A Cognitive Task-Analytic Framework for eHealth Literacy

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eHealth Literacy

- Set of knowledge and skills to fully engage in and benefit from eHealth tools
- Understanding gaps and barriers between a consumer/patient and an eHealth tool
- Can patients/consumers use a system or tool proficiently and autonomously
- Solutions for minimizing the digital divide
- Literacy as a mastery of cultural practices
  - Multiple literacies in eHealth

4:10-4:30 PM Monday, November, 16th
Consumer eHealth

- Devices, software and websites designed to facilitate:
  - Patients management of their health and wellness
  - Facilitate communication with providers and peers
- In-home devices and Home Telehealth
  - Remote monitoring
- Software
  - PDA software, Home PC software
- Websites
  - Information and resource portals (MedlinePlus, WebMD)
  - Patient education resources (tutorials, health games)
  - Decision support tools
Promise of Consumer eHealth

- Promote self management of chronic illness
- Educate patient and consumer about health
- Increase patient autonomy and choice
- Enable systematic monitoring and close scrutiny
- Adjust therapeutic regimens
- Increase healthcare provider-patient contact
- Increase access to health for medically underserved patients

- Potential to transform healthcare
- Potential to exacerbate health disparities

- Not a matter of choice
Widening Gulf in Consumer Health

- Design and Usability
- User knowledge and competence
Video
System Barriers (IDEATel study)

INTERFACE and SYSTEM:

- Wide world of widgets
  - Scroll bar, buttons and links
- Font size, spacing of links
- Task complexity
- Screen transitions
- System stability
- Human factors/ergonomics
Literacies

- Computer
- Health
- Basic Literacy
- Numeracy
Numeracy and Representational Fluency

- Understanding of covariation
- Cells and Rows
- Correspondence between monitoring device display and tabular presentation
- Recognizing anomalous/abnormal results
- Representations of bounded periods of time
- Discerning patterns of change over time
  - Drawing appropriate inferences
Representational Equivalence
Touchscreen
Different tools offer different resources and affordances
Different tasks make demands on different sets of reasoning and analysis skills
<table>
<thead>
<tr>
<th>Topic</th>
<th>Last reply by</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does anyone practice DBT or mindfulness?</td>
<td>1 minute ago</td>
<td>7 replies</td>
</tr>
<tr>
<td>nobody's in chat room and I'm having some kind of episode!</td>
<td>4 minutes ago</td>
<td>95 replies</td>
</tr>
<tr>
<td>Scary future</td>
<td>11 minutes ago</td>
<td>11 replies</td>
</tr>
<tr>
<td>PREDICTING OURSELVES TO HELL............WE CAN STOP</td>
<td>22 minutes ago</td>
<td>3 replies</td>
</tr>
<tr>
<td>Power of the Mind!</td>
<td>30 minutes ago</td>
<td>26 replies</td>
</tr>
<tr>
<td>Love verses a better life</td>
<td>about 1 hour ago</td>
<td>3 replies</td>
</tr>
</tbody>
</table>
NexProfiler Tool for Breast Cancer

STEP 1. BREAST CANCER QUESTIONNAIRE

Just as each person is unique, so is each diagnosis of breast cancer.

Welcome to the NexProfiler™ Treatment Options Tool for Breast Cancer. Your treatment options and outcomes reports are based on your answers to the questionnaire below. While you need not answer all the questions, you need to answer only 10 marked with a red asterisk to continue to the Next Step and receive your reports. Complete the steps in order, if you cannot answer some questions, or cannot complete the questions, click on Save and your answers will be stored for use when you return to this site.

This NexProfiler Tool for Cancer is designed for patients with invasive ductal and lobular breast cancer and ductal carcinoma in situ (DCIS or non-invasive breast cancer). Lobular carcinoma in situ (LCIS or non-invasive breast cancer) is not included as it is considered a marker of increased risk for invasive breast cancer, but not a true malignancy or cancer.

Please note: in some cases (although not common), separate and unrelated tumors can develop in both breasts and are discovered at the time of diagnosis. If this situation applies to you, you will need to profile each breast cancer separately, using a separate username and password for each tumor.

If your breast cancer is recurrent please return to the Select Your NexProfiler Tool for Cancer Type page to change your NexProfiler Tool type to “Recurrent”. There you will find the questionnaire and treatment options for your situation.
### Mastectomy

#### Summary Report:

<table>
<thead>
<tr>
<th>Treatment Factors to Consider</th>
<th>Your Answer</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your cancer spread to other areas of the body such as the lung, liver, or bone (Stage IV disease)?</td>
<td>No</td>
<td>OK</td>
</tr>
<tr>
<td>Are you in good general health?</td>
<td>Yes</td>
<td>OK</td>
</tr>
<tr>
<td>Are you minimally able to care for yourself and do you only need assistance occasionally?</td>
<td>Yes</td>
<td>OK</td>
</tr>
<tr>
<td>Does your doctor say you are a surgical candidate (medically fit and a good surgical risk)?</td>
<td>Yes</td>
<td>OK</td>
</tr>
<tr>
<td>Does your doctor say your tumor can be removed by surgery (is operable/resectable)?</td>
<td>Yes</td>
<td>OK</td>
</tr>
<tr>
<td>Do you have cancer appearing microcalcifications throughout the breast?</td>
<td>Yes</td>
<td>OK</td>
</tr>
</tbody>
</table>
| Do you have:  
  - multiple tumors in the same area (quadrant), or  
  - tumors in more than one area (quadrant) of the breast? | No          |      |
| Do you have:  
  - cancer that has spread into the skin of the breast or the chest wall, or  
  - inflammatory type breast cancer?                                                          | No          | OK   |

[Discuss with MD]
# Treatment Decision Tools

## Breast Conserving Surgery Only (selected patients)

### Summary Report:

<table>
<thead>
<tr>
<th>Treatment Factors to Consider</th>
<th>Your Answer</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has your cancer spread to other areas of the body such as the lung, liver, or bone (Stage IV disease)?</td>
<td>No</td>
<td>OK</td>
</tr>
<tr>
<td>Is your general health poor or frail?</td>
<td>No</td>
<td>Discuss with MD (1)</td>
</tr>
<tr>
<td>Are you partially or completely disabled so that you need help with many or all of your personal needs and general activities of daily living?</td>
<td>No</td>
<td>Discuss with MD (2)</td>
</tr>
<tr>
<td>Does your doctor say you are a surgical candidate (medically fit and a good surgical risk)?</td>
<td>Yes</td>
<td>OK</td>
</tr>
<tr>
<td>Does your doctor say your tumor can be removed with breast conserving surgery and satisfactory cosmetic results?</td>
<td>Yes</td>
<td>OK</td>
</tr>
<tr>
<td>Do you have ductal carcinoma in situ (DCIS) &amp; low grade (1 or 2)?</td>
<td>Not Enough Data</td>
<td>Not Enough Data</td>
</tr>
<tr>
<td>Are your surgical margins negative (clear of cancer cells)?</td>
<td>Yes</td>
<td>OK (3)</td>
</tr>
<tr>
<td>Is your tumor size less than or equal to 2.5 centimeters (cm)?</td>
<td>Yes</td>
<td>OK</td>
</tr>
</tbody>
</table>
| Do you have:  
  • cancer-appearing microcalcifications throughout the breast or  
  • on the post-biopsy mammogram (if one was necessary)?                                    | Yes         | Discuss with MD (4)  |
| Do you have a single tumor confined to one area (quadrant) of the breast?                    | Yes         | OK                   |
Welcome MyChart User

Health Summary

The Health Summary provides you with a convenient summary of important information in your health record. Your summary includes up-to-date information concerning your current health issues, medications, allergies, immunizations, and health reminders.

Help with Hyperlinks

Name: ____________________________
Medical Record Number: ____________
Primary Physician: Alan M. Weiss, MD
Clinic: Ccf Main Campus

Current Health Issues

Enter Search Keyword: ____________________________
Search

Health Issue: ____________________________
Date Noted: ____________________________

Hypertension (High Blood Pressure)
Elevated Cholesterol

Medications

Name: ____________________________
Instructions: ____________________________
Provider: ____________________________

GLUCOPHAGE 500 MG ORAL TAB
Take One(1) Tablet Three(3) Times Daily.
EpicCare Test MD

Health Reminders

Name: ____________________________
Due Date: ____________________________
Status: ____________________________
Last Done: ____________________________

Plasma Glucose Check
02/23/2007
02/23/2004

Cholesterol & Ldl Check M
04/11/2010
04/11/2005

Tetanus
03/15/2014
03/15/2004

If you would like to find out more information on your Health Reminders, click here:

Back to the previous page...
Fitness Articles

NYC marathoners running through the heart of Harlem

THE ING NEW YORK CITY MARATHON Nov. 1, 2009

Just because you’re old doesn’t mean you can’t exercise!

Exercise Tips for Older Americans:
- Check with your doctor before beginning an exercise routine.
- Pick rhythmic, repetitive activities and exercise at a pace that works for you.
- Pick activities that are fun, suit your needs and that you can do year-round.

Recent comments
- Sounds like a great idea! How 7 hours 19 min ago
- Hey, thanks! So, we’ve met? 7 hours 20 min ago
- Let’s start a 23 hours 52 min ago
- Thanks! In the meantime, take 23 hours 54 min ago
- Thanks for the link! I just 1 day 18 hours ago
- We should all be aware of the 1 day 18 hours ago
- Hi Nancy… I am not 2 days 11 hours ago
- This sounds awesome! I wish 1 2 days 13 hours ago
- Wow, I never would have 2 days 13 hours ago
Fancy Glucose Meters
LifeScan UltraSmart
Health Literacy

- Measure of patients’ ability to read, comprehend, and act on medical instructions
  - Difficulties processing oral communications
  - Conceptualizing risk
- Range of knowledge and competencies including cultural and conceptual knowledge, listening, speaking, quantitative, writing and reading skills (McCray, 2005)
  - The gamut of all interactions with the healthcare system
- Low literacy associated with poor healthcare outcome.
Cognitive eHealth Literacy Framework

- **eHealth Literacy model**
  - “fundamental skills consumers require to derive direct benefits from eHealth” (Norman & Skinner, 2006)

- **Revised Bloom’s Taxonomy**
  - Cognitive aspects of learning, skill acquisition, and performance (Bloom, 1956) (Krathwohl, 2002)

- **Models of Information Seeking and Decision Making**

- **Web Navigation/user trajectories (Colides)**
  - How people attend and comprehend
  - Kitajima, Polson and Blackmon (2006)
eHealth Literacy: the Lily Model

(Norman & Skinner, 2006)
Revised Bloom’s Taxonomy
Cognitive Processes

# eHealth Literacy Taxonomy

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remembering</td>
<td>Understanding</td>
<td>Applying</td>
<td>Analyzing</td>
<td>Evaluating</td>
<td>Creating</td>
</tr>
</tbody>
</table>

- **Computer Literacy**
- **Information literacy**
- **Media literacy**
- **Traditional Literacy & Numeracy**
- **Science literacy**
- **Health literacy**
# eHealth Literacy Taxonomy

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
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<th>4</th>
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</tbody>
</table>

- **Computer Literacy**
- **Information literacy**
- **Media literacy**
- **Traditional Literacy & Numeracy**
- **Science literacy**
- **Health literacy**

**C1**
Know what a computer and its associated components are (such as keyboard, mouse, monitor)
# eHealth Literacy Taxonomy

<table>
<thead>
<tr>
<th></th>
<th>1 Remembering</th>
<th>2 Understanding</th>
<th>3 Applying</th>
<th>4 Analyzing</th>
<th>5 Evaluating</th>
<th>6 Creating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer literacy</td>
<td></td>
<td></td>
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<td></td>
</tr>
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<td>Information literacy</td>
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<td></td>
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<td>Media literacy</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Traditional Literacy &amp; Numeracy</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Science literacy</td>
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<td></td>
</tr>
<tr>
<td>Health literacy</td>
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</tr>
</tbody>
</table>

**H3**
Use health information appropriately, ex) following medication directions
# eHealth Literacy Taxonomy

<table>
<thead>
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<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
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</tr>
</thead>
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<td></td>
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</tr>
<tr>
<td>Information literacy</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Media literacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional Literacy &amp;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numeracy</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Science literacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health literacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**S5**
Evaluate science-based information for accuracy, context. Weigh evidence, evaluate strengths and weaknesses of evidence.
Cognitive Task Analysis (CTA)

- Tools and techniques for describing knowledge and strategies required for task performance
  - Hierarchical Decomposition of Goals and Component Tasks

- Objective: Yield information about the knowledge, thought processes, and goal structures that underlie observable task performance

- Performed by Expert Analysts

4:10-4:30 PM
Cognitive Task Analysis (CTA)

1) identify steps used to complete task

2) characterize skills and knowledge required to complete each step

3) apply corresponding framework code to each step
Save Energy, Save Money

68 products & tips that can save you thousands
Today’s health news

- Our tests find range of BPA in canned food
- Most reliable condoms: We tested 20
- Overpriced: Just say ‘no’ to Nexium
- Swine flu shots: What you need to know
- CU backs the House health reform bill
- More health news

Conditions

Treatment Ratings

- What’s the best for high cholesterol?
  - We reviewed the evidence and found...

Common Conditions

- Back pain
- Cholesterol
- Depression
- Heart attack
- Erection problems
- Prostate cancer
- Dental problems

Health Experts

Partners in crime:
- Diabetes and obesity
- Marvin Lipman, M.D.
  - Consumer Reports chief medical adviser

Find the Best Rated Hospitals

- Find the best hospitals nationwide
Example question

- Identify the hospital that is least aggressive on the “Aggressive or Conservative” scale.

- What do these ratings of “Aggressive or Conservative” tell you about the hospital?
1. Identify the hospital that is least aggressive on the “Aggressive or Conservative” scale.

2. What do these ratings of “Aggressive or Conservative” tell you about the hospital?

4:10-4:30 PM
<table>
<thead>
<tr>
<th>Step #</th>
<th>Skills and Knowledge Required to Complete Step</th>
<th>Literacy and Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recognize results as a table of the 3 selected hospitals with their detailed ratings</td>
<td>Information 4 Numeracy 4</td>
</tr>
<tr>
<td>2</td>
<td>find the Aggressive or Conservative row of the table</td>
<td>Information 2 Numeracy 4 Reading 1</td>
</tr>
<tr>
<td>3</td>
<td>understand the legend for the Aggressive/Conservative scale - Understand that the &quot;least aggressive&quot; is furthest away from &quot;Most Aggressive&quot; end of scale, or closest to &quot;Most Conservative end of scale</td>
<td>Reading 2 Numeracy 4</td>
</tr>
<tr>
<td>4</td>
<td>Identify the hospital with the least aggressive rating</td>
<td>Numeracy 4 Reading 1</td>
</tr>
<tr>
<td>5</td>
<td>click on the &quot;learn more&quot; link, find the newly opened window, scroll down to description of what Aggressive/Conservative means, and understand and explain text</td>
<td>Computer 3 Reading 2 Writing 3 Health 4</td>
</tr>
</tbody>
</table>

By increasing complexity: 1=Remembering, 2=Understanding, 3=Applying, 4=Analyzing, 5=Evaluating, 6=Creating
Results of hospital ratings

Description of hospital ratings

The Hospital Ratings below are based on survey responses from more than 1 million patients. We know that higher patient ratings can mean higher quality of care. You can sort and refine your search and select up to five hospitals to compare. Click on a specific hospital to see more details behind these Ratings. Find out how well a hospital follows the correct procedures to prevent surgical infections and, for some states, the hospital's bloodstream infection rates.

Hospital Ratings

What's behind our Ratings?
Our Hospital Ratings are based on survey responses from more than 1 million patients from thousands of hospitals.

Ratings Preview
Showing 15 hospitals

Comparison of hospital ratings

Select up to 5 hospitals to compare for more detailed ratings

Sort by:
Overall Patient Rating
Doctor Communication
Nurse Communication
Room Cleanliness
Discharge Instructions

Hospital Name
Overall Patient Rating
Doctor Communication
Nurse Communication
Room Cleanliness
Discharge Instructions

1. U.S. Top Rated for Overall Patient Rating
   Details
   100

2. Hospital for Special Surgery
   New York, NY
   83

3. New York-Presbyterian Hospital
   New York, NY
   72

Table Legend

Indicator of subscription content
<table>
<thead>
<tr>
<th>Hospital Name</th>
<th>Rating</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital for Special Surgery</td>
<td>72</td>
<td>New York, NY</td>
</tr>
<tr>
<td>New York-Presbyterian Hospital</td>
<td>65</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Mount Sinai Hospital</td>
<td>64</td>
<td>New York, NY</td>
</tr>
<tr>
<td>New York Eye and Ear Infirmary</td>
<td>63</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Lenox Hill Hospital</td>
<td>63</td>
<td>New York, NY</td>
</tr>
<tr>
<td>New York Univ Medical Center</td>
<td>63</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Bellevue Hospital Center</td>
<td>60</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Metropolitan Hospital Center</td>
<td>59</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Beth Israel Medical Center</td>
<td>56</td>
<td>New York, NY</td>
</tr>
<tr>
<td>Harlem Hospital Center</td>
<td>55</td>
<td>New York, NY</td>
</tr>
</tbody>
</table>

You have chosen to compare:

Select up to 5 hospitals to compare for more detailed ratings.

---

INSIDE OUR RATINGS

We create unbiased health ratings to help you make informed decisions. Learn more.

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Human Performance of tasks

Data collection
- eHealth surveys
  - Health literacy
  - Numeracy
  - Computer and Internet self-efficacy
- Task categories
  - Information seeking
  - Decision making
  - Communication

Data analysis
- Rate answers
- Task performance
- eHealth literacy and complexity
# Preliminary findings

<table>
<thead>
<tr>
<th>Subject</th>
<th>S-TOFHLA Health Literacy</th>
<th>Numeracy (3 total questions)</th>
<th>Computer and Internet self-efficacy (1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adequate (36)</td>
<td>1</td>
<td>4.00</td>
</tr>
<tr>
<td>2</td>
<td>Adequate (36)</td>
<td>0</td>
<td>3.94</td>
</tr>
<tr>
<td>3</td>
<td>Adequate (36)</td>
<td>2</td>
<td>3.38</td>
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<tr>
<td>4</td>
<td>Adequate (33)</td>
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<td>3.56</td>
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<td>5</td>
<td>Adequate (35)</td>
<td>0</td>
<td>4.06</td>
</tr>
<tr>
<td>6</td>
<td>Adequate (35)</td>
<td>1</td>
<td>4.00</td>
</tr>
<tr>
<td>Step #</td>
<td>Skills and Knowledge Required to Complete Step</td>
<td>Code from CTA</td>
<td>Code from Observation</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------</td>
<td>---------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>3</td>
<td>understand the legend for Aggressive, Conservative scale - Understand that &quot;least aggressive&quot; is furthest away from &quot;Most Aggressive&quot; end of scale, or closest to &quot;Most Conservative end of scale</td>
<td>Reading 2, Numeracy 4</td>
<td>Reading 2, Numeracy 3</td>
</tr>
<tr>
<td>4</td>
<td>Identify the hospital with the least aggressive rating</td>
<td>Numeracy 4, Reading 1</td>
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By increasing complexity: 1=Remembering, 2=Understanding, 3=Applying, 4=Analyzing, 5=Evaluating, 6=Creating
## Preliminary findings

<table>
<thead>
<tr>
<th>Participant</th>
<th>Hospital task</th>
<th>Blood Pressure task</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Task performance score (max = 44)</td>
<td>Task performance score (max = 34)</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>6</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

✓ = correct answer  
X = Incorrect answer  
Task Performance Score per step (0-2): Difficulty, omissions, erroneous inferences, prompts
Conclusions

- One man’s affordance is another one’s HL demand
- Understand and bridge gaps between tools and consumer skills
- Aim to characterize knowledge and skills, and their association with eHealth tasks
- Range of health domains and eHealth tools
Conclusions

- design guidelines of tools
- evaluation heuristics
- task-based eHealth literacy assessment
- education objectives and curriculum
- educational media or other mediating tools
Thank you!
Question
Traditional Literacy and Numeracy: Reading and understanding written passages, speaking and writing a language coherently, quantitative skills and the ability to interpret information artifacts such as graphs, scales, and forms

Health literacy: acquisition, evaluation, and appropriate application of relevant health information that allows consumers to communicate about health, make health decisions, and utilize health services

Information Literacy: skills to articulate information needs, to locate, evaluate, and use information, and to apply information to create and communicate knowledge

Media literacy: ability to select, interpret, evaluate, contextualize, and create meaning from resources presented in a variety of visual or audio forms

Computer Literacy: skills to use computers to solve problems; these skills span a wide range from basic knowledge such as how to open a browser window to developing computer applications

Science literacy: a) familiarity with basic biological concepts, b) familiarity with scientific method, and the ability to understand, evaluate, and interpret health research findings using appropriate scientific reasoning
Bloom’s Taxonomy – Cognitive Processes

- **Creating** - putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing

- **Evaluating** - making judgments based on criteria and standards through checking and critiquing

- **Analyzing** - breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing

- **Applying** - carrying out or using a procedure through executing or implementing

- **Understanding** - constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining

- **Remembering** - retrieving, recognizing, and recalling relevant knowledge from long-term memory

## Preliminary findings

<table>
<thead>
<tr>
<th>Subject</th>
<th>Gender</th>
<th>Education</th>
<th>Age Group</th>
<th>Sources of Health Info</th>
<th># Times searched for health info online</th>
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<td>Internet</td>
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<td>Books, Magazines, Employer</td>
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<td>Magazines, News, Computer, TV</td>
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