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From Big Data to Big Knowledge – Optimizing Medication Management

Session 157, March 7, 2018

Dave Webster, RPh MSBA, Associate Director of Pharmacy Operations, URMC Strong

Maria Schutt, EdD, Director Education & Optimization Services, BD

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Conflict of Interest

David Webster, RPh, MSBA

Has no real or apparent conflicts of interest to report.

Dr. Maria Schutt, EdD
Has no real or apparent conflicts of interest to report.

Maria Schutt is an employee of BD

Agenda

1. Learning Objectives
2. Setting the Stage: Health System Profile
3. The Medication Availability Challenge
4. Practice Improvement Methodology
5. Inventory Optimization Analytics
6. University of Rochester Medical Center Optimization Case-study
7. Recommendations

Learning Objectives

- Define the challenges of inventory management with a focus on reducing medication waste across a health system
- Utilize analytics tools, national benchmarking and machine learning algorithms to target automatic dispensing cabinets (ADC) medication waste reduction
- Describe a business improvement plan to target medication waste reduction from ADCs
- Measure, monitor, and evaluate data to adjust program to maximize results
- Develop, define and execute a comprehensive action plan to reduce medication waste in ADCs using national benchmarking and predictive analytical tools

University of Rochester Medical Center (URMC)

Rochester, New York

Strong Memorial Hospital

- 839 beds
  - >100% occupancy
  - Quaternary care
  - Level 1 trauma
  - Pediatric hospital
  - Oncology hospital/Infusion centers (on and off-site)
- Off-site emergency services center
- Off-site ambulatory surgery center
- Off-site sterile compounding center
- 340B Eligible

Highland Hospital

- 261 beds
  - >100% occupancy
  - Acute care
  - Active emergency department
  - Known for:
    - Nationally ranked geriatrics program
    - Orthopedic surgery
    - Region's leading gastric bypass program
    - Comprehensive women's services
  - 340B (Rural Referral Center)

Regional Community Hospitals

- FF Thompson (125 beds)
- Jones Memorial Hospital (70 beds)
- Noyes Memorial Hospital (67 beds)
- Several contractual relationships with other community based hospitals and clinics

Ambulatory Sites

- Medical clinics/primary care
- Specialty Pharmacy Services
- Contract Pharmacy Services
- 10 licensed ambulatory pharmacies
- Home Infusion Pharmacy Services

Highland Pharmacy Model

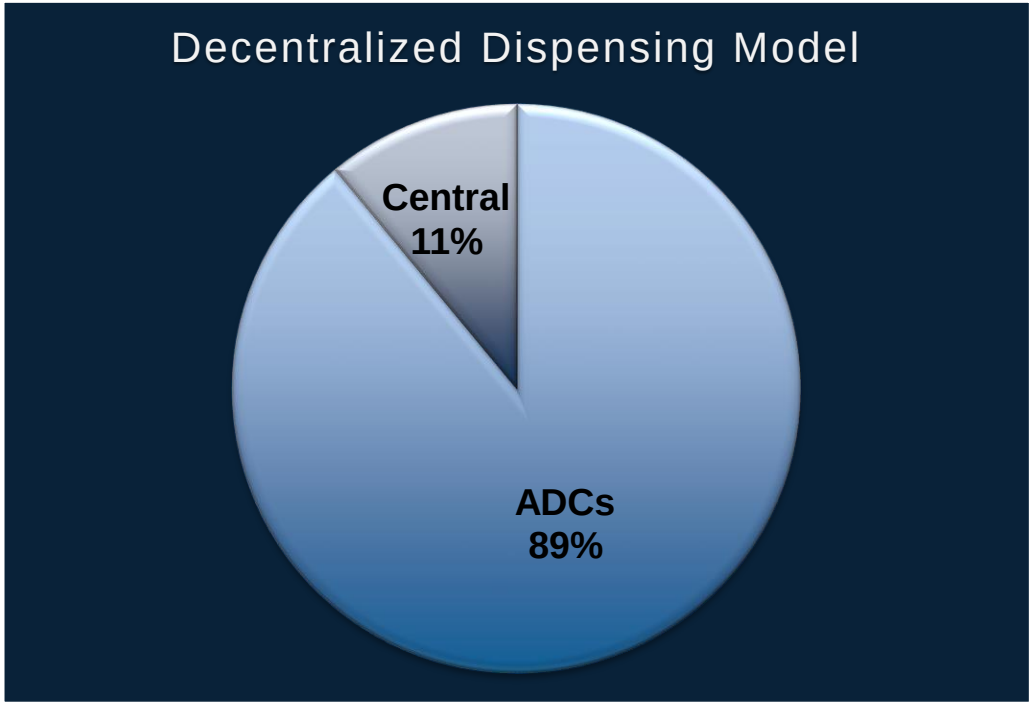
- Total Doses Dispensed:

  ~6,600 doses/day
- Total Doses Dispensed ADCs:

  ~5,900 doses/day

36 ADC units; 20 Anesthesia units

- Override Rate: **1.7%**
- ADC Replenishment: **Once Daily**
- 340B Facility
- Cartfill for patient specific orders

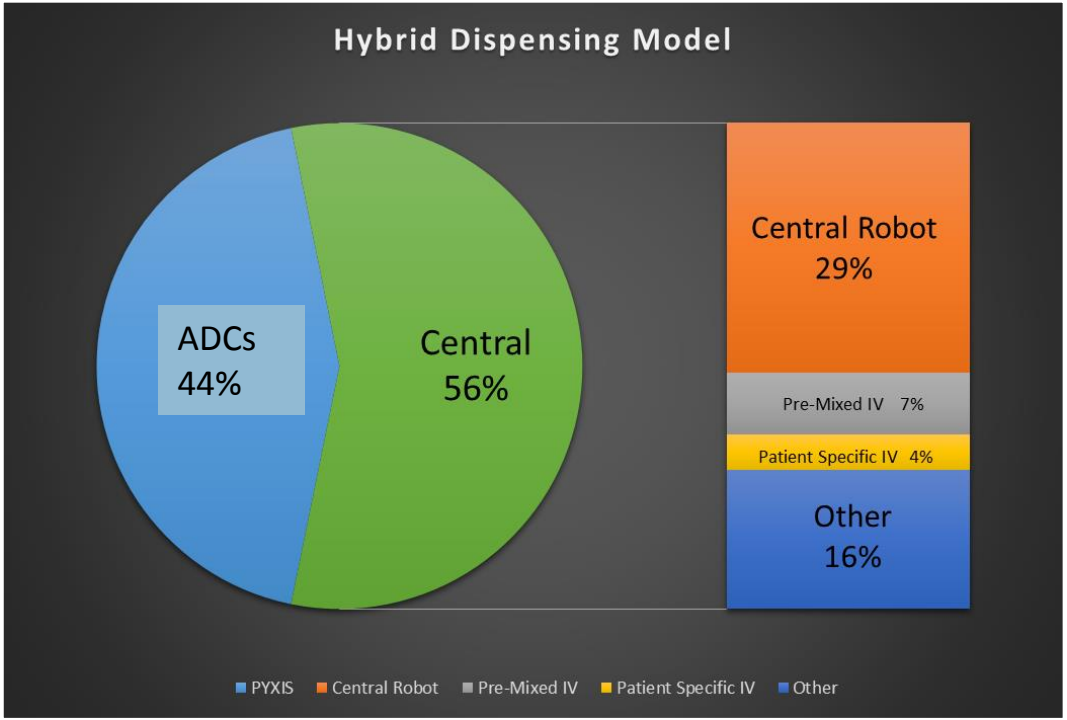


Strong Pharmacy Model

- Total Doses Dispensed
  ~18,000 doses/day
- Total Doses Dispensed ADCs:
  ~7,900 doses/day

124 ADC units; 63 Anesthesia units;

- Override Rate: **2.5%***
  *Inpatient + ED + PACUs
- ADC Replenishment: **2-3 times daily**
- 340B Facility
- Cart fill for patient specific orders



Polling Question!

How do you manage/adjust your facility's ADC PAR levels?

1. Review/adjust when prompted
2. Review/adjust annually
3. Review/adjust monthly
4. Review/adjust daily/weekly

Polling Question!

Generally, how often do you replenish your ADCs?

1. Less than once daily
2. Once daily
3. Twice daily
4. Three times or more daily

Pharmacy Dispensing Models: Highland and Strong Hospitals

73,632,000

…data messages per year for ADCs

Dispensing Data Transactions

12,113,516,199 (12 billion)

…data messages for ADCs
…2234 Facilities

Patient encounters (1,224,139,122) (1.2 billion)

Goal of a Medication Management System

"In essence, a well-planned and implemented medication management system supports patient safety and improves the quality of care by doing the following:

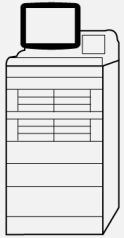
- *Reducing variation, errors, and misuse*
- *Using evidence-based practices to develop medication management processes*
- *Managing critical processes to promote safe medication management throughout the organization*
- *Standardizing equipment and handling processes, including those for sample medications, across the organization to improve the medication management system*
- *Monitoring the medication management process for efficiency, quality, and safety" - Excerpt from The Joint Commission*

1. **How are our peers performing?**
2. **How can we leverage data to drive action?**
3. **What is the recommended improvement methodology?**

Basis of Practice Improvement Methodology

Regulations & Guidelines
Review of industry guidelines and pharmacy practice regulations (JCHAO, ISMP)

White Papers
Supporting evidence based on previous published work



Device Generated Data
Starting with KPIs that are available in the device today

Medication Availability Challenge

Most hospitals face these challenges…..leading to these problems……creating a sizable impact…

Medication is out of stock at the medication dispensing machine

Inefficient workflow & productivity due to interruptions and distractions

>2,400 hours of time each year is consumed by nursing calls to pharmacy in a 350 bed hospital

20 minutes to track down each missing medication

Frequent refills creates **long wait times for nurses and extra work**

Picking cycle in pharmacy **does not correspond to demand on floors**

Low hospital staff satisfaction

Increased cost due to inefficient workflow

*Pharmacy staff spends **3-4 hours/day** on purchasing, receiving and stocking meds*

*On average, **~20% of ADC pockets** have not been accessed in 6 months*

Excessive inventory is stocked in automated dispensing cabinets to ensure medication availability SLA's

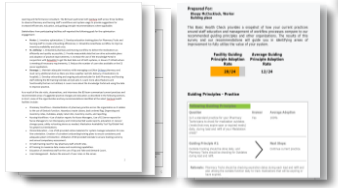
Increased cost due to Expired and wasted medication and bloated inventory on hand

*On average, **6-7%** of pharmacy inventory spend is wasted*

*An average hospital loses **$150k every 3 months** from expired medications*

Practice Improvement Methodology

PRACTICE ASSESSMENT & SUCCESS PLAN

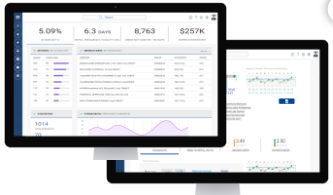


- *Site-Specific Success Plan*
- *Guiding Principles & Operational KPI's*

EDUCATION SERVICES & CORE COMPETENCIES

- *Training Plan, Workshops, & Certifications*
- *Success Community & User Group Access*

INTEGRATED ANALYTICS & BENCHMARKS



- *PAR Optimization & Workflow Analytics*
- *National Pharmacy Benchmarks*

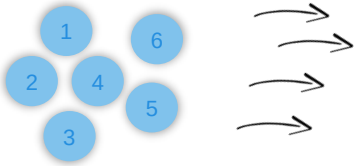
IMPROVEMENT & ADOPTION SUPPORT

- *Practice Improvement Platform*
- *Optimization Specialist Support*

EDUCATE – ADOPT - OPTIMIZE

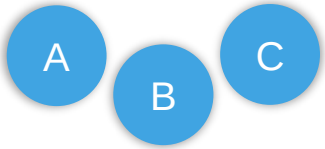
Utilizing Data, Analytics and Benchmarking to Optimize

GUIDING PRINCIPLES
(Practice, process, feature usage)



Defines a process, policy, or setting and the associated compliance metrics to track performance

KEY PERFORMANCE INDICATORS
(KPI)

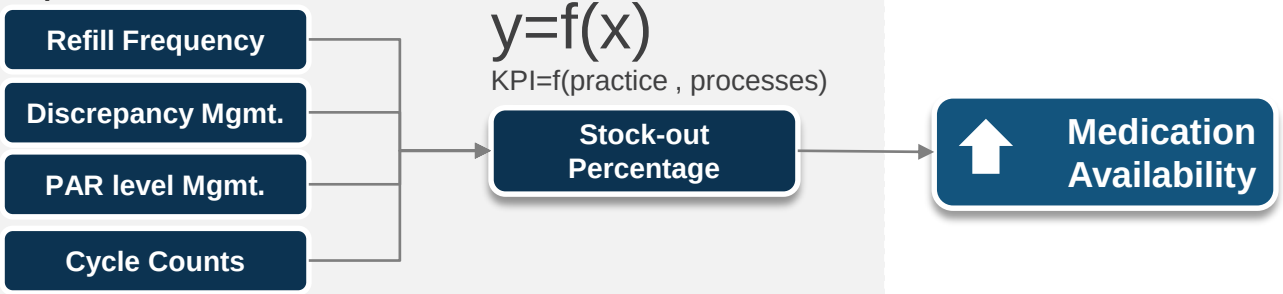


Measure of the customer's process, typically at a site or IDN level

SYSTEM LEVEL OUTCOMES

Financial, efficiency, or patient safety metrics

Example



Guiding Principles and Established KPIs

Guiding Principles

Refill Frequency	Remove - Pulling Practice
Nursing Inventory Counts	Remove - Override
Pharmacy Inventory Counts	Witness Override
Outdates	Temp Patients
Witness on Emptying Return Bin	Waste Witness
Destock	Discrepancy - Resolution
Standard Stock	Conformance to CS Policy

RATIONALE

Regulations & Guidelines

White Papers

Key Performance Indicators

- Stock-out percentage
- Vend-to-Refill ratio
- Blind stock-outs per station
- # of pockets w/out vend greater than policy days
- Average removed outdates per station
- Doses dispensed from Pyxis MedStation
- # of medications greater than 2 loads and unloads

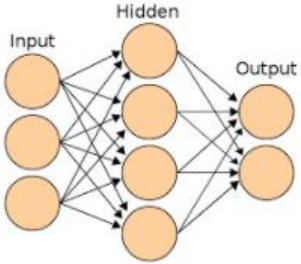
RATIONALE

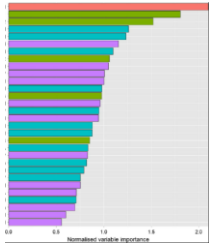
Device Generated Data

Data Science Approach

Features extracted from health system data → Build predictive models using multiple techniques → Optimal model(s) identified through testing and evaluation → Identify top variables that predict KPIs

AvgCncldTxnPerStn	TotalDosesDispensed
44.866667	737088
73.680970	623398
62.352836	1741185
46.766551	1383705
55.966667	845904
53.385885	1375318
32.042122	507601





- Goal: Understand the relationship between KPIs and Guiding Principles
- Foundation for “smart recommendation engine”
- Benchmarking data: >300 health systems, 330 million dispensed doses/year

Why Optimize?

HIGHLAND

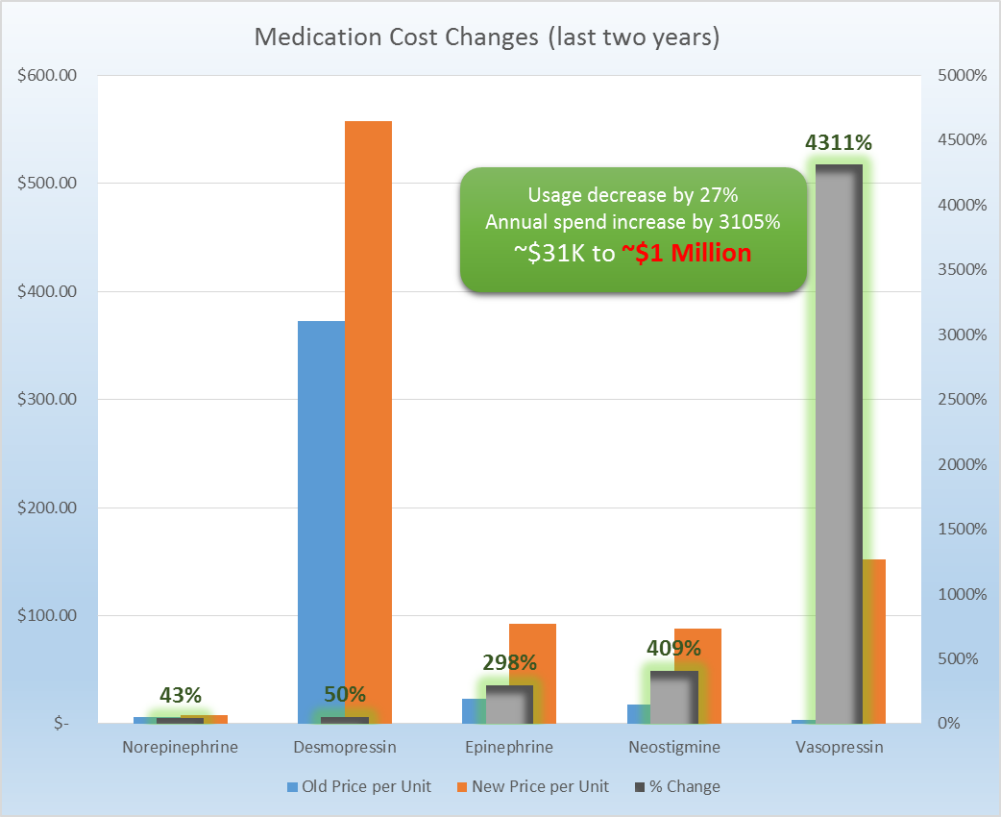
- **ADCs integral to the dispense model; 89% of all doses dispensed from ADCs**
- **Physical constraints impose challenge on distribution and need for efficient processes**
  - No pneumatic tube system
  - Size-constricted medication rooms limit ability to add storage capacity for medications
  - Maximize resources involved in refill process
  - Improve vend-to-refill ratios
- **Budgetary constraints**

STRONG

- **Waste Expired Medications from ADCs**
  - Business Improvement Plan (BIP) for waste reduction
  - Funding FTE to oversee process
- **Inefficiencies: Focus on Replenishment Process**
  - Maximize use of resources involved in refill process
  - Improve vend-to-refill ratios
  - Create process for managing changes in PAR levels
- **Stock-outs: Rates increasing, not meeting goals**
  - Goal of eliminating predicted stock-outs
  - Improve nursing satisfaction
  - Improve time-to-refill (service recovery)

Why Optimize?

Medication cost volatility continues to drive focus on cost reduction strategies, including inventory management



Initial Challenges and Considerations

- Adjusting PAR levels and reports required
- Data integrity
- Cost of file integration from EMR to ADC

Optimization Goals at Highland

Adopt guiding principles in refill process for ADCs	Vend-to-Refill Ratio	Optimize Vend-to-Refill ratio, work toward one major device replenishment per day
Maintain stock-out rate	Stock-out Rate	Maintain a stock-out rate at or below one percent
Maximize availability of medications from ADCs	Dispense % from ADCs	Target 90%+ dispenses from ADCs

Optimization Business Improvement Plan - Highland

1. Optimize Device Inventory

- Adjusted min/max (via report analysis)
- Move most-refilled medications to larger pockets in the ADC
- Add pockets specifically for highest-use medications

2. Planning for One Refill per Day

- Analyze department workflow and resources

3. Avoid Nurse-Tech Workflow Conflicts

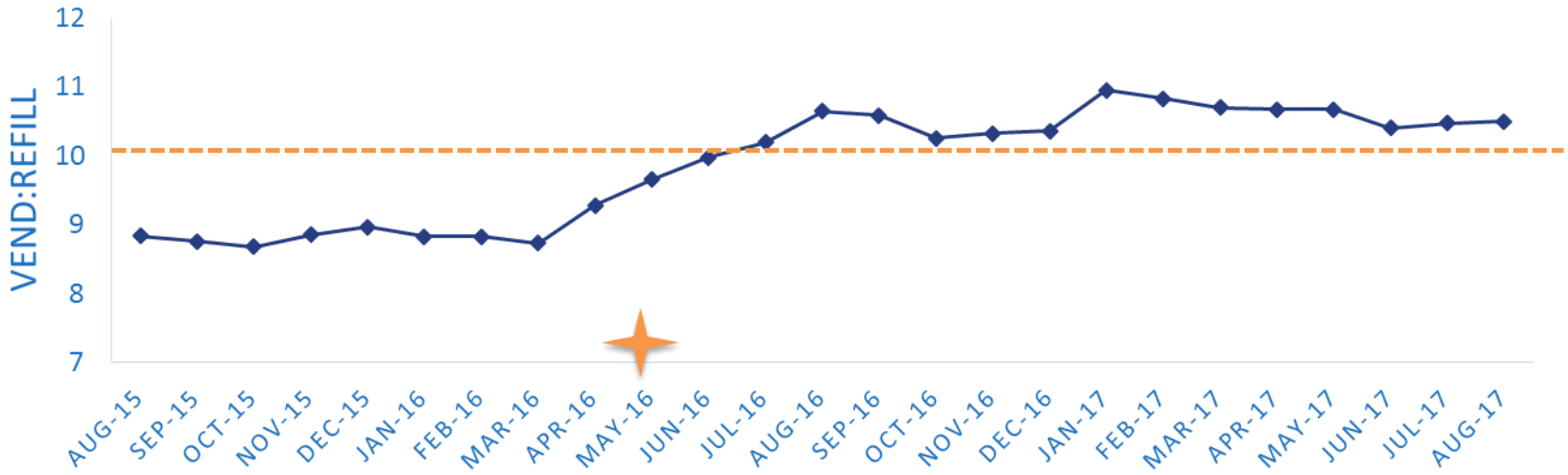
- Identify time of most frequent vends

Knowledge Check: True or False?

Medication inventory across a health system is becoming more important due to rising medication costs and health system complexities.

True!

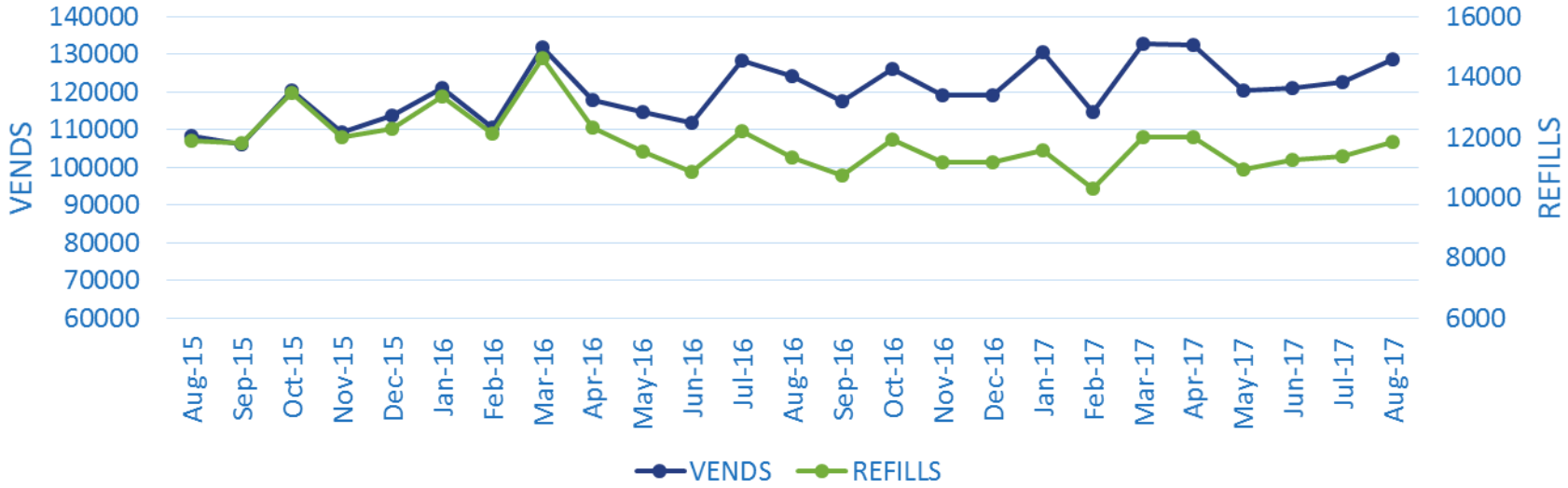
Inventory Optimization Results at Highland



Through change in process, Highland shifted Vend/Refill from **8.7 to 10.5**

Source: URMC Medication Dispensing Data: Aug 2015 –Aug 2017

Inventory Optimization Results at Highland



Changes eliminated ~80 refills of ADCs daily

Source: URMC Medication Dispensing Data: Aug 2015 –Aug 2017

Inventory Optimization Results at Highland

Mar 2016		Aug 2017
0.8% STOCK-OUT RATE	Initial Focus: Maintain stock-out rate below 1%	0.9% STOCK-OUT RATE

March 2016		Aug 2017
85% DISPENSE FROM ADCs	Initial Focus: Improve dispense %, particularly in the ED	89% DISPENSE FROM ADCs

Optimization Goals at Strong

ADOPT Destock feature on ES into waste reduction process

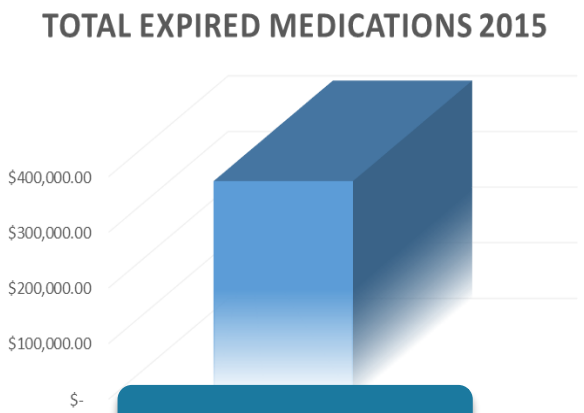
OPTIMIZE medication availability in ADCs

Expiring inventory	Reduce expiring inventory in ADCs
Inventory carrying cost	Reduce level of inventory in ADCs
Stock-out	Reduce or maintain stock-out rate

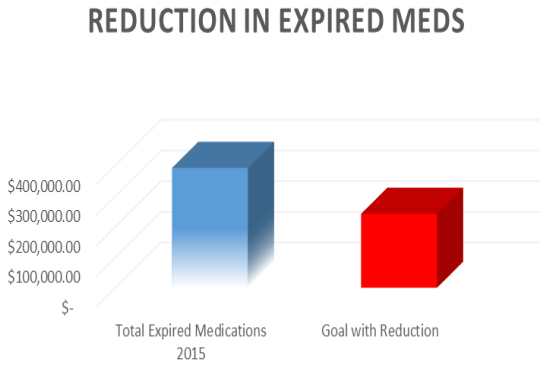
Dedicated resource for active inventory management

- Moving product from low use to high use areas with Destock feature
- Using reports to identify soon-to-expire medications
- Identify highest risk medications (short expiration date)

Waste Reduction Plan at Strong



Identify Baseline



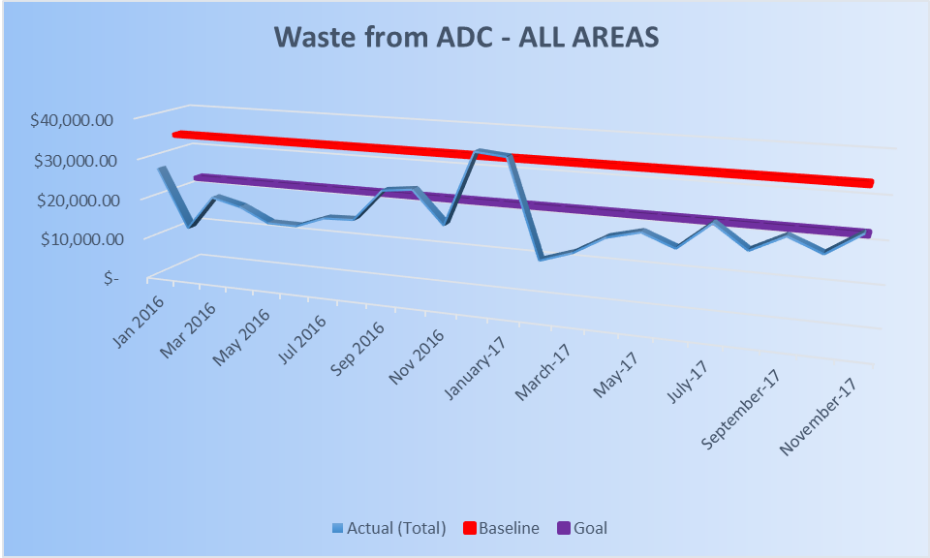
Create Goal

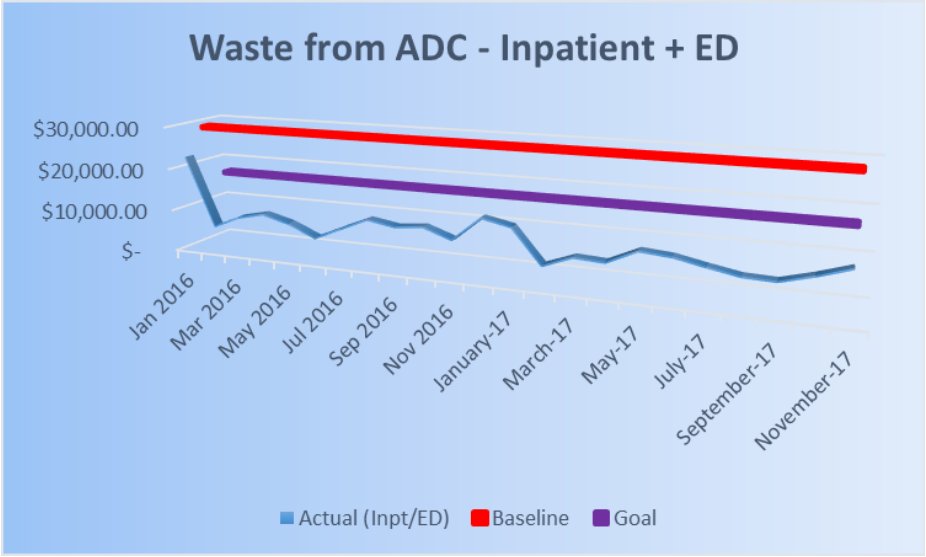
Total Expired Medications 2015	$391,409.00
Goal with Reduction	$241,409.00
Annual Savings	$150,000.00
Costs	$ 38,147.00
Net Savings	$111,853.00

Develop BIP

Source: URMC Medication Dispensing Data: Aug 2015 –Aug 2017

Waste Reduction Plan at Strong





2017 represents **~70%** reduction in waste compared to baseline year for inpatient/ED units

Source: URMC Medication Waste Data: January 2016 – November 2017

Inventory Optimization w/ Analytics: Strong

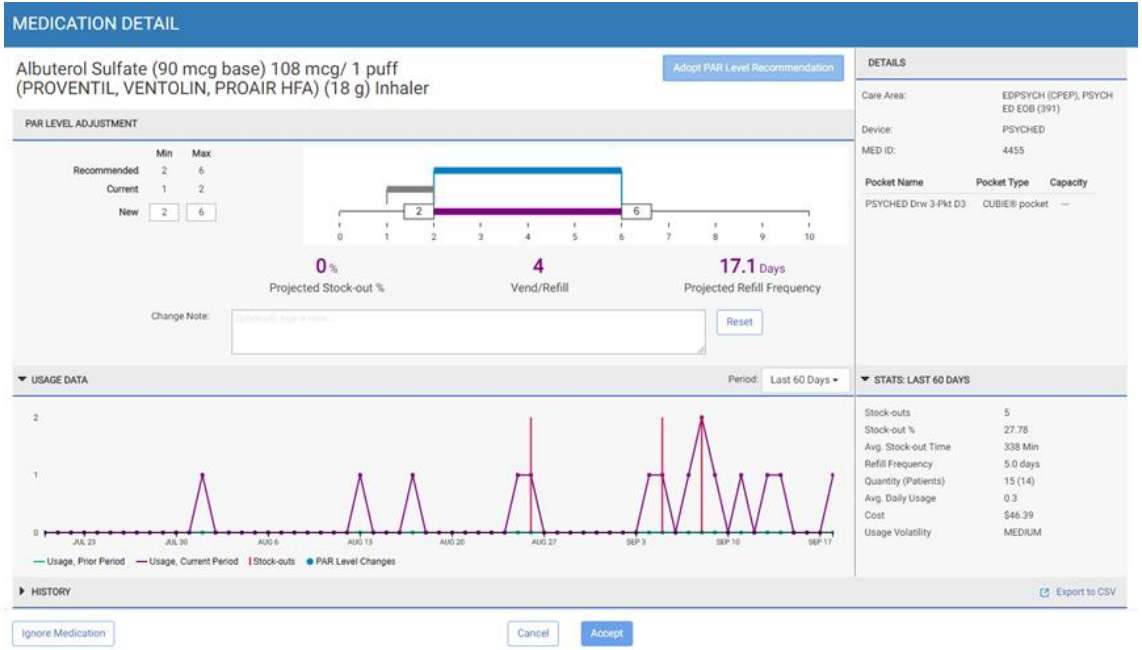
Inventory Optimization

Perform PAR level optimization to reduce stock-outs and waste at least 1x quarter

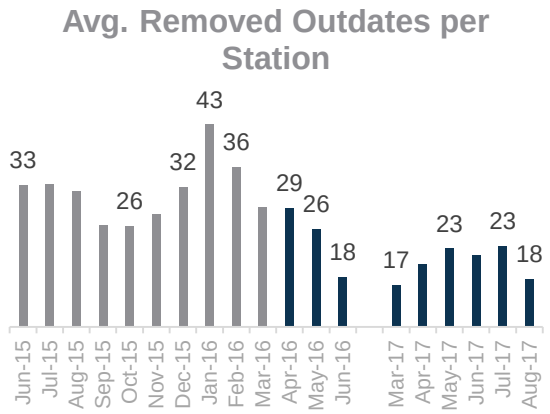
~3,200 recommendations for medication-locations accepted or modified…

Changed PAR levels on 4,000 medications on Standard stock

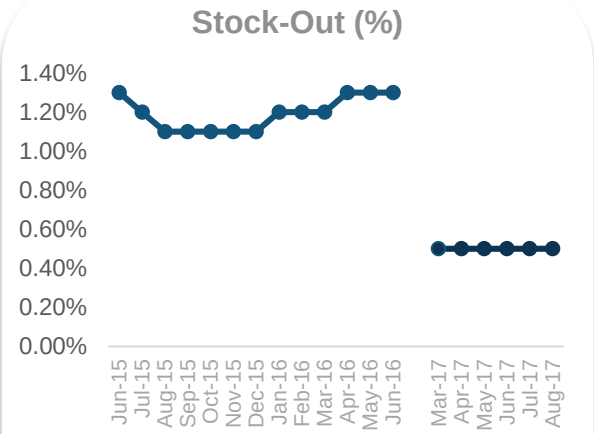
- Leveraging usage data in chart to look over previous 30,60, 90, 120, and 365 days
- Consider whether medication should be on standard stock in the first place
- Realized significant inventory carrying cost hiding in standard stock inventory



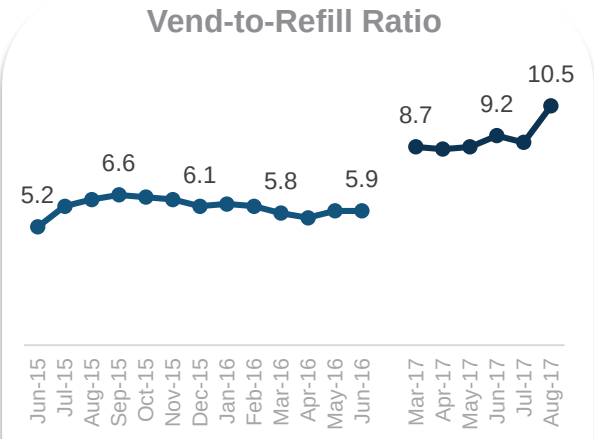
Inventory Optimization Results at Strong



Avg. Removed Outdates per Station nearly halved



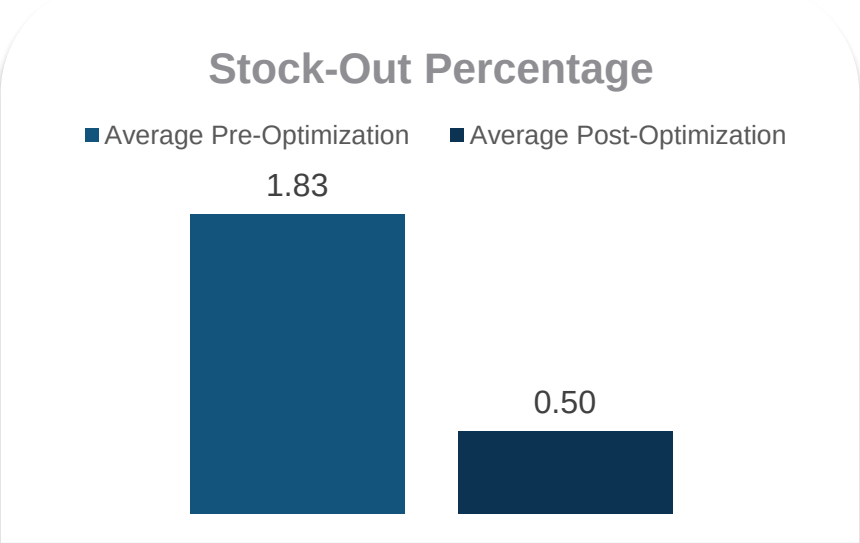
Stock out rate drops by >50%



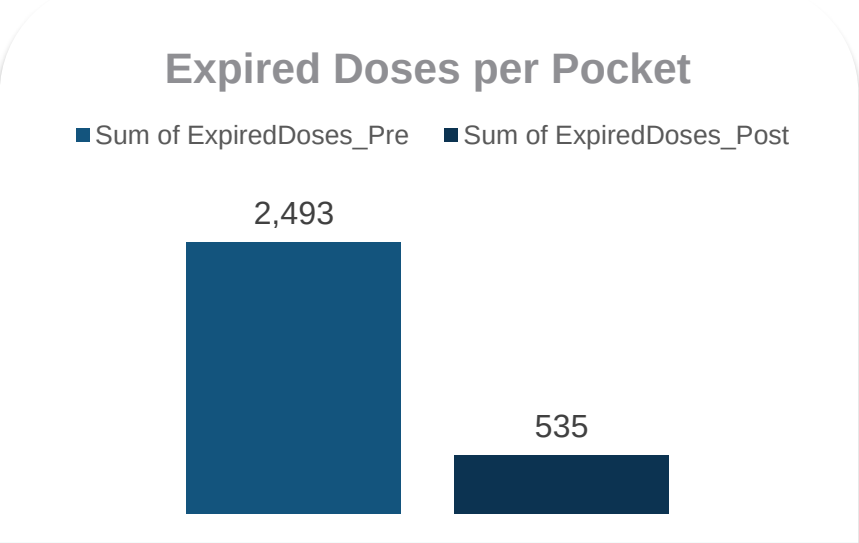
Vend / Refill ratio almost doubles

Source: URMC Medication Dispensing Data: June 2015 –Aug 2017

Inventory Optimization Results at Strong



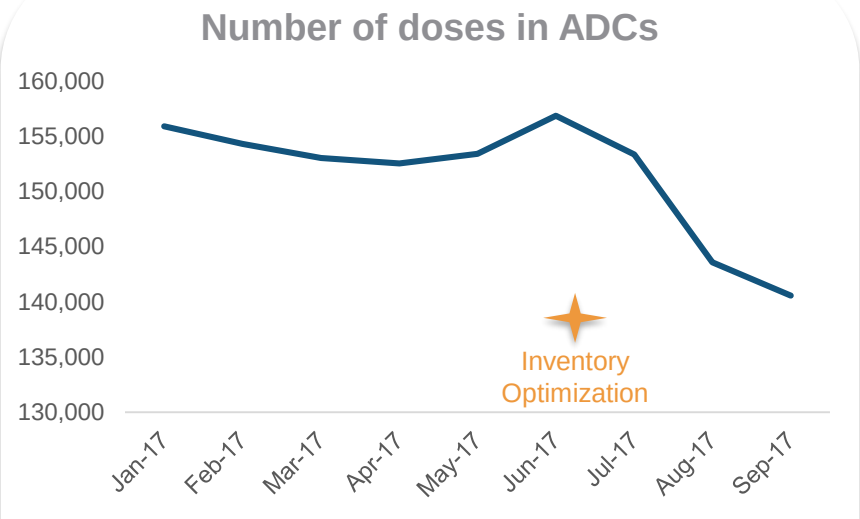
For over 3,200 medications, stock out rate has improved **266%**



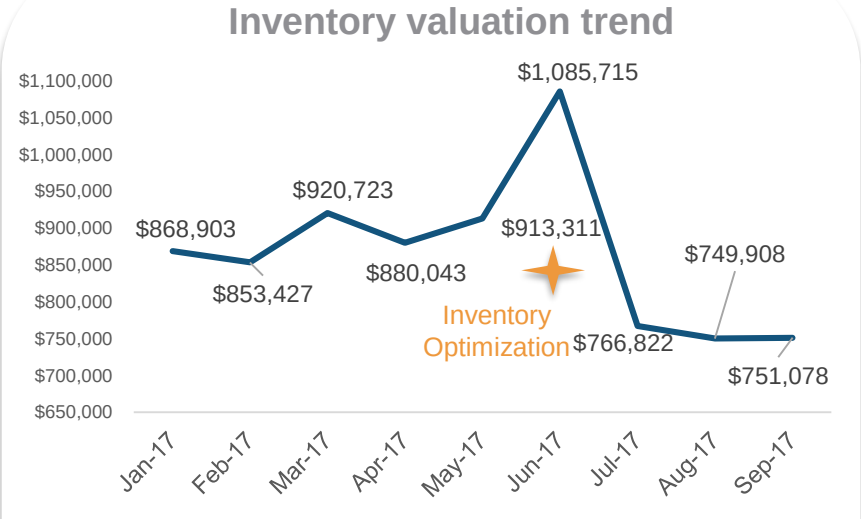
1,958 fewer expired medications in same pockets

Source: URMC Medication Dispensing Data: June 2015 –Aug 2017

Inventory Optimization Results at Strong



Doses on hand in ADCs have decreased **9.8%**



Primarily attributable to **standard stock optimization** lowering the carrying cost $200,000+

Source: URMC Medication Dispensing Data: Jan 2017 – Sep 2017

Inventory Optimization with Analytics at Strong

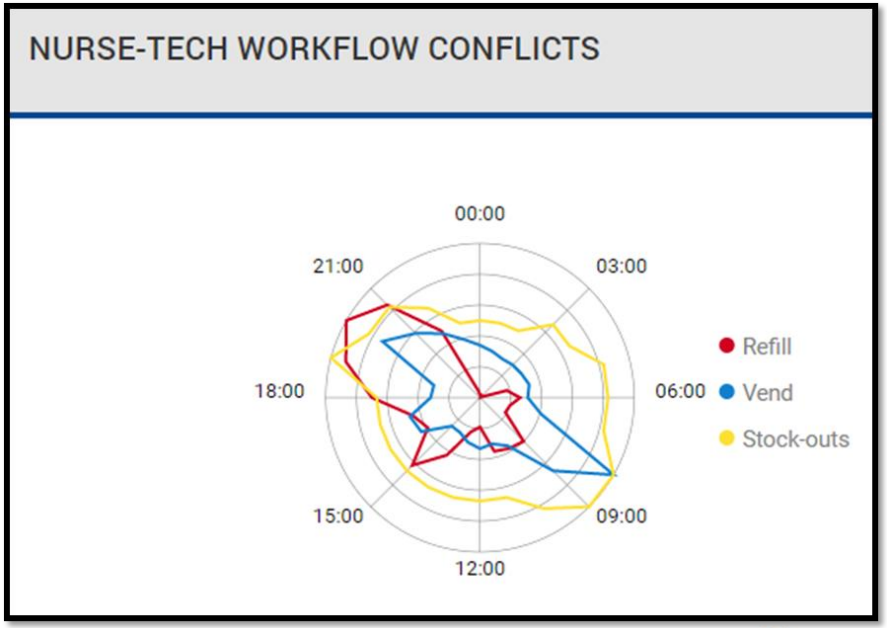
Inventory Optimization

Analyze delivery process and inefficiencies

Targeted Medical/Surgical floor receiving 3 times daily replenishment to ADCs (~130 beds)

Analyzed data, maximized PAR levels, focused on avoiding conflicts in delivery time

- Goal of once daily delivery
- Maximize vend-to-refill ratio
- Avoid negative impact on stock-out rate



Inventory Optimization Results at Strong

Once Daily Delivery

Number of Pockets Refilled Daily

49.3

Pre - Implementation (3 Deliveries

41.3

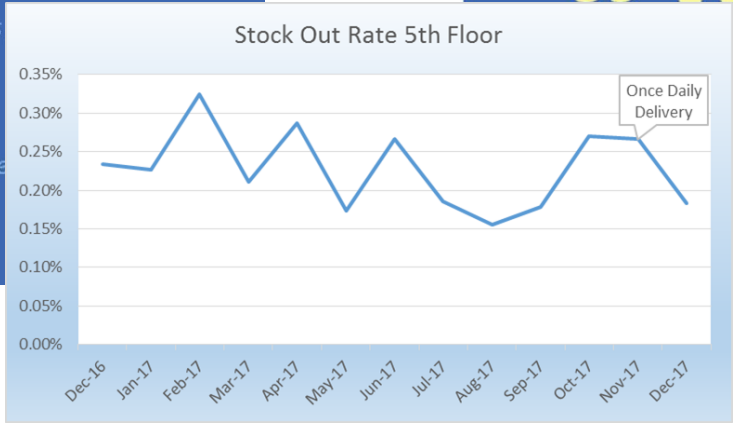
Post - Implementation (One Delive

Daily Refill Time (min) 5th Floor

59

Implementation (3 Deliveries per Day)

Implementation (One Delivery Per Day)



Knowledge Check!

Inventory optimization drives deeper insights into cost and waste reductions based on:

A. Analysis and benchmarking of drug costs, utilization, and KPIs

B. Formulary standardization

C. Assessment of clinical impact

D. Purchasing and packaging logistics

Recommendations

- Understand your goals and metrics
- Improve practice as the basis for inventory optimization
- Dedicate resources (inventory management and IT)
- Data integrity and price file integration
- Long term plan (remember optimization is ongoing)

Knowledge Check!

Achieving inventory optimization requires continuous data driven monitoring and adjustment of inventory levels based on:

A. Patient demand

B. Purchasing procedures

C. Hospital staff workflows

D. All of the above

Questions?

Dave Webster, RPh MSBA
Associate Director of Pharmacy Operations

University of Rochester Medical Center
Dave_Webster@URMC.Rochester.edu

Dr. Maria Schutt, EdD
Director, Education Services and Optimization

BD Medication Management Solutions
Maria.schutt@bd.com

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