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Impact of customized response options on medication alert salience

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Impact of Customized Response Options on Medication Alert Salience

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The speaker has no actual or potential conflict of interest in relation to this presentation.

Medication Alerts

Medication alerts are designed to promote safety and improve patient care.

Areas of Improvement

- Frequently are bypassed without clinical assessment
- Many do not elicit changed behavior
- *Reasons:*

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- *Reasons:*

Poor alert specificity

Alert irrelevance

Alert burden

Alert Management & Analysis

Medication Alert Management

- Detailed evaluations of the efficacy and value remains elusive
- Lack of consistent metrics and definitions

Alert Metrics



Alert Metrics

	Override Rate	Saliency Rate
Measures	Alerts that are dismissed or bypassed	Alerts that are acted upon
Comments	<ul style="list-style-type: none">• Provides limited information on alert effectiveness• Unable to determine if a clinical assessment occurred	<ul style="list-style-type: none">• Accounts for value-added actions• Useful when paired with alert response option data

Alert Management System

Software Capabilities

- Often designed to allow site-specific modifications
- Frequently adapted to require documentation of reason prior to proceeding
- Select systems have capabilities to implement:
 - *Free-text response fields*
 - *A customized list of response options*

Customized Response Options

Rational for a Customized Configuration

- Enhancing communication
- Prompting appropriate follow-up actions
- **Capturing:**
 - The clinical decision making thought process
 - Behaviors that are taken in response to an alert

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 - The clinical decision making thought process
 - Behaviors that are taken in response to an alert



Previous Study

Wright et al. 2019

Objective	To determine availability and use of structured response options for drug-drug interaction (DDI) alerts
Methods	Alert data was collected from 10 clinical sites across the US using a variety of EHR systems
Results	<ul style="list-style-type: none">• Median number of response options: 6 (3 – 100)• 3 categories accounted for 78% of all responses<ul style="list-style-type: none">▪ “will monitor or take precautions”▪ “not clinically significant”▪ “benefit outweighs risk”
Key Findings	Most response options did not capture actionable behaviors and many others lacked clear communication

Self-Assessment Question #1

What is alert saliency?

- A. A type of alert management software
- B. Describes when action is taken in response to an alert
- C. An informational “pop-up”
- D. Describes when an alert is dismissed or bypassed

Self-Assessment Question #2

Which of the following is FALSE?

- A. A carefully designed list of alert response options may improve communication between providers and pharmacists
- B. Assessing alert response option utilization may provide details on which alerts prompted action
- C. Medication alert effectiveness has not been consistently defined and measured in the past
- D. Override rates capture value-added actions

Quality Improvement Initiative

ALERT RESPONSE RE-CONFIGURATION

This project was deemed exempt from review by the Institution Review Board (IRB) by the institution's IRB screening process.



Purpose

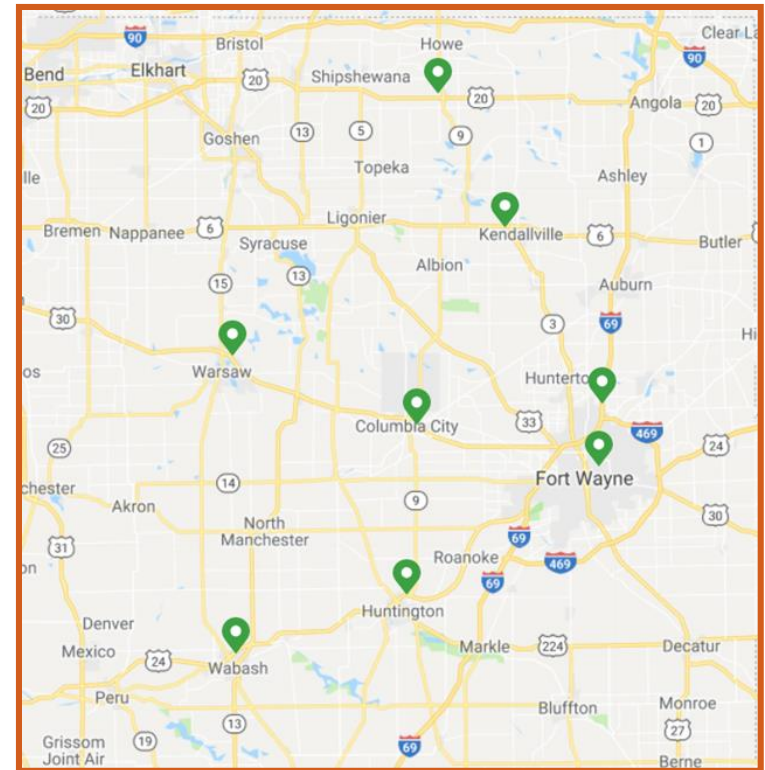
The objective of this study was to examine alert-engagement data

- Goals:
 - Quantify changes in alert salience
 - Identify opportunities to improve the alert management system in a targeted manner

Setting

Parkview Health

- Not-for-profit, community-owned organization
- Northeast Indiana and northwest Ohio
- 10 hospital health system
 - Over 900 inpatient beds
 - Over 200 primary care clinics

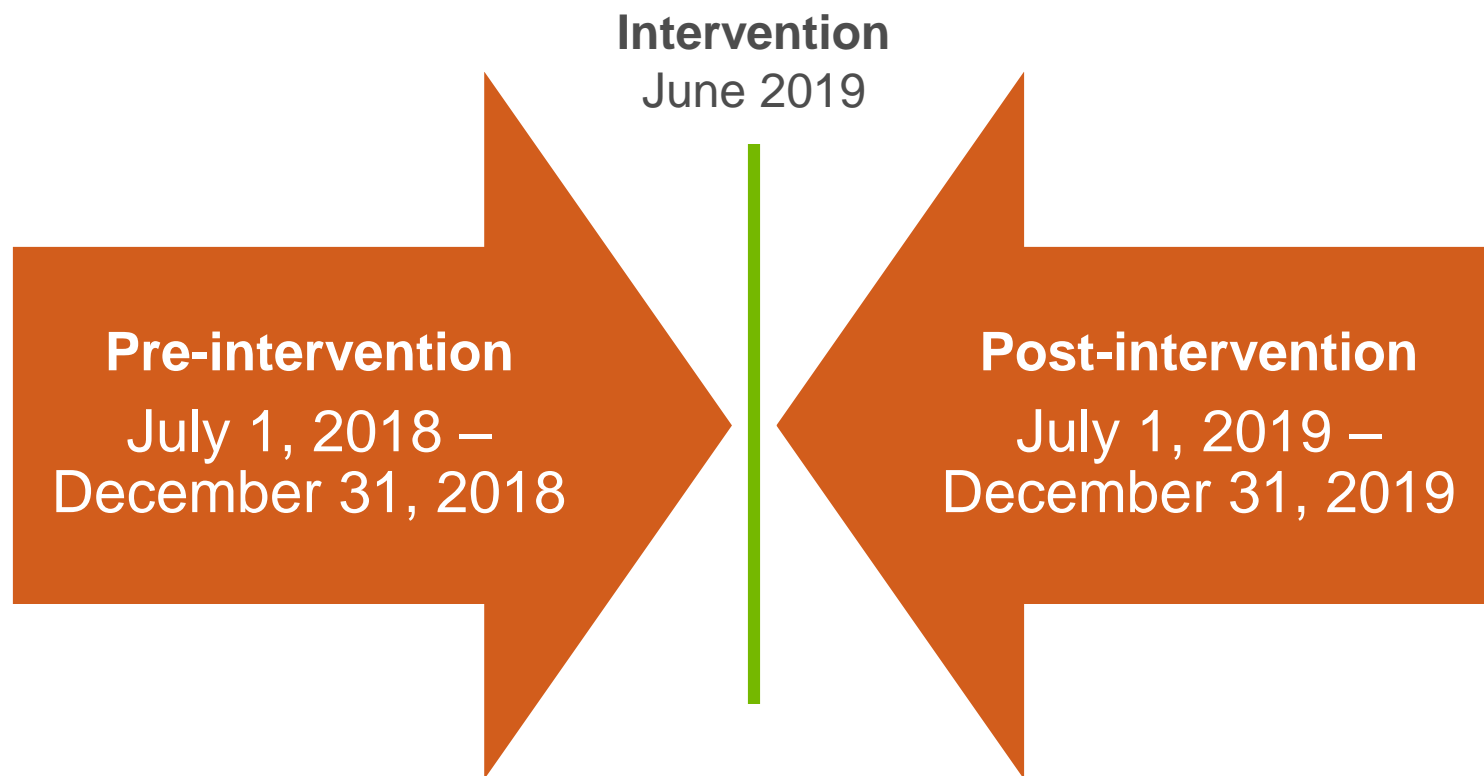


Alert Management System

The institution utilizes a certified EHR with an integrated alert management module.

- Medication Alert Software Capabilities:
 - Allows for modification of the alert response options list
 - The list cannot be customized or tailored based on alert type

Design



The analysis was conducted comparing pre-post intervention data

Data Collection

Inpatient & outpatient medication alerts

All medication alert types included

Filtered to order entry and verification alerts

Endpoints

Primary

- Medication alert salience
 - *Equation:*

$$\frac{\text{Salient Responses} + \text{Removed Orders}}{\text{Total Alerts}}$$

Secondary

- Alert salience by provider type
- Alert salience by alert type
- Utilization frequency of each override response option

Pre-Intervention

The screenshot shows a 'Medication Warnings' window with two active warnings:

- High Warning:** Drug-Drug: amiodarone and levoFLOXacin. Description: The concurrent use of amiodarone with other agents that prolong the QTc interval may result in potentially life-threatening cardiac arrhythmias, including torsades de pointes. (1-3). Medications listed: amiodarone (PACERONE) tablet 200 mg (Hospital medication. New) and levoFLOXacin (LEVAQUIN) tablet 750 mg (Hospital medication. New).
- Medium Warning:** Drug-Drug: insulin lispro and levoFLOXacin. Description: Concurrent use of quinolones and antidiabetic agents may result in severe hypoglycemia. (1-7) Hypoglycemia can lead to coma. Medications listed: levoFLOXacin (LEVAQUIN) tablet 750 mg (Hospital medication. New) and insulin lispro (HumaLOG) pump (Hospital medication. Active. Verified).

Each warning includes an 'Override Reason...' dropdown menu and a 'Details' link. At the bottom, there are buttons for 'Benefit outweighs risk', 'Not Clinically Significant', and 'Alert Inappropriate', along with an 'Override All Warnings...' dropdown and 'Override and Accept'/'Cancel' buttons.

An arrow points from the 'Override Reason...' dropdown of the second warning to a box containing the following text:

Benefit outweighs risk
Not clinically significant
Alert inappropriate
Defer to RPh

Alert configuration

Pre-Intervention

Responding to an alert

- Cancel & exit the activity
- Remove medication(s) that triggered the alert
- Choose a response option & proceed with the order +/- free-text comment

The screenshot shows a 'Medication Warnings' window with a list of medications. Each medication entry includes a name, a brief description, and an 'Override Reason...' dropdown menu. The medications listed are:

- levoFLOXacin (other agents that prolong the QTc interval may cause arrhythmias, including torsades de pointes.)
- amiodarone (PACERONE) tablet 200 mg (Hospital medication. New.)
- levoFLOXacin (LEVAQUIN) tablet 750 mg (Hospital medication. New.)
- levoFLOXacin (LEVAQUIN) tablet 750 mg (Hospital medication. New.)
- insulin lispro (HumaLOG) pump (Hospital medication. Active. Verified.)

Below the medication list is a response selection box with the following options:

- Benefit outweighs risk
- Not clinically significant
- Alert inappropriate
- Defer to RPh

At the bottom of the window, there is a section for 'Immediately override all warnings:' with buttons for 'Benefit outweighs risk', 'Not Clinically Significant', and 'Alert Inappropriate'. There is also an 'Override All Warnings...' dropdown menu and 'Override and Accept' and 'Cancel' buttons.

Alert configuration

Intervention

Reconfiguration of Alert Response Options

- A pharmacist-driven committee redesigned the alert response settings
 - **Adding** 10 new responses
 - **Removing** the “Defer to RPh” option
- Constructed by mining alert data for frequent and relevant free-text comments

Intervention

Salient Actions

- *Pre-Intervention Period:*
 - Exit alert and modify therapy
 - Removing the medication(s) that triggered alert
- *Post-Intervention Period:*
 - The previous actions
 - Choosing a salient response option

Intervention

Reconfiguration of Alert Response Options [±]

Override	Salient
Alert inappropriate*	Confirmed OBGYN status
Benefit outweighs risks*	Dose adjusted
Drug interaction not clinically significant*	Monitoring ordered
Other intervention	Multiple routes allowed
Provider contacted	Negative skin test
---	Previously tolerated
---	Prophylaxis ordered
---	Timing evaluated/adjusted

*Pre-intervention

[±] “Defer to RPh” removed from options

Post-Intervention

Medication Warnings for Vent, Vincent

Warnings Report

New Warnings (1)

Duplicate Therapy: HYDRomorphone, HYDRomorphone *PF*
Opioid Analgesics- IR (with all antitussive opiates)
High
Details

Override Reason...

HYDRomorphone *PF* (DILAUDID) syringe 0.5 mg, Every 3 hours PRN
Hospital medication. New. Remove

HYDRomorphone (DILAUDID) tablet 2 mg, Every 4 hours PRN
Hospital medication. New. Remove

Override Reason...

- Benefit outweighs risk
- Prophylaxis ordered
- Previously tolerated
- Provider contacted
- Dose adjusted
- Multiple routes allowed
- Timing evaluated/adjusted
- Confirmed OBGYN status
- Monitoring ordered
- Other intervention
- Negative skin test
- Drug interaction not clinically significant
- Alert Inappropriate

Immediately override all warnings:

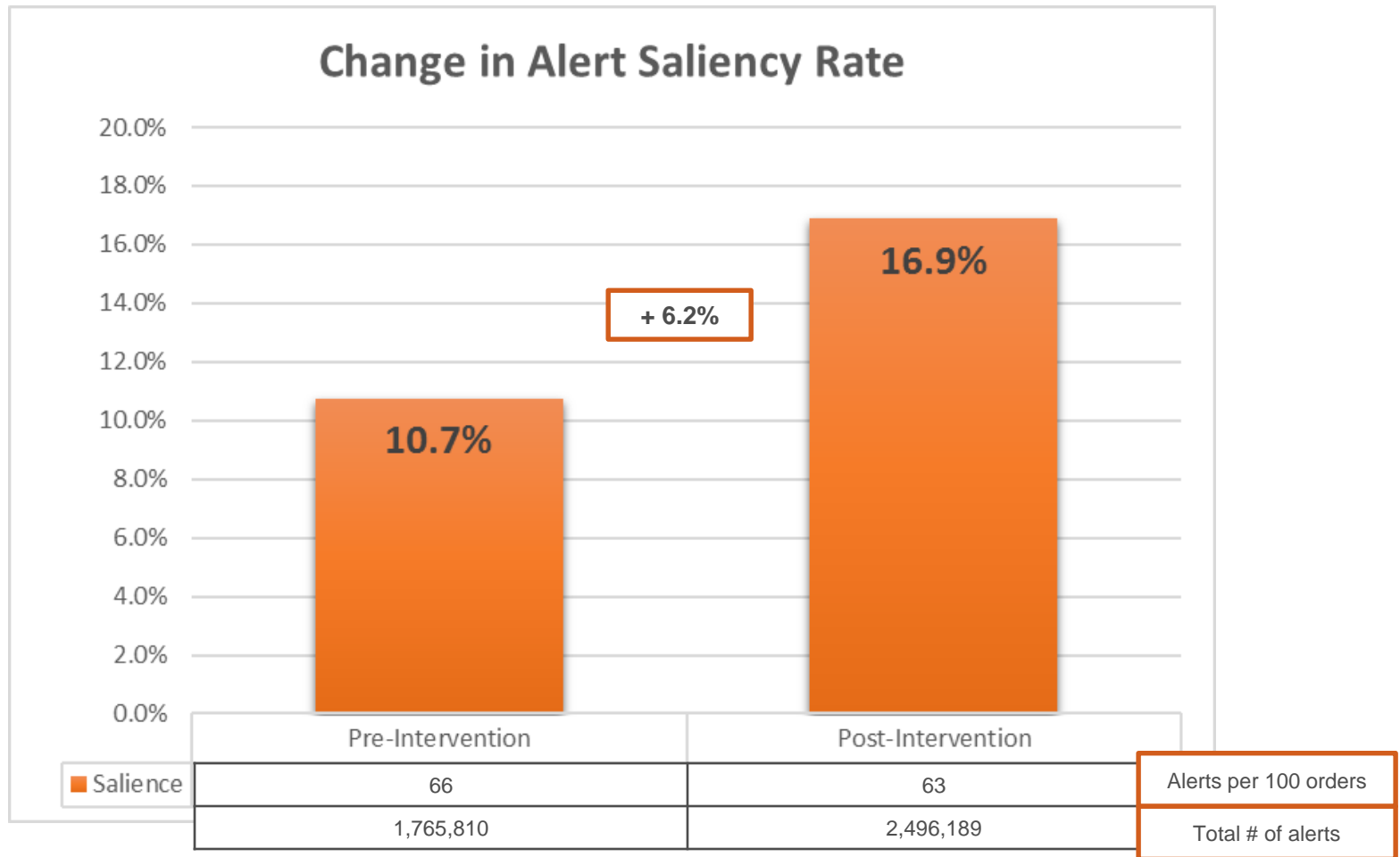
Benefit outweighs risk Dose adjusted Previously tolerated Alert Inappropriate

Override All Warnings...

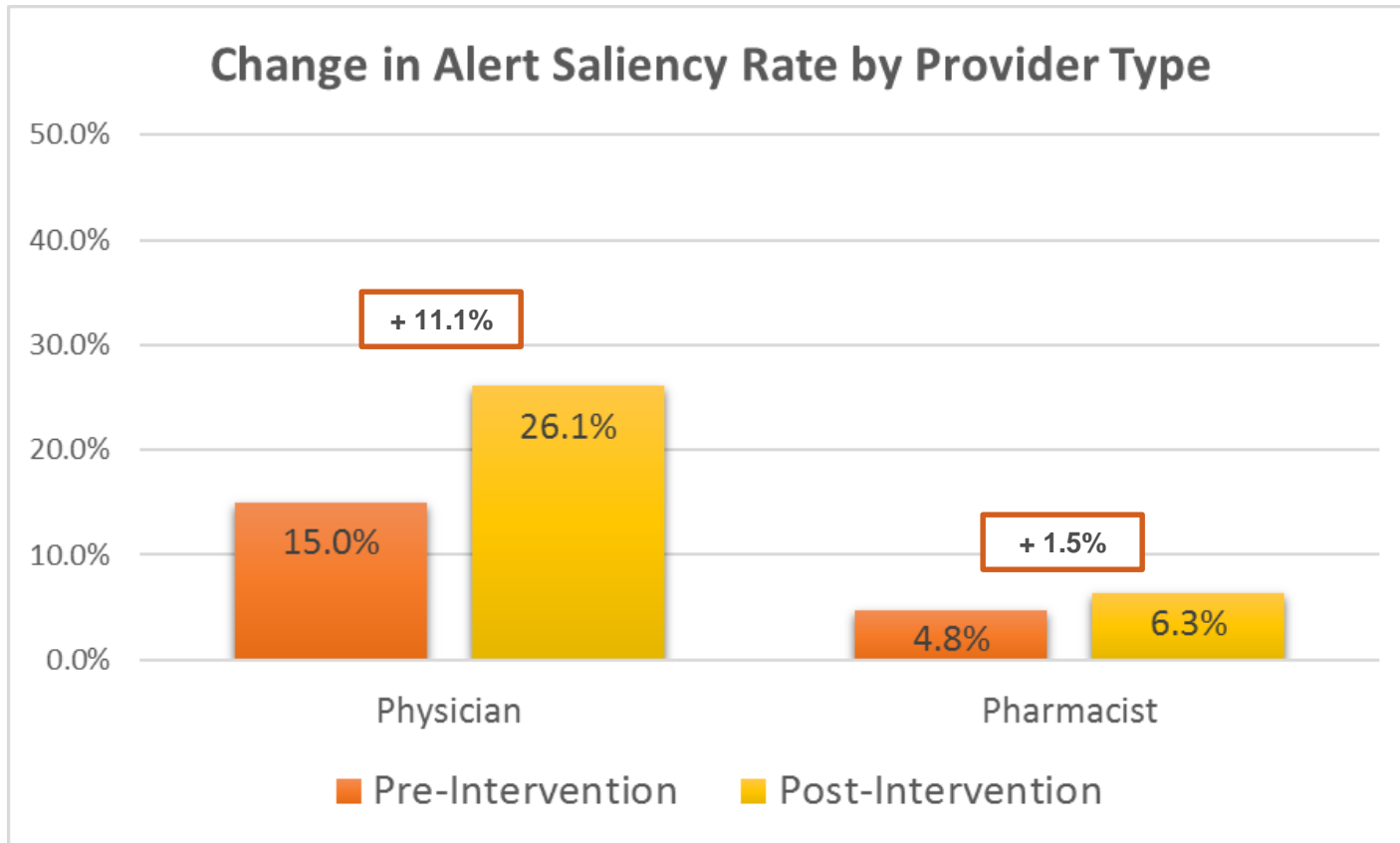
Override and Accept Cancel

Alert Configuration

Results – Primary Outcome



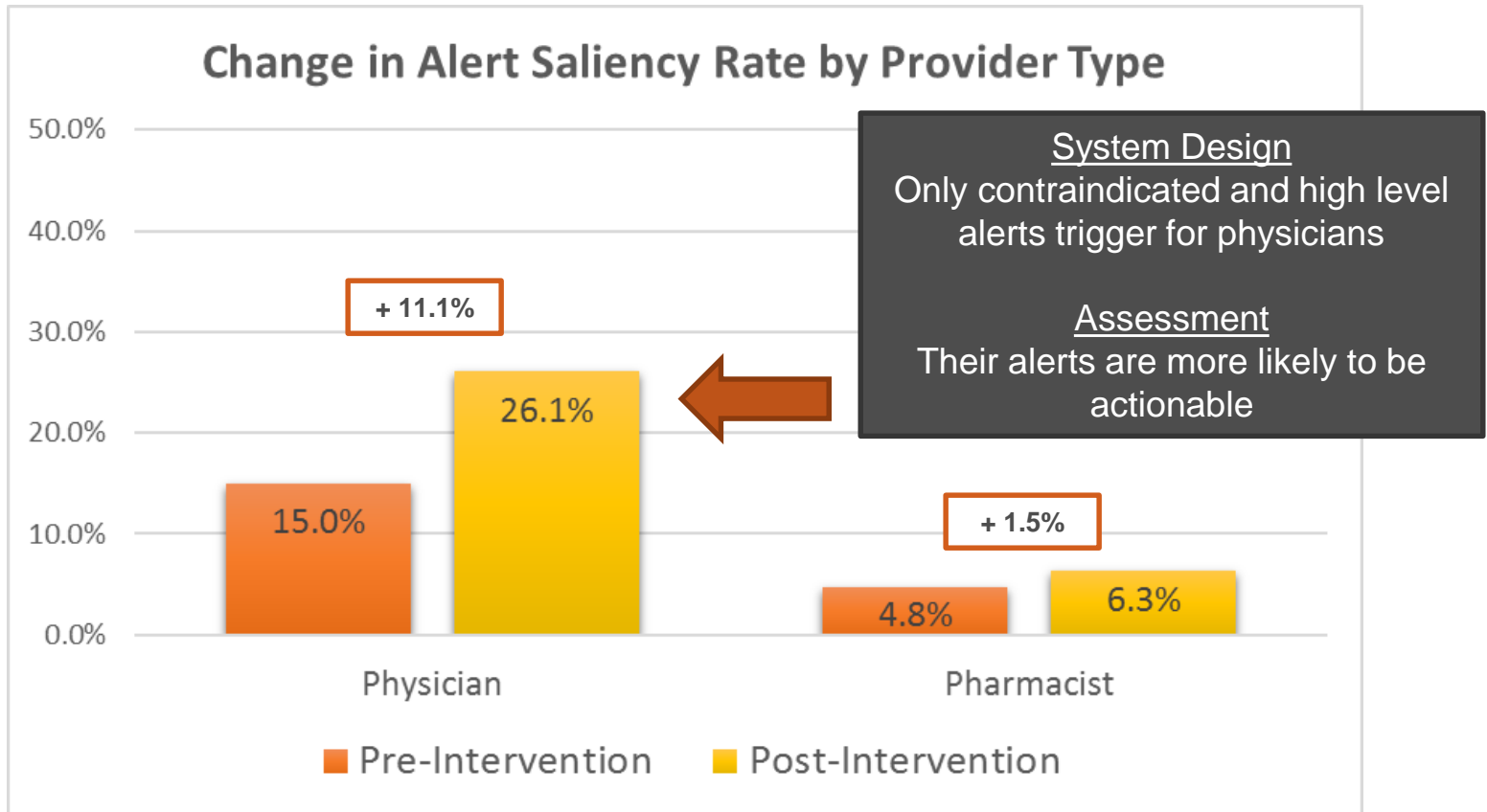
Results – Secondary Outcome



Physician profile: physicians, physician assistants, nurse practitioners, nurses

Pharmacist profile: order entry & verification

Results – Secondary Outcome

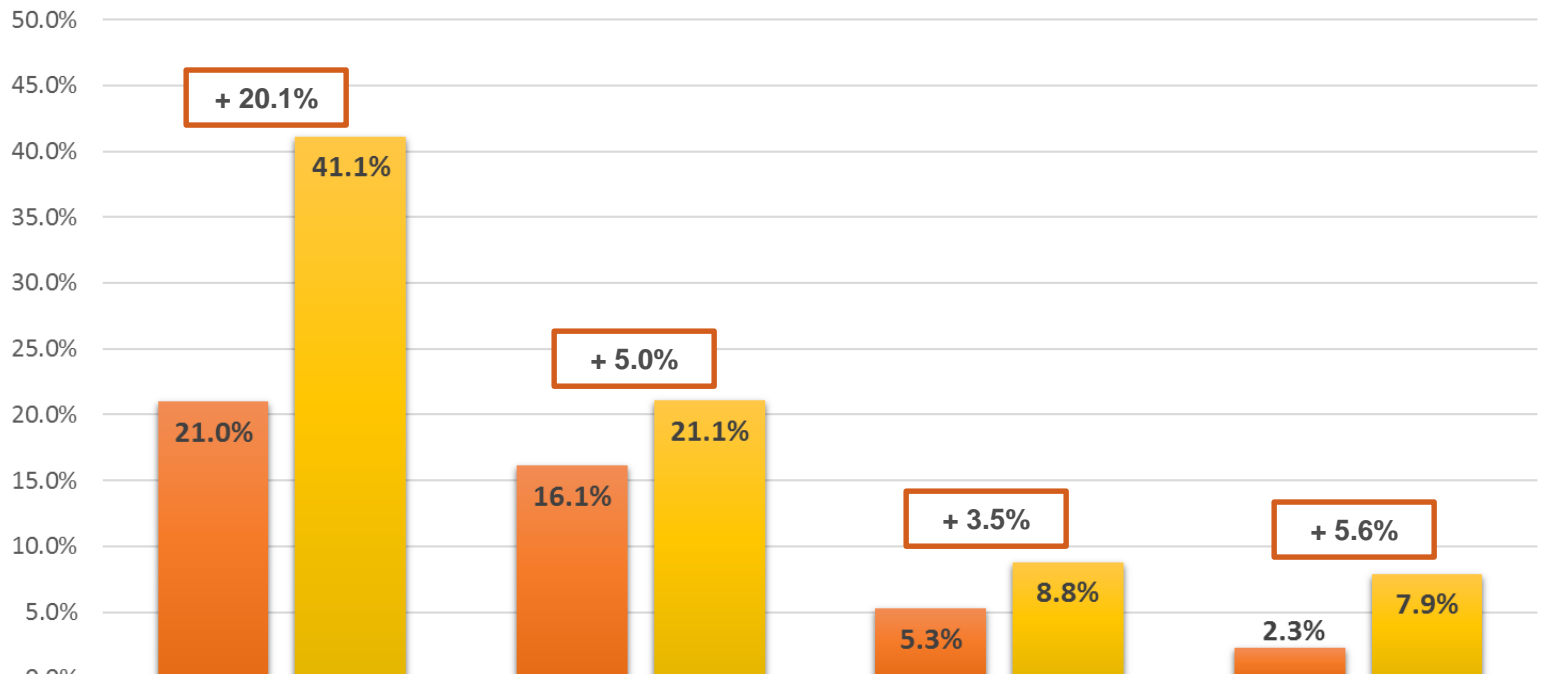


Physician profile: physicians, physician assistants, nurse practitioners, nurses

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Results – Secondary Outcome

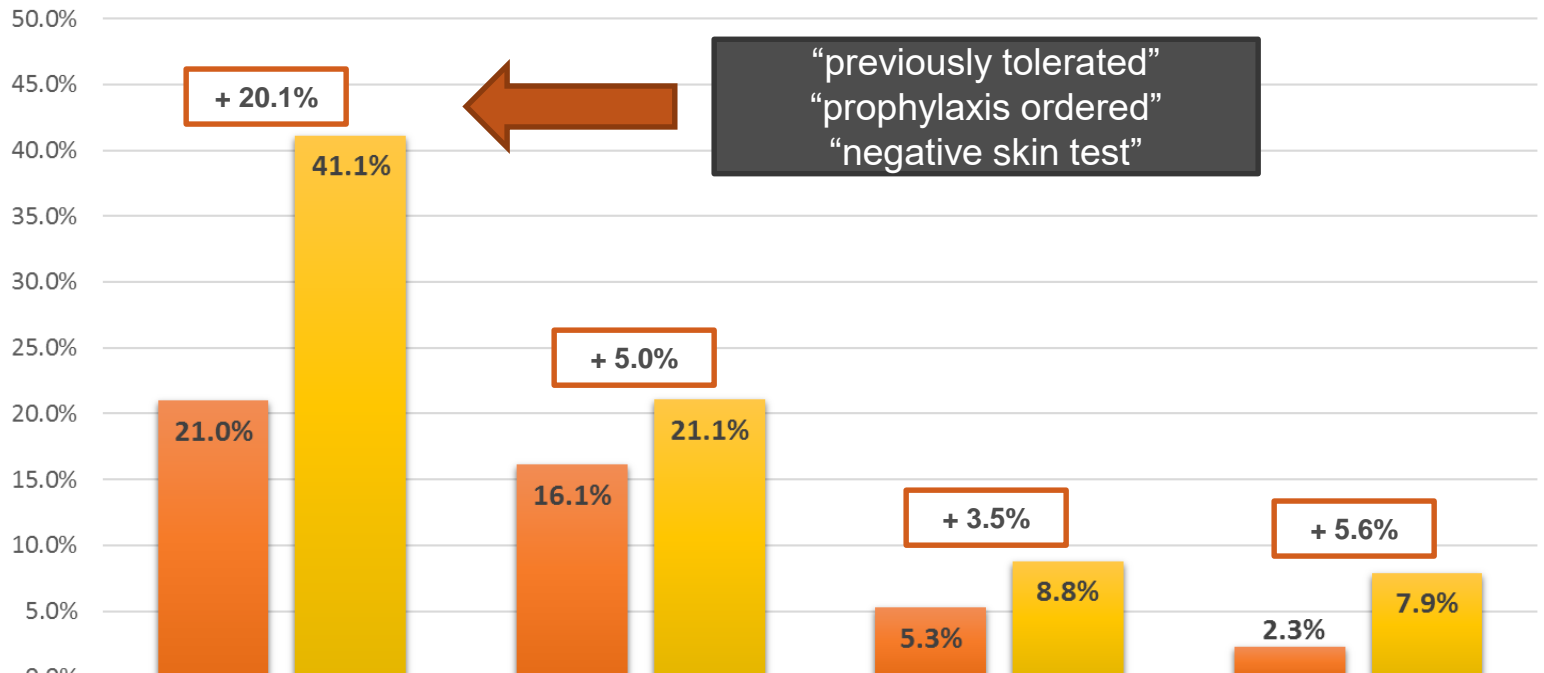
Change in Alert Saliency Rate by Alert Type



Pre-Intervention	206,004	647,333	592,272	152,886	Total # of alerts
Post-Intervention	299,239	870,665	1,020,383	150,774	

Results – Secondary Outcome

Change in Alert Saliency Rate by Alert Type



“previously tolerated”
 “prophylaxis ordered”
 “negative skin test”

■ Pre-Intervention
 ■ Post-Intervention

Drug-Allergy	206,004	647,333	592,272	152,886
Duplicate Therapy	299,239	870,665	1,020,383	150,774

Total #
of alerts

Results – Secondary Outcome

Utilization of Override Response Options

Pre-Intervention	Response Utilization		Post-Intervention
Benefit outweighs risk	72.92%	85.40%	Benefit outweighs risk
Alert inappropriate	4.48%	6.54%	Alert inappropriate
---	---	4.91%	Previously tolerated*
---	---	0.90%	Dose adjusted*
Not clinically significant	12.72%	0.75%	Not clinically significant
---	---	0.47%	Other intervention
---	---	0.31%	Provider contacted*
---	---	0.12%	Timing evaluated/adjusted*
---	---	0.12%	Multiple routes allowed*
---	---	0.11%	Prophylaxis ordered*
---	---	0.10%	Monitoring ordered*
---	---	0.09%	Confirmed OBGYN status*
---	---	0.03%	Negative skin test*
Defer to RPh	9.87%	---	----
Remove Order*	10.7%	10.8%	Remove Order*

* *Salient actions*

Results – Secondary Outcome

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Assessment
 Users simply pick the first option
 and/or
 Most often the most clinically
 relevant response

* *Salient actions*

Results – Secondary Outcome

Utilization of Override Response Options

Pre-Intervention		Response Utilization		Post-Intervention	
Buttons	Benefit outweighs risk	72.92%	85.40%	Benefit outweighs risk	Buttons
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---	---	0.12%	Timing evaluated/adjusted*
Assessment	---	0.12%	Multiple routes allowed*
Buttons more likely to be utilized than drop-down options	---	0.11%	Prophylaxis ordered*
---	---	0.10%	Monitoring ordered*
---	---	0.09%	Confirmed OBGYN status*
---	---	0.03%	Negative skin test*
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* Salient actions

Results – Secondary Outcome

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Validates that the increase in saliency is likely due to utilization of **new** response options

* *Salient actions*

Results

Summary

- Alert saliency increased following the response reconfiguration
- Of the new response options, “previously tolerated” was the most commonly utilized
 - Available as a button
- Buttons were more likely to be utilized than the drop-down menu

Limitations

Clinical correspondence of response selection to the alert type was not assessed

- Users may not always pick the reason they feel is most accurate
 - **Wright A, et al.** Users selected responses that were not relevant to the alert
- A low rate of site-specific incidence could provide insight and validate the likelihood that salient behaviors occurred

Limitations

A single user action can be attributed to a list of presented alerts

- Decreases the ability to capture the clinical thought process on each individual alert
- Limits a more robust data assessment

Future Directions

Continue to assess free-text comments

- Found highly informative in previous literature
 - **Aaron S, et al.** Comments provided insight on salient behaviors that were not captured by other methods
- Comments that were entered in correlation to the “other intervention” response selection may highlight a need for a new or modified alert response option

Future Directions

Survey user experience related to their engagement with the system interface

- To determine factors that may have influenced option selection
 - Number of override options
 - Buttons vs drop-down lists
- To clarify intended vs perceived meanings of response options
- To create user buy-in

Conclusion

Carefully designed alert response options

- Improves our ability to capture alert-user engagement
- May influence salient behaviors
- Provides insights on how to improve the alert management system in a targeted manner

Acknowledgments

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- Sarah Ferrell, PharmD
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- Aaron Daseler, PharmD, BCCCP

References

- Dexheimer JW, Kirkendall ES, Kouril M, et al. The effects of medication alerts on prescriber response in a pediatric hospital. *Appl Clin Inform.* 2017;8:491-501.
- Straichman YZ, Kurnik D, Matok I, et al. Prescriber response to computerized drug alerts for electronic prescriptions among hospitalized patients. *Int J Med Inform.* 2017;107:70-75.
- Payne TH, Hines LE, Chan RC, et al. Recommendations to improve the usability of drug-drug interaction clinical support alerts. *J Am Med Inform Assoc.* 2015;22:1243-1250.
- Kane-Gill SL, O'Connor MF, Rothschild JM, et al. Technologic distractions (part 1): summary of approaches to manage alert quantity with intent to reduce alert fatigue and suggestion for alert fatigue metrics. *Crit Care Med.* 2017;45:1481–1488.
- Wright A, McEvoy DS, Aaron S, et al. Structured override reasons for drug-drug interaction alerts in electronic health records. *J Am Med Inform Assoc.* 2019;26(10):934-942.
- Grizzle AJ, Mahmood MH, Ko Y, et al. Reasons provided by prescribers when overriding drug-drug interaction alerts. *Am J Manag Care.* 2007;13(10):537-578.
- Dekarse BM, Zimmerman CR, Chang R, Grant PJ, Chaffee BW. Increased appropriateness of customized alert acknowledgment reasons for overridden medication alerts in a computerized provider order entry system. *Int J Med Inform.* 2015;84:1085-1093.
- Aaron S, McEvoy DS, Ray S, Hickman T-TT, Wright A. Cranky comments: detecting clinical decision support malfunctions through free-text override reasons. *J Am Med Inform Assoc.* 2019; 26(1):37–43.

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