Usability and Human Factors

Electronic Health Records and Usability

Lecture a
Learning Objectives

• Define usability as it pertains to the EHR (*HIMSS document*) (Lecture a)
• Challenges of EHR design and usability in typical workflow (Lecture a)
Usability is one of the major factors—possibly the most important factor—hindering widespread adoption of EMRs

3 reports (AHRQ, HIMSS, NRC) last year

- strong, often direct relationship with
  - clinical productivity
  - error rate
  - user fatigue
  - user satisfaction, effectiveness, efficiency
- CCHIT or ARRA certification does NOT include usability as a criterion
Lack of usability and accessibility will result in:

- Lack of trust
- Potential abuse

Lessons from electronic voting:

- No election has been proven to have been hacked
- However, usability has altered the outcome of an election

User’s view of system conditioned by interface experience
## What Is It?

1. Simplicity
2. Naturalness
3. Consistency
4. Minimizing cognitive load
5. Efficient interactions
6. Forgiveness
7. Feedback
8. Effective use of language
9. Effective information presentation
10. Preservation of context
The State of the Art

No official certification or guidelines specifically for EHRs

Egregious bad design exists in current EHRs

Complicated by:

• Vendor contracts forbidding customer to talk about their experience
• Lack of ability to publish (e.g. screenshots) can hinder scholarly research
AHRQ Report on Vendor Practices

We’re not there yet

- Many legacy systems >10 years old (AHRQ, 2010)
- Standards are borrowed
- Best practices not defined
- Expectations unclear
- Communication is limited
- Formal usability testing rare
- Usability is perceived to be overly subjective
But…..

• Users involved in EHR design/review
• Vendors compete on usability [is this something that should be competed on? Not a basic requirement?]
• Users demand better products
• Plans for formal usability testing increasing
• Vendors willing to collaborate
Some feel clinicians have ‘given up’ due to difficulty of getting things changed

- Learned helplessness

Political and power struggle

- Administration vs. staff
- Vendor vs. users…

Lack of clinician input at design

- Or too limited clinician input at all phases, from design to rollout
“The field is competitive so there is little sharing of best practices to the community. The industry should not look towards vendors to create these best practices. Other entities must step up and define [them] and let the industry adapt.”

“Products are picked on the amount of things they do, not how well they do them.”

“There are no standards most of the time, and when there are standards, there is no enforcement of them. The software industry has plenty of guidelines and good best practices, but in HIT, there are none.”
The Bad and the Ugly

• Examples of egregious usability problems
  » (Silverstein, 2009)

• Related data far apart, requires user to click multiple times (‘clickorrhea’)
  – e.g. diastolic blood pressure 4 screens from systolic

• Diagnosis (Dx) lists with rare Dx at top, common at bottom, hidden terms
  – incorrect selection
What is Wrong With This Picture?

What is Wrong With This Picture? (cont.)

- Note the warning that there are no warnings about abnormal results
- "There are no indicator flags"

What is Wrong With This Picture? (cont.)

<table>
<thead>
<tr>
<th>Patient list</th>
<th>Reports</th>
<th>Orders</th>
<th>Labs</th>
<th>Admits</th>
<th>Meds</th>
<th>ED notes</th>
<th>Forms</th>
</tr>
</thead>
</table>

Microbiology Test Results

Please review all results carefully. There are no indicator flags.

Result Date/Time: 02/22/2009 2:23 AM

Blood culture

Acme Anvil Clinical Labs, Inc.

Patient: Jane Doe  ID: 483433  Sex: F  Date of birth: 12/27/1926
Ordering Physician: Scot Silverstein  Accession #: 21322

Specimen source: blood
Test name: blood culture
Collection: 02/19/2009 1:15 AM

Culture/General Comments:
colony count negative

Report status: (FINAL) 2
Reviewed by: JC
Addendum: above report amended. Positive for MRSA.

Result Date/Time: 02/17/2009 2:45 PM

• Results section says "negative" and "results final"
• Most busy clinicians' eyes would stop there, especially in the wee hours

What is Wrong With This Picture? (cont.)

- Addendum to the report that the result is actually positive for MRSA, a drug-resistant infection
- No flag on that addition, yet during data entry at the lab, a flag was requested and seen by the reporting technician

Clinician forced to hunt around every result for indications of normalcy or abnormally

Disparity between what is seen at the lab (abnormal addendum is flagged) and the clinician’s view

Not fictitious: treatment delayed >24 hours until someone later noticed the addendum

System is CCHIT certified

On paper, the wrong item could have been crossed out
More of the Bad

- Alphabetical problem list:
  - Convenient for programmer, not for the doctor
  - Should prioritize by importance

More of the Bad (cont.)

- List auto-populated by system
  - Not editable by clinician
  - Patient does not have atrial fibrillation (entered by nurse to speed order)
  - Requires vendor to remove

More of the Bad (cont.)

- Multiple diabetes entries (incorrect)
  - Lack of controlled terminology mapping
- Useless information:
  - ‘Medication use, long term’
  - Clutters screen

<table>
<thead>
<tr>
<th>Problem List: Mary Jones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Abdominal pain (3)</td>
</tr>
<tr>
<td>Atrial fibrillation ???</td>
</tr>
<tr>
<td>Diabetes mellitus (12)</td>
</tr>
<tr>
<td>Diabetes mellitus type I (14)</td>
</tr>
<tr>
<td>Diabetes mellitus type II (13)</td>
</tr>
<tr>
<td>Dizziness/Vertigo (1)</td>
</tr>
<tr>
<td>Gynecological Exam, routine</td>
</tr>
<tr>
<td>HYPERTENSION, ESSENTIAL (1)</td>
</tr>
<tr>
<td>Hypercholesterolemia (4)</td>
</tr>
<tr>
<td>Hyperlipidemia, mixed (2)</td>
</tr>
<tr>
<td>Hypertension benign (4)</td>
</tr>
<tr>
<td>Hypertension, essential (1)</td>
</tr>
<tr>
<td>Medication use, long term (1)</td>
</tr>
<tr>
<td>Screening for diabetes mellitus</td>
</tr>
<tr>
<td>Screening for breast cancer</td>
</tr>
<tr>
<td>Urinary retention</td>
</tr>
<tr>
<td>Alphabetic condition …</td>
</tr>
<tr>
<td>Alphabetic condition …</td>
</tr>
<tr>
<td>Alphabetic condition …</td>
</tr>
</tbody>
</table>

Latest
Mar 12 2006
Dec 3 2009
Jun 3 2007
Jun 3 2007
Jun 5 2007
Mar 13 2008
Sep 2, 2006
Jun 3, 2007
Mar 12, 2006
Jun 6, 2007
Jan 3, 2009
1/12/2000
1/12/2000
Jun 5, 2007
Jun 6, 2007
1/13/2000

More of the Bad (cont.)

- Repetition, extraneous information, lack of focus and clarity
- Lack of any symbolic or diagrammatic representations, and general clutter

More of the Bad (cont.)

- Forces user to keep track of columns with finger on screen
- Easy to confuse columns

More of the Bad (cont.)

- Units (e.g. mg/dL) in every line, repetitious, distracting
- Lab panel components scattered

Electronic Health Records and Usability

Summary – Lecture a

• State of the Art
• AHRQ reports on vendor practices
• Examples of how wrong data are input into EHR systems
References


Images