SOS: Shortage of Solutions — Technologies to Assist in Managing IV Solution Shortage

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Disclosure

• **Claire Knight**: Becton Dickinson, Inc.: Employee
• **Dennis Tribble**: Becton Dickinson, Inc.: Employee
• All other planners, presenters, and reviewers of this session report no financial relationships relevant to this activity.
Objectives

• Describe the operational impact for alternatives for dealing with the IV shortage in the ASHP recommendations.
• Develop and analyze plans for proposed alternatives that have impact on caregivers and patient safety.
• Analyze technological strategies to mitigate shortages of IV solutions and effectively communicate and document those plans.
• Evaluate possible outcomes of various strategies discussed.
Extent of the problem

• Initially Baxter 0.9% Sodium Chloride and Dextrose 5% in water SVP’s
• Involves dextrose and saline bags from B Braun, Baxter, ICU Medical (formerly Hospira) and Fresenius\(^1\)
• Also included MiniBagPlus SVP’s and ADD-vantage SVP’s\(^2\)
• Empty IV containers are now in short supply\(^3\)
• Lidocaine premix now in short supply\(^4\)
• Dextrose 5% in Water in short supply 100 mL 250 mL, 500 mL, 1000 mL (FK)\(^4\)
• Heparin premix in 0.9% sodium chloride in short supply (Baxter and Hospira)\(^4\)
• 0.9% Sodium chloride all sizes, all vendors\(^4\)

\(^1\) US Food and Drug Administration FDA Drug Shortages [https://www.accessdata.fda.gov/scripts/drugshortages/dsp_ActiveIngredientDetails.cfm?AI=Sodium%20Chloride%200.9per%20Injection%20Bags&st=c] viewed 2018-04-01
\(^2\) US Food and Drug Administration FDA Drug Shortages [https://www.accessdata.fda.gov/scripts/drugshortages/dsp_ActiveIngredientDetails.cfm?AI=Dextrose%205per%20Injection%20Bags&st=c] viewed 2018-04-01
\(^3\) US Food and Drug Administration FDA Commissioner Scott Gottlieb, M.D., updates on some ongoing shortages related to IV fluids [https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm595020.htm] viewed 2018-04-01
\(^4\) US Food and Drug Administration FDA Drug Shortages [https://www.accessdata.fda.gov/scripts/drugshortages/dsp_ActiveIngredientDetails.cfm?AI=Sodium%20Chloride%200.9per%20Injection%20Bags&st=c] viewed 2018-04-01
Small Volume Parenteral Solution Shortages:

Suggestions for Management and Conservation

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Pharmacy Operational</th>
<th>Nursing Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace use of SVP to start IV lines with flush solutions, or LVP’s</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Switch to IV Push – Pharmacy compounded</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Switch to IM/SQ</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Switch to PO</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Switch to LVP</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use which ever base solution is most available</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mix-on-Demand products (AddVantage, MiniBag Plus, etc.)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Purchase frozen pre-mixed products</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Repackage from LVP</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Mix from Concentrates</td>
<td>X</td>
<td></td>
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</tbody>
</table>
Polling Question

How many of you have had to make programmatic changes due to the IV shortage?

A. I have had to change administration methods to deal with the shortage

B. I have NOT had to change administration methods to deal with the shortage
Polling Question

How many of you have been able to increase conversions to alternative routes?

A. ORAL
B. IM/SQ
C. NO
Polling Question

How many of you have been able to preserve piggybacks by changing line starting procedures to use flush syringes or LVP solutions?

A. YES

B. NO
Polling Question

How many of you preferentially use mix-on-demand (MOD) IV containers for IVPB medications in suitable containers?

A. Yes – antibiotics only

B. Yes – all possible drugs

C. Typically do not use MOD containers
Polling Question

How many of you have moved to IV push?

A. Yes – antibiotics only

B. Yes – all possible drugs

C. NO
Polling Question

If you use MOD containers, do you:

A. Have pharmacy pre-assemble them in the hood

B. Have nursing assemble them on the floor

C. Typically do not use MOD containers
Polling Question

How many of you have reverted to use of in-line burettes in one or more settings?

A. YES
B. NO
Strategy

Changing IV start/KVO practices

• Flush Syringes - Not all lines are created equal

• LVP solutions
  • Contribute to further shortages
  • Added waste
  • Infection concerns

• Many secondary IV’s can be delivered with a saline flush of the delivery set (KVO not really required).
Strategy

Switch to IV Push

• Pharmacy
  • Stability issues\(^5\)
  • Osmolarity tolerance – requires *slow* IV push
  • Changes to CPOE
  • Changes to DERS libraries
  • Labor to prepare syringes

• Patient Care
  • Who can give IV Push
  • Nurse training
  • Additional time at bedside
  • Syringe pump availability
  • Syringe infusion set? Availability?

\(^5\)Ampicillin, for example, is normally delivered in concentrations of 20 mg/mL (1 gm in 50 mL, 2 gm in 100 mL) at which concentration they are stable enough for batch preparation (8 hr.). In syringes, the necessary concentration would have one hour stability.

American Society of Health-System Pharmacists *Handbook of Injectable Drugs* 2013 (version 9.0.9)
Strategy

Switch to IV Push – Technology available – Pharmacy pumps

• Calibration
• Speed vs Accuracy
• Limits of volume and accuracy
• Airflow around device in hood
• Capping
• Bulk solution preparation
• Stability within syringes

https://www.youtube.com/watch?v=tByWTrG76YQ

https://www.youtube.com/watch?v=7u3urXuL2jg
To Push or Not to Push....

<table>
<thead>
<tr>
<th>TABLE 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chronological List of Organizations Providing Recommendations for Intravenous Push Medications</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organization Providing Recommendation</th>
<th>Date Recommendation Published</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centers for Disease Control and Prevention, Health Care Infection Control Practices Advisory Committee</td>
<td>December 2007</td>
</tr>
<tr>
<td>Anesthesiology Patient Safety Foundation</td>
<td>June 2010</td>
</tr>
<tr>
<td>Centers for Disease Control and Prevention</td>
<td>February 2011</td>
</tr>
<tr>
<td>American Society of Health-System Pharmacists</td>
<td>September 2013</td>
</tr>
<tr>
<td>Centers for Medicare &amp; Medicaid Services</td>
<td>March 2014</td>
</tr>
<tr>
<td>The Joint Commission</td>
<td>April 2014</td>
</tr>
<tr>
<td>American Association of Nurse Anesthetists</td>
<td>April 2014</td>
</tr>
<tr>
<td>Infusion Nurses Society</td>
<td>January 2016</td>
</tr>
</tbody>
</table>


Strategy

Switch to IV Push – Patient Care

• Who and how are you training your nursing staff?
  • What tools can pharmacy provide?

• Resource planning
  • Who can administer an IV Push

• Syringe Pump
  • Utilize Smart Pump features to provide additional information
Strategy

Switch to IM/SQ

• **Pharmacy**
  - Stability issues\(^5\)
  - Osmolarity tolerance –
  - Changes to CPOE
  - Smaller volumes – can use technology to pre-fill?

• **Patient Care**
  - Nurse training
  - Additional time at bedside
  - Nurse preparation
  - Permitted injection volumes may be too small to support dose
  - Pain on injection
  - Site rotation

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Strategy

Switch to IM/SQ – Technology available – pharmacy pumps

- Pharmacy
  - Stability issues\(^5\)
  - Osmolarity tolerance –
  - Changes to CPOE
  - Limits of pumping accuracy – volumes may be too low to pump
  - Appearance of accuracy – an accurate pump may appear inaccurate on syringe

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Strategy

Switch to LVP administration

• Pharmacy
  • Limited number of drugs with supporting documentation
  • Changes to CPOE
  • Changes to IV Workflow systems
  • Changes to DERS libraries
  • Stability of preparation
  • New (uncommon) admixture methods
  • Probably would reduce SVP doses prepared

• Patient Care
  • Nurse training
Strategy

Flex between D5W and NS based on availability

• Pharmacy
  • Possible in CPOE? – The physician doesn’t specify
  • Stability of preparation (e.g., Ampicillin in Dextrose)
  • Compatibility with carrier (e.g., Amphotericin B and Saline)
  • Labeling to help nurse manage line compatibility
  • Managing to patient intolerance

• Patient Care
  • Nurse training to disregard carrier vehicle
  • Pump issues?
  • Nurse management of compatibility issues
  • Managing to patient intolerance for one or the other
Strategy

• Flex between D5W and NS based on availability

Strategy

Mix on Demand (Point-of-Care Activated) products

• Pharmacy
  • Probably already in use where practical
  • Part of the shortage
• Patient Care
  • Nurse training to remember to ‘activate’
Strategy

Frozen products

• Pharmacy
  • Freezing and thawing
  • Managing dating on thawed products
  • Limited supply

• Patient Care
  • No real impact on nursing as long as they remain available
  • Increase in air in line alarms if incompletely thawed - outgassing
Strategy

Repackaging LVP solutions

• **Pharmacy**
  • Dating – medium risk under current USP <797>
  • Process – use of pharmacy pump technology
    • Regular calibration
    • Labeling
    • Actual fill volume? Has to be able to deliver 50 mL or 100 mL.
  • Additional pharmacy workload
  • Risk
  • If changing available sizes of IVPB, must ensure that affected systems (CPOE, IV pump settings).

• **Patient Care**
  • No real impact on nursing as long as they remain available
  • Bags will look different
  • Education on replacement products
Strategy

Change to Oral

• Pharmacy
  • Aren’t we already doing this
  • Opportunity size?
  • Surveillance software to better identify potential candidate patients

• Patient Care
  • No real impact on nursing as long as the solutions remain available
Strategy

• Prepare from concentrates

• Pharmacy
  • Concentrated NaCl and Dextrose currently in short supply
  • Can be done with a TPN compounder:
    • Best done in small batches
    • Cross-contamination – best if new tube set used for each preparation
    • Careful formulary build to ensure no errors
    • Prepare individual doses or prepare a bulk bag and use pump to prepare doses?
  • Dating is also a problem
  • Costly
  • Preparation by hand impractical and probably unsafe (Emily Jerry story)

• Patient Care
  • No real impact on nursing as long as they remain available
Plans for any change

Communication Plans

• Notification types and frequencies for initiation of change
• Modifications to presentation in CPOE and nu
• Notification systems to keep providers informed
• Ensuring that providers receive appropriate training and reference materials for new (and unfamiliar) methods.
• On-line repositories with links on commonly-used applications
• Training and onboarding changes for new hires, especially nurses
• Remember your audience...
  • Looking for quick reference – they don’t want to read a novel
  • Organized around likely questions with simple answers
  • How-to documents with pictures and/or drawings
Plans for any change

Staffing Plans

• For pharmacy
  • Impact of new methods on pharmacy workload – staffing up to meet the need
  • Changes to the pharmacy system to enable new workload
  • IV workflow systems to support and drive new admixture behaviors

• For Nursing
  • Determination of labor impact on nursing staff
  • Is there work the pharmacy can do to offload additional nursing workload
Plans for any change

Technology Plans

• How any new technology or supplies will be deployed
• Training on new technology
  • Will users have to be certified?
  • Presence of experts to help at bedside?
  • Will physicians require assistance navigating changes to CPOE?
• Quality assurance and management plans for operation of new technology
• Unwind plan – how/when will any new technology be removed when shortage ends?
Plans for any change

Quality Assurance Plans

• How will you measure success in your chosen change(s)
• Quality assurance and management plans for operation of new technology
  • Consider likely failure scenarios and how you might detect them
  • Consider how to ensure that training has been effective
  • Consider how to ensure that patient care has not declined as a result
• If/when the time comes to unwind the changes you have adopted, the same
  questions will need to be answered again.
Group Activity

• Problem statements
  – Mix-on-demand unavailable
  – IV Push antibiotics
  – Preparing SVP from LVP
  – 96-hour change time for plain IV’s

• Report out on
  – Timetable
  – Pharmacy Plan
  – Patient Care Plan
  – Quality Assurance Plan
KEY TAKEAWAYS

1) None of the alternatives is without risk. Planning is necessary

2) Virtually all of these options will result in increased needs for staff in pharmacy, nursing or both.

3) Change management will be important; none of these changes will be easy or natural.