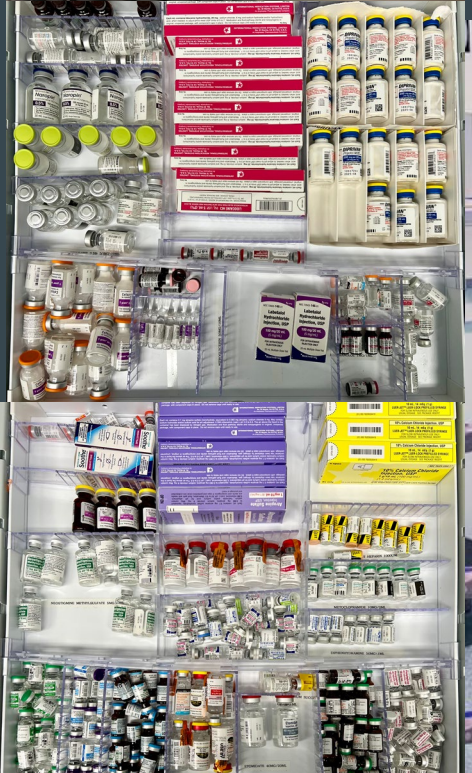
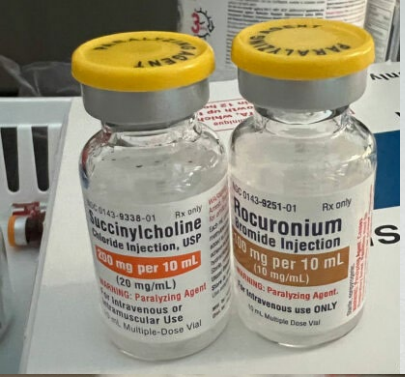
Medication Errors: A Resident's Perspective

Amanda Milburn, DO
Anesthesiology Resident, PGY-3
Paterson, NJ

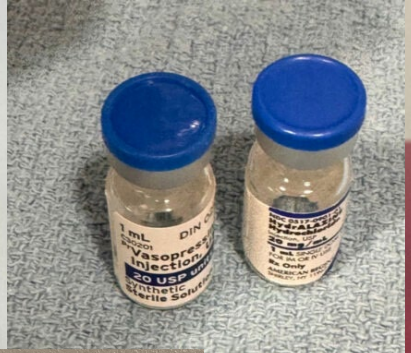
St. Joseph's Health

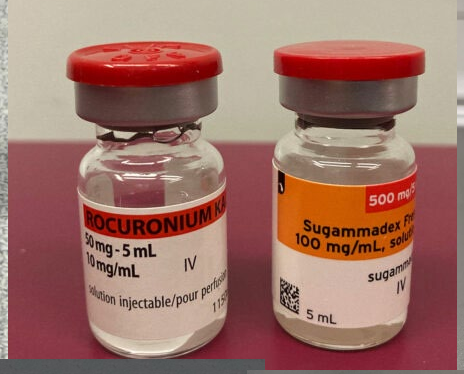
WELCOME!

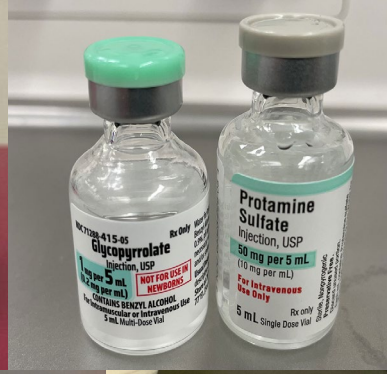


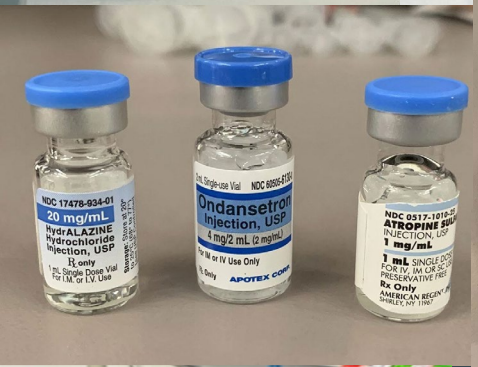

Succinylcholine
Rocuronium
Rx only

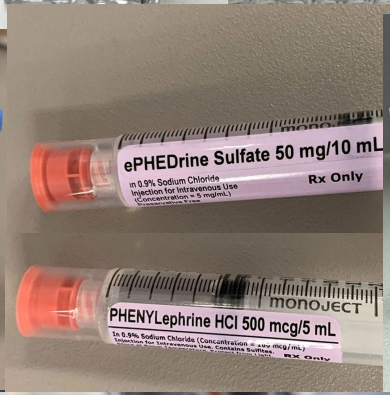

Tranexamic
Martaine
glucose

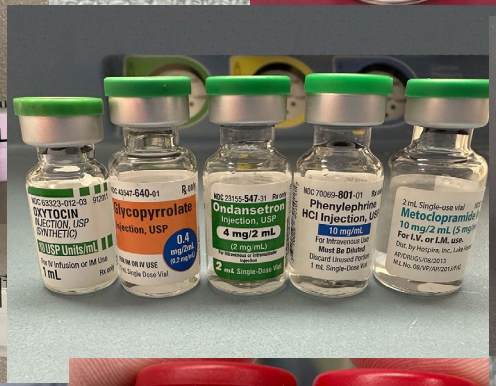


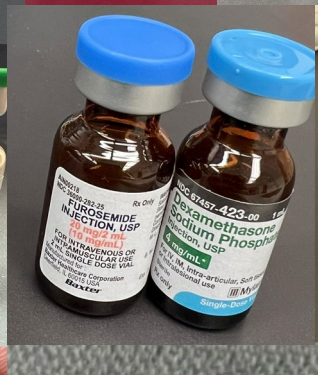

ROCURONIUM
Sugammadex
100 mg/mL
5 mL

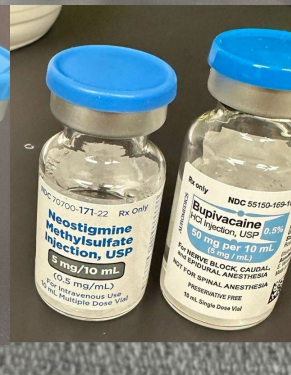

Glycopyrrolate
Protamine
Sulfate
Injection, USP
50 mg per 5 mL
(10 mg per mL)
5 mL Single Dose Vial

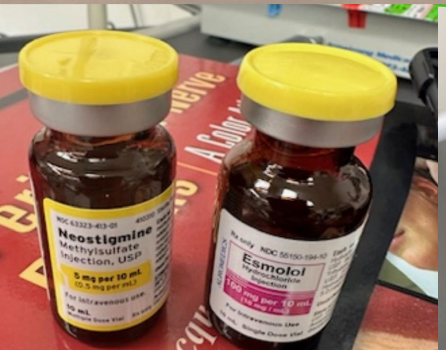

HydrALAZINE
Hydrochloride
Injection, USP
Ondansetron
Injection, USP
4 mg/2 mL (2 mg/mL)
ATROPINE
1 mg/mL


ePHEDrine Sulfate 50 mg/10 mL
Rx Only
PHENYLephrine HCl 500 mcg/5 mL
monoject

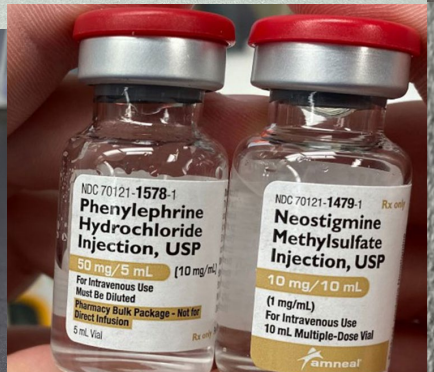

OXYTOCIN
Glycopyrrolate
Ondansetron
Phenylephrine
Metoclopramide


FUROSEMIDE
Dexamethasone
Sodium Phosphate


Neostigmine
Methylsulfate
Injection, USP
Bupivacaine
HCl Injection, USP

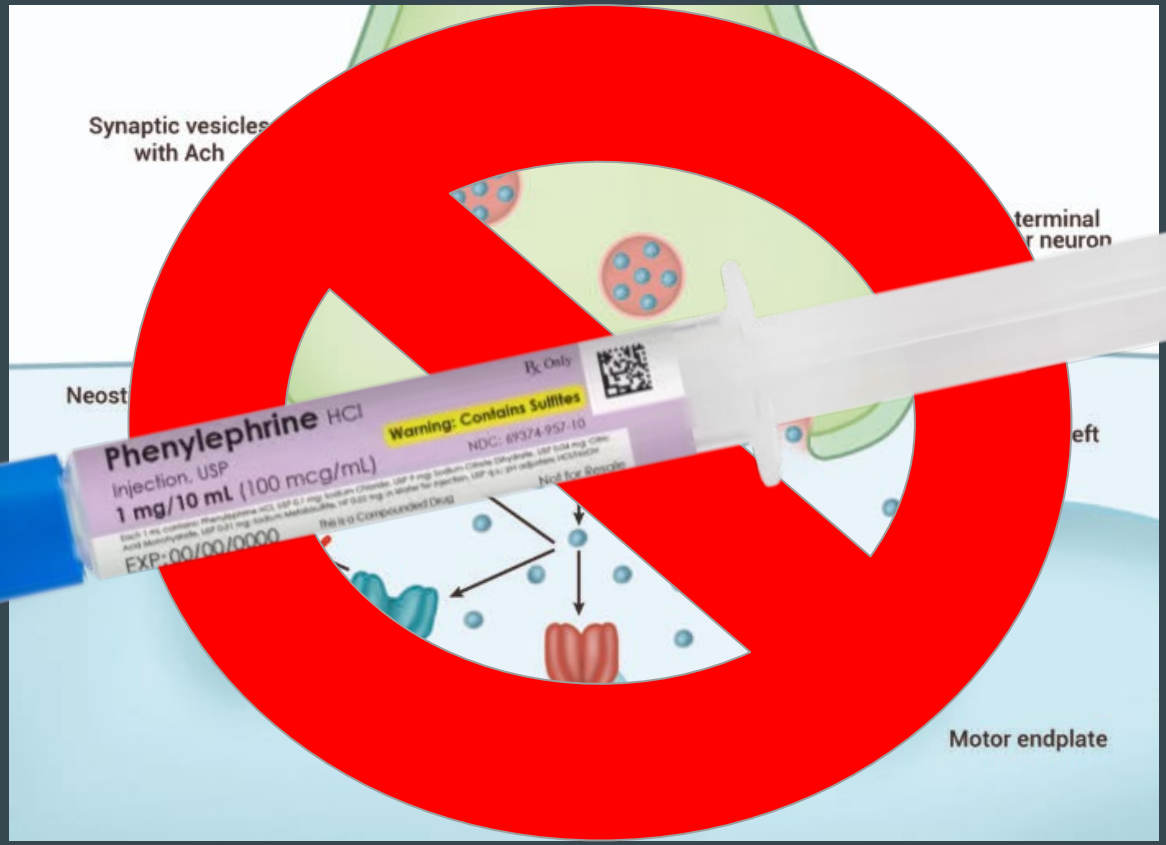

Neostigmine
Methylsulfate
Injection, USP
Esmolol


Polocaine®– MPF
Mepivacaine HCl Injection, USP
2%
20 mL Single Dose Vial
10% Calcium Chloride
Injection, USP
1 Gram/10 mL

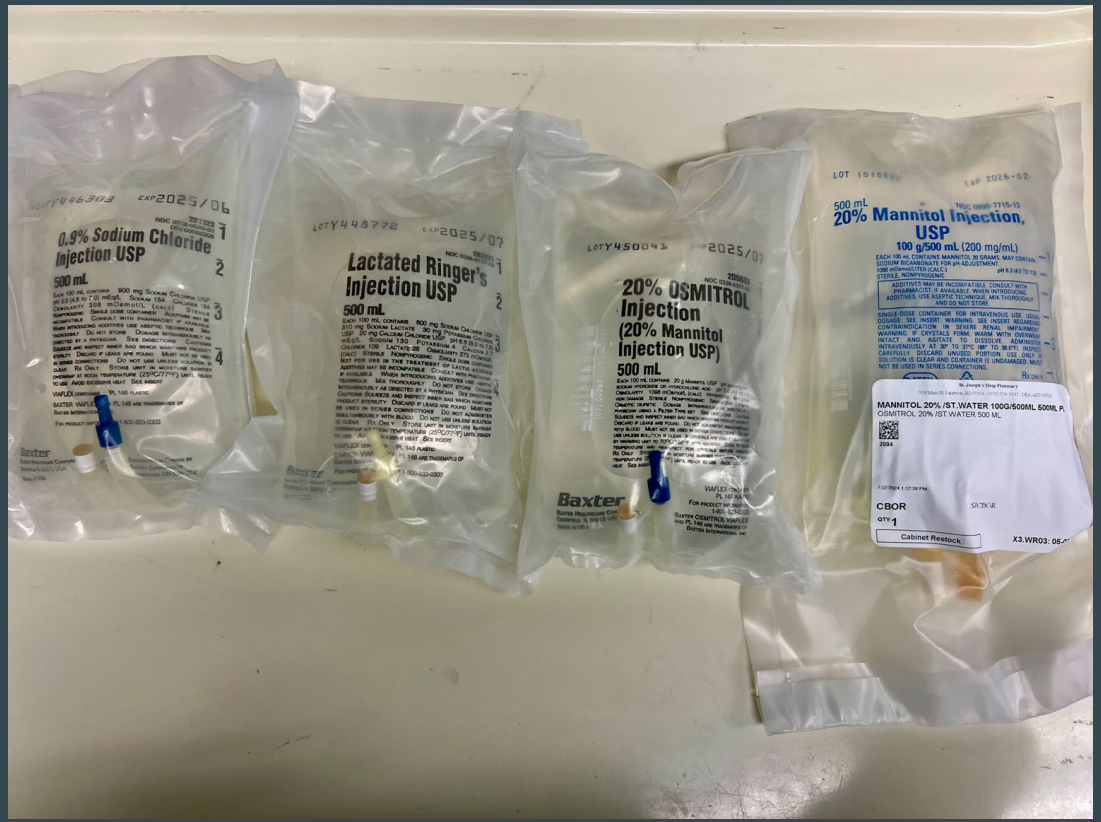

Phenylephrine
Hydrochloride
Injection, USP
50 mg/5 mL
Neostigmine
Methylsulfate
Injection, USP
10 mg/10 mL
amneal


Midazolam
Injection USP
2 mg/2 mL
1 mg/mL
Ketamine
Hydrochloride
Injection USP
100 mg / 2 mL

“Give Neo”


Synaptic vesicles
with Ach
terminal
r neuron
Neost
eft
Phenylephrine HCl
Injection, USP
1 mg/10 mL (100 mcg/mL)
EXP: 00/00/0000
Rx Only
Warning: Contains Sulfites
NDC: 69374-957-10
Motor endplate

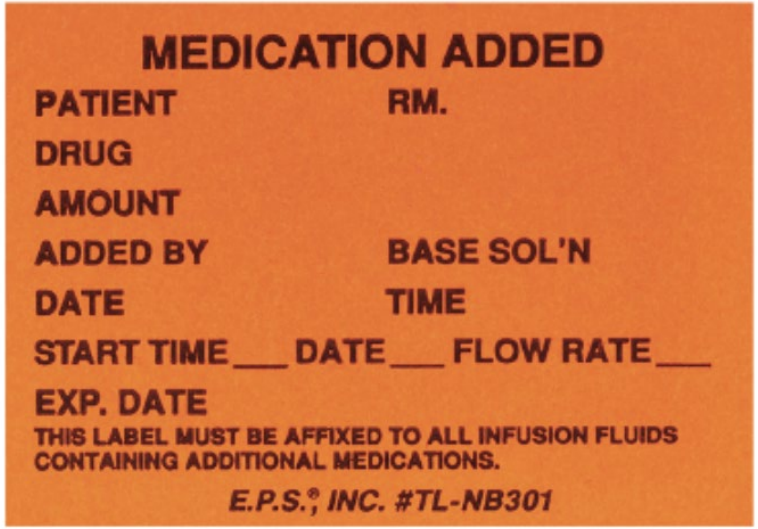
IV Fluids


0.9% Sodium Chloride Injection USP
500 mL
Lactated Ringer's Injection USP
500 mL
20% OSMITROL Injection (20% Mannitol Injection USP)
500 mL
Baxter
500 mL
20% Mannitol Injection, USP
100 g/500 mL (200 mg/mL)
MANNITOL 20% /ST.WATER 100G/500ML 500ML P.
OSMITROL 20% /ST.WATER 500 ML
CBOR
QTY 1
Cabinet Restock

Intrathecal Administration

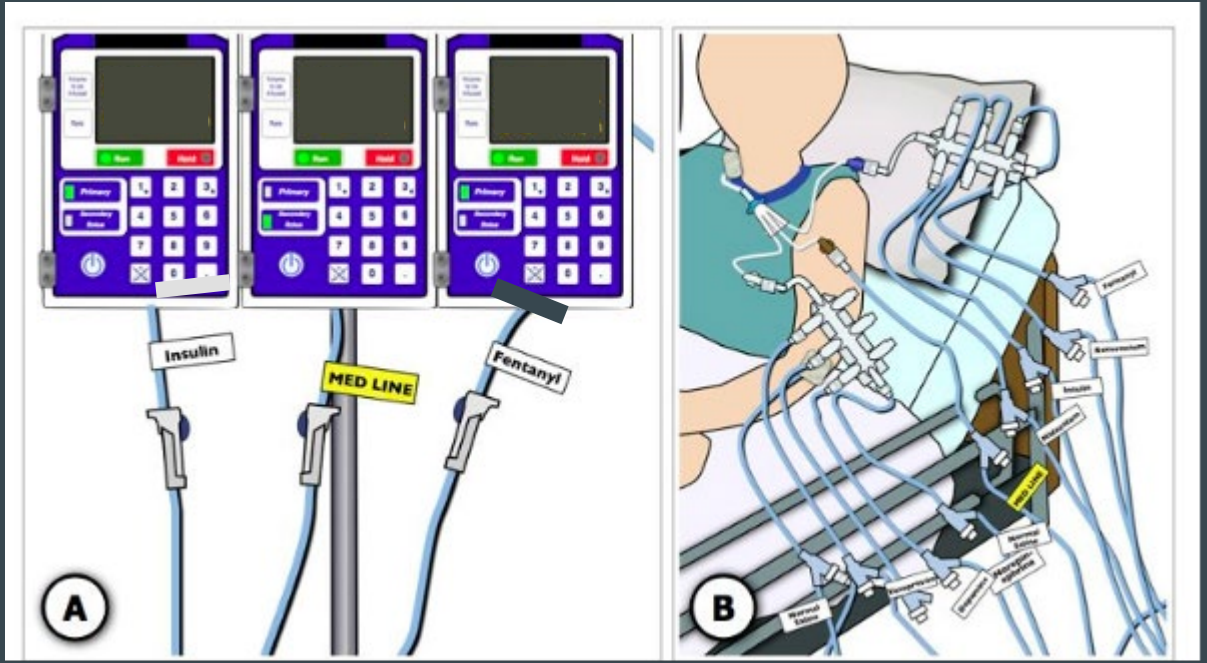
IV Fluids

IV Label
Medication Added



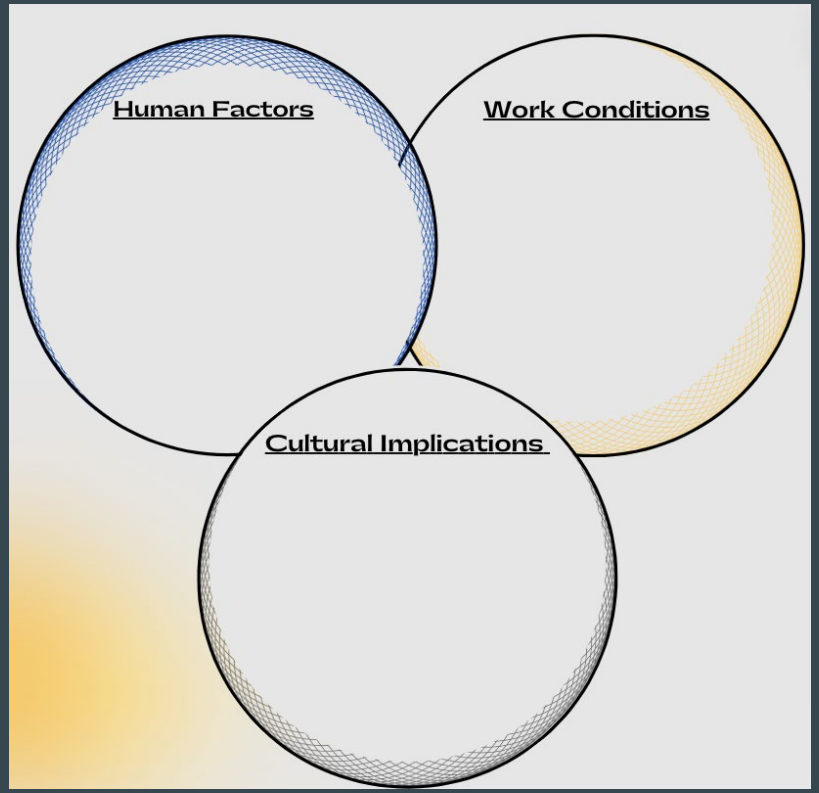
Intravenous Administration

Labeling Your Lines



How Does a Medication Error Occur?

Factors Prone to Error (Especially Relevant to Residents)



Human Factors

- Sleep deprivation (24h shifts)
- Sleep inertia
- Hunger
- Dehydration

Work Conditions

- High stress environments
- High patient acuity/treatment complexity
- Lack of standardization among different ORs
- Drug shortages/limited resources
- Poor lighting in laparoscopic rooms
- Not having the necessary drug labels stocked in each room

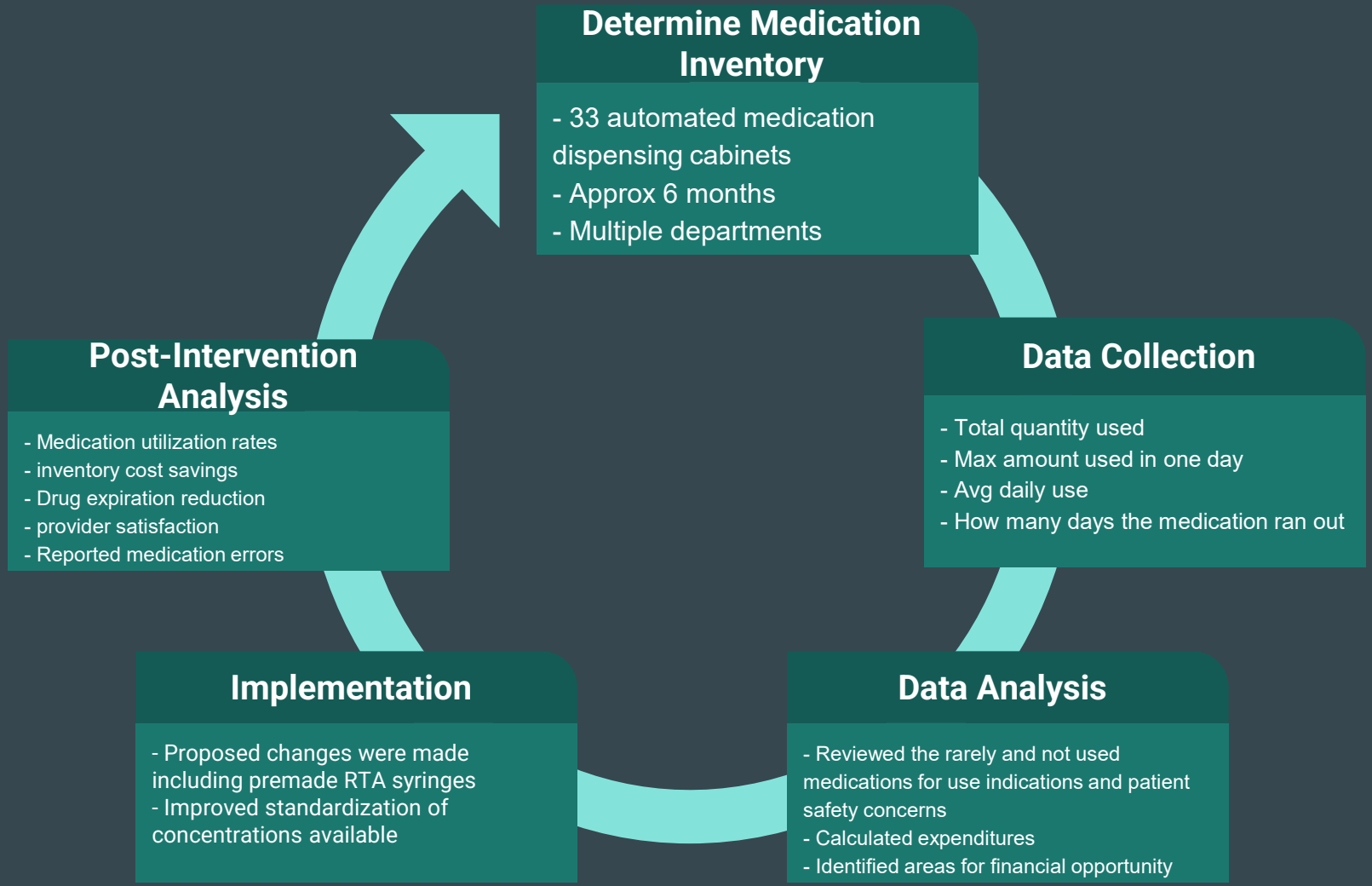
Cultural Implications

- Multiple training site
- Different attendings request different concentrations (ex: diluting opioids)
- Power gradients
- Production pressures

Interdepartmental Quality Improvement Initiative

GOALS

1. Decrease Preventable Waste
2. Improve Patient Safety
3. Limit Expenditure
4. Increase Operational Efficiency
5. Enhance Environmental Sustainability
6. Boost Patient Satisfaction Scores & Outcomes


Determine Medication Inventory
- 33 automated medication dispensing cabinets
- Approx 6 months
- Multiple departments
Data Collection
- Total quantity used
- Max amount used in one day
- Avg daily use
- How many days the medication ran out
Data Analysis
- Reviewed the rarely and not used medications for use indications and patient safety concerns
- Calculated expenditures
- Identified areas for financial opportunity
Implementation
- Proposed changes were made including premade RTA syringes
- Improved standardization of concentrations available
Post-Intervention Analysis
- Medication utilization rates
- inventory cost savings
- Drug expiration reduction
- provider satisfaction
- Reported medication errors

QUESTIONS

Sterile Cockpit

Examples of Tools Derived From Aeronautics that are Applicable to the Operating Room

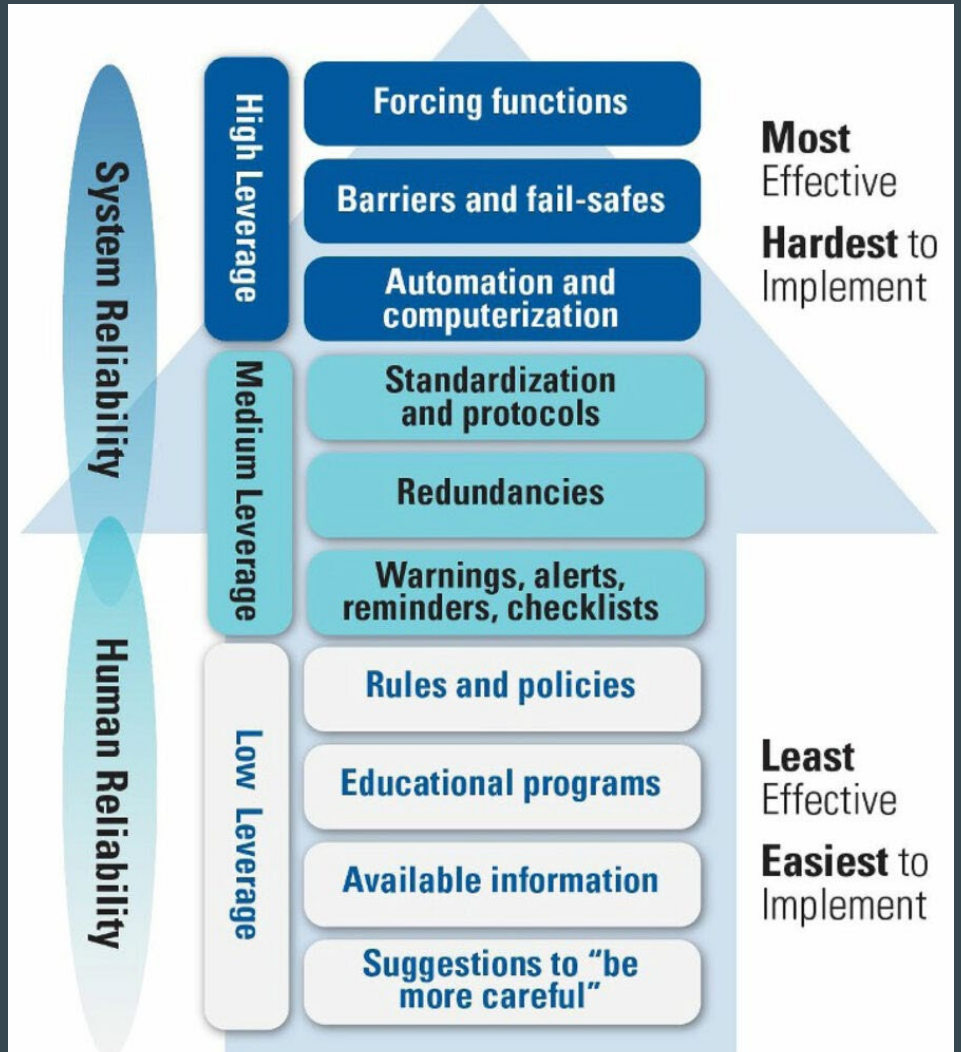
	Aeronautics	Medicine
"Sterile cockpit"	• Flight below 10,000 feet • Take-off • Landing • Alarms	• Drug preparation • Induction of anesthesia • Emergence from anesthesia • Complex surgery
Coding system	• Wrong ICAO field code inserted in the FMS • Incoherence between left and right QNH settings	• Connection of fluids to the wall socket • Different cap colors for injection and infusion bottles
Cross-check	• Setting heading, speed, altitude • Selection of appropriate check-list	• Setting up a morphine PCA • Identification of drugs transferred from the original packaging
Data concordance check	• Altitude difference between QNH and standard pressure	• Name of drug on the vial and sticker on the syringe • Surgical side concordance between patient's words, medical record and skin mark
Rejection of absurd data	• QNH setting beyond normal range	• Weight and height in electronic patient care reporting
Check-list	• Before start C/L • Before take-off C/L • After take-off C/L	• Before induction of anesthesia • Before skin incision • Before waking-up • Before awake intubation
Flows	• After engine ignition • Before line-up and take-off • Emergency descent	• Connection from airway device (tracheal tube, laryngeal mask…) to ventilator • Visual pattern after intubation to check oximetry, ventilation, blood pressure and anesthesia drug delivery
Readback	• All clearances from ATC • Speed, altitude, heading changes ordered by the ATC	• All orders (drug preparation and/or injection) • Unusual demand

ICAO, International Civil Aviation Organization; FMS, flight management system (computer of the plane); QNH, barometric altimeter setting (height above sea level); PCA, patient-controlled analgesia; C/L, check-list; ATC, air traffic control.

Vigilance is key

“Trust but verify”

Good Catch


System Reliability
Human Reliability
High Leverage
Medium Leverage
Low Leverage
Forcing functions
Barriers and fail-safes
Automation and computerization
Standardization and protocols
Redundancies
Warnings, alerts, reminders, checklists
Rules and policies
Educational programs
Available information
Suggestions to "be more careful"
Most Effective
Hardest to Implement
Least Effective
Easiest to Implement

Classes/Categories of Medications

- adrenergic agonists, IV (e.g., **EPINEPH**rine, phenylephrine, norepinephrine)
- adrenergic antagonists, IV (e.g., propranolol, metoprolol, labetalol)
- anesthetic agents, general, inhaled and IV (e.g., propofol, ketamine)
- antiarrhythmics, IV (e.g., lidocaine, amiodarone)
- antithrombotic agents, including:
  - anticoagulants (e.g., warfarin, low molecular weight heparin, unfractionated heparin)
  - direct oral anticoagulants and factor Xa inhibitors (e.g., dabigatran, rivaroxaban, apixaban, edoxaban, betrixaban, fondaparinux)
  - direct thrombin inhibitors (e.g., argatroban, bivalirudin, dabigatran)
  - glycoprotein IIb/IIIa inhibitors (e.g., eptifibatide)
  - thrombolytics (e.g., alteplase, reteplase, tenecteplase)
- cardioplegic solutions
- chemotherapeutic agents, parenteral and oral
- dextrose, hypertonic, 20% or greater
- dialysis solutions, peritoneal and hemodialysis
- epidural and intrathecal medications
- inotropic medications, IV (e.g., digoxin, milrinone)
- insulin, subcutaneous and IV
- liposomal forms of drugs (e.g., liposomal amphotericin B) and conventional counterparts (e.g., amphotericin B desoxycholate)
- moderate sedation agents, IV (e.g., dexmedetomidine, midazolam, **LOR**azepam)
- moderate and minimal sedation agents, oral, for children (e.g., chloral hydrate, midazolam, ketamine [using the parenteral form])
- opioids, including:
  - IV
  - oral (including liquid concentrates, immediate- and sustained-release formulations)
  - transdermal
- neuromuscular blocking agents (e.g., succinylcholine, rocuronium, vecuronium)
- parenteral nutrition preparations
- sodium chloride for injection, hypertonic, greater than 0.9% concentration
- sterile water for injection, inhalation and irrigation (excluding pour bottles) in containers of 100 mL or more
- sulfonylurea hypoglycemics, oral (e.g., chlorpro**PAMIDE**, glimepiride, gly**BURIDE**, glipi**ZIDE**, **TOLBUT**amide)

Specific Medications

- **EPINEPH**rine, subcutaneous
- epoprostenol (e.g., Flolan), IV
- insulin U-500 (special emphasis*)
- magnesium sulfate injection
- methotrexate, oral, nononcologic use
- nitroprusside sodium for injection
- opium tincture
- oxytocin, IV
- potassium chloride for injection concentrate
- potassium phosphates injection
- promethazine injection
- vasopressin, IV and intraosseous

**All forms of insulin, subcutaneous and IV, are considered a class of high-alert medications. Insulin U-500 has been singled out for special emphasis to bring attention to the need for distinct strategies to prevent the types of errors that occur with this concentrated form of insulin.*

Background

Based on error reports submitted to the ISMP National Medication Errors Reporting Program (ISMP MERP), reports of harmful errors in the literature, studies that identify the drugs most often involved in harmful errors, and input from practitioners and safety experts, ISMP created and periodically updates a list of potential high-alert medications. During June and July 2018, practitioners responded to an ISMP survey designed to identify which medications were most frequently considered high-alert medications. Further, to assure relevance and completeness, the clinical staff at ISMP and members of the ISMP advisory board were asked to review the potential list. This list of medications and medication categories reflects the collective thinking of all who provided input.