

Health Informatics and HCI

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Outline

- What is Health Informatics?
- Some HCI-focused projects I've done
- Some core HCI lessons in health
- Some more AI-oriented health informatics with HCI aspects
- Some neat stuff in the wider world
- A project where I'd like a next PhD student

'Health Informatics' defined

- One of the journals in the field is called *Methods of Information in Medicine*
- Anything about how to process and distribute information to support health and healthcare
 - Clinical decision support systems (CDSS)
 - Electronic medical records
 - Consumer Health Informatics (e.g. use of Internet)
 - Medical imaging (CT, MRI, etc.)
 - Also, standards, and strategy and policy...

An HCI study I did: PREDICT usability

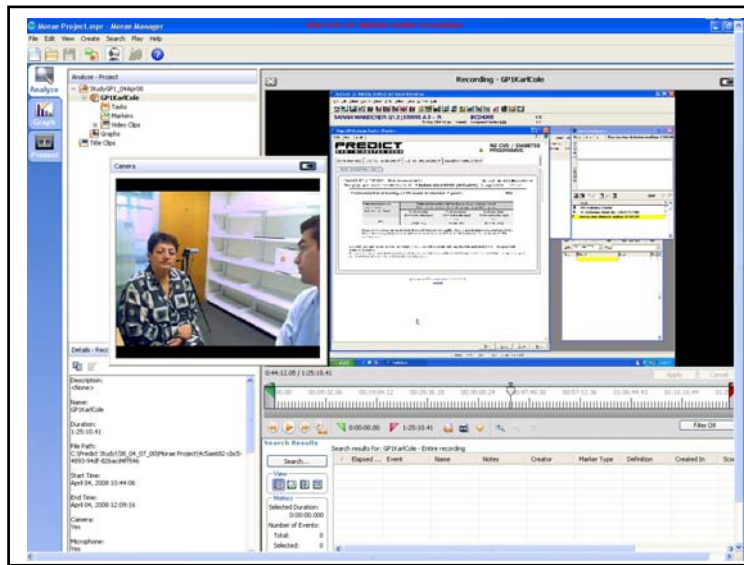
- PREDICT is a CDSS that computes probability of a patient having a cardiovascular event (e.g. heart attack, stroke) in the next 5 years (CVR₅)
 - Can play 'what if' should patient change risk factors (lower blood pressure, quit smoking)
 - Has about 1000 rules to compute recommended actions to manage down CVR
- Has been used in about 250,000 consults, mostly in general practice

Usability (and safety)

- Some say PREDICT usability could be better; what kind of problems might be present?
 - Data entry burden is high
 - Data validation is awkward
 - Uptake of data from the Practice Management System (PMS) database is incomplete
 - Recommendations are too numerous
- Well, so let's study PREDICT in use and see

Challenge: Consent, Recruitment and the Problem with Video

- Videotape and General Practice can be a little difficult to mix
- Most decision support tools are only used on a proportion of patients
 - i.e., only want to recruit and to invoke equipment sporadically



Challenge: Realistic Test Cases and Software Environment

- Sounds easy enough to put a 'realistic' patient into a PMS
- But when does their record begin?
 - Our scenario began with a sick certificate for flu the previous week (now GP wanted to assess CVD risk)
 - But we need to set up complete history, including that visit a week ago
- Time moves on!
 - 'A week ago' keeps moving
 - Actually very hard to synthesize patients
 - Physicians very sensitive to infeasible clinical data!
 - Ethics issues in re-using past real case data
 - And to keep them current
 - PMS designed to enter data as you go – not to fake a past!

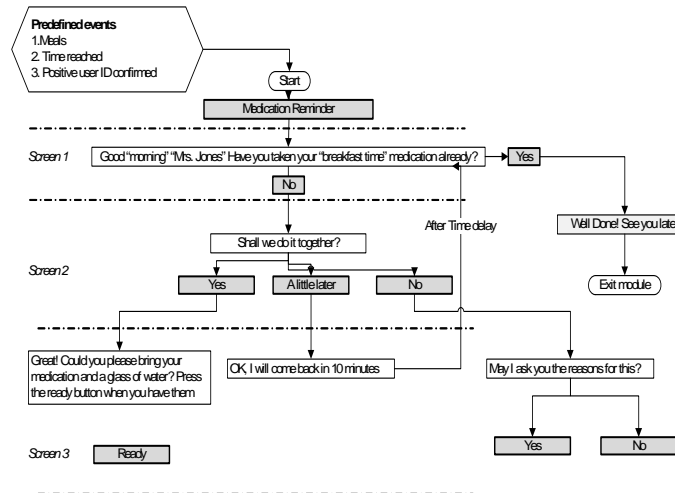
Another study: Robotic elder care



- 'Cafero' waiter robot with clinical monitoring tools on the tray
- Linux based navigation system on bottom
- Windows touchscreen and voice interface up top

Application / Study

- Elder care
 - Testing in a residential care facility (supported living: periodic caregiver visits, nurse on call)
 - Promoting quality use of medicine
 - Adherence to taking it (or knowing why not)
 - Physiological monitoring of effectiveness (and for safety)
 - Asking about side-effects
 - Providing education (and entertainment)
- Tested with morning medications of 12 residents



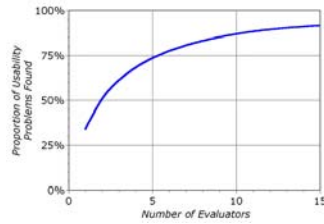
Measures / findings

- Video recorded
- Interviewed
 - Structured, open-ended
- Needed to tilt head lower!
- Patients like it and can use it well enough unless having significant dementia or macular degeneration
- Want features to video call and alert family



Lesson 1: Remember Nielsen

- A common problem will appear after a few sessions



Based here on 34% probability of one independent use evaluator finding the problem

- For systems in production use, you can just ask a couple real users and they'll tell you about all the worst problems ("saturation")

Lesson 2: Show name, the right name (aka, don't kill the patient: type 1)

Lesson 3: Show all the data (aka, don't kill the patient: type 2)

- Must always avoid truncating a field

Amoxicillin should be given under no circumstances due to severe allergic reaction

- Must do best to make navigation easy and presence of more data apparent
- Most medical data is indefinite upper bound repeating groups (e.g., problems, medications)
 - No obvious answer; tabs are used a lot
 - Allow comments fields on every visual 'chunk' of patient data (hmm... if only you knew how the data might get transmitted and reformatted!)

Lesson 4: Microsoft CUI

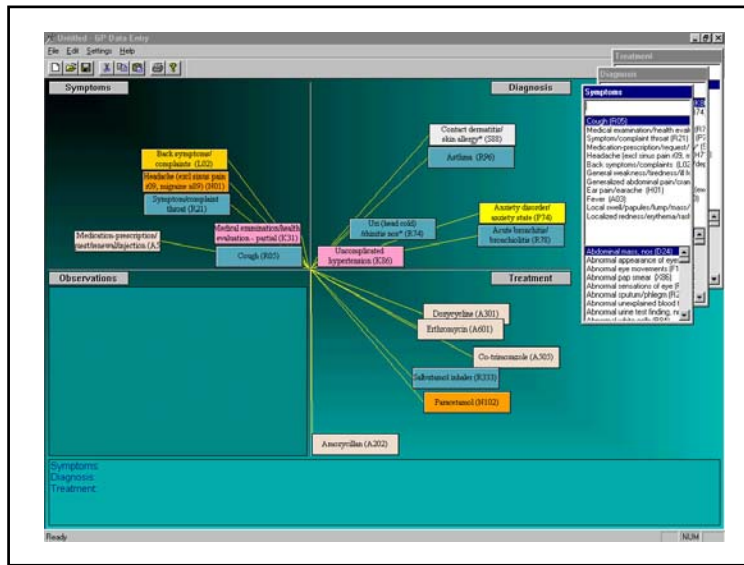
- API and style guide based on extensive study of common clinical HCI problems

Lesson 5: research ethics

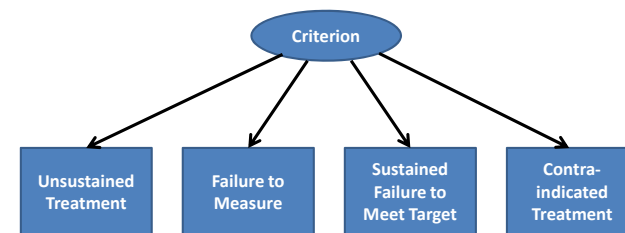
- There's not much you'll do research-wise in this area without needing research ethics approval (called IRB – institutional review board – in the US)
 - Takes time; doesn't always go smoothly
 - Acknowledge risks (confidentiality, safety): they're always there
 - Indicate benefits and safeguards
- Need clinical collaborators

More AI-ish: anticipative interfaces

- Can learn from existing general practice records
 - Frequencies of symptoms, diagnoses/problems, and treatments (particularly drug prescriptions)
 - Can learn associations of these items: conditional probability
 - $P(Dx|Sy) = P(Sy \wedge Dx) / P(Sy)$, can be quite different than the *a priori* $P(Dx)$
- Leverage this to speed data entry – offer most probable items for easy selection
 - E.g. as 'intelligent' split menu

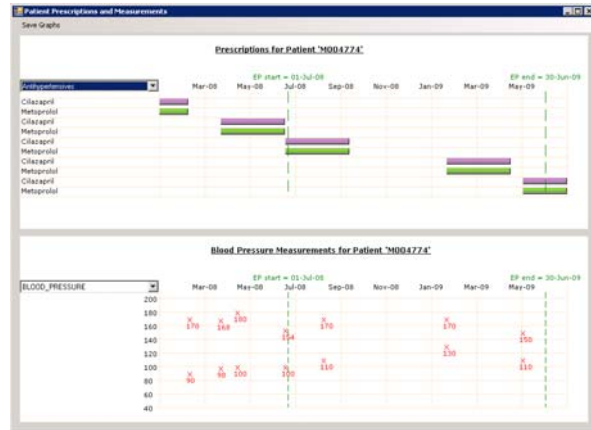


Even less HCI-ish: quality audit

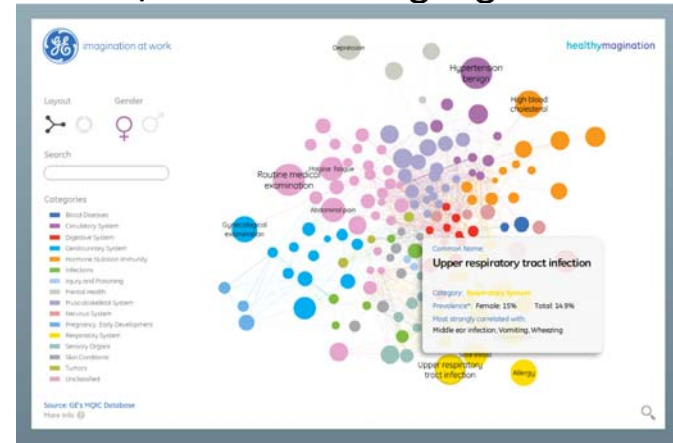


- Model of criteria for long-term treatment
 - Use an ontology (in Protégé/OWL) to hold parameters of treatments, problems and measurements

Example visual presentation of a case with low Medication Possession Ratio (MPR)



GE / MIT unlocking big data



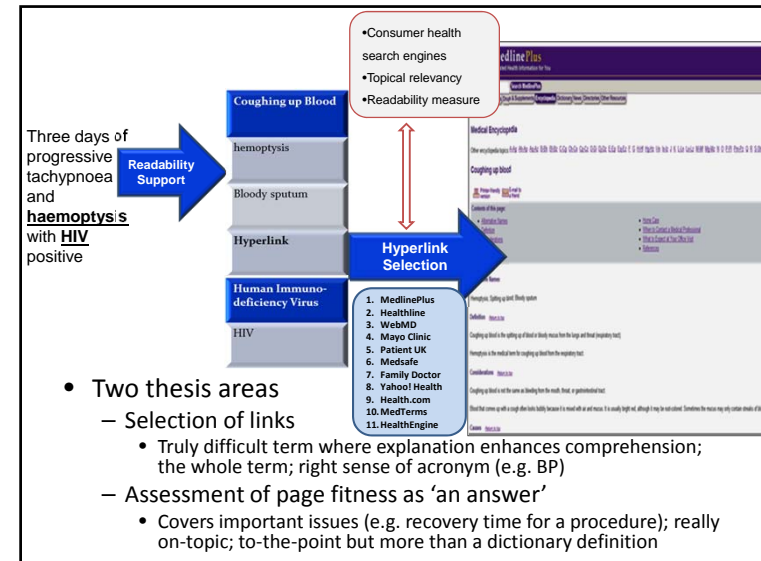
<http://www.gereports.com/the-magic-of-big-data-ge-mit-unveil-new-way-of-visualizing-disease/>

Next for Watson: Health!

- Social networking for health information and support
 - What are other people with my condition doing / taking? And how are they making out?
 - The wisdom of a good-sized group of patients is surprisingly good

Reading support for health consumers

- Increasingly, health consumers (patients) will be getting online access to complex 'medicalese' documents
 - Hospital discharge statement, referral letter, consultant report, lab test report, clinical summary
 - These will become common parts of 'Patient Internet Portals' or feeds to 'Personal Health Records' for most citizens in US, Australia and New Zealand (despite withdrawal of Google Health)
- Can we find the 'difficult' terms and provide hyperlinks to readable AND reliable resources that explain the denoted concepts?



If you're interested

- Jim Warren
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 - Tamaki based – office at the School of Population Health (building 730)
 - On study leave this year, but I'll be in and out