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Reasons for Physician Non-Adherence to Electronic Drug Alerts

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Abstract

Context *Many adverse drug errors may be prevented through electronic order entry systems that provide decision support to physicians by screening prescriptions for dosing errors, drug-disease, drug-allergy and drug-drug interactions. The adherence to such decision aids is varied and the reasons for this variance not well understood.*
Objective *To assess the feasibility and performance of automated drug alerts within an integrated, electronic decision support system for physician prescribing.*
Methods *Drug alert data were collected from a pilot project with 30 participating general practitioners who were provided with interactive electronic prescription capabilities through a personal digital assistant (PDA).*
Results *6,260 electronic prescriptions resulted in a total of 1,869 drug alerts. The most common alert types were analysed, along with reasons for non-adherence to automated drug alerts.*
Conclusions *Non-adherence to alert information appears to be associated with additional knowledge of the clinical situation, beyond that inherent in the decision support tool, for the specific patient context. Further work is required to understand how best to provide this type of support to physicians.*

Keywords:

Non-adherence, electronic prescribing, electronic drug alerts, medication errors, general practitioners.

Introduction

Prescription drug use is the fastest growing portion of health care spending, accounting for more than $15.5 billion in 2001 [1,2]. While the clinical benefits of drug therapy are substantial, the societal benefit remains sub-optimal, in part because of errors in prescribing, dispensing and compliance. Adverse drug effects are the 6th leading cause of mortality [3,4], while adverse drug-related events in hospital settings, due to errors in dosing or order transcription or the failure to note allergies and other contraindications, are also increasingly documented [5-8]. Many of these errors are preventable [9,10], and may be effectively addressed through electronic order entry systems that are capable of screening prescriptions for dosing errors, drug-disease, drug-allergy, and drug-drug interactions [11-14].

General practitioners generate the majority of prescriptions in Canada [15], thus, the opportunity exists to reduce the frequency and consequences of prescribing, transcription, and dispensing errors. However, changing behavior for complex aspects of care remains a major challenge as it relates to reduction of medication errors [12]. The traditional prescription system creates multiple opportunities for errors at each step in the process. These are the result of a myriad of difficulties including organizational issues, physician knowledge, communication challenges, including lack of standardization around technology, clinical comprehensiveness, and a focus on individual behavior rather than systems change. The impact of corrective measures focused on preventing a specific type of error, or on an individual producing the error, tends to be short-lived and ultimately unsuccessful. No single method appears to be effective in changing physician behaviour to deliver services in a more effective or efficient manner [16].

This paper describes a pilot project assessing the utilization of, and adherence to, an integrated electronic drug management and alert system to improve prescribing patterns.

Materials and Methods

MOXXI III

The Medical Office of the Twenty First Century (MOXXI-III) project tests the potential benefits of implementing an electronic prescription, drug and disease management system for primary care physicians, community-based pharmacists and their patients. The participating physicians utilize a personal digital assistant (PDA) with an integrated drug management system that includes a dynamic prescription pad with treatment indications, which forwards an electronic prescription to participating pharmacies. A drug profiler allows the physician to view a graphic representation of each patient's prescription medication(s) for the prior 12 months, including drugs prescribed by other physicians utilizing data from the provincial health insurance data base. The alert system flags drug interactions, therapeutic duplications, contraindications for specific allergies or diseases and verifies drug dosage.

The project is taking place in the West Island of Montreal with 30 participating physicians, 32 pharmacies and 12,500 patients. The online nature of the MOXXI-III electronic prescription system is expected to reduce the number of pharmacy calls to physicians' offices, increase the rate of stop/change orders being sent to pharmacists, and reduce the proportion of patients with

dosing errors, drug disease and drug allergy contraindications, drug interactions, therapeutic duplication, and excess therapy duration for targeted drugs. This will, consequently, produce reductions in ER visits and hospitalizations. .

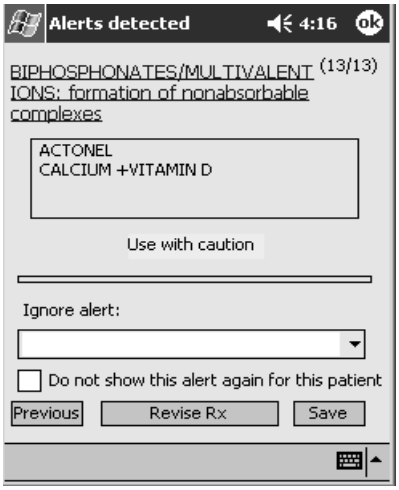

Figure 1 - MOXXI-III drug alert screen

Of particular interest for this analysis is what type or category of alerts physicians action, which ones exhibit non-adherence and, why they do so.

Vigilance Santé

The content for the e-prescrption drug alerts was provided by Vigilance Santé Inc., via their Rx Vigilance therapeutic advisor. It provides continually updated, comprehensive drug-drug interaction information at pre-selected severity levels. A specific message is automatically generated on the physician's PDA that provides a summary of the situation and allows the physician to respond in an autonomous manner. The drug alert screen is illustrated in Figure 1.

The eight categories of drug alerts captured by the MOXXI-III e-prescription system are illustrated in Table 1.

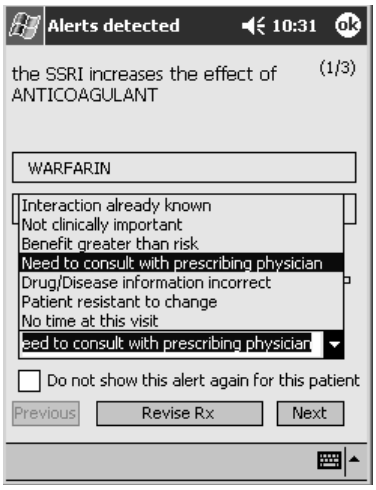

Figure 2 - MOXXI-III reasons to ignore drug alerts

Messages generated for the physician are specific to the medication, clinical problem list and patient demographics. The alerts are automatically generated and appear on the PDA before the electronic prescription is sent. This interactive nature of the system allows the physicians to alter the prescription according to the alert at the time of the patient visit.

The physician may choose to ignore the alert generated. If this occurs a pop-up menu appears (Figure 2). Physicians are able to choose from seven options to provide a reason for ignoring an alert: interaction already known; not clinically important; benefit greater than risk; need to consult with prescribing physician; drug/disease information incorrect; patient resistant to change; and, no time at this visit. No free-text option was provided for the pilot study.

Table 1: MOXXI-III Alert Categories

Alert Category	Description
AGE	Medication contraindicated for age of the patient
ALLERGY	Potential allergic reaction
HEALTH CONDITION	Medication contraindicated for patient health condition
DOSING ERROR	Error in medication dose
DUPLICATION	Therapeutic duplication
INTOLERANCE	Patient known to be intolerant to this medication
INTERACTION	Medication interaction
TOXICITY	Potential toxicity effects

Statistical Analysis

Preliminary analysis focused on the practical utility and performance of the MOXXI-III drug alert system. All alerts generated for the study were included, except 13 error messages caused by incomplete information regarding diagnostic or problem list items. Ignored alerts, for which no exclusionary reason was provided by the physicians (n=125; 7%), were intentionally included, even though they may have occurred because of online connectivity problems.

Frequency tables were generated to investigate the total number of alerts, the ratio of alerts to prescriptions, the adherence versus non-adherence by alert category and the reason for non-adherence by alert category. A further assessment will be undertaken at the conclusion of the study to examine various characteristics which may facilitate or impede the utilization or adherence to electronic order entry.

Results

Study Population

The physician group was comprised of 13 females and 17 males, all active general practitioners, from the West Island of Montreal, Quebec.

Every electronic prescription written by the study physician between 2 June and 9 September 2003 was included in the data capture, as well as all alerts generated during this period. A total of 6260 prescriptions were written during the study period by the participating physicians (maximum 1040; minimum 1). These generated 1869 alerts for an overall alert rate of 30%. It is im-

portant, in this regard, to note that one prescription may generate several specific alerts.

Electronic Alerts by Physician

The minimum number of alerts per physician was 2 and the maximum was 414. Future analysis of this issue will be performed with a larger sample size to explore the characteristics of multiple alerts. Figure 3 illustrates, in ascending order, the total number of alerts for each physician in the study.

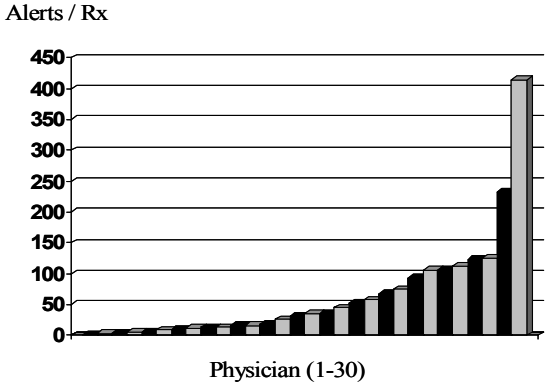

Figure 3 - Alerts by physician

Response to Electronic Alert

Of the 1869 alerts generated during the study period, 45% (n=830) precipitated action and 55% (n=1027) were ignored. The most frequent categories of alerts were: medication contraindicated for patient health condition (40%); medication interaction (22%); potential toxicity effects (17%); and, therapeutic duplication (11%). These four categories accounted for 90% of all alerts.

The three principal alerts associated with altered prescriptions were: contraindications for patient age; health condition; and, medication interactions. Table 2 displays the response to all alerts by category.

Toxicity alerts, potential allergic reactions, therapeutic duplication, dosing errors and known intolerance to a medication were the most often ignored alerts. Of note, any known medication intolerance must be entered by the physician.

Table 2: Alert Response by Category

Alert Category	Alert Response	Alert Ignored
AGE (n=90)	91%	9%
INTERACTION (n=415)	65%	35%
HEALTH CONDITON (n=735)	53%	47%
TOXICITY (n=319)	16%	84%
ALLERGY (n=7)	14%	86%
DUPLICATION (n=205)	14%	86%
DOSING ERROR (n=80)	10%	90%
INTOLERANCE (n=6)		100%

Of particular interest was the reason that a physician ignored a given alert. MOXXI-III provides a drop-down menu when an alert is ignored. They must then choose a reason for ignoring each alert generated. Possible reasons include: interaction already known; not clinically important; benefit greater than risk; need to consult with prescribing physician; drug/disease information incorrect; patient resistant to change; and, no time at this visit.

Table 3 presents the complete data regarding all reasons for non-adherence. The results indicate the most frequent reasons for ignoring an alert were: the interaction is already known and/or it is not clinically important. These two reasons account for 79% of the reasons cited for all ignored alerts.

Discussion

In this selected sample of urban general practitioners, 30% of prescriptions were associated with protocol-driven alerts. The most common reasons for alerts were medication contraindicated for patient health condition, medication interaction, potential toxicity effects and therapeutic duplications. The data reveal that 45% of these alerts produced changes to the prescription.

The categories driving the highest proportion of changes were drug contraindication based on patient age and/or diagnosis and medication interaction. The most common alerts ignored were: patient known to be intolerant to medication; possible dosing errors; therapeutic duplications; and, allergic reactions.

The most commons reasons given for ignoring these alerts were: interaction already known; interaction not clinically important; and, benefit assessed to be greater than the risk. It appears that non-adherence to alert information is based on additional knowledge of the clinical situation, beyond that inherent in the e-based decision aid, for the individual patients. However, to determine the validity of this notion, this should be verified by outcomes data associated with response and not-response to drug alerts.

Interactive drug alert systems must be utilized to be effective, but provision of technology alone does not produce improvements in practice and outcomes. For example, electronic order entry systems such as those provided by MOXXI-III make available necessary information regarding the patient's condition as well as all medication dispensed to that patient from that physician as well as all other physicians. This allows the physician to deal more effectively with increasingly complex drug regimes due to innovation in pharmaceutical therapies. Improvement in patient specific drug knowledge may not, however, be sufficient on its own to eradicate medication errors.

Ultimately, practice patterns are influenced by a variety of factors that determine physician behavior and may be used to predict facilitators and barriers to utilization and adherence. For example, the complex issues known to be associated with guideline adherence [17,18] likely come into play in the utilization of technology to improve practice and outcomes. Future studies must broaden and deepen the investigation of the reasons for adherence and non-adherence to drug alerts and any difference in associated outcomes.

It is difficult to compare the findings of this study to previous work because the paucity of similar studies involving reasons for adherence or non-adherence to drug alerts. Further research in the area of ambulatory care is necessary. Many of the benefits illustrated in acute settings can potentially be realized in other contexts [19,20]. Some previous attempts to develop, and operate, similar computerized systems have encountered resistance,

Table 3: Reasons Given for Alert Non-Adherence

Reason for Non-Adherence	AGE (n=4)	ALLERGY (n=5)	HEALTH CONDITION (n=297)	DOSING ERROR (n=65)	DUPLICATION (n=161)	INTOLERANCE (n=4)	INTERACTION (n=111)	TOXICITY (n=255)
Interaction already known	50%	60%	40%	20%	56%	75%	47%	45%
Not clinically important	25%	20%	37%	55%	27%		26%	34%
Benefit greater than risk	25%	20%	16%	17%	9%	25%	14%	13%
No time at this visit			4%	3%	2%		5%	4%
Drug/disease information incorrect			1%	5%	6%		5%	4%
Need to consult prescribing physician			4%				5%	
Patient resistant to change								1%

dissatisfaction and ultimate failure. Therefore, further work is required to confirm that this technology, which appears to be time and cost efficient, as well as clinically effective, is valuable across a wide spectrum of physician type, disease type and geography.

Factors that influence physician behavior come from the system, organizational, and individual level [21]. The interplay of these factors is a complex and poorly understood phenomenon that results from the array of experiences related to formal education, training, and practice that occur both in predictable and unpredictable patterns, but which can be evaluated as to their contribution to understanding drug alerts.

However, based on data from a large intention-to-treat analysis of physician drug prescribing patterns in patients with heart attacks, which indicated many more similarities than differences across physician type and geography, it seems reasonable to assume future studies of different physician groups and clinical settings will demonstrate findings similar to the current analysis [22].

Conclusion

This research describes physician response to an integrated and interactive electronic drug management system. Reasons for physician non-adherence to electronic drug alerts were provided in the overwhelming majority of the cases and those reasons generally centered on prior and specific knowledge regarding the patient condition.

It is of note that the majority of drug alerts were not actioned. This suggests that to aid in the further development of interventions to improve patient safety and reduce potential adverse drug events, analysis of the reasons for non-adherence require further exploration. This includes developing an understanding of the facilitators and barriers to adherence based on system, organizational and individual level predictors.

Such an understanding of the interplay of these factors has enormous potential to close documented care gaps, and to positively alter physician practice patterns to improve patient safety and outcomes in an effective and efficient manner with respect to medication errors.

This work suggests that an e-based decision support system appears feasible as a method to enhance patient safety and outcomes in a manner that is layered into, rather than onto, physicians' usual daily work patterns.

Acknowledgments

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