Advanced clinical decision support as an alternative to traditional drug-drug and drug-pregnancy interaction alerts

Michael Wisner, PharmD[1]; David Mulherin, PharmD[1]; Scott D. Nelson, PharmD, MS[1,2]

[1]HealthIT, Vanderbilt University Medical Center, Nashville, TN; [2] Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN

Introduction

Computerized prescriber order entry (CPOE) linked with clinical decision support (CDS) has been shown to significantly reduce the incidence of ordering related medication errors.

Alert fatigue, due to an overabundance of non-specific alerts can lead to providers becoming desensitized, and as a result ignore potentially relevant alerts.

The term basic CDS has been coined to describe CDS that focuses on a single pairing of triggering criteria, such a drug-drug interaction or drug-disease state interaction.

Advanced CDS, which takes into consideration multiple patient factors, has been proposed as a more specific alterative to basic CDS alerts.

The purpose of this project is reduce the alert firing rate and improve the rate of override by replacing a select number of basic CDS alerts with advanced CDS.

Methods

Based upon review of basic CDS alert triggering and override rates, three groups of alerts were identified as possible targets for conversion to advanced CDS (Table 1).

Table 1. Selected Drug Alerts and Provider Response Rates from 10/1/18-10/31/18

K-Supplements / K-Sparing Diuretics	Viewed	136	(4.7%)
	Canceled	125	(4.3%)
Drug-Drug Interaction Alert	Removed	31	(1.1%)
	Overridden	2,630	(90.0%)
	Total	2,922	
NSAIDs/Pregnancy	Viewed	277	(8.5%)
	Canceled	114	(4.3%)
Drug-Pregnancy Alerts (7 total alerts)	Removed	23	(0.9%)
	Overridden	2,305	(86.4%)
	Total	2,669	
QTc Prolonging Medications	Viewed	637	(6.0%)
	Canceled	770	(7.3%)
Drug-Drug Interaction Alerts (49 total alerts)	Removed	133	(1.3%)
	Overridden	9.013	(85.4%)
	Total	10,553	

Hyperkalemia Risk Scoring System

Proposed scoring system criteria:

- +1 to score if: age > 70, CrCl < 50, DM, HF, ACE-I/ARB, K-Sparing Diuretic, Potassium Supplement
- -2 to score if: most recent, but within the past 3 days, serum K level <4 mEq/L
- -1 to score if: most recent, but within the past 3 days, serum K level <4.5 mEq/L

CPOE alert if ordering ACE, ARB, potassium sparing diuretics, or potassium supplements and risk score is >2.

Applicable risk factors and recent lab values displayed with alert.

Failsafe CDS alert will trigger if at anytime a high potassium lab value returns while patient is on ACE, ARB, potassium sparing diuretics, or potassium supplements.

Nonsteroidal Anti-Inflammatory Drugs and Pregnancy Alert

Alert currently triggers for women with active pregnancy status and women of child bearing age whom do not have any documented negative pregnancy status.

- 97% of these alerts are attributable to not having a documented negative pregnancy status.

Aim to reduce alert burden due to undocumented pregnancy status.

The teratogenic potential of NSAIDs is linked to third trimester. A BMI threshold will be incorporated to attempt to identify any patient who might have progressed into the third trimester without knowing it.

Proposed advance CDS criteria:

- Active pregnancy status
- No documented pregnancy status and BMI > 30 (would reduce number of alerts due to undocumented pregnancy status by 78%)

QT-Prolongation risk scoring system

Proposed scoring system criteria based upon validated risk score:

- +1 to score if: Age ≥ 68 years old, female, loop diuretic
- +2 to score if: Serum K <3.5 mEq/L, QTc ≥ 450 ms, h/o MI
- +3 to score if: QTc-prolonging drug already prescribed, sepsis, heart failure

Interruptive CPOE alert when ordering QTc prolonging medication if risk score ≥ 8 or if patient has of a diagnosis of long QTc syndrome.

Failsafe CDS alert if, at any time while on any QTc prolonging medication, the QTc becomes ≥ 500 ms or if the QTc increases by ≥ 60 ms since the last measurement.

Alert to include details about risk factors and include suggestions for discontinuing medications and orders for QTc monitoring.

Measuring Outcomes

The replaced basic CDS alerts will be filtered from user view; however, the alerts will still trigger in the background. This will allow for direct comparison alert trigger rates between the two types of CDS.

Provider response and override rates will be compared in the pre and post implementation.

In order to assess the sensitivity of the potassium related CDS, will compare rates of hyperkalemia between patients identified by the basic CDS and advanced CDS.

Will monitor the enterprise wide internal adverse drug event reporting system for any reports that may be contributed to the proposed changes.

Anticipated Challenges

The EHR system employed by Vanderbilt University Medical Center is used in both the inpatient hospital and outpatient clinic setting and the proposed CDS changes will need to be customized to meet the needs these different settings.

The proposed risk scoring systems are based upon models that have been developed for adult patients and customization of the advanced CDS alerts will be required to accommodate the needs of the 267 bed pediatric hospital associated with our organization.

Acknowledgments

Phillip W. Stewart, DPh
PGY2 Informatics Residency Director

Contact Information

Michael Wisner, PharmD
Michael.K.Wisner@vumc.org