



# **Design Health Challenge**

**Rethinking the Medical Record**

**Submission from Mathew Sanders**

@mathewsanders

mathewsanders.com

# A Temporal Structure

Instead of grouping content by type (e.g. lab results / plan of care / encounters) the proposed structure takes a temporal approach of what is upcoming, what's happening now, and what has happened in the past.

This does leads to some repetition of content (mainly for medication), a small cost for greater understanding of information for the individual, caregiver or medical professional.

## Who?

## Tomorrow

## Today

## Yesterday

**Personal Health Record**  
Ellen Ross  
Printed May 8, 2007

### Known Allergies

- SEVERE REACTIONS**
  - Bee stings.** Causes anaphylactic shock
  - Peanuts.** Causes anaphylactic shock
- MODERATE TO SEVERE REACTIONS**
  - Penicillin.** Causes hives
  - Latex.** Causes hives & difficulty breathing
- MODERATE REACTIONS**
  - Codeine.** Causes shortness of breath
  - Dogs/Pets.** Causes sneezing and running nose
- MILD REACTIONS**
  - Pollen.** Causes watery eyes, itchy nose (self reported)

### Your Details

Born March 7, 1960	Gender Female	Primary Contact Details Phone (415) 555-1229 17 Daws Road, Portland, OR 97006
Languages Spoken English, Spanish	Marital Status Married	Guardian's Contact Details Martha Shan (sister) Phone (816) 276-6909 1357 Amber Drive, Beaverton, OR 97006
Ethnicity Asian	Religious Affiliation Christian	

**Health Planner** Ellen Ross  
Your notes

### Upcoming Dates

- 28 Office Consultation**  
9:30 a.m. at Ashby Medical Center  
Consultation with Dr. George Pissinac for Asthma
- Sputum Culture**  
10:00 a.m. at Ashby Medical Center
- 1 Chest X-Ray**  
9:00 a.m. at Ashby Medical Center
- 16 Refill prescriptions this week**  
Indomethacin (50 mg Tablet)  
271 89 54  
Prescribed by Ashby Medical Center
- 3 Compensation & Pension Appointment**  
11:00 a.m. at Ashby Medical Center  
With Dr. Eliza Marin

### To-do

- 1 Schedule Colon Cancer Screening**  
Schedule with Ashby Medical Center
- 2 Schedule Influenza Vaccination**  
Schedule with Ashby Medical Center  
Last completed May 8, 2000

### Your Healthcare Providers

Ashby Medical Center • Phone: (415) 555-1200 • Visit: 1002 Healthcare Dr, Portland, OR 97266

**Current Medications** Ellen Ross

### Prescribed Medications

NAME	LIQUID	HOW OFTEN	NOTES	FIRST PRESCRIBED
2 puffs Acetaminophen with Codeine	each day	2 puffs once a day		June 15, 2005
NAME	CAPSULE	HOW OFTEN	NOTES	FIRST PRESCRIBED
1 pill Lipitor	each day	one pill a day		June 15, 2005
NAME	TABLET	HOW OFTEN	NOTES	FIRST PRESCRIBED
50 mg Indomethacin	2 times per day	50mg bid with food		June 15, 2005
NAME	CAPSULE	HOW OFTEN	NOTES	FIRST PRESCRIBED
1 pill Klonopin	2-3 times a day	2-3 times per day		June 15, 2005

### Self Reported

- Ginko Biloba**  
- Two capsules taken once a day  
- Take in the morning with breakfast  
TAKEN SINCE: June 15, 2005
- Asprin EC 81 mg tablet**  
- One tablet daily  
- Daily regime for heart health  
TAKEN SINCE: June 15, 2005

**Medical Conditions & History** Ellen Ross  
2000 — 2007

### Overview of Medical Conditions

- 1 Pregnancy** 9 months
- 2 Cholecystitis** 13 months
- 3 Migraine Headaches** Blinding pain and sensitivity to light 4 years, 3 months
- 4 Diabetes** 2 years, 2 months
- 5 Ankle Sprain** 1 week
- 6 Vertigo** Feels dizzy while at work 1 year, 7 months

### Medical History

2000 — 2007

- March 7, 2000: 40 today
- April 4, 2000: **Immunization: Tetanus & Diphtheria Toxoids**  
50 mcg intramuscular injection  
Mild pain or soreness in the local area
- March 7, 2001: 41 today
- May 8, 2000: **Immunization: Influenza Virus Vaccine**  
50 mcg intramuscular injection  
Possible flu-like symptoms for three days
- July 19, 2000: **Office Consultation**  
with Dr. Bala Venkataraman at Ashby Medical Center
- October 28, 2001: **Pregnancy observed**
- October 28, 2001: **Emergency Department Visit**  
with Dr. Henry Seven at Community Hospital  
Surgery postponed until after delivery
- March 7, 2002: 42 today

medical history continues on next page  
medical history continues on next page

#Allergies  
#Demographics  
#Guardian

#Plan of care  
#Medication  
#Provider

#Medication

#Problem list  
#Encounters  
#Procedures  
#Lab Results  
#Medication  
#Immunizations

## Common Principles

Avoid label/value approach as much as possible when presenting information. Instead, reformat content so that as often as possible it can be read as a natural sentence.

```
# Allergies  
Allergy Name: Penicillin  
Reaction: Hives  
Severity: Moderate to severe
```

---

1 Starting labels/values

```
# Allergies  
Allergy Name: Penicillin  
Reaction: Hives  
Severity: Moderate to severe
```

---

2 Remove labels

```
# Allergies  
Penicillin  
Causes Hives  
Moderate to severe reactions
```

---

3 Add text to give context

## Known Allergies



MODERATE TO SEVERE REACTIONS

**Penicillin.** Causes hives

**Latex.** Causes hives & difficulty breathing

4 Reorder and separate content with visual weight

# Another Example...

## 1 Remove labels

# Medication  
~~Date:~~ March 28, 2005  
~~Type:~~ Liquid  
~~Name of Medication:~~ Acetaminophen with codiene  
~~Instructions:~~ 2 puffs once a day  
~~Dose Quantity (value / unit):~~ 2 / puffs  
~~Rate Quantity (value / unit):~~ 1 / day  
~~Name of Prescriber:~~ Ashby Medical Center

---

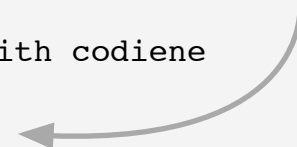
## 2 Add text to give context

# Medication  
March 28, 2005  
Liquid  
Acetaminophen with codiene  
**NOTES** 2 puffs once a day  
**TAKE** 2 puffs  
**HOW OFTEN** 1 day  
Ashby Medical Center

## 3 Reorder content

**TAKE** 2 puffs  
  
Liquid  
Acetaminophen with codiene  
  
**HOW OFTEN** 1 day  
  
**NOTES** 2 puffs once a day  
  
Ashby Medical Center  
March 28, 2005

*if possible hardcode  
substitutions like 'each day'  
to replace '1 day'*



## 4 Add visual hierarchy

### Prescribed Medications

---

TAKE	LIQUID	HOW OFTEN	NOTES	ASHBY MEDICAL CENTER
2 puffs	Acetaminophen with Codiene	each day	2 puffs once a day	March 28, 2005

## The Health Planner





The coversheet mostly exists so that sensitive medical information is not exposed on the first page. Individuals will most likely skip over this page, however for a caregiver viewing this document for the first time (and perhaps dealing with multiple records) this provides critical information on the first page.

# “Who?”

## Personal Health Record Ellen Ross

Printed May 8, 2007

### Known Allergies

-  SEVERE REACTIONS
  - Bee stings.** Causes anaphylactic shock
  - Peanuts.** Causes anaphylactic shock
-  MODERATE TO SEVERE REACTIONS
  - Penicillin.** Causes hives
  - Latex.** Causes hives & difficulty breathing
-  MODERATE REACTIONS
  - Codeine.** Causes shortness of breath
  - Dogs/Pets.** Causes sneezing and running nose
-  MILD REACTIONS
  - Pollen.** Causes watery eyes, itchy nose (*self reported*)

### Your Details

Born  
March 7, 1960

Gender  
Female

Primary Contact Details  
Phone (415) 555-1229  
17 Daws Road, Portland, OR 97006

Languages Spoken  
English, Spanish

Marital Status  
Married

Guardian's Contact Details  
Martha Shan (*sister*)  
Phone (816) 276-6909  
1357 Amber Drive, Beaverton, OR 97006

Ethnicity  
Asian

Religious Affiliation  
Christian



## The Health Planner

This page aggregates any content in the health report that is timestamped for the future.

For core CCD fields this is only planned care, but other providers (such as VA can extend to include additional data such as wellness reminders and prescriptions due for renewal).

Ideally this page would become a living document that individuals or caregivers would stick on their fridge or pinboard as a visual reminder.

### If changes are needed

If the patient or caregiver needs to make an update, contact details for their healthcare providers are quickly accessed from the same page.

# “Tomorrow”

**Health Planner** Ellen Ross

---

**Upcoming Dates** Your notes

---

**May 28** **Office Consultation**  
9:30 a.m. at Ashby Medical Center  
*Consultation with Dr. George Potomac for Asthma*

**Sputum Culture**  
10:00 a.m. at Ashby Medical Center

---

**June 1** **Chest X-Ray**  
9:00 a.m. at Ashby Medical Center

---

**June 16** **Refill prescriptions this week**  
Indomethacin (50 mg Tablet)  
**R 271 89 54**  
*Prescribed by Ashby Medical Center*

---

**July 3** **Compensation & Pension Appointment**  
11:00 a.m. at Ashby Medical Center  
*With Dr. Eliza Morrin*

---

**To-do** Your notes

---

**1** **Schedule Colon Cancer Screening**  
Schedule with Ashby Medical Center

---

**2** **Schedule Influenza Vaccination**  
Schedule with Ashby Medical Center  
*Last completed May 8, 2000*

---

**Your Healthcare Providers**

Ashby Medical Center • Phone: (415) 555-1200 • Visit: 1002 Healthcare Dr, Portland, OR 97266

### Space for notes

Leave a space as an affordance for individuals or caregivers to write notes. This could be questions to bring up in the appointment, or updates to the appointment times.



## Current Medications

This page shows prescribed medications and self reported medications and supplements.

For individuals and caregivers it's a easy view of what medications need to be taken each day.

For healthcare professionals it's a single view of all medications that the patient is currently taking.

If current medications can not be calculated from the core CCD data, then this would be a list of all medications historically prescribed.

# "Today"

### Current Medications Ellen Ross

#### Prescribed Medications

TAKE	LIQUID	HOW OFTEN	NOTES	FIRST PRESCRIBED
2 puffs	Acetaminophen with Codiene	each day	2 puffs once a day	June 15, 2005
TAKE	CAPSULE	HOW OFTEN	NOTES	FIRST PRESCRIBED
1 pill	Lipitor	each day	one pill a day	June 15, 2005
TAKE	TABLET	HOW OFTEN	NOTES	FIRST PRESCRIBED
50 mg	Indomethacin	2 times per day	50mg bid with food	June 15, 2005
TAKE	CAPSULE	HOW OFTEN	NOTES	FIRST PRESCRIBED
1 pill	Klonopin	2-3 times a day	2-3 times per day	June 15, 2005

#### Self Reported

##### Ginko Biloba

- Two capsules taken once a day
- Take in the morning with breakfast

TAKEN SINCE  
June 15, 2005

##### Asprin EC 81 mg tablet

- One tablet daily
- Daily regime for heart health

TAKEN SINCE  
June 15, 2005



## Medical Conditions

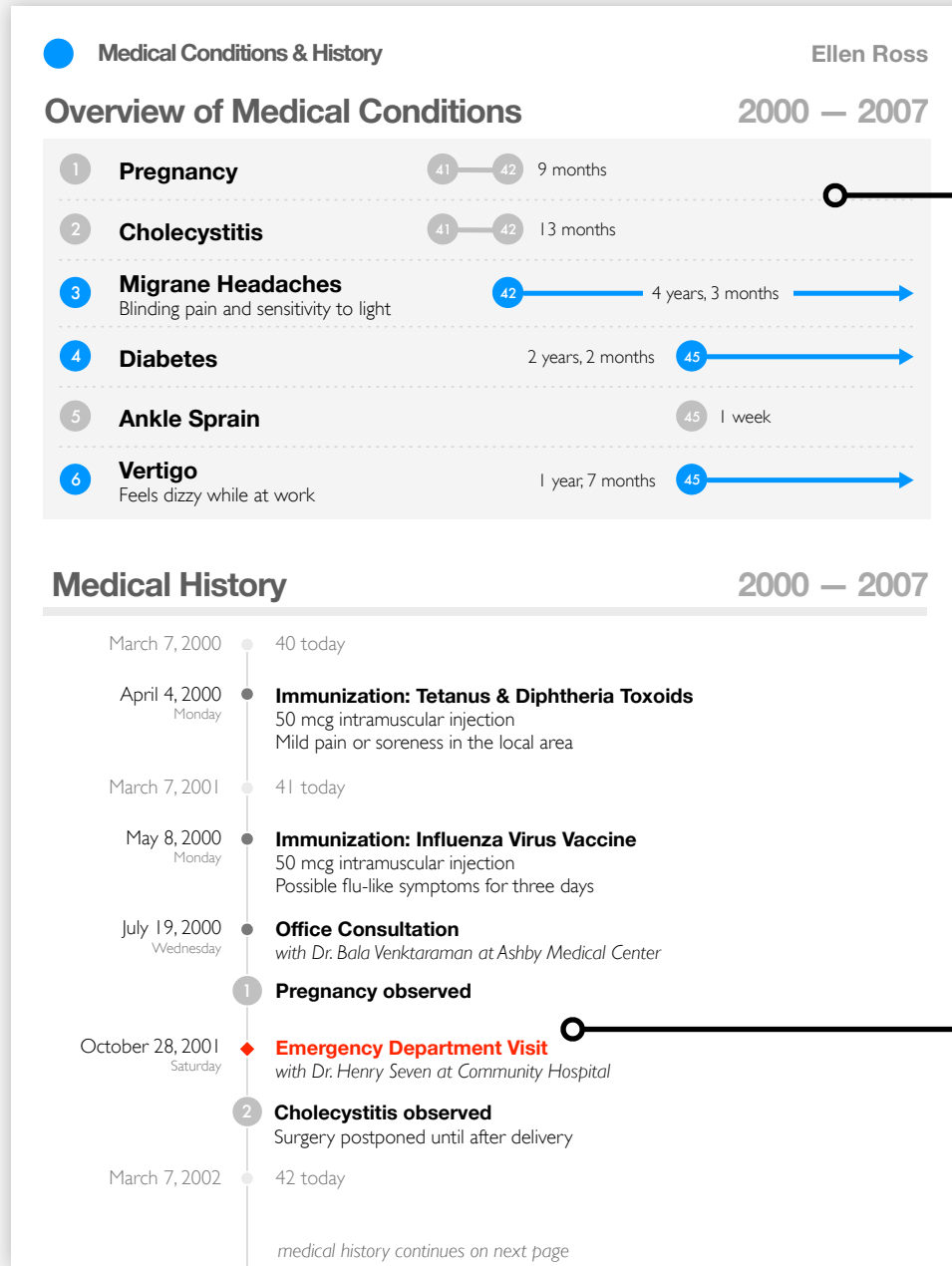
While the health planner looks at what is happening in the future, and medications look at the present, medical conditions examine the medical history for an individual.

By listening items in a chronological order instead of grouping by functional type **cause and effect** can be seen (for example new medications prescribed following lab results) and **context** can bring an otherwise complex list of data to life.

Additionally, presenting items in a timeline format immediately helps start to tell a story about the individual.

For example, a medical professional reviewing the history may notice the **Emergency Department visit during pregnancy** and **emphasize with the patient the stress they would have experienced.**

# “Yesterday”



## Problem List

A quick summary of resolved and active problems gives a high-level view of the individual.

A medical professional can then drill down deeper into the medical history for more detailed information and possible context around the problem.

## Color

Color is used sparingly so that when it is used it has even greater emphasis.





# “Yesterday”

March 21, 2002 **● Labor and Delivery**  
with Dr. Tiffany Martinez at Ashby Medical Center

**● Cesarean Section**  
with Dr. Tiffany Martinez at Ashby Medical Center

September 28, 2002 **● Gall Bladder Surgery**  
with Dr. Bala Venktaraman at Ashby Medical Center

February 4, 2003 **3 Migrane Headaches observed** ○  
Blinding pain and sensitivity to light

December 10, 2003 **R Indomethacin (50 mg Tablet)**  
50 mg / two times per day  
Prescribed by Ashby Medical Center

March 7, 2003 ● 43 today

August 15, 2003 **● ACL Surgery**  
with Dr. John Kindle at Ashby Medical Center

March 7, 2004 ● 44 today

March 7, 2005 ● 45 today

March 10, 2005 **● Office Consultation**  
with Dr. Bala Venktaraman at Ashby Medical Center

**● Lab Results: Renal Panel**

TEST	LOW	REFERENCE RANGE	HIGH	
Calcium		8.6 10.5	150	mg/dl
Potassium		3.6 5.1	50	mg/dl
Creatinine		0.5 1.4	1.6	mg/dl
Urea Nitrogen		6 20	22	mg/dl
Glucose		65 100 110		mg/dl
Chloride	96	98 108		mEq/L
Creatinine EGFR	58	60 —		—
Sodium	110	136 145		mg/dl

medical history continues on next page

## “Quiet Periods”

Birthdays are shown on the timeline as a natural way to show the age at onset for a problem, and also as a reminder for individuals to provide some context around appointments and medical events.

Showing birthdays also helps create a rhythm to the timeline and illustrate periods where there has been no medical events (itself interesting information.)

## Give context of problems

Have events occurred in the recent past for this patient (procedures, medication?) that may be associated with a newly observed problem?

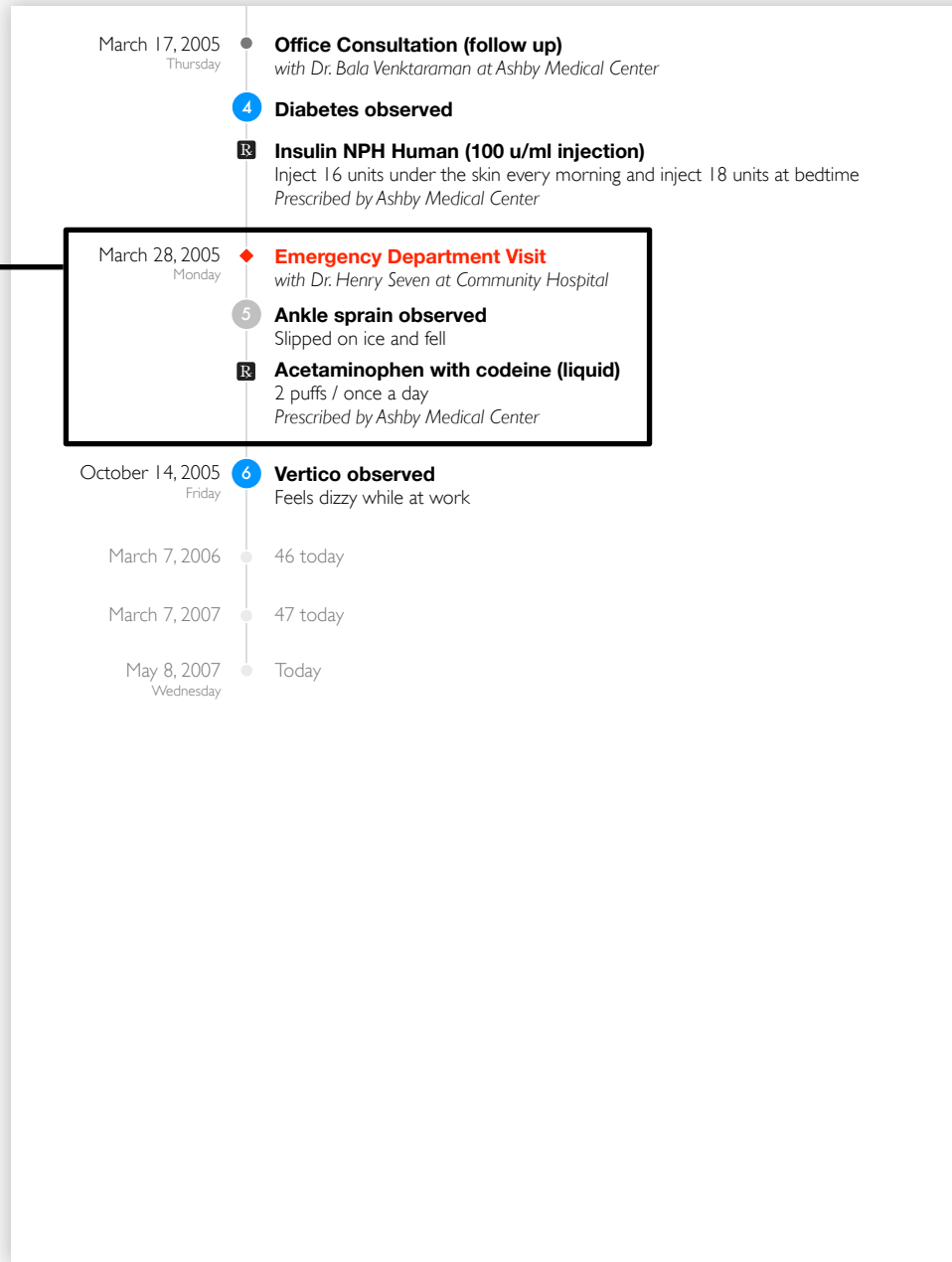
What actions were taken after the onset of a problem? e.g. example a prescription of a new medication or ordering of a lab test.



# “Yesterday”

## Context / Stories

Grouping data chronologically instead of by type (e.g. encounters, problems or prescriptions) tells a story that is greater than the sum of all it's parts.



# Lab Results

A simple grid-based layout with careful use of text alignment can convey a rich amount of information to health professionals while at the same time providing a clear layout of details for a patient.

● **Lab Results: Renal Panel**

TEST	LOW	TARGET RANGE	HIGH	
■ Calcium		8.6	10.5	150 mg/dl
■ Potassium		3.6	5.1	50 mg/dl
■ Creatinine		0.5	1.4	1.6 mg/dl
■ Urea Nitrogen		6	20	22 mg/dl
■ Glucose		65	100	110 mg/dl
■ Chloride	96	98	108	mEq/L
■ Creatinine EGFR	58	60	—	—
■ Sodium	110	136	145	mg/dl

**Test order**  
Ordering of test results from critically high → high → normal → low → critically low could help professionals interpret results<sup>1</sup>.

**High & Low Values**  
Color and text alignment indicate if the value for this test is low, critically low, high, or critically high.

**Target Ranges**  
The target range is shown by the shaded area. Edges are labeled with low and high bounds for the range.

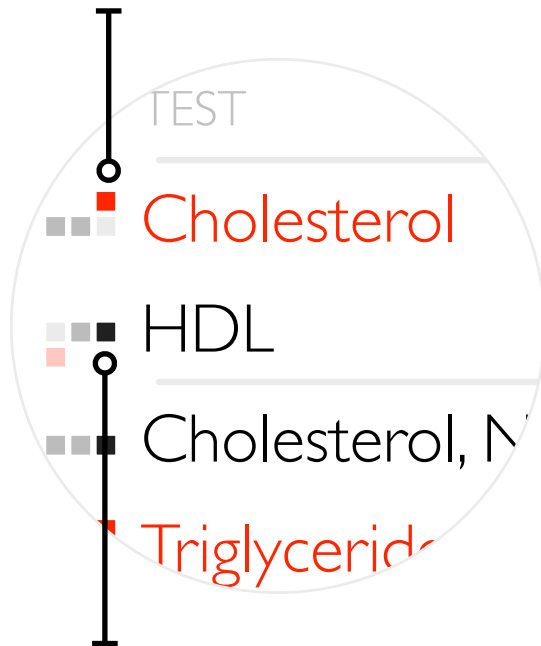
Careful use of text alignment (left, centered, right aligned) provides additional visual information about if the value is in the high or low end of the target range.

<sup>1</sup> Unless tests have a standard convention of order or there is a purposeful order of tests with relationships to each other, e.g. Creatinine and Creatinine EGFR.

## Sparklines for repeated lab tests

For tests that have been repeated multiple times a small sparkline graphic can show previous test results (simplified to high/normal/low readings)

Current value for cholesterol is high, but the last 2 tests showed values in the normal target range.



Current value for HDL is normal, but two tests ago is was low.

November, 2000

### Lipid Panel Results

TEST	LOW	TARGET RANGE	HIGH	
Cholesterol		119 <200		mg/dl
HDL	39	40+		mg/dl
Cholesterol, NON-HDL		76		mg/dl
Triglyceride		49 <150		mg/dl
LDL		66		mg/dl

November 2003

### Lipid Panel Results

TEST	LOW	TARGET RANGE	HIGH	
Cholesterol		180 <200		mg/dl
HDL		40+ 60		mg/dl
Cholesterol, NON-HDL		76		mg/dl
Triglyceride		112 <150		mg/dl
LDL		149		mg/dl

November 2005

### Lipid Panel Results

TEST	LOW	TARGET RANGE	HIGH	
Cholesterol		<200	240	mg/dl
HDL	40+	43		mg/dl
Cholesterol, NON-HDL		76		mg/dl
Triglyceride		<150	202	mg/dl
LDL		241		mg/dl

# Example record for Ellen Ross follows with sample data provided from:

<http://blue-button.github.com/challenge/files/sample-challenge-record.txt>

<http://blue-button.github.com/challenge/files/more-fields.txt>

## Personal Health Record Ellen Ross

Printed May 8, 2007

### Known Allergies



#### SEVERE REACTIONS

**Bee stings.** Causes anaphylactic shock

**Peanuts.** Causes anaphylactic shock



#### MODERATE TO SEVERE REACTIONS

**Penicillin.** Causes hives

**Latex.** Causes hives & difficulty breathing



#### MODERATE REACTIONS

**Codeine.** Causes shortness of breath

**Dogs/Pets.** Causes sneezing and running nose



#### MILD REACTIONS

# Personal Health Record

## Ellen Ross

Printed May 8, 2007

### Known Allergies



#### SEVERE REACTIONS

**Bee stings.** Causes anaphylactic shock

**Peanuts.** Causes anaphylactic shock



#### MODERATE TO SEVERE REACTIONS

**Penicillin.** Causes hives

**Latex.** Causes hives & difficulty breathing



#### MODERATE REACTIONS

**Codeine.** Causes shortness of breath

**Dogs/Pets.** Causes sneezing and running nose



#### MILD REACTIONS

**Pollen.** Causes watery eyes, itchy nose (*self reported*)

### Your Details

Born

March 7, 1960

Gender

Female

Primary Contact Details

Phone (415) 555-1229

17 Daws Road, Portland, OR 97006

Languages Spoken

English, Spanish

Marital Status

Married

Guardian's Contact Details

Martha Shan (sister)

Phone (816) 276-6909

Ethnicity

Asian

Religious Affiliation

Christian

1357 Amber Drive, Beaverton, OR 97006

## Upcoming Dates

Your notes 

May

28

### Office Consultation

9.30 a.m. at Ashby Medical Center

*Consultation with Dr. George Potomac for Asthma*

### Sputum Culture

10.00 a.m. at Ashby Medical Center

June

1

### Chest X-Ray


9.00 a.m. at Ashby Medical Center

June

16

### Refill prescriptions this week

Indomethacin (50 mg Tablet)

 271 89 54

*Prescribed by Ashby Medical Center*

July

3

### Compensation & Pension Appointment

11.00 a.m. at Ashby Medical Center

*With Dr. Eliza Morrin*

## To-do

Your notes 

1

### Schedule Colon Cancer Screening

Schedule with Ashby Medical Center

2

### Schedule Influenza Vaccination

Schedule with Ashby Medical Center

*Last completed May 8, 2000*

## Your Healthcare Providers

Ashby Medical Center • Phone: (415) 555-1200 • Visit: 1002 Healthcare Dr, Portland, OR 97266

## Prescribed Medications

TAKE	LIQUID	HOW OFTEN	NOTES	ASHBY MEDICAL CENTER
2 puffs	Acetaminophen with Codiene	each day	2 puffs once a day	June 15, 2005
TAKE	CAPSULE	HOW OFTEN	NOTES	ASHBY MEDICAL CENTER
1 pill	Lipitor	each day	one pill a day	June 15, 2005
TAKE	TABLET	HOW OFTEN	NOTES	ASHBY MEDICAL CENTER
50 mg	Indomethacin	2 times per day	50mg bid with food	June 15, 2005
TAKE	CAPSULE	HOW OFTEN	NOTES	ASHBY MEDICAL CENTER
1 pill	Klonopin	2-3 times a day	2-3 times per day	June 15, 2005

## Self Reported

### Ginko Biloba

- Two capsules taken once a day
- Take in the morning with breakfast

TAKEN SINCE  
June 15, 2005

### Asprin EC 81 mg tablet

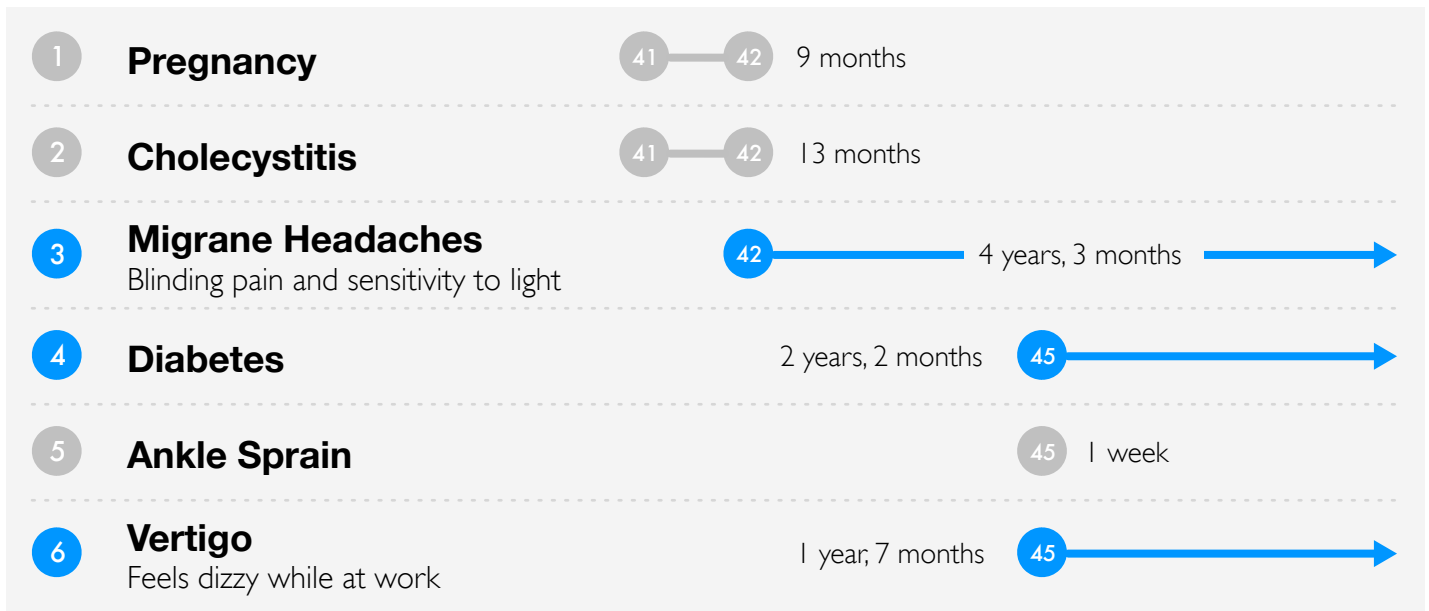
- One tablet daily
- Daily regime for heart health

TAKEN SINCE  
June 15, 2005



# Overview of Medical Conditions

2000 — 2007



# Medical History

2000 — 2007



medical history continues on next page

March 21, 2002  
Thursday

● **Labor and Delivery**  
with Dr. Tiffany Martinez at Ashby Medical Center

● **Cesarian Section**  
with Dr. Tiffany Martinez at Ashby Medical Center

September 28, 2002  
Saturday

● **Gall Bladder Surgery**  
with Dr. Bala Venktaraman at Ashby Medical Center

February 4, 2003  
Monday

3 ● **Migrane Headaches observed**  
Blinding pain and sensitivity to light

December 10, 2003  
Wednesday

R ● **Indomethacin (50 mg Tablet)**  
50 mg / two times per day  
Prescribed by Ashby Medical Center

March 7, 2003

● 43 today

August 15, 2003  
Wednesday

● **ACL Surgery**  
with Dr. John Kindle at Ashby Medical Center

March 7, 2004

● 44 today

March 7, 2005

● 45 today

March 10, 2005  
Thursday

● **Office Consultation**  
with Dr. Bala Venktaraman at Ashby Medical Center

● **Lab Results: Renal Panel**

TEST	LOW	REFERENCE RANGE	HIGH	
Calcium		8.6 10.5	150	mg/dl
Potassium		3.6 5.1	50	mg/dl
Creatinine		0.5 1.4	1.6	mg/dl
Urea Nitrogen		6 20	22	mg/dl
Glucose		65 100 110		mg/dl
Chloride	96	98 108		mEq/L
Creatinine EGFR	58	60 -		—
Sodium	110	136 145		mg/dl

medical history continues on next page

March 17, 2005  
Thursday

● **Office Consultation (follow up)**  
*with Dr. Bala Venktaraman at Ashby Medical Center*

4 **Diabetes observed**

℞ **Insulin NPH Human (100 u/ml injection)**  
Inject 16 units under the skin every morning and inject 18 units at bedtime  
*Prescribed by Ashby Medical Center*

March 28, 2005  
Monday

◆ **Emergency Department Visit**  
*with Dr. Henry Seven at Community Hospital*

5 **Ankle sprain observed**  
Slipped on ice and fell

℞ **Acetaminophen with codeine (liquid)**  
2 puffs / once a day  
*Prescribed by Ashby Medical Center*

October 14, 2005  
Friday

6 **Vertigo observed**  
Feels dizzy while at work

March 7, 2006 ● 46 today

March 7, 2007 ● 47 today

May 8, 2007 ● Today  
Wednesday

# Thank you

Thank you for this interesting challenge!

