An overview of medical informatics and usability in healthcare

Usability of eHealth Systems 2013
“Disturbing or supporting?”

2013-10-31 Lecture 2: 13.15-15.00
Today's Usability seminar in the MI course

Usability in Health Informatics

Introduction – HI / MI

Usability

Importance of evaluation

The usability standard

Guidelines

UCD methods

Assignment Suggestions

The report: Disturbing or supporting
Usability of Swedish eHealth systems - 2013

Isabella Scandurra
Building usability into Health Informatics

Med. Dr. Isabella Scandurra

- M. Sc in System Engineering
  - Human-Computer interaction
  - Pedagogy – human resources

- Ph.D in Medical Informatics
  - Usability in homecare applications

- Usability – User-centred methods
  - Requirements gathering
  - Workflow processes
  - Design of health information systems
  - Usability & benefit evaluations

- Researcher
  - Applied research, action research
  - Triple Helix methodology

http://publications.uu.se/abstract.xsql?dbid=8403
Health Informatics / eHealth

We do not know much about the future, but we are all part of shaping it!

- Background of my research area
  - Why usability in health informatics?
  - We are trying to create good and secure CARE!

AIM:

- Provide general knowledge about Usability and usability evaluation
  - Concepts, theories, methods…

Isabella Scandurra
We are trying to create good & secure care

- Health informatics is an important tool
  - Not only for clinicians
    - Other professions
    - Patients & relatives
  - Not only for diseases
    - Maintain health
    - Prevention

Isabella Scandurra
How to create good and secure care?

It is all about PRODUCING ”GOOD SOFTWARE”

What is ”good software”?
- Few errors..? Few design flaws...? Few bugs..?

› systems providing a benefit! = good software

Constraints: technical, social, economic, organizational…
- @, db, .net/java
- Interaction & Visualization
- Changes in organization
- Maturity among the users
- Maturity of the organization

SAME SAME BUT DIFFERENT...
What is benefit?

Systems that:
- Perform what you require
- Are fast and efficient
- The potential users understand!
- Provide an increase of value in the work process
- Support the organization economically
How to create “good software”?

Interact with ICT -

Don’t get interfered by IT
(nor interFEARed ;))
Why is a usability approach so important?
Dubbla medicinlistor bidrog till att patient i Växjö avled

Av Simon Rothelius

Centrallasarettet i Växjö får kritik av Socialstyrelsen efter ett dödsfall föråret. Två separata datorsystem med medicinlistor gjorde att patienten fick dubbla doser blodfortunnande medel.

Den 91-åriga kvinnan kom in till Centrallasarettet i Växjö i augusti 2007 med en misstänkt blodpropp i benet.

En knapp vecka senare avled hon efter en stor blödning och organstyrk.

Socialstyrelsen kritiserar sjukvårdens agerande på flera punkter. Enligt myndigheten fanns det stora brister i kommunikationen mellan läkare och sjukköterskor på olika avdelningar på sjukhuset. Det bidrog till att patienten inte fick den vård hon skulle ha.

En annan brist var att sjukhusets datorbaserade journalsystem inte var länkade till Apotekets läkemedelslista, som användes av det kommunala äldreboendet där kvinnan bodde. Därför uppmärksammar inte sjukhuset att patienten redan behandlades med blodfortunnande medel.

Problemet med att de olika systemen inte kommunikerar med varandra finns i de flesta av landets landsting, enligt byrådirektören Eva Hansson på Socialstyrelsens regionala tillsynsenhet i Malmö.
We are trying to create good and secure care
Crucial to involve users!

"Användares medverkan avgörande"

Av Lena Furmark Löfgren m fl


I Sverige genomförs nu en unik och välkommen nationell satsning för att etablera en samordnad och gemensam it-infrastruktur för vården. Arbetet bygger på den it-strategi för vård och omsorg som berörda parter utarbetade under åren 2005–2006. Från it-industrin välkomnar vi denna kraftsamling. Då arbetet ännu befinner sig i en inledande fas vill vi delta med oss av några erfarenheter och synpunkter som vi ser som avgörande:

Healthcare supported by a HCI framework

- It is **crucial to involve users** in the development… …We’ve said that for a long time…
- **How** to involve the users, and how to work with them effectively & efficiently is still not clear…

- Based on Human-Computer Interaction Science

- Users, Usability and User Centred Development
  - Usability standard ISO 9241-11
  - User analysis (context/usage analysis)
  - *User centred design ISO 9241-201 (OLD@HOME)*
  - Usability evaluations *(DOME)*
Utility, Usability and usefulness

**Functionality (Utility)**
- The more tasks the product is designed to perform, the more utility it has.
- Usability refers to the ease of learning and performing these tasks.

**Usefulness (Usability)**
Again: usefulness, usability and utility

Usability is often related to the more general concept of:

- **Usefulness** (encompasses two concepts)
  - **Utility** (presence of functionality)
  - **Usability** (how it is to reach and use the functionality)

_But it really doesn’t matter if a system, hypothetically, can do what you want from it, if you can’t do it since the interface is too hard to understand and operate_

_And also it doesn’t matter if something is easy to do if that’s not what you want to do with it_

- **Could you use it?** (Usability) - **Would you use it?** (Usefulness)
ISO 9241-11 (1998) defines usability as:

The extent to which a product can be used by specified users to achieve specified goals with

- effectiveness,
- efficiency and
- satisfaction

in a specified context of use
Usability in practice

Based on this definition we can assess how:

- **effective**, [do the users reach their goals?]
- **efficient** and [resources spent in reaching goal..?]
- **satisfactory** [are they satisfied when doing that?]

A product is, in order to be considered as having good usability for:

→ A specific group of **users**
→ performing specific **tasks**
→ in a specified environment/**context**
Framework for Usability – before/during/after development

User groups
Tasks
Equipment
Environment
Context

GOAL

System/Product

Planned result
Measurable

Results
In real usage

Effectiveness
Efficiency
User satisfaction
Usability

(Figure after ISO 9241-11, 1998, s3)
Human-centred design for interactive systems

ISO 9241-201

Identify need for Human-centred design

Understand and specify context of use

System meets specified functional, user and organizational requirements

Specify user and organizational requirements

Evaluate designs against requirements

Produce design solutions
The importance of focusing on the need

- Most education is focused on solving problems
- Little attention to solving the right problem / need
- The MT/MI road from idea to product is long and expensive:
  - Technical development costs are a only a small part
  - Regulatory restrictions
  - Intellectual property
  - Reimbursement model
  - Quality management
- Investors and companies cannot afford to fail at a late stage
How do we find the right problem?

- Deep understanding of the clinical environment
- Focus on the need
- Consider all aspects of product development
- Find the “cheap” pitfalls early on

Fail fast!
User-Centred Design Process in Care

Multi-disciplinary Thematic Seminars
Collaborative design method for interdisciplinary working groups
- Specification of future work scenarios
- Iterative prototyping, use of use cases
→ Support communication between different professions
→ Enhance transfer of user needs to detailed system specifications

Isabella Scandurra
Define potential *specific* user groups

- **Composition** - age, gender, number, language, education, disabilities
- **Training** and experiences – background, domain knowledge, computer experience
- **Support** and tools – first line support, training, documentation
- **Usage** of the application - how often, how long, mandatory (or not)

*for a *specific* use situation*
Context of use – analysis (2/2)

- Examine the usage situation

- External factors affect usage and can potentially lead to failure
Usability – which questions to ask?

- To whom?
- In which situation? In which context?
- Solving which task?

It is a letter knife. You use it to open your mail.

What a stupid invention!
Disturbing or Supporting? – eHealth in 2013

www.storandeellerstodjande.se

https://www.vardforbundet.se/Documents/Rapporter/Nationella/St%C3%B6rande%20el%20st%C3%B6djande_eHA%20slutrapport_rev2.pdf

Isabella Scandurra
INTRODUCTION
- Aim and objectives with the project
- National eHealth Strategy 2010
- Stakeholders
- Perspective on Usability and User Centred Development

METHOD
- Future workshops for requirements gathering on a national level
- Participants from health practice, profession organizations, researchers and Health IT vendors

RESULTS → REPORT
- 7 areas of actions (with examples)
- List of priorizations – 10 actions that are "most important now"

NEXT STEP
- Build in Usability National action plan and
- Dissemination of the report and presentations of the results
Usable and accessible information

Action area 2, point 4:

- “deeper forms of cooperation with ICT suppliers shall be established to accelerate the further development of existing eHealth services or the creation of new ones”

→ BUT HOW??

Isabella Scandurra
Usable and accessible information

1. eHealth strategy… 2010
2. National Audit office… 2011
3. Gartner report… 2012
4. Ministry of Health & Social Affairs

→ THE MISSION!

Usability of eHealth systems 2013
From the Gartner questionnaire (June 2012)

The staff is overall satisfied with the IT support they get within their work, but...

- Great need to improve fundamental aspects such as usability, simplicity and the ability to exchange information
- Low availability compared to other domains, e.g. industry
- 20% have weekly disturbances in the systems that adversely affect the work
- Lack of necessary information to provide good and secure care
- 1/3 of the physicians stated that they have inadequate information systems
- Knowledge of national initiatives is low
- Many professionals find laws and regulations as obstacles in the work
  - /2440 Questionnaire answers
Background to the "eHA project"

**Initiative:**

*Profession organizations in National Coordination group of eHealth in health and social care*

- *Kommunal*
- *Sveriges läkarförbund*
- *Svenska Läkaresällskapet*
- *SVENSK SJUK-SKÖTERSKES FÖRENING 1910*

**Financed by:**

- **Uppsala University**
- **Karolinska institutet**
- **Skövde University**
- **Blekinge Technical University**
- **Göteborgs University**
- **Linné University**
- **Luleå Technical University**

---

Isabella Scandurra
Background to the "eHA project"
eHA - Project aim

National Coordination group for eHealth in health and social care

• Gather and display lessons learned and good examples. Answer questions such as:
  • What problems do users experience today?
  • What solutions are seen as most important? (by whom?)
  • What do we know about usability in eHealth based on previous research and project results?
Goals with the eHA 2013 project

Create a knowledge base anno 2013:
- A broad stakeholder group prioritizes.
- Suggestions on usability improvements
- Short, medium and long time perspectives
- 10 important actions → eHealth possibilities
- Embryos to research articles, policy work
- Start-up: The beginning of the beginning!
Steering group and research

- Karolinska Institutet HIC, Centre for Health informatics
- Physicians’ union (Läkarförbundet)
- Uppsala University, Department of information technology
- Skövde University, School of humanities and informatics
- Association for Swedish Nurses (swenurse.se)
- Care union (Vårdförbundet)
- Swedish association for physicians
- And users!

Isabella Scandurra
Participatory method

Starting point
• Gartner report + Previous experiences
• A basis for till National action plans in eHealth

Work in common
• cooperation on different levels
• Intra-professional
• Multi-disciplinary
• ORIENTATE
• CONCRETISIZE
• REALISATION

Practic data collection
Good examples from practice.
- Based on ActionResearch
- Methods to create and measure usability and healthy work.
• Where does it hurt, the most?
## Workshops

<table>
<thead>
<tr>
<th>Workshop</th>
<th>Participants</th>
<th>Content</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS1: Orientation</td>
<td>Care profession organizations, action researchers, repr. from ministry of health [n=10]</td>
<td>Orientation; aim, definitions, delimitations.</td>
<td>Steering group Project organization Common project goal</td>
</tr>
<tr>
<td>WS2: Orientation, Concretization</td>
<td>User and care profession organization representatives, action researchers [n=20]</td>
<td>Problem description, future work scenario</td>
<td>Opportunities and barriers r/t system, workplace and communication</td>
</tr>
<tr>
<td>WS3: Concretization</td>
<td>User and care profession organization representatives, action researchers [n=20]</td>
<td>Integrated care process, future patients’ views on care</td>
<td>Opportunities and barriers r/t process Start prioritizing results</td>
</tr>
<tr>
<td>WS4: Vendor perspective: Presentation, Concretization</td>
<td>Vendor organization representatives, care prof. org, action researchers [n=15]</td>
<td>Walk through of results from WS1-3</td>
<td>Opportunities and barriers, Start prioritizing from vendors’ point of view</td>
</tr>
<tr>
<td>WS 5-7: Feedback tour: National eHealth action researchers</td>
<td>Other action researchers, user representatives, process leader [n=13]</td>
<td>Walk through of results from WS1-4</td>
<td>Feedback on users and vendors work, other perspectives</td>
</tr>
<tr>
<td>WS8: Realisation</td>
<td>National committee for eHealth issues, Steering group, action researchers [~30]</td>
<td>Prioritizing of the results from WS1-4</td>
<td>List of prioritized actions</td>
</tr>
<tr>
<td>WS9: Presentation</td>
<td>All stakeholders [~60]</td>
<td>Open workshop at national eHealth conference, presentation of work and results</td>
<td>Feedback for government stakeholders before ministerial decision</td>
</tr>
</tbody>
</table>

**KICK OFF!**

Usability work for National action plans

Isabella Scandurra
## Focus of the Workshops

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of eHealth system?</td>
<td>Mainly EHRs + other systems to manage patient data</td>
</tr>
<tr>
<td>For whom?</td>
<td>Health &amp; social care professional Daily work, in patient meeting</td>
</tr>
<tr>
<td>Perspective?</td>
<td>Today → future care From the patients care flow</td>
</tr>
<tr>
<td>Focus?</td>
<td>Possible improvements how (different) the systems are used</td>
</tr>
</tbody>
</table>
Vision for good eHealth / 7 R:s + 1

- Right care professional can – with an easy operation - get
- Right information about the
- Right patient at the
- Right place in the
- Right amount, presented in a
- Right way, adapted to
- Right situation

To support a good patient meeting and cooperation between different care actors.

And, the information should only be registered only once and with little effort and time consumption.
7 Action areas

1. eServices for accessibility and empowerment
   – Support, involve, motivate and empower individuals

2. Usable and accessible information
   – Decision support for the staff

3. Knowledge management, innovation and learning
   – Better basis for research, monitoring and decision-making

4. Technical infrastructure
   – The basic prerequisite for the secure and efficient sharing of information

5. Information structure, terminology and standards
   – The basic prerequisite for structured and uniform information

6. Laws and regulatory frameworks
   – Regulatory frameworks that combine

7. Management
   - Responsibility and national cooperation

Isabella Scandurra
The 10 most important actions v1:1

1. eHealth systems must be managed, evaluated and continuously optimized in relation to the organizational processes. Increased integration between IT and Care dept.

2. Improved involvement of usability experts, health informaticians and USERS in development & evaluation.

3. All staff should have a basic understanding and knowledge of the local eHealth systems. Education and training at work must be prioritized / enhanced.

4. Technical requirements for documentation / access to information where care meeting takes place is required (specifically regarding municipality)

5. The technical infrastructure and environment must be reliable. Savings can be made by improved coordination of operation/management.

Isabella Scandurra
6. Structured and standardized graphical display is required to quickly find information in different systems. Management should be based on role, activities and work situation.

7. “Double documentation” must be eliminated. "National Infrastructure" & "National Terminology" and the transfer of data must be accelerated.

8. Important information must follow the patient across organizational borders. Unnecessary legal barriers must be eliminated. eHealth need to be designed to "make it easy to do right" (r/t ethics/ laws).

9. Research on usability must be strengthened and knowledge must be applied to get more useful systems → improved data and improved feedback.

10. eHealth competence is a strategic resource that must exist at all levels of management. Understanding of usability is key to useful and essential support to a good and safe care.
What next?

Continued work on **Usability of eHealth systems**

**Communication plan**
Disseminate the report
Present results and proposals

In order to get the results and proposals built into the National eHealth Strategy Action Plans

Isabella Scandurra
Assignment

- A small project, assignment, to be performed in groups of 4-5 persons.

- HANDS-ON: To analyse an existing system, evaluate its usability and suggest preliminary solutions to usability problems.
  - or.....

- LITERATURE STUDY: To investigate, by literature studies etc., some interesting facts related to the use of IT in medicine or healthcare.

- Start early, i.e. now!!!

- In both types of assignments, the focus should be on usability, design of the user interface and the benefit for the healthcare professionals and/or for the patients. You are supposed to spend one week working time per person for the assignment (~40 hours).
The purpose of the assignment is

- To get a feeling for how professionals in healthcare use IT as a tool in their everyday work,
- to understand problems that are associated with use of IT in healthcare,
- to understand problems related to development and deployment of IT in healthcare,
- to see which positive effects that potentially could be reached, if everything was made in an optimal way.
Assignment, logistics

- **Step 1:** Form groups of 5 persons. This should be done **latest Monday Nov 4**. Each group should send an (one) email to Bengt Göransson (Bengt.Goransson@it.uu.se) and Isabella Scandurra (Isabella.Scandurra@it.uu.se) latest Nov 4, with a list of the group members’ names. Write “Medical Informatics” on the subject line.

- **Step 2:** You must specify your assignment and get an approval before starting the assignment work. Also here, write an email to Bengt.Goransson@it.uu.se & Isabella.Scandurra@it.uu.se and specify your assignment, the application area, contact persons and a few lines about how you plan to perform your assignment project.

  You will get a reply with an OK or some advice how to proceed. This should be done **latest Monday Nov 11**.
Assignment considerations

As the time for the assignment is rather short you should especially consider:

- It takes time to specify the objectives, to establish contacts, to book meetings etc. So start as early as possible!

- It is much better to study a very small application/system/problem and have time to analyse it in more detail. Do not try to look at larger systems. It is better to study a (very) small isolated part of a larger application or system.

- **Focus on users, usability and benefits.**
List of Suggestions for your assignment

- Hands-on projects
- Literature studies
- 2 LUL as a Customer-projects

**Hands-on work r/t IT-development phases in eHealth development**

- Mobile interface design of personal EHRs
  - Students chose design tools and degree of mockup/prototype level.

- Use of personas to evaluate current version of Sustains
  - Access to your personal EHR is needed
  - Students need to select appropriate evaluation method and
  - Create personas, or possibly use Evry’s personas?

- Create an online feedback (Sustains /eRecord) to improve user engagement
  - In Sweden? In other countries?
  - Compare to other domains’ (eg. Banking) design regarding content and design
  - Discuss constraints and design issues to succeed in improvement?
    - Describe needed workflow (both in system and in organization) to satisfy “public users”

- Evaluate consumer health products and suggest improvements
  - Aftonbladet Health, RunKeeper…
  - Patient wearables and other gadgets

- Your own patient experiences: Private Health data in relation to Personal EHRs provided by the Healthcare organisation – which data belongs where and why?
  - Specific patient groups (org) or your own data and needs - Initial contact with CeHis/mina vårdkontakter?
List of Suggestions for your assignment

- Literature studies 1/2

Literature studies – as ROOM FOR IMPROVEMENT (search pubmed etc)

- RCT studies in eHealth where other evaluations methods could have been used…

- User Centred Design – when, where, how and why is it used in eHealth? In relation to the UCD standard and methodology – do the projects follow the standard or..?

- Who publish failures in eHealth (uni/healthcare org/industry?) and what kind of failures – what can we learn?
  - National/international perspectives
  - Socialstyrelsens Lex Maria for MI/MT deviations

- Ethical and legal issues regarding accessible EHRs internationally
  - How do others do? Based on what? (search pubmed, EU-sites etc)

- Patient empowerment r/t public eHealth systems
  - definitions by EPF and application in practice?

- Progress in Europe/globally/ regarding Patient access to EHR?
  - Different countries’ eHealth strategies and current status regarding work towards patient access.
  - Literature + interviews – what they say and what they do…
List of Suggestions for your assignment

- Literature studies 2/2
  2 LUL as a Customer-projects

**Interview/Literature studies – as ROOM FOR IMPROVEMENT (search pubmed etc)**

- Virtual communities in healthcare (patientslikeme, quantifyself and others)
  - Who are they, how are the communities built, how do they work..? aims and objectives? improvement suggestions?

- Clinical apps (often consumer/self-management) in relation to patient empowerment?
  - Do clinical apps work as patient empowerment tools?

- Consumer empowerment via Health Apps in **Public health**
  - Stop smoking, chronic diseases; get fit, lose weight… - How do this work IRL?

- Physicians (or Med.Stud’s) views on Patient-related eHealth and its impact on Patients, Physicians and their relationships. (Interviews required in Swedish?)
  - EU study on communication via e-mail exists, extend that study to include attitudes, respect and relationships etc.

- Review of /mobile/ Health applications related to /Mobile/ UC Design Guidelines
  - To what extent do they follow the guidelines? Effects related to that?

- International comparisons – how to take care of patient’s interests (differences in Europe)? Different patient organisations’ point of view (interviews?)

*Isabella Scandurra*
List of Suggestions for your assignment

- Literature studies

**Literature studies – as ROOM FOR IMPROVEMENT (search pubmed etc)**

- RCT studies in eHealth where other evaluations methods could have been used…

- User Centred Design – when, where, how and why is it used in eHealth? In relation to the UCD standard and methodology – do the projects follow the standard or..?

- Who publish failures in eHealth (uni/healthcare org/industry?) and what kind of failures – what can we learn?
  - National/international perspectives
  - Socialstyrelsens Lex Maria for MI/MT deviations

- Ethical and legal issues regarding accessible EHRs internationally
  - How do others do? Based on what? (search pubmed, EU-sites etc)

- Patient empowerment r/t public eHealth systems
  - definitions by EPF and application in practice?

- Progress in Europe/globally/ regarding Patient access to EHR?
  - Different countries’ eHealth strategies and current status regarding work towards patient access.
  - Literature + interviews – what they say and what they do…

Isabella Scandurra
List of Suggestions for your assignment

- 2 LUL as a Customer-projects – Swedish speaking persons are mandatory
  
  Deliverables: graphs/diagrams and oral presentation + report.

How is the clinical data used by the users?

- Statistical analyses of the Sustains/Cosmic data out of .xls documentation (Sept 2013)
  - Which patients are using the system, when? Where? How often?
  - What do they want to know? Control the logs? Change access?
  - Do they read other’s records? Children? Elderly?

Examine patients’ general knowledge of Sustains/eRecords and if they use/have entered the JPN that is accessible in Uppsala (LUL).

- Data collection = 4 questions (do you know.. If yes, have you accessed, age/gender?)
  - Outside Primary care units/hospital entrances: 3 days/student: and 2 studenter/entrance.

- → 2 groups are out collecting in 3 days → visiting 6 care units
  - Requirement: to get as many answers as possible.

- Try to compare with the data in Sustains: Did your presence changed the behaviour?
  - if your interviews made patients/people go and access their personal EHR?
Assignment – hand in and presentation

The presentation of your assignment work must be made both **orally** and in **written form**.

- The written report will normally be approx. 6-10 pages.
- Send the written report by mail to Bengt Göransson (Bengt.Goransson@it.uu.se) and Isabella Scandurra (Isabella.Scandurra@it.uu.se) no later than **Monday Dec 9, 13.00**
- The oral presentation is specified in the course schedule (**Wednesday December 11**).
  - Plan for 10 minutes presentation of your work and 5 minutes for questions
  - It’s mandatory to stay during all presentations, not just your own group.
- There is also a written examination which takes place on Wednesday December 11.
- The projects that have LUL (County Council of Uppsala) as a customer need to present their work at a special “LUL occasion”. **To be announced.**
The written report – outline suggestions

- **Abstract** – Short summary.
- **Background** – Describe the application area and the system you study.
- **Problem description** – Describe the problem you find outgoing from the users’ perspective.
- **Describe the system** under study in more detail.
- **Analysis** - Describe the method, the analysis and the results. This should be related to usability issues.
- Describe your **ideas for improvements** of the system, how the usability problems could be solved. Give some preliminary descriptions of what the solution could look like. Motivate and try to evaluate your ideas.
- **Discussion**. – For instance: Potential different solutions or things you could have done alternatively. Knowledge you gained during the work that is worth bringing forward.
- **Conclusion** – a short section describing your most important findings.
- **References** – interviews as well as other sources should be stated.
Lecture materials

- **Building usability into health informatics (Isabella’s thesis)**
  
  [http://publications.uu.se/abstract.xsql?dbid=8403](http://publications.uu.se/abstract.xsql?dbid=8403)

- **Methodological Review (Kushniruk & Patel)**
  - Cognitive and usability engineering methods for the evaluation of clinical information systems.
    
    *Journal of Biomedical Informatics 37 (2004) 56-76*

- **Jytte Brender:**
  - Handbook of Evaluation Methods for Health Informatics, 2006
  - Trends in assessment of IT-based solution in healthcare and recommendations for the future
    
    *Int. Journal of Medical Informatics 52 (1998) 217-227*

- **Bonnie Kaplan:**
  - Evaluating informatics applications - clinical decision support systems literature review.
    
    *Int. Journal of Medical Informatics 64 (2001) 15-37*
Continue to read regarding evaluations

- **Human-Centred computing in health information systems – part 2: evaluation** (J. Zhang)

  9 articles+

- Evaluating user interactions with clinical information systems: a model based on Human-Computer interaction models.
  - Despont-Gros, Mueller, Lovis
  - *Journal of Biomedical Informatics* 38 (2005) 244-255

- Cognitive evaluation: How to assess the usability of information technology in healthcare.
  - M. Beuscart-Zéphir
  - *Computer Methods and Programs in Biomedicine* 54 (‘97)19-28

  - Ammenwerth E, de Keizer N.
Medical Informatics
Period 2, 2013

http://www.it.uu.se/research/hci

Course home page:
http://www.it.uu.se/edu/course/homepage/medinf/ht13