The safety of computerised prescribing in hospitals

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SUMMARY

The implementation of computerised prescribing can result in large reductions in prescribing error rates. The flow-on effects to patient outcomes are not well studied.

The reduction in errors is dependent on prescribers becoming proficient in using the electronic prescribing system. All potential safety benefits are therefore not expected to be achieved immediately.

Electronic prescribing systems introduce new types of errors, most frequently errors in selection. Some of these errors can be prevented if the system is well designed.

Computerised decision support embedded in electronic prescribing systems has enormous potential to improve medication safety. However, current support systems have a limited capacity to provide context-relevant advice to prescribers.

Introduction

Although most general practices are now computerised,[1,2] Australia lags behind the USA in the adoption of electronic prescribing systems in hospitals.[3] The key benefits of electronic prescribing systems include improved legibility, improved availability (anywhere and anytime) and improved continuity of care, for example by having rapid access to a patient's medication list from a previous admission. A major benefit is reducing medication errors. However, electronic prescribing systems can introduce new errors.

Preventing medication errors

Medication errors are among the most frequently reported incidents in hospitals and a major patient safety priority. The World Health Organization has announced the third Global Patient Safety Challenge to be 'medication without harm'.[4] The Australian Commission on Safety and Quality in Health Care endorses the use of electronic prescribing systems for medication management in hospitals, suggesting that these programs can 'improve the safety and quality of health care'.[5] But do they?

There is now considerable evidence to show that medication errors in hospitals decline following the implementation of electronic prescribing systems.[6] The evidence includes an Australian-controlled before-and-after study of the introduction of two commercial electronic prescribing systems in two Sydney hospitals.[7] These interventions resulted in a large (>50%) reduction in prescribing error rates. Whether this sizeable reduction in medication error led to improved outcomes for patients is uncertain. Very few studies go beyond evaluating the effect of electronic prescribing systems on medication errors, although a large Australian trial is currently attempting to measure the impact of the systems on patient harm.[8]

Delayed benefits

There is no evidence to show whether or not the benefits of electronic prescribing systems on medication errors are immediate. Researchers typically avoid the treacherous 'shakedown' phase,[9] and wait for the use of electronic prescribing systems to become routine before measuring the post-implementation prescribing error rates.

Users of electronic prescribing systems describe the period immediately following implementation as risky, as prescribers attempt to navigate the unfamiliar, often unintuitive landscape that is computerised prescribing.[10] Even if familiar with prescribing in one system, using a different system requires new training and practice as systems differ considerably in display, features, functions and navigation. This is in contrast to using the standard National Inpatient Medication Chart.[11]

It is likely that the introduction of electronic prescribing systems results in a transient increase in prescribing errors, as users familiarise themselves with the system. This is followed by a substantial decline in errors (as reported in a large number of trials), once proficiency in computerised prescribing is achieved. Heightened vigilance and close monitoring of system use is therefore essential in the early stages of implementation, especially for the detection of unanticipated problems with the design of the system

and its use or implementation, for example system glitches and gaps in training for prescribers.

New errors

Accompanying reports on the effectiveness of electronic prescribing systems is a growing body of evidence showing that these systems can introduce new types of errors.[12,13] In a study of electronic prescribing system errors in the USA, researchers identified 22 types of medication error risks that were facilitated by the electronic system.[13] These included errors such as doctors ordering drugs for the wrong patient, or using the wrong log-in, because the previous user had failed to log out of the system at the computer terminal.

These problems are not unique to the USA and evidence of electronic prescribing system-related errors in Australia is increasing. For example, in a survey of 664 users of electronic prescribing systems (doctors, nurses and pharmacists) in Victoria, 58% of respondents said that they thought the electronic system had introduced new types of error.[14] An audit of discharge medications at a tertiary Brisbane hospital found more errors in computer-generated prescriptions than paper-based prescriptions.[15] In the one large-scale Australian study to quantify the rate at which these system-related errors occur, approximately 42% of prescribing errors were related to the use of an electronic prescribing system – that is 78 system-related errors per 100 patient admissions.[16]

The most frequent type of error was selection error, where prescribers made the wrong selection from a drop-down menu. An interesting result was that, although the study was undertaken at two hospitals, each using a different electronic prescribing system, the overall rate of system-related errors was equivalent at both sites. However, selection errors were four times more likely in one hospital than the other. This reflected differences in the design of the systems (as one system required doctors to make many more selections from drop-down menus).

The design of electronic prescribing systems is important in preventing, or facilitating, prescribing errors. Placing the most frequently used items at the top of a drop-down menu is likely to minimise selection errors, as is limiting the number of options on a list.[16,17] In a study that explored the use of lists of antibiotic orders in an electronic prescribing system, a doctor said 'Sometimes there are a lot of options…I know my colleagues have accidentally clicked the wrong dose just because there are a million different regimens or dosages'.[18] As expected, the more choices a user is presented with, the longer they take to make a selection (the Hick-Hyman Law[19]). This is an important rule to keep in

mind when designing systems for use on a busy hospital ward. The result of presenting too many options in electronic prescribing systems is likely to be intentional mis-selection from a list, with users choosing the first option on a menu to save time.

Decision support

Despite the emergence of new types of errors, research has shown that computerised prescribing eliminates many more errors than it creates.[15] One of the fundamental components of electronic prescribing, perceived to be critical to achieving the anticipated benefits of improved safety and quality, is computerised decision support.

Common forms of computerised decision support include alerts and reminders, pre-written orders and order sets, calculators, and access to online reference material.[20,21] However, decision support is also implicit in the design of electronic prescribing systems. For example, limiting the options on a drop-down menu to doses that are appropriate for a drug can prevent a dose 10 times larger than intended being prescribed. Preventing prescribers from ordering a drug unless a patient's allergies (or 'no allergy') are entered into the electronic prescribing system, can avoid a patient receiving a drug to which they are allergic.

Problems

Although the potential of computerised decision support is enormous, the enthusiasm for what is possible has overshadowed a careful consideration of the users and the environment in which they work. In many cases, the result has been a significant misalignment of computerised decision support and prescriber workflow. Alert fatigue, an inevitable consequence of too many alerts being presented, is an established and enduring problem for prescribers.[22] Automation bias, a user's over-reliance on the system to detect errors ('the system did not alert me, so the prescription is OK'), is also a risk for prescribers.[23]

Not all computerised decision support integrates well with hospital clinical information systems, and current computerised decision support systems are unlikely to capture all types of errors. In taking a closer look at the types of prescribing errors that declined following the implementation of electronic prescribing in two Australian hospitals, the majority of the decline was in procedural errors such as incomplete and illegible orders.[7] The computerised systems were not as effective in targeting clinical errors, such as the wrong doses and wrong drugs, which are the types of error that could be prevented by well-designed computerised decision support.

Different electronic prescribing systems (and different configurations of the same electronic prescribing

systems) include varying levels and types of computerised decision support.[7] This is the case even for the same types of decision support. For example, there is no standardised list of drug–drug interaction alerts to include in a system or a standardised way to present information in an alert, resulting in high variability across systems.[24] This is despite users being fairly consistent in their preferences for how alert information should be displayed.[25] Variability is particularly challenging for prescribers who work across multiple sites or organisations. Inconsistencies between electronic prescribing systems are something prescribers should keep in mind. User training should include clear information about the computerised decision support capabilities of the particular system the prescribers will be using.

Solutions

For computerised decision support to reach its full potential, smarter programs are needed. These would not assume that all patients are non-geriatric (or all are geriatric) and have normal physiological function. Computerised decision support should be context-aware to trigger alerts only when relevant for a particular patient (age, renal function) and when a particular drug form, dose, or frequency is prescribed. Although trials of smart computerised decision support have begun to emerge in the USA,[26,27] Australia is not quite there yet.

Conclusion

There is now little doubt that computerised prescribing reduces medication errors in hospitals. However, it also introduces new types of errors. Well-designed systems that provide context-relevant information to prescribers are likely to result in the largest benefits to users and patients. ◄

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