Caring Wisely Program

PROPOSAL TITLE: Medication Error Reduction

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EXECUTIVE SPONSOR(S): Kelly Puou and Peter Oishi

ABSTRACT -

Medication and fluid errors contribute the highest volume of events submitted to the incident reporting system at Benioff Children's Hospitals, impacting length of stay, and length of mechanical ventilation and mortality. Benioff Children's Hospitals have integrated Medication Harm Reduction into the Quality and Safety Strategic plan, which aligns with and supports the Organizational goals to achieve zero harm. A cross-bay medication errors taskforce has convened to assess medication harm data and perform gap analysis. Two major Medication Harm reduction interventions are planned:

- Provider prescribing education and EHR support for high-risk medication prescribing.
- Optimization of and compliance to use of the ***icuMedical smart pump*** library, with pharmacy and nursing associated.

With both interventions, our aim is to reduce harm events in FY24 by 10% with projections for continued reductions beyond funding year from this foundation building initiative

TEAM –

Project leads: Mary Willoughby, Julie Nguyen
Pharmacy: Kimery Leong, Kathy Ghomeshi
QI and Patient Safety: Scout Hebinck
Nursing: Karen Jennings, Shannon Fitzpatrick
Physician Providers: Aurora Chin McAlister, Chris Vlasses, Michael Love, Lavinia Mihaila, Emily Moody

PROBLEM –

Children are 2.5 times more likely than adults to experience harm or death from a medication error. The total cost of looking after patients with medication-associated errors exceeds $40 billion each year, nationally. The literature states that in addition to the monetary cost, patients experience psychological and physical pain and suffering as a result of medication errors. Finally, a major consequence of medication errors is that it leads to decreased patient satisfaction and a growing lack of trust in the healthcare system. Prescribing errors play a role in medication errors, particularly prescribing practices for high-risk medications including opiates, anticoagulants, insulin, and some antibiotics. Prescriber side issues were present in 15 of 36 medication errors from FY24 YTD. Case review of prescriber errors from FY23 and FY24 YTD shows that root causes of these errors are multifactorial and can include data entry/typographical errors or inaccurate dosing selection, use of the incorrect body weight assessment for a patient (use of actual body weight when ideal body weight should be used), errors due to the medication or formulation selected (ie the type of insulin used) and other causes. Prescribing errors lead to mild or moderate harm events for patients in all cases including the need for additional medical interventions, lab draws and monitoring and prolongation of the hospitalization. In some cases patients had end organ damage including kidney injury due to these errors.

Due to several differences between pediatric patients compared to adults, there is a greater risk of harm from medication errors. The reasons for extra vulnerability to harm include:

- Different and changing pharmacokinetic (PK) parameters
- Need for calculation of individualized doses; unique risk for 10-fold errors
- Lack of available dosage forms and concentrations appropriate for administration
- Need for precise dose measurement and appropriate drug delivery systems
- Lack of published information or FDA-approved labeling regarding dosing, PK, safety, efficacy, and clinical use
- Limited reserve to withstand errors
- Limited ability to communicate to prevent an error or signal that an error has occurred
- Wide range of correct dosages depending on indication

One of the recurring medication errors at BCH are preventable infusion administration errors. Approximately a third of the reported medication errors in 2023 were infusion pump related. After partnering with *icuMedical*, the manufacturer of the infusion pumps used in BCH Oakland, we identified a significant opportunity to improve our pump library organization, to increase the content to include more medications, and to change the culture of using generic volume over time instead of selecting specific drugs by name with guardrails built in. Our Medication Error Reduction QI Taskforce found that our Med Fusion drug library compliance for April 1st through June 30th is only 19.5%. This falls far short of the 2024-2025 Institute of Safe Medications guideline*Targeted Medication Safety Best Practices for Hospitals*. The guideline's Best Practice #8 states:

A) Administer all* medication and hydration infusions via a programmable infusion pump utilizing dose error-reduction systems.†

b) Maintain a compliance rate of greater than 95% for the use of dose error-reduction systems.

c) Monitor compliance with use of smart pump dose error-reduction software on a monthly basis.

d) If your organization allows for the administration of an intravenous (IV) bolus or a loading dose from a continuous medication infusion, use a smart pump that allows programming of the bolus (or loading dose) and continuous infusion rate with separate limits for each.

e) Further, implement bi-directional (e.g., auto-programming and auto-documentation‡) smart infusion pump interoperability with the electronic health record and establish organizational expectations (e.g., compliance goals) for the use of auto-programming and documentation for medication and hydration infusions

* Unless the rate of the infusion exceeds the delivery limits of the infusion pump.

† Dose error-reduction systems (DERS): Refers to the integral computer software in smart infusion pumps intended to aid in prevention of infusion programming-related errors and warn users of potential

over- or under-delivery of a medication or fluid by checking programmed doses/rates against facility configurable preset limits specific to a medication, fluid, and to a clinical application (e.g., epidural administration) and/or location (e.g., neonatal intensive care unit, medical/surgical unit).

‡ Auto-programming: Automatic-programming of infusion parameters from the electronic health record system to the smart infusion pump (which are then verified, and the infusion is started manually by the practitioner) after use of the barcode medication administration system to associate the patient, fluid container (e.g., bag, bottle, syringe), and pump channel. Auto-documentation (also known as auto-charting or infusion documentation): Sending infusion information such as intake data, dose/rate changes, and infusion stop time, to the electronic health record system for manual clinician confirmation to enable accurate recording of this information to the patient's record after the infusion is started.

Item e) is not feasible with the current make/model of infusion pump at BCH Oakland. There is a UC-wide plan to standardize all campuses' institution to a new pump that integrates with the EHR. However, the UCOP reports that the pump brand, make, and model selection is still in progress and it may be several years before we have this technology, after selection, contracting, programming, training, and implementation. We need to address the issue immediately to prevent further harm.

TARGET

1. An interdisciplinary cross bay taskforce was launched in 2023 with the goal to decrease medication errors that result in harm 10%, from 75 to 68, for the inpatient, peri-op/operative area, emergency, diagnostic imaging, and infusion center care settings by 06/30/2024, with a future goal of 25% reduction to meet strategic plan

BENEFITS-

A decrease in medication harm events contributes to our organizational journey and True North goal of achieving zero harm. More importantly, a reduction in medication harm events can lead to the patient experiencing one less event of physical, psychological or emotional pain or burden and can significantly reduce morbidity. Solidifying medication processes and use of error prevention technology helps the health care team perform with high reliability, increasing efficiencies, catching errors, and ultimately providing the safest possible care for the patient.

INTERVENTION

Within the scope of medication processes in an inpatient and relating setting within BCH, the project and interventions have the potential to have widespread impact across the children's hospitals, Oakland and San Francsico. The impacted areas include acute care, critical care, peri-op/operative area, emergency, diagnostic imaging, hematology/oncology and infusion center.

The cross-bay medication errors taskforce assessed medication errors event reporting from FY19 to FY24TD data, analyzing how the medication safety events occurred, why they occurred and any major areas of opportunity. A gap analysis was conducted including 5 whys activity, which reviewed 2 areas that warrant focus.

- **Prescribing Process Improvement** – Gap analysis and analysis of harm data revealed prescribing errors involving high risk medications (anticoagulants, chemotherapy, opioids, insulin and some antibiotics). In general, prescribing actions are performed by trainees. Evaluation of previous

medication errors supports the need for both expanded education of trainees and supervising attending physicians surrounding avoiding the common errors that currently occur with high-risk medication prescribing (including errors in dosage entry, incorrect patient weight used for dosing, proper medication and formulation selection, and others.) Evaluation of historical cases also suggests a role for an increase in ordering provider decision making support in the EHR itself to provide additional 'just in time' educational reminders for prescribers and to promote additional clarity in signaling between the prescribing provider and our pharmacy and nursing colleagues.

- Our team will develop an educational module to present to trainees and attending physicians with a goal of presenting in person or a recorded video session to all residents and Pediatric hospitalist medicine providers. We will offer the education to attending providers from additional services including heme-onc and ICU as well.
  - Incentives will be used to promote attendance and participation in these programs by trainees and team members.
  - A physician champion for the project, Dr. McAlister Chin, will oversee development and implementation of this educational module.
  - The educational module will be accompanied by supportive tipsheets, signage and badge buddies which prescribing providers can use as tools to promote best practices going forward.
- Our team will partner with APeX to develop and implement EHR improvements to support prescribing providers and decrease errors. We expect these improvements to include changes like the following.
  - Informational text boxes added to some orders and order sets that promote best practices and remind providers of errors that may occur.
  - Additional use of buttons in the ordering that can help providers order correct dosages and communicate the intentions of their ordering (example: buttons that indicate in an order that a provider is **weaning** a sedative so that the pharmacy team and nursing team are aware of what is intended.

- **Medication administration Process Improvement –** Analysis of harm data revealed administration errors as top category of medication error type. Errors due to IV pump programming are more likely to result in harm events requiring intervention. In gap analysis and going to the bedside, pump library guardrails accuracy and effectiveness and pump compliance were major areas of opportunity for medication harm prevention. With funding, the aim is to optimize the pump library guardrails for effective dose/rate error prevention, develop a process to monitor and improve compliance and to provide training for use of the error prevention technology available in the smart pumps. Potential barriers to the implementation include cultural shift in current practices. Potential adverse outcomes may result from change and lack in familiarity with technology and practice.

  Planned interventions:

Here are some nursing interventions related to smart pump usage:

1. **Training and Education:**
- Provide comprehensive training to nursing staff on the proper use and programming of smart pumps.
- Ensure that nurses are familiar with the specific smart pump models used in the healthcare facility.
- Train nurses on the interpretation of pump alarms and how to respond appropriately.
2. **Programming Accuracy:**
- Double-check all medication orders before programming the smart pump to ensure accuracy.
- Utilize barcode scanning or other technologies to verify the medication, patient, and dosage information before programming the pump.
- Follow established protocols for entering infusion rates, concentrations, and other parameters into the smart pump.
3. **Drug Library Management:**
- Regularly update and maintain the drug library within the smart pump to reflect the most current medications, concentrations, and safety limits.
- Work with pharmacy staff to review and revise the drug library based on formulary changes and updates.
4. **Alert Management:**
- Respond promptly to smart pump alarms and alerts, and investigate the cause of the alarm.
- Document the actions taken in response to alarms in the patient's medical record.
- Report recurring or persistent issues with alarms to the appropriate personnel for investigation and resolution.
5. **High-Alert Medication Awareness:**
- Exercise heightened caution and implement additional safety checks when administering high-alert medications using smart pumps.
- Encourage a culture of double-checking and collaboration among nursing staff when administering critical medications.
6. **Collaboration with Pharmacy:**
- Collaborate with the pharmacy department to ensure accurate medication concentrations and compatibility with smart pump settings.
- Communicate effectively with pharmacy staff regarding any discrepancies or issues related to medication orders and smart pump programming.

A pharmacist will collaborate with an ***icuMedical*** technician to overhaul and re-design the medication pump library. The library will include almost all formulary infusion medications and the most common IV hydration fluids.

- A table of contents of the revised drug library will be created so that users may easily map the medication and understand the organization of the pump library. It will be made available by scanning a QR code on the pump.
- Nurse managers will generate excitement among nursing staff and emphasize the positive impact of using the new pump library on patient safety.
- Nurse educators will champion in-person teaching of nurses on how to navigate and utilize the pump's library. The goal is to use the pump library >95% of the time.

- A pharmacist or Medication Safety Officer will conduct monthly analysis of the drug library usage compliance rate and number of pump related medication errors. These rates will be reported to the Nurse managers to provide feedback to the nurses on their contributions towards patient safety. They can also encourage more usage if they continue to fall below 95% compliance. Small incentives may be used to improve compliance rates. Analysis of certain departments or groups may assist in targeting those with the lowest compliance rates and/or highest error rates.

PROPOSED EHR MODIFICATIONS

This project will include some EHR modifications as documented above. Our team is meeting with APeX team to implement.

RETURN ON INVESTMENT (ROI)

Each year, in the United States, 7,000 to 9,000 people die due to a medication error. Additionally, hundreds of thousands of other patients experience but often do not report an adverse reaction or other complications related to a medication. One adverse drug event (ADE) adds more than $2,000 on average to the costs of hospitalization.

Bates D, Spell N, Cullen D, et al. "The costs of adverse drug events in hospitalized patients. Adverse Drug Events Prevention Study Group." JAMA. 1997;277(4):307- 311. https://www.ncbi.nlm.nih.gov/pubmed/9002493

A more recent report indicates that the total cost of looking after patients with medication-associated errors exceeds $40 billion each year, with over 7 million patients affected, translating to an average cost of $5714.

Rayhan A. Tariq; Rishik Vashisht; Ankur Sinha; Yevgeniya Scherbak. "Dispensing Errors and Prevention." National Institutes of Health (NIH) National Library of Medicine, National Center for Biotechnology Information. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan. 2023 May 2.

In considering costs to the Benioff Children's Hospitals, a more conservative average cost of $4000 was applied to the medication errors that resulted in some level of harm:

- In FY23, the 75 medication errors translate to a cost of $300,000
- In FY24 Jan to date, the 32 errors translate to another $128,000.

From a review of medication errors to FYTD24 it was determined that increased expenses were seen in the form of extended length of stay, transfer of higher level of care, and increased moniotring and/or interventions for patients having medication errors in harm. Two patients with increased length of stay and eight requiring interventions and monitoring.

With a targeted 25% reduction across all True North priority harms within 5 years, the direct cost savings of reducing medication errors by 25% from the baseline in FY23 is estimated at a minimum of $75,000 understanding some medication errors will result in a much greater expense than the average rate used.

SUSTAINABILITY - *If successful, how will this intervention be sustained beyond the funding year? Who are the key UCSF leaders/process owners that can plan for and budget operational resources to keep the intervention going after the project year?*

Prescriber education modules will be created for ongoing use in the resident curriculum year over year. Drs. Vlasses and McAllister-Chin

If successful, pump library optimization and pump compliance improvement has the potential for continued return on investment year over year following funding year and nominal ongoing maintenance. Key leaders/process owners to maintain the intervention after project year include: Mary Willoughby, Julie Nguyen, Kimery Leong, Kathy Ghomeshi, Shannon Fitzpatrick, Karen Jennings, Chris Vlasses, Aurora McAllister Chin.

BUDGET -

44,000 – Pump Library Optimization

- Project Time/Fund for Pharmacist Subject Matter Expert for BCH-Oakland 8 weeks full-time dedicated pharmacist, approx. $40,000
- Education Time for Nursing training for BCH-Oak and BCH-SF - get guidance from nursing leads
- Development of materials/resources/module for Nursing training for BCH-Oak and BCHSF get guidance from nursing leads
- Development of compliance reporting/dashboard for ongoing monitoring get guidance from nursing leads
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6,000 – High Risk Medication Prescribing Education/Training

- $2,500 - Stipend for Physician champion Dr. McAllister Chin to create and lead multiple educational sessions
- $1,000 - Production of supportive resources including tipsheets, badge buddies, signs
- $2,500 - Incentives for trainee participation including food at presentations, gift cards for course completion