

New and Emerging Strategies for Minimizing Errors in I.V. Preparation: Focus on Safety and Workflow Efficiency

Current State of Pharmacy Compounding

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Learning Objectives

- Review the current environment in i.v. admixture services, including the need for improvements in patient safety and workflow processes.
- Review currently available sterile compounding technology (e.g., bar coding, automated compounders, robots, workflow software, validation software).
- Compare the accuracy of volumetric and gravimetric processes for preparing sterile i.v. preparations.
- Describe the potential effects of i.v. technology on waste, cost, and efficiency.

TO AVOID ACCIDENTS AND AFFORD SECURITY
FOR SELF AND PATIENT
WHEN ORDERING OR PRESCRIBING MERCURY BICHLORIDE,
SPECIFY

THREADED MERCURY BICHLORIDE TABLETS S & D.

Each tablet is attached to all other tablets BY A THREAD, and packaged in a specially designed bottle, thereby rendering it impossible that a tablet should be used either day or night without having first detached it by cutting the thread or slipping the tablet from the thread.

Besides this unique feature of threading, these tablets are TREFOIL IN SHAPE, BLUE IN COLOR, STAMPED POISON and packaged in bottles of peculiar shape with the word POISON blown in raised letters on the corners.

ACCURACY, EFFICIENCY AND SAFETY ASSURED.
PROTECT YOURSELF AS WELL AS YOUR PATIENT BY SPECIFYING
THREADED MERCURY BICHLORIDE TABLETS S & D.
PACKAGED ONLY IN BOTTLES OF 25 TABLETS EACH.

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What is your primary job position?

?

- A. Director of Pharmacy
- B. Associate or Assistant Director of Pharmacy
- C. Clinical Coordinator or Other Supervisory Role
- D. Staff Pharmacist
- E. Clinical Pharmacist
- F. Medication Safety Coordinator
- G. Informatics/Technology Specialist
- H. Faculty

Who says what we have to do?

- Regulatory agencies
- Accreditation organizations
- Professional guidelines

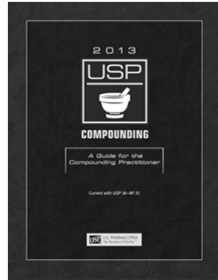
Regulatory Agencies

- National
 - Food and Drug Administration (FDA)
 - United States Pharmacopeia (USP)
- State
 - Board of Pharmacy
 - Department of Health

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USP

- Nonsterile compounding
 - Chapter <795>
- Sterile compounding
 - Chapter <797>
- Hazardous drugs
 - Coming soon



Accreditation Organizations

- The Joint Commission
- Det Norske Veritas (DNV) Healthcare
- Healthcare Facilities Accreditation Program
- Center for Improvement in Healthcare Quality
- Ambulatory Accreditation Organizations


Best Practices

- ASHP
- American Society for Parenteral and Enteral Nutrition (ASPEN)
- Oncology Nursing Society (ONS)
- Physician organizations
- Nursing organizations



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ASHP's New Compounding Sterile Preparations Guidelines



American Society of Health-System Pharmacists
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Practice and Policy

Policy Positions & Guidelines

- About ASHP Statements & Guidelines
- Browse by Topic
- Browse by Document Type
- New Guidance Documents
- Draft Guidance Documents
- Participate in ASHP Guideline Development
- Suggest a Topic for ASHP Policy


Resource Centers

Guidelines

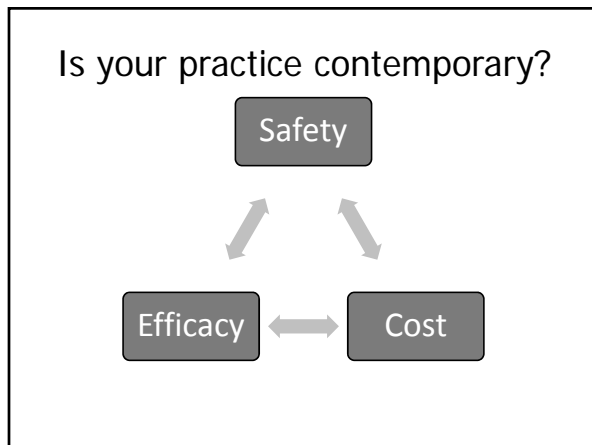
ASHP's professional policies contain varying levels of detail. Policy positions are short pronouncements on one aspect of practice. Statements express basic philosophy, and guidelines (including what were formerly called "technical assistance bulletins") offer programmatic advice. Therapeutic position statements are concise responses to specific therapeutic issues, and therapeutic guidelines are thorough, evidence-based recommendations on drug use.

- Activities of Vendors' Representatives in Organized Health Care Systems (pro)
- Adverse Drug Reaction Monitoring and Reporting (pro)
- Compounding Sterile Preparations (pro) new
- Emergency Medicine Pharmacist Services (pro)
- Handling Hazardous Drugs (pro)
- Home Infusion Pharmacy Services (pro) new

Need advice on Electronic Health Records?



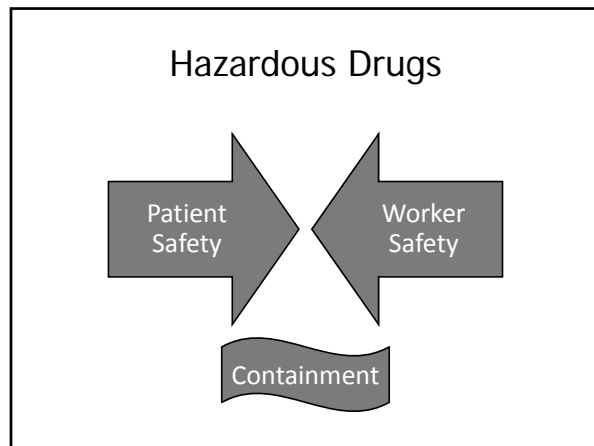
<http://www.ashp.org/DocLibrary/BestPractices/PrepGdlCSP.aspx>

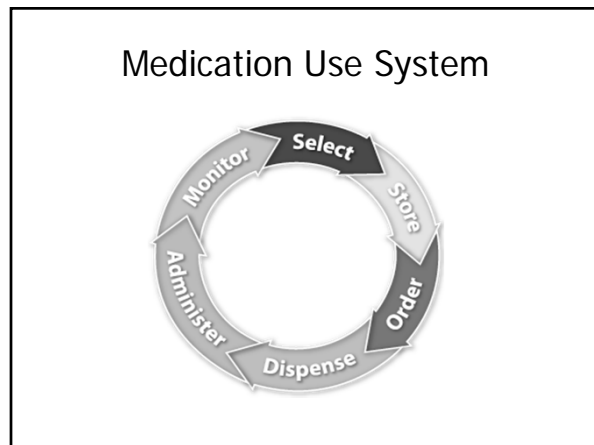


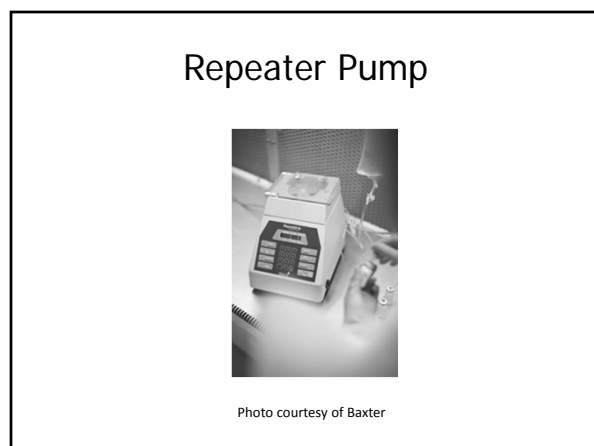
Patient Safety

- Facilities
 - Rooms
 - Devices
 - Equipment
- Personnel
- Environmental monitoring
- Beyond-use dates

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Smart Infusion Pumps



Courtesy of CareFusion. All rights reserved.

Closed System Transfer Devices

- A drug transfer device that mechanically prohibits the transfer of environmental contaminants into the system and the escape of hazardous drugs or vapors outside the system



Photo courtesy of BD

Automated Compounding Device



Photo courtesy of Baxter

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Robots



Photo courtesy of Baxter

Workflow Software



Photo courtesy of Baxter

Workflow Software



Photo courtesy of BD

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Workflow Software

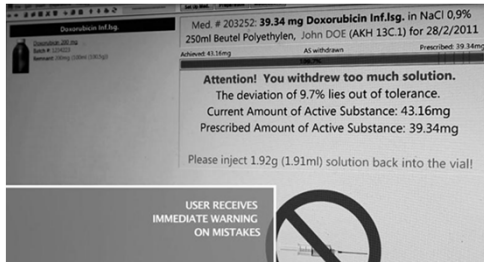
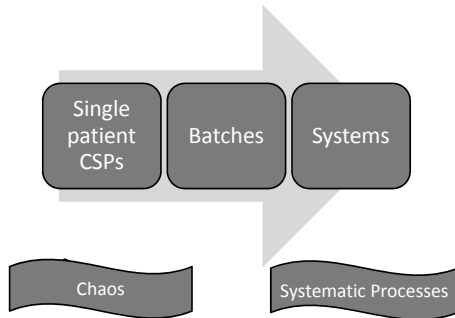


Photo courtesy of BD

Evolution



CSP=compounded sterile preparation

Workflow Methods

- Develop workflow methods to support quality practices
 - Existing practices: 1970s → 2013
 - Contemporary standards: USP Chapter <797> and others
 - Contemporary guidance: ASHP and others

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Our Goal

- Decrease errors
 - Standardization
 - Streamline workflow
- Increase safety
- Increase efficiency



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I.V. Preparation Procedures: Evaluating Processes for Improving Quality and Safety

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Objectives

- Review currently available sterile compounding technology (e.g., bar coding, automated compounders, robots, workflow software, validation software).
- Compare the accuracy of volumetric and gravimetric processes for preparing sterile i.v. preparations.

Overview of I.V. Technology

- Robotics
 - Apoteca: APOTECACHemo
 - Health Robotics: i.v. STATION ONCO
 - Intelligent Hospital Systems: Riva
 - Baxter: IntelliFill i.v.
 - ICU Medical: Diana
- I.V. workflow systems
 - Baxter: DoseEdge
 - BD: Cato

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Which i.v. robotics technology is being used within your organization?

?

- A. No i.v. robotic technology is being used
- B. Apoteca: APOTECACHemo
- C. Health Robotics: i.v.STATION ONCO
- D. Intelligent Hospital Systems: Riva
- E. Baxter: IntelliFill i.v.
- F. ICU Medical: Diana
- G. Not applicable

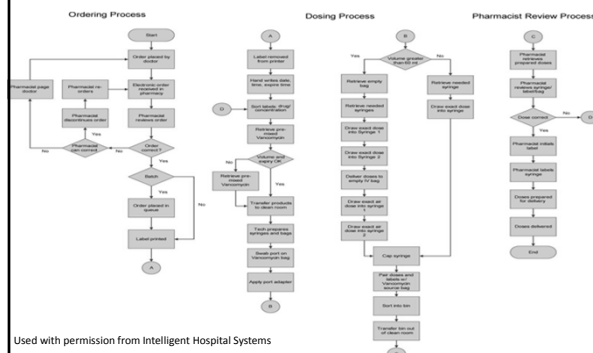
Which i.v. workflow system is being used within your organization?

?

- A. No i.v. workflow systems are being used
- B. Homegrown i.v. workflow system
- C. Baxter: DoseEdge
- D. BD: Cato
- E. Not applicable

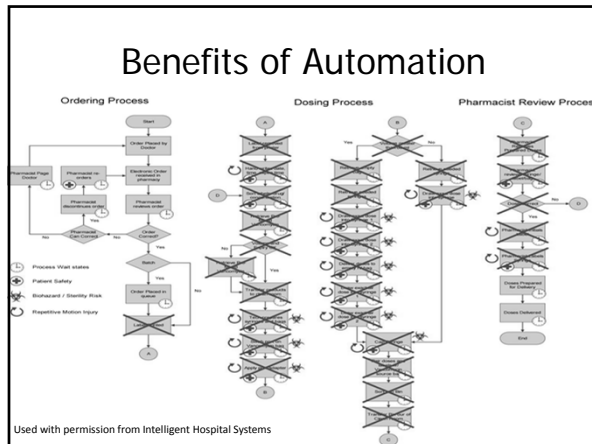
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Steps in Preparing a Medication



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APOTECACHemo

- Currently only compounds chemotherapy
- Prepares syringes, i.v. bags, and elastomeric pumps
- Uses both gravimetric and volumetric check
- 12-40 preparations per hour
- Uses barcode, size and shape of vial, and label scan for product identification
- One published study describing implementation

www.apotecausa.com



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Implementation of APOTECACHemo

- Description of the implementation and experience at Cleveland Clinic
- 7,384 doses over 13 months
- Performance issues categorized
 - Dose issues: 1.2% were manually modified
 - Mechanical issues: 155 documented
 - Human error: 12 instances
 - Interface / IT issues
- Does not prepare syringes for them
- They did not reduce full-time equivalents (FTEs)

Yaniv AW, et al. *Am J Health-Syst Pharm.* 2013; 70:2030–7.

Riva

- Currently compounds chemotherapy and non-chemotherapy items
- Prepares both syringes and i.v. bags
- Uses gravimetric check
- I.V. bags: 12–28 per hour
- Syringes: 29–60 per hour
- UV sanitation of vials and bags
- No published studies of effectiveness

www.intelligenthospitals.com



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i.v. STATION

- Currently compounds chemotherapy and non-chemotherapy items
- Also has an i.v. workflow system
- Prepares glass bottles up to 100 mL, syringes and i.v. bags
- Uses gravimetric check
- 10–40 preparations per hour
- Barcode scans both drug and diluent
- Published studies of effectiveness

www.health-robotics.com

i.v. STATION



Used with permission from Health Robotics

Impact of Robotics on Chemotherapy Preparation

- Utilized direct observer technique
- Results

	Baseline (1,421)	Intervention (972)	P value
Medication errors	9 (0.7%)	7 (0.7%)	NS
Staff safety events	73 (5.1%)	28 (2.9%)	P=0.007
Unintended consequences	---	45 (4.6%)	
Medication accuracy	23 (12.5%) of 184	1 (0.9%) of 110	P=0.002
Workflow – overall	7 min 24 sec	10 min 51 sec	P=0.009
Costs – personnel	\$5.22	\$5.10	
Costs – ancillary materials	\$13.36	\$6.44	P<0.001

Seger AC, et al. *J Oncol Pract.* 2012;8: 344–349.

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Health Robotics Evaluation

- Monoclonal antibodies are difficult to reconstitute
 - Foaming hampers drawing correct doses into syringes
 - Aggregates associated with immune reactions
- Robotic reconstitution and compounding are similar to manual process
- Manual compounding can cause upper limb disorders (ULD)
- Automated compounding was associated with a lower ULD risk than manual processes

Peters BJM, et al. mAbs 2013;5:162–70; McLeod M. *European Journal of Hospital Pharmacy*. 2012;19:293–298.

IntelliFill i.v.

- Only prepares syringes
- Range of volume is from 0.5 mL to 11.5 mL
- While it can make up to 600 syringes per hour, a usual rate is 360 per hour
- Requires the use of special syringes (IntelliFill i.v. banded syringes)
- No published studies of effectiveness

IntelliFill i.v.



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Diana

- User controlled (as opposed to robotic)
- Requires the use of a closed system transfer device during compounding
- Can prepare i.v. bags, syringes, and elastomeric pumps
- Two channels
 - Low volume: <20 mL
 - High volume: up to 50 mL
- No published studies of effectiveness

Diana



Used with permission from ICU Medical

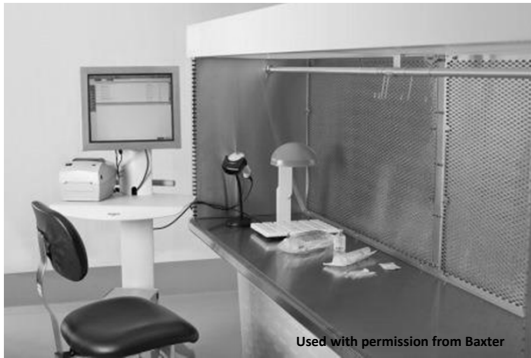
DoseEdge

- Pharmacy workflow manager
- Can assist with preparation of more than i.v. doses (TPN; oral syringes)
- Utilizes bar-code scanning of product
- Volumetric method (camera) for checking
- Allows for remote order verification
- Assists in compliance with preparation best practices
- Can be used within a glove box
- No published studies of effectiveness

www.baxtermedicationdeliveryproducts.com/pharmacy-workflow/doseedge.html

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DoseEdge



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Cato

- Information system that allows for physician order entry (regimens / protocols), pharmacy order verification and preparation, and nursing administration
- Pharmacy workflow manager
- Guides the technician when preparing a product
- Gravimetric method (balance) for checking – organization sets the tolerance
- Can be used within a glove box
- No published studies of effectiveness

www.chemocato.com

Cato



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Major Concerns / Issues With Chemotherapy Dispensing

Efficiency
Safety

What is your usual chemotherapy
turnaround time?

?

- A. >60 minutes
- B. 45-60 minutes
- C. 30-45 minutes
- D. 15-30 minutes
- E. <15 minutes

Using Lean Principles to Improve Adult Outpatient Chemotherapy Preparation Turnaround Time in a Large Cancer Hospital Infusion Pharmacy

Matt Lamm, Pharm.D., MS, BCPS
Lindsey Poppe, Pharm.D., MS, BCPS
Stephen F. Eckel, Pharm.D., MHA, BCPS

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Background

- Opened new cancer center pharmacy in August, 2009
 - Consolidation of two dispensing sites
- 42% total growth in chemotherapy volume since opening
 - 51% increase in outpatient chemotherapy
- 215 total chemotherapy preparations per day
- Minimal change to staffing (5 pharmacists; 6 technicians)

Chemotherapy Wait Time

- 2011 – anecdotal data of 1 hour total turnaround time
- 2012 – interim goal of 45 minutes
- 2013 – final goal of <30 minutes
- Turnaround time includes
 - Primary verification and order entry into the pharmacy system by a pharmacist
 - Preparation by a chemotherapy pharmacy technician
 - Secondary verification by a pharmacist located inside the infusion cleanroom
 - Delivery to the patient by a pharmacy technician

Study Initiation

- Phase 1 – gathered baseline data for chemotherapy turnaround time for Adult Infusion Clinic patients
- Phase 2 – implemented various experiments using Lean principles in an effort to decrease chemotherapy preparation turnaround time

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Phase 1

- Data collected between January 14th and January 25th, 2013 (9 days)
- Orders were separated into three main categories
 - Preapproved orders in advance (processed 48 hours in advance)
 - On-demand
 - Investigational Drug Service

All Chemotherapy Preparations Results – Phase 1

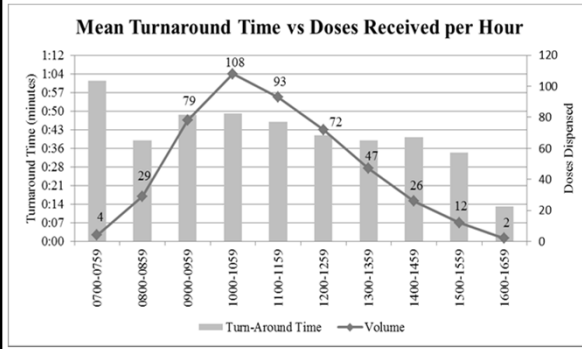
Results of Time-Motion Analysis of All Chemotherapy Preparations				
Variable (n=472)	Mean ± S.D. Total Time per Preparation (min)	Median Total Time per Preparation (min)	Maximum Time per Preparation (min)	Minimum Time per Preparation (min)
Total Turn-Around Time	44 ± 18	42	140	9
Automated Dispensing Cabinet (ADC) to Prep Table	12 ± 11	11	85	0
Prep Table to Technician Start	9 ± 10	6	72	0
Technician Preparation	6 ± 5	5	43	0
End of Tech Preparation to Pharmacist Check	8 ± 7	6	35	0
Pharmacist Check	2 ± 1	2	10	0
Pharmacist Check to Delivery	6 ± 4	5	30	0

Categorized Chemotherapy Preparations Results – Phase 1

	Advance Preparations	On-Demand Preparations	Investigational Drug Service Preparations
	Mean ± S.D. Total Time per Preparation (min) (n=234)	Mean ± S.D. Total Time per Preparation (min) (n=193)	Mean ± S.D. Total Time per Preparation (min) (n=45)
Total Turnaround Time	39 ± 16	48 ± 18	57 ± 22
ADC to Prep Table	5 ± 8	18 ± 10	20 ± 14
Prep Table to Technician Start	10 ± 10	8 ± 10	9 ± 13
Technician Preparation	6 ± 5	5 ± 4	7 ± 4
End of Tech Preparation to Pharmacist Check	8 ± 6	7 ± 7	10 ± 7
Pharmacist Check	1 ± 1	2 ± 2	2 ± 2
Pharmacist Check to Delivery	6 ± 5	5 ± 3	7 ± 4

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Phase 1 Results



Phase 2

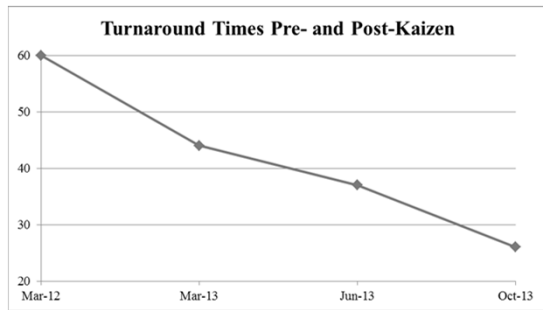
- Implemented a Kaizen event (used A3 model)
- Formed 4 different groups to evaluate functions
 - Outside the cleanroom (CR) checking pharmacist
 - CR technicians
 - CR pharmacist
 - Supplies management

Phase 2

- Suggested changes to the process evaluated
 - Moving the double check of chemotherapy orders from the CR pharmacist to a pharmacist outside the cleanroom
 - Having the CR pharmacist focus on final product checking instead of performing a second clinical check
 - Changing technician product preparation from batch processing to 1-piece flow
 - Remove excess products from the supply room

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Phase 2 Results



Do you use the syringe pull back method?

?

- A. Yes
- B. No
- C. Not sure

Does your i.v. preparation process utilize a gravimetric method to evaluate accuracy?

?

- A. Yes
- B. No
- C. Not sure

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Assessment of dosing accuracy when using volumetric technique in the preparation of chemotherapy

Lindsey Poppe, Pharm.D., MS, BCPS
Scott Savage, Pharm.D., MS
Stephen F. Eckel, Pharm.D., MHA, BCPS

Objectives

- Primary outcome – determine the accuracy of volumetric measurements in the preparation of chemotherapy by using the gravimetric method
- Secondary outcome – evaluate the accuracy of volumetric measurements based on volumes prepared, syringe size used, patient age, preparations requiring reconstitution, drug prescribed, and technicians preparing the agents

Background

- Conducted at the UNC Cancer Hospital
- Approximately 160 chemotherapy doses prepared per day
- 10 different pharmacy technicians are employed there
- All technicians are trained and tested on chemotherapy preparation competencies
- At the time of this study, utilized the syringe pull-back method

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Methodology

- Placed an electronic balance in one hood
- All technicians that were scheduled to work there participated in the study
- Data collected between December 15, 2010, and March 30, 2011
- Doses excluded if no specific gravity, agent given via non-i.v. route, or data transcription incorrect

Methodology

- Empty syringe with a closed system transfer device (CSTD) was weighed
- Medication prepared using the typical process with the syringe pull back method (volumetric technique)
- Full syringe with the drug to be dispensed was weighed
- Drug was dispensed in syringe or transferred to an i.v. bag
- No change was made to the pharmacist checking process

Calculation of Primary Outcome

- Percent volume difference for the dose dispensed compared to the dose prescribed
 - Weight of drug in syringe (full weight minus empty weight)
 - Reduction based upon estimated residual volume
 - Divided by the specific gravity to determine volume dispensed
 - Compared to the prescribed amount to determine difference

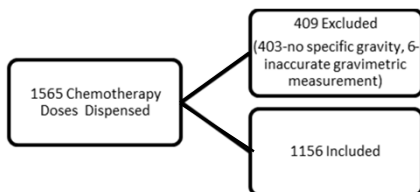
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Few Considerations

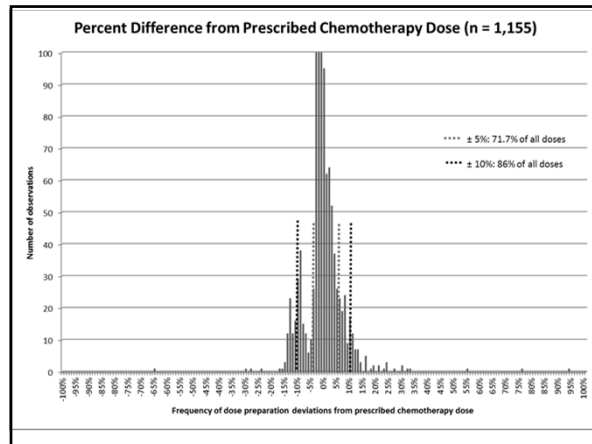
- Concerns with over-dosing and under-dosing of chemotherapy
- Inherent inaccuracies in the current process
 - Percent label strength of the parent product
 - Issues associated with reconstitution
 - Syringe tolerance variability
- Nurse need for and reliance on syringe markings for double check

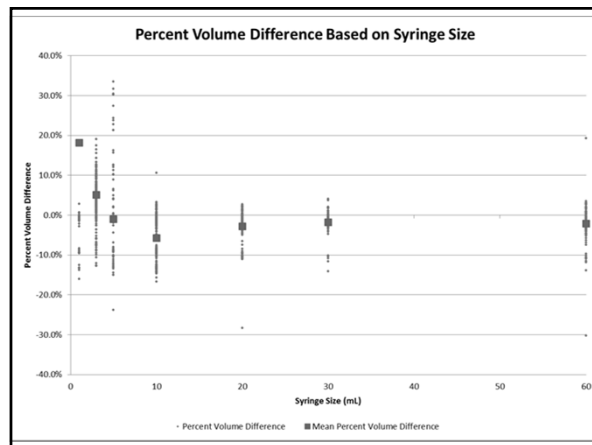
Results

Enrollment



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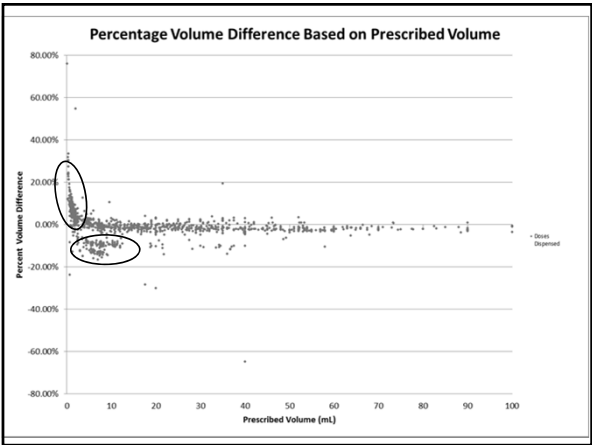
Percent Volume Difference of Drugs Prepared

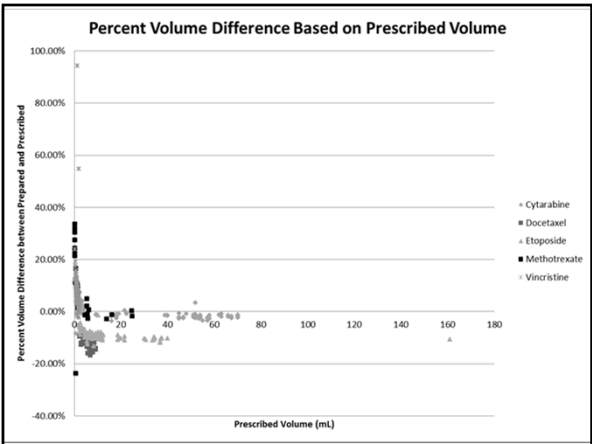
Drug prescribed*	Sample Size	Mean % Volume Difference	Median % Volume Difference	Range (Min, Max)	Confidence Interval
A	165	7.07%	5.76%	(-2.34%, 94.22%)	(-0.066, 0.207)
B	122	1.47%	-0.74%	(-8.37%, 30.2%)	(-0.062, 0.092)
C	57	-0.99%	-0.62%	(-14.08%, 2.02%)	(-0.045, 0.025)
D	50	-0.52%	-1.22%	(-15%, 12.62%)	(-0.07, 0.047)
E	86	-3.46%	-2.15%	(-7.4%, 1.88%)	(-0.081, 0.039)
F	88	-2.31%	-2.36%	(-11.66%, 1.76%)	(-0.05, 0.004)
G	53	-2.42%	-2.46%	(-10.6%, 3.09%)	(-0.049, 0.004)
H	106	-7.24%	-9.05%	(-13.26%, -1.41%)	(-0.143, -0.001)

*Drugs with sample size > 50

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Percent Volume Difference Based on Technician Preparing the Drug					
Tech #	Sample Size	Mean % Volume Difference	Median % Volume Difference	Range (Min, Max)	Confidence Interval
1	51	2.91%	-1.28%	(-12.77%, 94.22%)	(-0.015, 0.073)
2	5	-0.05%	-0.68%	(-1.86%, 3.69%)	(-0.128, -0.111)
3	441	-0.07%	-0.52%	(-13.49%, 32.68%)	(-0.009, 0.006)
4	39	-0.16%	-1.41%	(-11.47%, 30.2%)	(-0.019, 0.021)
5	292	-0.45%	-1.32%	(-23.74%, 76.09%)	(-0.013, -0.001)
6	94	-1.67%	-1.21%	(-15.67%, 10.57%)	(-0.026, -0.007)
7	31	-1.73%	-1.45%	(-30.21%, 6.92%)	(-0.038, 0.004)
8	131	-2.10%	-2.00%	(-16.65%, 31.72%)	(-0.034, -0.015)
9	60	-2.80%	-1.92%	(-64.9%, 11.21%)	(-0.051, -0.005)
10	12	-4.76%	-2.79%	(-28.34%, 5.76%)	(-0.094, 0.065)





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Evaluation of Final Product

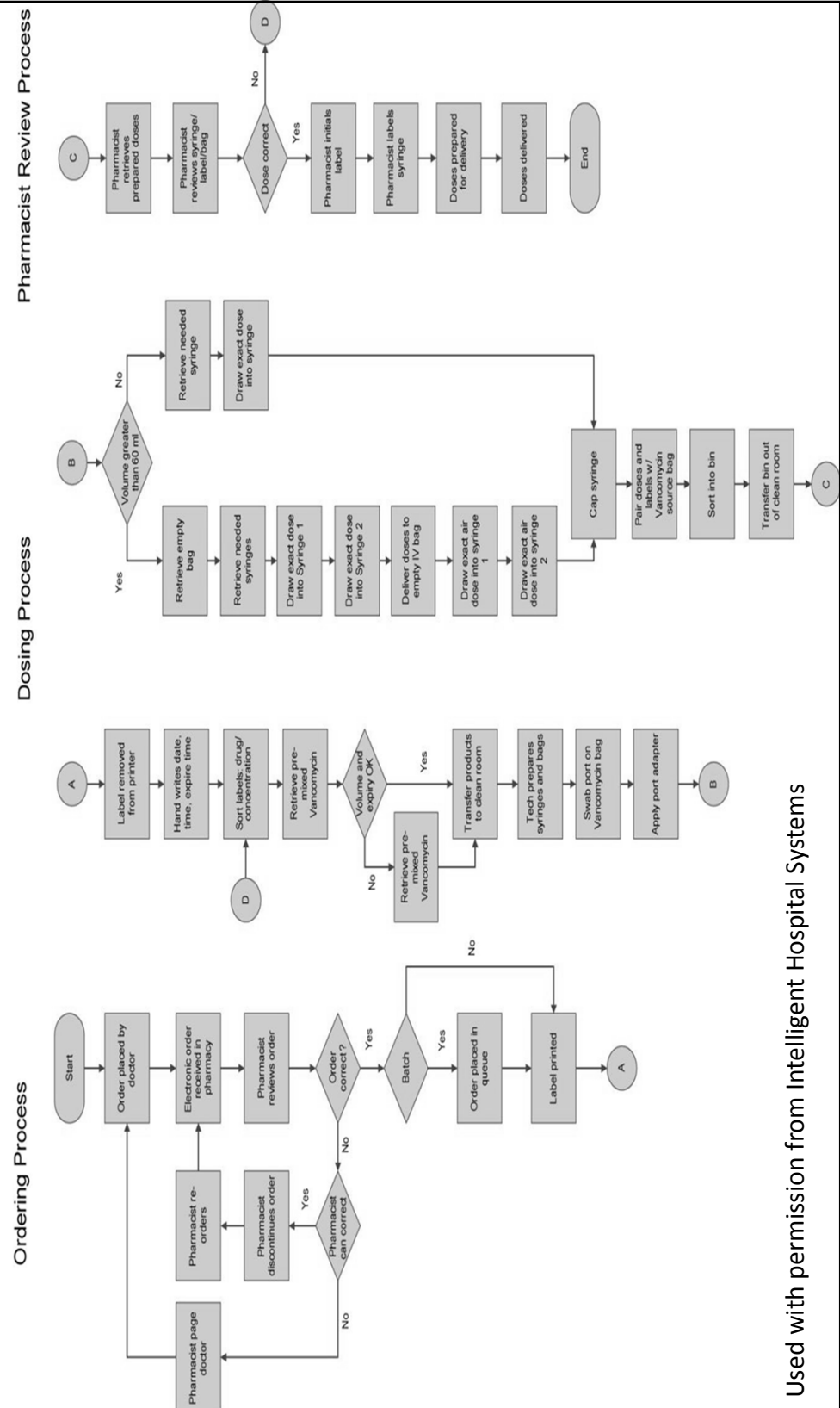
- One limitation with study is use of syringe pull-back method
- Classified data on whether dispensed as syringe or i.v. bag

	Number	Mean % Volume Difference	Median % Volume Difference	Range
Total	1,156	-0.53%	-1.27%	
Bags	915 (79%)	-1.80%	-1.69%	(-28.34% to 76.09%)
Syringes	241 (21%)	4.27%	3.68%	(-64.90% to 94.22%)

Conclusions

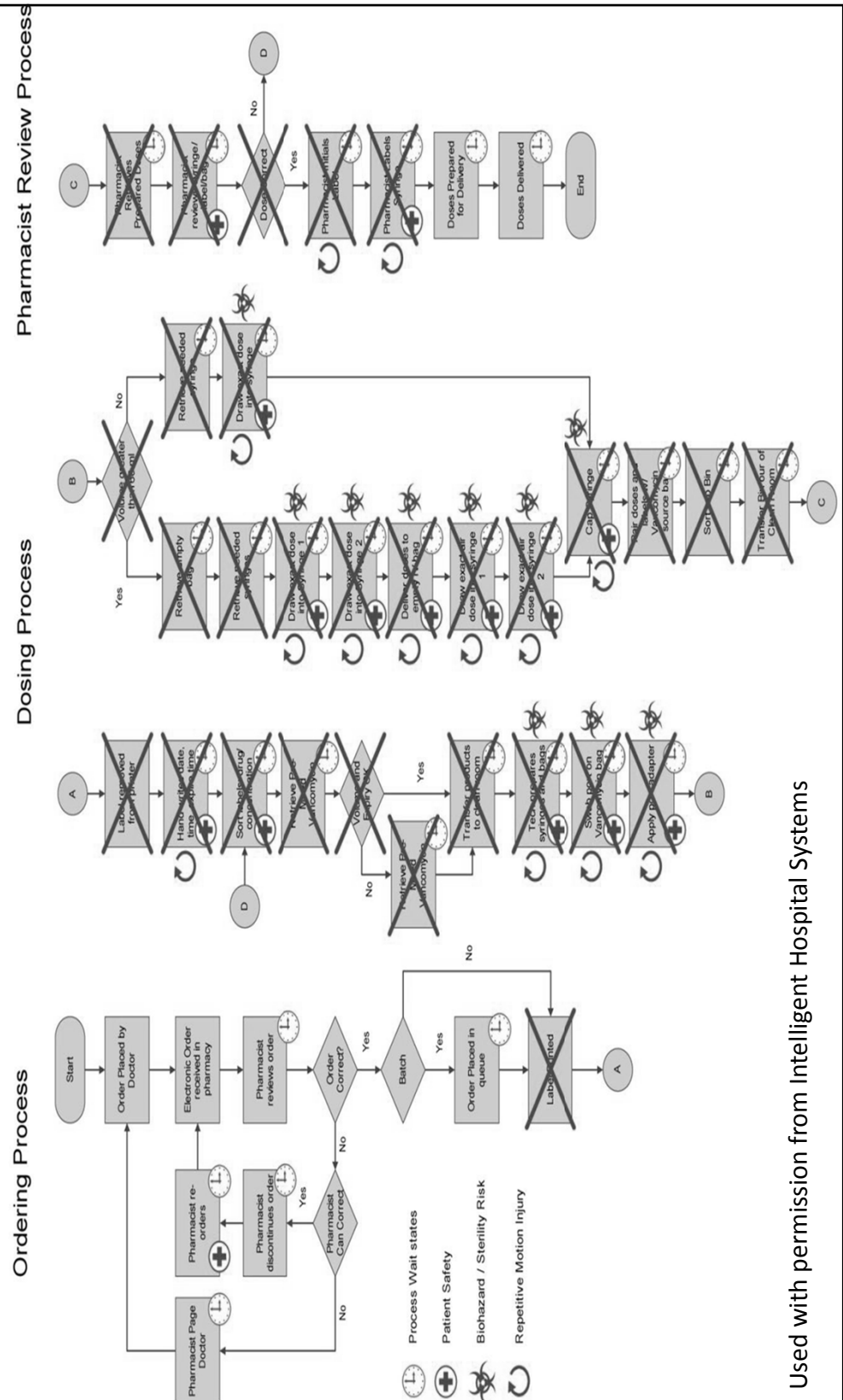
- Continued development of new technology to aid in preparation of chemotherapy
 - These have both differences and similarities
- Limited literature evaluating their impact and effectiveness
- Need for continued research into current processes and systems
- Focus on enhancing efficiencies while maintaining safety in chemotherapy preparation

Steps in Preparing a Medication



Used with permission from Intelligent Hospital Systems

Benefits of Automation



Used with permission from Intelligent Hospital Systems

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Using Technology to Promote Safety and Minimize Errors in I.V. Preparation

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MD Anderson Cancer Center
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Objectives

- Describe the potential effects of i.v. technology on waste, cost, and efficiency.

MD Anderson Cancer Center (MDACC) Division of Pharmacy

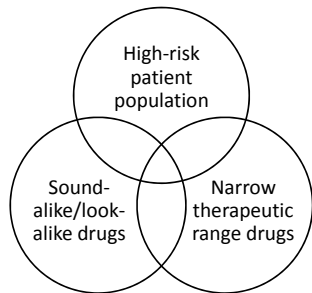
- 557 Pharmacists and Technicians
- 14 Production Areas
- Ambulatory Treatment Center (ATC) prepares 225,000 chemotherapy doses/yr.



Photo courtesy of MD Anderson

New and Emerging Strategies for Minimizing Errors in I.V. Preparation: Focus on Safety and Workflow Efficiency

Chemotherapy Preparation Risks



Where do you see the most risk for error during compounding?

?

- A. Drawing up diluent
- B. Final concentration calculation
- C. Bag labeling
- D. Pharmacist verification

I.V. Chemotherapy Preparation Errors Exploratory Study

- Field observations at six Canadian cancer centers
- Five critical process steps
 - Staging
 - Reconstitution
 - Mixing
 - Verification
 - Labeling

White R, et. al. *J Oncol Pharm Practice*.2013 Feb 1. [Epub ahead of print]

New and Emerging Strategies for Minimizing Errors in I.V. Preparation: Focus on Safety and Workflow Efficiency

I.V. Chemotherapy Preparation Errors Exploratory Study

- Reconstitution (2 sites)
 - No diluent verification
- Mixing (5 sites)
 - Multiple preparations in the biological safety cabinet (BSC)
- Labeling (3 sites)
 - Patient-specific label not paired with bag

White R, et. al. *J Oncol Pharm Practice*.2013 Feb 1. [Epub ahead of print]

I.V. Chemotherapy Preparation Errors Exploratory Study

- Dispensing errors range <0.1% up to 65%
- Methods of detection unreliable
 - Chart review
 - Self-reporting
 - Direct observation

White R, et. al. *J Oncol Pharm Practice*.2013 Feb 1. [Epub ahead of print]

MDACC Reported Medication Related Errors

- Patient Safety Net reviewed between September 2011 to February 2013
- 27 reports including
 - Wrong amount of vehicle ($n=15$)
 - Wrong amount of drug ($n=2$)
 - Wrong drug ($n=1$)
 - Wrong bag type ($n=1$)

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MDACC Cost of Chemotherapy Preparation Errors

Total doses= 49910
Error rate 0.12%

Types of errors (Oct 2012- July 2013)	Cost
Wrong amount of vehicle (n=8)	\$21,609.39
Wrong vehicle (n=8)	\$7,501.25
Calculation/Math error (n=2)	\$5,083.96
Expired drug vial (n=5)	\$2,727.50
No drug vial to check (n=2)	\$2,491.53
Wrong amount of drug (n=9)	\$2,151.69
Reconstitution error (n=2)	\$2,034.00
Wrong drug (n=3)	\$1,688.57
Unspecified mixing error (n=11)	\$1,222.61
Wrong type of bag (n=2)	\$1,173.38
No weight slip included (n=5)	\$1,110.76
Missing expiration info on bag (n=3)	\$44.68
Recycle error (n=1)	\$19.62
Total errors (n=61)	\$48,858.94

Analysis of I.V. Preparation Process

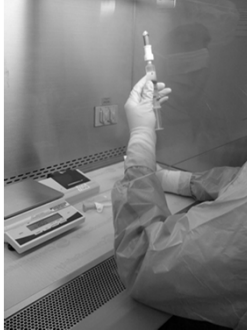


Photo courtesy of K. Reece

Failure Mode and Effects Analysis for I.V. Preparation Steps

- Process steps – detail, detail, detail
- Failure modes – What could go wrong?
- Failure effects (Severity)
- Causes (probability)
- Controls (detectability)
- Process improvement / recommended actions

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MDACC FMEA Process Summary

I.V. Process Steps	# of Steps	# of Failure Modes
1) Review Label	4	19
2) Gather Components	8	28
3) Preparation Plan	8	24
4) Vehicle Bag Preparation	13	49
5) Vial Preparation	23	106
6) Final Product Preparation	12	58
* Vinca Alkaloids Process	15	19
* Intrathecal Process	14	31
Total	97	334
334 Potential Failures x 170 doses/day = 56,780 chances for error in one day		

FMEA=failure mode and effects analysis

I.V. Management System Implementation

- Initiated pilot in October 2012
- Involvement from pharmacy, informatics, and software vendor
- 28 drugs currently in production
- Over 12,000 products prepared

Hardware Components

- Computer
- Barcode scanner
- Balance
 - Accuracy ± 0.01 g
 - Verification of drug volume based on actual concentration and density of drug
- Label printer

New and Emerging Strategies for Minimizing Errors in I.V. Preparation: Focus on Safety and Workflow Efficiency

Working with I.V. Management System

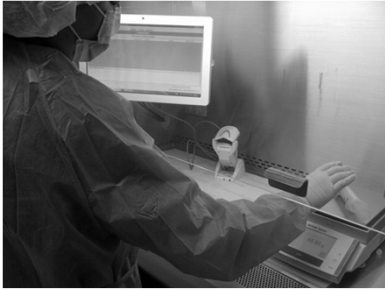


Photo courtesy of K. Reece

Software Features

- Dose management queue
- Standardizes process steps
- Documents preparation steps
- Prints patient label with correct beyond-use date (BUD)
- Manages vial inventory
- Records drug waste
- Generates reports including productivity and inventory management

What is your main concern with i.v. technology?

?

- A. Increased preparation time
- B. Increased cost
- C. Increased waste
- D. Complex process

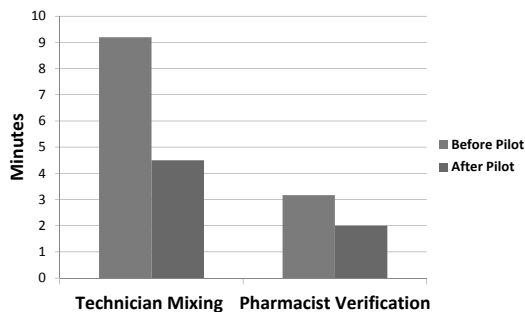
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I.V. Management System Pilot Evaluation

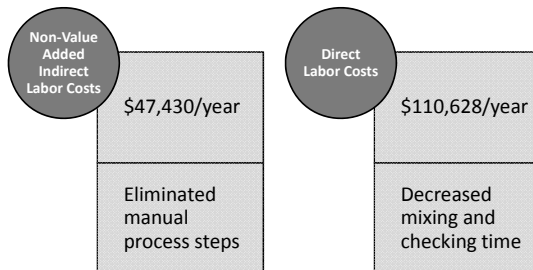
Productivity
Waste
Safety

The Office of Performance Improvement
Miguel Lozano
Sr. Quality Engineer

Cycle Times

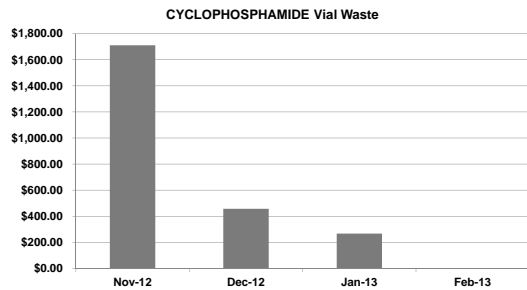


Cost Savings



New and Emerging Strategies for Minimizing Errors in I.V. Preparation: Focus on Safety and Workflow Efficiency

Cost of Opened Vial Waste



Potential Risk Reduction

I.V. Process Steps	# of Failure Modes	# of Failure Modes with I.V. software
1) Review Label	19	16
2) Gather Components	28	14
3) Preparation Plan	24	20
4) Vehicle Bag Preparation	49	24
5) Vial Preparation	106	25
6) Final Product Preparation	58	44
* Vinca Alkaloids Process	19	13
* Intrathecal Process	31	19
Total	334	175

52% of Failure Modes Impacted by I.V. Technology

Detection of Preparation Errors

Preparation Failures detected during drug weighing	11/1/12 - 1/23/13 (Immediately following pilot)	1/23/13 - 3/25/13
Doses prepared	1560	1242
Doses over tolerance	36	19
Doses under tolerance	46	28
Percentage out of tolerance	5.26%	3.78%

New and Emerging Strategies for Minimizing Errors in I.V. Preparation: Focus on Safety and Workflow Efficiency

The Joint Commission Sentinel Event Alert

- Warning issued about technology-related adverse events
- Suggested actions
 - Assess workflow processes
 - Careful planning and implementation
 - Staff training programs
 - Monitor continuously

The Joint Commission. Safely implementing health information and converging technologies. Issue 42; Dec 2008.

Challenges

- Reluctance by pharmaceutical companies to provide drug density (g/mL)
- Non-standardized barcodes
- Acceptance by staff of new processes

Summary

- ✓ System uses gravimetric validation method
- ✓ Eliminates manual processes
- ✓ Provides step-by-step documentation
- ✓ Improves accuracy
- ✓ Allows barcode scanning for drug and vehicle
- ✓ Provides more efficient pharmacist verification process
