Using Information Systems to Improve Quality

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Outline

• Quality in health care
• How IT can improve quality
  – Clinical decision support
  – Knowledge-based CDS
• Quality on the ground
• Conclusions
Background

• Quality can be defined and measured precisely
  – Science of quality measurement is evolving

• Definition of quality is
  – degree to which health services are likely to achieve desired health outcomes and are consistent with current professional knowledge

*IOM Roundtable on Health Care Quality JAMA 1998;280:1000-5*
Background

- “Quality problems are extensive and serious”
- “Problems may be classified as underuse, overuse, or misuse”
- “Large numbers of Americans are harmed as a result”
- “Current approaches to quality improvement are inadequate”
- “…constraint to quality improvement is …lack of information system infrastructure”

IOM Roundtable on Health Care Quality JAMA 1998;280:1000-5
Examples

• **Underuse**
  - Inadequate management of AMI patient
    – 79% of elderly did not get b-blockers
  - 45%-65% of women do not get scheduled mammograms

• **Overuse**
  - 21% of antibiotic prescriptions for inappropriate indications
  - 17% of angiographies, 32% of carotid endarterectomies, 17% of UGI endoscopies inappropriate
Problems managing lab results

- 4 days to adjust medications when creatinine rises; 3 days with e-mail alerts\(^1\)
- Only 50% of certain critical results treated appropriately\(^2\)
- 4% of ADEs might be prevented with better communication of lab results\(^3\)
- 27% of certain critical results not treated for > 5 hours\(^4\)

Misuse of medical intervention

Preventable complications of treatment

- Adverse events due to negligence occurred in 1% of hospitalizations\(^1\)
- 6.5 adverse drug events per 100 admits
  - ADE associated w/ 2 day increase LOS
  - 28% of ADEs preventable; 43% serious\(^2\)
- Recent data show preventable ADEs in outpatient settings and nursing homes\(^3,4,5\)
- Above studies have led to focus on safety

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1-NEJM 1991 324;370-376, 2- JAMA 1995;274:29-43,
3-JAMA 2003 289:1107-1116, 4- NEJM 2003 348:1556-64,
Rand Quality of Care study

- 7000 patients, 12 metropolitan areas
- Phone survey/record review
- 30 conditions and preventive care
  - 439 indicators
- Patients received recommended care 55% of time
- Can’t solve problem w/ current system

McGlynn NEJM 2003; 348:2635-2645
### Examples of Quality: Underuse

**Crossing the Quality Chasm**

<table>
<thead>
<tr>
<th>Health Care Service</th>
<th>Sample Description</th>
<th>Data Source</th>
<th>Quality of Care</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PREVENTIVE CARE</strong></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td><strong>Immunizations</strong></td>
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</tr>
<tr>
<td><em>Childhood Vaccines</em></td>
<td>Three Polio; four Diptheria, Tetanus, Pertussis; one Measles, Mumps, Rubella; and three Haemophilus influenzae type b (Hib) by 18 months old. (Three to four doses of Hib are recommended, depending on formulation; three Hepatitis B virus vaccines [HBV] are also recommended but were not included in this particular study.) (American Academy of Pediatrics [AAP], 1994; Centers for Disease Control and Prevention [CDC], 1995a).</td>
<td>Children 19–35 months old in 31,997 households from a nationally representative sample of the United States (U.S.).</td>
<td>National Immunization Survey (NIS), 1985.</td>
<td>74% received all the vaccines. (If three doses of Hib are not included, the percentage is 76%).</td>
</tr>
<tr>
<td><strong>Influenza Vaccine</strong></td>
<td>Annual vaccination of all people ≥ 65 years old is recommended (U.S. Preventive Services Task Force [USPSTF], 1989). This recommendation has since been reiterated (USPSTF, 1996).</td>
<td>Approximately 8,000 adults ≥ 65 years old from a sample of people representative of the U.S. civilian, noninstitutionalized population.</td>
<td>National Health Interview Survey (NHIS), 1991.</td>
<td>52% received annual influenza vaccine.</td>
</tr>
<tr>
<td>Same as above.</td>
<td>From a sample of 7,997 randomly selected patients ≥ 20 years old who had visited a clinic during the</td>
<td>Mailed surveys with phone follow-up of patients who visited one of 44 clinics from August 1, to</td>
<td></td>
<td>72% of people ≥ 65 years had an influenza vaccine in the prior year.</td>
</tr>
</tbody>
</table>
### Examples of Quality: Underuse

**TABLE A-1** Continued

<table>
<thead>
<tr>
<th>Health Care Service</th>
<th>Sample Description</th>
<th>Data Source</th>
<th>Quality of Care</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prenatal Care: Other Routine Prenatal Care</strong>&lt;br&gt;Includes first prenatal visit during first trimester, accurate determination of gestational age, screening for inherited disorders, measurement of symphysis-fundal height, and blood pressure measurement.</td>
<td>Same as above.</td>
<td>Same as above.</td>
<td>Among six HMOs, women received 78%–87% (average 84%) of five processes of routine prenatal care.</td>
<td>Murata et al., 1994</td>
</tr>
<tr>
<td><strong>Prenatal Care: Pregnancy Complications</strong>&lt;br&gt;Includes diagnostic and treatment interventions after abnormal screening test results, and care to mitigate effects of pregnancy-induced hypertension and gestational diabetes.</td>
<td>Same as above.</td>
<td>Same as above.</td>
<td>Among six HMOs, women received 54%–77% of care for complications of pregnancy.</td>
<td>Murata et al., 1994</td>
</tr>
<tr>
<td><strong>Prenatal Care: Proteinuria</strong>&lt;br&gt;Urine is checked for protein to evaluate for the presence of preeclampsia, a serious complication of pregnancy.</td>
<td>Inpatient records for 2,336 women from a sample of 2,878 births in 1985; prenatal care records for 823 of these women.</td>
<td>Medical records for patients sampled from Medicaid claims files for women and children enrolled in Aid to Families with Dependent Children (AFDC) in two communities in California and two communities in Missouri, 1985.</td>
<td>Testing was provided at 75%–83% of visits. Follow-up was performed for 41%–65% of patients with proteinuria.</td>
<td>Carey et al., 1991</td>
</tr>
</tbody>
</table>
Examples of Quality: Underuse

**Crossing the Quality Chasm**

- **Childhood Asthma Care**
  - Includes various components of asthma care consistent with prevailing standards of care.
  - Children < 18 years old in a group of 393 adults and children diagnosed with asthma, from a sample of 2,024 patients of 135 providers.
  - Same as above.
  - For each type of clinical setting, the study reports the average percentage of technical quality indicators for childhood asthma that were not met. Each of the averages was located in the 30%–40% range. Between 0% and 20% of care was inappropriate.
  - Starfield et al., 1994

- **Asthma Care**
  - Includes various components of asthma care consistent with prevailing standards of care.
  - 5,580 patients ≥ 14 years old who were prescribed asthma medications.
  - Survey of patients from multiple sites of a health maintenance organization in California, 1996.
  - 72% of patients with severe asthma had a steroid inhaler, 26% of patients needing daily medications had a peak flow meter at home, and 42% were advised about self-management tools.
  - Legorreta et al., 1998

- **Diabetes Mellitus**
  - **Diabetes Mellitus: Dilated Eye Examination**
  - Annual dilated eye examination to screen for retinopathy starting at time of diagnosis of non-insulin-dependent diabetes mellitus (NIDDM) and 5 years after diagnosis of insulin-dependent diabetes mellitus (IDDM).
  - 2,392 adults ≥ 18 years old with IDDM (124 patients), NIDDM treated with insulin (922 patients), and NIDDM not treated with insulin (1,346 patients) from a sample of 84,572 people
  - 49% had a dilated eye examination in the prior year; 66% had an examination in the prior 2 years; 61% and 57% of patients at high risk of vision loss because of a
  - Brechner et al., 1993

*continues*
### Examples of Quality: Overuse

**Crossing the Quality Chasm**

**TABLE A-2 Continued**

<table>
<thead>
<tr>
<th>Health Care Service</th>
<th>Sample Description</th>
<th>Data Source</th>
<th>Quality of Care</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carotid Arteries</strong></td>
<td><strong>Carotid Endarterectomy</strong></td>
<td>Random sample of 1,302 cases of carotid endarterectomy.</td>
<td>Medicare physician claims data and medical records from three sites selected from thirteen sites in eight states (Arizona, California, Colorado, Iowa, Massachusetts, Montana, Pennsylvania, South Carolina), 1981.</td>
<td>32% of carotid endarterectomies were inappropriate, 32% were equivocal, and 35% were appropriate.</td>
</tr>
<tr>
<td><strong>Gastrointestinal Disease</strong></td>
<td><strong>Upper Gastrointestinal Tract Endoscopy</strong></td>
<td>Random sample of 1,585 cases of upper gastrointestinal tract endoscopy.</td>
<td>Same as above.</td>
<td>17% of upper gastrointestinal tract endoscopies were inappropriate, 11% were equivocal, and 72% were appropriate.</td>
</tr>
<tr>
<td><strong>Cataracts</strong></td>
<td><strong>Cataract Surgery</strong></td>
<td>1,020 patients who underwent a total of 1,139 cataract surgeries.</td>
<td>Medical records for patients from 10 academic medical centers, 1990.</td>
<td>2% of cataract surgeries were inappropriate, 7% were equivocal, and 91% were appropriate.</td>
</tr>
</tbody>
</table>
**Examples of Quality: Misuse**

**Crossing the Quality Chasm**

<table>
<thead>
<tr>
<th>Health Care Service&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Sample Description</th>
<th>Data Source</th>
<th>Quality of Care</th>
<th>Reference&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mental Health</strong>&lt;br&gt;Depression: Treatment</td>
<td>1,198 patients hospitalized with depression, representative of all Medicare elderly patients hospitalized in general medical hospitals with a discharge diagnosis of depression.</td>
<td>Medical records for Medicare patients from 297 hospitals in five states (California, Florida, Indiana, Pennsylvania, Texas), July 1, 1985, to June 30, 1986.</td>
<td>33% of patients discharged with antidepressants had doses below recommended level.</td>
<td>Wells et al., 1994b</td>
</tr>
<tr>
<td>Includes treatment consistent with prevailing standards of care.</td>
<td>64 patients with major depression from a sample of 2,592 consecutive primary care patients 18–65 years old who attended one of the study clinics.</td>
<td>Patient surveys and interviews, physician surveys, and computerized pharmacy records from 3 primary care clinics of Group Health Cooperative of Puget Sound in Washington.</td>
<td>Among patients with major depression who received antidepressant medications, 78% received dosages within the recommended ranges.</td>
<td>Simon and VonKorff, 1995</td>
</tr>
</tbody>
</table>
Crossing the Quality Chasm

Appendix

• Examples of underuse – 40 pages
• Examples of overuse – 10 pages
• Examples of misuse – 3 pages
“A Research Agenda for Bridging the Quality Chasm”

• Innovative health care organizations
• Effective professional training and continuing education
• Increasing the evidence base in health care
• Assuring that evidence is applied
• Aligning reimbursement with quality
• Implementing IT, including EHRs

Fernandopulle, Health Affairs, 2003;22:178-90
How EHRs can improve quality

• Fundamentally change how work is done
• Serve as a data source for organizations measuring their performance
• Knowledge-based clinical decision support to alter clinicians’ decision making
How do EHRs change workflow?

- Clinical results management
- Order management
- Clinical encounter documentation
- Clinical communication
- Can provide clinical decision support
Clinical decision support

- Knowledge-based CDS
- Non-knowledge-based CDS
Drug safety features of CPOE

- Increased legibility
- Calculations
- More efficient communication to ancillary services
- Easy access to patient and reference data while ordering
- Order sets and dosing suggestions
- Reminders to use an appropriate drug
- Reminders to monitor levels
- Drug-drug and drug-allergy warnings

Kuperman JCJQI 2001;27:509-21
Impact of CPOE on Serious Medication Error and ADE Rates

delta = -55%  
p < .01

delta = -5%  
p = 0.77

Bates JAMA 1998;280:1311-16
“Corollary” order reminders reduce errors of omission

• Target - corollary order pairs (n=87)
  – NSAID – creatinine level
  – Aminoglycoside – drug levels, creatinine
  – Warfarin – routine protimes

• Intervention -- display reminder at time of ordering

Overhage JAMIA 1997;4:364-375
Effect of alerts on compliance

Overhage JAMIA 1997;4:364-375
Effect of an antibiotic advisor

All results statistically significant
Costs, LOS also reduced
Evans NEJM 1998;338:232-238
Dose suggestions

DOSE: DIGOXIN  PO

ALTERNATE DAYS
VARIABLE
0.0625 MG
0.125 MG
0.25 MG
0.375 MG
0.5 MG
OTHER
Proportion of doses exceeding recommended maximum

Paper-based: 2.10%
Computer ordering: 0.60%

Teich Archives Int Med 2000;160:2741
Dose suggestions in renal impairment
Dosing appropriateness in patients with renal impairment

Both results
P < 0.001

Chertow JAMA 2001;286:2839-44
Outpatient reminders for preventive care management

- E.g., breast/cervical/colorectal cancer screening, cardiovascular and DM risk reduction, etc.
- Reminders delivered at time of visit
- Several studies done
- Meta-analysis showed adjusted odds ratio was 1.77
  - Varies by reminder
  - Still significant fractions of patients non-compliant

Shea JAMIA 1996;3:399-409
Why aren’t reminders followed?

• Insufficient data
  – E.g., aspirin not on the medication list
• Incomplete logic
  – E.g., false if patient on warfarin
• Physicians ignore reminders
• Patients ignore suggestion
  – E.g., ophthalmology exam
Automatic alerting architecture

Applications (new data) -> Patient database

Event monitor inference engine (decisions)

Rule editor

Knowledge base

Notify (page/email)

MD

Alert review/Action

Coverage List

new data

existing data

alerts

who’s covering?

new data

rules
## Time (hours) until:

<table>
<thead>
<tr>
<th></th>
<th>Treatment ordered</th>
<th>Condition resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>median (25-75%)</td>
</tr>
<tr>
<td>Intervention</td>
<td>94</td>
<td>1.0 (0.2-2.6)</td>
</tr>
<tr>
<td>Control</td>
<td>98</td>
<td>1.6 (0.6-4.2)</td>
</tr>
<tr>
<td>p value</td>
<td>0.003*</td>
<td></td>
</tr>
</tbody>
</table>

Kuperman JAMIA 1999:6:512-519
Impact of reminders to administer prophylaxis for venous thromboembolism on occurrence of deep vein thrombosis

Risk stratification algorithm including:
- Dx=cancer (3)
- Prior DVT (3)
- Hypercoagulable (3)
- Major surgery (2)
- Elderly (1)
- Obesity (1)
- Bedrest (1)
- OCs, HRT (1)

Score $\geq 4$ defined as high risk

RCT; intervention group received alerts w/ option to order prophylaxis

Model of knowledge-based CDS

- Trigger event (data or time)
- Patient database
  - Data
  - Rules
- Inference engine
  - Alert
- Rule base (knowledge base)
- Notification functions
  - Real-time
  - Page
  - E-mail
  - Log file
  - etc
- End user
Prerequisites to knowledge-based clinical decision support

- Clinicians must be users of the system
  - E.g., prescribing for drug alerts
- Requisite data must already be present
  - "ask" infrequently
- Data must be structured and coded
- Need appropriate notification modalities
  - Tell the right person in the right way
- Must create and maintain knowledge-base
  - Knowledge engineering
Model for knowledge engineering

The knowledge engineer translates clinical needs into specifications, keeping in mind system constraints.

- Domain expert (physician)
- Knowledge engineer (informatician)
- Software developer (programmer)
- Computerized rule base

- Medical knowledge
- Technical specifications
- Software

The knowledge engineer translates clinical needs into specifications, keeping in mind system constraints.
Knowledge engineering

• Hard, in and out of medicine
• Must resolve ambiguities, vagueness, multiple opinions
• “Clashing” of rules
• Evolution of medication knowledge
  – Half-life of an AHRQ guideline is 5.8 years

2 Hayes Roth, 1983
3 Lenat, 1990
4 Shekelle, JAMA, 2001;286:1461
Knowledge engineering at NYPH

Old model

Alerts

Alert Committee

Alerts

Alerts

New model

Domain experts from throughout the institution

Ideas

Process created by Alert Committee

Alerts

Alerts
NYPH alert request form

- Alert title
- Sponsoring dept or committee
- Requestor (contact person)
- Description of alert
- Rationale for alert
- Evaluation metric
- Applicable on all units or just some?
From request to software at NYPH

1. Sponsor completes request form
2. Alert Committee reviews form for completeness
3. Sends to technical team for estimate of work effort
   - May be complex; may require clarification of intent and negotiation of functionality
4. Prioritization of alert
5. Development begins
Maintenance of knowledge

• Review knowledge on a regular basis
  – Ostensibly, responsibility of sponsor
  – Retract the rule if not re-approved

• Easy in theory, hard in practice
  – People leave
  – People don’t respond to e-mail
  – It’s hard enough to do it once
  – The process requires resources
  – Need “teeth”

• Indiana does this well
  – Names and dates on the alerts
Quality on the ground

• What is quality informatics?

• Using IT to improve quality from the health care organization’s perspective
Dimensions of Quality: NYPH view

- **Clinical Excellence/Safety, compliance with guidelines**
- **Efficiency/Operational Excellence**
- **Service Excellence** - Patient/Family Is Focus, Enhanced Care Experience, Commitment to Patient

*NewYork-Presbyterian*
The University Hospital of Columbia and Cornell
# NYPH Quality Initiatives

<table>
<thead>
<tr>
<th>Regulatory Affairs</th>
<th>Performance Excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td>- JCAHO core measures</td>
<td>- Length of Stay (Craniotomy, CAP)</td>
</tr>
<tr>
<td>- NYSDOH cardiac measures</td>
<td>- Radiology Wait Time</td>
</tr>
<tr>
<td>- JCAHO National patient safety goals</td>
<td>- Discharge Room TAT</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Safety</td>
<td>Research</td>
</tr>
<tr>
<td>- Pyxis Overrides</td>
<td>- Perioperative beta blockers</td>
</tr>
<tr>
<td>- Incident reporting</td>
<td>- Heparin dosing algorithm</td>
</tr>
<tr>
<td>- Ordering Alerts in Eclipsys</td>
<td>- Medications on the sterile field</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Pay for Performance</td>
<td>Health System Efforts</td>
</tr>
<tr>
<td>- Oxford/UHC Contract</td>
<td>- Stroke Center Measures</td>
</tr>
<tr>
<td>(discharge/readmission)</td>
<td>- ED Indicators</td>
</tr>
<tr>
<td>- CMS Hospital Quality Measures</td>
<td></td>
</tr>
</tbody>
</table>
## Regulatory reporting requirements

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Agency Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>NQF</td>
<td>National Quality Forum's National Voluntary Consensus Standards for Hospital Care</td>
</tr>
<tr>
<td>CMS</td>
<td>Centers for Medicare and Medicaid Services Hospital Quality Alliance Data</td>
</tr>
<tr>
<td>JCAHO</td>
<td>Joint Commission on Accreditation of Healthcare Organizations Core Measures</td>
</tr>
<tr>
<td>NYSDOH</td>
<td>New York State Department of Health</td>
</tr>
<tr>
<td>NYSDOH-Surg</td>
<td>Cardiac Surgery/Society for Thoracic Surgery</td>
</tr>
<tr>
<td>NYSDOH-PCI</td>
<td>Percutaneous Coronary Interventions</td>
</tr>
<tr>
<td>AQHC</td>
<td>Agency for Quality Health Care</td>
</tr>
<tr>
<td>NNIS/CDC</td>
<td>National Nosocomial Infections Surveillance System / Centers for Disease Control</td>
</tr>
<tr>
<td>ACOS</td>
<td>American College of Surgeons Commission on Cancer Standard</td>
</tr>
<tr>
<td>NHCQR</td>
<td>National Healthcare Quality Report</td>
</tr>
<tr>
<td>NYODN</td>
<td>New York Organ Donor Network</td>
</tr>
<tr>
<td>UNOS</td>
<td>United Network for Organ Sharing</td>
</tr>
<tr>
<td>NSQIP</td>
<td>National Surgical Quality Improvement Program</td>
</tr>
<tr>
<td>NDNQI</td>
<td>National Database of Nursing Quality Indicators</td>
</tr>
<tr>
<td>PG</td>
<td>Patient Satisfaction Press Ganey for inpatient (PRC for ambulatory)</td>
</tr>
<tr>
<td>Comm Insurer</td>
<td>Various</td>
</tr>
<tr>
<td>Leap Frog</td>
<td>Leap Frog</td>
</tr>
</tbody>
</table>
Example: JCAHO core measures

• Acute MI
  – ASA on admit and d/c, b-blocker on admit and d/c, ACEI for LV dysfunction

• CHF
  – Measurement of LV function
  – ACEI

• Community acquired pneumonia
  – Antibiotics with 4 hrs., oxygenation assessment, delivery of pneumovax

• Others suggested (and reported)

• If don’t report, lose 0.4% of CMS update
## Use of Thrombolytics and PCI Information

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Missing Date</th>
<th>Missing Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is there documentation of ST segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Was Thrombolytic Therapy received During Hospital Stay?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thrombolytic Start Date (mm/dd/yyyy)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thrombolytic Start Time (H-MM)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First PCI Date (mm/dd/yyyy)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First PCI Time (H-MM)</strong></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

## Left Ventricular Function Assessment Documentation

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LV Ejection Fraction Value From Report</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Enter actual number rounded to a whole number. If a range is given, enter the mid point value.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Narrative LV Function Description</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Normal to Mild LVSD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moderate to Severe LVSD</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LVEF Unknown/ND</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

## Use of ACEI and ARB Information

<table>
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<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Was the patient participating in a clinical trial testing alternatives to ACEIs as first-line heart failure therapy at DISCHARGE?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Is a potential contraindication reason for not prescribing an ACEI at Discharge documented?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Is a potential contraindication reason for not prescribing an ARB at Discharge documented?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Was an ACEI prescribed at DISCHARGE?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Was an ARB prescribed at DISCHARGE?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Smoking Cessation Advice and Counseling Documentation

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Did the patient smoke cigarettes anytime during the year prior to hospital arrival?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Was the patient given smoking cessation advice or counseling during this hospital stay?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Impact of public reporting on patient decision making

Since 1992, the Pennsylvania Consumer Guide to Coronary Artery Bypass Graft [CABG] Surgery provided risk-adjusted mortality ratings of all cardiac surgeons and hospitals in the state.

In 1996, only 12% of patients surveyed reported awareness of the report before undergoing cardiac surgery. Fewer than 1% knew the correct rating of their surgeon or hospital and reported that it had a moderate or major impact on their selection of provider.

...unlikely to succeed without a tailored and intensive program for dissemination and patient education.
Management of core measures data

Solucient web site: Tells NYPH which patients need to have core measure data collected and allows data to be entered.

JCAHO, DOH, CMS

Core measures data abstractors

Potential target for structured documentation in Eclipsys

ER data (arrival, meds)

OR records

Inpatient meds

Discharge Instructions

Clinical documentation e.g., smoking, vaccination

ICD-9 data from all NYPH discharges

Lab results

Echo results

Filter for AMI, CHF, pneumonia patients

Solucient system
Transplant reporting requirements

• At wait list, at transplant and then at regular intervals
• Different kinds of patients
• Could be up to 100 elements for each patient at each point in time
## Sample of transplant data

<table>
<thead>
<tr>
<th>Between Listing &amp; Transplant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfusions:</td>
</tr>
<tr>
<td>Pulmonary Embolism:</td>
</tr>
<tr>
<td>Infection Requiring IV Therapy within 2 wks prior to Tx:</td>
</tr>
<tr>
<td>Cerebrovascular Event:</td>
</tr>
<tr>
<td>Dialysis:</td>
</tr>
<tr>
<td>Implantable Defibrillator:</td>
</tr>
<tr>
<td>Prior Cardiac Surgery (non-transplant):</td>
</tr>
<tr>
<td>Prior Lung Surgery (non-transplant):</td>
</tr>
<tr>
<td>Episode of Ventilatory Support:</td>
</tr>
<tr>
<td>Tracheostomy:</td>
</tr>
<tr>
<td>Malignancies between listing and transplant:</td>
</tr>
<tr>
<td>Multiple Organ Recipient</td>
</tr>
<tr>
<td>Procedure Type:</td>
</tr>
<tr>
<td>Heart Procedure:</td>
</tr>
<tr>
<td>Was this a retransplant due to failure of a previous thoracic graft:</td>
</tr>
<tr>
<td>Total ischemia Time: Heart, Heart-Lung//Heart, Heart-Lung:</td>
</tr>
<tr>
<td>Incidental Tumor found at time of Transplant:</td>
</tr>
<tr>
<td>Graft Status:</td>
</tr>
<tr>
<td>Primary Cause of Graft Failure:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post Txp Pre DC Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Drug Treated Infection:</td>
</tr>
<tr>
<td>Stroke:</td>
</tr>
<tr>
<td>Dialysis:</td>
</tr>
<tr>
<td>Cardiac Re-Operation:</td>
</tr>
</tbody>
</table>
Management of transplant data

- Manual sources (e.g., social workers, nurses, etc.)
- Clinical Data Warehouse
- UNOS database
- Other silo'ed data (e.g., transfusion dialysis)
- Automated source systems (e.g., lab, rad, ADT, etc.)
- Workflow functions (e.g., reminders for data collection, list management, etc.)
- Transplant database
  - Tab-delimited file
  - Summary / comparative statistics

Automated transfer

Some manual intervention
Cardiac surgery and PCI data

II. Procedural Information

Hosp. that perf. diag. cath

Primary physician perf PCI

Time at start of procedure

Diag. cath same lab visit

Previous PCI this admission

PCI prior to this adm. & hosp.

Date of PCI

Procedure Related Medicines

Fractionated Heparin

(Enoxaparin)

(Nadroparin)

Un-Frac Heparin

(Dalteparin)

(Direct Thrombin Inhibitors)

(Bivalirudin)

(Leperudin)

If IV GPⅡbⅢa Platelet Inhibitors

Abciximab

All Others

Use of IV GPIIb/IIIa Platelet Inhibitor

Thrombolytics

Timing

Contraindicated: Yes
Management of cardiac data

Source systems

- Progress notes
- Cath lab database
- Eclipsys
- Lab systems
- ADT system
- Etc.

Cath lab and QI personnel

Cardiac Care

- ACC
- STS
- DOH

Not yet
Is structured documentation going to help us?

<table>
<thead>
<tr>
<th>Previous Open Heart Operations</th>
<th>Previous MI (most recent)</th>
<th>Hemodynamic Instability at time of procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 One</td>
<td>4 &lt;6 hours</td>
<td>9 Cerebrovascular Disease</td>
</tr>
<tr>
<td>2 Two</td>
<td>5 6-23 hours</td>
<td>10 Peripheral Vascular Disease</td>
</tr>
<tr>
<td>3 Three or more</td>
<td>6 [days (use 21 for 21 or more)]</td>
<td>12 Unstable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 Shock</td>
</tr>
</tbody>
</table>

| 7 Check here if Transmural MI | 9 21 (for 21 or more) |

| 18 Congestive Heart Failure, Current | 27 Renal Failure, dialysis | 39 Any Previous Organ Transplant |
| 19 Congestive Heart Failure, Past | 28 Immune System Deficiency | 40 Heart Transplant Candidate |
| 20 Malignant Ventricular Arrhythmia | 30 Emergency Transfer to OR after Dx Cath | 61 Cardiomegaly |
| 21 Chronic Obstructive Pulmonary Disease | 31 Emergency Transfer to OR after PCI | 62 Active Endocarditis |
| 23 Extensive Aortic Atherosclerosis | 32 Previous PCI, this admission | |
| 24 Diabetes requiring medication | 33 PCI before this admission | |
| 25 Hepatic Failure | 38 Stent Thrombosis | |

IV. Major Events Following Operation (answer all that apply)

| 0 None | 5 Bleeding Requiring Reoperation |
| 1 Stroke (new neurological deficit) Intra-Op to 24 hrs | 8 Sepsis or Endocarditis |
| 1A Stroke (new neurological deficit) over 24 hrs | 9 GI Bleeding, Perforation or Infarction |
| 2 Transmural MI (new Q waves) | 10 Renal Failure |
| 4 Deep Sternal Wound Infection (bone-related) | 13 Respiratory Failure |
| | 14 Unplanned Cardiac Reoperation or interventional procedure |
Definition of CHF, current

• Within 2 weeks prior to procedure
  – Paroxysmal nocturnal dyspnea
  – Dyspnea on exertion due to CHF
  – CXR w/ pulmonary congestion
  – Lung exam positive for rales, treated w/ Lasix
Summary – regulatory reporting requirements

• Understand what data is needed for regulatory reporting requirements

• Which systems would make most sense to interface to CDW?

• What opportunity does automated clinical documentation offer?
  – Can documentation templates be created?
  – Can they be maintained over time?
JCAHO National Patient Safety Goals

• Improve the accuracy of patient identification
  – Use at least two patient identifiers (neither to be the patient's room number) whenever administering medications or blood products;

• Improve the effectiveness of communication among caregivers
  – For verbal or telephone orders or for telephonic reporting of critical test results, verify the complete order or test result by having the person receiving the order or test result "read-back" the complete order or test result.
  – Standardize a list of abbreviations, acronyms and symbols that are not to be used throughout the organization.
  – Measure, assess and, if appropriate, take action to improve the timeliness of reporting, and the timeliness of receipt by the responsible licensed caregiver, of critical test results and values.

= may involve use of IT

• Improve the safety of using medications
  – Remove concentrated electrolytes (including, but not limited to, potassium chloride, potassium phosphate, sodium chloride >0.9%) from patient care units.
  – Standardize and limit the number of drug concentrations available in the organization.
  – Identify and, at a minimum, annually review a list of look-alike/sound-alike drugs used in the organization, and take action to prevent errors involving the interchange of these drugs.

• Improve the safety of using infusion pumps
  – Ensure free-flow protection on all general-use and PCA (patient controlled analgesia) intravenous infusion pumps used in the organization.

• Reduce the risk of health care-associated infections.
  – Comply with current Centers for Disease Control and Prevention (CDC) hand hygiene guidelines.
  – Manage as sentinel events all identified cases of unanticipated death or major permanent loss of function associated with a health care-associated infection.

• Accurately and completely reconcile medications across the continuum of care.
  – During 2005, for full implementation by January 2006, develop a process for obtaining and documenting a complete list of the patient's current medications upon the patient's admission to the organization and with the involvement of the patient. This process includes a comparison of the medications the organization provides to those on the list.
  – A complete list of the patient's medications is communicated to the next provider of service when it refers or transfers a patient to another setting, service, practitioner or level of care within or outside the organization.

• Reduce the risk of patient harm resulting from falls.
  – Assess and periodically reassess each patient's risk for falling, including the potential risk associated with the patient's medication regimen, and take action to address any identified risks.
“Pay for performance”

- Payers (employers) are instigating
- Several early examples
  - Outpatient and inpatient
- Differences in
  - Amount remunerated
  - Reward for structure/process/outcome
  - Fraction of patients affected
  - Can be competitive or not

CMS web site
Epstein NEJM 2004;350:406-410
Rosenthal Health Affairs 2004;23:127-141
CMS / Premier P4P pilot

- Started 2003; inpatient
- AMI, CHF, Pneumonia, CABG, hip/knee replacements
- Process and outcome measures
- Top 10% of hospitals get 2% bonus
- Will cost $21 million over 3 years
P4P – outpatient examples

GE Bridges to Excellence (MA, etc.)
- $55/year/diabetic patient if have registries, care coordination programs, EHRs and decision support
- Additional $100/y/pt if MD is ADA-recognized
  - Requires large fraction of patient in compliance

Integrated Healthcare Association (CA)
- Scorecard: 50% preventive and chronic disease measures, 40% patient satisfaction, 10% use of IT
An inpatient example

• Insurer – hospital system
• Patients w/ CAD, stroke, CHF, diabetes
• Hospital obligations
  – Pre-discharge education
  – Dispense take home medications and arrange for mail-order prescriptions
  – Arrange for visit to specialist
  – Document and report on each of the above
• Small graded increase in payment for each
  – Also benefit for reduced re-admission rate
Example P4P obligations

- Patient with CAD, diabetes, stroke, CHF
- Educate member
- Dispense meds
- Put in mail order rx
- Manage referral process
- Document that each activity has taken place
- Report
- Readmission rates
- Payer
Issues in implementing P4P

• Ideally, would use IT to
  – Remind you to carry out the obligation
  – Assist in carrying out the obligation
  – Documenting the activity
  – Reporting

• Must create processes for each obligation
  – Determine who “effectors” will be
    • E.g., nursing, pharmacy, case management
  – Understand the workflow of each effector
  – Use IT effectively
    • Otherwise, will have manual processes

• Must work hard to fit IT into the process
Issues with P4P

- Mostly a mix of structure and process
  - Reward for outcomes uncommon
- Reward for performance, not improvement
  - Disincentive to those who may need help
- Take resource away from other activities
  - Pay for quality, or what we can measure?
- Targeting sub-processes may stifle more global innovations
- Providers needs sufficient numbers of patients
- A single provider may have many arrangements
The future of P4P

• No evidence yet of its efficacy
• Much to be learned
• Will probably increase over time
• Need to figure out how to turn “micro-improvements” into broad improvements
• Probably not sufficient in and of itself; should be combined w/ other approaches – IT, CDS
• Provides a stimulus for use of IT
What is Six Sigma?

• *Measurement*-based quality improvement strategy that focuses on process improvement and variation reduction

• Fixed sequence
  – Define
  – Measure
  – Analyze
  – Improve
  – Control

• Quantitatively rigorous
  – Means data is needed
Six Sigma

• Started by Motorola
• Popularized by GE
• Claim: can reliably improve quality and reduce costs of the enterprise
• Beginning to be used increasingly in health care
  – Extra challenge in health care: physicians as key decision makers
Six sigma at NYPH

• Adopted in a big way
• Currently, 40 “black belts”
  – Full time devoted to leading projects and implementing 6 sigma techniques
• 200 “green belts” – 20 days of training
• Huge culture change
• Many health care workers not used to using data-driven analytic techniques (!)
• Projects aligned with strategic goals
NYP 6 Sigma Projects

- Cath/EP Room Turnaround Time
- Patient Wait Times in Radiology
- CT OR Room Turnaround Time
- Hip Fracture LOS
- Housekeeping Turnaround Time
- Non-Invasive Cancellation Reduction
- PACU Criteria Met to PACU Exit
- Billing Compliance for Screening Mammograms
- ED Throughput
- Craniotomy LOS
- Radiology Report Turnaround Time
- Transport Response Time for Patient Care Units
- Outpatient Lab Charge Capture
- Hem/Onc Infusion Center Cycle Time
- Outpatient Transplant Room Utilization
- Medical Records to Ambulatory Care
- Attending of Record Accuracy
- Antibiotic Utilization
- Psych ED LOS
- Accuracy & Timeliness of Pharmacy Charge Posting
- Medication Delivery Turnaround Time
- Radiology Turnaround Time in ED
- Timeliness of Cancer Registry TNM Staging
- Ambulatory Surgery Turnaround Time
- Antibiotic Delivery in Cardiothoracic ORs
- Scheduled Induction Wait Time in L&D
- Blood Delivery Turnaround Time
- Pyxis Overrides
- Smoking Cessation Counseling
- Nursing Communication Patient Satisfaction
- Ambulatory Surgery Wait Time
- ICU Throughput
- Intradisciplinary Plan of Communication
- Isolation Room Throughput
- Use of Abbreviations in Medical Records
- Information Transfer for Antenatal to L & D
- Improve AOB Process in Radiology
- Inpatient Tray Accuracy
- Call Bell Response Time
- Discharge Instruction Process
An example:

Children’s Hospital of New York-Presbyterian
February 2004 – October 2004
PICU Stay Reduction for Post-operative Cardiac Patients

**Project Mission:**
Improve the quality of care for postoperative cardiac patients at Children’s Hospital of New York-Presbyterian by reducing PICU length of stay to target values, and reduce inpatient costs.

**Project Successes:**
- Reduce ICU length of stay to targets (4 diagnoses)
- Save roughly $327K (annual)
### PICU Stay Reduction for Post-operative Cardiac Patients

#### MICHIGAN SEP 2002 - AUG 2003 DATA (Source: UHC)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2003 Cases</th>
<th>Mean 2003</th>
<th>Std Dev 2003</th>
<th>Median 2003</th>
<th>Mean U of M Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOF</td>
<td>43</td>
<td>8.21</td>
<td>17.27</td>
<td>4</td>
<td>9.1</td>
</tr>
<tr>
<td>Fontan</td>
<td>31</td>
<td>8.58</td>
<td>8.03</td>
<td>7</td>
<td>3.6</td>
</tr>
<tr>
<td>Glenn</td>
<td>50</td>
<td>9.86</td>
<td>15.3</td>
<td>5</td>
<td>4.1</td>
</tr>
<tr>
<td>AV Canal</td>
<td>23</td>
<td>6.26</td>
<td>5.14</td>
<td>5</td>
<td>5.7</td>
</tr>
</tbody>
</table>

#### Mean, Standard Deviation, Median and Sample Variance

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Median</th>
<th>Sample Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOF Repair</td>
<td>14.2</td>
<td>8.21</td>
<td>4</td>
<td>311.6</td>
</tr>
<tr>
<td>Fontan</td>
<td>14.31</td>
<td>3.60</td>
<td>7</td>
<td>265.62</td>
</tr>
<tr>
<td>Glenn</td>
<td>11.75</td>
<td>4.10</td>
<td>7.5</td>
<td>167.27</td>
</tr>
<tr>
<td>AV Canal</td>
<td>11.1</td>
<td>5.7</td>
<td>4.1</td>
<td>71.2</td>
</tr>
</tbody>
</table>

#### Team Focus

- The team compared CHONY baseline to University of Michigan benchmarks to select Operative Procedures for project focus.
- Team questioned the calculation of this benchmark:
  - May include neonates
  - May include more complex pts, e.g. pulmonary atresia
  - May include pre-op PICU stay
  - No other benchmark data available at start of project.

---

*The University Hospital of Columbia and Cornell*
PICU Stay Reduction for Post-operative Cardiac Patients

Fontan LOS by Quarter - 2003

AV Canal LOS by Quarter - 2003

Glenn LOS by Quarter - 2003

TOF LOS by Quarter - 2003

Boxes represent interquartile range
Predictors

23 variables were studied.

3 Variables found to be significant:
1) Postop day of extubation
2) Postop day of pressor wean
3) Preop RSV infection


### PICU Stay Reduction for Post-operative Cardiac Patients

After multivariate analysis of clinical parameters expected to affect LOS, the team proposed several interventions:

<table>
<thead>
<tr>
<th>Factors Correlated with Long Stay</th>
<th>Interventions</th>
</tr>
</thead>
</table>
| **Postop day of Vasopressor weaning** | • Rapid weaning from inotropes, consistent with nursing guidelines for BP, HR and perfusion  
• Consider switching to oral agents (afterload reducers and digoxin) within 48 hours of surgery |
| **RSV +** | Preoperative RSV screening to include:  
• nasal washings for symptomatic patients  
• CXR and CBC with differential  
• Parents instructed to call with any change in clinical status  
• Symptomatic patients with negative tests are discussed case by case with CT surgery  
• Use of Synergis prophylaxis |
PICU Stay Reduction for Post-operative Cardiac Patients

Fontan – Pre and Post Improvement

<table>
<thead>
<tr>
<th>Quarter</th>
<th>N</th>
<th>Mean</th>
<th>StDev</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q103</td>
<td>6</td>
<td>11</td>
<td>15.81</td>
<td>5.5</td>
</tr>
<tr>
<td>Q203</td>
<td>6</td>
<td>8.5</td>
<td>3.27</td>
<td>7.5</td>
</tr>
<tr>
<td>Q303</td>
<td>13</td>
<td>8</td>
<td>6.57</td>
<td>7</td>
</tr>
<tr>
<td>Q403</td>
<td>7</td>
<td>10.29</td>
<td>8.08</td>
<td>7</td>
</tr>
<tr>
<td>Q104</td>
<td>3</td>
<td>11</td>
<td>7.94</td>
<td>8</td>
</tr>
<tr>
<td>Q204</td>
<td>7</td>
<td>6.86</td>
<td>9.77</td>
<td>3</td>
</tr>
<tr>
<td>Q304</td>
<td>10</td>
<td>6.8</td>
<td>9.987</td>
<td>4</td>
</tr>
<tr>
<td>Q404</td>
<td>10</td>
<td>5.4</td>
<td>4.326</td>
<td>4.5</td>
</tr>
</tbody>
</table>

First three quarter’s results (n= 27) show reduced median and mean LOS
Six sigma -- summary

• Data driven
• Puts demands on IT
• Challenge: Projects are ad hoc
  – Could be any kind of data that is required
• As with regulatory, trying to understand the kinds of data that are required to prioritize our warehousing strategy
• Structured documentation will help somewhat
IT and Quality: Summary

• Quality problems exist in health care
• IT in general, EHRs, and CDS can help
• Getting a solid EHR platform is important
• Warehousing architecture is important
• Structured documentation can be a source of data, but still will leave gaps
• Regulatory requirements are rampant
  – Some cannot be addressed by IT
• Quality requirements and IT capabilities currently are not well aligned
  – Each need to shift
• There are hard problems out there
  – Leadership and innovation is important