Supplementary Appendix A: Cases and Survey Questions

Today is (DATE)

Bold indicates intended correct answers.

Each case was followed by a question about the case’s relative difficulty, rated 1 to 7.

Case 1. Diabetes
You are a busy primary care physician with a transferred patient from a colleague who you have not met named Eleanor Smith.

Ms. Smith is a 60-year old woman with a 1-year history of diabetes. She has come in several times since her diagnosis and seems to be adherent. All preventive care and cancer screening is up to date. She reports that she has not changed any health habits or her lifestyle.

Laboratory values and other clinical data visible in the electronic health record.

In addition:
- Fasting glucose 220
- Urine: +1 protein

**Question 1.1**
Does HbA1c look out of range?
HbA1c – yes___/no___

Does the creatinine look abnormal or concerning to you?
Creatinine – yes___/no___

Does the BMI look abnormal or concerning to you?
BMI – yes___/no___

Why did you make those choices?

**Question 1.2**
What is the next measure you would take for Ms. Smith?
A. Recommend diet and exercise
B. D/C metformin
C. D/C metformin and add insulin
D. D/C metformin and add another oral diabetic medication
E. D/C metformin, add insulin, and add another oral diabetic medication

Why did you make that choice?

**Question 1.3**
What other medications would it be important to add? (can choose more than one)
A. Sulfonylurea
B. ACE Inhibitor (other answers also potentially correct.
We wanted to see if they added an ACE given Cr rise)
C. Loop diuretic
D. DPP-4 Inhibitor

Why did you make that choice?

**Question 1.4**
What other test(s) would you conduct?
A. None indicated
B. Electrolytes
C. Liver panel
D. Colonoscopy
E. Chest radiograph and CBC

Why did you make that choice?

**Question 1.5**
Ms. Smith says she has not changed her diet and has not increased her exercise. What is your next step?
A. Encourage her to begin exercising as all patients should exercise
B. Ask about recent weight gain/loss and goals
C. Refer to physical therapy

Why did you make that choice?

New Page

1.6
Did you notice that her Cr was rising?
Did you notice that her weight was decreasing?

Case 2
Mr. B is an otherwise healthy 55-year-old man. He feels well and says he is compliant with his medications, but his A1C has been increasing and he reports his home blood sugars are in the 200 range in the mornings. His history is significant for diabetes and hypercholesterolemia. He is been having some shortness of breath over the past month. A recent stress was negative and a chest X-ray showed mild interstitial edema.

He is still having shortness of breath, so he comes to you today.

Medications and laboratories in the electronic health record (EHR).

**Question 2.1**
What would you do next?
A. D/C metformin and thiazolidinedione
B. D/C metformin
C. D/C thiazolidinedione
D. Add buproprion

Why did you make that choice?

**Question 2.2**
What medication would you add? The following are all covered with the same copayment and he is not adverse to injections.
A. GLP-1 analog
B. Insulin
C. Glyburide
D. Increase metformin

Why did you make that choice?
Question 2.3
Could the shortness of breath have been prevented?
A. No—natural progression of disease/unpreventable
B. Yes—medications could have been adjusted earlier
Why did you choose that answer?
New page

2.4
Did you notice that his weight was increasing?
Did you notice the correlation between thiazolidinedione and weight?
Did you notice the correlation between shortness of breath and thiazolidinedione?

Case 3. Chronic Heart Failure
Mrs. Dorothy Zink is a 65-year-old woman with history of high blood pressure and heart failure. She also has chronic knee pain. She was recently admitted for a congestive heart failure (CHF) exacerbation and treated with extensive diuretics and was sent home.
She comes in today for a follow-up.
Medications and laboratory values are visible in the EHR.

Question 3.1
To what would you attribute the CHF exacerbation given the information in the EHR?
A. Progression of underlying disease
B. New medication contributing to weight gain
C. Poor adherence to diet
D. Immobilization leading to weight gain leading to exacerbation
Why did you make that choice?

Question 3.2
What would you do to manage the CHF exacerbation given the information in the EHR?
1. Increase Lasix dose
2. Add metolazone for resistant CHF
3. Refer to nutritionist and cardiologist
4. Reevaluate current meds
Why did you make that choice?

Question 3.3
Did you notice that she is taking an antidepressant?
Did you notice her weight gain?

Case 4. CHF
Mr. M is a 61-year-old man who comes to the hospital with a complaint of worsening shortness of breath for 6 days. He has a 30-year smoking history and a history of hypertension, CHF, and coronary artery disease. He had an myocardial infarction many years ago, and his last echocardiogram done 2 years ago showed an EF of 55%. His CHF has been stable since then.
On further questioning, you understand that he has been admitted several times in the last month for chronic obstructive pulmonary disease exacerbations. The echo done at his last hospitalization showed no significant change.
On physical examination, he has crackles, a jugular venous pressure of 10, and some pitting edema.
Laboratory values and medications are in the EHR.

Question 4.1
What is causing the shortness of breath?
A. Natural course
B. Salt intake
C. Medication
D. Infection
E. Not enough information
Why did you make that choice?

Question 4.2
The most appropriate next step for this patient would be:
A. Increase dose of steroids
B. D/C steroids
C. Start antibiotics
D. Watchful management with daily weights and decreased salt in diet
Why did you make that choice?

Question 4.3
Why are steroids a problem in this patient based on information in the EHR?
A. Patient gains weight when steroids are used
B. Patient dose of steroids is too high
C. Patient allergic to steroids
D. Steroids interact with another medication
E. Steroids contraindicated because of another diagnosis
Why did you make that choice?

New page

Question 4.4
Did you notice that his weight was increasing?
Did you notice the relationship between steroids and weight?

Qualitative questions 5
Please answer the following questions regarding the visualizations you saw. Please evaluate the special visualizations and not the online medical record. We also ask a few demographic questions.
Please comment on the visualization and whether it helped you in any way.

Do you have other suggestions as how to improve this visualization?

http://hcibib.org/perlman/question.cgi

Please answer the following questions evaluating the visualization you saw at the bottom of some of the cases. Some may not be applicable.

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</thead>
<tbody>
<tr>
<td>1. Overall, I am satisfied with how easy it is to use this system</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<td>Strongly agree</td>
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<td>2. It was simple to use this system</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>3. I can effectively complete my work using this system</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<td>Strongly agree</td>
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<td>4. I am able to complete my work quickly using this system</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>5. I am able to efficiently complete my work using this system</td>
<td>Strongly disagree</td>
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<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
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<td>6. I feel comfortable using this system</td>
<td>Strongly disagree</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
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<td>7. It was easy to learn to use this system</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>8. I believe I became productive quickly using this system</td>
<td>strongly disagree</td>
<td>☐</td>
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<td>☐</td>
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<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>9. The system gives error messages that clearly tell me how to fix problems</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>Strongly agree</td>
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<tr>
<td>10. Whenever I make a mistake using the system, I recover easily and quickly</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>11. The information (such as online help, on-screen messages, and other documentation) provided with this system is clear</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>12. It is easy to find the information I needed</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
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<tr>
<td>13. The information provided for the system is easy to understand</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>☐</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>14. The information is effective in helping me complete the tasks and scenarios</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>15. The organization of information on the system screens is clear</td>
<td>Strongly disagree</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>16. The interface of this system is pleasant</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>17. I like using the interface of this system</td>
<td>☐</td>
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</thead>
<tbody>
<tr>
<td>1. The visualization helped me make better clinical decisions</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>2. The visualization made my decision-making take longer</td>
<td>Strongly disagree</td>
<td>☐</td>
<td>☐</td>
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<td>Strongly agree</td>
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</table>
Demographics
What is your specialty?
- A. Medicine
- B. Family
- C. Other
A._____
If additional board certification, in what?
_____ How many years have you been in practice (since MD degree)?
- A. 0–5 years
- B. 6–10
- C. 11–15
- D. 16–20
- E. 21–25
- F. 26–30
- G. 31–35
- H. >35 years
What is your gender?
M/F/Other/Decline
What is your first language?
________________________
What is your year of birth?
________________________

Final questions
Any comments, questions, or other feedback?
________________________
ID # for participant
On a separate sheet of paper
Would you like to be contacted with the results of this research?
If so, how would you like to be contacted?
________________________

Supplementary Appendix B: Qualitative Responses
Open-ended responses to “please comment on the visualization and whether it helped you in any way.” Typos not corrected. Categorization manually into positive and constructive comments by S.H.F.

Positive
“Yes, definitely helped me visualize the relationship between meds and clinical parameters.”
“Yes, the visualization is helpful and allows you to see all of the information in one glance.”
“Visualizations help people identify trends in data and see associations that would otherwise be elusive.”
“As a visual type learner, I enjoy graphs and I think that was pretty helpful for me.”
“Visualizations provided a graphic representation of the relevant changes in both vital signs and medications. I think this allowed the clinician to more quickly realize temporal relationships.”
“Much more effective way to analyze data, allows for temporal relationships to be graphically represented. Last case was much more challenging without visualization.”
“Very useful to be able to see multiple pieces of data (such as weight, medication start/stop dates, and hospitalizations) together. Also, numerical as well as graphical representation is useful for quickly understanding and using data.”
“Yes, big time!”
“Visualization is very helpful and allowed more rapid understanding. The cases presented showed patients on far fewer meds than is often the case in real life, but would almost certainly still be effective.”
“Visualizations were helpful in both cases, esp the 4th.”
“Definitely, I am a visual person and I respond better to charts than lists. Seeing the med timeline and the other parameters next to one another in that format helps connect the dots faster, even if you would get there eventually, but by having to toggle back and forth.”
“The visualization certainly made comparisons easier and may have prevented error on case 2 with overlooking pioglitazone.”
“Yes, esp when correlated with medical records.”
“Yes, it helped me correlate the new med and the weight gain in 3. In case 1, it should have helped me, but I was not paying attention. She lost a lot of weight. Had I processed that, I would have noticed that something else was going on.”
“Graphs helped.”

Positive and Constructive
“Helpful, but it is also helpful to see the discrete values as well.”
“I thought it was helpful in the cases we had it... harder to tell what was going on in the last case.” (in which this doctor did not have the visualization available)
“I like to (sic) graphing but donot like the forced screens and limited data available was not clinically realistic.”
“The graphs and meds time course is helpful. That should be the few clicks as possible.”