Clinical Decision Support & CPOE: The Good, The Bad, and The Ugly

Jim Carpenter, RPh, MS
Regional Information Services
Providence Health System
Portland, Oregon
CPOE Alerts Reminders

CPOE=Computerized Provider Order Entry

Electronic Health Record

Med Images
- CT
- MR
- US
- NM
- XR
- Card
- Endo
- Path

Waveforms
- ECG
- EEG
- ICU

Multidisc Charting/Bar-coded Med Admin

MedSurg
Crit Care
OB
Periop
ED

Lab reports
X-ray reports
General dictation
Machine formatted MD progress notes
CPOE Goals:

- **1st goal (TDS System – through the 70’s)**
  - Simple communication of orders
  - Workflow management

- **Next:**
  - Provide Cognitive value / Clinical Decision Support
  - Provide an alerts engine
  - Anticipate user needs

- **Dissonance / Paradoxes**
  - Instant transmission of orders / order entry time
  - Shifting of work burden
  - Security
Why do errors happen?

- Physicians report skipping peer orders due to illegibility
- 29.0% of orders require Health Unit Coordinator follow-up
Why do errors happen?
ProvExpert: Our Vision

- McKesson Horizon Expert Orders ➔ “ProvExpert”
- Goal: Facilitate order creation and communication in a knowledge-rich environment
- Providence Portland Medical Center: Rehab Unit Pilot Fall of 2005
- 2008 and beyond
Providence Health System Overview

- **18 hospitals**
  - 3 Portland Service Area Hospitals

- **5,000+** acute and long-term licensed beds

- Served more than **750,000** people through managed care plans

- **Primary care visits**: 1,523,286

- **Outpatient facility visits**: 2,873,246

- **Inpatient admissions**: 159,259

- **Employees (FTE)**: 36,000

- **Revenue**: $3.8 billion
ProvExpert Goals

- CPOE: Computerized Physician Order Entry
  
- Goal: Facilitate order creation and communication in a knowledge-rich environment

- Goal: Improve Patient Safety

- Goal: Make Care More Efficient
ProvExpert: A System for Experts

- Peer Reviewed Software
- Content Snapshot:
  - ~3000 medication orderables vs. ~2000 non-med orderables
  - 500+ Order Sets and Bundles
  - Develop new order sets & order bundles and DSS to meet new needs
- Other Decision Support:
  - Just-in-time Instructions
  - Corollary Orders
- Content requires constant care and feeding
Expected Benefits

- **Patient Safety! – Decreased ADE’s**
  - Legibility
  - True “Closed Loop” Medication Management
    - Eliminate transcription step (Pharmacy / Nursing)
    - Closed Loop Allergies
  - Decision Support at the time of order creation
- **Ubiquitous “chart” availability**
- **Faster turn-around times**
  - Medications
  - Labs, Ancillary Exams
What makes this so hard?

- Re-invention of how orders are communicated
- Disruption of the facility’s “magic glue”
- Hybrid (paper and electronic) information flow during transition to electronic ordering
- Developing supporting content for decision-making and determining when to deliver it
- Support Model
What makes this so hard?


"... professional knowledge and information cannot be conceptualized as atomic bits and pieces that can be stored and retrieved at will, and that can be unequivocally mapped on simple, universal schemata.”
How did we engage our staff?

ProvExpert Testing Sessions (‘PET’ Sessions)
- Content Validation / Usability Testing
Who’s Engaged at Providence?

- **Pharmacy**
  - Regional Director of Pharmacy
  - Regional Pharmacy Clinical Coordinator
  - Prov Portland Clinical Specialist(s)
  - Prov Portland Pharmacy IT coordinator
  - 3 staff pharmacist “Super-Users”
  - Many other staff members (test drive / Q&A) during testing

- **Information Systems**
  - CMIO
  - Director of Nursing Informatics
  - CPOE Analysts (dedicated)

- **Physicians**
  - Physician Leaders
  - Community Physicians
  - Hospitalists
  - Residents

- **Administration**
  - CEO
  - Director of Nursing
  - PPMC Nurse Informaticist
Pharmacists Needed!

- In the Project’s Committees:
  - ProvExpert Executive Committee
  - Clinical Decision Support Committee
  - Communication w/ P&T / Quality & authority issues

- In System Design & Testing:
  - Experience with local order entry and pitfalls
  - Awareness of local and even unit-specific workflow
  - Integration with NEW Pharmacy System, AMDMs, and Bedside Barcoding
Pharmacists Needed!

... As communicators:
- Given a sense of ownership
- Viral Marketing: can become very credible “champions”

... For Content Management ...
“Paper or Plastic?”

- Pharmacist Work Queue
  - Verification, “making orders right” and co-signature implications

- Questions we’re wrestling with:
  - How will pharmacists use the CPOE application?
  - How do the application alerting strategies differ?
  - Will RNs be involved in Order Entry?
  - How readily will the Prov Portland build translate to other facilities?

- What is the legal record?
Day 1 Stories

- Order for Venous Duplex – Instant Transmission to Radiology

- Oxycontin Clarification
  - Oxycontin 15 bid 0830 – clarified 10 bid at 1550

- “Feels weird” – Trust issues
Real Impacts of CPOE

- 33 min. reduction in STAT troponin turn-around time
- 31% reduction in Diagnostic Imaging order correction due to ordering errors
- 37 min. reduction in routine med turn-around time
- 1-2 significant errors mitigated per day

“Like the fast time turnaround to receive & implement orders.”
Janice, 2K Charge Nurse
Medication Alerts – By the Numbers (April ’08)

- **Total Drug Alerts Fired**: 43,117
- **Alerts Presented to Users**: 363
  - **Allergies**: 319 presented
    - 40 / 12.5% accepted (order cancelled)
  - **Interactions**: 44 presented (8584 suppressed)
    - Only CONTRAINDICATED alerts presented
    - 6 / 13.6% accepted (order cancelled)
    - With SEVERE alerts showing were seeing a 95-97% override rate
  - **All other alert types suppressed**
Content Development Governance

- ProvExpert Executive Committee
  - Reports directly to Med Exec Committee
- Composition and Goals of CDSC
  - Dotted line to Pharmacy & Therapeutics Committee
- Nursing Orders Workflow Group
- Pharmacy Workflow Group
- Cross-Communication Issues
The Content Lifecycle

- Physician “Owner” describes a need
- Paper specification
- Presentation to Owner – iterative re-development
- Owner sign-off
- Presentation to CDSC (iterative re-development)
- Quality Assurance
- Implementation in LIVE environment
So what does this mean?

- Recent user survey on alerts
- Overridden alerts STILL have value

- New functionality
- Clinical Content and Alert Strategy requires **CONSTANT CARE AND FEEDING**
Decision Support Types

- Processing Information
- Prompts for Drug Dose Frequency Duration
- Defaults
- Formulary Interventions
- Drug-Drug Interactions
- Drug-Allergy Contraindications
- Linked Orders
- Information Links
- Order Bundles
- Order Sets
- I-Forms
Quick orders

1. lisinopril  [prinivil] quick orders »

...or maybe...

2. quick / serial lab orders »
3. lorazepam  [ativan] quick order »
4. acetaminophen  [tylenol] quick orders »
5. kcl  [controlled rel] quick orders »
6. pantoprazole  [protonix] quick orders »
7. ondansetron  [zofran] quick orders »
8. promethazine  [phenergan] quick orders »
9. oxycodone  quick orders »
10. zolpidem  [ambien] quick orders »
11. furosemide  [lasix] quick orders »
Quick orders (cont.)

LISINOPRIL [PRINIVIL] QUICK ORDERS

Hypertension Initial Dose: 10mg/day; Max: 80mg/day
CHF Initial Dose: 5mg/day; Target 20mg/day; Max: 40mg/day

1. lisinopril [prinivil] 2.5 mg oral daily
2. lisinopril [prinivil] 2.5 mg oral bid

3. lisinopril [prinivil] 5 mg oral daily
4. lisinopril [prinivil] 5 mg oral bid

5. lisinopril [prinivil] 10 mg oral daily
6. lisinopril [prinivil] 10 mg oral bid

7. lisinopril [prinivil] 20 mg oral daily
The Bad & Ugly

- QA Process – TIME CONSUMING!!!
  - Now flirting with “Software Engineering”
- Some “Gotchas” discovered once moved to Production
- Formatting issues – establish consistent:
  - Font
  - Color palette
  - Header / Layout Consistency
  - Button placement
- Analyst Team Competencies – what if a problem with a complex form is identified over a weekend?
# Insulin Ordering I-Form

## Subcutaneous Insulin Order Set: Eating Meals

### 1. Blood Glucose Monitoring:
- AC 8 HS (automatic unless unchecked)
- At 2 AM

### 2. Scheduled Insulin Dose (units SQ)

#### a) Scheduled Basal Insulin

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Usual Frequency</th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
<th>Bedtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPH (Novolin N)</td>
<td>b.i.d.</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
</tr>
<tr>
<td>Glargine (Lantus)</td>
<td>daily</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
</tr>
<tr>
<td>Novolin 70/30</td>
<td>b.i.d.</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
</tr>
</tbody>
</table>

#### b) Scheduled Mealtime Insulin

<table>
<thead>
<tr>
<th>Insulin Type</th>
<th>Administration</th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lispro (Humalog)</td>
<td>before meal</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
</tr>
<tr>
<td>Regular (Novolin R)</td>
<td>give 30 minutes after meal</td>
<td>Units</td>
<td>Units</td>
<td>Units</td>
</tr>
</tbody>
</table>

### 3. Pre-meal Correction Insulin Dose, units SQ

- **Daytime Insulin sc to be administered in addition to scheduled insulin dose.**
- **Select Insulin type:** Regular Insulin, Lispro

<table>
<thead>
<tr>
<th>CBG (mg/dL)</th>
<th>Mild Scale</th>
<th>Moderate Scale</th>
<th>Aggressive Scale</th>
<th>Custom Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70-150</td>
<td>No additional insulin</td>
<td>No additional insulin</td>
<td>No additional insulin</td>
<td></td>
</tr>
<tr>
<td>151-200</td>
<td>1 unit</td>
<td>3 units</td>
<td>4 units</td>
<td></td>
</tr>
<tr>
<td>201-250</td>
<td>2 units</td>
<td>6 units</td>
<td>7 units</td>
<td></td>
</tr>
<tr>
<td>251-300</td>
<td>4 units</td>
<td>8 units</td>
<td>10 units</td>
<td></td>
</tr>
<tr>
<td>301-350</td>
<td>6 units</td>
<td>10 units</td>
<td>12 units</td>
<td></td>
</tr>
<tr>
<td>351-400</td>
<td>8 units</td>
<td>12 units</td>
<td>15 units</td>
<td></td>
</tr>
<tr>
<td>&gt;400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Follow Hypoglycemia Protocol, decrease scheduled meal insulin dose by 1 unit

- **Call MD**

### 4. Bedtime Correction Insulin, units SQ

- If not scheduled, same dose as daytime unless ordered. No correction insulin will be given at 2:00 AM unless specifically requested in section 1 above.

**Buttons:** Back, Home, Close
EDIT, IF,, premeal_regimen, EQ,"low", THEN
EDIT, SET, LOCAL, dose2, TO,"0 units", AND
EDIT, SET, LOCAL, dose3, TO,"1 units", AND
EDIT, SET, LOCAL, dose4, TO,"2 units", AND
EDIT, SET, LOCAL, dose5, TO,"4 units", AND
EDIT, SET, LOCAL, dose6, TO,"6 units", AND
EDIT, SET, LOCAL, dose7, TO,"8 units"
#EDIT, SET, LOCAL, dose8, TO,"Call MD"

EDIT, IF,, premeal_regimen, EQ,"moderate", THEN
EDIT, SET, LOCAL, dose2, TO,"0 units", AND
EDIT, SET, LOCAL, dose3, TO,"3 units", AND
EDIT, SET, LOCAL, dose4, TO,"6 units", AND
EDIT, SET, LOCAL, dose5, TO,"8 units", AND
EDIT, SET, LOCAL, dose6, TO,"10 units", AND
EDIT, SET, LOCAL, dose7, TO,"12 units"
#EDIT, SET, LOCAL, dose8, TO,"Call MD"

EDIT, IF,, premeal_regimen, EQ,"high", THEN
EDIT, SET, LOCAL, dose2, TO,"0 units", AND
EDIT, SET, LOCAL, dose3, TO,"4 units", AND
EDIT, SET, LOCAL, dose4, TO,"7 units", AND
EDIT, SET, LOCAL, dose5, TO,"10 units", AND
EDIT, SET, LOCAL, dose6, TO,"12 units", AND
EDIT, SET, LOCAL, dose7, TO,"15 units"
#EDIT, SET, LOCAL, dose8, TO,"Call MD"
The Ugly – Interaction Screening

Pharmacy warning(s) for GATIFLOXACIN [TEQUIN]:
1. Not Screened | Drug | ANTACID OF CHOICE Coding System: NDC was not screened against GATIFLOXACIN [TEQUIN] for drug-drug interactions. ID 0000000004 was not recognized by FDB.
2. Not Screened | Drug | LAXATIVE OF CHOICE Coding System: NDC was not screened against GATIFLOXACIN [TEQUIN] for drug-drug interactions. ID 0000000004 was not recognized by FDB.

Warning

There was a partial screening failure
Drug-Drug Screen Partial Failure: One or more medications WERE NOT RECOGNIZED by FDB

HEORx

$0.00

Literature

Micromedex

For more information
The Ugly – Unintended Consequences

- Wrong-Patient Order Entry
- Wrong-Account Order Entry
- Disruption of traditional communication strategies – order awareness
  - “what do you mean my patient needs to go to radiology?”
  - Pharmacist Rounding
- User Error
- System Maintenance
- See also:
The Ugly – Cont…

- “Interleaving” paper orders in the chart
- Communication to Other Providers:
  - ACM
  - REHAB
  - Radiology – Patient Safety Form
- Disruption and re-gelling of magic nursing glue
- Miscellaneous Orders
- SPEED
The Ugly – System Integration

ProvExpert Project has become the:

“ProvExpertPORTALconfirmInCareOrganizer-VerificationInHMMwhileKeepingAclose-EyeOnSTARandCernerAndComputrician” . . . .
...... Project
Demo
Keys to Physician Adoption

- Unwavering commitment from Administration
- Visible Physician Champions
  - ProvExpert Medical Director
  - Chair of P&T
  - Medical Director of Quality
- Engagement in Content Development
Managing Staff Concerns

- Staff Demos
- Participation in system build and testing
- Emphasize that their cognitive role in medication management is a requirement
- Honesty
- ENGAGEMENT
Unintended Consequences

- More / New Work -
- Unfavorable workflow – especially around hand-offs
- Never-ending system demands – on build team / end-users
- Paper Persistence - OCR
- Communication practice & pattern changes – used to be communicated verbally - STATs
- Negative emotions – impacts on experts / used to doing things on their own – now dependent
- New errors – wrong patient / duplicate labs
- Changes in power structure – loss of autonomy / should be a clinical project – not IT
- Overdependence on technology – don’t remember how to use paper!

Lessons Learned

- Start Small (& go slow)
- Staff are incredibly resilient & supportive
- Support needs for Nursing much higher than anticipated
- Works well for single orders for patients already admitted to the unit – entry of a lengthy admission orders is frustrating
- Nurses become heavy advocates for system use
In Summary

- Try to find ways to meaningfully engage staff in system design & testing

- The project’s committees will play a crucial role; a strong Pharmacy presence is vital

- Beware the viscosity of the present – this is an excellent opportunity to continue to refine the department’s 5-year vision

- The need for Pharmacy to have an excellent collaborative relationship with IS will be ongoing
Thanks!!

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