Clinician In the Driver’s Seat:
New approaches to health information system design

Yalini Senathirajah, PhD
ISP 2/22/19
Areas of AI

• Predictive delivery in a composable system, based on human-led configurations + produsage + machine-led recommender systems
• Provide the infrastructure for rapid consistent incorporation of AI recommendations at the point of care
• Mobile health tracking data, for visualizations, predictive recommendations for providers
• RPA for information extraction – another approach to interoperability?
Outline

I. Introduction
   • a new model for healthcare information systems
   • System capabilities and architecture

II. Studies
   • Cognitive and HCI effects
     • Uses of space, repeat navigation, time savings,
   • Brief results: Safety, accuracy/errors, arguments
   • Interaction design for safety

III. Other research areas
   • The Last Mile problem
   • Patient-facing: mobile, voice, overseas in low-resource settings

IV. Discussion
This is about a whole approach, see short concept paper at: http://www.ehr2.org/newsite2/new

MedWISE: Medical Widget-based Information Sharing, (extension, evolution) Environment

Important Ingredients for Health Adaptive Information Systems

Yalini SENATHIRAJAH\textsuperscript{a,b} and Suzanne BAKKEN\textsuperscript{a,b}

\textsuperscript{a}Columbia University Department of Biomedical Informatics
\textsuperscript{b}Columbia University School of Nursing

Abstract: Healthcare information systems frequently do not truly meet clinician needs, due to the complexity, variability, and rapid change in medical contexts. Recently the internet world has been transformed by approaches commonly termed ‘Web 2.0’. This paper proposes a Web 2.0 model for a healthcare adaptive architecture. The vision includes creating modular, user-composable systems which aim to make all necessary information from multiple internal and external sources available via a platform, for the user to use, arrange, recombine, author, and share at will, using rich interfaces where advisable. Clinicians can create a set of ‘widgets’ and ‘views’ which can transform data, reflect their domain knowledge and cater to their needs, using simple drag and drop interfaces without the intervention of programmers. We have built an example system, MedWISE, embodying the user-facing parts of the model. This approach to HIS is expected to have several advantages, including greater suitability to user needs (reflecting clinician rather than programmer concepts and priorities), incorporation of multiple information sources, agile reconfiguration to meet emerging situations and new treatment deployment, capture of user domain expertise and tacit knowledge, efficiencies due to workflow and human-computer interaction improvements, and greater user acceptance.
The problem(s)

- Complex needs, contexts vary by specialty, role, institution, context, patient,…
- **gap between clinicians and programmers**
  - software doesn’t reflect clinician ways of thinking, needs
- Rapidly changing, high-stakes, time-pressured collaborative work
- Changing systems takes consensus, time, cost
- Ease of use?

Nanaimo doctors say electronic health record system unsafe, should be shut down

CINDY E. HANNEITT / TIMES COLONIST
MAY 27, 2015 06:40 AM
Drug ordering v. shopping cart

Major commercial system

34 clicks

Amazon (with shipping)

18 clicks
Explosion of new info sources, analytics

How to incorporate it at point of care?
Optimal – the dream

• Software is able to take stock of all the context, ‘read one’s mind’, and predictively deliver the right information at the right time for the right context
• Same with decision-making: present the options integrated into workflow
• We’re far from being there, due to the ‘last mile’ problem
Who really knows about medicine, context, policies....?

Doctors, nurses and other healthcare professionals

Basic Idea: give nonprogrammer clinicians a modular, composable ('drag/drop') platform to create and share their own tools, interfaces, according to their concepts and needs
History of printing

User control = explosion of activity
Modular, composable → Both standards and flexibility

- Flexible evolutionary development mediated by user knowledge
- "Metadesign" – users aware of context create aspects of the system accordingly at runtime, e.g. spreadsheets
- Idea of the ‘pluripotent system’
What it is and is not

Flexible architecture (‘Lego’) concept is separate from having user control; can be used in many ways

e.g. clinical teams standardize care together

Automated pre-population

Individual user preferences

Specialty design

Expertise embodied in code and transmitted across institutions (aided by vocabulary translation)
CC: "Chest pain" x 1 day

HPI

58 year old woman with a history of hypertension recently diagnosed, on anlodipine and HCTZ, a NIDDM, and ongoing tobacco use l presents with her husband with a chief complaint of chest pain for the past 2 days. She states that for the last 24 hrs she has had a pressure-like sensation in her substernal area radiating up into her left shoulder and neck, 6/10 severity, with associated nausea, shortness of breath, lightheadedness and sweating. She has had several episodes over the past several months of chest pressure that resolved with Mylanta, but this time the Mylanta hasn’t worked. The chest pain has been constant since onset and is worse with exertion but not relieved with rest. At baseline, her exercise tolerance is about 15 blocks. She uses 1 pillow to sleep and denies any LE edema. She does not note any recent new medications and has no other significant medical history. She denies any abdominal pain, vomiting, change in bowel or urinary habits, fever, chills or weight change.

Of note, her last PMD visit was 3 yrs ago. She started HCTZ at her PMD at that time but since then, she has seen multiple other doctors, one of which started anlodipine for persistent HTN. She was also started on glybeside with poor compliance on fingersticks and is unsure of her last A1c.
MedWISE architecture

Purple – MedWISE components
Circled – NYP systems
Doctors v. programmers -

This %^*#(&@$ software doesn’t fit the way I think!!

Don’t look at me – I’m not a doctor.
Fit to task

- Lego set that doctors and nurses could arrange the way they want
- Most situations could be covered.

I’m a cardiologist, I need EKG, labs, vitals...

I’m a psychiatrist, I need notes, drug reactions, meds list...
Gather any desired EHR elements together on same screen (by clicking in left menu)

Set whole tab as a template (labs self-updating)

Share tabs or created elements

Create custom lab panels

Plot multiple lab results on same axes (plot mashup)

RSS feeds (standing Pubmed)
HCI Concepts: Distributed Cognition

- **Theory of Distributed Cognition** – cognition occurs over the entire system of people, physical artifacts, computer systems...

- Humans use tools to offload cognition

- **Externalization → reflection**
  - Internal v. external location of representations affects usability, cognitive load (Horsky et al.)


Forgetting

Bring together any elements → decrease keyhole effect
Conventional EHRs – repeat views are common

Senathingiah, unpublished
Conventional system use:
The user perceives each piece of information sequentially and keeps it in working memory while reading the next item (usually on a different screen). This information combines with the user’s clinical knowledge, and decision-making occurs. The user then writes a note in the external (screen) space. More screen switching may be required for copy and paste.

MedWISE use:
The user selects items which are placed together, visible on the screen. The user uses direct perception of the juxtaposed information, which combines with the user’s clinical knowledge, and decision-making occurs. One-click entry enters all selected items into a note. The user then writes into the note.
Research Questions

Use Patterns

• How do users create, what patterns emerge?
• Do users use the control to solve problems?

HCI effects re:

◦ Decreased repeat navigation: \( H_0 \): there will be no significant difference in the proportion of sessions which have repeat navigation for MedWISE and WebCIS for the same patient records and same user roles.

◦ Intelligent uses of space?
◦ Decreased cognitive load?
Results: what do users do?

• All first get last ‘good’ note; frame subsequent search; classify elements same way

• 3 main strategies: ‘bag of stuff’ (12); structured (19); dynamic stage (~11)

• Preferences: Left->right (26); right->left (11)
  • No difference in Dx, other aspects?
‘Dynamic stage’
Most common uses of space

- **Clustering of like objects for a purpose**
  - e.g. lab tests which should be monitored in future to determine whether a condition is progressing

- **Clustering of like objects for organization**
  - e.g. grouping labs or studies for ease of finding them and general organization

- **Clustering for ordering** – placing items in order in a section, to denote order of importance, priority in a process
  - e.g. prioritize problem list and associated labs

- **Setting aside a region** to designate significance (‘the important stuff is all on the right’)

- **Placement of items together** to facilitate calculation (**epistemic action**)  
  - e.g. two subsequent tests to view a trend, or placing protein above creatinine to facilitate ratio calculation
Repeats

Back and forth navigation sessions reduced ~70%

Repeats reduced 6X

As per logfiles, over a population of users theoretical #actions reduced 56-93%.

Significant difference, p<.0001

<table>
<thead>
<tr>
<th></th>
<th>Repeats</th>
<th>No repeats</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MedWISE</td>
<td>6</td>
<td>35</td>
<td>41</td>
</tr>
<tr>
<td>WebCIS</td>
<td>123</td>
<td>52</td>
<td>175</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
<td>87</td>
<td>216</td>
</tr>
<tr>
<td>Step</td>
<td>Action</td>
<td>Representation Location (at end of step)</td>
<td>Internal</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Read panel 1</td>
<td>2 clicks + read</td>
<td>Working memory (WM)</td>
<td>Working memory (WM)</td>
</tr>
<tr>
<td>Read panel 2</td>
<td>2 clicks + read</td>
<td>WM</td>
<td>WM</td>
</tr>
<tr>
<td>Read panel 3</td>
<td>2 clicks + read</td>
<td>WM</td>
<td>WM</td>
</tr>
<tr>
<td>Consideration/decisionmaking</td>
<td></td>
<td>WM + LTM (internal medical knowledge)</td>
<td>WM + LTM (internal medical knowledge)</td>
</tr>
<tr>
<td>Note writing: a) data entry</td>
<td>write/copy text into note field</td>
<td>WM (data)</td>
<td>WM (data)</td>
</tr>
<tr>
<td>Note writing: b) synthesis writing</td>
<td>Writing into note field</td>
<td>WM</td>
<td>WM</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>11 steps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Representation Location (at end of step)</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get panel 1</td>
<td>2 clicks</td>
<td>screen</td>
<td>screen</td>
<td></td>
</tr>
<tr>
<td>Get panel 2</td>
<td>2 clicks</td>
<td>screen</td>
<td>screen</td>
<td></td>
</tr>
<tr>
<td>Get panel 3</td>
<td>2 clicks</td>
<td>screen</td>
<td>screen</td>
<td></td>
</tr>
<tr>
<td>Consideration/decisionmaking</td>
<td></td>
<td>LTM (internal medical knowledge)</td>
<td>Screen (all read together)</td>
<td></td>
</tr>
<tr>
<td>Note writing: a) data insertion</td>
<td>1-click data entry</td>
<td>Screen (data entered)</td>
<td>Screen (data entered)</td>
<td></td>
</tr>
<tr>
<td>Note writing: b) synthesis writing</td>
<td>Writing into note field</td>
<td>WM</td>
<td>WM</td>
<td>screen (Diagnosis, conclusions)</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>8 steps</td>
<td>2</td>
</tr>
</tbody>
</table>

Decrease in # of steps and shift from internal to external representation

WebCIS (conventional system)

Stepwise analysis

- MedWI SE
Evidence for decreased cognitive load

• No need to use paper, notepad, other apps
• Self-report
  • “oh, it is easier to see it all together…” (often said suddenly on first use for a case)
• Lack of repeats (both from logfiles and 2 users ‘WebCIS-style’)
• Fewer steps, shift from internal to external representations
Reactions

Wow!
Awesome
Save time
I want it!

- cognitive ease, checklist effect
- Ability to share with colleagues “will make it really take off”
- Fit to task
- High interest and engagement
Diagnosis Momentum error

• Errors may be caused by a clinician being overly influenced by the view of a previous clinician; perhaps omitting subtle clues to a different interpretation
  ◦ In a user-created system, omissions might lead to errors, propagation (if shared)

Research question: Does user control affect the possibility of diagnosis momentum errors?

Accuracy

- 12 users, MedWISE, 3 cases
- 6 users, conventional system, 3 cases
- Expert-derived set of elements, Dx

<table>
<thead>
<tr>
<th>Case</th>
<th>MedWISE</th>
<th>WebCIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>6.8</td>
<td>6</td>
</tr>
<tr>
<td>Case 2</td>
<td>5.5</td>
<td>5.3</td>
</tr>
<tr>
<td>Case 3</td>
<td>4.4</td>
<td>4.3</td>
</tr>
</tbody>
</table>

(p>0.2 in all cases)
Discussion ...and Thought Experiment

- Small studies, more work needed
- At first glance, accuracy comparable
- Healthcare necessarily concerned, but why such strong objections?
- Innovation – easy to criticize things we are used to that are missing; harder to criticize current practices re: what's missing, dangerous
- Common syndrome of laughing until it is there (e.g. iPad)
## Potential risks (partial list)

<table>
<thead>
<tr>
<th>Composable EHR</th>
<th>Conventional EHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Omission by user → error</td>
<td>• Omission by user in search, → error</td>
</tr>
<tr>
<td>• Shared omission → Dx momentum error?</td>
<td>• Cognitive load due to need to retain items in WM</td>
</tr>
<tr>
<td>• Cognitive load due to different interfaces</td>
<td>• User viewing patterns hard to view</td>
</tr>
<tr>
<td></td>
<td>• Possible lack of fit to patient case, specialty, role</td>
</tr>
<tr>
<td></td>
<td>• No checklist</td>
</tr>
</tbody>
</table>
| | • Hard to change as per situation → potential error?
“...clinicians may need to switch between different display windows to ascertain all the information needed...This requires the practitioner to ...remember what was on previous screens as he switches between them. The practitioner becomes the de facto integrating agent for all such data and hence bears the brunt of all the cognitive demands required for such integration.” (Woods et al. 2010).

• “practitioners are forced to access data serially even when the data are highly related and most usefully viewed in parallel”.

• “Mismatch between assumption of software designers and the actual work environment...
Display fragmentation in a commercial inpatient system - clinical elements only

Total 37 clicks to access all the elements shown in black.
ED workflow and fragmentation analysis
Anand Maharaj, Downstate Medical Center

Total 100 clicks

Majority of the items for one note is two steps from the origin. However, for the remaining note and orders require at least several screens and clicks associated with each level.

Number of clicks from the center of the diagram all the way to the outer leaves for 2 of the notes and 2 of the orders used in this study come to the sum of 100 clicks.

Unpublished data
R01 Methods

• establish basic science knowledge of HCI/safety issues

• Conventional tools e.g. surveys, interviews have problems (self-report)

MedWISER will be used for

• Needs elicitation – users compose screens while solving cases

• Prototyping, testing prototypes/design patterns

• Experiments around specific interaction effects

  • Effects of interruption, nonlinear work
  • Fit to task, cognitive overload, omissions $\rightarrow$ errors
  • Large online studies – error/omission transmission?
Eyetracking

Pupils dilate with increased mental effort
Software subtracts effects of lighting - a more objective measure of cognitive load?
Time pressure

• Ebola (US) flaw: commercial systems generally took >2 weeks to create workaround
  • How many patients exposed to unsafe IT?

• Average time to complete: (w/o outliers): short tasks 13d  long tasks 46d  (range 1 – 374)

• Deployment → massive usage data → increasing automated delivery → speed things up?
Interaction Design
Tall man lettering – drug selection

- acetaZOLAMIDE vs. acetoHEXAMIDE
- buPROPion vs. busPIRone
- chlorproMAZINE vs. chlorproPAMIDE
- clomiPHENE vs. clomiPRAMINE
- cycloSERINE vs. cycloSPORINE
- DAUNOrubicin vs. DOXOrubicin
- DOBUTamine vs. DOPamine
- hydrALAzone vs. hydrOXYzine
- TOLAZamide vs. TOLBUTamide
- vinBLASTine vs. vinCRIStine
Fit to task – need for UI/UX

What can we learn from Gaming platforms?

• “what makes or breaks immersion is how easy it is for your player to convert an idea into an in-game action”

• Requires: fast thinking, just enough information, rapid action

What does this UI mean for the PC player? Almost everything is *literally* one click away. If you want to look at your skills you scroll the character window. If you want to equip something, you drag it onto your paper doll. The interface is fast and accessible, and almost every type of item in the world has a unique inventory icon.
User Interface Design Patterns

Getting input
- Forms
  - Password Strength Meter
  - WYSIWYG
  - Forgiving Format
  - Input Feedback
  - Captcha
  - Replace Editor
  - Calendar Picker
  - Good Defaults
  - Fill In The Blanks
  - Live Preview
  - Input Prompt
  - Structured Format
- Explaining the process
  - Wizard
  - Inline Help Box
  - Tour
  - Blank Slate
  - Steps Left
- Community driven
  - Vote To Promote

Navigation
- Tabs
  - Navigation Tabs
  - Module Tabs
- Jumping in hierarchy
  - Shortcut Dropdown
  - Home Link
  - Fat Footer
  - Breadcrumbs
- Menus
  - Horizontal Dropdown Menu
  - Vertical Dropdown Menu
  - Accordion Menu

Content
- Carousel
- Archive
- Continuous Scrolling
- Event Calendar
- Article List
- Pagination
- Tag Cloud

Social
- Activity Stream
- Auto-sharing
- Like
- Direct Messaging
- Invite Friends
- Follow
- Friend List
- Ego
  - Collectible Achievements
  - Completeness Meter
- Miscellaneous
  - Adaptable View
  - Product Page
- Paywall
- Pricing Table
  - Shopping Cart
  - Pricing Table
  - Shopping Cart
2005-2010 – 216 deaths due to alert / alarm fatigue
sulfamethoxazole-trimethoprim (BACTRIM DS, SEPTRA DS) 800-160 mg tablet

<table>
<thead>
<tr>
<th>Dose</th>
<th>mg</th>
<th>mg/kg of trimethoprim</th>
<th>2.5 mg/kg of trimethoprim</th>
<th>5 mg/kg of trimethoprim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Type</td>
<td>Actual</td>
<td>Dosing</td>
<td>Order-Specific</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>38.6 kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Actual weight: 38.6 kg (recorded 12 hours ago)

Administer Dose: 6,160 mg of trimethoprim

160 mg/kg of trimethoprim = 38.6 kg

Normal max

WARNING: 38X normal max
Findings – macro level

**Efficiency**

2x-7x theoretical time savings if all care team members create and share patient-specific tabs (based on logfile studies)

71% decrease in repetitious navigation v. conventional systems (p<.0001)

~6X time savings in individual case navigation (cf. Koopman 2011, Agha 2014)
NASA MCT – unique needs, like healthcare

• Unprecedented challenges, e.g. software must work the first time on Mars, no rehearsal
• Like healthcare, users are scientific experts
• Large number of needs, contexts, challenges

• Problem: creating tools for new missions, or updating current software takes time, everything has to be re-vetted.

• Security and reliability are paramount
• Only users know what is needed (auto didn’t work)
NASA Mission Control – high-stakes, collaborative, complex...

Meets their needs for
• Reliable extensibility with low risk
• components certified → low maintenance /new item costs
• fast innovation, fit to user needs
Multi-domain composition

Figure 9. A multi-domain composition showing plots, timelines, logs, orbits, and other data.
Business case

• **Efficiency**: Reduced clinician time *(6x)*: navigation, sharing

• **Reduced cost of change**, new tool creation
  
  • Ebola (US) flaw: commercial systems generally took >2 weeks to create workaround
  
  • How many patients exposed to unsafe IT?
  
  • Average time to complete: *(w/o outliers)*: short tasks 13d long tasks 46d *(range 1 – 374)*

• **Safety**: reduced exposure to bad configuration; better interaction design, reduced display fragmentation

• Cognitive support → ease of use, safety, communication

• Fit to task: specialties, individuals, contexts

• **user satisfaction**

  • safer coding (as per NASA, modules vetted and then composed, faster, safer, lower cost)
Analytics at point of care – the Last Mile

• Analytics → recommendations; visualize and insert usable at point of care
• ‘patients like this at this institution’...
• Safety: force review of critical information
  • e.g. patient went into surgery with team not knowing s/he had multiple pulmonary emboli – info buried
  • e.g. Ebola snafu
Usual EHR change process....

• Request meeting with IT staff .....3 months
• Discuss changes
• Get through committees (up to 8)
• Wait until staff is assigned....
  Can be up to 2 years
• ..... 

Ebola: major vendors took 3 weeks to implement preventive changes
Findings, Limitations

Can the system be configured to provide most required info + logic for H1N1 as per CDC guidance?

- 83% success (# elements required/available)
- unreliable structured data for some risk factors e.g. pregnancy; long-term aspirin Tx, requires text search;

Time taken?

- Rapid configuration v. usual programming (~7 hours, not days)
Clinical decision support – the big promise

• Drug-drug interactions: 2-5 million pts,
• 220K ED visits/year

• Image analysis: e.g. analyze head image for possible stroke by ML, move to top of queue
• Cost savings
• “alert-fatigue”, clinicians ignore more of the alerts shown (87.8%)

https://www.intechopen.com/books/decision-support-systems/knowledge-bases-for-clinical-decision-support-in-drug-prescribing
The problem

~28% of the time the finding is serious:

- e.g. Tumors, brain lesions, vascular aneurysms

A patient is injured and visits ED...

Arm fracture
(reason person came into ED)

Suspicious lump
(could be a tumour, needs to be checked)

The lump is called an ‘incidental finding’
ED docs are busy, and it’s not their primary job...

How often does this happen?
A lot, from 5-53% of the time there is no follow-up

Consequences:

- increased LOS: (8.7 vs 6.7, p=0.005)¹
- readmissions²
- Risk of legal action³, noncompliance with guidelines/law/ethics³
- Preventable morbidity, deaths
- Costs: 2x-4x cost of early alerting
What is needed for AI to be used at point of care?

Integration of more and more info sources:
• Genomics + instructions to doctors
• Questions + answers from consults
• Social media
• ‘social determinants of health’ – geographic, SES, language, education...
• Information collected at visit: e.g. pregnancy status, recent travel, OTC... + patient preferences
• Devices: Fitbit... Images: xrays, photos, MRI, graphical displays
• Guidelines e.g. asthma national, diabetes...
• Prescriptions and med history
• Concierge services e.g. social work, home care

And these must be...
• ‘common ground’ shareable displays, voice/text communication with other services
• Timelines and other complex visualizations
• Rapid to comprehend by stressed clinicians (36-hour shift same impairment as being drunk)
• raising or lowering emphasis as situation evolves, signals to other providers, prioritize different things for other providers
• CDS hooks or using what standards and tech are available now
• Guidelines, other text aids, digested
RPA (robotic process automation) for integration?

Current proposals: require heavy institution, gov’t, vendor cooperation:

- FHIR (new std) – must be included by vendor, turned on by hospital; 6 month matching task
- Elements must be shown in manifest, match what you want to do
- Staff time/cost
- Currently: hard coded; months to years
- No gov’t std for provider-facing applications

- Can RPA help? Low-hanging fruit; well developed in other industries
- Everything from API feeds to scanned docs must be handled
A plea – this is not a only a technical problem

Sociotechnical – why your EHR is less usable than commercial/web:

<table>
<thead>
<tr>
<th>Commercial web/phone</th>
<th>EHR</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Tight feedback loop – bad shopping carts directly lose sales → millions invested in usability for the average person</td>
<td>• Extra work, no extra sales? No need?</td>
</tr>
<tr>
<td>• Code sharing culture → ~54% of internet code is free/open source (often free as in beer as well free as in speech);</td>
<td>• Even showing screenshots forbidden, IP protections including UI, look/feel jealously guarded</td>
</tr>
<tr>
<td>• High visibility of improvements; ability to borrow code. → continual improvement is the norm</td>
<td>• Viewing restricted to users, admins</td>
</tr>
<tr>
<td>• Low barriers to entry – anonymous contribution</td>
<td>• Must be ‘in the club’</td>
</tr>
<tr>
<td>• Fit to task – standards, diverse uses</td>
<td>• Diverse code for single uses → waste?</td>
</tr>
<tr>
<td>• Feedback - Large public knowledge</td>
<td>• little public knowledge</td>
</tr>
</tbody>
</table>

Aaron Swartz

major contributions

at age 15
Other research interests: Multilingual/multicultural patient communication + workflow

• in care venues treating the underserved

Multilingual, culture-specific Data input by patient (waiting room)

Visualization/summary with decision support to doctor (before seeing patient)

Time, meds
NICHD mobile game for minority teen ‘stress management’, mental health training

prototype + resubmission
Voice interfaces – many questions

• voice control of the EHR → lower load
• Voice for ‘coaching’ people in their daily lives, chronic disease
  • ‘remember to take your pill by 8am…’
  • ‘You could finish your 10K steps if you get off at this stop and walk’
  • Do you want your prescription delivered?
• Do some people really feel loneliness is relieved by voice agents? How do different people view / feel this?
  • Viz. robots for the elderly (Japan)
• What is most convincing in behavior change?
  • Doctor’s voice, your voice, your mother’s voice? When?
• How can voice be used with those speaking rarer languages? (e.g. Haitian Creole, ... increase access to care?)
Acknowledgments

This work is funded by the US Agency for Healthcare Research and Quality AHRQ 5R01HS023708-03
Contact

Yalini Senathirajah
yalini@pitt.edu
347-619-4021
http://www.ehr2.org/newsite2/new

Skype: yalinisen

Join us!
• CMIOs, CIOs – Clinicians – opinions, subjects in our research
• Vendors – incorporate results, collaborate in research
• Researchers – collaborations welcome
• Students – get involved in projects
• Designers/inventors/programmers

Postdoc, predoc + RA positions
Main Papers (many on ResearchGate)

• **Clinician in the Driver’s Seat, parts 1 and 2**: Journal of Biomedical Informatics, Nov/Dec 2014. Senathirajah Y, Kaufman D, Bakken S.


