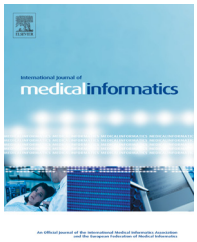

Identifying effective computerized strategies to prevent drug–drug interactions in hospital: A user-centered approach

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ABSTRACT

Background: Drug–drug interactions (DDIs) are an important and preventable cause of medication errors in hospitals. Recent developments in technology have seen new strategies emerge for preventing DDIs but these computerized strategies are rarely evaluated and are typically implemented with little input from the individuals using them.
Aim: To determine the opinions of both experts and users (prescribers) on computerized strategies available to assist in the identification and prevention of DDIs in hospitals.
Method: Eight drug safety experts and 18 prescribers took part in semi-structured interviews. Participants were asked about their confidence in identifying DDIs and their views on potential computerized strategies to prevent DDIs.
Results: No prescribers reported complete confidence in identifying dangerous DDIs, with junior prescribers appearing less confident than senior prescribers. Most prescribers believed that computerized alerts would be the most effective strategy for preventing DDIs, while experts were more critical of alerts.
Conclusion: The lack of confidence displayed by prescribers in their ability to identify DDIs suggests that an appropriate strategy would be one that does not rely on individuals seeking out the information themselves. While a large number of problems related to DDI alert implementation have been reported in the literature (e.g. alert overload), prescribers appeared to be receptive to the idea of being alerted. By ensuring users are aware of the limitations of the system and involving them in DDI strategy design we expect greater use and satisfaction with the adopted strategy.

1. Introduction

Drug–drug interactions (DDIs) are a preventable cause of medication errors in community and hospital settings and account for 2.4–4.4% of hospital admissions [1,2]. They occur when two or more drugs are taken in combination that leads to a change in the activity of either or both drugs [3,4]. DDIs can result in adverse effects; commonly these include low blood pressure, bleeding or kidney damage [5]. Additionally, DDIs can lead to

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therapeutic failure, where one or both of the drugs are unable to achieve their desired clinical effect [5].

Research has shown that both prescribers and pharmacists are often unable to recognize potential DDIs [6,7]. Recent developments in technology have seen new strategies emerge to assist in DDI identification and prevention. In particular, alerts integrated into electronic prescribing systems (ePS) have frequently been adopted by hospitals in an attempt to minimize DDI occurrence [8,9]. To date, there is limited evidence demonstrating reductions in DDI errors or adverse drug events following DDI alert introduction, with evaluations typically comprising a review of the number of alerts generated and acted on by prescribers [10,11]. Two studies examined the impact of a single customized DDI alert on the concurrent ordering of two medications, but they report inconsistent findings [12,13] and in one case, introduction of a near hard-stop DDI alert resulted in unintended consequences (e.g. delays in appropriate treatment) [13].

Computerized DDI checking programs are also commonly discussed in the literature as a strategy to target DDI errors [14,15]. Prescribers enter medication names into the program, which then checks medication combinations for potential DDIs. The main difference between this strategy and an alert system is that software programs are typically voluntarily used and so are non-interruptive. Evaluation of DDI checking software usually includes an assessment of its ability to identify DDIs, most often in the form of an analysis of sensitivity and specificity, [16,17] but in one study it was demonstrated that compulsory use of a DDI checking program resulted in a 50% reduction in the incidence of DDI errors [18].

Given the complexity of the emerging field of health informatics, the focus is now shifting toward consulting users to develop more effective and efficient systems [19]. Users' views are important because users have a unique ability to pick up problems and suggest ideas for improvement that system developers sometimes overlook [19]. Research has also shown that user involvement in system design can lead to greater system usage and satisfaction [20].

The aim of this study was to determine the opinions of both experts and users on computerized strategies available to target DDIs. Experts' ideas about potential DDI strategies in Phase 1 were used in Phase 2 to ascertain what users perceived to be the best strategy to implement in hospital for preventing unwanted DDIs. This study is unique in its approach to DDIs; most studies only assess user views post-implementation of a specific system [6,21]. We hoped seeking input from users before implementation would allow us to identify user needs and perceived system requirements, and to determine perceived barriers and facilitators to successful uptake of a DDI computerized strategy.

2. Methods

2.1. Setting

This study was conducted at a 326-bed teaching hospital in metropolitan Sydney. At the time of the study, all wards of the hospital used an ePS (MedChart® version 4.2.0) except the emergency department. MedChart® (www.isofthealth.com) is a commercial electronic medication management system that links prescribing, pharmacy and drug administration. The system interfaces with a locally developed computerized provider order entry system and results reporting system. When MedChart® was implemented (pilot 2005, complete implementation 2010), a decision was made not to incorporate DDI alerts into the system because it was felt that having a large number of alerts would lead to prescribers being over-alerted and so to alerts being ignored.

2.2. Recruitment

2.2.1. Phase 1

Purposive sampling was used to recruit participants for Phase 1. Members of clinical pharmacology or pharmacy with expertise in the area of medication safety were invited to participate in the study via telephone, email or face-to-face. Of the 11 participants contacted, eight agreed to take part in the study. Three were clinical pharmacologists and five were pharmacists.

2.2.2. Phase 2

Convenience sampling was used to recruit participants for Phase 2. Prescribers working in a variety of specialities, and of differing levels of seniority were contacted via telephone, email, or face-to-face. Of the 35 participants contacted, 18 agreed to take part in the study (eight JMOs (junior medical officers–interns, residents and registrars) and 10 staff specialists). Recruitment in both phases continued until saturation of themes had been achieved (see Section 2.4 below).

2.3. Data collection

Semi-structured interviews were carried out for both phases. During Phase 1, participants were asked to identify and discuss potential strategies to prevent DDIs. The responses from Phase 1 were used to shape the focus of the subsequent phase. In Phase 2, prescribers were asked about their confidence in identifying DDIs and about their views of the different strategies identified in Phase 1. To minimize interviewer bias and encourage maximal discussion of the issues raised, questions were open-ended and were piloted with a clinical pharmacology expert and prescriber prior to commencement of data collection (see on-line Appendix). Interviews were approximately 20 min in duration in Phase 1, and 10 min in duration in Phase 2.

Ethics committee approval was obtained by the human research ethics committee of the participating hospital and the University of NSW.

2.4. Data analysis

Interviews were audio recorded and transcribed. Two investigators separately reviewed each of the transcripts to identify key themes. The investigators discussed the themes to ensure