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Global Conference & Exhibition

FEB 11–15, 2019 | ORLANDO

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Improving Medication Practice & Patient Safety Through Artificial Intelligence

Session ISED10, February 13, 2019

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Conflict of Interest

BD has provided support for Katelyn Hipwell's portion of this presentation

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Agenda

- Introduction & Overview
- Information Architecture (IA) to support Artificial Intelligence (AI)
- Operationalizing AI for Healthcare
- Applying AI to a real-world clinical problem: Drug Diversion
- Process improvement for Diversion Management
- Q&A

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Learning Objectives

- Define Artificial Intelligence and machine learning as it applies to healthcare
- Understand the success factors necessary to optimize data analytics across information systems
- Demonstrate the use of AI/Machine Learning to address a specific patient safety & medication practice issue

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Information Architecture to Support Artificial Intelligence

Scott Loebig

VP, Research & Development

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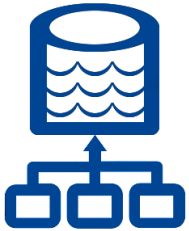
Information Architecture (IA) is Foundational to Succeeding in Unlocking Value through Artificial Intelligence (AI)



Ingest & centralize (virtually or physically) data assets from across your organization to solve a problem

Curate, standardize, & enrich data through people, processes, and tools to drive consistency in models that drive outcomes

Document, secure, and make data accessible to empower teams to drive new innovation with data science

On average 80% of data scientist time is collecting, cleaning, and preparing data and 20% is spent on data analysis

Source: The Cognitive Coder, Infoworld from IDG, September 26, 2017

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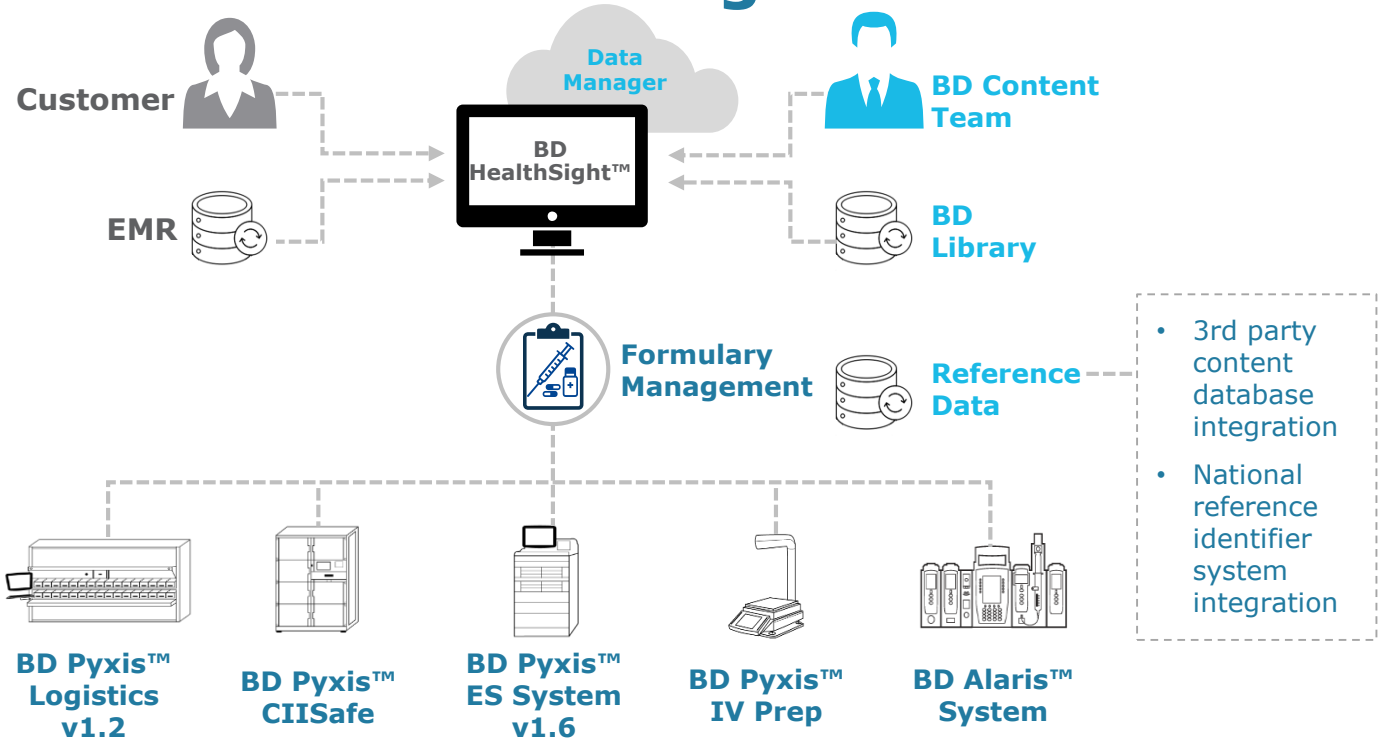
Example: BD HealthSight™ Data Manager is a Foundational Technology to Unlock Actionable Insights



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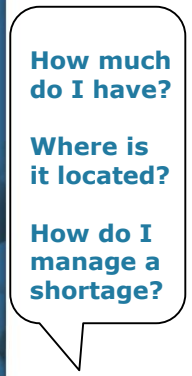
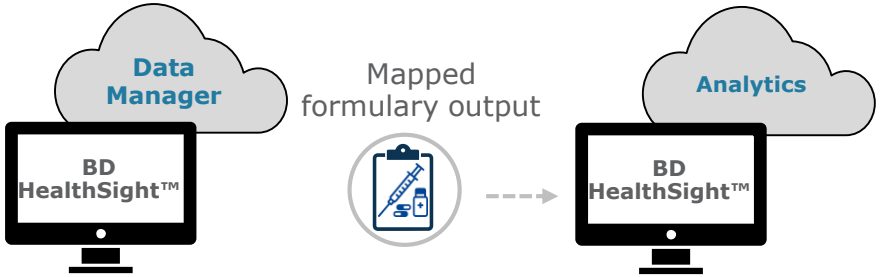
Mapping Disparate Med IDs from Multiple EMRs to Enable Analytics



EMR 1
Morphine
MedID XX-XXX

EMR 2
Morphine
MedID YY-YYY

EMR 3
Morphine
MedID ZZ-ZZZ



Enterprise visibility across all facilities

Centralized **shortage management** and redeployment

Ability to **identify opioids across different forms**

Ability to **match the dispense and administration** of a specific dose

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Operationalizing AI in Healthcare

Ken Tanner

Global Solutions Architect

CTO Office for Data & AI

Microsoft

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Advanced Analytics Represents a Growing Opportunity

Global business value derived from **AI in 2022** will reach

$3.9T

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"Forecast: The Business Value of Artificial Intelligence, Worldwide, 2017-2025", Gartner, April 2018.

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Health & Life Sciences Use Cases

DNA sequences	Real world analytics	Image deep learning	Sensor data	Social data listening
FAST-Q BAM SAM VCF Expression	HL7/CCD 837 Pharmacy Registry EMR	MRI X-RAY CT Ultrasound	Readings Time series Event data	Social media Adverse events Unstructured
Genomics and precision medicine	**Clinical and claims data**	**GPU image processing**	**IoT device analytics**	**Social analytics**
Single cell sequencing Biomarker, genetic, variant and population analytics ADAM and HAIL on Databricks	Claims data warehouse Readmission predictions Efficacy and comparative analytics Prescription adherence Market access analysis	Graphic intensive workloads Deep learning using Tensor Flow Pattern recognition	Aggregation of streaming events Predictive maintenance Anomaly detection	Real-time patient feedback via topic modelling Analytics across publication data
Faster innovation for drug development	**Improved outcomes and increased revenue**	**Diagnostics leveraging machine learning**	**Predictive analytics transforms quality of care**	**Improved patient communications and feedback**

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Adopting Advanced Analytics in Your Organization

Where do you see your organization today?

Where do you see your top competitors today?

Where do you see your organization in the future?

Analytics capabilities

← Basic — Advanced →

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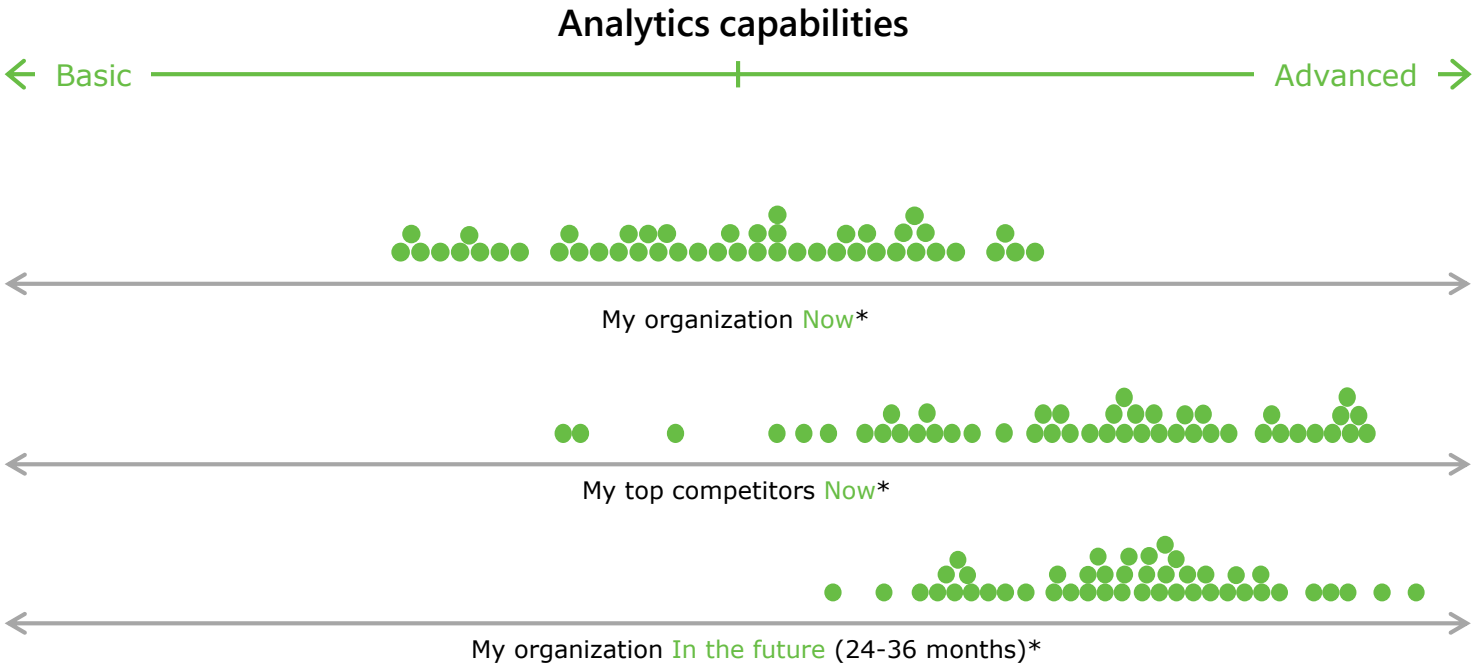
What the Research Tells Us



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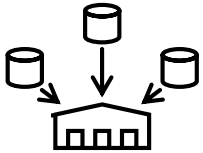
*Based on independent market research in the form of focus groups and in-depth-interviews

How Organizations are Transforming

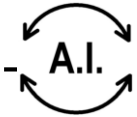
Serving business users and end users with intelligent and dynamic applications



Build a unified and usable data pipeline

Develop/Train ML and DL models to derive insights

Operationalize models and distribute insights at scale



AI Service Management

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But There is a Lot to Consider

Complexity of solutions

Many options in the marketplace

Data silos

Incongruent data types

Difficult to scale effectively

Performance constraints

And most aren't satisfied with their current solutions

46% Are satisfied with ease of use of analytics software

21% Are satisfied with access to semi-structured and unstructured data

28% Are satisfied with ability to scale to handle unexpected requirements

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"What it Takes to be Data-Driven: Technologies and Best Practices for Becoming a Smarter Organization", TDWI, 2017.

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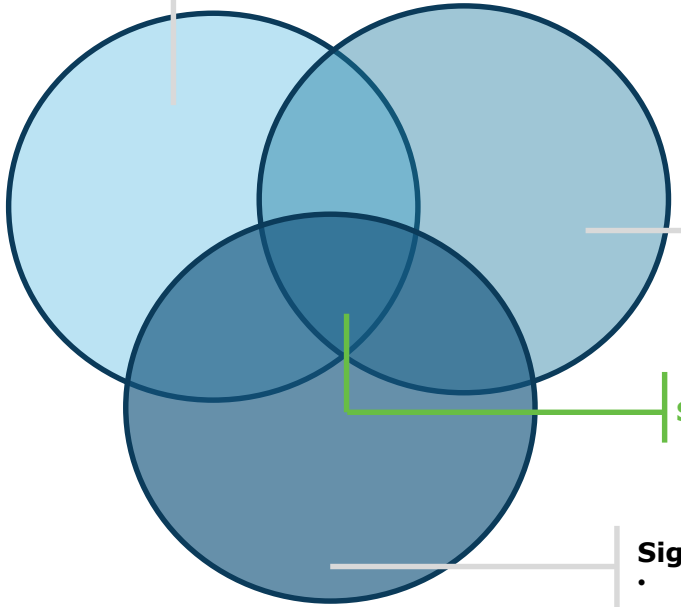
Opportunity Shaping – Assess & Prioritize Business Opportunities



Feasibility

- Do I have or can I get the data requisite to drive the intelligence.
- Can the AI (prediction) be delivered?

Surmountable Barriers to adoption

- Technical Implementation leveraging existing and new systems
- Business adoption of AI outcomes

SWEET SPOT

These are the use cases that will be prioritized for implementation as part of building AI COE and gradually building analytics platform, accompanying process, organization and culture.

Significant Business value

- What business value can we derive from the solution?
- Quantifiable? How much?

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Agile Data Estate Evolution over Data Field of Dreams

- Capture / Evolve your Architecture Patterns
- Capitalize on capabilities from cloud
- Leverage Your Existing Data Estate
- Align / Refine your architecture as you grow your Analytics Platform
- Prioritize Business Results

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Agile, DevOps… with AI?

- Design and engineering with scale in mind
  - Choose your run AI Platform
  - Engineer for Target Run Platform
- Focus on team integration
  - AI Engineering Transition States
- AI Service Management
  - Start with monitoring
  - Build in intelligence then automation (retrain/re-engineer/retire)

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Applying AI to a Real-World Clinical Problem : Diversion Analytics

W. Perry Flowers, RPh, MS

VP Medical Affairs, Enterprise Medication Management

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Opioid Epidemic

National Public Health Emergency

[U.S. Department of Health & Human Services, Oct. 26, 2017]

Started Years (read: decades) Ago

[Science 21 Sep 2018: Vol. 361, Issue 6408]

Now Impacting Life Expectancy Calculations

[NCHS Data Brief, No. 293, December 2017]

Diversion of pharmaceutical grade product is a basic foundation of a healthcare leaders' charge and the law with passage of the Controlled Substances Act in 1970 [United States Drug Enforcement Administration, United States Code (USC) Controlled Substances Act]

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Opioid Crisis: By the Numbers

10 – 15%

Source: Crit Care Med. 2007; 35 (suppl) :S106-16

$ 115 M
$ 44 M
$ 2.3 M
$ 4.3 M

Source: DOJ/DEA press releases

Staggering numbers from 2017 CDC data

[NCHS Data Brief, No. 329, Nov 2018]
[U.S. Opioid Prescribing Rate Maps]

- The age-adjusted rate of drug overdose deaths in the United States was **9.6%** higher than the rate in 2016
- 70,237 drug overdose deaths in the USA in 2017
- 16% of U.S. counties have enough opioid prescriptions dispensed for every person in that county to have one
- The overall opioid prescribing rate dropped to 58.7 prescriptions per 100 people

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Healthcare Facility Diversion

Multiple Victim Crimes

Healthcare workers & patients

Reputational Risks

Organization, profession, and person

Opioid User Disorder

Estimated to be costing U.S. Employers $18B per year in lost productivity and medical expenses

[Castlight Health, 2016]

Prevention Measures are Critical

ASHP Guidelines on Preventing Diversion of Controlled Substances, 2017, offers a thorough review of measures and controls from procurement thru to product waste and removal

[Am J Health-Syst Pharm. 2017; 74:e10- 33]

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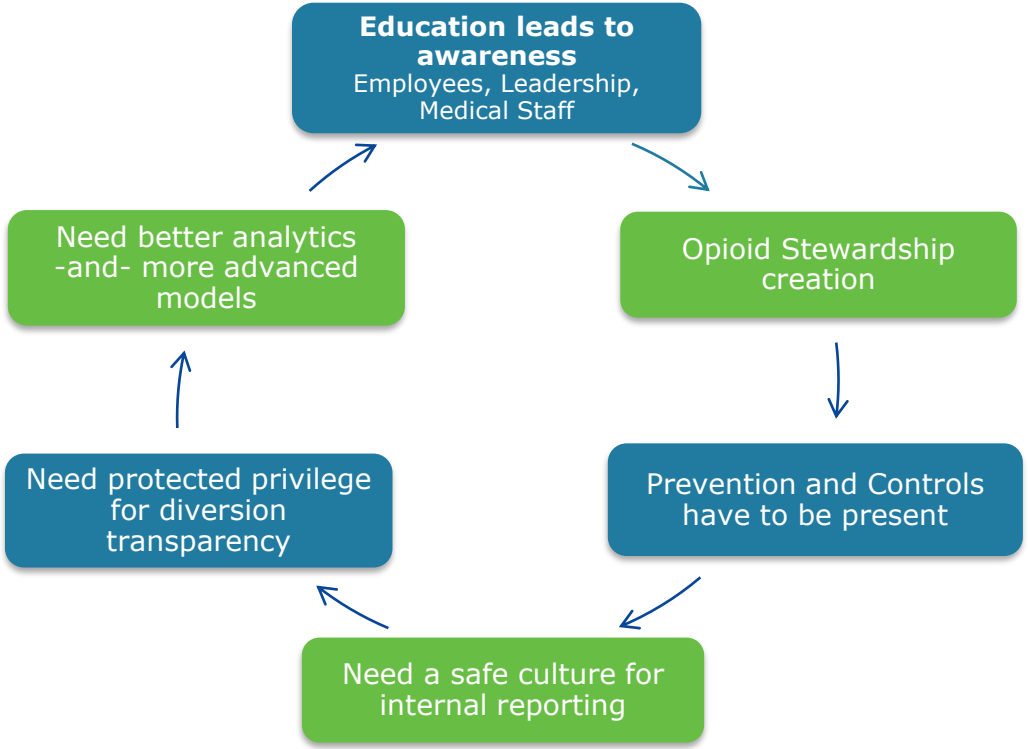
Healthcare Leadership Challenges



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BD HealthSight™ Diversion Management Application

- Masked Healthcare Clinician to reduce bias
- Machine Learning Algorithms
- Variations in patient care within the same episode of care
- Internal investigation documentation capability within the same application

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Specific User Risk Score & Top Anomalous Behaviors View

BD HealthSight Analytics

Megan.Donnelley

Queue | Reconciliation | Closed | Legacy Reports

Nurse
431
Unmask

Assigned to
Doris Ivy

Complete

Key Trends

Risk Score 2018

Aug	Sep	Oct	Nov
6.5	9.2	8.4	9.8

9.8

Anomalous Behavior

Behavior Guide

- Waste delay hydromorphone injectable
- Waste delay morphine injectable
- Dispensed morphine injectable
- Canceled transactions

History

Add Comments

Newest

Opened Wed, Oct 18, 2017, 13:12

Investigation R00075
Reason for Investigation:
Hey Doris, this persons risk score spiked again. They have changed to a much slower ward, but I am seeing many of the same behaviors (delays, overrides) in this new environment as I reported while there were assigned to the ICU. Sent a note to Michael to particularly watch their use of meperidene and hydromorphone injectables.
Megan Donnelly

Transactions | Prior Investigations

Last data upload: May 15, 2018 Export Report

Time Frame	Patient	Medication	Issue	Sort	Station Name
Nov 21, 2017- Nov 21, 2017	V345678	Morphine sulfate Injection, + 3 ...	All	Dispense Time	1EastBlueA + 2 others

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Process Improvement for Diversion Management

Katelyn Hipwell, PharmD, MPH

Pharmacy Clinical Operations Manager

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UVA Demographics

- Tertiary care academic medical center
- 612 Beds
  - 494 Average Daily Census
  - 28,359 Inpatient Admissions
- 64,780 ED Visits
- 878,781 Outpatient Visits
- Level 1 Trauma Center
- Comprehensive Transplant and Stroke Center
- Nationally recognized Cancer and Heart Center

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2018 statistic data

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Major Areas of Concern for Diversion

Documentation Requirements

Reporting

Surveillance

Investigation

Record Keeping

Chain of Custody

UVA

- 8,119 Full-time Equivalents (FTE)
- 526,610 Annual Controlled Substance Transactions*
- Automated Dispensing Cabinets (Pyxis ES)
  - 141 Medstations
  - 66 Anesthesia Stations
- Electronic Medical Record
  - Epic

Healthcare Providers

Patients

Support Staff

Family & Caregivers

Accessibility

Human Resources

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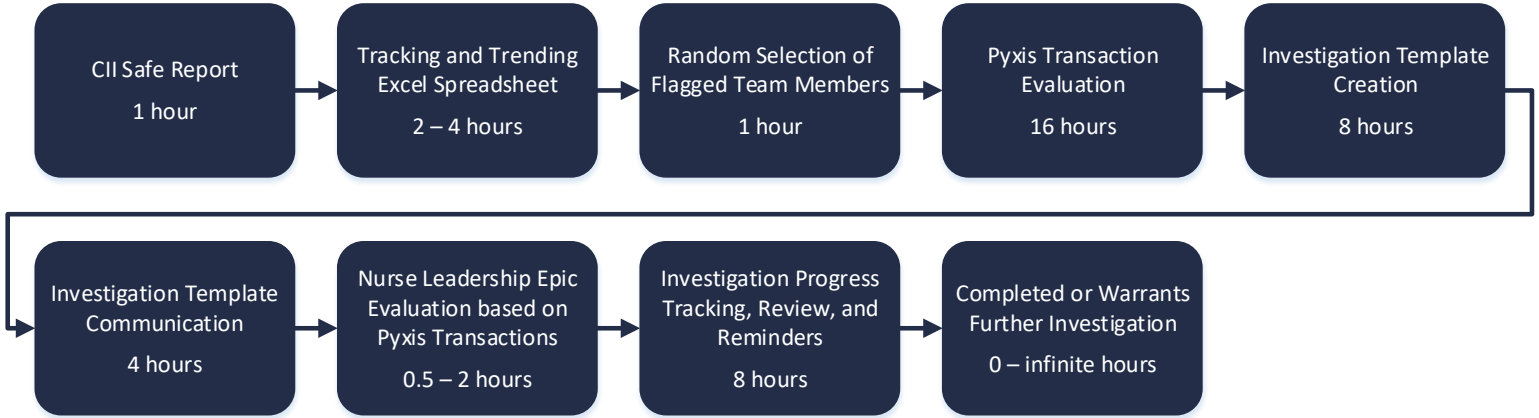
Current Controlled Substance Audit Process

Background:

- Team members that handle controlled substances (CS) are compared to team members from the same practice area whose administration data shows ≥ 2+ SD higher than team members on the unit
  - Completed on a monthly basis



40 – 44+ hours/month

Surveillance Audit Template

Pyxis Activity Log							Documentation Assessment - EPIC					Pain Assessment - EPIC				Assignment Assessment		
Provided by Pharmacy							Review by Manager					Review by Nursing				Review by Manager		
Patient Name	MRN	Transaction Type	Medication Name	Quantity	Waste quantity (if applicable)	Witness (if applicable)	Time documented on MAR	Delay from Pyxis removal, or charted as given before removed?	EPIC medication order description	Dose removed from Pyxis match Epic order?	Waste appropriate? (if applicable)	Pain score prior to dose	Pain score after dose	Was dose documented appropriate for pain score?	Are pain scores consistent with previous and subsequent caregivers?	Medication removed prior to or after shift?	Was patient assigned to this caregiver?	Was p the c

Sections of Template

- Blue = Pyxis Activity Log
- Yellow = Documentation Assessment – Epic
- Orange = Pain Assessment – Epic
- Green = Assignment Assessment

Tracking Issues Manually

Number of Issues	Classification
7.6%	Documentation Practice
8.9%	Multiple discrepancies/More reports to audit
3.8%	Override Practice
7.6%	Owner of audit
32.9%	Did not complete
15.2%	Pain Score
1.3%	Wrong Patient
21.5%	Wasting Practice
1.3%	Wrong Frequency
100.0%	**Total**

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Pain Points

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Challenges vs. Enhancements

Current Limitations	BD HealthSight™ Improvements
1. Not specific to patient care type	1. Evaluation based on machine learning
2. Limited comparison by Pyxis machine	2. Compares similar patient types regardless of Pyxis machine
3. Manually tracking in excel spreadsheets a. Investigation transactions b. Quality assurance trends c. Trends d. Receipt, Completion, Actions	3. All tracking is automated and completed within the tool
4. High rate of false positives	4. Potential to decrease false positives a. Determine post-implementation
5. Data Assessment a. Manual monthly intervals	5. Data Assessment a. Updated and available daily
6. Traveler staff leave before detection	6. Timely traveler staff detection
7. Communication and investigation completion a. Emails	7. Communication and investigation completion a. Located in tool

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UVA Controlled Substance Metrics

Measure by Priority	Frequency	Reported Metric	Expected Changes
Unreconciled Dispenses	Nursing – Daily Pharmacy – Daily Reported - Monthly	% = Unreconciled CS ADC Dispenses/ All CS ADC Dispenses	• Ability to assess daily • % trend down
Unresolved Discrepancies > 24 hours	Nursing – Daily Pharmacy – Weekly Reported – Weekly	% = CS Discrepancies unresolved >24 hours/All CS Discrepancies % = CS Discrepancies/All CS ADC Transactions	• Maintain
Undocumented Waste	Nursing – Daily Pharmacy – Weekly Reported – Weekly	% = CS Not Wasted/All CS Waste Transactions	• Ability to assess daily • % trend down
Overrides	Nursing – Daily Pharmacy – Weekly Reported – Monthly	% = Override CS ADC Dispense/All CS ADC Dispenses % = Linked Override CS ADC Dispense to Order/All Override CS ADC Dispenses	• Increase in resolution of unlinked overrides • % trend down
Time to Administration	TBD	Minutes = Time CS Dispensed from ADC to Administration Charted Minutes = Time CS Dispensed from ADC to Wasted if applicable	• Start consistently measuring • Establish baseline

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Questions

- Katelyn Hipwell: KMP4S@hscmail.mcc.virginia.edu
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- Stephen Smith: Stephen.Smith2@bd.com
- Ken Tanner: Ken.Tanner@microsoft.com

- Please complete online session evaluation

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