Utilizing Multiple Technology Vendors to Implement Medication Safety Initiatives from Procurement to Bedside

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PinnacleHealth System

- Located in Harrisburg, PA
- Quality and Safety - keystone for strategic plan
- 3 hospital system
  - > 600 licensed inpatient beds
- Community teaching hospital
  - Approximately 100 residents
  - Approximately 900 attending physicians
- Dispense approximately 15,000 doses per day
  - 8,000 – 10,000 inpatient doses
Medication Management Technology Plan

- Support the PinnacleHealth Strategic goal of patient safety
- Reduce risk of errors by implementing technology at different stages of the medication use process (prescribing, dispensing, administering, monitoring and documenting)
- Senior leadership / Board commitment
- 5-year plan (mid ’03 – mid ’08)

In what order ???
Sources of harm

Errors: 28% (39%)

Transcribing: 11% (12%)

Dispensing: 10% (11%)

Administering: 51% (38%)

Source: JAMA 1995;274:35-43
<table>
<thead>
<tr>
<th></th>
<th>CPOE</th>
<th>Bar Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expense</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Difficulty with</td>
<td>Very High</td>
<td>Very High</td>
</tr>
<tr>
<td>implementation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System complexity</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Effectiveness in</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>reducing error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main group impacted</td>
<td>Physician</td>
<td>Nurse/Pharmacist</td>
</tr>
<tr>
<td>Ownership / Impact</td>
<td>Physician</td>
<td>Nurse/Pharmacist</td>
</tr>
</tbody>
</table>
Technology Vendors - 2003

- Siemens Pharmacy
- Baxa TPN Compounder
- AmerisourceBergen (wholesaler)
- PYXIS (Automated Dispensing Cabinets)
- Medi-Dose

Maintain relationships if possible...
Medication Management Technology Plan

- Considered the data
- Considered our environment
- Considered current vendors
- Considered available systems

Start with bedside scanning
Building a Safe Medication Technology System

- MUST BE WELL PLANNED
- Success depends on all practitioners working together

It must be easier to do the right thing and harder to do the wrong thing
Master Plan

- Created an empowered multi-disciplinary work team (grass roots)
- Engaged vendors (worked with multiple vendors simultaneously)
- Justified a Pharmacy IT Analyst position
- Installed a complete test system
- Consideration of entire project (5 yr plan)
Getting Everyone On Board

✓ Nurses spent time in the pharmacy
✓ Pharmacists passed meds with nurses
✓ Educated IT
✓ Engaged vendors
✓ Respected each other’s perspectives
✓ Recognized each other’s limitations

Walked a mile in each other’s shoes...
How to Get There?

Paper MAR

Bedside Scanning / Automated MAR

- No additional FTEs  (Had to increase efficiency)
How to Get There?

???

Pyxis
Where Were We With Pyxis?

- Pyxis machines on all inpatient units and some procedural units
- Controlled substances and emergent first doses only
- Homegrown interface
Interim Step - Pyxis Upgrade

- Installed Pyxis SN / profile interface to get Nursing and Pharmacy on the same page and to assure quick access to meds
- Rebuilt Pharmacy system by dosage form
- Brought units live one by one
- Took 18 months – BUILDING…. for future
- Created a “trap”
“Trap”

- How to assure databases match?
- Siemens Pharmacy is our “master” system
- Governs entire medication delivery system
- Use Siemens to populate like fields in downstream databases
- Info “trapped” for final review to assure all systems are in sync

Started with Pyxis
PYXIS – Current Set-up

- BioID
- CII Safe
- Profile Interface
- Cartless (90-95% of meds)
- All drawer types
- Typical configuration
  - Main/Aux (15-20 beds)
  - Towers on ICUs/specialty units
  - Remaining 5-10% meds are filled with cartfill into “locked cabinets”
- PARx at Pyxis MedStation
- Pyxis 3500 Upgrade – April ‘07
Bedside Scanning / Automated Medication Charting

Were we ready ???

- Paper MAR
- Only 19% of meds were ready to scan
- Accurately barcoded medications
- Reliably scanned at the bedside
- Shoot for 100%
- Had to increase efficiency
- How to prepare / support system ???
Next Step - Barcoding / Automated Distribution (What did we want?)

- Carousel / Packager / Labeling software
- One integrated database
- “Trap”
- Concentrate on Pyxis fill (95% of meds)
- A vendor that would help us achieve our goals

Chose Talyst
Medication Carousel

Automated storage of medications in Pharmacy that utilizes bar code technology to dispense
Talyst autoPACK™

- Bar codes and packages unit-dose oral solids
- Interfaced with Carousel software
- Limitations—covered with Medi-Dose “MILT” system
  - Hazardous meds
  - Powdery meds
  - Allergenic
  - Hygroscopic
Talyst autoLABEL™

- Labels various types of oddly shaped medication containers
  - Eye drops
  - Inhalers
  - Suppositories
  - Others
Talyst Install

- Primary goals:
  - Assure there is a readable barcode on every dose
  - Replenish Pyxis machines efficiently
- Dissected software in great detail
- Pharmacist involved at every step, every day
- Completely rethought our distribution model
- Interface with wholesaler / Siemens / Pyxis
- Automatically places a suggested wholesaler order
- Cartfill (1 year later)
Daily Receiving Process

- Starts with wholesaler delivery
- Pharmacy scans one dose of each lot, every day at the unit of use level to assure it is reliably readable at the bedside
- Medications are then separated into groups:
  - Ready to go
  - Needs to be cross-referenced
  - Needs to be relabeled (Talyst autoLABEL™)
  - Needs to be packaged and labeled (Talyst autoPACK™ / Medi-Dose)
- Pharmacist check occurs at every step
Medication Process is Complex

1. Medication Needed
   - Pharmacy-Medicine Consult
     - Wait
     - Order
       - Order Sorted & Prioritized
         - [Items]
         - Conflict
           - ADR
           - Interaction
           - Allergy
           - Illegible
         - Contact Practitioner
       - Review
         - Wait
         - OK
         - Order Entry
           - OK
           - Medication Dispensed
             - Wait
             - Medication Delivered
               - Wait
               - Medication Administered
                 - Documentation on MAR
More Complex ???

New Product
Summary of Daily Activities

- Receive order
- Scan check in Siemens and Talyst
- Update databases as needed (weekdays)
  - (Siemens, Talyst, Pyxis, Medi-Dose)
- Barcode products if necessary
- Replenish carousel
- Replenish packager as needed (forecast report)
- Pharmacist check at every step
- Sort and deliver
- PARx at each Pyxis MedStation
Talyst - Added Bonuses

- Scan on dispense
  - Carousel
  - Remote Stock (batch)
  - Packager
  - First doses
Medication errors in hospitals are common (1, 2), and dispensing errors made in the pharmacy contribute considerably to these errors (3). Overall, dispensing error rates are relatively low, but because of the high volume of medications dispensed, more than 100 undetected dispensing errors may occur in a busy hospital pharmacy every day (4). Because only about one third of these dispensing errors are detected, the actual number of dispensing errors is likely much higher (5). Studies have shown that the use of bar code technology can help reduce dispensing errors (6, 7). As a result, hospitals are beginning to adopt this technology to increase the accuracy of the dispensing and administration processes. Despite enthusiasm for this technology, few published studies have evaluated the effect of bar code technology on dispensing errors (9, 10). Previous work has also demonstrated that the implementation of health information technology (HIT) may result in unintended consequences.
Talyst - Added Bonuses

- Scan on dispense
  - Carousel
  - Remote Stock (batch)
  - Packager
  - First doses

- Information Labels
<table>
<thead>
<tr>
<th>Medication</th>
<th>Category</th>
<th>Instructions</th>
</tr>
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<tbody>
<tr>
<td>Vecuronium (non OR areas)</td>
<td>PARALYTIC AGENT</td>
<td>Pull 1 vial per bottle and follow the instructions below.</td>
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Automated Med Charting / Bedside Scanning Overview (Siemens MAK)

- Data is populated from the Siemens Pharmacy System
- Nursing charts on-line, creates on-line MAR
- Medications administered utilizing bar code technology
- Many advantages for patient safety
Administration Process

- The Nurse views the active work list and clicks on the med to be administered.
- The med barcode is scanned and the System checks for med, dose, route, time.
- If all are correct, a check mark is placed to the left of the medication name.
- When scanning a med, the System warns if the med, dose, route or time is incorrect.
- Special messages can be used to give guidance on administration procedures.
Administration Process (con’t)

- Once all meds to be administered are scanned, the nurse scans the patient’s barcoded ID bracelet and the system checks for the correct patient
  - If incorrect, a warning is displayed
  - If correct, a final verification screen is displayed

- The nurse clicks Chart to complete the administration process

- The electronic MAR and Clinical Repository are updated
Preparation

- Continued Steering Committee
- Completely changed all processes
- Recognized and addressed workarounds
- New printers (Pharmacy)
- Nursing equipment (devices / carts / scanners)

Assured a readable barcode on all meds as well as caregivers and patients
Printers

- Chose Zebra label printers / Data Ray interface
- Thermal printer with no ribbons
- Excellent barcode imprint
- Reliable technology with small footprint
- Low cost, simple to implement option
- Vendor was willing to develop a TallMan option within the print server interface
- Required no interface work with Siemens
Lionville MAK Carts
MAK Alerts

- "Notes" from Nursing to Pharmacy
  - Intervention message – ? about Pharmacy interpretation
  - Rx message - Note to Pharmacy about a specific order

- MAK Message – (Nursing pop up at time of administration)

- Med Warnings - (pre-attached to a specific medication)

- Conditional Orders - (reminders to Nursing)

- Mandatory co-signatures

- Vital Sign Alerts
Developed Several Reports to Support New Processes

- Cabinet exchange report
- Complex med workaround
- Carousel Remote Stock report
- Carousel Pharmacy Prep report
- Pyxis stock-out report
- Packager forecast report
Data Analysis

- > 98% of meds administered via MAK are confirmed with a barcode scan

- Med administrations are stopped each day
  - Wrong patient / wrong med

- Numerous opportunities......

- Data must be scrubbed
When MAK was implemented, more errors were reported while less errors reached the patient.

Medication Related Events - Severity Level Comparison
Events Reaching Patient

- % of Events that reached the patient
- Total Events Reported

MAK Implementation
Using the Data

- Opportunities to identify trends
- Opportunities to combine data from multiple systems

Must confirm validity of data
Hospira Smart Pumps

Additional barcoding challenges...
Hospira Smart Pumps (cont.)

- Smart PCA Pumps
  - Live - Summer ‘06
  - Use PharMEDium PCA cartridges
  - Scan check before dispensing
  - Wireless updates

- Smart Infusion Pumps
  - Working on “Trap”
  - Planned Live Fall ‘07
Technology Vendors

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- Baxa TPN Compounder
- AmerisourceBergen (wholesaler)
- PYXIS (Automated Dispensing Cabinets)
- Medi-Dose
- Talyst autoCAROUSEL™ / autoPACK™ / autoLABEL™
- Siemens On-line Charting / MAR / MAK
- Hospira Smart PCA Pumps
- Siemens Soarian (April ‘07)
- Hospira Smart IV Pumps (September ‘07)
- Siemens CPOE (early ‘08)
Other Supporting Vendors

- Zebra / DataRay
- MMI
- PharMEDium / CAPS
- Lionville carts
- HandHeld scanners
- Various pharmaceutical companies
Considerations / Tips

- Barcode in advance
- Product changes require strict adherence to protocol
- NDDF update
- Provide adequate training
- Don’t underestimate time commitment
Summary

- Requires senior leadership / board support
- Requires multi-disciplinary input
- Engaged vendors
- High-level, detail-oriented employees
- Requires passion
Conclusions

“It is important to recognize that an automated barcoding process does not exonerate pharmacists from performing necessary checks and balances.”
Conclusions (cont.)

- It is unrealistic to expect a vendor to build your system alone.
- It requires shared brain power.
- These systems are mere templates that must be molded to meet an individual health system’s goals.
- Choosing vendors that have the capability to help you implement your vision is critical.
Barcoding is NOT faster, easier or cheaper but it is definitely safer when done correctly.
Swiss Cheese Model
Defenses Against Errors