An Upside to Drug Shortages?

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Conflicts of Interest

- Nothing to disclose

Objectives

Pharmacists

- Describe trends related to the upside of drug shortages influencing inpatient care
- Discuss options for pharmacist-initiated methods of mitigating the impact of drug shortages

Technicians

- Recognize common drug shortages
- Explain impact on drug preparation and delivery

Background

- National (and global) issue
- Timeline of response in US:

- Impact felt hardest at local and health-system level

Scope of the problem

Quarter	National Drug Shortages
Q4-12	299
Q1-13	295
Q2-13	299
Q3-13	294
Q4-13	288
Q1-14	305
Q2-14	306
Q3-14	320
Q4-14	301
Q1-15	265
Q2-15	219
Q3-15	190
Q4-15	185
Q1-16	195
Q2-16	191
Q3-16	174
Q4-16	176
Q1-17	176
Q2-17	174
Q3-17	174
Q4-17	183

Y-axis: 0, 50, 100, 150, 200, 250, 300, 350

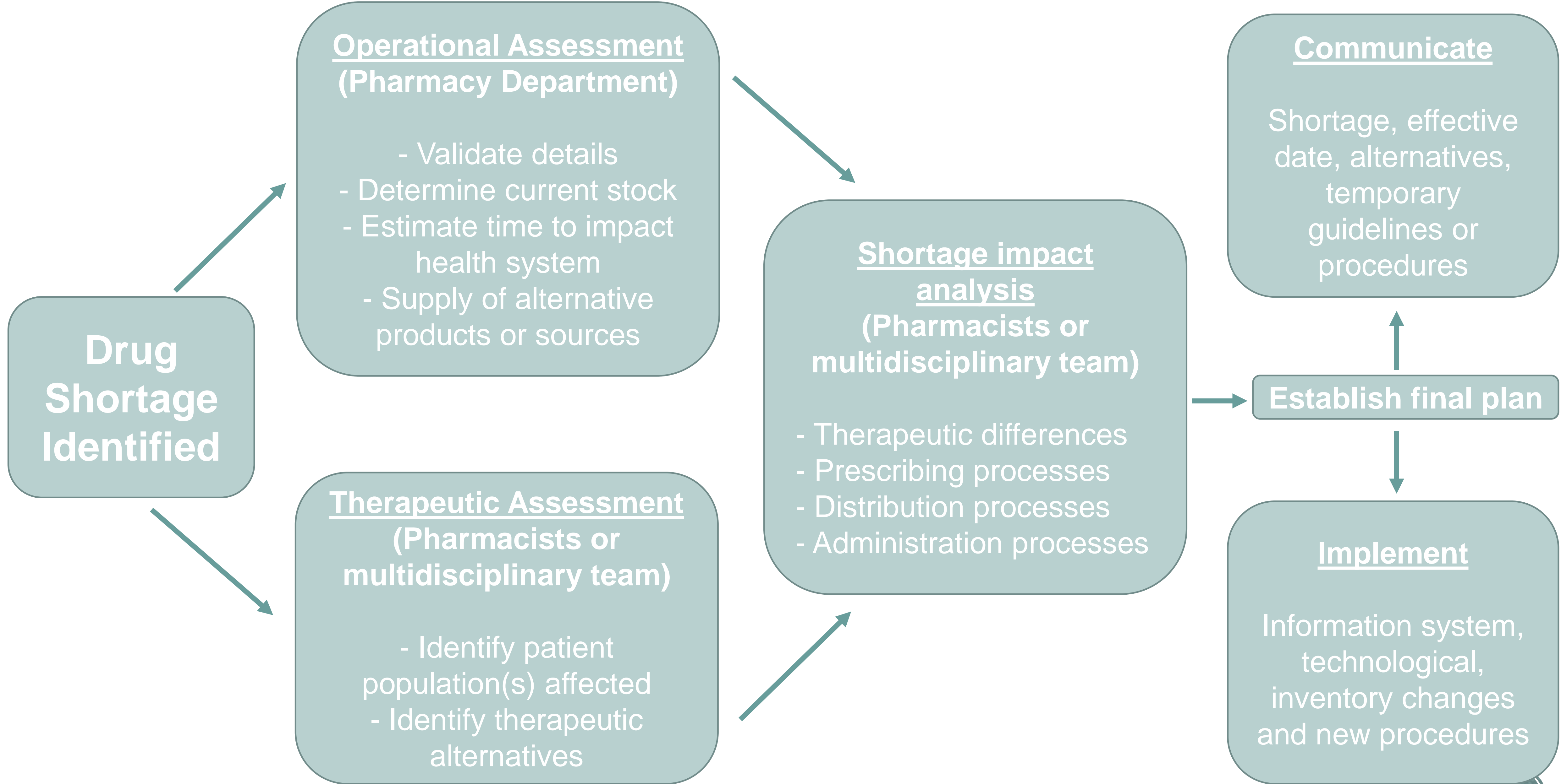
National Drug Shortages (by quarter)

University of Utah Drug Information Service
Contact: Erin.Fox@hsc.utah.edu, @foxerinr for more information.

https://www.ashp.org/Drug-Shortages/Shortage-Resources/Drug-Shortages-Statistics: Accessed 3.19.2018

The downside

- The ever-increasing volume of critically important medications in short supply
- The use of less desirable, unfamiliar alternative drugs—if available
- Potential errors and poor patient outcomes caused by absent or delayed treatment or preventable adverse drug events caused by the use of alternative drugs or dosage forms
- The lack of advanced warnings about impending shortages
- Precious clinical hours lost to time-consuming activities required to manage drug shortages.



https://www.ashp.org/-/media/assets/policy-guidelines/docs/guidelines/managing-drug-product-shortages.ashx; Accessed 3.19.2018

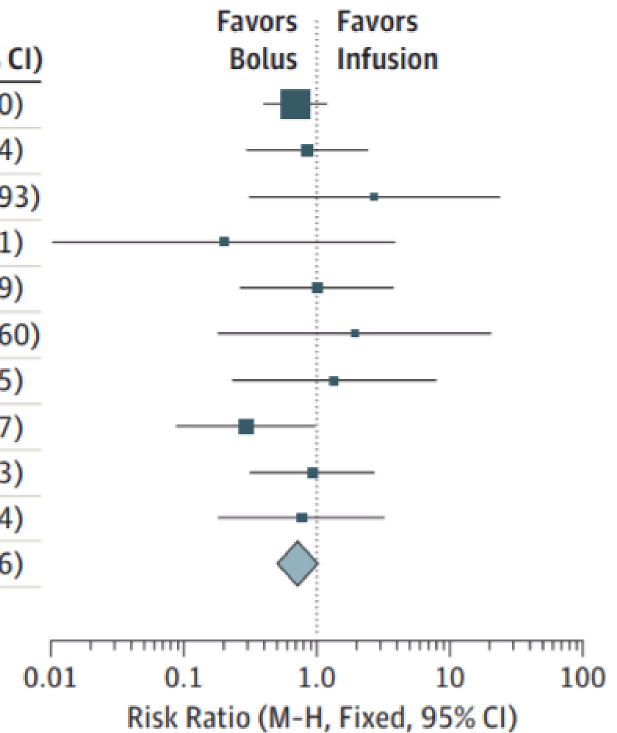
An Upside?

Pantoprazole IV

- IV to PO whenever possible for stress ulcer prophylaxis
- Gastrointestinal bleeding
  - Common strategy 80mg IV bolus followed by 8mg/hr x 72 hours
    - 16 (40mg) vials

Source	Intermittent Bolus, No.		Continuous Infusion, No.		Risk Ratio
	Events	Total	Events	Total	(M-H, Fixed, 95% CI)
Andriulli et al,[14] 2008	19	239	28	243	0.69 (0.40-1.20)
Chen et al,[16] 2012	6	101	7	100	0.85 (0.30-2.44)
Choi et al,[17] 2009	3	21	1	19	2.71 (0.31-23.93)
Jang et al,[24] 2006	0	19	2	19	0.20 (0.01-3.91)
Javid et al,[20] 2009	4	53	4	53	1.00 (0.26-3.79)
Kim et al,[21] 2012	2	54	1	52	1.93 (0.18-20.60)
Sung et al,[25] 2012	3	105	2	95	1.36 (0.23-7.95)
Ucbilek et al,[26] 2013	3	37	10	36	0.29 (0.09-0.97)
Yamada et al,[22] 2012	4	13	5	15	0.92 (0.31-2.73)
Yüksel et al,[23] 2008	3	49	4	50	0.77 (0.18-3.24)
Total (95% CI)	47	691	64	682	0.74 (0.52-1.06)

Heterogeneity: $\chi^2_9 = 5.96$ ($P = .74$) $I^2 = 0\%$
Test for overall effect: $z = 1.65$ ($P = .10$)



Am J Gastroenterol 2012; 107:345–360
JAMA Intern Med. 2014;174(11):1755-1762.
J Med Assoc Thai. 2012 Mar;95(3):349-57.
Am J Gastroenterol. 2008;103(12):3011-3018

Pantoprazole IV

- Opportunity to reduce IV pantoprazole use by 9 vials

Literature Review

Order set Revision or Development

Collaboration

Intravenous fluids

- Large-volume (and small-volume bags)
- Seemingly all patients receive IV hydration
- Why is this the culture?

Target Hydration Goals*:
Target times are given for the amount of liquid remaining at 2 sips or 30 ml every 3 min (or every 5 min)

- 1000 ml remaining: 0 min (0 min)
- 750 ml remaining: 25 min (40 min)
- 500 ml remaining: 50 min (1 hr 20 min)
- 250 ml remaining: 1 hr 15 min (2 hr)
- 0 ml remaining: 1 hr 40 min (2 hr 40 min)

N Engl J Med 2018 DOI: 10.1056/NEJMp1801772
Cochrane Database Syst Rev 2006;3:CD004390
Int J Epidemiol 2010;39 Supp 1:i74-i87

Intravenous fluids

- Is intravenous administration always necessary?
  - Can potentially avoid IV catheter insertion

Literature Review

Order set Revision or Development

Best Practice

Scholarly Activity

Hypertonic saline

Shortage of 23.4% NaCl	2% NaCl	3% NaCl – readily available
Need exists to reserve for ICP emergencies	Compounded from 23.4% Administered via peripheral access	Administered via central access Concern for extravasation, infusion-related complications

Hypertonic saline

- Presented changes to P&T Committee:
  - 3% NaCl may be administered via central or peripheral access
  - If central access, maximum 200ml/hr
  - If peripheral access, maximum rate 75ml/hr
    - If possible, preferred peripheral access: large bore catheter in a proximal large vein
  - Recommended duration: 72h
    - If requires for longer, consult for central access may be warranted

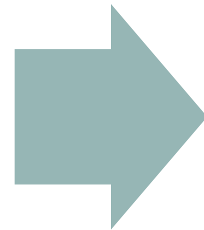
Literature Review | Policy Change | Compounding or Preparation Practices | QA/QI, MUE, Project

Am J Crit Care 2017; 26(1): 37-42
J Neurosci Nurs 2017; 49(3): 191-195
J Intensive Care Med 2018 Jan;33(1):48-53

Antimicrobials

Product shortages

- Piperacillin/tazobactam
- Cefepime
- Ampicillin/sulbactam
- TMP-SMX
- Acyclovir



Shortage of small-volume IV bags

- IV push administration
- Subsequently SWFI shortage

Antimicrobials

- Emerging Infectious Network (EIN) reported at IDWEEK 2016:

"This, I think, is one of the highlight results…. In 2011, we had no specific question or comments received about [Antimicrobial Stewardship Programs], and here in 2016, 83% of respondents' institutions had developed guidelines related to drug shortages."

"And then, of course, the other theme across the board was ***our new asset***," he said, explaining that some respondents commented on ***the value of ASP pharmacists and programs*** to help with drug shortage issues.

https://www.mdedge.com/idpractitioner/article/117969/practice-management/infectious-disease-physicians-antibiotic-shortages; Accessed 3/25/18

Antimicrobials

Collaboration

Educational Platform

Policy Change

Best Practice

New Pharmacy Service

Technology Interface

Parenteral Nutrition

Electrolytes

- Magnesium, potassium salts, phosphate salts

Amino acids

Lipids

Multivitamins

Trace elements

Parenteral Nutrition

- ASPEN website
  - https://www.nutritioncare.org/
- University of Michigan pharmacy department removed magnesium from TPN
  - Adults
  - Excluded <30kg, CrCl <40ml/min, CRRT, enteral nutrition >20ml/hr, continuous infusion diuretics
- Primary endpoint: daily potassium dose
  - Potassium doses and hypokalemia exposure were not higher during shortage

QA/QI, MUE, Project

New Pharmacy Service

Compounding or Preparation Practices

J Parent & Enteral Nutri 2016;40(5)688-692.

New Opioid Crisis

Severe shortage	Concerns	Administration

• IV opioids
  • Hydromorphone
  • Morphine
  • Fentanyl
	• Malignancy
	• Palliative care
	• Major surgery
	• Trauma
	• Analgosedation in the ICU
		• Oral is a good solution when possible

New Opioid Crisis

- Take a step back
  - Why is the culture to preferentially use IV?
  - Where is this truly necessary?
  - How can providers be engaged?

Enteral, ENTERAL, ENTERAL!
Non-opioid options
'Opioid stewardship'

Opioids

- Anecdotally, cardiothoracic surgery team has embraced the enteral administration movement
  - PO is ordered as soon as feasible
  - Alternatives include local anesthetics, acetaminophen, occasional NSAIDs
- Change in mindset, traditional practices

Best Practice

QA/QI, MUE, Project

C-Suite Awareness

Collaboration

Order set Revision or Development

Costs

- Nitroprusside
  - $900/vial
- Isoproterenol
  - $2,200/vial
- Calcitonin
  - $2,500/vial
- Ethacrynic acid
  - $3,000/vial

Best Practice

Collaboration

QA/QI, MUE, Project

Educational Platform

Safety

- Institute for Safe Medication Practices (ISMP)
- Survey in Fall 2017
  - Exhaustive account of frustrations, safety concerns, misused resources
  - Emergency care (87%), anesthesia care (85%), pain management (81%), infectious disease (71%), cardiovascular care (68%)
- Many respondents indicated they needed full time staff to manage shortages

New Pharmacy Service

Technology Interface

ISMP 2018; 23(1)1-7

The Hierarchy of Intervention Effectiveness

FORCING FUNCTIONS

AUTOMATION & COMPUTERIZATION

SIMPLIFICATION & STANDARDIZATION

REMINDERS, CHECKLISTS & DOUBLE CHECKS

RULES & POLICIES

EDUCATION & TRAINING

\+ MORE EFFECTIVE

LESS EFFECTIVE −

System-focused

People-focused

https://patientsafe.wordpress.com/the-hierarchy-of-intervention-effectiveness Accessed 3.19.2018

Effective interventions

Communication

and

Collaboration

are

Essential

The UPSIDE

- Technology Interface
- Collaboration
- Policy Change
- C-Suite Awareness
- New Pharmacy Service
- Literature Review
- Legislative Opportunities
- Educational Platform
- Compounding or Preparation Practices
- Best Practice
- Order set Revision or Development
- QA/QI, MUE, Project

Perception

- Pharmacists have a marketing problem
- We need to be the recognized leaders

Summary

- The drug shortage crisis can be seen as both detrimental and beneficial to inpatient pharmacy practice
- Temporary strategies identified during medication shortages have the potential to lead to permanent changes when product or process issues have been resolved
- The pharmacy team can *and should* be the leader in reducing the impact of shortages on patient care

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