Our Amazing Team

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Overview

- Evolution of the Health Kiosk Project
- Iterative, user-centered design process
- Laboratory and community-based usability testing
- Longitudinal pilot study of user needs, motivations and preferences
Background

- Health IT empowers people to monitor/manage their health

- Limited access and lagging adoption disproportionate among person who are poor, disabled, living where comprehensive cell/internet service is lacking

- Factors affecting underuse: access, affordability, poor design

- Muddle of condition-specific devices/apps fail to support daily health habits and chronic conditions *in an integrated fashion*

- Potential for health kiosks to support self-management and collaboration with PCP, regardless of resources or distance
Technological Solutions

Goals
- Prevent, eliminate, or ameliorate health and functional impairment
- Fit seamlessly into everyday life
- Enhance quality of life

Process
- User-centered and iterative
- Resource-intensive
RUPHI Focus Groups

- Acceptability and feasibility of commercially available, multi-user kiosk use
- 6 senior housing residents and 3 UPMC LAH/SAH staff

Key findings
- Limited functionality despite high cost
- Unreliable and not easily customizable
- Personal privacy and property security concerns
- Perception that self-monitoring would enable co-management of health and chronic conditions with PCP
Commercial kiosks inadequate...

Why not build one from scratch?

Quality of Life Technology Center
a National Science Foundation Engineering Research Center

- Longstanding CMU-Pitt partnership
- Design, development, and evaluation of technologies to enhance quality of life for all including older adults and persons with disabilities
Design Requirements

- Modular platform
- Compatible with low or high speed data transfer
- Secure, HIPAA compliant, password/smartcard-protected
- HL 7-compliant for future integration with EMRs
- Customizable client access (user only viewing own data)
- Usage tracking
- Parameter options for measurements, alerts, notifications
- Touch screen display
- Keyboard, audio, video for surveys and educational content
- Graphical display of trend data
- Videoconferencing
- Automated and printable reports
- Easy to clean
Health Kiosk.v1: Proof of Concept
Cabinet Re-design
Health Kiosk.v2: Robust Prototype
Laboratory Testing \((N=7)\)

- Concept appealing
- Physical design acceptable
- Touch screen too sensitive
- Graphical display of data easily interpretable
- More detail and illustration of instructions
- Blood pressure cuff difficult to apply
- Retrieving and sending brief messages OK
Health Kiosk.v3: Interface Redesign
Main Page.v1
Mock-ups by HCI Students

Hello Mary!
What would you like to measure?

Blood Pressure
Weight
Pulse

MESSAGES
HISTORY
HELP
EXIT

STEP 1
Squeeze the clip to open.

STEP 2
Insert your index finger

NEXT

MESSAGES
HISTORY
HELP
EXIT
Mock-ups by HCI Students
Main Page.v2

Pulse oximetry selected
Guest User
Blood Oxygen

Step 1
Open the pulse oximeter by squeezing its base like a clothespin.

Step 2
Place the middle finger of your other hand into the pulse oximeter.

Step 3
Wait until you can see numbers on the device's screen.

4. Keep the pulse oximeter on and tap here.

Guest User
Measurement In Progress

Please Wait...
The kiosk is recording your measurement.

Guest User
Measurement Finished

Blood Oxygen Level: 99 %

Tap Here to Return to Home Screen
Main Page.v2

Grip Strength selected
Step 4. Tap the start button, then squeeze the grip strength device as tightly as you can for 10 seconds.
Main Page.v2

Surveys selected
**Quality of Life**

**Taking Medicine**

**Concern About Falling**

**Sleep Quality**

**Sleepiness**

**Mood**

**Sample Item**

---

**Guest User**

**Concern about Falling**

On a scale from 1 to 10, with 1 being very confident and 10 being not confident at all, how confident are you that you do the following activity without falling:

- **Getting dressed and undressed without falling**

  - Very Confident
  - Not Confident At All

---

**Guest User**

**Sleep Quality**

During the past month, what time have you usually gone to bed at night?

**Bed Time**

9:30 PM

---

**Guest User**

**Sleep Quality**

Please describe the other reason(s) you had trouble sleeping during the past month.

```
roommate
```
Main Page.v2

Messages selected
Thursday, September 15, 2011 5:13 AM
From: Dr. Clinician User
How are you feeling this week?

Reply To Message   Print Message   Close Message
Current Features & Functionalities

☑ Desk-sized, platform with wheeled base
☑ On-board computer, printer, speakers, and headphones
☑ Touch screen monitor with a swivel base and adjustable arm
☑ Embedded RFID reader for personal swipe card or key fob
☑ Seated scale, pulse oximeter, BP monitor, hand dynamometer
☑ Illustrated instructions for device use and survey completion
☑ Measurements automatically entered into a secure database
☑ Viewable/printable reports displayed numerically or graphically
☑ Messaging to share reports, exchange queries, and save messages
☑ Modular design
Community-based Usability Testing

Aims
- To examine usability with community-residing older adults
- To explore feasibility and reliability of delivering standardized survey instruments via the kiosk

Sample
N=40 older adults age 65+ from 4 sites
  - Elder-ado, The Avenue, Longwood at Oakmont, Bellmead

Data Collection
2 sessions 2 weeks apart
Tasks Performed

- Log on and off
- Adjust touch screen
- Identify scheduled measurements on home page
- Locate devices and measure BP, O₂ saturation, weight
- Print report of today’s measurements
- View weight measurements over 3 and 6 months
- Interpret graphical display of trend data and view values
- Print trend data
- Identify unread message, write response, and send it
- Adjust kiosk setting
- Complete surveys
Focused Participation
Sample \((N=40)\)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>31</td>
<td>78</td>
</tr>
<tr>
<td>Age M (SD)</td>
<td>76.59 (6.84)</td>
<td>--</td>
</tr>
<tr>
<td>Caucasian</td>
<td>30</td>
<td>75</td>
</tr>
<tr>
<td>Not married</td>
<td>33</td>
<td>83</td>
</tr>
<tr>
<td>Household income (\leq $20,000)</td>
<td>25</td>
<td>63</td>
</tr>
<tr>
<td>(\leq) High school education</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>Not employed</td>
<td>36</td>
<td>90</td>
</tr>
<tr>
<td>Living independently in senior housing</td>
<td>28</td>
<td>70</td>
</tr>
<tr>
<td>Fair or poor self-reported health</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Health problems interfere with doing things at least sometimes</td>
<td>15</td>
<td>38</td>
</tr>
</tbody>
</table>
Usability* ($N=40$)

*Measured on 11-point scale, e.g., 0 = not at all easy and 10 = extremely easy

**p<.05
User-inspired Modifications

Visual display
- Stopped hiding passwords, showing plain text instead of ****s
- Increased contrast and text size and simplified time input format
- Changed “Scheduled” indicator display on the main page

Physical measures
- Blood pressure - Added mercury tilt switch and simplified instructions
- Weight - Added audio instructions, circuit board to control the scale buttons remotely, and relocated seated scale to the side of the kiosk
- Grip strength - Added meter display

Surveys
- Added border, background color, changes to item format (stems, grid answers), and "Skipped Question" functionality
- Altered touch screen sensitivity to mitigate double taps
Additional Sensors

Force and Vibration Sensors
- Strength and sensation

Depth Cameras
- Duration, speed, precision of movement
- Balance
- Sit-to-Stand, Get-Up-and-Go,
- GARS-M

Activity Tracking
- Sleep-wake patterns
Pilot Study: 12-month deployment

**Aims**

- Explore usability, acceptability, and helpfulness of kiosk over time
- Describe self-management needs, motivations, design preferences, and use patterns
- Compare traditional vs. automated methods of assessment for selected health and functional parameters
- Identify factors that may influence intensity of kiosk use among adults with a range of needs for a healthier lifestyle and improved self-management of chronic diseases
Pilot Study: 12-month deployment

Sample and Settings
Adults age 21+ at three congregate sites
- Jewish Community Center of Greater Pittsburgh
- Silver Lake Commons
- Vincentian Villa

Data Collection
Baseline and 6 months
Periodic, brief usability surveys
Monthly health services use
Pre, intra, and post-intervention measures

Validation Sub-study
Single session with up to 50 participants
<table>
<thead>
<tr>
<th>physiological parameter</th>
<th>traditional method (T)</th>
<th>automated method (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight &amp; height</td>
<td>T = step-on digital scale and height rod or wall chart</td>
<td>A = seated scale and Kinect sensor</td>
</tr>
<tr>
<td>Heart rate &amp; $O_2$ saturation</td>
<td>T = radial pulse; skin: pallor, blanching, mottling</td>
<td>A = pulse oximeter</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>T = BP cuff, sphygmomanometer, stethoscope</td>
<td>A = blood pressure monitor</td>
</tr>
<tr>
<td>Peripheral sensation</td>
<td>T = manual tuning fork or Bio-thesiometer</td>
<td>A = time to sense motor vibration at 128 Hz and 256 Hz</td>
</tr>
<tr>
<td>Range of motion</td>
<td>T = observed movement of extremities while standing and sitting</td>
<td>A = Kinect sensors</td>
</tr>
<tr>
<td>Strength of large muscle groups</td>
<td>T = manual muscle testing</td>
<td>A = Kinect sensors, force sensors, hand dynamometer</td>
</tr>
<tr>
<td>Grip strength</td>
<td>T = manual testing of grip strength</td>
<td>A = hand grip dynamometer</td>
</tr>
<tr>
<td>Lower extremity function and balance</td>
<td>T = Short Physical Performance Battery</td>
<td>A = Kinect sensors</td>
</tr>
<tr>
<td>Gait characteristics and smoothness of walking</td>
<td>T = Modified Gait Abnormality Rating Scale (GARS-M)</td>
<td>A = Kinect sensors</td>
</tr>
<tr>
<td>Motor skill</td>
<td>T = Figure of 8 Walk</td>
<td>A = Kinect sensors</td>
</tr>
</tbody>
</table>

*T= Traditional measurement  **A=Automated measurement
Pilot: Assessment & Intervention

Measures
- Objective and subjective appraisal of need to improve health-related behaviors

Health Modules
- Patient/family caregiver-provider communication
- Chronic disease self-management training
- Sleep
- Mobility and balance
- Lifestyle (nutrition and physical activity)
- Bladder health
What is so novel about all this???

- Self-administered consent via health kiosk
- Computerized Assessment of Mild Cognitive Impairment (CAMCI)
- Wireless uploading and display of actigraphy (24/7 sleep/wake activity X 7 days X 2) and electronic diary data incorporated into Sleep and Bladder Health intervention
- HIPAA/IT risk assessment and disability evaluation
Welcome to the Health Kiosk

To begin, hold key fob in front of START below

Quality of Life Technology Center

Milwaukee folks: Please tap here to start the demo
Mary Smith
Chances Earned for This Week's Drawing

So far you have earned 9 chances for this week's drawing on Wednesday, December 4, 2013.

Number of Chances Earned by Kiosk Users at the JCC

Your Chances

Tap Here to Continue
Mary Smith
New messages: Tap a message to read it

From Kiosk Coordinator
20 Nov 2013

From Kiosk Coordinator
25 Nov 2013

From Kiosk Coordinator
29 Nov 2013

Tap Here to Continue
Survey #3
Health Information
The following questions are about how you interpret health information on a nutrition label. This information is on the back of a container of a pint of ice cream.
If you eat the entire container, how many calories will you eat?

Number of calories

Nutrition Facts
Serving Size: ½ cup
Servings per container: 4

- Amount per serving:
  - Calories: 250
  - Total Fat: 13g
  - Cholesterol: 28mg
  - Sodium: 55mg
  - Total Carbohydrate: 30g
  - Dietary Fiber: 2g
  - Sugars: 23g
  - Protein: 4g

*Percentage Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.
Mary Smith

Health Information

You usually have 42 grams of saturated fat each day, which includes one serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day?

Saturated fat grams

7 8 9
4 5 6
1 2 3
. 0 <--
Mary Smith
Scheduled Measures

Tap Here to Complete Scheduled Measures
Mary Smith
Blood Pressure Measurement

Have you exercised within the last hour?

- Yes
- No

Next Step
Mary Smith
Blood Pressure Measurement

Have you exercised within the last hour?

- Yes
- No

Next Step
Mary Smith
Blood Pressure Measurement

Open the drawer and find the blood pressure cuff.

Previous Step  Next Step
Mary Smith
Blood Pressure Measurement

Place the cuff on your upper arm. The red part of the cord should be close to your elbow.
Mary Smith
Blood Pressure Measurement

Rest your arm on the desk with your wrist facing upwards and press the blue button on top of the blood pressure meter.
Mary Smith
Blood Pressure Measurement

Wait for the cuff to inflate then deflate. After the cuff is deflated, tap the "Next Step" button below.
Mary Smith
Blood Pressure Measurement

Please Wait...
The kiosk is recording your measurement.
Mary Smith
Blood Pressure Measurement

Blood Pressure: 114 / 84
Mary Smith
Scheduled Health Modules

Sleep
20% Completed

Your Goal: To get at least 6 hours of sleep per night in 4 weeks

Tap Here to Complete Scheduled Modules
Mary Smith
Scheduled Health Modules

Sleep

20% Completed

Your Goal: To get at least 6 hours of sleep per night in 4 weeks

Number of Hours Asleep

Your Goal

Tap Here to Complete Scheduled Modules
Hello, Mary!
Tap the button for your next activity

Measures
- Weight
- Grip Strength
- Surveys
- Blood Oxygen

Blood Sugar
Mobility
Blood Pressure
Pulse

Health Modules
- Communication
- Lifestyle
- Bladder Health
- Chronic Disease

Kiosk Perks
Today's Results
Past Results
Settings
Messages
Exit
Find the grip strength meter in the drawer.
Hold the meter as shown and get ready to squeeze.
Mary Smith
Grip Strength Measurement

Squeeze the meter as tightly as you can for 10 seconds.

Time Remaining: 4 seconds
Mary Smith
Grip Strength Measurement

Your Maximum Grip Strength:
51.76 lbs of force

Tap Here to Continue
Here’s the TAKE HOME message

- Practice good science
- Design with users and stakeholders in mind
- Respect the technology and don’t underestimate its complexity
- Allow yourself to be *new* at things
- *Truly* collaborate
<Question Type="MultiChoiceResponse" QuestionID="Sleep_Wk1Interest_1c">
  Why is this <Bold>Sleep Module</Bold> of interest to you?<LineBreak/>
  Please select all that apply.
  <MultiChoiceResponse>
      <Response Text="This health kiosk suggested that I complete this module." Score="4"/>
      <Response Text="Not sleeping well gives me daytime problems that bother me." Score="3"/>
      <Response Text="None of the above" Score="0"/>
  </MultiChoiceResponse>
</Question>

 SlideSet>SleepModule_Wk1_Part3</SlideSet>

<Question Type="SingleChoiceResponse" QuestionID="Sleep_Wk1 Agree_2">
  <Bold>Agreement to Participate</Bold><LineBreak/><LineBreak/>Do you agree to engage in the activi
  <SingleChoiceResponse>
      <Response Text="Yes, I agree." Score="1"/>
      <Response Text="No, I do not agree." Score="0"/>
  </SingleChoiceResponse>
</Question>

<Decision>
  <QuestionCondition QuestionID="Sleep_Wk1 Agree_2" Response="Yes, I agree.">
    <GoTo SegmentID="Part3"/>
  </QuestionCondition>
</Decision>

<Decision>
  <QuestionCondition QuestionID="Sleep_Wk1 Agree_2" Response="No, I do not agree.">
    <GoTo SegmentID="Part2"/>
  </QuestionCondition>
</Decision>

</Segment>

Segment ID="Part2" ViewedByAll="False"
DateTime dirCreation = (new DirectoryInfo(fullPath)).CreationTime;

if (dirCreation > fileCreation)
    return; //directed created after pptx, don't need to re-extract slides

Array.ForEach(Directory.GetFiles(fullPath), File.Delete); //directory exists, delete all

string imagesLocation = fullPath;


try
{
    Microsoft.Office.Interop.PowerPoint.Presentation p = ps.Open(pptxLocation, MsoTriState.msoTriStateTrue);

    {
        int slideNumber = pptSlide.SlideNumber;
        string slideImageName = String.Format("Slide{0}.png", slideNumber);

        Console.WriteLine(String.Format("Found slide: {0}", slideNumber));

        pptSlide.Export(Path.Combine(imagesLocation, slideImageName), "PNG", 1024, 768);

        rawPPTSlides.Add(pptSlide);
    }
}
Multi-user Health Kiosk

- Touch Screen
- RFID Card and Key Fob
- Embedded RFID Reader
- Hand Dynamometer
- Pulse Oximeter
- Blood Pressure Monitor
- Secure side cabinets for computer, printer, and paper storage
- Seated Scale