National Infusion Collaborative Clinical Meeting

Fall Clinical Meeting
September 25, 2024

Bainbridge Health

ashp News CENTER

ASHP

ASHP Joins the National Infusion Collaborative to Advance Safety and Stewardship of Intravenous Medication Use

Published: April 15, 2024

Meeting Logistics and Introductions

Jeff Hurren, PharmD, BCPS
Medication Safety Officer
Michigan Medicine

Mary Ann Kliethermes, B.S., Pharm., Pharm.D., FAPhA, FCIOM
Director of Medication Safety and Quality
ASHP

Joanne Hatfield, PharmD, BCPS
Director - Clinical Solutions
Bainbridge Health

Sean O'Neill, PharmD
Chief Clinical Officer
Bainbridge Health

Navigating Zoom

Q&A Box and Chat Box: For any questions or comments throughout the presentation

Raise Hand: For the open mic discussion, please press "Raise Hand" if you wish to speak

Post-Meeting Survey: Following today's meeting, please let us know how we can improve going forward

Agenda

National Infusion Collaborative Infusion Trends

Joanne Hatfield, PharmD, BCPS
Director - Clinical Solutions
Bainbridge Health

Standardize 4 Safety Implementation

Jeff Hurren, PharmD, BCPS
Medication Safety Officer
Michigan Medicine

Standardize 4 Safety Updates and Outlook

Mary Ann Kliethermes, B.S., Pharm., Pharm.D., FAPhA, FCIOM
Director of Medication Safety and Quality
ASHP

Open Mic / Q&A

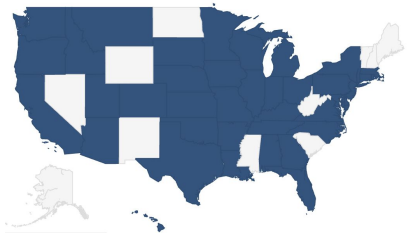
National Infusion Collaborative

Infusion Metric Trends

Joanne Hatfield, PharmD, BCPS
Director - Clinical Solutions
Bainbridge Health

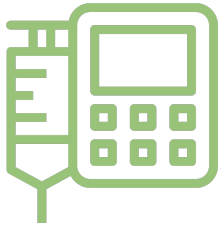
National Infusion Collaborative

6/1/24 - 8/31/24



>400
Hospitals

>40,000
Infusion Pumps



>10 million
Infusion Records

> 643,000
Alerts

National Infusion Collaborative

Key Performance Indicators

	Compliance	Alert Rate	Override Rate
6/1/24 – 8/31/24	87.9%	6.4%	66%

Standardize 4 Safety

Implementation

Jeff Hurren, PharmD, BCPS
Medication Safety Officer
Michigan Medicine

Michigan Medicine

Michigan Medicine is the medical arm of the University of Michigan
Ann Arbor, Michigan

- University Hospital
- CS Mott Children's Hospital
- Rogel Cancer Center
- Frankel Cardiovascular Center
- Kellogg Eye Center
- 162 clinics

- $1.86 billion in research 2023
- US News Best Hospital

“We are Better Together”

Medication Safety Team

- Scott Ciarkowski - Manager
- Courtney Doellner - Pediatrics
- Jeff Hurren - Adults
- Christina Seeley - Med Safety Tech

PHARMACY

Outline

- Process
- Progress
- Success
- Barriers

You may be ahead, behind, or right beside us! ☺️

Our Process

1. Determine current adherence
2. Prioritize meds to focus on
3. Assess options
4. Propose changes
   - Consult with Rx specialists
   - Involved Nursing & Prescribers PRN
   - Focus on Rx operations area managers
5. Work through barriers
6. Implement where possible

https://www.ntaskmanager.com/wp-content/uploads/2021/03/what-is-the-pdca-cycle-700x280.jpg

Standardize 4 Safety

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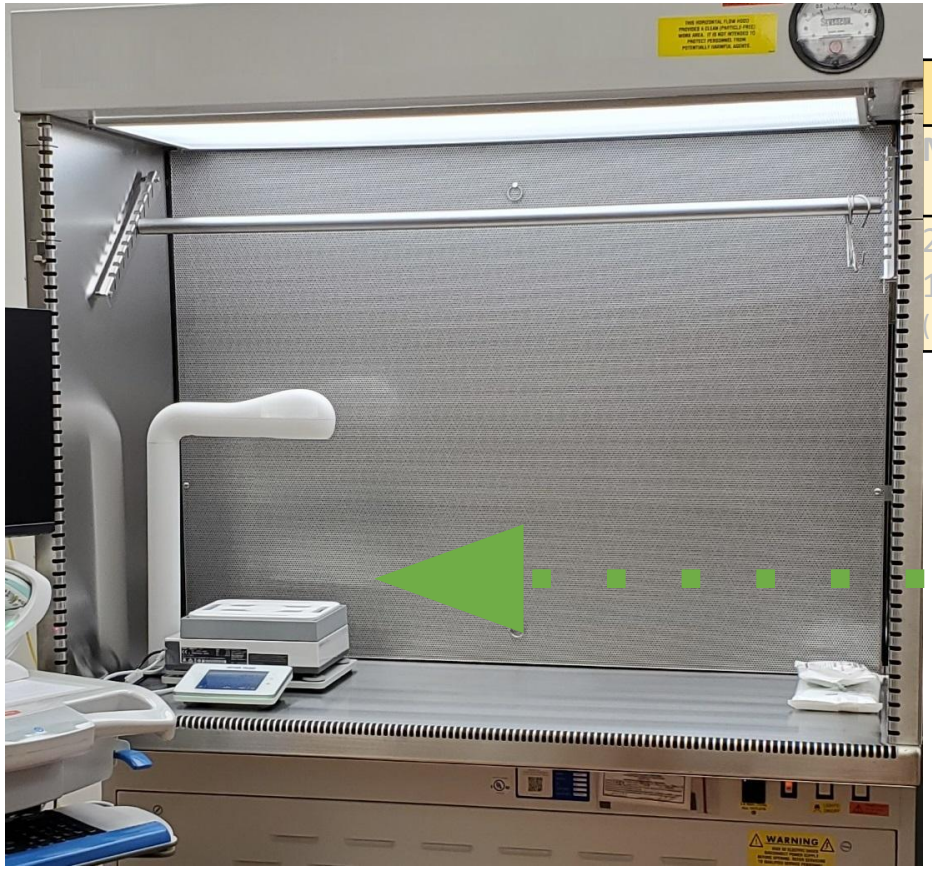
Process – Determine Adherence

	Concentrations (mg/mL)					Dosing Units		Other Considerations		
Drug	**S4S 1st**	**S4S 2nd**	**MM 1st**	**MM 2nd**	**MM 3rd**	**S4S**	**MM**	**Mfg available**	**503b available**	**Min gravimetric volume of 0.4mL?**
Furosemide	2	10	1	2.5	10	mg/kg/hr	mg/kg/hr	2 mg/mL: No 10 mg/mL: Yes (*undiluted from vial)	2 mg/mL: No 10 mg/mL: No	2 mg/mL: 0.8 mg 10 mg/mL: 4 mg

Standardize 4 Safety

PHARMACY

Process – Determine Adherence



Other Considerations		
Mfg available	503b available	Min gravimetric volume of 0.4mL?
2 mg/mL: No 10 mg/mL: Yes (*undiluted from via	2 mg/mL: No 10 mg/mL: No	2 mg/mL: 0.8 mg 10 mg/mL: 4 mg

Standardize 4 Safety

PHARMACY

Assessing Options – Dose-weight-rate calculator

Concentration (unit/mL)	Weight (kg)	Lowest Dose (unit/kg/hr)	Lowest Rate (mL/hr)	Highest Dose (unit/kg/hr)	Highest rate (mL/hr)	Syringe Size (mL)	Lowest Rate Duration (hrs)	Highest Rate Duration (hrs)
0.05	**0.4**	0.05	0.4	1	8	20	50.0	2.5
0.05	**1**	0.05	1	1	20	20	20.0	1.0
0.05	**2.5**	0.05	2.5	1	50	20	8.0	0.4
0.05	**3**	0.05	3	1	60	20	6.7	0.3
0.05	**4**	0.05	4	1	80	20	5.0	0.3
0.05	**5**	0.05	5	1	100	20	4.0	0.2

Standardize 4 Safety

PHARMACY

Assessing Options – Dose-weight-rate calculator

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0.05	**2.5**	0.05	2.5	1	50	20	8.0	0.4
0.05	**3**	0.05	3	1	60	20	6.7	0.3
0.05	**4**	0.05	4	1	80	20	5.0	0.3
0.05	**5**	0.05	5	1	100	20	4.0	0.2

Standardize 4 Safety

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Assessing Options – Dose-weight-rate calculator

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0.05	**4**	0.05	4	1	80	20	5.0	0.3
0.05	**5**	0.05	5	1	100	20	4.0	0.2

Dose range

Rate range

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Syringe volume

Duration range

PHARMACY

Assessing Options – Dose-weight-rate calculator

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Standardize 4 Safety

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Example: EPINEPHrine

PEDIATRIC CONTINUOUS INFUSION STANDARDS

Standardize 4 Safety

Drug	Concentration Standards	Dosing units	Commercially available	Concentration vs. unit mismatch	References
EPINEPHrine[1]	1. 10 mcg/mL[2] 2. 20 mcg/mL 3. 40 mcg/mL	mcg/kg/min	No	Possibly, depending on pharmacy or outsourcing facility label	1. Hook R, Neault A, Scharrer, et.al. Chemical stability of epinephrine 10 mcg/mL diluted in 0.9% sodium chloride and stored in polypropylene syringes at 4 degrees and 25 degrees C. Int J Pharm Compd. 2023;27:347-351. 2a. Allwood MD. The stability of four catecholamines in 5% glucose infusions. *J Clin Pharm Ther*. 1991:16:337-40. 2b. VanMatre ET, Ho KC, Lyda C, et.al. Extended Stability of Epinephrine Hydrochloride Injection in Polyvinyl Chloride Bags Stared in Amber Ultraviolet Light-Blocking Bags. *Hospital Pharmacy*. 2017;52:570-573. 3a. Carr RR, Decarie D, EnsomMHH. Stability of Epinephrine at Standard Concentrations. *Can J Hosp Pharm*. 2014;67:197-202. 3b. Peddicord TE, Olsen KM, ZumBrunnen TL, et.al. Stability of high-concentration dopamine hydrochloride, norepinephrine bitartrate, epinephrine hydrochloride and nitroglycerin 5% dextrose injetion. *Am J Health-Syst Pharm*. 1997;54:1417-19.

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Example: EPINEPHrine

Concentration (mcg/mL)	Weight (kg)	Lowest Dose (mcg/kg/min)	Lowest Rate (mL/hr)	Highest Dose (mcg/kg/min)	Highest rate (mL/hr)	Syringe Size (mL)	Lowest Rate Duration (hrs)	Highest Rate Duration (hrs)
10	**0.3**	0.01	0.018	0.1	0.18	**30**	1,666.7	166.7
10	**1**	0.01	0.06	0.1	0.6	**30**	500.0	50.0
10	**9**	0.01	0.54	0.1	5.4	**30**	55.6	5.6
20	**10**	0.01	0.3	0.1	3	**50**	166.7	16.7
20	**50**	0.01	1.5	0.1	15	**50**	33.3	3.3
20	**51**	0.01	1.53	0.1	15.3	**250**	163.4	16.3
20	**110**	0.01	3.3	0.1	33	**250**	75.8	7.6

Standardize 4 Safety

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Example: EPINEPHrine

Concentration (mcg/mL)	Weight (kg)	Lowest Dose (mcg/kg/min)	Lowest Rate (mL/hr)	Highest Dose (mcg/kg/min)	Highest rate (mL/hr)	Syringe Size (mL)	Lowest Rate Duration (hrs)	Highest Rate Duration (hrs)
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10	**1**	0.01	0.06	0.1	0.6	**30**	500.0	50.0
10	**9**	0.01	0.54	0.1	5.4	**30**	55.6	5.6
20	**10**	0.01	0.3	0.1	3	**50**	166.7	16.7
20	**50**	0.01	1.5	0.1	15	**50**	33.3	3.3
20	**51**	0.01	1.53	0.1	15.3	**250**	163.4	16.3
20	**110**	0.01	3.3	0.1	33	**250**	75.8	7.6

- Short durations: operational issues - refills & compounding load/risk
- Long durations: opportunity to reduce waste
  - Variable: our org line change frequency is minimum q96 hours

Standardize 4 Safety

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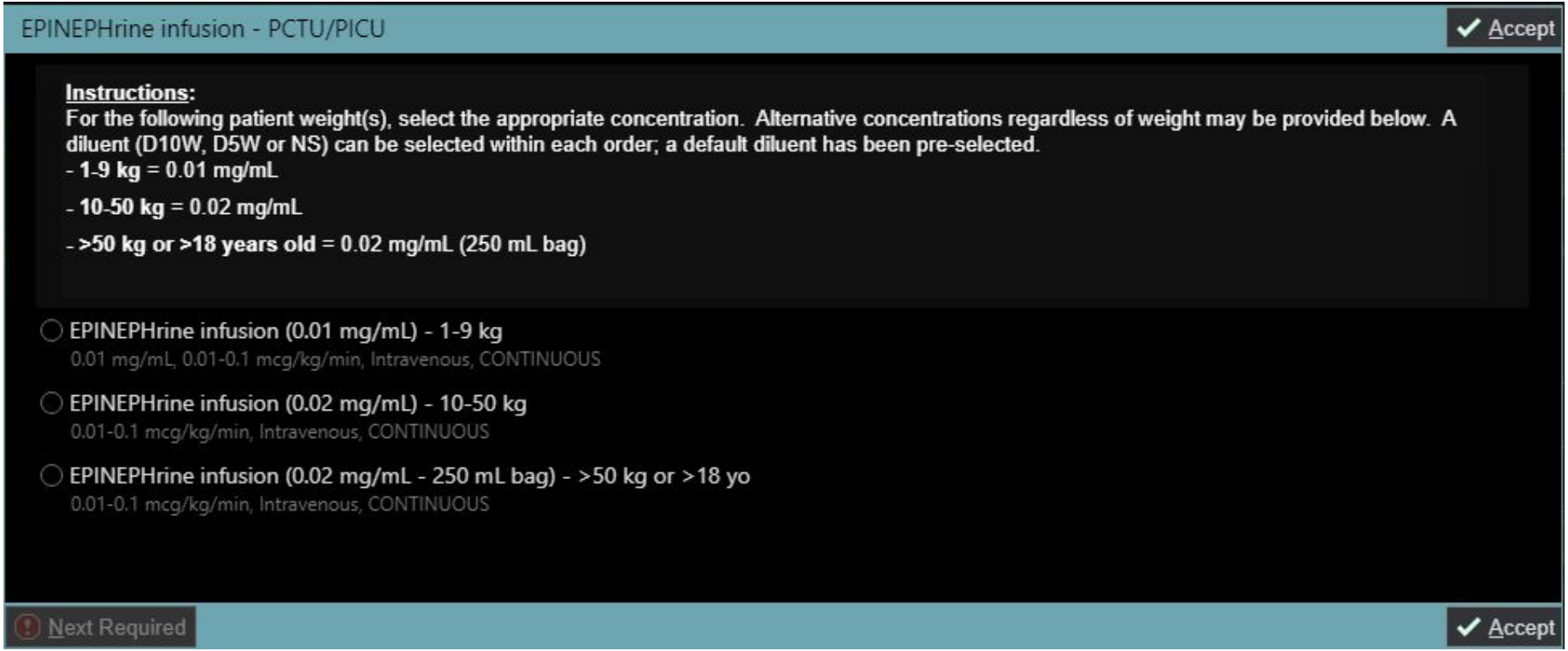

Standardize Safety

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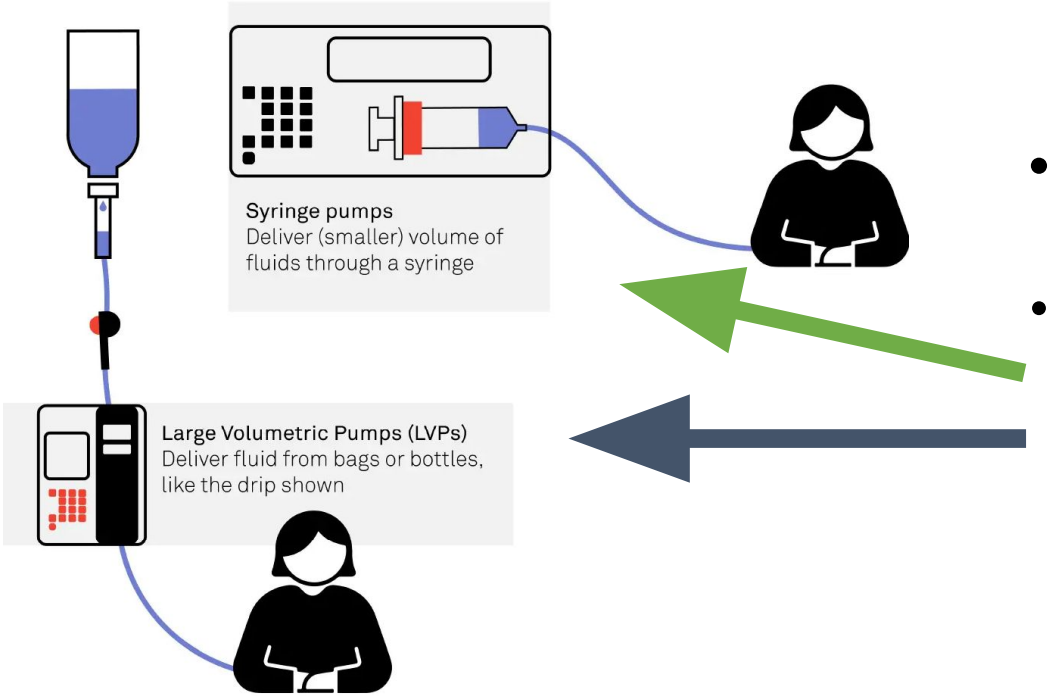
Additional Risk Reduction Strategies



- **<u>Segregate concentration by infusion modality</u>**
- Example: Ketamine
  - **2** mg/mL on **syringe** pump
  - **10** mg/mL on **large volume** pump

https://assets.team-consulting.com/wp-content/uploads/2021/06/24125030/Artboard-2final.jpg

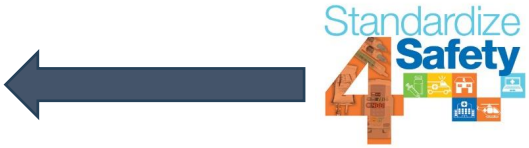
Additional Risk Reduction Strategies

- **<u>Standardize concentration across syringe size</u>**
- Align standard presentations & pump library:
  pump prompts assist correct programming
- Internal Data:
  31% reduction in wrong concentration selection (non-interoperability)

				
Size ⇨	**20 mL**	**30 mL**	**50 mL**	**Bag** (Volumes > 50 mL)
Drug ⇩	**⇩ Concentration ⇩**			
DOBUTamine	**0.5 mg/mL**	**1 mg/mL**	**4 mg/mL**	**4 mg/mL** (250 mL)
DOPamine	**1.6 mg/mL**	**0.5 mg/mL**	**3.2 mg/mL**	**1.6 mg/mL** (250mL) **3.2 mg/mL** (250mL)
EPINEPHrine	**0.005 mg/mL** * NEWBORN ONLY *	**0.01 mg/mL**	**0.02 mg/mL**	**0.02 mg/mL** (250 mL)
Insulin	**0.2 unit/mL**	-	**1 unit/mL**	**1 unit/mL** (100 mL)
Ketamine	**2 mg/mL**	-	**2 mg/mL**	**10 mg/mL** (100 or 250 mL)
Midazolam	**0.1 mg/mL**	**0.5 mg/mL**	**1 mg/mL**	**1 mg/mL** (100 mL)
Milrinone	**0.2 mg/mL**	-	-	**0.2 mg/mL** (100 mL) **0.5 mg/mL**** (250 mL)
Morphine	**0.05 mg/mL**	**0.2 mg/mL**	**1 mg/mL**	**1 mg/mL** (100 mL)

Challenges - Ketamine

- Ketamine dosing units:
  - 0.05 to 0.25 **mg**/kg/**hour**
  - 0.8 to 4.2 **mcg**/kg/**minute**



- Anesthesia concern:
  - Decimal place-related dosing errors (e.g., 0.05)
  - Concerns alleviated:
    - Phased implementation - Adult ICUs → Adult ORs → Peds ICUs → Peds ORs
    - Default initial dose in pump
- Similar concern across multiple meds

Challenges - Naloxone

- Naloxone dosing units:
  1. 16 mcg/mL
  2. 40 mcg/mL
- We went from 4 concentrations to S4S Standard 2
- Build complexity
  - Mcg/kg/hour
    - Pediatrics (0.4 mg/25 mL)
    - Pruritus / hyperalgesia (1.6 mg/100 mL)
  - Mg/hour
    - Opioid reversal (10 mg/250 mL)
    - Clonidine overdose (20 mg/500 mL)

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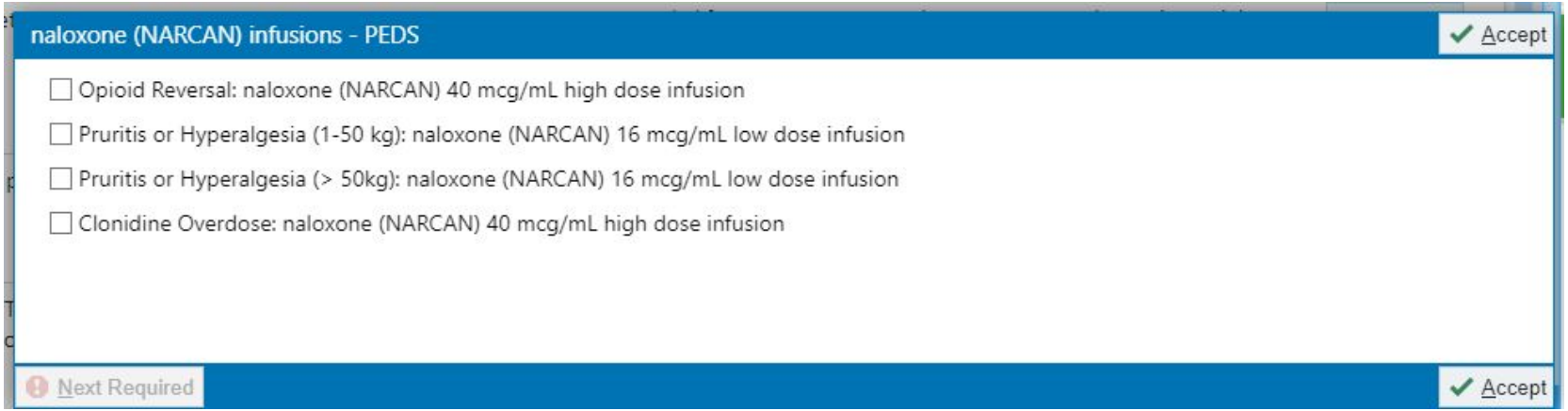
Challenges - Naloxone



Adult and peds mostly shared, except syringe infusions

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Challenges - Insulin

- Insulin concentrations:
  1. 0.2 units/mL
  2. 1 units/mL
- Scope increase:
  - Calcium channel blocker / beta-blocker overdose
    Protocols developed by Michigan Poison Control Center
  - Pulmonary compromise due to fluid overload at lower concentrations
- Added another concentration = 16 units/mL*

*https://pubmed.ncbi.nlm.nih.gov/27432286/

Challenges - Vasopressin

- Vasopressin volumetric rates:
  1. 0.05 units/mL
  2. 0.2 units/mL
  3. 1 units/mL
- Nursing concern for neonates (0.04 units/mL):
  - More dilute due to minimum pump rate 0.1 mL/hr
    - Continuous infusion dispensed syringe sizes 20-50 mL
      - Long-standing org convention to avoid IV push errors

Standardize Safety 4

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Challenges - Amiodarone

- Amiodarone concentrations:
  1. 1.8 mg/mL
- Multiple considerations
  - Commercially available 150 mg/ 100 mL (1.5 mg/mL)
    - Aligns presentation with typical adult loading dose
    - Smaller size supports more pre-deployment in ADCs
  - Internal data: ↑ venous injury at concentrations over 1.5 mg/mL

*https://pubmed.ncbi.nlm.nih.gov/27432286/

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Challenges – Premature Infants

- Success creates new challenges!
- Extremely Low-Birth Weight (ELBW) newborns
  - Definition: under 1,000 grams (2 lbs, 3 oz)
  - Some 300 grams in our org
- Multiple medications affected
  - “Seat of our pants” standards
  - Vasopressors and insulin most commonly affected

Standardize 4 Safety

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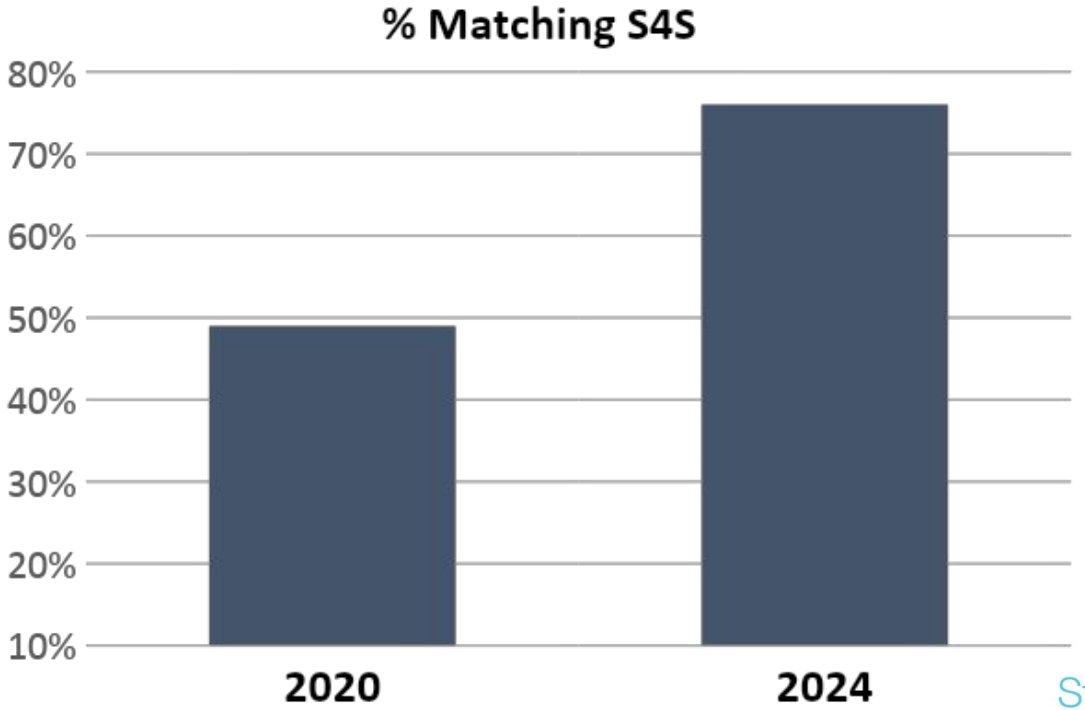
Progress to Date



Standardize 4 Safety

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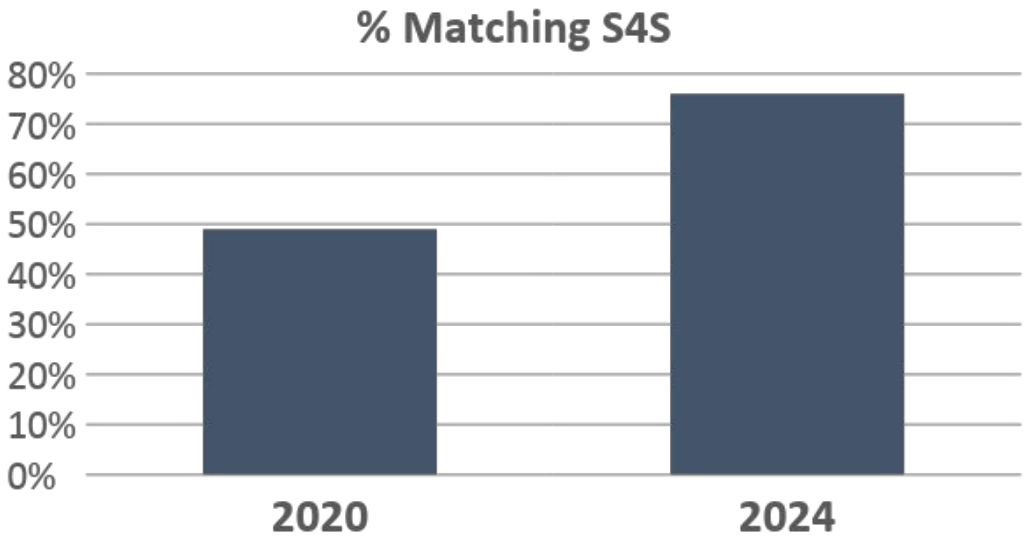
Progress to Date

Other S4S work ongoing:

- Intermittents
- Orals
- PCA



Standardize Safety

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Progress to Date

Impressions:

- Change is hard
- Patience is harder
- Persistence is key
- Work on 1-2 at a time (unless you can do better!)
- Progress easier when a mfg product available
  - “Chicken or egg – which came first?”

Standardize Safety

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Standardize 4 Safety

Updates and Future Outlook

Mary Ann Kliethermes, B.S., Pharm., Pharm.D., FAPhA, FCIOM
Director of Medication Safety and Quality
ASHP

Standardize 4 Safety: Maintaining the Standards

Mary Ann Kliethermes, BS, PharmD, FAPhA, FCIOM
Director of Medication Safety and Quality
American Society of Health System Pharmacist

ashp

Standardize 4 Safety

The Standardize 4 Safety Journey

2018 Adult Continuous Infusion

2018 Oral Compounded Liquids

2020 Pediatric Continuous Infusion

2022 PCA/Epidural Continuous Infusion

2025 Intermittent Infusion

Coming Oral Liquid Rounding

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Maintaining the Standards

Advisory Committees

- Adult and pediatric
- Established in 2023
- Composed of members from the Expert Panels renewable 2- or 3-year terms

Meet quarterly

- August, November, February, May
- Updates the 15th of the month following the meeting (Date posted on table)

Charge

- Review implementation and update the S4S concentrations
- Address submitted public questions, comments and recommendations
- Make recommendations to update S4S Standards as appropriate and needed
- Assure the standards reflect current evidence and optimal healthcare practice
- Participate in dissemination and implementation strategies

Standardized 4 Safety Website

www.ashp.org/standardize4safey

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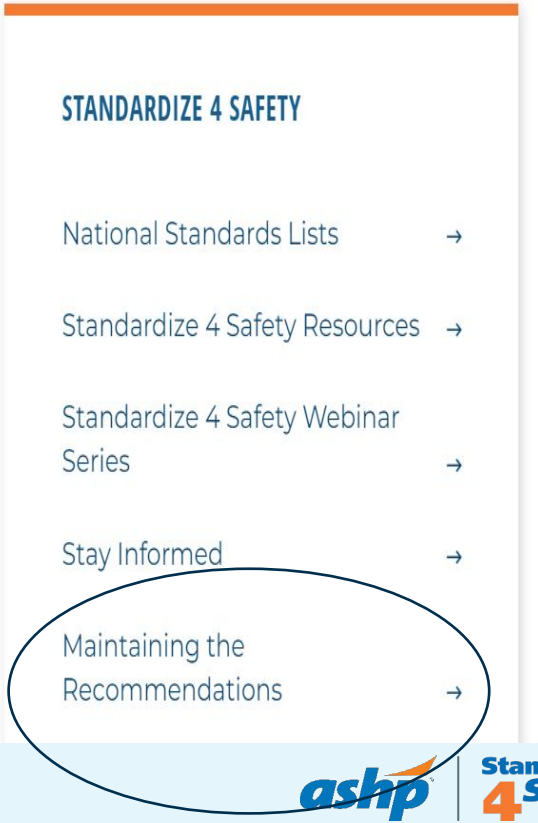
Scroll down on face page to middle section

Standardize 4 Safety

ASHP received funding from the Food and Drug Administration's (FDA) Safe Use Initiative to develop and implement national standardized concentrations for intravenous (IV) and oral liquid medications.

Standardize 4 Safety is the first national, interprofessional effort to standardize medication concentrations to reduce errors, especially during transitions of care. It establishes standardized concentrations for intravenous and oral liquid medications for patients of all ages in settings ranging from hospital to home.

In collaboration with pharmacist, nurse, and physician experts from across the care continuum, ASHP has created several standardized concentration lists. Hospitals and health systems are encouraged to adopt these standardized concentration lists to improve patient safety and decrease medication errors. Additional lists are coming soon. Register to receive Standardize 4 Safety Updates from ASHP.



Maintenance of Standards Information

- **Maintaining the Recommendations**

  Explains the process in greater detail

- **Goal**
  - **Discusses the purpose of the advisory committees**
- **Standardize 4 Safety Advisory Panels: Adult and Pediatric**
  - **Describe the panel composition, role and terms of service**
- **Recommendations for Standardize 4 Safety Lists**
  - Any advisory panel member or public stakeholder may make a recommendation to update, add or delete medications, or other changes to the existing standards. The requests may be submitted by completing this online form.

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On Line Form – Fields to complete

- Name, Title, E-mail
- Profession
- Organization name and location
- Select the standard you wish to comment on
- Describe the recommendation you wish to make
  - Add/remove a medication
  - Add/remove/replace a concentration for an existing medication
- What site of care is this recommendations intended useThe medication, its concentration, and rationale for the request
- Stability information for any new medication or concentration

In Summary Standardize 4 Safety

Improve safety of patients who receive these medications

- Less variability
- Safer transitions
- Incentivize pre-made products

Attain a national standard where the standards concentrations are ordered, compounded and administered majority of the time.

Questions?

Navigating Zoom

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