Computerized Physician Order Entry (CPOE) Project

HINF4519

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Computerized Physician Order Entry (CPOE) Project

SUMMARY & ANALYSIS
Ohio State University Health System

Quick Facts

• 800,000 patient visits/year
• 6000 employees
• 950 physicians
• 500 residents
• 850 medical students
• Up to 90,000 CPOE orders monthly

A/P/S – Ambulatory, Primary and Specialty Care Offices
Initiatives Towards EHR

- Board began initiatives towards an EHR in the 1970s:
  - 1970's and 1980's – ancillary systems and IS infrastructure put in place towards EHR implementation
  - Early 1990's - strategic vision for a computerized patient record (CPR) was established. Implementation of CPOE seen as key element of CPR
  - 1990 - Deployed Clinical Information System (CIS)

- See next slide
<table>
<thead>
<tr>
<th>Decade</th>
<th>Description</th>
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</table>
| 1980s  | • Ethernet network  
|   | • Health Level 7 (HL7) format for clinical information  
|   | • Electronic document transmission enabled by interface engine |
| 1990s  | • Single front-end Clinical Information System (CIS)  
|   | • Siemens CPOE system and lifetime clinical record (LCR) |
| 2000s  | • Deployment for CPOE system  
|   | • Electronic discharge instruction (EDI)  
|   | • Patient scheduling system  
|   | • Outpatient registration and billing system and electronic signature system  
|   | • Information warehouse for clinical and financial data access |
| 2010s  | • Installation of Siemens Soarian suite  
|   | • Development of clinical document imaging |
Measures of Success

- Development of a portable and scalable system that could be implemented across diverse and physically distinct clinical environments

- Identification of the physician as the primary user, and customization of the system to meet physicians' needs

- Clinical acceptance.
5 Phases of CPOE Implementation

- Needs analysis and clinical system selection
- System analysis and design
- System modification
- Initial system implementation
- Complete system deployment
Physician Order Entry System Requirements:\(^1\):

1. Easy maintenance of the system.
2. Capable of supporting advancing technologies and migration paths.
3. All order requirements met for the patients' medical records.
4. Stability and intuitive use.
5. Business, clinical and ancillary system interfaces.
7. Easily expanded system for a variety of clinical users and environments.
Needs Analysis and Clinical System Selection

Vendor Selection

Why Siemens Chosen as CPOE Vendor:

- Integrated with in-house CPR components
- Served inpatient and ambulatory environments
- Graphical user interface
- Data dictionary
<table>
<thead>
<tr>
<th>Physician Consultant Team</th>
<th>Clinical Staff</th>
<th>Information Systems Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Specialties Represented:</td>
<td>- Laboratory</td>
<td>- Responded to clinical</td>
</tr>
<tr>
<td>- Emergency Medicine</td>
<td>- Pharmacy</td>
<td>recommendations by:</td>
</tr>
<tr>
<td>- Oncology</td>
<td>- Nursing</td>
<td>- Rapid application</td>
</tr>
<tr>
<td>- Gynecology</td>
<td>- Respiratory</td>
<td>development principles</td>
</tr>
<tr>
<td>- Pulmonary</td>
<td>Therapy</td>
<td>- Prototype approval</td>
</tr>
<tr>
<td>- Cardiology</td>
<td>- Radiology</td>
<td>- Pathway design</td>
</tr>
<tr>
<td>- Surgical Oncology</td>
<td></td>
<td>for review</td>
</tr>
<tr>
<td>- Surgical Transplant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pathology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Radiology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- General Medicine</td>
<td></td>
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</tbody>
</table>
All orders are electronic.

All orders are physician orders.

Order sets are designed by physician shadowing.

Physician feedback and participation led to successful rollout.

Physician Centered
System Modification

Alerts for Patient Allergies

Alerts for Drug Interaction

Drug Route Restriction

Weight-based Dosing

Order Duplicate Checking

Decision Support Tools
Initial Implementation

Pilot Studies

February through October, 1998
- Check of System Functionality

February 15, 2000
- 23-Bed OSU Transplant Surgery Unit
Complete System Deployment

Initial Deployment
- April 4, 2000 – Go Live Date
  - The James Cancer Hospital

Complete Implementation
- By April, 2001, Go Live at
  - The University Hospital
  - Dodd Hall Rehabilitation Hospital
Clinical Improvements after CPOE Implementation

- **Patient Safety Measures**
  - Reduced errors in medication orders
  - Improved medication delivery
  - Reduced laboratory report time
  - Reduced radiology report time

- **Continuity of Care Measures**
  - Improved discharge instructions

- **Financial Measures**
  - Expedited billing processes
  - Reduced cost in printing forms

- **Continuous Quality Improvement Measures**

<table>
<thead>
<tr>
<th></th>
<th>Before CPOE</th>
<th>After CPOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transcription Errors</td>
<td>26.2%</td>
<td>0%</td>
</tr>
<tr>
<td>Medication Delivery</td>
<td>5:28</td>
<td>1:51</td>
</tr>
<tr>
<td>Radiology Completion</td>
<td>7:37</td>
<td>4:21</td>
</tr>
<tr>
<td>Lab Results Reporting</td>
<td>31.3 min.</td>
<td>23.4 min.</td>
</tr>
<tr>
<td>Counter-signature at Discharge</td>
<td>56.36%</td>
<td>99.5%</td>
</tr>
</tbody>
</table>
Key Success Factors for CPOE Implementation

Multidisciplinary Committee
- Development of comprehensive protocols and tools
- Development of widely accepted protocols and tools

Software Integration
- Data from CIS easily integrated
- Graphical user permits graphing and trending results
- Data dictionary permits shared information

Rapid Deployment
- Maximal Physician Utilization
- High Scalability and Portability
Computerized Physician Order Entry (CPOE) Project

CRITIQUE
Strategic IS Planning

- Advance organizational and IT strategic planning was not directly discussed in this case study. However it is evident that strategic planning was conducted.

- OSUHS had an EHR philosophy and stated goal.

- EHR goal: “enhance quality and efficiency of patient care by providing a lifetime of complete patient information – available across time and place – with safeguards for patient privacy and support for teaching and clinical research”

- Board began initiatives towards an EHR in the 1970s:
  - 1970’s and 1980’s – ancillary systems and IS infrastructure put in place towards EHR implementation
  - Early 1990’s - strategic vision for a computerized patient record (CPR) was established. Implementation of CPOE seen as key element of CPR
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- A similar comprehensive integrated health care delivery system, Adventist Health System, spent 4 years migrating all of its hospitals to the same core clinical system.

- Board provided funding for CPOE in early 1990s
SDLC stage 1. System Planning

- Correct project planning structure in place:
  - Information Systems Steering Committee
  - Task Force Subcommittee
  - Multidisciplinary project team, physician consultants

- Excellent system planning occurred:
  - Defined specific goals, Analyzed and identified user needs and concerns, Established selection criteria, Conducted clinician surveys and interviews, Performed workflow analysis, Assembled list of CPOE requirements

- Recommendation made to move forward with selection of vendor-based solution

- Recommendations also made for future phases of the project

- Recommended that physicians be the primary users of CPOE, with all subsequent decisions driven by this premise

- Heavy physician focus. Best ROI would occur if physicians interacted directly with the system.
  - Patient-safety focused strategies support the physician as the primary user of the CPOE system and are felt to positively influence physician acceptance

- Developed three measurement criteria for successful CPOE implementation
  - Broad system deployment across diverse clinical environments
  - Physicians as primary users
  - Clinician acceptance of the system
It is interpreted from the case study that change management was acknowledged early on as a key factor and CSFs were identified. Based on the literature, the three top CSFs have been identified as:

1) the “before go-live training”;
2) adequate clinical resources during implementation; and
3) the time needed for physicians to enter orders into CPOE.

These CSFs, and several more, were addressed during the system planning, design and implementation stages of this project.

The only blemish regarding system planning had to do with flawed resource allocation and project scheduling:

- Project stopped for 14 months as the IT department had to divert resources to prepare systems for Year 2000
Phase 1 - Preliminary Investigation

- Case study does not discuss preliminary investigation activities.
- According to the literature it is generally accepted in the healthcare industry that the patient care, quality and standardization benefits of CPOE have already been well documented and accepted. Therefore preliminary investigation activity can be minimal.

Phase 2 – Detailed Analysis

- Existing processes were studied
- Functional needs were assessed
- Committee determined core features
- Excellent physician resources allocated to design and analysis phase:\(^1\)
  - Non-physician clinical personnel assigned to project full-time
  - Formalized physician consultant team established and empowered to approve system design and policies
  - Validation from other physicians, particularly house staff, was sought
- Efforts to standardize practices and policies across the enterprise became an integral part of the CPOE project\(^1\)
- Determined that advance creation of order sets were necessary to facilitate physician utilization and promote clinical standardization\(^1\)

Grade: A
Phase 1 – System design

- System design was adequately done.
- Customer requirements were converted into system specs
- Decision made to purchase vendor CPOE with integration to existing ancillary systems

Phase 2 – System evaluation

- Proper system evaluation activities were conducted. This included:
  - Committee designed the selection process
  - Committee developed the evaluation tools
  - Committee discussed benefits of CPOE during development of RFP
  - Committee approved contents of RFP

Phase 3 – System selection

- Proper system selection activities were conducted. This included:
  - Final RFP development
  - Demos
  - Site visits
  - User interviews
  - System comparisons to key attributes

- This stage was also used to identify CSFs via interviews with CPOE system users
Phase 4 - Design of CPOE prototype:

- It is important to standardize as many elements of the system and resulting work processes as possible across different environments. Understanding current-state workflows and redesigning inefficient processes are critical steps to ensuring successful adoption of CPOE. CPOE is a disruptive technology that fundamentally changes the processes used to place, review, authorize, and carry out orders.

- To accomplish this Task Force subcommittee embarked on customizing the vendor system based on Physician consultant team recommendations and results of extensive workflow analysis.

- Design of the CPOE prototype involved adapting and customizing the selected system. This was needed to integrate design specs recommended by physician consultant team. This included:
  - Foundation order elements
  - Order work flow
  - Screen design
  - User interface consistency across all departments
  - Decision support tools such as order defaults, best-practice order sets and clinical rules.

- A critical foundation for CPOE is the rapid development of order sets prior to deployment. A solid development plan must be built based on clinician workflow.
SDLC stage 3. System Design, continued

Phase 4 - Design of CPOE prototype, ctd.:

- Development of order sets was approached in a systematic fashion for all departments. In fact it became policy not to implement CPOE system on a nursing unit serving a particular specialty until the necessary order sets had been developed and coded for use. Over 450 standardized order sets were created.²

- Each ancillary department had to ensure that order sets were created for all their common orders. “This reengineering was achieved by order pathway and order set development through faculty consensus and strong registered nurse informatics capability with full time RN’s working in the IS department to translate the clinical requirements into electronic format.”⁶

- The Task Force and physician consultant team reviewed all orderable services in order to automate workflow all the way through the ancillary departments.⁶

- Screen design and user interfaces were developed to be as consistent and standardized as possible.

Grade: A
SDLC stage 4. Implementation

- Project implementation plan was excellent.

- Project success was assured because CSFs were identified in advance and plans executed to implement those factors. By involving physicians at all levels throughout the process and emphasizing the correlation between CPOE and improved patient care and safety, outstanding physician buy-in and participation was achieved.

- Continuous, frequent training and retraining are critical to the success of inpatient CPOE initiatives. Therefore multiple training and support programs were implemented, including the use of “red-coats” and super-users. In addition, permanent clinical support positions were created. An effective campaign of change management was implemented.

- Keys to project success were: the focus on the physician as the primary user; the intense concentration on physician participation on all levels; and the advance creation of order sets during system design.

- There was an effective pilot program initiated to validate system design stability and further system enhancements and process improvements. This was similar to Adventist Health System which used pilots to test and build methodology needed for CPOE rollout to the other hospitals and units.
Implementation included a phased install in different areas of the hospitals. “100% of orderable services were available at the time of each of these installs. All medications, imaging studies, nursing activities, diets, consults, and labs were orderable electronically at the time of CPOE rollout.”

Based on studies from the Leapfrog Group\(^2\), the implementation time period was longer than the implementation time for similar healthcare organizations (12 to 30 months). This was attributable to the upfront work in systems design to create standardized order sets - the “first two years of implementation were focused on system programming to meet comprehensive physician workflow requirements. This time was necessary to develop a product that was acceptable for physician use.”

Similarly, Adventist Health System, prior to CPOE implementation, invested more than two years in development of evidence- and expert-based content based around order sets.\(^7\)

It is believed that this extra time was well spent as it led to smoother implementation where physicians and clinicians were able to immediately realize the potential for improvements in patient care and safety.

There was no mention of CPOE-themed kickoff events that are recommended as part of change management.

This, along with the lengthy implementation period, are two items that affected their grade.

Grade: A-
SDLC stage 5. System Support

- System requests and feedback were solicited from users in a variety of ways. These included help-desk phone calls, conversations with red coats, e-mail, intranet forms, communication with IS staff, and multiple meetings.

- Support requests were monitored. There was a decline in user modification and enhancement requests since implementation.

- Types of requests were tracked. None required significant changes to the system.

- There was no mention of a CQI program.

- Operational and maintenance costs were not discussed.

- Cost savings from process improvements and physician time were not evaluated.  

![User requests for enhancements and modifications](chart.png)

**Number of tickets (y axis) vs. Months gone by (x axis)**

Grade: B
References


5. Not used.


