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The effect of provider characteristics on the responses to medication-related decision support alerts

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ABSTRACT

Background: Improving the quality of prescribing and appropriate handling of alerts remains a challenge for design and implementation of clinical decision support (CDS) and comparatively little is known about the effects that provider characteristics have on how providers respond to medication alerts.

Objectives: To investigate the relationship between provider characteristics and their response to medication alerts in the outpatient setting.

Design and participants: Retrospective observational study using a prescription log from the automated electronic outpatient system for each of 478 providers using the system at primary care practices affiliated with 2 teaching hospitals, from 2009 to 2011 for six types of alerts. Provider characteristics were obtained from the hospital credentialing system and the Massachusetts Board of Registration in Medicine.

Main measures: Override rates per 100 prescriptions and 100 alerts.

Results: The providers' mean override rates per 100 prescriptions and per 100 alerts were 0.52 (95% confidence interval (CI), 0.46–0.58) and 0.42 (95% CI, 0.38–0.44) respectively. The physicians ($n = 422$) on average overrode drug alerts with rates of 0.48 per 100 drugs and 0.44 per 100 warnings. Univariate analysis revealed that six physician characteristics (physician type, age, number of encounters, medical school ranking, residency hospital ranking, and acceptance of Medicaid) were significantly related to the override rate. Multiple regression showed that house staff were more likely to override than staff physicians ($p < 0.001$), physicians with fewer than 13 average daily encounters were more likely to override than others with more than 13 encounters (p (range), <0.001–0.05), and graduates of the top 5 medical

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schools were more likely to override than the others ($p = 0.04$). All six predictors together explained 30% and 50% of the variance in override rates, respectively.

Conclusions: Consideration of six specific physician characteristics may help inform interventions to improve prescriber decision-making.

1. Introduction

Despite the promise that computerized medication-related clinical decision support (CDS) systems will improve medication safety, there is wide variability in their use and in the responses to provider recommendations generated by these systems. Investigators have reported wide variations in override rates, ranging from 25% to 96% depending on the site, settings, and alert type [1–5]. The reported proportion of inappropriate overrides also varies widely, from 8% to 82% [4,5].

This variability in provider responses to medication-related CDS recommendations could be due to many factors, including the knowledge base used, how the alerts are displayed and where they occur in the workflow, the setting in which the system is deployed, and the provider characteristics [6]. In 2008, investigators working with the Leapfrog Group set up a "flight simulator" approach to computerized provider order entry (CPOE) aimed at estimating a system's potential effect on safety by examining how it handles dangerous ordering scenarios implemented in hospitals [7]. They evaluated 81 US hospitals and found wide variation in the frequency with which medication orders judged likely to cause serious harm to adult patients were detected by CPOE decision support [8]. The key finding of that work was the wide variation among hospitals in terms of which decision support they implemented, and there was also wide variation within vendor – in fact little correlation with vendor, suggesting that many key decisions must be made at the hospital level. Several systematic reviews [6,9,10] of CDS systems across a range of clinical domains and review studies [3,11–14] have identified key steps that organizations should take to ensure the successful implementation and maintenance of a CDS system.

However, there have been few explorations of provider-level variation in terms of how prescribers respond to alerts, or what provider attributes affect override rates. Some studies have evaluated physician characteristics associated with alerting medication CDS and researchers have addressed the possibility of provider influence on alerts compliance [6,13,15–17], but relatively little empiric work has been done in routine clinical practice. If overrides of important warnings are clustered by physician, it might be possible to intervene with the high over-riders, and this information might also be used for credentialing, for example.

The present study was designed to assess the effect of provider-level characteristics on variation in prescribing patterns, with two specific aims: (i) to describe provider prescribing patterns relative to the rates of triggering alerts and overriding the alerts, and (ii) to determine the effects of provider characteristics on alert and override rates. We investigated 3 years of logs of the prescriptions of individual providers and responses to multiple domains of medication CDS alerts obtained from primary care practices.

2. Methods

2.1. Setting

We evaluated primary care practices affiliated with two Harvard teaching hospitals, Brigham and Women's Hospital and Massachusetts General Hospital (Boston, MA, USA). These sites are part of a regional integrated healthcare delivery system, called the Partners HealthCare System. Most of the clinical sites evaluated in this study are community-based practices, and the study included several community health centers. All providers in the Partners network use the same electronic health records (EHRs) with medication-related CDS alerts with exactly the same set of rules in their outpatient primary care clinics. The medication related alerts have six types of warnings: patient allergies, drug–drug interactions, duplicate drugs, age-based suggestions, renal suggestions and formulary substitutions.

2.2. Provider characteristics relevant to responses on medication alerts

As in prior work [5], we analyzed the reasons for provider overrides; the most common reasons were those associated with their clinical uncertainty about warnings, even which were based on current evidences, such as "*patient has taken previously without adverse reaction,*" "*will monitor as recommended,*" and "*patient has tolerated this drug in the past.*" Regarding uncertainty and physician behavior in clinical practice, Gerrity et al. [18] proposed a conceptual model for identifying factors affecting how physicians react to uncertainty and how reactions to uncertainty might influence their behavior (Fig. 1). The model highlighted five major elements: the patient, the medical problem or illness, the physician, test and treatment characteristics, and the organizational structure.

Several previous studies have identified the following factors as being associated with the decision to override alerts: prescriber type [4], knowledge and training [6], preferences [6], the degree to which a physician believes that health information technology will contribute to medication safety [17,19], and workload [17] such as the number of patients cared for, the staffing of the department, and the duration of the shift or the time of the day.

Based on the model of Gerrity et al. and other previous work, we explored the variables that were available in the Partners HealthCare databases, including provider type, gender, age, race, specialty, practice site, medical school attended, graduation year, board certification, board certification year,