

Improving Safety and Efficiency in the IV Room: Key Features of Automated Workflow Systems

Tom J. Lausten, R.Ph., M.B.A.

Steve Speth, R.Ph.

Caryn Belisle, R.Ph., M.B.A.



ASHP Section of Pharmacy Informatics and Technology Advisory Group on Pharmacy Operations Automation is recognized for organizing this webinar.

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Objectives

- Describe the most common IV Compounding Safety technologies available in workflow programs today
- Describe and contrast the types of errors that the workflow technologies may affect
- List key benefits of workflow systems beyond the reduction of errors
- List and describe key considerations when choosing an IV workflow system



Disclosure

Faculty, planner, ASHP staff and consultants report no relevant financial relationships pertinent to this activity.



Medication Error Reduction Strategy Using Dispense Preparation and Dispense Check

Tom Lausten, R.Ph., M.B.A.

Director of Pharmacy,

Children's Hospital of Wisconsin



Organization

Children's Hospital of Wisconsin

- Milwaukee, WI
- 296 bed capacity
- Values
 - ◊ Purpose – We act in service of children and families.
 - ◊ Collaboration – We work together to care for children and families.
 - ◊ Integrity – We build confidence and trust in every interaction.
 - ◊ Health – We are at our best.
 - ◊ Innovation – We commit to breakthrough solutions with continuous learning.
- In February 2013, we were Ranked #4 in the nation by *Parents Magazine*



Polling Question

Do you have a technological solution to assure that the correct product is being chosen at the point of the initial preparation of a medication?

- A. Yes
- B. No
- C. Unsure



Why Dispense Prep. and Dispense Check

- As a commitment to the Pharmacy and Therapeutics Committee and the Patient Safety Committee, we were obligated to re-evaluate our preparation process to help improve patient safety
 - ❖ We had a number of serious errors that included wrong drug or wrong concentration that was either dispensed and/or administered to the patient
 - ❖ There was no effective way to track any of the involved parties to follow up on the details of the event
 - Checking was a manual system of signing labels
 - Signatures were illegible and not easily traceable



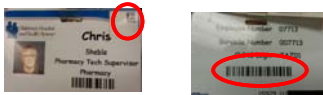
Why Dispense Prep. and Dispense Check

- Nurses are required to scan medications prior to administration to minimize error
 - ❖ Pharmacy had no technological system in place at the preparation process to have medications verified as correct
 - ❖ Reliance was solely on the preparing technician and the checking pharmacist
- We looked into other products that would help with this checking process including Dose Edge.
 - ❖ Beginning in April of 2015 we added cameras in our sterile product rooms to facilitate checking of compounded sterile product. Our current system allows us to check real time or check product that may have been prepared earlier.
- On an average day, we prepare:
 - ❖ 750-1000 oral syringes
 - ❖ 750-1000 injection syringes



Overview of Dispense Preparation vs. Dispense Checking

- Dispense Preparation
 - ❖ Electronically documents the individual who has prepared the medication and the time of preparation
 - ❖ Electronically documents the product used for the preparation
 - ❖ Has the ability to electronically document Lot numbers and Expiration dates of products
 - IVIG, Blood Factor product, etc.
- Process
 - ❖ 1. Scan barcode on badge (for identification of individual) → 2. Scan barcode(s) on patient label → 3. Scan medication barcode → 4. Scan barcode on badge to complete Dispense Preparation activity



Overview of Dispense Preparation vs. Dispense Checking

- Dispense Check
 - ❖ Electronically documents the individual checking the medication and the time of check
- Process
 - ❖ 1. Individual must log into Epic → 2. Scan barcode on patient label (This completes electronic documentation)
 - ❖ Does NOT check the product



How has Dispense Prep and Check improved efficiency?

- Waste has been minimized
 - ❖ Epic identifies if order is discontinued or if patient has been discharged
- Accuracy has improved
 - ❖ With Dispense Prep, an additional verification step is gained
 - ❖ Pharmacists are able to see what medication the tech has scanned
- It has the ability to track medications
 - ❖ When med was made by tech/pharmacist
 - ❖ When med was checked by a pharmacist



Workflow

- To gain understanding, we walked through the basic workflow of the activity with the Epic team and Build team
 - ❖ The Build team brought hands on simulations
 - ❖ The process evolved over the course of several meetings
 - ❖ Key parties included
 - Epic team
 - Build team
 - Management team
 - Staff members
- Collaboration with Key parties was essential for success!!!!



Equipment Needs

- There was a walkthrough with consultants and key parties to figure out where to place the equipment and what equipment would best suit the locations
 - ❖ Wireless PCs were selected as the best fit for our needs
 - Our assumption when these were purchased was that the PCs were completely wireless, but in reality they, required a wired power source
 - This has caused some frustration and incurred extra cost for supplying additional power to areas
 - ❖ Upon recommendation, **Touch screen PCs** were also selected for the oral liquid and IV room preparation areas
 - Has been well accepted and made the activities much more user friendly



Equipment Used



Equipment Needs

- Our initial estimate for the number of PCs that would be needed to efficiently utilize the activities was too low
 - ❖ Ordered more PCs within the first week of go-live
- We have a PC at each workstation in the IV room
 - ❖ Every piece of equipment is easily cleaned to maintain standards in the clean rooms
 - ****washable keyboards****



Washable Keyboard

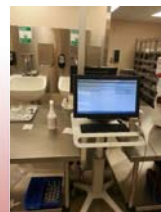


Equipment Needs

- Scanners
 - ❖ Possibly the most crucial piece of dispense preparation and dispense check
 - ❖ Make sure scanners purchased are of high quality and are reliable
 - In hindsight, we would most likely have invested in wireless scanners
 - Suggestion: Try both wireless and wired scanners
 - ❖ Our initial estimate for the number of scanners needed was too low
 - Ordered 2x more the first week of go-live
 - Currently all the computers in the main pharmacy have scanners attached



Equipment

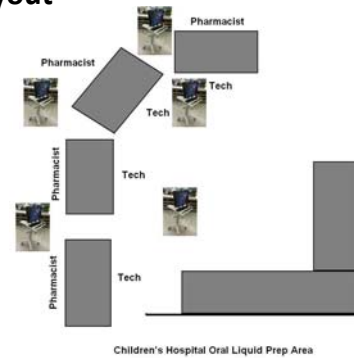


Equipment Needs Evaluation tool

- Determine how many Techs are working in an area during a normal preparation time
 - ❖ About 1 PC for every 1-2 Technicians
- Determine areas where Pharmacists check medications (i.e. Inpatient table, Oral Liquid prep area, IV room, etc.)
 - ❖ 1 PC for every Pharmacist
- Example: Our Oral Liquid preparation area
- Do not underestimate equipment needed



Layout



Training

- Based on our collaboration with our Epic team and Build team, the Pharmacy leadership team had a comprehensive understanding of Dispense Prep and Dispense Check and realized that to implement it would require intensive training
 - ❖ We dedicated several hours of training for each staff member to learn the dispense preparation/dispense check activities and how to use it effectively in daily workflow
 - ❖ Employed a hands-on simulation lab
 - Used common examples of medications that were prepared on a daily basis to help staff learn the workflow
 - This contributed to the successful implementation of the Dispense Prep and Dispense Check activities



Measuring outcomes

- We have been able to significantly decrease the number of dispensing errors in the pharmacy with the use of Dispense Preparation and Dispense Check. We went from an average of 5-7 reported medication errors per month as a result of the preparation process down to 2 errors in 2014. Both errors were due to a technician overriding the warning and the pharmacist not catching the override.



Improvement Opportunities

- **Scanners not working**
 - ❖ Important to research before purchasing
- **Insufficient quantity of workstations**
 - ❖ Do not underestimate equipment needed
- **Preparation time has increased**
 - ❖ As staff became more comfortable with the workflow, the increased prep time has significantly decreased over time



Improvement Opportunities

- **Lack of a barcode on employee identification badge**
 - ❖ We initially created barcode stickers to make workflow easier
 - ❖ Now our pharmacy badges include a barcode used specifically for Dispense Prep
- **Audible alert when an error occurred did not work properly**
 - ❖ Replaced entire fleet of wireless WOW(s)
- **Camera placement in sterile product rooms has been a challenge**
- **Ability of the technician to override a serious (red warning) is a concern.**
- **Pharmacists can see that a warning has been overridden but it does not give an audible alarm and the visual indication to the pharmacist is easy to miss.**



Key Messages

- Our organization has been successful with the implementation of Dispense Prep and Dispense Check
- Do not underestimate the equipment needed
- Clearly understand what type of equipment you need and test to make sure it satisfies your needs
- Have staff comfortable with the process before implementation
- The value the activity brings increases patient safety despite minimal increases in preparation time



IV Workflow Systems: Barcode Plus Volumetric Verification

Steve Speth, R.Ph.
Pharmacy Operations Manager
IU Bloomington

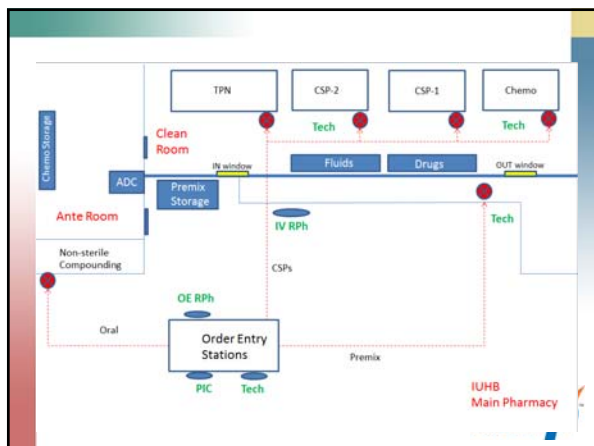
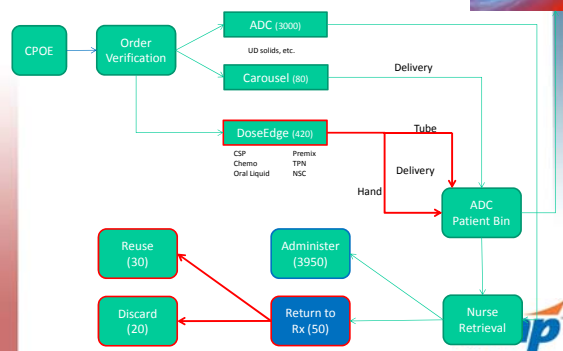


Indiana University Health Bloomington Hospital

- Not-for-profit community hospital
- Located in Bloomington, Indiana
- Average daily census = 180
- De-centralized medication distribution system
- McKesson automation, Cerner PIS
- CPOE, BCMP, BCMA, ADC, Carousel, anesthesia dispensing carts



IUHB Medication Process



Why is barcode scanning needed in IV room?

- LASA drugs & fluids



- Variability in compounding technique
- Mixing multiple doses at once
- After removal from mfr container, drugs are no longer identifiable

clear drug + clear fluid = clear dose



ISMP Summit On IV Admixture Safety

- Technology and automation such as **bar code verification** or **IV robotics** should be utilized as much as possible for preparing and verifying CSPs
- **Intravenous workflow software** (e.g., DoseEdge, Script Pro Telepharmacy, and I.V. Soft or similar technology) should be used to augment manual processes whenever possible.

Institute for Safe Medication Practices
Sterile Preparation Compounding Safety Summit
DRAFT OF THE PROCEEDINGS—Aug. 2012



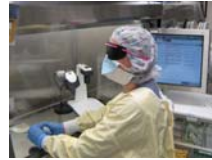
Old CSP Process



Labels Printed



Labels Sorted



Dose Prepared

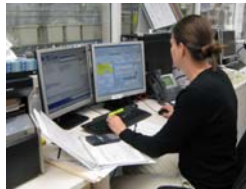


Dose Verified

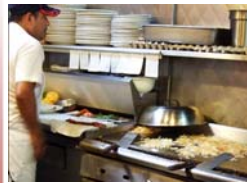


How is a CSP Like a Burger?

Order is received and entered



Order is prepared



Order is verified



Order is administered



What assurance that order was prepared correctly?



Multiple Vendors & Options

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Volumetric Verification Systems

| System Name | DoseEdge | Verification | SP for Sterile Compounding | Phocus Rx |
|---------------------|--|-------------------------------|----------------------------|----------------------|
| Vendor | Baxter | MedKeeper | ScriptPro | Grifols |
| P.I.S. Integration | print feed HL7 | print feed HL7 | print feed HL7 | print feed HL7 |
| Web Based? | verification | Y | N | verification |
| Remote Access? | Y | Y | Y | Y |
| Label Printing? | Y | Y | Y | N |
| Special Features | dose tracking, color printing, analytics | mobile devices, dose tracking | video chat communication | integrated into hood |
| Market Introduction | 2008 | 2013 | 2006 | |

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New CSP Process

Barcoded Medication Preparation (BCMP)

1. Select dose
2. Print label
3. Prepare Dose
 - a) Scan Barcode
 - b) Capture Image
4. Verify dose

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Workstation

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Dose Preparation

Dose Calculations

Compounding Instructions

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Warning Message

System hard stop if wrong drug, diluent or fluid is scanned

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Pharmacist Verification—Step 1

View barcode scan documentation

Order sentence from pharmacy computer

Ingredients scanned during preparation

| | | | |
|---|------------------------------------|--------------|------------------|
| enalaprilat [VASOTEC] 1.25MG,ns [SODIUM CHLORIDE 0.9%] 50ML in 51mL | | | |
| ID: | 102907 | | |
| Prepared By: | [Redacted] | | |
| Preparation Mode: | Default - Default preparation mode | | |
| Products Used | | | |
| enalapril 1.25 mg/mL 1mL | 1.25 MG | / | 1.25mg/mL = 1 mL |
| Sodium Chloride 0.9% 50mL | 50 ML | / | 1 mL/mL = 50 mL |
| Ingredients / Materials | | | |
| Name | Amount | Type | |
| enalaprilat [VASOTEC] | 1.25 MG | Drug Request | |
| ns [SODIUM CHLORIDE 0.9%] | 50 ML | Drug Request | |



Pharmacist Verification—Step 2

View images of:

- Drug vial
- Syringe volume
- IV fluid



Status Board

Bloomington Hospital

| Drug | Quantity | Time | Time |
|---|----------|-------------|-----------|
| enalaprilat [VASOTEC] 1.25MG,ns [SODIUM CHLORIDE 0.9%] 50ML in 51mL | 108 | 108 Minutes | 1 Minutes |
| apixolon [ZOVIRAX] 750MG,ns [SODIUM CHLORIDE 0.9%] 100ML in 100mL | 268 | 268 Minutes | 3 Minutes |
| gabapentin [NEURONTIN] 300MG,ns [SODIUM CHLORIDE 0.9%] 50ML in 50mL | 277 | 277 Minutes | 3 Minutes |
| gabapentin [NEURONTIN] 300MG,ns [SODIUM CHLORIDE 0.9%] 50ML in 50mL | 21 | 21 Minutes | |



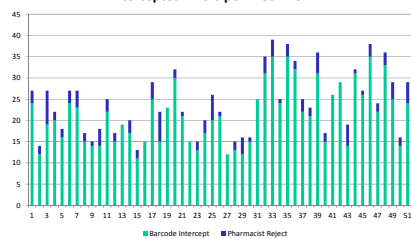
Benefits of BCMP

- Safety
- Efficiency
- Standardization
- Reduced waste



Safety

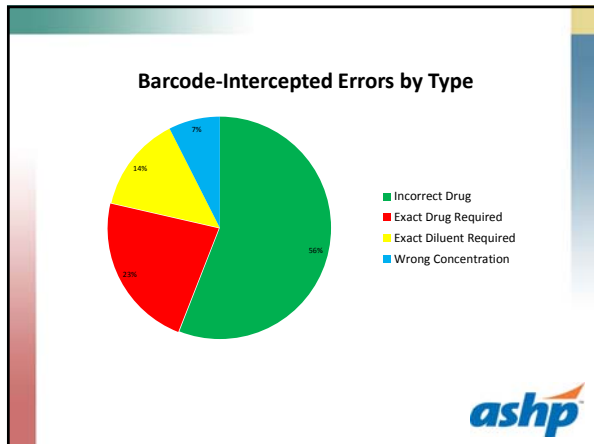
Intercepted Errors per Week-2014



Barcode Intercepted Errors/Week

| | 2011 | 2012 | 2013 | 2014 |
|--------------|-----------|-----------|-----------|-----------|
| Premix | 20 | 16 | 13 | 14 |
| CSP | 7 | 6 | 6 | 5 |
| Oral | | 0.6 | 0.6 | 0.5 |
| Chemo | 0.6 | 0.5 | 0.4 | 0.4 |
| TPN | | 0.6 | 0.4 | 0.3 |
| Total | 28 | 24 | 20 | 20 |



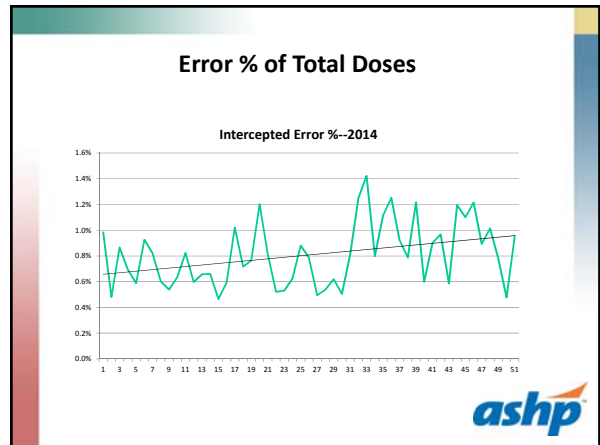
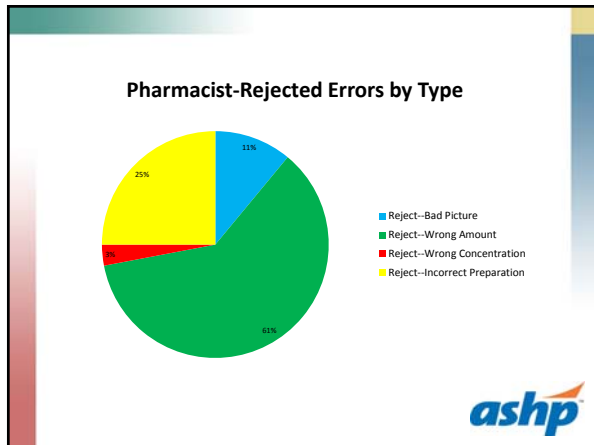


Pharmacist Rejected Doses/Week

| | 2011 | 2012 | 2013 | 2014 |
|--------------|----------|----------|----------|----------|
| CSP | 3.6 | 2.3 | 2.2 | 1.5 |
| Oral | | 0.3 | 0.3 | 0.2 |
| Chemo | 0.4 | 0.3 | 0.2 | 0.2 |
| TPN | | 0.1 | 0.2 | 0.1 |
| TOTAL | 4 | 3 | 3 | 2 |

- Prior to barcode scanning?
- Unknown

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Intercepted Error Examples

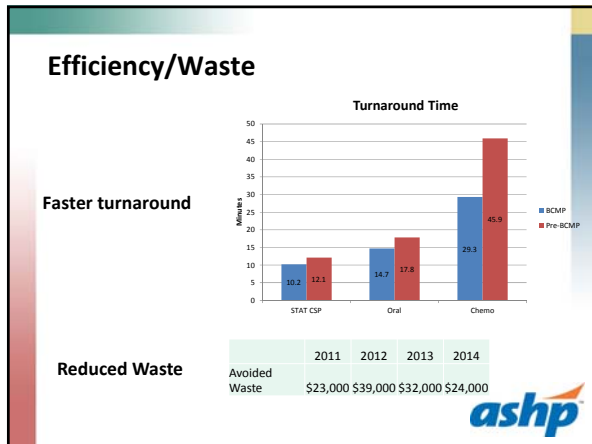
| Drug Scanned | Correct Drug | Cause? |
|-----------------|-------------------|--------------------------------------|
| Amikacin | Aminocaproic acid | adjacent bin |
| Promethazine | Phenylephrine | adjacent bin |
| Propranolol | Promethazine | adjacent bin |
| Heparin | Magnesium sulfate | look-alike vial |
| Furosemide | Midazolam | look-alike vial |
| Rituximab | Infliximab | LASA name |
| Ondansetron | Palonosetron | LASA name |
| Ciprofloxacin | Fluconazole | similar package |
| Cefoxitin 1g | Cefoxitin 2g | adjacent bin LASA similar package |
| D51/2NS + 20KCl | D51/2NS + 30KCl | adjacent bin LASA similar package |

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Additional Uses of BCMP

- Non-sterile compounding
- Oral liquid syringes

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- ### Lessons Learned
1. Needs analysis
 2. Workflow mapping
 3. Definition of scope
 4. Vendor selection
 5. Hardware acquisition
 6. **Change management**
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Cost Benefit Analysis

| | year 1 | year 2 | year 3 |
|---|--------------|--------------|-------------|
| Cost per Dose (\$) | -0.54 | -0.28 | -0.22 |
| Benefit per Dose (\$) | 0.25 | 0.25 | 0.25 |
| Subtotal (\$) | -0.29 | -0.03 | 0.03 |
| Decreased Patient Harm per Dose ¹ (\$) | 0.09 | 0.09 | 0.09 |
| Net per Dose (\$) | -0.20 | 0.06 | 0.12 |

¹ based on 1% error rate, 99% pharmacist 'catch' rate and \$4685 cost per event

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Net Cost/Benefit Per Dose

| | year 1 | year 2 | year 3 |
|--------------------------|-----------|---------|---------|
| 97% error detection rate | \$ (0.01) | \$ 0.25 | \$ 0.31 |
| 95% error detection rate | \$ 0.17 | \$ 0.44 | \$ 0.50 |

¹ % of compounding errors caught by pharmacist without BCMP

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- ### Polling Question
- What is the most common reason for barcode-intercepted errors captured by iv room workflow systems?
- Wrong dose
 - Wrong drug
 - Wrong time
 - Wrong diluent
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- ### Summary
- **IV room barcode workflow systems can:**
 - ❖ Increase safety
 - ❖ Reduce waste
 - ❖ Streamline and standardize workflow
 - **It's time for a change**
 - ❖ Barcode scanning in the IV room should become the standard of practice
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Automated i.v. Workflow Systems and Technologies

*Caryn Belisle, R.Ph., M.B.A.
Director of Pharmacy Regulatory Compliance, Quality and Safety
Brigham and Women's Hospital*



Brigham and Women's Hospital Boston, MA



Introduction

- Discuss the need for patient safety-related improvements to our current Compounded Sterile Product (CSP) admixture services
- Describe two examples of improvements in pharmacy workflow resulting from the integration work flow assist systems into the CSP preparation process
- Identify several examples of potential problems or new sources of errors associated with implementation of CSP admixture workflow technology
- Discuss key lessons learned when implementing a gravimetric-controlled work flow assist device



Evidence Demonstrating Concerns about Sterile IV Admixtures Prepared by Healthcare Workers

The Emily Jerry Story



Volumetrics vs. Gravimetrics

- ❖ A gravimetric measurement process utilizes Specific Gravity to weigh and verify the accuracy of all components used to prepare a Compounded Sterile Product (CSP)
 - Technology using gravimetric assessment can have accuracy parameters set for each specific drug depending on accuracy needed.
- ❖ A volumetric measurement process relies on the ability of a pharmacy technician to accurately reconstitute, measure and draw up all components used to prepare a CSP. Precision accuracy in a manually prepared CSP is impacted due to the variability in the products used:
 - IV bags are frequently overfilled by 10%
 - Medication vials have an accuracy range of +/- 10%
 - Syringes are accurate +/- 5%
 - Human variability



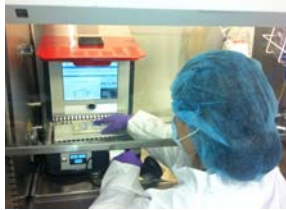
What do we want to see in an i.v. workflow device?

- ❖ Bar code verification
- ❖ Specific gravity and gravimetric verification
- ❖ Remote pharmacist verification
- ❖ Optical scanning
- ❖ Central data storage
- ❖ High degree of accuracy and precision
- ❖ Workflow prioritization



i.v. Soft Assist

- Checks human preparation process at each step using
 - ❖ Optical scanning
 - ❖ Bar code verification
 - ❖ Gravimetric checking
- Interface with CPOE system
- Patient specific doses



Remote Pharmacist Verification



With permission of Health Robotics

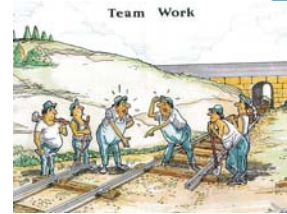
Centralized Electronic Data Storage and Database Management

- We need the capability to electronically store all data associated with the preparation of CSPs
 - ❖ Date/time
 - ❖ Source of preparation (Device and Operator)
 - ❖ All ingredients with lot numbers and Exp. Date
 - ❖ Accuracy of final product
 - ❖ Production time for efficiency
- We need the capability to analyze and utilize the data to continuously improve the process and staff proficiency



Changing the Work Flow

- Can be very difficult and can be upsetting to staff.
 - ❖ "I can do it faster!"
 - ❖ "Don't you trust me?"
- Do not underestimate the time and effort required to do this right!



How We Dealt With It.....

- Lean concepts
- STAFF DRIVEN Tabletop exercises
- STAFF DRIVEN Time and Motion Studies



LEAN SIX-SIGMA



Potential Concerns with Changing to New Processes for CSP Preparation

- Technology is relatively new and is still developing
 - ❖ We are in the early adopter phase
- The technology is not proven as yet with a multitude of evidenced based studies
- Potential exists for new kinds of errors to occur due to the introduction of the new technology, new processes and new roles for staff
- Staff will need additional training to adapt to the additional steps of workflow devices
- Staff may over-rely on the technology and vigilance may be reduced



Key Lessons Learned

- Set expectations early & mobilize commitment
- Daily huddles during implementation and weekly check-in during sustain phases
- Encourage input from all SPR staff
 - ❖ All ideas will be considered
 - ❖ Some parts of the process are negotiable, others are not – speak up proactively
 - ❖ Focus on the positive



Key Lessons Learned

- Incorporate QA measures directly into daily workflow
- Ensure operators, not just super-users continually work with the iv workflow device
- Adaptation of processes & change management.
 - ❖ Techs must be first line for improvement recommendations with new technologies
 - ❖ What works and what doesn't work
- A face-to-face "Thank You" is unquantifiable!



Additional Lessons Learned

- It takes time to add and validate new products to the database...patience is key
- Product shortages can greatly impact output volume
- New problems can arise unexpectedly and can be related to:
 - ❖ vial sizes
 - ❖ drug product composition
 - ❖ Hardware
 - ❖ Software
 - ❖ Human interface issues



Additional Lessons Learned

- You must have clearly written implementation and validation protocols
- You must also have clear change management protocols for when hardware or software are upgraded
- Training of both the pharmacist and technical staff is a key success driver
- Establish a partnership with your vendor to keep in constant contact during implementation and expansion and upgrade periods



Polling Question

i.v. Workflow system technologies can provide which of the following below?

- A. Barcode verification
- B. Efficient workflow
- C. Optical scanning
- D. Central data storage
- E. All of the above



Conclusion

- It's time for the old process of compounding and visual checking to be retired
- Innovative technology is now available that will allow for precise and accurate sterile product preparation
- Pharmacy leaders need to embrace the change and lead their departments into the future



QUESTIONS



Thank you for attending!

- Remember to process and claim your CE credit no later than 60 days from today at elearning.ashp.org

Enrollment Code: **15014**

- Please send any remaining questions to sections@ashp.org

