Role of Nurse in System Analysis and Design

Objective
List the types of organizational computer systems
Define the role of a nurse in systems analysis and design
Know the steps in the Systems Development Lifecycle
Understand the impact of technology on Quality, Safety and Education

Definition: Systems Analysis and Design
Seeks to understand what humans need; to analyze data input or flow systematically, process or transform data, store data and output information in the context of a particular business.

Series of processes systematically undertaken to improve a business through the use of computerized information systems.

Involves working with current and eventual users of information systems to support them in working with technologies in an organized setting.

- Transaction Processing Systems (TPS)
- Office Automation Systems (OAS)
- Knowledge Work Systems (KWS)
- Management Information Systems (MIS)
- Decision Support Systems (DSS)
- Expert Systems (ES)
- Executive Support Systems (ESS)
- Group Decision Support Systems (GDSS)
- Computer-Supported Collaborative Work Systems (CSCWS)

Role of the Nurse as a Systems Analyst

Systematically assesses how users interact with technology and businesses functions by examining the inputting and processing of data and the outputting of information with the intent of improving organizational processes.

EHR Team Member
Selection
Design
Implementation
Evaluation

Agent of Change
Consultant
Supporting Expert

Role of the Nurse: Systems Development Life Cycle

1. Identify problems, opportunities and objectives
2. Determine human information requirements
3. Analyze systems
4. Design the recommended system needs
5. Develop and document software
6. Test and maintain the system
7. Implement and evaluate the system
Role of Nurse: Cost/Benefit Analysis

Over time the total cost of maintenance is likely to exceed that of systems development.

At a certain time it becomes feasible to perform a new systems study, because the cost of continued maintenance is greater than that of creating an entirely new information system.
The Nurse as a Systems Analyst

Qualities of a Systems Analyst
Problem Solver who systematically finds a solution through the application of tools, techniques and experience

Communicator capable of relating meaningfully to a variety of different disciplines

Understands human needs in interacting with technology and is knowledgeable in the capabilities of computers.

AACN Essentials - BSN
Demonstrate an awareness of complex organizational systems

Demonstrate skills in using patient care technologies, information systems, and communication devices that support safe nursing practice.

Apply safeguards and decision making support tools embedded in patient care technologies and information systems to support a safe practice environment for both patients and healthcare workers.

Quality, Safety and Education (QSEN)

Setting
1. Transitions of Care
2. Adverse Drug Events
3. Catheter Associated Infections
4. Central Line Infections
5. Injuries from Falls
6. Pressure Ulcers
7. Surgical Site Infections
8. Obstetrical Adverse Events

AACN BSN ESSENTIALS

I. Liberal Education for Baccalaureate Generalist Nursing Practice
II. Basic Organizational and Systems Leadership for Quality Care and Patient Safety
III. Scholarship for Evidence Based Practice
IV. Information Management and Application of Patient Care Technology
V. Healthcare Policy, Finance, and Regulatory Environments
VI. Inter-professional Communication and Collaboration for Improving Patient Health Outcomes
VII. Clinical Prevention and Population Health
VIII. Professionalism and Professional Values
IX. Baccalaureate Generalist Nursing Practice
**QSEN Informatics Prelicensure KSA’s**

<table>
<thead>
<tr>
<th>Explain why information and technology skills are essential for safe patient care</th>
<th>Seek education about how information is managed in care settings before providing care</th>
<th>Appreciate the necessity for all health professionals to seek lifelong, continuous learning of information technology skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify essential information that must be available in a common database to support patient care</td>
<td>Navigate the electronic health record</td>
<td>Value technologies that support clinical decision-making, error prevention, and care coordination</td>
</tr>
<tr>
<td>Contrast benefits and limitations of different communication technologies and their impact on safety and quality</td>
<td>Document and plan patient care in an electronic health record</td>
<td>Protect confidentiality of protected health information in electronic health records</td>
</tr>
<tr>
<td>Describe examples of how technology and information management are related to the quality and safety of patient care</td>
<td>Employ communication technologies to coordinate care for patients</td>
<td>Value nurses' involvement in design, selection, implementation, and evaluation of information technologies to support patient care</td>
</tr>
<tr>
<td>Recognize the time, effort, and skill required for computers, databases and other technologies to become reliable and effective tools for patient care</td>
<td>Respond appropriately to clinical decision-making supports and alerts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use information management tools to monitor outcomes of care processes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use high quality electronic sources of healthcare information</td>
<td></td>
</tr>
</tbody>
</table>
Understanding Organizational Style and Its Impact on Information Systems

Teaching Objectives:

Understand organizations are systems and nurses need to take a systems approach.

Depict systems graphically using process flow diagrams

Recognize different levels of organizational management require different systems

Comprehend that organizational culture impacts the design of IS

Teaching Strategies

– Review Case Studies
– Write SMART Objectives
– Define Problems
– Analyze Cause and Effect
– Review Tools of the Trade
  • Cause and effect diagrams
  • Process flow diagrams
  • Other tools
– Select a problem to solve
– Select a use case
– Investigate solutions using information technology
Organizations as Systems

- Systems have boundaries; from permeable to impermeable (open source vs proprietary).
- All systems are interrelated and independent.
- When any element of a system is changed or eliminated, the rest of the system’s elements and subsystems are significantly affected.
- Patient errors occur during times of system transition (unintended consequences)


AHRQ Accessed 8/10/2012:
Case Study

Benefits

Provides an opportunity to understand the entire system. (hospital, clinics, nursing homes, home care).

Unfolds as a story and is engaging.

Shows the connections between:

– Practice
– Culture
– Technology
– Cause and effect

Forces critical thinking

Characteristics of a good CS

Story has relevance to nurses work environment (nursing unit, clinic, department)

Transcends the organization both inter-professionally to inter-disciplinary (from point of care to CNO and from nursing unit to lab, x-ray, and other)

Provides enough information to be engaging (must search for data)

Provides an opportunity to use tools for data reduction
Case Study Example: Levels of Analysis

COMMUNITY HEALTH SERVICES

A 22 page case study that tells the story of a small Midwest health system as it transitions its primary care clinics to a Patient Centered Medical Home Model.

DRILL DOWN

1. Case Study
2. Use case
3. Data flow diagrams
4. Data structures
5. Data elements
Case Study – SMART Objectives

**Specific**
What exactly are we going to do for whom?

**Measurable**
Is it quantifiable and can we measure it?

**Attainable**
Can we get it done in the proposed time frame?

**Relevant**
Will this objective have an effect on the desired goal or strategy?

**Time bound**
When will this objective be accomplished?

---

**SYSTEM OBJECTIVES**
- Meet or exceed quality performance benchmarks
- Increase growth in market share
- Improve access to clinical services
- Reduce expenses.
Case Study: Sub-objectives

Financial

CHS clinics must operate at the 50th percentile for financial indicators by the end of one year and at the 75th percentile by the end of year 2 as measured by the American Medical Group Management Associations (MGMA) benchmarks for Primary Care Clinics.

Quality

CHS clinics will maintain an average compliance with the pay for performance program of Level 3 (90%) at the end of one year.

Access

CHS clinics will certify two clinics as Patient Centered Medical Home models of care (NCQA) over the next two years.
Case Study – Sub-objectives

CHS clinics will maintain an average compliance with the pay for performance program of Level 3 (90%) at the end of one year.

<table>
<thead>
<tr>
<th>DIABETES - Ages 18 years and older</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process Measure</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Microalbumin (annual)</td>
</tr>
<tr>
<td>Dilated Eye exam (annual by an optometrist or ophthalmologist)</td>
</tr>
<tr>
<td>Foot exam (annual)</td>
</tr>
<tr>
<td><strong>Outcome Measures</strong></td>
</tr>
<tr>
<td>Proportion w/HgA1c less than 8</td>
</tr>
<tr>
<td>Proportion w/LDL less than 100</td>
</tr>
<tr>
<td>Proportion w/BP less than 140 systolic and less than 80 diastolic Blood pressure checked each visit</td>
</tr>
</tbody>
</table>

Wellmark Collaboration on Quality, accessed on 8/24/2012
http://www.wellmark.com/HealthAndWellness/ChooseCare/CoQMeasures.aspx
The Problem – Average Compliance is 72%

What is the cause and how do we fix it?

<table>
<thead>
<tr>
<th>Bin</th>
<th>Frequency</th>
<th>Bin</th>
<th>Frequency</th>
<th>Bin</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.95%</td>
<td>1</td>
<td>7.95%</td>
<td>4</td>
<td>36.31%</td>
<td>0</td>
</tr>
<tr>
<td>29.46%</td>
<td>3</td>
<td>29.46%</td>
<td>9</td>
<td>50.44%</td>
<td>8</td>
</tr>
<tr>
<td>50.96%</td>
<td>11</td>
<td>50.96%</td>
<td>24</td>
<td>64.57%</td>
<td>8</td>
</tr>
<tr>
<td>Average</td>
<td>72.47%</td>
<td>27</td>
<td>72.47%</td>
<td>24</td>
<td>78.69%</td>
</tr>
<tr>
<td>93.98%</td>
<td>39</td>
<td>93.98%</td>
<td>27</td>
<td>92.82%</td>
<td>40</td>
</tr>
<tr>
<td>115.48%</td>
<td>18</td>
<td>115.48%</td>
<td>8</td>
<td>106.95%</td>
<td>24</td>
</tr>
<tr>
<td>136.99%</td>
<td>0</td>
<td>136.99%</td>
<td>3</td>
<td>121.07%</td>
<td>0</td>
</tr>
<tr>
<td>StDev</td>
<td>21.51%</td>
<td>21.51%</td>
<td>14.13%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With a 30% Improvement

All Clinics $100,187.50

Current Total Reward: $59,063.00
Role of the Nurse as a Systems Analyst

Where are opportunities for staff nurses to be part of the solution?

- Unit based performance improvement committee
- Participation as a member of an IS Team:
  - Selection
  - Design
  - Implementation
  - Evaluation

Why Participate?

- Nurses understand the work of nurses
- Can communicate nurse workflow to computer programmers
- Stakeholders - They will have to actually use the system
- Natural problem solvers
- Better to be part of the solution rather than be handed it!
Analyze Cause and Effect

Information Gathering
Interactive Methods

— Objectives

• Construct interview questions to elicit human information requirements

• Design and administer effective questionnaires

Unobtrusive Methods

— Objectives

• Review key org. documents

• Recognize and select appropriate workflow analysis tools and methods


Freebooks, accessed 8/27/2012>
http://freebooks.uvu.edu/NURS3400/index.php/ch13-employment.html
Interactive Methods: Effective Interviews

Problem

– Community Health Services primary care clinics are able to achieve Level 3 pay for performance (PFP) on only 72% of indicators.

Purpose of Interactive Information Gathering

– Understand the process of collecting PFP data.
– Identify key stakeholders
– Determine the relationship between cause and effect

Teaching Methods

– Divide class into groups of 4-5
– Provide background material
– Establish interviewing objectives
– Decide who will interview
– Prepare the interviewee
– Decide question types and structures
– Conduct a group interview of the course instructor.
Examples of Interview Questions

1. Please describe your thoughts on the culture within CHS. As one example, does the average clinic employee easily embrace change, or is embracing change a considerable issue within the culture?

2. What do you see as your biggest problems/challenges/areas of concern regarding implementing an EHR?

3. What was the last "big change" or system implementation that this clinic system has experienced? What were the barriers? Can you identify the elements of that implementation that went well? What was the staff reaction? How long did it take for the staff to move from development to mastery of the skills necessary for this change/implementation?

4. The pay for performance is not included in the organizations strategic plan or discussed with Community Health Services board members.” In addition, it suggests that clinics are unaware of the potential financial incentives. Would you say that this Readiness Report finding is still accurate, or is CoQ now a known and discussed strategic plan across the CHS organization?
What do you like about the Advantage EHR?

– e prescription
– Medication decisions support doesn’t work well. If you drop medication into field, it drops text into PDR you have to scroll through. End users would use google.
– Practice side, scheduling worked well. Medical manager has been used for a long time. Practice management software is robust and works well. EHR isn’t working very well. People are not utilizing functionality that could be used.
– People didn’t build into workflow.
– re-entering of data, scanning of results= OLD system!
Questionnaires

Questionnaires are useful in gathering information from key organization members about:

• **Attitudes**
  – what people in the organization say they want.

• **Beliefs**
  – What people think is actually true

• **Behaviors**
  – what organizational members do

• **Characteristics**
  – Properties of people or things

**Teaching Strategies**
– Divide class into group of 4-5 and either;
  • Develop their own questionnaire
  • Use a standard questionnaire previously developed.

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EHR Usability Toolkit: A Background Report on Usability and Electronic Health Records

Prepared for:
Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services
540 Guesser Road
Rockville, MD 20850
www.ahrq.gov
### Table 2. Advantages and disadvantages of usability and other human factors methods (continued)

<table>
<thead>
<tr>
<th>Method</th>
<th>Description of Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Appropriateness Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Evaluation</td>
<td>System records events as user works through the tasks and collects results of questionnaires. Includes asynchronous and synchronous approaches.</td>
<td>Accurate performance measures can be obtained. Data can be ready for analysis from questionnaires.</td>
<td>Software can be costly.</td>
<td>Low</td>
</tr>
<tr>
<td>Usability Questionnaires</td>
<td>Questionnaires that measure efficiency, satisfaction, learnability, system usefulness, information quality and many other measures.</td>
<td>Questionnaires are easy to administer online and provide written feedback and scores. Many are reliable and validated.</td>
<td>May not be specific to EHR systems; may only focus on assessing overall usability.</td>
<td>High</td>
</tr>
<tr>
<td>Predictive Modeling — GOMS/KLM</td>
<td>Determines user goals to complete a task, operators to perform the goal, methods to accomplish the goal, and selection rules to reach the goal. Is part of the cognitive task analysis.</td>
<td>Calculates the time to reach the goal. Includes Key-Stroke level models.</td>
<td>Very time intensive and requires usability expertise.</td>
<td>Low</td>
</tr>
</tbody>
</table>

AHRQ Publication No. 11-0084-EF August 2011
## Example of User Interface Satisfaction Survey

**PART 7: System Capabilities**

<table>
<thead>
<tr>
<th>7.1 System speed</th>
<th>too slow</th>
<th>fast enough</th>
<th>1 2 3 4 5 6 7 8 9</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 The system is reliable</td>
<td>never</td>
<td>always</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td>NA</td>
</tr>
<tr>
<td>7.3 System tends to be</td>
<td>noisy</td>
<td>quiet</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td>NA</td>
</tr>
<tr>
<td>7.4 Correcting your mistakes</td>
<td>difficult</td>
<td>easy</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td>NA</td>
</tr>
<tr>
<td>7.5 Ease of operation depends on your level of experience</td>
<td>never</td>
<td>always</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td>NA</td>
</tr>
</tbody>
</table>

4.3 Screen layouts were helpful | never | always | 1 2 3 4 5 6 7 8 9 | NA |
4.4 Sequence of screens | confusing | clear | 1 2 3 4 5 6 7 8 9 | NA |
Unobtrusive Information Gathering
Organizational Reports

Management Reports

– Number and percent of users accessing the system daily
– Number of alerts fired per day for medication orders
– Average time per day for users accessing the system
– System downtime per quarter
– Number of e-prescriptions generated per day
– Percent of providers using provider order entry.

Potential US Annual EHR data

<table>
<thead>
<tr>
<th>Service</th>
<th>Annual Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit notes</td>
<td>1,000,000,000</td>
</tr>
<tr>
<td>Admit notes, discharge summary</td>
<td>35,000,000</td>
</tr>
<tr>
<td>Procedure notes</td>
<td>46,000,000</td>
</tr>
<tr>
<td>Prescriptions</td>
<td>3,000,000,000</td>
</tr>
<tr>
<td>Laboratory tests</td>
<td>1,000,000,000</td>
</tr>
<tr>
<td>Facts</td>
<td>&gt;50,000,000,000</td>
</tr>
</tbody>
</table>

– Impact of Health IT on Nurses' Time Spent on Direct Patient Care
– Length of Stay
– Patient Use of Secure Messaging
– Prescribing Patterns of Preferred or Formulary Medications
– Prescribing Patterns of Cost-Effective Drugs
– Reduction in Hospital-Acquired Complications and Infections
– Improved Accuracy of Coding
– Medication Turnaround Time in the Inpatient Setting
– Percentage of Alerts or Reminders That Resulted in Desired Action
– Percentage of Orders Entered by Authorized Providers Using CPOE
– Percentage of Verbal Orders

http://healthit.ahrq.gov/portal/server.pt/community/health_it_tools_and_resources/919
Unobtrusive Information Gathering: Organizational Charts

**President and CEO**
(Community Medical System)

**Not for Profit Hospital**
(Community Health Hospital)

**VP Finance**
- CIO
- VP Strategy
- Director IT
- Managers IT
- IT Staff

**VP Strategy**
- Director Marketing
- Marketing Staff

**Director**
- Business Office
- Medical Records
- Human Resources
- Planning

**Nursing Directors**
- Inpatient
- OR
- Critical Care

**Managers**
- ECU
- ICU
- OR
- Ortho.
- Surgery
- OB/GYN
- Medicine
- SNF
- Telemetry
- Home Health
- Assist Living

**Nursing Staff**

**VP Nursing**
- Director of Quality and Risk Mgmt
- Department Staff

**VP Prof/Support Services**
- Lab
- Radiology
- Pharmacy
- Engineering
- Housekeeping
- Dietary

**Manager**
- Centralized Billing
- Billing Staff
- Clinic Staff

**For Profit Clinics**
(Community Medical Services)

**VP Medical Staff**

**VP Clinics**
- Manager

**Appendix B; CMS ORGANIZATIONAL CHART**

**Department Staff**
Workflow Analysis

Workflow is the process, progress, or "flow" of work within a system and the rate at which that happens.

Workflow analysis refers to observing how this process takes place. The analysis also involves evaluating the process and improving it for efficiency and effectiveness.

Used to graphically represent a process

Teaching Strategies

- Students divide into groups of 4-5
- Review Interactive and unobtrusive data gathering information
- Review Case Study workflow summary.
- Use appropriate tools to determine current state workflow for a typical CHS clinic.
## Common Data Gathering Methods for Workflow Analysis

### Table 14: Tools identified in the user stories

<table>
<thead>
<tr>
<th>Tools</th>
<th>Workflow information collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus groups</td>
<td>Feedback on health IT, in general, feedback on user interface, how tasks are performed</td>
</tr>
<tr>
<td>Usability</td>
<td>Assessment of user interface</td>
</tr>
<tr>
<td>Observation</td>
<td>How tasks are performed, pre-implementation state, information flow, duplicated tasks, nonintegration of existing systems, type and format of information collected, patient handoff processes, nonstandardization of work processes, inflexibility of system, time to complete tasks, how system used, inter-provider communication, system use</td>
</tr>
<tr>
<td>Interview</td>
<td>User feedback on system, how tasks are performed, who performs what tasks, steps in process, processing time, user workload, integration of systems, type and format of information, reasons for poor user satisfaction</td>
</tr>
<tr>
<td>Flowchart, process map, cross-functional flowchart, activity diagram</td>
<td>Workflow (&quot;reality state&quot;), pre-implementation workflow, pre- and (planned) post-implementation workflow</td>
</tr>
<tr>
<td>Gantt chart</td>
<td>Project management</td>
</tr>
<tr>
<td>Checklist</td>
<td>System configuration requirements</td>
</tr>
<tr>
<td>Lean</td>
<td>Present and future workflows</td>
</tr>
<tr>
<td>Questionnaire/survey</td>
<td>Acceptance, attitude toward health IT, user satisfaction with health IT</td>
</tr>
</tbody>
</table>

**Workflow Analysis Questionnaire**

**HRSA Health IT Toolbox**

<table>
<thead>
<tr>
<th>Exam</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MD does exam</td>
<td></td>
</tr>
<tr>
<td>What does MD do if he needs something or needs the MA during visit?</td>
<td></td>
</tr>
<tr>
<td>Lab</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td>Assistance with exam</td>
<td></td>
</tr>
<tr>
<td>Does the MA keep the MD on schedule? How?</td>
<td></td>
</tr>
<tr>
<td>What is the process when a patient has to leave the room for lab, x-ray, etc. and then comes back?</td>
<td></td>
</tr>
<tr>
<td>Visit documentation</td>
<td></td>
</tr>
<tr>
<td>MD</td>
<td></td>
</tr>
<tr>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Does MA put anything else in the chart after the patient leaves?</td>
<td></td>
</tr>
<tr>
<td>Is there anything else?</td>
<td></td>
</tr>
</tbody>
</table>

| Add additional questions here: |  |

| End of visit |  |
| When is the visit documentation completed? |  |
| As the visit concludes |  |
| Immediately after the visit in the nursing station |  |
| Between visits, when the MD has time |  |
| At the end of the day |  |
| Days/weeks later |  |
| Usually within _____ hours/days |  |

What does workflow measure?

Table 1: Typology of workflow measures with examples

<table>
<thead>
<tr>
<th>PROCESS</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proximal measures</strong></td>
<td><strong>Outcome measures</strong></td>
</tr>
<tr>
<td>Type of measure</td>
<td>Examples</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Duplication of work</td>
</tr>
<tr>
<td>Processing time</td>
<td>Patient waiting time</td>
</tr>
<tr>
<td>Communication</td>
<td>Number of questions asked by a patient</td>
</tr>
<tr>
<td></td>
<td>Form of communication used between a nurse and provider</td>
</tr>
<tr>
<td>Added tasks/ modified tasks</td>
<td>Increased data entry</td>
</tr>
<tr>
<td></td>
<td>Coding of services by physicians</td>
</tr>
<tr>
<td>Coordination</td>
<td>Change in triage procedures</td>
</tr>
<tr>
<td>Information flow</td>
<td>Information provided to specialist</td>
</tr>
<tr>
<td>Usability of health IT</td>
<td>Perceived ease of health IT use</td>
</tr>
<tr>
<td>Acceptance of health IT</td>
<td>Willingness and eagerness of providers to use the health IT application</td>
</tr>
<tr>
<td>Distal measures</td>
<td>Patient health process rates</td>
</tr>
<tr>
<td></td>
<td>Ordering of tests</td>
</tr>
<tr>
<td></td>
<td>Screening for disease</td>
</tr>
<tr>
<td></td>
<td>Prescription of medications</td>
</tr>
<tr>
<td></td>
<td>Performance of tests</td>
</tr>
</tbody>
</table>

Different tools measure different things

<table>
<thead>
<tr>
<th>Tool category</th>
<th>Tool category description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collection</td>
<td>These tools provide a means of gathering information related to a task or issue.</td>
</tr>
<tr>
<td>Data display/organization</td>
<td>These tools provide standard and readily comprehensible means of visually presenting data.</td>
</tr>
<tr>
<td>Idea creation</td>
<td>These tools offer varying formats for identifying new or different ideas.</td>
</tr>
<tr>
<td>Problem solving</td>
<td>These tools provide team members organized, established methods for better understanding and then solving problems.</td>
</tr>
<tr>
<td>Process improvement</td>
<td>These tools offer means of scrutinizing and improving processes to enhance output/outcomes.</td>
</tr>
<tr>
<td>Process mapping</td>
<td>These tools offer visual means of conveying the flow and interaction of information, work and processes.</td>
</tr>
<tr>
<td>Project planning/management</td>
<td>These tools furnish project managers, participants, and upper management a means of understanding tasks associated with a project as well as progress associated with the project’s timeline.</td>
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<tr>
<td>Risk assessment</td>
<td>These tools are used for identifying and/or analyzing known or anticipated problems associated with specific processes.</td>
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<tr>
<td>Statistical</td>
<td>Statistical tools attempt to provide meaning to a larger group of data by conveying relationships between the data and/or summarizing them.</td>
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<tr>
<td>Task analysis</td>
<td>These tools provide a variety of methods that can be used to better understand tasks, generally those associated with work processes.</td>
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<tr>
<td>Usability</td>
<td>Usability evaluations are conducted to obtain user input and/or identify design issues related to aspects of a system (e.g., a specific health IT system) such as appearance, function and navigation.</td>
</tr>
<tr>
<td>Health IT</td>
<td>Health IT applications can provide tools by reporting data or identifying poor performance (e.g., through exception reporting). These data can be used to better understand known or potential workflow issues.</td>
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<td>Top-down Flowchart</td>
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<td>Tree Diagram</td>
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<td>Usability Evaluation</td>
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<td>Value Stream Mapping</td>
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<td>Value-added Analysis</td>
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<td>Verbal Protocol Analysis (VPA)</td>
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<td>Workflow Diagram</td>
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<td>Workflow Editor/Engine</td>
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<td>Workload Profile Technique</td>
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</table>
A **flowchart** is a type of diagram that represents an algorithm or process, showing the steps as boxes of various kinds, and their order by connecting these with arrows. This diagrammatic representation can give a step-by-step solution to a given problem. Process operations are represented in these boxes, and arrows connecting them represent flow of control. Data flows are not typically represented in a flowchart, in contrast with data flow diagrams; rather, they are implied by the sequencing of operations. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.1

Accessed 8/24/2012
The day of the clinic visit, the patient enters through the front door and proceeds to the check-in window where a receptionist greets the patient.

Receptionist finds the patient in Advantage by querying their social security number and verifying the patient identity using the last name, and if needed, first name.

Any missing demographic information is completed at check-in with the receptionist.

(The receptionist is allowed access to the EMR portion of Advantage.)
Build a typical clinic workflow and then conduct a gap analysis

Patients could complete health assessment on-line

Patients could self schedule on-line

Need enterprise-wide patient ID

Need to identify PFP patient in advance

Nurse could receive a list of all PFP in advance from EHR so tests could be done at point of care

Nurse receives an Alert pt is a PFP patient
- **Time study** is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task and it is often used.

- **Work study**, consists of observing the details of a worker’s activities while recording the time.

- This integrated approach to work system improvement is known as methods engineering and it is applied today to industrial as well as service organizations, including banks, schools and hospitals.

Work Analysis
Time and Motion Studies

1. Define and document the standard method.
2. Divide the task into work elements.
   - Steps 1 and 2 are conducted prior to actual timing. They familiarize the analyst with the task and allow the analyst to attempt to improve the work procedure before defining the standard time.
3. Time the work elements to obtain the observed time for the task.
4. Evaluate the worker’s pace relative to standard performance to determine the normal time.
   - Note that steps 3 and 4 are accomplished simultaneously. During these steps, several different work cycles are timed, and each cycle performance is rated independently. Finally, the values collected at these steps are averaged to get the normalized time.
5. Apply an allowance to the normal time to compute the standard time.

Time and Motion Studies
Determine Basic Setting

• Type of System
  – System genre (commercial vs homegrown)
  – Maturity (eg. 1 year post implementation)
  – Institutional type (Hospital, clinic, large, small)
  – Locale (urban, rural)

Time and Motion: Considerations in Design and Planning

- Protocol (before & after)
- Duration (all observations in a week, month?)
- Shift distribution (all day, morning shifts only)
- Observation hours (hours of direct observation)
- Task definition and classification
- Prior study

Time and Motion: Considerations in Data Recording & Analysis

- Observed functions (continuous, sampling, self-reported, time stamped data)
- Non-observed functions (lunch)
- Between task transitions
- Collection tools (clock, PDA, EHR software, forms)
- Interruptions
- Interactions (interpersonal communications)
- Multi-tasking
- Location of observation
- Definition of key measures (start – end)

Time and Motion: Considerations in Observers

- Size of field team
- Training for observers
- Experience of observers (background)
- Inter-observer uniformity
- Continuity (continuity of observers pre and post)
- Assignment of observers to subjects

Time and Motion: Considerations in Subjects

- Number of subjects
- Recruitment and randomization
- Continuity (same subjects pre and post)
- Background (demographics, prior experience on EMR, computer literacy).

The Time and Motion Database is a tool that evaluates workflow efficiencies by capturing how time is spent on clinical and administrative tasks (http://www.innovations.ahrq.gov/content.aspx?id=2489).


The Health IT Evaluation Toolkit. The toolkit and report discuss methods such as observations, time and motion studies, interviews and focus groups for evaluating workflow efficiencies, e.g., patient throughput and percentage of orders requiring a pharmacy callback. (http://www.hrsa.gov/healthit/toolbox/)
4 Center
Orders Process

1. RN distributes orders - white-chart; pink-Pharmacy; yellow-unit clerk

2. Unit Clerk enters orders into computer

3. Unit Clerk writes order number on yellow copy

4. RN writes order number on original charted order

5. DX services ordered?
   - Yes
   - No

6. DX departments perform tests/exams

7. Results print on floor

8. Results normal?
   - No
   - Yes

9. Unit Clerk posts results in patient's chart

10. RN notifies physician

11. Patient requires therapies or diet?
   - Yes
   - No

12. Therapy departments and Dietary carry out orders and chart

13. Patient requires meds?
   - Yes
   - No

14. RN writes medication on MAR

15. meds in PYXIS?
   - Yes
   - No

16. Pharmacy verifies that medication is appropriate

17. RN removes medication

18. RN begins ongoing care

19. Meds in supply bin?
   - Yes
   - No

20. Pharmacy verifies that medication is appropriate and sends medication to floor in tube

21. RN verifies medication against information on MAR

22. RN takes med to patient; checks arm bracelet, verifies name and birthdate with patient

23. RN notifies physician

24. RN administers medication to patient

25. RN begins ongoing care

Each department has its own flow chart for therapy and dietary processes

Pharmacy generates/updates/distributes MAR every 24 hours, once orders are received; RN writes new orders on MAR; MAR includes patient name/dose/route/time

1/2" - 5"

15" per med

1 - 30"

1/2" - 5"
Workflow modeling and computer simulation provides a fast and accurate method to determine what factors must be in place to successfully adopt a new product, technology or best practice.

Simulated Model

Primary Care Clinic
Traditional Model

08:00:00

$958/Day
Develop a cause and effect diagram

Cause and Effect Diagram: Community Health System

- Staff
  - Culture
  - 1 FTE system support for 12 clinics
  - Unclear responsibilities
  - No one designated for data clean up
- Patients
  - Telephone advice is time consuming
  - Data entry is time consuming
  - Concerns re: implementation
  - Customer engagement
  - Lack of e-mail & online interaction
  - Continuous care across the organization
  - Unwillingness for follow up care
- Providers
  - Not enough patients
  - Patient outreach & education
  - Patient satisfaction
  - Patients incorrectly classified
  - Prolonged visit times
  - Provide all direct care
  - Need decision support tools
  - Some out-perform others
  - Low clinic case loads
  - PAs not always assigned to same patients
  - Technical experience
  - Too few patients per day
  - Decision making
- Leadership
  - Management
  - Project sponsorship
  - Communication
  - Accountability
  - Strategic planning

Systems
- Coding inaccuracies
- Lack of eMPI
- Difficult to track patients
- Reporting is time consuming
- Lack of auto-alerts
- Lack of CoQ data collection
- Lack of interfacing systems
- Patient co-morbidities stored in separate templates
- Some paper records still in use
- Lack of lab interface
- Records exist in multiple systems
- PACS isn’t utilized
- Follow up with patient
- Risk for transcription errors
- Timing inconsistencies
- Difficult to track when results are complete
- Buy-in
- Appropriateness
- Changes in roles and responsibilities
- Resistance
- Lack of felt benefit / efficiency
- Fiscal constraints
- Lack of I.T. support
- Change
- Processes

Problems: quality, market share, expenses, sharing data
What was missing?

**Clinical and Financial Outcomes for Chronic Disease Populations**
- IT systems were inoperable and failed to provide aggregate information
- Limited provider feedback on performance (for example: dashboards).
- Variation in practice (Inconsistent use of evidence based guidelines).

**Coordinated Care**
- Care was episodic (appointments were driven by events)
- Transitions between different levels of care (ER, Hospital, Sub-acute, Home)
- Specialists and other provider referrals (PT, OT, RT) were uncoordinated
- Processes were cumbersome and time consuming (medication mgt)

**Behavior Modification Methods**
- Confusion regarding patient education versus behavior modification
- Responsibility for health was with the physician not the patient
Examples

- Unplanned, episodic visits (average visit time – 20 min. per patient, 15 per day)
- Demographic data, health hx collected at the time of visit not ahead of time
- Information from other healthcare providers (specialists, ER, hospital) unavailable
- Lab, radiology and other report availability was inconsistent
- Screening guidelines inconsistent (no evidence based guidelines).
- No clinical decision support reminders for screening lab, radiology other
- Medication reconciliation completed at the visit (time intensive)
- .5 FTE nurse per MD, primarily for rooming patients, messaging for Rx refills
- MD’s had both a clinic and hospital practice (7 hour clinic day)
- MD saw every patient, limited use of nurse practitioners
- Documentation time by MD was time intensive (no standardized templates for H&P)
- Order sets were not standardized with limited use of auto-execute functions
- Computer literacy was highly variable among all staff
- Insurance coding for visits was highly variable among physicians
- Order sets varied among providers
- No dashboards for provider feedback
- Staff did not function as a team (huddles, plan of care)
Create a list of recommendations

Key Recommendations
1. Identify a CHS clinic currently demonstrating success in full utilization of Advantage as a model.
2. Create a prototype for the standardized best practice workflow.
3. Create data stops, alerts and electronic reminders for gathering key data elements required by PFP.
5. Allocate funds to hire additional IT support staff and informaticians for implementation and training.

Teaching Strategies
Opportunity to introduce solutions to problems through various EHR options.
Introduction to:
- Patient portal
- Personal health record
- Electronic Health Record
- Provider order entry system
- Medication management
- Consumer informatics
Patient Portal

- **Patient Portals:** Healthcare-related online applications that allow patients to interact and communicate with their healthcare providers, such as physicians and hospitals.

- Web sites, integrated into an existing web site of a healthcare provider or added onto an existing EHR.

- Allows patients to interact with their medical information via the Internet.

- The lines between an EHR, a personal health record, and a patient portal are blurring.

1. Self Scheduling
2. On-line registration
3. On-line health history
4. Personal health record
5. Education
Electronic Health Record (EHR)

Systematic collection of electronic health information about individual patients or populations.

- Stored in digital format capable of being shared across different health care settings by way of network-connected enterprise-wide information systems and other information networks or exchanges.
- Includes demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal stats like age and weight, and billing information.

1. Identify PFP patients
2. Send alerts and reminders (CDS)
3. Orient to Provider Order Entry
4. Integrate EBG’s

Order History

- Provides a listing of all the orders placed on the resident.
- Can be sorted by category, procedure, status, etc.
- Can provide an audit trail regarding who placed the order, made edits, or discontinued the order.
Bar Code Medication Administration (BCMA): system designed to prevent medication errors in healthcare settings and improve the quality and safety of medication administration.

- Portable or desktop computer with wireless connection,
- Computer server.
- Bar-code reader

1. Nurse scans barcode on the wristband on the patient to validate the right patient.
2. Nurse then scans the barcode on medicine and verifies the right medicine at the right dose at the right time by the right route ("Five rights").

1. Patient Safety through prevention of errors
2. Reminders and alerts
3. Links to pharmacy literature

AHRQ Archive @
http://archive.ahrq.gov/about/annualmtg07/0926slides/mcquay/Mcquay-25.html
Investigate Solutions using IT

Objective

- Prioritize and select a key problem
- Understand how information technology can solve the problem
- Select the appropriate software application
- Understand fundamental concepts of:
  - Clinical decision support (CDS) and its role in patient safety

Teaching Strategies

1. Select one problem within the system and solve it through information technology.
2. Search for or create a best practices use case that solves the problem.
3. Discuss data flow diagrams
   - Physical
   - Logical
4. Discuss data dictionaries
   - Data structures
   - Event response tables
Select a Problem

Problem:
CHS clinics are not maintaining an average compliance with the pay for performance program of Level 3 (90%) at the end of one year.

Recommendation:
Create data stops, alerts and electronic reminders for gathering key data elements required by PFP.
Use Case

A list of steps, typically defining interactions between a role (known in Unified Modeling Language as an "actor") and a system, to achieve a goal. The actor can be a human or an external system.

- Represents functionality of the system contained within its boundary.
- Actors interact with events and entities within the case through various symbols

AHRO Archive @
http://archive.ahrq.gov/about/annualmtg07/0926slides/mcquay/Mcquay-25.html
Office of the National Coordinator
For Health Technology – Use Cases

Consumer Preferences
Common Data Transport
General Laboratory Orders
Order Sets
Medication Gaps
Clinical Note Details
Common Device Connectivity
Newborn Screening
• Newborn Screening Companion Document
Medical Home: Problem Lists & Practice-Based Registries
Maternal and Child Health
Long Term Care - Assessments
Consumer Adverse Event Reporting
Scheduling
Prior-Authorization in Support of Treatment, Payment, & Operations
Preliminary Consumer Preferences Extension/Gap
Remote Monitoring
Patient - Provider Secure Messaging
Personalized Healthcare
Consultations and Transfers of Care
Public Health Case Reporting
Immunizations & Response Management
Emergency Responder — Electronic Health Record (PDF)
Consumer Empowerment: Consumer Access to Clinical Information
Medication Management
Quality

AHRQ Archive @
http://archive.ahrq.gov/about/annualmtg07/0926slides/mcquay/Mcquay-25.html
ONC Use Case for Quality Information Collection and Reporting

Data Flow Diagrams

Data flow diagrams allow systems analysts to conceptualize how data move through the organization, the processes of transformation that the data undergo, and what the outputs are.

Although interviews and the investigation of hard data provide a verbal narrative of the system, a visual depiction can crystallize this information for users and analysts in a useful way.


http://effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=150
Accessed 8/25/2012
**Entity**

- An entity is a person, group, department, or any system that either receives or originates information or data.

**Data Flow**

- A data flow shows that information is being passed from or to a process

**Process**

- A process means that some action or group of actions take place.

**Data Store**

- The data store may represent a manual store, such as a filing cabinet or a computerized file or database.

---

Diagram “0”
Parent and Child Diagrams
Event Response Table

An event table is used to create a data flow diagram by analyzing each event and the data used and produced by the event.

Every row in an event table represents a data flow diagram fragment and is used to create a single process on a data flow diagram.
<table>
<thead>
<tr>
<th>Event</th>
<th>Source</th>
<th>Trigger</th>
<th>Activity</th>
<th>Response</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Visit HbA1c test</td>
<td>Vitera: Patient Record (Lab Results Tab)</td>
<td>Vitera triggers an alert: 2 week before scheduled planned care appt w/patient: ICD-9 = 250.*, Diabetes, ? 18 years &amp; older and time since last HbA1c test &gt; 12 months</td>
<td>Send alert to clerical to schedule HbA1c lab test</td>
<td>Alert triggered in Vitera</td>
<td>Vitera: Health Tab</td>
</tr>
<tr>
<td>Pre-Visit Lipid Profile (LDL)</td>
<td>Vitera: Patient Record (Lab Results Tab)</td>
<td>Vitera triggers an alert: 2 week before scheduled planned care appt w/patient: ICD-9 = 250.*, Diabetes, ? 18 years &amp; older and time since last LDL &gt; 12 months</td>
<td>Send alert to clerical to schedule LDL lab test</td>
<td>Alert triggered in Vitera</td>
<td>Vitera: Health Tab</td>
</tr>
<tr>
<td>Pre-Visit Microalbumin</td>
<td>Vitera: Patient Record (Lab Results Tab)</td>
<td>Vitera triggers an alert: 2 week before scheduled planned care appt w/patient: ICD-9 = 250.*, Diabetes, ? 18 years and time since last Microalbumin test &gt; 12 months</td>
<td>Send alert to clerical to schedule Microalbumin lab test</td>
<td>Alert triggered in Vitera</td>
<td>Vitera: Health Tab</td>
</tr>
<tr>
<td>Pre-Visit Dilated Eye exam</td>
<td>Vitera: Patient Record (Interop Tab)</td>
<td>Vitera triggers an alert: 2 week before scheduled planned care appt w/patient: ICD-9 = 250.*, Diabetes, ? 18 years old and time since last Dilated Eye exam &gt; 12 months</td>
<td>Send alert to clerical to schedule Dilated Eye exam test</td>
<td>Alert triggered in Vitera</td>
<td>Vitera: Health Tab</td>
</tr>
<tr>
<td>BMI calculated</td>
<td>Patient</td>
<td>Vitera triggers an alert: Patient check-in ICD-9 = 250.* Diabetes, ? 18 years and time since last BMI calculated &gt; 12 months</td>
<td>Send alert to MA/LPN to obtain weight &amp; height</td>
<td>Alert triggered in Vitera</td>
<td>Vitera: Vitals Tab</td>
</tr>
<tr>
<td>Patient check in</td>
<td>Vitera: Patient Record (Lab Results and Interop Tab)</td>
<td>Vitera triggers an alert: If CoQ data missing at check-in and ICD-9 = 250.*, Diabetes, ? 18 years, time since last CoQ indicators (except BMI) &gt; 12 months (not</td>
<td>Send alert to CC to arrange COQ labs and eye exam done in-house pre-HCP Exam</td>
<td>Alert triggered in Vitera</td>
<td>Vitera: Patient Info Tab</td>
</tr>
</tbody>
</table>
Data structures are made up of smaller structures and elements

• A structure consists of records or groups of elements, such as:
  - Customer Name
  - Address
  - Telephone

• Each of these must be further defined until they are broken down into their component elements

• It is at the “element level” that codes for standardized nursing languages are represented.

Process Specifications

- Reduce process ambiguity
- Obtain a precise description of what is accomplished
- Validate the system design

Structured English
- Express all logic in terms of sequential structures, decision structures, case structures, or iterations
- Use and capitalize accepted keywords such as IF, THEN, ELSE, DO, and PERFORM

Clinical Decision Support

Elements

Structured Language & CDS
Alerts and Reminders

Health reminders are based on diagnosis, chronic conditions (problems), age, gender, allergy, medication, history, or findings.

If patient falls under one of the guidelines it will be listed here. The indicator will appear showing clinical staff to look under Health Tab.

Health reminders can be satisfied manually (as done below) or if a result is entered through a form or electronically received.
Human Computer Interaction

- Ensuring system functionality and usability, providing effective user interaction support, and enhancing a pleasant user experience.

Fit
Task
Performance
Well-being

AHRQ Archive @ http://archive.ahrq.gov/about/annualmtg07/0926slides/mcquay/Mcquay-25.html
Monitor Progress Dashboards