visualization for communicating health

Benjamin Watson
bwatson@ncsu.edu
vxlab.csc.ncsu.edu

go-vxlab.csc.ncsu.edu/vizforhealthtalk

go-vxlab.csc.ncsu.edu/vizforhealthpaper
ehr adoption and promise
Find Patients in ED

From date: 1/3/2017 (T-7) 05:55 PM (N)
To date: 1/10/2017 (T) 05:55 PM (N)

ED Events to Include

- ED ARRIVED
- ED ARRIVED
- Providers: My patients?
- Yes

Find Patients in ED between 1/3/2017 (T-7) 05:55 PM (N) and 1/10/2017 (T) 05:55 PM (N)
Basic EHR adoption increased while certified EHR adoption remained high.

Figure 1: Percent of non-Federal acute care hospitals with adoption of at least a Basic EHR with notes system and possession of a certified EHR: 2008-2015.

NOTES: Basic EHR adoption requires the EHR system to have a set of EHR functions defined in Table A1. A certified EHR is EHR technology that meets the technological capability, functionality, and security requirements adopted by the Department of Health and Human Services. Possession means that the hospital has a legal agreement with the EHR vendor, but is not equivalent to adoption.

*Significantly different from previous year (p < 0.05).

SOURCE: ONC/American Hospital Association (AHA), AHA Annual Survey Information Technology Supplement.
For all states, at least 6 in 10 hospitals adopted a Basic EHR.

Figure 4: Percent of non-federal acute care hospitals with adoption of at least a Basic EHR system at the State-Level for years 2008, 2011, and 2015.

NOTES: Basic EHR adoption requires the EHR system to have at least a basic set of EHR functions, including clinician notes, as defined in Table A1. Estimates for states shaded gray did not meet the standards for reliability (NR). See the Table A2 for a complete list of 2008, 2011, and 2015 hospital adoption by state.

Trends in EHR adoption show increasing use of advanced functionality.

Figure 5: Percent of non-federal acute care hospitals with adoption of EHR systems by level of functionality: 2008-2015.

NOTES: Definitions of Basic EHR and Comprehensive EHR systems are reported in Table A1.
*Significantly different from previous year (p < 0.05).
ehr ux is not good
Q11. What impact, if any, has using the EMR/EHR had on your free time?

<table>
<thead>
<tr>
<th>Description</th>
<th>Count (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have much more free time (e.g., I get home much earlier and/or have much less patient chart-and practice-related work at home)</td>
<td>9 (2.2)</td>
</tr>
<tr>
<td>I have somewhat more free time (e.g., I get home somewhat earlier and/or have somewhat less patient chart-and practice-related work at home)</td>
<td>52 (12.7)</td>
</tr>
<tr>
<td>It’s had no impact on my free time. (Assume zero minutes; skip to Q14.)</td>
<td>106 (25.8)</td>
</tr>
<tr>
<td>I have somewhat less free time (e.g., I get home somewhat later and/or have somewhat more patient chart-and practice-related work at home)</td>
<td>153 (37.2)</td>
</tr>
<tr>
<td>I have much less free time (e.g., I get home much later and/or have much more patient chart-and practice-related work at home).</td>
<td>91 (22.1)</td>
</tr>
</tbody>
</table>

Q12. On average how many minutes of free time have you gained per clinic day? (n = 61), mean (SD)

   39.0 (21.4)

Q13. On average, how many minutes of free time have you lost per clinic day? (n = 244), mean (SD)

   -77.5 (40.9)

Q15. Which tasks, if any, take more of your overall time to perform using the EMR than they did before you used the computer? (Consider both the time to complete each task as well as any increase/decrease in the number of tasks. Choose all that apply.) (n = 410)

<table>
<thead>
<tr>
<th>Task</th>
<th>Count (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing takes longer</td>
<td>42 (10.2)</td>
</tr>
<tr>
<td>Managing calls and messages, refill requests, and new test results (With the EMR, these are usually in-box functions.)</td>
<td>129 (31.5)</td>
</tr>
<tr>
<td>Writing visit notes</td>
<td>262 (63.9)</td>
</tr>
<tr>
<td>Ordering and scheduling tests</td>
<td>166 (40.5)</td>
</tr>
<tr>
<td>Finding and reviewing medical record data</td>
<td>143 (34.9)</td>
</tr>
<tr>
<td>Writing prescriptions</td>
<td>101 (24.6)</td>
</tr>
<tr>
<td>Reading the clinical notes that other clinicians enter into your office EMR</td>
<td>132 (32.2)</td>
</tr>
<tr>
<td>Other (28 write-ins [which included 7 unique responses])</td>
<td>28 (6.8)</td>
</tr>
</tbody>
</table>
Response spectrum: 'This EHR helps me see more patients per day (or go home earlier) than I could with paper charts.'
Response spectrum: 'This EHR doesn’t just enable me to meet meaningful use criteria; it actually helps me provide better patient care.'
Figure 3. Physician Satisfaction with EHRs (n = 3,239)*

- Very Satisfied: 35%
- Somewhat Satisfied: 38%
- Somewhat Dissatisfied: 13%
- Very Dissatisfied: 14%

*Analysis based on respondents who reported having an EHR at their main practice location and who answered the question about satisfaction with EHRs.
Response Spectrum: Sum of all responses to the 19 'satisfaction' items.
Response spectrum: 'This EHR helps me focus on patient care rather than on the computer.'
<table>
<thead>
<tr>
<th>Impact</th>
<th>Physicians n=106</th>
<th>Patients n=392</th>
<th>p (^{a})</th>
</tr>
</thead>
<tbody>
<tr>
<td>On duration of the consultation (^{b})</td>
<td>-0.31 (1.174) (^{c})</td>
<td>+0.72 (1.039) (^{c})</td>
<td>0.000</td>
</tr>
<tr>
<td>On confidentiality</td>
<td>-0.38 (1.060)</td>
<td>+0.83 (0.984)</td>
<td>0.000</td>
</tr>
<tr>
<td>On ability to look at the patient</td>
<td>-1.12 (0.902)</td>
<td>+0.57 (1.222)</td>
<td>0.000</td>
</tr>
<tr>
<td>On ability to listen to the patient</td>
<td>-0.72 (0.837)</td>
<td>+0.64 (1.107)</td>
<td>0.000</td>
</tr>
<tr>
<td>On ability to talk to the patient and collect information</td>
<td>+0.92 (1.079)</td>
<td>+0.70 (1.124)</td>
<td>0.085</td>
</tr>
<tr>
<td>On ability to provide information to the patient</td>
<td>+1.08 (0.852)</td>
<td>+0.98 (1.017)</td>
<td>0.338</td>
</tr>
<tr>
<td>On ability to understand the patient</td>
<td>-0.03 (0.736)</td>
<td>+0.81 (1.068)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

\(^{a}\) Independent-Samples T Test, 95% Confidence Interval.

\(^{b}\) Scores ranging from -2=very negative impact to +2=very positive impact.

\(^{c}\) Mean (Standard Deviation).
visualization can help
The areas of the blue, red, & black wedges are each measured from the centre as the common vertex.
The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic Diseases, the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes.
The black line across the red triangle in No. 1854 marks the boundary of the deaths from all other causes during the month.
In October 1854, & April 1855, the black area coincides with the red, in January & February 1856, the blue coincides with the black.
The entire areas may be compared by following the blue, the red & the black lines enclosing them.
visualization for communication
SUGAR: TOO MUCH OF A SWEET THING

The American Heart Association recommends that women consume no more than 6 teaspoons and men no more than 9 teaspoons of added sugars per day. Even one 20 oz. soda contains far more than that.

- 6 teaspoons added sugars for women per day
- 9 teaspoons added sugars for men per day

VS

- 15 teaspoons of sugars in a 20 oz. Coke

23 teaspoons
Actual added sugars consumed by average American per day

385 Calories consumed daily from added sugars by the average American

Burning those calories would take:

- Walking: 1¼ hours
- Basketball: 1 hour
- Biking: ¾ hour
- Jogging: ¾ hour

source
engagement
memorability
MONSTROUS COSTS
Total House and Senate campaign expenditures, in millions

MONSTROUS COSTS
Total House and Senate campaign expenditures, in millions

1972  '74  '76  '78  '80  '82 est.

Figure 1. A chart by Holmes [7] (above), and a ‘plain’ version.
understanding
Expelling 60 Russians, U.S. Joins Allies in a Harsh Rebuke
by KATIE ROGERS and PETER BAKER

- President Trump ordered 60 Russian officials to leave the country, joining a coordinated campaign by two dozen countries to retaliate for the poisoning of a former Russian spy in Britain.
- The joint action intensified the conflict between Russia and the West, yet Mr. Trump avoided any public condemnation of Russia’s role in the attack.

How an Outraged Europe Agreed to a Hard Line on Putin
by STEVEN GILANDER 2:36 AM ET

Faced with new aggressiveness from the newly re-elected President Vladimir V. Putin, the European Union backed Britain and sent a strong message to Moscow.

She Was Shot in Parkland. Can She Turn Trauma Into Change?
Onstage, Samantha Fuentes, 18, is helping to lead a national conversation about gun control. Behind the scenes, she’s reeling from mental and physical trauma.

Listen to ‘The Daily’: Violence as Daily Threat
Students on the South Side of Chicago joined protests spurred by the Florida school shooting, but they also felt frustration. Why hadn’t gun violence in their community earned the same outrage?
disjoint grouping

reinforced grouping

cmn

col

A B C D

H E F G

A B C D

H E F G

cmn-col

cmn

col

cmn

col

A B C D

H E F G

A B C D

H E F G

cmn-col

cmn

col

cmn

col

A B C D

H E F G

A B C D

H E F G

cmn-col

cmn

col

cmn

col

source
### Recorded response of children for playing computer games (in %).

<table>
<thead>
<tr>
<th>Reason for playing video games</th>
<th>Agree percentage</th>
<th>Reason type</th>
</tr>
</thead>
<tbody>
<tr>
<td>It's just fun</td>
<td>94.85</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Something to do when bored</td>
<td>89.05</td>
<td>Non-violent</td>
</tr>
<tr>
<td>It's exciting</td>
<td>79.8</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Challenge of figuring things out</td>
<td>79.35</td>
<td>Non-violent</td>
</tr>
<tr>
<td>To compete and win</td>
<td>73.2</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Nothing else to do</td>
<td>64.65</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Helps me relax</td>
<td>53.5</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Create my own world</td>
<td>52.5</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Learn new things</td>
<td>52.25</td>
<td>Non-violent</td>
</tr>
<tr>
<td>To forget problems</td>
<td>45</td>
<td>Non-violent</td>
</tr>
<tr>
<td>My friends like to play</td>
<td>36.5</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Teach others how to play</td>
<td>34</td>
<td>Non-violent</td>
</tr>
<tr>
<td>I like to &quot;MOD&quot; games</td>
<td>31.75</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Feel less lonely</td>
<td>29</td>
<td>Non-violent</td>
</tr>
<tr>
<td>Make new friends</td>
<td>14.75</td>
<td>Non-violent</td>
</tr>
<tr>
<td>To get my anger out</td>
<td>37</td>
<td>Violent</td>
</tr>
<tr>
<td>Like guns and weapons</td>
<td>35</td>
<td>Violent</td>
</tr>
</tbody>
</table>
visualization for communicating health
engagement & persuasion
Figure 2: Body Mass Index (BMI) infographic from WICER showing an out-of-range value (38.3). Initially, we presented the body silhouettes (top portion) and the reference range number line (bottom portion) in participatory design sessions as separate graphical formats. We combined them into a single infographic at the suggestion of design session participants. The attributes of the data drove numerous design decisions.
understanding
Figure 5. Icon arrays representing a treatment risk reduction of 50% with (a) equal and (b) different samples of treated and nontreated individuals. Affected individuals are represented in dark gray. Healthy individuals are represented in light gray.
Figure 4. Percentage of participants with low and high numeracy and low and high graph literacy who correctly inferred treatment risk reduction, as a function of condition (numbers vs. visual aids). In the visual-aids condition, icon arrays and bars reported the entire population at risk. Error bars represent one standard error. Adapted from “Who Profits From Visual Aids: Overcoming Challenges in People’s Understanding of Risks,” by R. Garcia-Retamero and M. Galesic, 2010, Social Science & Medicine, 70, 1019–1025. Copyright 2010 by Elsevier Ltd. Adapted with permission.
Figure 4. Percentage of participants with low and high numeracy and low and high graph literacy who correctly inferred treatment risk reduction, as a function of condition (numbers vs. visual aids). In the visual-aids condition, icon arrays and bars reported the entire population at risk. Error bars represent one standard error. Adapted from “Who Profits From Visual Aids: Overcoming Challenges in People’s Understanding of Risks,” by R. Garcia-Retamero and M. Galesic, 2010, Social Science & Medicine, 70, 1019–1025. Copyright 2010 by Elsevier Ltd. Adapted with permission.
open problems
thanks.
questions?

Benjamin Watson
bwatson@ncsu.edu
vxlab.csc.ncsu.edu

go-vxlab.csc.ncsu.edu/vizforhealthtalk
go-vxlab.csc.ncsu.edu/vizforhealthpaper