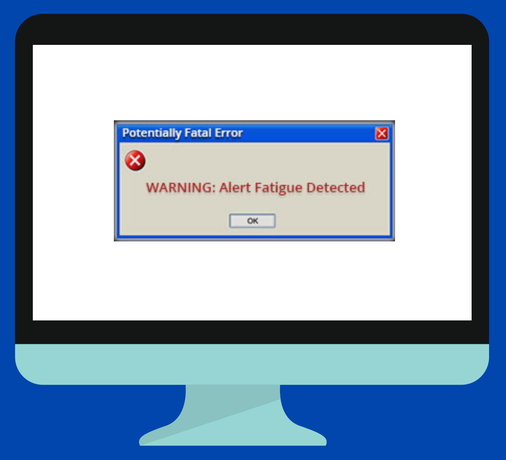
A WAVE OF ALERTS:
WHAT IS THE IMPACT OF ENABLING DDI ALERTS ON PRESCRIBER ALERT BURDEN?

SANDHU A. (1), WESTBROOK J. (2), ZHENG W. (3), WALTER S. (2), BAYSARI M. (3)
1. Pharmacy Department, St Vincent's Hospital, Sydney; 2. Australian Institute of Health Innovation, Macquarie University; 3. Faculty of Health Sciences, University of Sydney
Contact: anmol.sandhu@svha.org.au

BACKGROUND AND OBJECTIVE:

- The volume of clinical decision support (CDS) alerts encountered by prescribers (i.e. alert burden) within electronic medication management (EMM) systems is likely to influence whether CDS alerts are read and acted upon.
- A judicious approach to alert implementation is required to ensure a balance between the effective provision of supportive information vs. inundating prescribers with alerts such that they ignore all alerts including those that are critical in nature (alert fatigue).
- Drug-drug Interaction (DDI) alerts are difficult to implement effectively, particularly due to the large number of known DDIs and lack of alert specificity. For example, the dose, route, patient attributes etc. are often not considered in the alert algorithm, resulting in a large number of context-poor alerts being triggered.
- The threshold at which alert fatigue sets in has not been established.
- This study therefore aims to determine the alert burden experienced by prescribers with existing CDS alerts, and then how this would change if DDI alerts were added to the EMM system.



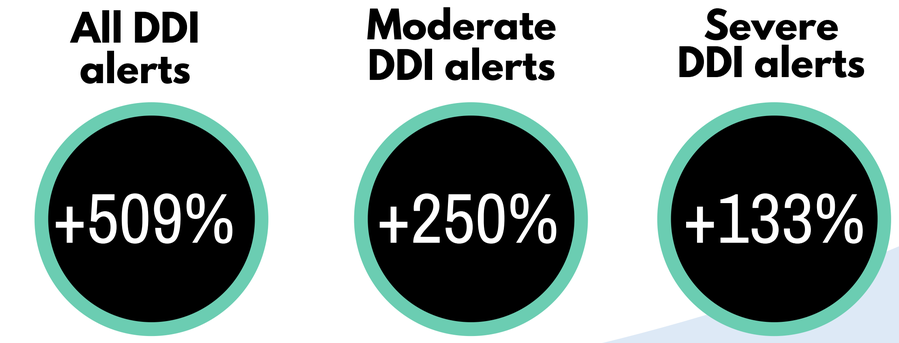
METHOD:

This was a simulated cohort study. Clinical data for a given study date were extracted from a 'live' EMM system in use at a tertiary teaching hospital. No DDI alerts were enabled in the hospital at the time. The same medication orders were then replicated via manual entry into a simulated version of the EMM system where DDI alerts were enabled. CDS alert data from the live and simulated systems were extracted and compared. DDI alert results were analysed according to type - 'unknown', moderate and severe; whereby 'unknown' refers to DDI alerts triggered by the system to notify prescribers of the absence of interaction information for the prescribed drugs.

RESULTS:

Overall alert volume

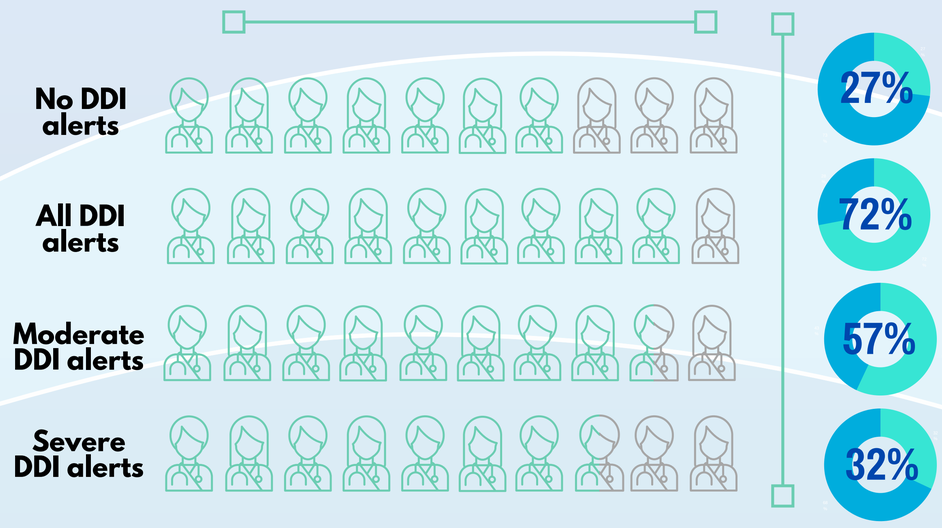
- The addition of all DDI alerts (i.e. unknown + moderate + severe) saw a five-fold increase in the number of alerts generated from **209** to **1063** alerts (p<0.0001). This change was less pronounced, albeit statistically significant for moderate (n=**522**; p<0.0001) and severe (n=**277**; p<0.05) DDI alerts.
- The proportion of prescribed medicines that triggered at least one alert increased from **25.2%** (no DDI alerts) to **60.4%** (p<0.0001), **40.1%** (p<0.0001) and **28.5%** (p=0.21) for all, moderate and severe DDI alerts respectively. Similarly, the mean number of alerts per medication order increased from **1.4** alerts per order to **3.1** (all; p<0.0001), **2.3** (moderate; p<0.0001) and **1.7** (severe; p=0.08).



Increase in alert volume associated with enabling DDI alerts

Prescriber alert burden

- In the absence of DDI alerts, most doctors (**70.5%**; n=55) received at least one CDS alert whilst prescribing. When all DDI alerts were enabled, almost all doctors (**91%**; p=0.002) were alerted. Similarly, with only the moderate or severe DDI alerts enabled, **86%** (n=67; p=0.28) and **76%** (n= 59; p=0.71) of doctors encountered alerts respectively.
- Each doctor encountered on average **3.8** alerts over the course of the study date with the existing CDS alert setting. This rate increased to **15** alerts/doctor (range 1-85; p<0.0001) with the addition of all DDI alerts, **7.8** (range 1-38; p<0.0001) for moderate and **4.7** (range 1-18; p<0.05) for severe DDI alert categories.
- In assesssing alert burden at an individual prescriber level, it was observed that **27%** of a prescriber's medication orders triggered an alert with the existing alert setup, whilst with inclusion of all DDI alerts, this increased to **72%**. Moderate DDI alerts increased this proportion to **57%** (p<0.0001), whilst a modest increase was seen with severe DDI alerts to **32.4%** (p=0.2)



Left: Increases in alert exposure to doctors with DDI alerts
Right: Proportion of an individual's prescribed medicines that triggered an alert

DDI alert profile

- Almost two-thirds **(63.1%)** of all DDI alerts generated corresponded to the 'unknown' alert type, followed by **29%** of moderate and **8%** severe DDI alerts. The top 5 DDI alert pairs by frequency accounted for **27%** of all DDI alerts, with 4 out of 5 of these involving the drug class 'opioid agonists'

OPIOID AGONISTS + BENZODIAZEPINES – (40)
OPIOID AGONISTS + OPIOID ANTAGONISTS – (17)
OPIOID AGONISTS + GENERAL ANAESTHETICS – (10)
OPIOID AGONISTS + PREGABALIN – (9)
OPIOID AGONISTS + ANTIPYSCHOTICS – (9)

Top 5 alert pairs (number of alerts triggered)

DISCUSSION

- The implementation of all DDI alerts will significantly increase prescriber alert burden.
- The severe DDI alert subset did not significantly increase prescriber alert burden and could potentially be implemented without contributing to alert fatigue.
- It was not possible to benchmark our prescriber-centric alert burden outcomes as similar studies are lacking.
- Interestingly, our top 5 alerting DDI pairs did not correspond to those prioritised by US researchers.
- This study was limited in scope to one day, one EMM system, one DDI knowledgebase and one hospital. It did not examine changes in prescribing decisions or clinical outcomes as a result of enabling DDI alerts.
- This work was highly manual and laborious in nature, hampering its scalability. It also brought to light a number of challenges associated with CDS alert data extraction, analysis and utility.
- It did however assess cumulative impact of CDS alerts and this methodology could be used to assess impact of other CDS alert types in the future.

RECOMMENDATIONS & CONCLUSION

- DDI alerts need to be refined prior to their implementation:
  - 'Unknown' DDI alerts should be disabled as they provide little additional benefit & constituted more than half of all the DDI alerts generated
  - Clinical significance of the moderate and severe DDI alerts should be determined
  - Alert algorithm should be adjusted to include contextual factors
- It is important to consider cumulative alert burden e.g. non-medication related alerts from electronic medical records
- Future work should focus on prescriber-related alert burden outcomes
- A centralised body is needed to develop and curate CDS content and knowledgebases to ensure standardisation across Australian healthcare organisations.