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# Optimization of drug-drug interaction alerts in an effort to reduce pharmacist alert fatigue in a hospital system

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# Disclosure Statement



- These individuals do not have anything to disclose concerning possible financial or personal relationships with commercial entities (or their competitors) that may be referenced in this presentation:
  - Jose Ojeda, B.S., Pharm.D.
  - Kristina Lee, Pharm.D., BCPS
  - Claudia Chang, Pharm.D., BCPS
  - Frances Ordieres-Gonzalez, Pharm.D.
  - Aman Rai, Pharm.D.



# Presentation Objective



- Assess the impact of drug-drug interaction alerts on pharmacists during order verification



# Drug-Drug Interactions



- A drug-drug interaction (DDI) occurs when one medication affects either the pharmacokinetics or pharmacodynamics of another medication
- These interactions can modify the therapeutic efficacy of a medication or increase potential risks
- DDIs can result in preventable adverse drug events (ADEs), which can cause harm to patients



# Clinical Decision Support



- A clinical decision support (CDS) system is a health information technology program that assists with clinical decision-making tasks
- CDS systems are capable of reducing the frequency of preventable ADEs
- Studies have found that only around 10% of the alerts fired by CDS systems are applicable in all the circumstances they fire
- Despite their benefits, medication-related alerts are often ignored and have high override rates



# Alert Fatigue



- Alert fatigue occurs when both important and non-important alerts are ignored because of the mental exhaustion and time required to look through too many alerts
- Such nuisance alerts interrupt workflow and distract from patient care, leading to the routine override of alerts
- There is a lack of evidence when it comes to deciding which alerts should be removed and which should be kept as part of the CDS system
- The decision to manage these alerts is usually institution-specific



# Setting



## Baptist Health South Florida (BHSF) system-wide initiative

- Baptist Hospital of Miami
- Doctors Hospital
- Corporate Enterprise
- Fishermen's Hospital
- Homestead Hospital
- Miami Cancer Institute
- Mariners Hospital
- South Miami Hospital
- West Kendall Baptist Hospital



South Miami Hospital

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# Study Objectives



## **Primary objective:**

- Identify common DDI alerts that are consistently being overridden by pharmacists

## **Secondary objectives:**

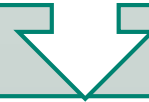
- Decrease the quantity of clinically insignificant DDI alerts firing to pharmacists
- Evaluate alert fatigue experienced by pharmacists during order entry/verification



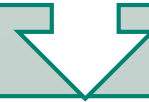
# Methodology



Lights On Network<sup>®</sup> was used to identify the DDI alerts firing in November 2019



Using Excel, the list was filtered to include only “major” alerts being overridden at least 95% of the time



Top 50 alerts within this list were selected



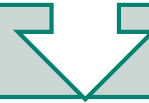
Top 50 alerts were reviewed by the Medication Safety and Clinical Optimization committees



# Methodology: Survey



A pre-implementation survey was sent to pharmacists in the first two weeks of February



Alerts were removed from Cerner on February 28<sup>th</sup>



Pharmacists were provided a few weeks to interact with the updates to the system



Post-implementation survey was sent the last two weeks of March



# Methodology: Survey



Please answer the next 4 questions about yourself -

1. How many years have you been practicing as a pharmacist at Baptist Health South Florida?

Less than a year  
 1-5 years  
 6-10 years  
 More than 10 years

2. Which entity within Baptist Health South Florida do you work for?

Corporate Enterprise  
 Baptist Hospital of Miami  
 South Miami Hospital  
 West Kendall Hospital  
 Miami Cancer Institute  
 Homestead Hospital  
 Doctors Hospital  
 Fishermen's Hospital  
 Mariners Hospital

3. What is your current position?

Clinical Pharmacist I or II  
 Clinical Specialist I or II  
 Clinical Coordinator or Clinical Manager  
 Other (please specify)

4. How many hours per week do you spend doing order entry/verification?

Less than 10 hours  
 10-20 hours  
 21-40 hours  
 More than 40 hours

Please answer the following 6 questions in regards to Drug-Drug Interaction (DDI) Alerts:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
5. The DDI alerts fired by Cerner provide clinically relevant information that is useful to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. The number of DDI alerts being fired by Cerner is just right	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I have the time during order entry/verification to review every DDI alert fired by Cerner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Baptist Health South Florida is currently trying to optimize drug-drug interaction alerts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I estimate that I override approximately ___% of DDI alerts:	<input type="radio"/> Less than 40% <input type="radio"/> Between 41-60% <input type="radio"/> Between 61-80% <input type="radio"/> More than 80%				

10. Do you have any other comments regarding DDI alerts? (Free response)

# Results: Top 50 DDI Alerts



## Alert Name

Lorazepam & morphine  
Hydromorphone & morphine  
Hydromorphone & oxycodone-acetaminophen  
Morphine & oxycodone-acetaminophen  
Haloperidol & prochlorperazine  
Ondansetron & tramadol  
Fentanyl & ondansetron  
Fentanyl & hydromorphone  
Hydromorphone & oxycodone  
Morphine & temazepam  
Morphine & oxycodone  
Aspirin & enoxaparin  
Diltiazem & metoprolol  
meperidine & ondansetron  
Hydromorphone & tramadol  
Enoxaparin & ketorolac  
Hydromorphone & lorazepam

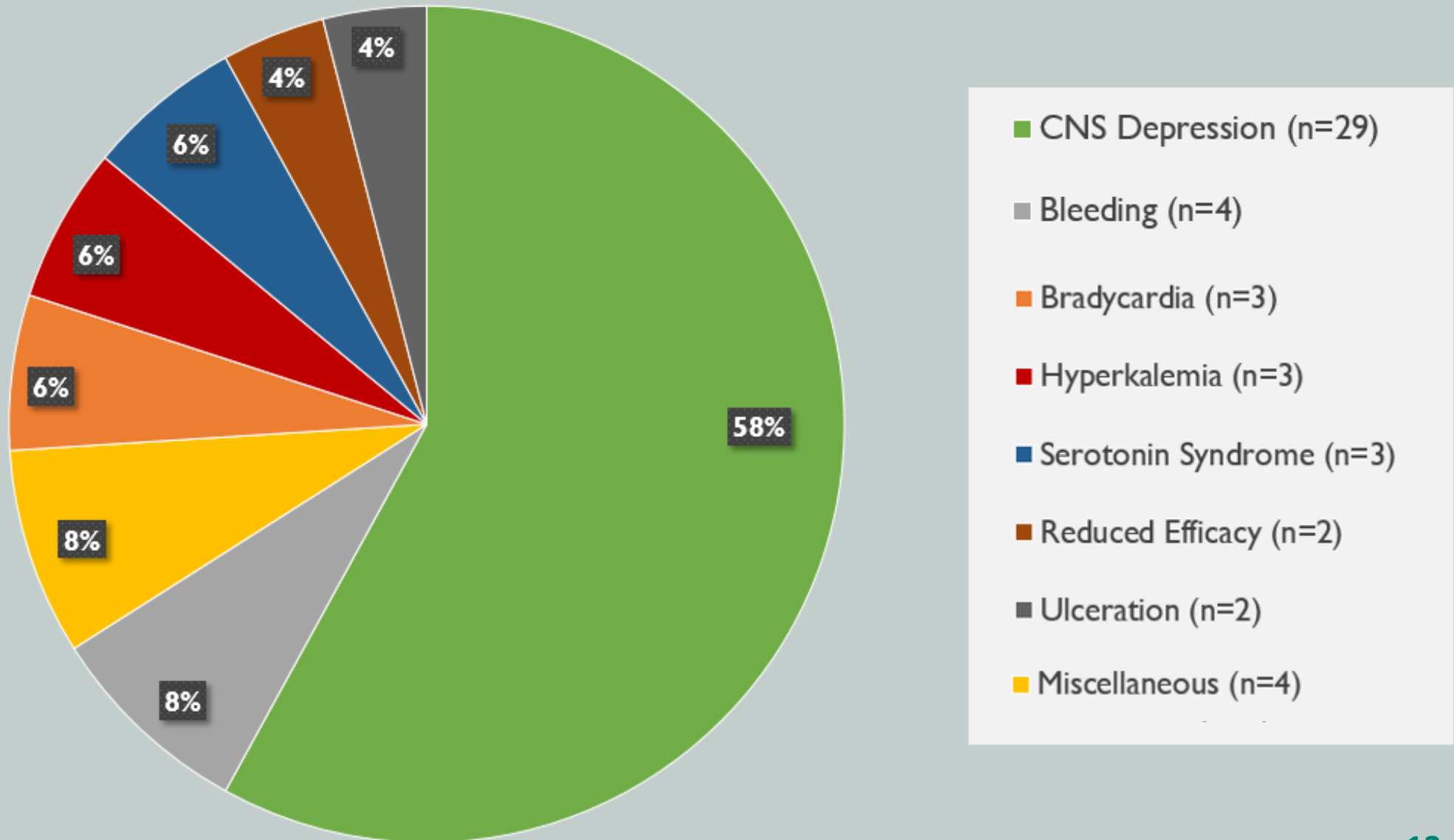
## Alert Name

Morphine & tramadol  
Fentanyl & morphine  
Hydromorphone & meperidine  
Hydromorphone & temazepam  
Diphenhydramine & potassium chloride  
Heparin & ketorolac  
Fentanyl & oxycodone-acetaminophen  
Hydromorphone & zolpidem  
Meperidine & morphine  
Chlorpromazine & morphine  
Losartan & potassium chloride  
Alprazolam & morphine  
Oxycodone-acetaminophen & zolpidem  
Morphine & zolpidem  
Amiodarone & furosemide  
Oxycodone & tramadol  
Oxycodone-acetaminophen & temazepam

## Alert Name

Clopidogrel & enoxaparin  
Oxycodone & temazepam  
Potassium chloride & prochlorperazine  
Lisinopril & potassium chloride  
Carvedilol & ipratropium-albuterol  
Lorazepam & oxycodone-acetaminophen  
Clonidine & metoprolol  
Insulin lispro & levofloxacin  
Dexamethasone & oxycodone-acetaminophen  
Levofloxacin & methylprednisolone  
Enalapril & potassium chloride  
Alprazolam & hydromorphone  
Clonazepam & morphine  
Meperidine & oxycodone-acetaminophen  
Dexamethasone & oxycodone  
Fentanyl & meperidine

# Top 50 DDI by Type of Interaction



# DDI Alerts Removed



## Alert Name

Lorazepam & morphine

~~Hydromorphone & morphine~~

~~Hydromorphone & oxycodone-acetaminophen~~

~~Morphine & oxycodone-acetaminophen~~

Haloperidol & prochlorperazine

Ondansetron & tramadol

~~Fentanyl & ondansetron~~

~~Fentanyl & hydromorphone~~

~~Hydromorphone & oxycodone~~

Morphine & temazepam

~~Morphine & oxycodone~~

Aspirin & enoxaparin

Diltiazem & metoprolol

meperidine & ondansetron

~~Hydromorphone & tramadol~~

Enoxaparin & ketorolac

Hydromorphone & lorazepam

## Alert Name

~~Morphine & tramadol~~

~~Fentanyl & morphine~~

~~Hydromorphone & meperidine~~

Hydromorphone & temazepam

Diphenhydramine & potassium chloride

Heparin & ketorolac

~~Fentanyl & oxycodone-acetaminophen~~

Hydromorphone & zolpidem

~~Meperidine & morphine~~

Chlorpromazine & morphine

~~Losartan & potassium chloride~~

Alprazolam & morphine

Oxycodone-acetaminophen & zolpidem

Morphine & zolpidem

~~Amiodarone & furosemide~~

~~Oxycodone & tramadol~~

Oxycodone-acetaminophen & temazepam

## Alert Name

Clopidogrel & enoxaparin

Oxycodone & temazepam

Potassium chloride & prochlorperazine

~~Lisinopril & potassium chloride~~

Carvedilol & ipratropium-albuterol

Lorazepam & oxycodone-acetaminophen

Clonidine & metoprolol

Insulin lispro & levofloxacin

~~Dexamethasone & oxycodone-acetaminophen~~

~~Levofloxacin & methylprednisolone~~

~~Enalapril & potassium chloride~~

Alprazolam & hydromorphone

Clonazepam & morphine




~~Meperidine & oxycodone-acetaminophen~~

~~Dexamethasone & oxycodone~~

~~Fentanyl & meperidine~~

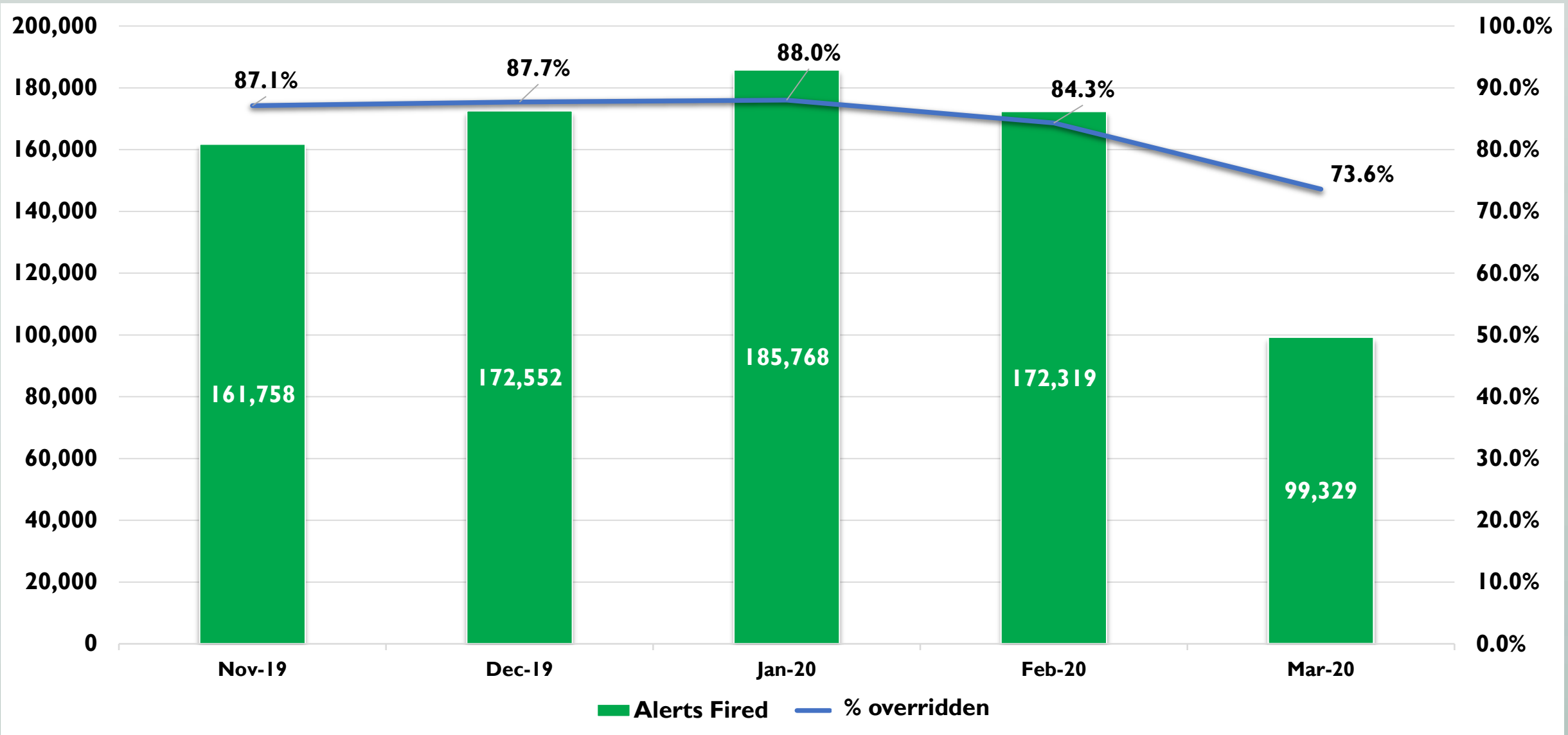
Total Alerts Removed = 23/50

# Results: DDI Alerts (November vs March)

DDI Alerts	November 2019	March 2020	Difference
<b>Total number of alerts firing</b>	161,758	99,329	 39%
<ul style="list-style-type: none"><li>Alerts being overridden</li></ul>	140,948 (87%)	73,095 (74%)	 13%
<ul style="list-style-type: none"><li>Top 50 DDI alerts accounted for</li></ul>	73,873 (46%)	23,182 (23%)	 23%



# DDI Alerts Fired and Overridden by Pharmacists 🍍







# Survey Demographics



Characteristic	Pre-implementation (n=94)	Post-implementation (n=55)
<b>BHSF entity:</b>		
• Baptist Hospital of Miami	30 (32%)	19 (35%)
• South Miami Hospital	26 (28%)	18 (33%)
• West Kendall Baptist Hospital	15 (16%)	6 (11%)
• Homestead Hospital	11 (12%)	4 (7%)
• Miami Cancer Institute	7 (7%)	4 (7%)
• Corporate Enterprise	3 (3%)	3 (5%)
• Doctors Hospital	2 (2%)	1 (2%)
<b>Amount of years working for BHSF:</b>		
• Less than a year	30 (32%)	13 (24%)
• 1 to 5 years	15 (17%)	22 (41%)
• 6 to 10 years	17 (18%)	6 (11%)
• More than 10 years	31 (33%)	13 (24%)
<b>Current position:</b>		
• Clinical Pharmacist I or II	54 (57%)	31 (56%)
• Clinical Specialist I or II	16 (18%)	11 (20%)
• Clinical Coordinator or Clinical Manager	5 (5%)	2 (4%)
• Other	19 (20%)	11 (20%)
<b>Amount of hours per week doing order entry:</b>		
• Less than 10 hours	21 (22%)	15 (28%)
• Between 10 to 20 hours	26 (28%)	10 (19%)
• Between 21 to 40 hours	36 (38%)	25 (46%)
• More than 40 hours	11 (12%)	4 (7%)

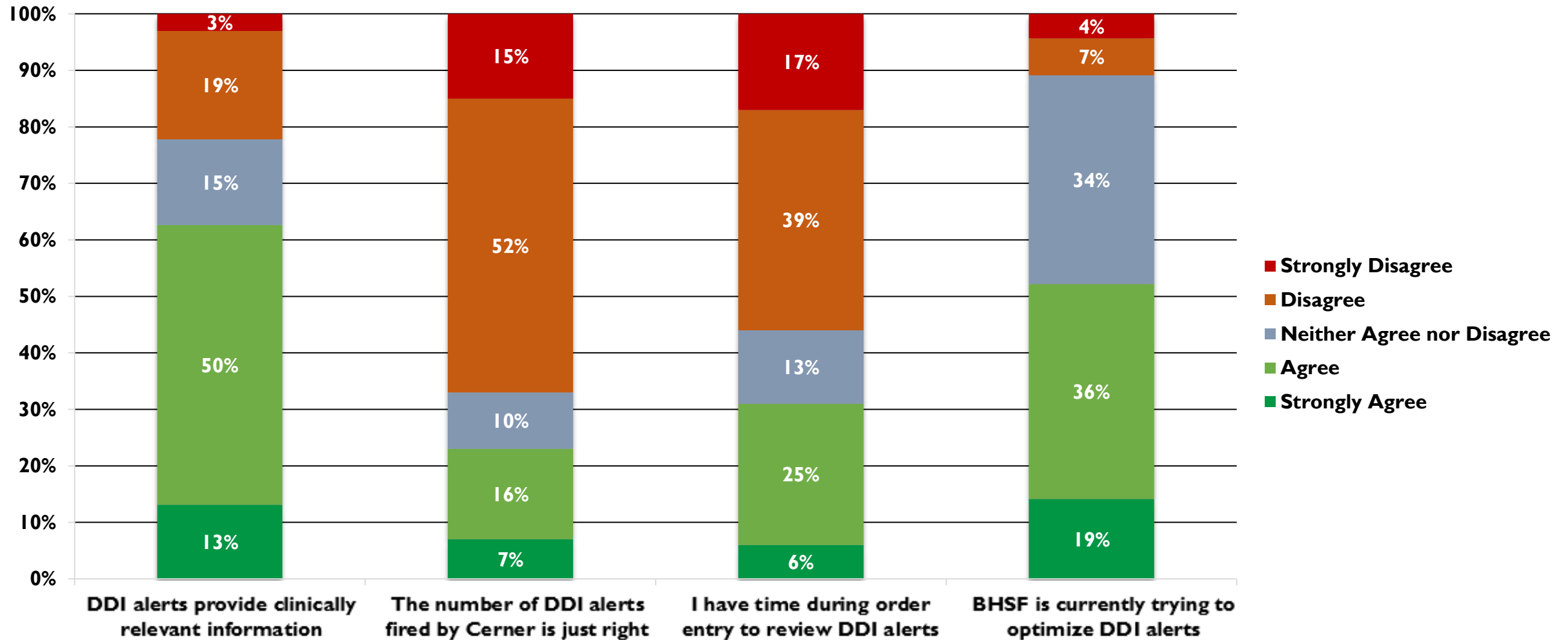
# Pharmacist Survey



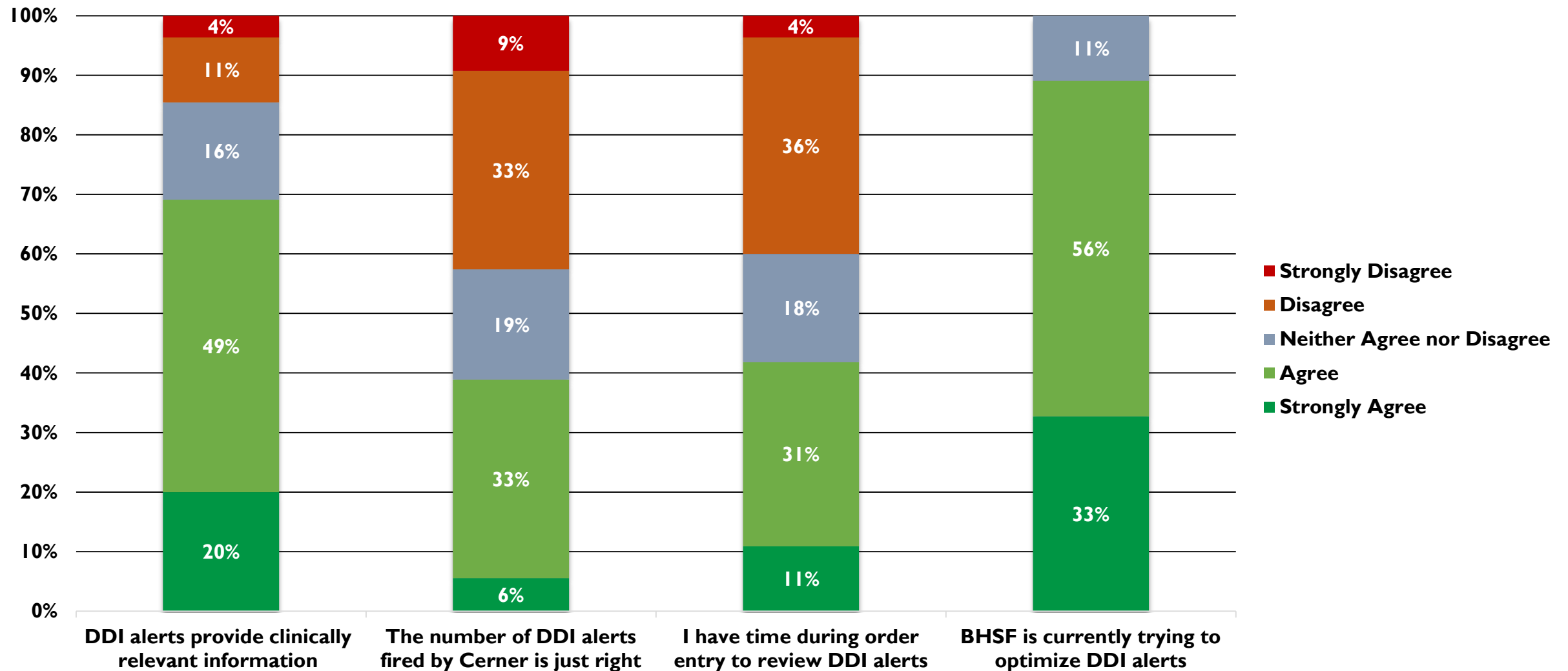
Survey Question	Mean $\pm$ S.D. Pre-Implementation Likert Scale*	Mean $\pm$ S.D. Post-Implementation Likert Scale*
The DDI alerts fired by Cerner provide clinically relevant information that is useful to me	3.50 $\pm$ 1.0	 3.70 $\pm$ 1.0
The number of DDI alerts being fired by Cerner is just right	2.50 $\pm$ 1.2	 3.00 $\pm$ 1.1
I have the time during order entry/verification to review every DDI alert fired by Cerner	2.65 $\pm$ 1.2	 2.80 $\pm$ 1.1
BHSF is currently trying to optimize DDI alerts	3.60 $\pm$ 1.0	 4.20 $\pm$ 0.6

\*Likert scale (1-5): 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

# Pre-Implementation Survey



# Post-Implementation Survey



# Pharmacist Survey



Pre-Implementation

I estimate that I override approximately ____% of DDI alerts:	Survey Responses	Percentage
Less than 40%	17	18%
Between 41-60%	18	19%
Between 61-80%	41	44%
More than 80%	18	19%
<b>Grand Total</b>	<b>94</b>	<b>100%</b>

63%

Post-Implementation

I estimate that I override approximately ____% of DDI alerts:	Survey Responses	Percentage
Less than 40%	7	13%
Between 41-60%	15	27%
Between 61-80%	24	44%
More than 80%	9	16%
<b>Grand Total</b>	<b>55</b>	<b>100%</b>

60%

# Discussion



- There was a decrease in both the number of DDI alerts fired and percentage of alerts being overridden in the month of March
- After implementation, more pharmacists agreed or strongly agreed that the number of DDI alerts being fired by Cerner is just right (23% pre vs 39% post)
- Another area with demonstrated improvement is the perception that our system is working to optimize drug-drug interaction alerts (55% pre vs 89% post)
- Even though the percentage of alerts overridden decreased by 13% after implementation, pharmacist perception regarding the amount of alerts being overridden did not drastically change



# Conclusion



- More needs to be done to improve alert fatigue in our system
- Not every alert with a high override should be removed
- Optimizing the alerts firing in a healthcare system should be an ongoing process





# Study Limitations



- Short time period
- Due to COVID-19, institutions had a lower census in March
- Possibly biased results in the post-implementation survey
- Limited amount of responses for post-implementation survey
- Additional DDI alerts were turned off in certain PowerPlans



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# Assessment Question



**Which of the following is not true regarding drug-drug interaction alerts?**

- A. Only around 10% of DDI alerts are applicable in all the instances they fire
- B. Alert fatigue is a safety concern because it can lead to important alerts being ignored
- C. A continuous process to evaluate DDI alerts is the best practice to reduce alert fatigue
- D. Alert fatigue is only a concern for physicians



# Assessment Answer



**Which of the following is not true regarding drug-drug interaction alerts?**

- A. Only around 10% of DDI alerts are applicable in all the instances they fire
- B. Alert fatigue is a safety concern because it can lead to important alerts being ignored
- C. A continuous process to evaluate DDI alerts is the best practice to reduce alert fatigue
- D. Alert fatigue is only a concern for physicians**



# Questions?



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# References



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