Health Design Challenge

Reimagining the Patient Record

TEAM

Amanda Greenberg MSPH
Gina Assaf
Jennifer Tran
Jonas Gebhardt
Jonathan Chan
Kelsey Humphries
Kristina May Lustig
Louise Briguglio
Luis Gonzalez
Luis Guzman
Noah Bornstein
Raunaq Gupta
Rebecca Jablonsky MA

OVERVIEW AND DESIGN PROCESS SUMMARY

As designers, we often find ourselves longingly staring at commonly-used, heavily-handled, and important documents in the medical field, thinking about how we would improve the status quo, focus more on the end-user, and ultimately, improve the patient experience. To our team, this challenge is a welcomed opportunity to revolutionize the field of health information, so thank you. Our educational and professional backgrounds are diverse, which makes our approach and designed product unique. The majority of our team are Masters students in Carnegie Mellon's Human-Computer Interaction Institute. Our program lives at the intersection of computer science, design, and psychology, and as students and professionals, we are focused on one thing, the user. We have been designers, engineers, consultants, and creative directors in the high-tech, political, entertainment, medical, human resource, government, and public relations sectors. To ensure we were in-touch with the medical world, we rounded out our skill areas and perspectives with public health and medical professionals.

To develop our proposed design, we used a hybrid design approach. Our process included a literature review; interviews with patients, providers, and caregivers; affinity diagramming; and concept mapping. We used what we learned to inform our next step: development of the meta-organization and information architecture. With some broad parameters, our team split into groups to brainstorm and ideate the production of each section. We then performed a short competitive analysis to better understand different aspects of how information can be displayed, what is most effective in a specific space, and why. With initial designs developed, we began graphic design iteration, checking-in with our user population and revising as necessary. Additional information about our design process is included in Appendix A.

Included below is our final product - a refreshed, revised, clear, accessible, approachable, digestible, useable medical record. It's designed for every patient because as you note, our healthcare system takes care of a diverse set of individuals. Patients, like all humans, aren't sterile, static beings: they are dynamic and need a medical record that represents the holistic, fluid nature of health. Each patient deserves a medical record that they can understand, reference, and use, and that is the lens through which we created and designed.

Primary Care Provider
Dr. Adrian Llama
T: (816) 276-1939
1002 Healthcare Drive
Portland, OR 97266

Ellen Ross
dob: 3/7/1960
T: (503) 276-6906
17 Daws Road
Beaverton, OR 97006

Ellen Ross

patient record DATE RETRIEVED: 11/14/2012

Your Next Steps

Start cholesterol-lowering medication (Lipitor).

Take daily multivitamin.

Begin introducing healthy diet choices as discussed.

Future Appointments:
Lab Test: Complete Blood Count
Scheduled for: January 13, 2013

Additional Providers

Dr. Henry Seven - Orthopedist
Community Hospital
(816) 276-6909
1357 Amber Drive
Beaverton, OR 97006

Dr. Tim Lee - Internist
Ashby Medical Center
(816) 276-1939
1357 Amber Drive
Beaverton, OR 97006

Dr. Bala Venkta - Gastroenterologist
Ashby Medical Center
(816) 276-1939
1357 Amber Drive
Beaverton, OR 97006

Current Medication Summary

Acetaminophen 300mg	every 4 hours
Multivitamin	1 pill, 1x daily

Known Allergies Summary

Bee Stings	severe
Penicillin	moderate to severe
Codeine	moderate

Demographics

dob:	3/7/1960
gender:	Female
blood type:	B+
status:	Married
religion:	Christian
ethnicity:	Asian
languages:	English

Emergency Contact

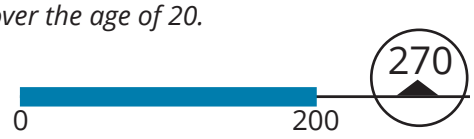
Martha Shan – Sister
(503) 555-1229
1357 Amber Drive
Beaverton, OR 97006

Recent Lab Results

Lipid Panel — November 10, 2012

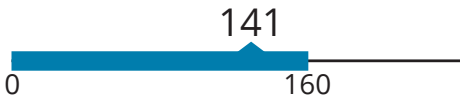
This test helps to assess your risk for heart disease. Testing cholesterol at least every five years is important for all adults over the age of 20.

Cholesterol (mg/dl)

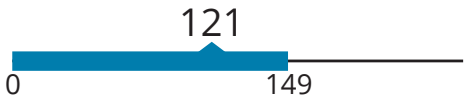


HDL (mg/dl)

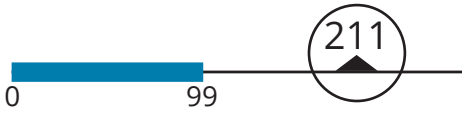
Non-HDL (mg/dl)



Triglyceride (mg/dl)



LDL (mg/dl)



PROVIDER'S COMMENTS

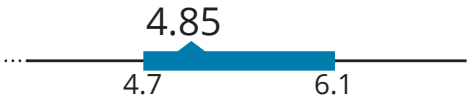
Start patient on cholesterol lowering medication.

Educate patient on healthy diet choices.

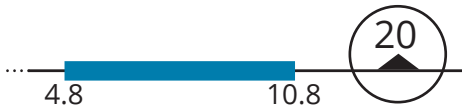
Complete Blood Count — November 10, 2012

A Complete Blood Count test can help to diagnose various conditions, and provides valuable information about your blood cells and numbers of cells.

Red Blood Cells (m/cmm)



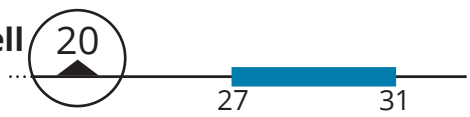
White Blood Cells (mg/dl)



Hemoglobin (mg/dl)

Hematocrit (fl)

Hemoglobin Per Cell (pg)



PROVIDER'S COMMENTS

Order follow-up Complete Blood Count to rule out infection.

Start iron supplement daily.

= ABNORMAL RESULT

Bee Stings — severe

SYSTEMIC

Reaction: anaphylactic shock [Historic]

Penicillin — moderate to severe

DRUG, ANTI-MICROBIAL

Reaction: hives [Observed]

Comments: developed rash with first dose

Entered by: Ashby Medical Center on October 10, 2007

Codeine — moderate

DRUG, ANALGESIC

Reaction: shortness of breath [Observed]

Comments: reported difficulty breathing

Entered by: Ashby Medical Center on October 10, 2007

Medication History

Acetaminophen 300mg tablet — prescribed March 25, 2012

Take **1** tablet by mouth **every 4 hours** as needed.

Can cause liver failure. Do not take more than the prescribed 1800mg per day.

For ankle pain.

Prescribed by Ashby Medical Center.

Prescription #: 111222333

ACTIVE

Notes:
Continue prescription until ankle pain subsides.

Penicillin liquid — prescribed May 30, 2009

Allergic Reaction !

Ms. Ross had a moderate allergic reaction. See Known Allergies for details.

1 teaspoon each day for **14 days**.

For treatment of ear infection.

Prescribed by Ashby Medical Center.

Prescription #: 111222333

Notes:
Penicillin discontinued when patient developed a rash.

(Full Medication History to be continued here)

MMR (Measles, Mumps, Rubella) — Recommended

Instructions: Two shots are needed.

Information: Protection from Measles, Mumps, and Rubella. For people born after 1952 and all women of childbearing age.

Your History: **Never Received**.

Tetanus — Recommended

Instructions: One shot every 10 years.

Information: Prevents a disease known to cause muscle spasms.

Your History: Received **August 02, 2001**. No reaction.

Hepatitis B — Completed

Instructions : Three shots required. Second shot needs to be one month at first dose. Third shot needs to be at least six months after first dose.

Information: Prevents an inflammatory infection of the liver.

Your History: Received **December 11, 2010**. No reaction.
Received **January 09, 2011**. No reaction.
Received **June 12, 2011**. No reaction.

(Full Immunizations to be continued here)

A Summary of Your Medical History

2012	Mar 25	Problem	**Ankle Sprain ACTIVE**
		Visit	**ED Visit for Ankle Sprain**
		Medication	**Acetaminophen ACTIVE**
2011	Sept 18	Problem	**Cholecystitis**
		Visit	**ED Visit for Acute Cholecystitis**
		Lab Test	**Complete Blood Count**
		Procedure	**Laparoscopic Cholecystectomy**
2010	May 10	Problem	**Knee Sprain**
		Visit	**ED Visit for Knee Sprain**
		Medication	**Acetaminophen**
	Jan 09	Problem	**Anxiety**
		Visit	**Primary Care Visit**
		Medication	**Lorazepam**
2009	Oct 10	Lab Test	**Lipid Panel**
1960	Mar 07	Birth	

2012

Mar 25 — Problem — **Ankle Sprain**

Comments: Fell down steps
Status: **ACTIVE**

Visit — **ED Visit for Ankle Sprain**

Provider: Dr. Henry Seven
Location: Community Hospital

Medication — **Acetaminophen 50mg**

Form: Tablet
Instructions: Take 2 pills once daily
For: Ankle pain caused by fall
Prescription #: 111222333
Prescribed by: Ashby Medical Center
Status: **ACTIVE**

2011

Sept 18 — Problem — **Cholecystitis**

Comments: Surgery postponed because of infection
Status: Resolved

Visit — **ED Visit for Acute Cholecystitis**

Provider: Dr. Tim Lee
Location: Ashby Medical Center

Lab Test — **Complete Blood Count**

Provider: Dr. Adrian Llama
Location: Ashby Medical Center

Procedure — **Laparoscopic Cholecystectomy**

Provider: Dr. Bala Venkta
Location: Ashby Medical Center

2010

May 10 — Problem — **Knee Sprain**

Comments: Slipped on ice and fell
Status: Resolved

Visit — **ED Visit for Knee Sprain**

Provider: Dr. Henry Seven
Location: Community Hospital

Medication — **Acetaminophen 50mg**

Form: Tablet
Instructions: Take 2 pills once daily
For: Knee pain caused by fall
Prescription #: 333222111
Prescribed by: Ashby Medical Center

1960

Mar 07 — Birth

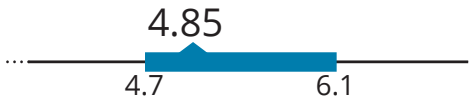
Lab Results History

Complete Blood Count — September 18, 2011

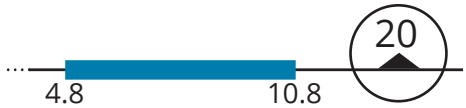
A Complete Blood Count test can help to diagnose various conditions, and provides valuable information about your blood cells and numbers of cells.

PROVIDER'S COMMENTS

Red Blood Cells (m/cmm)



White Blood Cells (mg/dl)

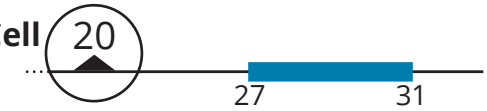


Indicates possible infection - discuss with provider.

Hemoglobin (mg/dl)

Hematocrit (fl)

Hemoglobin Per Cell (pg)



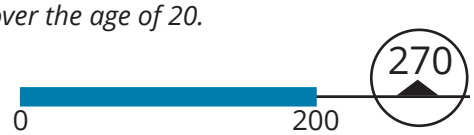
Start iron supplement daily.

Lipid Panel — October 10, 2009

This test helps to assess your risk for heart disease. Testing cholesterol at least every five years is important for all adults over the age of 20.

PROVIDER'S COMMENTS

Cholesterol (mg/dl)



Start patient on cholesterol lowering medication.

= **ABNORMAL RESULT**

(Full Lab Results History to be continued here)

IMPORTANT: This card provides your key medical information and will be helpful as you receive care or in an emergency.

INSTRUCTIONS: Cut out this card and keep it in your possession – your purse, wallet, or pocket.

ELLEN ROSS **(503) 276-6906**

DOB: **Mar 07, 1960**

17 Daws Road,
Portland, OR 97006

Emergency Contact:
Martha Shan **(816) 276-6909**

Primary Care:
Dr. Adrian Llama **(848) 193-1939**

Insurer:
HighMark BlueShield **1-800-BLUE-428**

Medications:

Multivitamin		**1/day**
Acetaminophen	**300mg**	**every 4 hrs**

Conditions:
- **High Cholestrol**
- **Migraines**

Allergies:
- **Bee Strings**
- **Codeine**
- **Penicillin**

APPENDIX A: DESIGN PROCESS

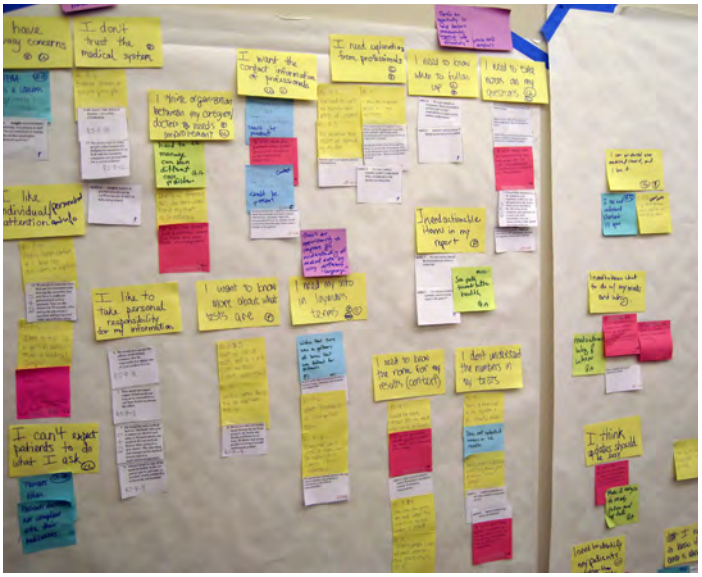
To best meet the challenge objectives, our team used a hybrid approach of formal and informal user-centered design methodologies. We focused on the patient as our end-user, and our design methods were selected to take into account this specific perspective. As an alternative to engineering and feature driven models of creating new systems, we ensured user-based data drove the process from beginning to end.

We completed a literature review to better understand which components of current medical records work and which don't. Just as we approach any challenge, it was most important for our team to understand the current landscape: *What are the gripes? What is working? In a perfect world, what would a record look like? How would it feel? How would it communicate?* These are the types of questions we researched, and we started to further understand the obvious complexities involved with this design opportunity. We used the relevant conclusions and discussion points to inform our direction and next steps.

Following our literature review, we conducted in-person and phone interviews with providers, caregivers, and patients to better understand their own interactions with the medical field and their wants/needs in a medical record. We ensured that consistent evaluation questions were posed to each participant and that our sample was diverse and representative of your list of personas: the more perspectives to inform our design, the better. We considered conduction of these interviews the single most important step in our process: the user data would become the living and breathing foundation of our record's design.

Next, we created an affinity diagram, which allowed us to consolidate and interpret the user data by following the user-centered principles of the Contextual Design (CD) process. For those unfamiliar with the CD process, there are several exceptional books available for additional details, but for a quick overview, please visit the CD process Wikipedia page. Using this method allowed us to better understand the needs of our user segments and clarify the global themes that emerged across and among the three roles. To identify these themes, we placed each "want/need/gripe" on an individual post-it note and began grouping these notes. It is important to note that during this type of exercise, themes are NOT predetermined, rather, they organically emerge as you work through the process and the data become sorted. Examples of identified themes include:

"I like personal/individual attention and info"
"I want to more about what tests are"
"I like to take personal responsibility for my information"
"I need actionable items in my report"
"I need to see all the links between fields"



Affinity Diagram

Once these themes were identified, "opportunities" were drafted for each "want/need/gripe." In CD, this process is referred to as "data consolidation and interpretation."

We then applied our knowledge from consolidation and interpretation to develop our record's meta-organization and information architecture. We placed each section and field found in the CCD on a post-it note and began establishing our framework, prioritizing sections and fields based on the input received during the earlier phases of our design process. Once we established a clear framework, we asked for additional feedback from several of the same interviewees and new reviewers - we wanted to gather fresh perspectives. As you know, design done correctly shouldn't need to be explained - it should be immediately understood and naturally work. This was our goal, and as we gathered feedback, we revised our framework. Our entire process, like all design processes, was both iterative and intense.

Meta-Organization

Our team split into groups to brainstorm and ideate the production of each section. This format provided an opportunity for teams to further research how information is currently and commonly presented for each section and how this presentation could be improved. We then performed a short competitive analysis. To perform this task, we gathered medical records from patients and used various

other information sources (e.g., data visualizations, veterinary medical records, iPhone applications, mailing labels). This information helped the team understand different aspects of how information can be displayed, what is most effective in a specific space, and why. We put them all on a board, annotated them, took notes, and synthesized our findings in order to better inform our design work.

Competitive Analysis

After initial designs were developed, we began graphic design iteration. We continuously checked in with our user population, revised drafts as necessary, and worked to finalize our product: the reimagined patient record.

APPENDIX B: DETAILED PROBLEM SNAPSHOT

One important patient concern discovered during our interviews was the difficulty of tracking specific health problems over time, including all associated treatments, encounters, medications, procedures, and labs. This led us to believe that the ability to highlight existing relationships within a patient's historic data could be very useful to patients, allowing them to review a detailed snapshot of a specfic medical problem. In order to make patients' (potentially vast) amounts of medical information more accessible to them, we designed an "issue tracker" in the form of a timeline containing all encounters, medications, procedures, etc., related to a specific problem.

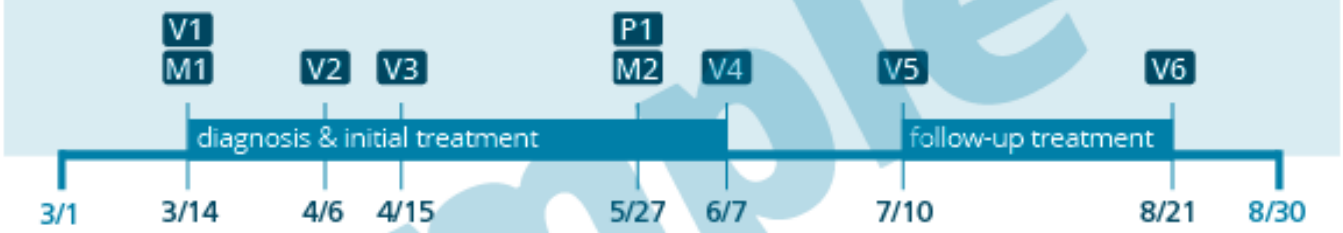
A difficulty with this idea is the inability to group together different history items based solely on their existing data fields. Although medical classification systems such as ICD-9-CM or CCD and their associated relationships exist, they may not provide sufficient information for a reliable grouping that takes into account the entire medical history of the patient. Consequentially, we decided to not include this idea in our main design, but rather add it as an optional proposal for future implementation.

We propose the addition of two fields for each event: "issue group" and "treatment phase." These fields could be filled by either the patient or medical provider and would tie together all events related to a specific issue. Below is a preliminary design of the issue timeline, which could be easily added to our existing design as soon as the required grouping fields become available in the underlying system. The issue group shown is "Sciatica," which includes two treatment phases ("treatment" and "follow-up").

Sciatica (back pain related to sciatic nerve)

ICD-9-CM Diagnosis Code 724.3

Mar 2007 – Aug 2007



V1	Visit	Provider: Dr. Gupta
M1	Medication	Codeine / Vicodin 15mg
V2	Visit	Provider: St. Sharpe Hospital. Comments: X-Ray, MRI
V3	Visit	Provider: Dr. Gupta
P1	Procedure	Laminectomy – Provider: Dr. Gonzalez
M2	Medication	Codeine / Vicodin 25mg
V4	Visit	Provider: Dr. Gonzalez. Comment: Follow-up
V5	Visit	Provider: Dr. Bornstein. Comment: Physical Therapy
V6	Visit	Provider: Dr. Bornstein. Comment: Physical Therapy