Identification of strategies to reduce computerized alerts in an electronic prescribing system using a Delphi approach

Melissa T. Baysarid, Johanna I. Westbrookb, Brian Eganb, Richard O. Daycd

d Australian Institute of Health Innovation, Faculty of Medicine, University of New South Wales, Sydney, Australia
b Department Clinical Pharmacology & Toxicology, St Vincent’s Hospital, Sydney, Australia
c Faculty of Medicine, University of New South Wales, Sydney, Australia

Abstract

Objective: To reach consensus among prescribers of different specialties and experience on the usefulness of computerised alerts and strategies for reducing low-value alerts within a commercial electronic prescribing system.

Method: We conducted a Delphi technique where participants were sent a 10-question survey in rounds 1 and 2 to rate the usefulness of existing alert types and to indicate if 1) therapeutic duplication alerts should be adjusted so that they fired only when both medication orders were active; 2) local messages should be changed to hyperlinks rather than alerts. Forty-seven prescribers completed round 1 and 21 round 2.

Results and discussion: Prescribers varied in their views on alerts of little value but agreed allergy and intolerance alerts should be retained. Most prescribers indicated that the proposed strategies for reducing local messages and duplication alerts would not compromise patient safety. Involving users in customization of alerts proved to be a successful approach.

Keywords:
Medication alert system, electronic prescribing, Delphi technique.

Introduction

Most studies evaluating the effect of computerized alerts on prescribing behaviour demonstrate positive and often substantial effects.[1] But many report that doctors override computerised alerts, sometimes up to 95% of the time.[2-4]. ‘Alert fatigue’ due to excessive numbers of alerts has been identified as the primary reason for alerts being overridden[4]. At our site, we shadowed teams of doctors as they prescribed medications on ward-rounds using an electronic-prescribing (e-prescribing) system and found that nearly half of medication orders triggered one or more computerised alerts. Only 17% of alerts were read by prescribers[5]. Most doctors believed that they received too many alerts and that many were redundant. Some doctors explained that they had become desensitized to the warnings because they were triggered too frequently[5]. Embedding effective real-time alerts into an e-prescribing system is a major challenge. Deciding what alerts to remove from a system following the discovery that too many alerts are being presented has also proven to be a difficult task. In one study, doctors and pharmacists were interviewed to determine what alerts they believed could be safely turned off from a hospital-wide computerised provider order entry (CPOE) system[6]. Despite many alerts being frequently overridden, there were no alert types that all clinicians agreed could be turned off, and specialties differed considerably in the number and type of alerts they thought could be safely removed from the system[6]. The Delphi technique is a group facilitation technique used to obtain consensus among experts in a systematic way[7]. Consensus is typically reached by allowing participants to consider their responses to a survey in light of the overall group’s responses to the survey[8]. This technique has previously been used to identify appropriate information to be included in computerized alerts[9, 10] and to determine what information about the clinical user and context is helpful in prioritizing and presenting alerts[11]. In this study, we set out to apply the Delphi technique to identify the alert types in our e-prescribing system that could be removed with minimal impact on patient safety. No previous studies have employed the Delphi technique for this purpose. While customization of alerts for local sites has been recommended[12] and it has been suggested that obtaining consensus from medical staff during customization is necessary[13], most previous Delphi research has involved the recruitment of experts in CPOE or decision support implementation, not users of the system[10, 11]. The aim of this study was to reach consensus among prescribers of different specialties and with various levels of experience at our site on appropriate strategies for reducing computerized alerts within our e-prescribing system.

Materials and Methods

Study site

The study was conducted at a teaching hospital with approximately 320 beds in Sydney, Australia. At the time of the study, all inpatient wards except for the emergency department used the e-prescribing system MedChart (Version 4.2.0B1). MedChart is an electronic medication management system that allows prescribing, pharmacy review and drug administration.

Computerized alerts

Decision support alerts enabled in MedChart include allergy and intolerances, pregnancy, therapeutic duplication and approximately 100 hospital developed messages, most offering prescribers advice about the medication selected (see Table 1). Drug-drug interaction alerts are not yet operational. All alerts appear to the prescriber immediately following the selection of a drug or drug product. Alerts vary in length but all use Courier 10 font and included a bold heading specifying the alert type (e.g. “Substance Duplication”). An example alert appears in Figure 1.
Table 1 – Alert types enabled in the MedChart system

<table>
<thead>
<tr>
<th>Alert type</th>
<th>Description and Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergy &amp; Intolerances</td>
<td>Displays when a patient is prescribed a medication containing a generic component that is identical to, or belongs to the same therapeutic class as a generic component to which the patient has a recorded allergy or tolerance. A patient’s allergy status should be entered into the system prior to the ordering of any medications. Example alert: “The patient is allergic to Paracetamol”</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>Displays when a medication belonging to an Australian Advisory Committee on Prescription Medicines (ACPM) category other than ‘A’ is prescribed for a female patient in the age range of 12 to 55 years. Note: all ACPM categories but A indicate a possibility of harmful effects to a fetus (<a href="http://www.tga.gov.au/hp/medicines-pregnancy.htm">http://www.tga.gov.au/hp/medicines-pregnancy.htm</a>). Example alert: “Pregnancy category C – Diazepam”</td>
</tr>
<tr>
<td>Therapeutic duplication</td>
<td>Displays when a patient is prescribed a medication containing a generic component that is identical to, or belongs to the same therapeutic class as a generic component that has already been prescribed. Alert displays if both orders are active, or if the first order is no longer active, but was ceased less than 24 hours previously. Example alert: see Figure 1</td>
</tr>
<tr>
<td>Local message</td>
<td>Displays when a patient is prescribed a medication linked to a local message Example alert: “Haloperidol Decanoate (Haldol) is a long acting anti-psychotic used monthly by deep IM injection into the gluteal muscle. Haloperidol (Serenace) is short acting and can be given by deep IM, subcut or IV routes. Please check you have prescribed the correct drug”</td>
</tr>
</tbody>
</table>

Figure 1 - Substance duplication alert triggered in response to Paracetamol being selected.

Approximately half the alerts are for information only, while others require the prescriber to take action. In most cases, prescribers are required to tick an ‘override box,’ but for approximately 10% of the alerts, prescribers must also enter an override reason before proceeding with the order. All but seven of the alerts allow the prescriber to continue to prescribe a medication regardless of whether they change their order in response to the alert.

Survey development

A 10-question web-based survey was developed using Survey Monkey (http://www.surveymonkey.com). Input was sought from prescribers, pharmacists, and clinical information system staff to ensure questions were relevant, useful and easy to understand. The number of questions was kept to a minimum to increase the likelihood of prescribers completing multiple Delphi rounds. In the survey, prescribers were asked to indicate what alert type(s) they found useful and not useful in warning them about prescribing something potentially dangerous for their patients, and what types, if any, they would remove from the system. They were asked to rate each alert type on a five point Likert scale of usefulness (never useful, rarely useful, something useful, often useful) and were also asked to indicate whether or not they believed two potential strategies for reducing alert numbers would compromise patient safety. These strategies were identified in our previous work on alert fatigue[14] and comprised: 1) Modifying therapeutic duplication alerts so that they fired only when both medication orders were active, not when one was ceased within 24 hours (see Table 1), and 2) Modifying most local messages so that most were presented as hyperlinks on the prescribing screen, rather than as interruptive alerts.

Procedure

We conducted a Delphi technique where participants were sent the survey in rounds 1 and 2. Consensus was defined as 80% agreement between participants on questions requiring a single response. Although consensus was not reached on all questions following two Delphi rounds, response stability was apparent after two rounds, making it unlikely that participants would change views during a third round.

To recruit prescribers from various specialties and levels of experience, an advertisement for the survey (including a hyperlink) was posted in the weekly Junior Medical Officer (JMO) bulletin, sent to all JMOs (interns, residents and registrars) at the site (n=350, JMOs from prescribing specialties=297). JMOs were targeted because our previous work revealed that the majority of staff specialists at the site do not use the e-prescribing system[5, 14]. In round 2, doctors who completed round 1 were sent a personalized email containing a link to the round 2 survey. Feedback about round 1 responses was incorporated into each question in round 2. An example of this feedback appears in Box 1.

The percentages beside each option below indicate the proportion of doctors who selected that option in round 1.

Q2. If you could remove only one alert type from the current alert set in MedChart, which type would you remove?

In round 1, you selected ‘Pregnancy’.

☐ Allergy & intolerances (2%)
☐ Pregnancy (34%)
☐ Therapeutic duplication (28%)
☐ Local rule (13%)
☐ None, I’d not remove any alert type (23%)

Box 1 – Sample question from the survey administered in Round 2 of the Delphi
Forty-seven prescribers completed round 1 and 21 prescribers completed round 2 of the Delphi. Table 2 lists specialty services of the JMO prescribers who completed the Delphi rounds. Most hospital specialties were represented in round 1 but a number of specialties were not included in round 2 (e.g. Gastroenterology). Ten registrars, six residents and five interns completed both rounds. Ethics approval was obtained from the participating hospital and the University of New South Wales.

Table 2 – Specialties of participants who completed round 1 and 2 of the Delphi

<table>
<thead>
<tr>
<th>Round 1</th>
<th>Round 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol and drug</td>
<td>Alcohol and drug</td>
</tr>
<tr>
<td>Anesthetics</td>
<td>Cardiology</td>
</tr>
<tr>
<td>Cardiology</td>
<td>Clinical Pharmacology</td>
</tr>
<tr>
<td>Clinical Pharmacology</td>
<td>Emergency medicine</td>
</tr>
<tr>
<td>Dermatology</td>
<td>Geriatrics</td>
</tr>
<tr>
<td>Emergency medicine</td>
<td>Surgery</td>
</tr>
<tr>
<td>Gastroenterology</td>
<td>Hematology</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>Immunology</td>
</tr>
<tr>
<td>Surgery</td>
<td>Intensive care services</td>
</tr>
<tr>
<td>Hematology</td>
<td>Medical oncology</td>
</tr>
<tr>
<td>Immunology</td>
<td>Neurology</td>
</tr>
<tr>
<td>Intensive care services</td>
<td>Palliative care</td>
</tr>
<tr>
<td>Medical oncology</td>
<td>Psychiatry</td>
</tr>
<tr>
<td>Nephrology</td>
<td>Rehabilitation</td>
</tr>
<tr>
<td>Neurology</td>
<td>Night shift/seconded</td>
</tr>
<tr>
<td>Palliative care</td>
<td></td>
</tr>
<tr>
<td>Psychiatry</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td></td>
</tr>
<tr>
<td>Respiratory medicine</td>
<td></td>
</tr>
<tr>
<td>Urology</td>
<td></td>
</tr>
<tr>
<td>Night shift/seconded</td>
<td></td>
</tr>
</tbody>
</table>

Results

Results are presented as areas where consensus was reached among prescribers and areas where no consensus was reached. This allowed us to identify clear approaches for reducing alert numbers.

Areas where consensus was reached among prescribers

Although prescribers varied in their views on what alerts should be removed, prescribers agreed on what alert type should be retained. During round 2, 81.0% of participants rated allergy & intolerance alerts as the most useful alert type for warning them about prescribing something potentially dangerous for their patients. No participant believed that this type was useful. In both rounds, providers had favorable views of the strategies we suggested to reduce alerts. In round 2, 90.5% of respondents thought it would be safe to change duplication warnings so that they only fired when both orders were active on a patient chart. In the same way, 95.2% of respondents thought that it would be safe to change local messages so that they appeared as hyperlinks on the prescribing screen, rather than as interruptive alerts.

Areas where consensus was not reached among prescribers

The majority of prescribers (85.7%) believed that an alert type should be removed from the current alert set in MedChart but no consensus was reached on what type could be safely removed. As shown in Figure 3, both pregnancy and therapeutic duplication alerts were frequently selected as alert types that prescribers would remove from the system. When asked to rate each alert type on a Likert scale of usefulness, pregnancy alerts were rated most poorly, with 76.2% of prescribers indicating that this type is ‘never’ or ‘rarely’ useful. No participant rated Pregnancy alerts as ‘often’ useful. The responses for therapeutic duplication alerts were more variable, with 23.8% of doctors indicating that these alerts are ‘often’ useful and 9.5% that they are ‘never’ useful. These responses are shown in Figure 2.

Discussion

While some research indicates that tiering alerts and presenting only critical safety warnings in an interruptive fashion leads to greater acceptance of alerts,[15] approaches for deciding how best to tier alerts have been varied. A common approach involves the selection of high-priority warnings by ‘experts,’[16] with few studies seeking input from users. Feedback from users about a system can reveal strengths of the design and highlight areas for
improvement[17]. User involvement in system design has also been shown to result in greater system usage and satisfaction[18]. By involving users here, we expect greater ownership and acceptance of alerts by prescribers.

Using a Delphi approach we identified several strategies that system users viewed as appropriate for reducing the rate of alerts. Nearly all prescribers agreed that local messages could be removed from the e-prescribing system and presented as ‘hyperlinks’ on the prescribing screen. This was not unexpected as many of the local messages provide doctors with low priority information and thus unnecessarily interrupt workflow. Most prescribers also indicated that they believed the proposed strategy for reducing duplication alerts would not compromise patient safety. A recent audit of alerts at the hospital revealed that therapeutic duplication alerts are the most frequently triggered alerts[14]. More than half would not be triggered if the system was reconfigured so that alerts only fired when two orders were active on a patient’s chart, rather than when one medication had been discontinued within 24 hours[14]. Prescribers were agreeable to reconfiguring the system in this way, most likely because the 24 hour timeframe for these alerts is useful for a small number of medications (e.g. colchicine, which carries a risk of cumulative toxicity due to its low therapeutic index) but not the majority.

In contrast, prescribers viewed allergy & intolerance alerts favorably and no prescriber wanted them removed. This is almost certainly because allergy alerts are patient tailored – an alert is triggered only if a patient is prescribed a medication containing a generic component to which the patient has a recorded allergy or tolerance. Ensuring high alert specificity (i.e. that alerts are clinically important for the patient) is essential for appropriate and useful alerting[4]. Designing pregnancy alerts at our site in this way was a suggestion made by prescribers in our survey and was a recommendation that emerged from our previous work at the site[5, 14].

Limitations

Only 21 participants completed both rounds, but it has been suggested that reliable outcomes can be obtained with a Delphi panel consisting of a small number of participants if they have similar training and a general understanding of the topic area[19]. Although a convenience sample was used, we were able to recruit participants from a range of specialties and with varying levels of experience, resulting in diverse points of view. But it is important to note that a number of specialties were not represented in round 2 and some specialties were represented by only one participant. Although we examined perceived usefulness of alerts, we did not explore reasons for perceived usefulness (e.g. alerts not viewed as useful because not experienced vs. alerts not viewed as useful because experienced but not relevant). Examining reasons for perceived usefulness would allow us to identify more specific strategies for system redesign. The results collected here may not be directly applicable to other sites but the alert types studied are those frequently included in other e-prescribing systems. Our approach also proved to be a very useful way of engaging users in system design.

Conclusion

To alleviate alert fatigue, alert numbers should be reduced and interruptions to workflow minimized. However, deciding what alerts to remove from a system is a difficult task. This study used a Delphi approach to identify strategies that system users believed would be appropriate for reducing computerized alerts within our e-prescribing system. Although prescribers varied in their views on what single alert type should be removed, prescribers agreed that allergy & intolerance alerts should be retained. Prescribers also agreed that duplication warnings should be changed so that they would only fire when both orders are active on a patient chart and that most local messages should be modified so that they appear as hyperlinks on the prescribing screen. Involving users in customization of alerts proved to be a successful approach as the two favored strategies would eliminate a large proportion of the alerts being triggered at the site.

Acknowledgments

This research was supported by a NH&MRC Program Grant 568612.

References


Address for correspondence
Melissa Baysari, Department of Clinical Pharmacology & Toxicology, Therapeutics Centre, Level 2 Xavier Building, St Vincent’s Hospital, Darlinghurst NSW 2010, Australia. Email: m.baysari@unsw.edu.au