Benefits and Risks of Electronic Health Records

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Large U.S. Investment in Health IT: Meaningful Use Program

1. Electronic health records (EHRs)
   – $9-27 billion in Medicare/Medicaid incentives to physicians and hospitals

2. Adoption support
   – Workforce
   – Regional extension centers

3. Health information exchange (HIE)
   – State grants
   – Standards and certification
   – Privacy and security
What is an Interoperable EHR?
Pumpkin

Meaningful Use of a Pumpkin
Health IT is Foundational for Health Reform

Foundation of Health IT
Electronic Health Records and Information Exchange

Sustainable quality & efficiency improvements

Care delivery innovations
• Decision support
• Rx management
• Care coordination
• Discharge planning

Measurement & Provider Feedback
• Quality
• Efficiency
• Pop. health

Payment Reform
• Reforms to make improvements in efficiency/quality sustainable

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Overview

• EHRs and safety benefits
• EHRs and safety risks
• An approach to comparing the safety benefits to the safety risks
• Values that must be balanced in this approach
EHRs and Safety Benefits

• Medication safety: strongest data for this domain of patient safety but still limited
  • CPOE
  • E-prescribing
  • Bar coding
  • Smart IV pumps
  • Clinical decision support
  • Computerized ADE monitoring
• Early data regarding laboratory safety (both critical tests and follow-up), smart monitoring, and hand-overs
Computerized Provider Order Entry (CPOE)

Medication Errors and Adverse Drug Events (ADEs)


Source: Bates et al. JAMA. 1998; 280(15)1311-16
Electronic Prescribing: Medication Errors


Bar-coding: Potential Adverse Drug Events

- 51% decrease
- 19% decrease

Smart IV Pumps: Continuous Medication Infusion Errors

73% decrease

Larsen, Parker, Cash, et al. *Pediatrics* 2005
HIT and Safety Benefits

• Laboratory safety
  • RCT critical result notification: time to resolution 29% shorter\(^1\)

• Smart monitoring
  • Remote monitoring in a 10-bed ICU decreased mortality 46-68%\(^2\)

• Hand-overs
  • Computerized sign-out reduced adverse event risk 5-fold\(^3\)

\(^1\) Kuperman G et al, *JAMIA* 2000  
\(^2\) Rosenfeld BA et al, *Crit Care Med* 2000  
\(^3\) Petersen LA et al, *Jt Comm Journal* 1998
EHRs and Safety Risks

- Many documented risks
- Most qualitative or anecdotal
- Few quantitative
  - No standard operational definition of a computer error limiting the number of studies
  - Existing quantitative data has some important flaws
1. **Hardware and software failures**

- Power outage 5/9/2006 lasted for 55 hours and affected all Kaiser Permanente sites
  - Began during a hardware upgrade
- Full scale failure at Beth Israel Deaconess Medical Center lasted for 4 days
  - Advanced system including orders, and access to labs, radiology reports, and EKGs
  - Researcher sharing data with colleagues inadvertently flooded network

2. Clinical Content

- Gaps in available decision support
  - Acetaminophen dosing decision support available for all weight ranges except one
  - Increased incidence of dosing errors for that one weight range
  - Corrected the decision support with resultant decrease in incidence of dosing errors
3. Implementation processes

- Three times increase in mortality after the introduction of CPOE at Children’s Hospital of Pittsburgh but not at Seattle Children’s Hospital

- Differences:
  - CHP deployed in 6 days
  - Limited involvement of ICU staff
  - No order entry until patient was in hospital
  - No order sets in critical care unit
  - Only inter-facility transfers

4. Workarounds

- Bar-coding workarounds: 4.2% patients, 10.3% medications
- 15 types of workarounds
  - Affixing patient identification barcodes to computer carts, scanners, doorjambs, or nurses' belt rings
  - Carrying several patients' pre-scanned medications
- 31 causes of workarounds
  - Unreadable medication barcodes
  - Malfunctioning scanners or failing batteries
  - Unreadable or missing patient ID wristbands (chewed, soaked, missing)
  - Non bar-coded medications

5. Communication

• 18% (217 of 1196) of imaging alerts not acknowledged
• 8% of alerts lacked timely follow-up
• Dual communication to two health care providers as a “safe-guard” to protect against loss of follow-up was associated with lack of timely follow-up
• However, verbal communication improved rates of timely follow up

6. Measurement and monitoring

- RCT to reduce concomitant orders for warfarin and bactrim by introducing a nearly hard-stop alert
- IRB initially concerned with having a control group
- Significant decrease in concomitant orders in intervention group
- Early termination of RCT since 4 dangerous delays in ordering of medications when deemed necessary for patients

An Approach to Comparing HIT Safety Benefits versus Risks

• HIT is a health service

• A well-accepted approach in the quality of care literature for comparing health services:

  • **Overuse**: Provision of a health service where risks outweigh benefits
    • Too many alerts leading to alert fatigue

  • **Underuse**: Failure to provide a health service when their benefits exceed their risks
    • No provision of clinical decision support

  • **Misuse**: When an appropriate health service has been selected but is then poorly provided
Misuse: Electronic Prescribing

85% decrease

48% decrease

Conclusions

• Documented benefits for a few technologies in specific settings in medication safety
  • More technologies, settings, and domains of safety need to be studied

• Significant and diverse risks
  • More quantitative measures of HIT related risks and of patient harm need to be developed and employed
  • Greater focus on morbidity/mortality instead of errors

• Balancing risks/benefits: overuse, underuse, misuse
  • HIT needs to be developed to address more types of safety
  • Need more work to determine and spread most effective HIT
  • Ongoing measurement from multiple sources and iterative refinement