



Intelligent Health Lab



Children's Hospital  
Informatics Program



Harvard  
Medical School



## Building the App Store for Biosurveillance



SMART

**Kenneth D. Mandl, MD, MPH**

Director, Intelligent Health Laboratory

Boston Children's Hospital Informatics Program (CHIP)

Harvard Center for Biomedical Informatics

Co-Director CDC Center of Excellence in Public Health Informatics



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**HOW DO WE  
BI-DIRECTIONALLY LINK  
BETWEEN PUBLIC HEALTH  
AND THE POINT OF CARE?**

## NATIONAL STRATEGY FOR BIOSURVEILLANCE

“Providing information to the health care system can substantially benefit decisions regarding patient treatment, infection control measures, and hospital staffing.”

JULY 2012





## Use Case 1—Delivering General Alerts to the EMR

\* Reuters is not responsible for the content in this press release.

Mon Feb 21, 2011 8:00am EST

### CDC to Test Actionable Alerts with GE Healthcare

A GE Healthcare, Alliance of Chicago and CDC Collaboration Project

After a full year of feasibility studies, the Centers for Disease Control and Prevention (CDC) is taking a significant step toward providing public health information at the point-of-care. CDC is collaborating with GE Healthcare, a unit of General Electric Company (NYSE: GE), to explore the efficacy of actionable health alerts, delivered instantly to a physician's electronic medical record.

"When a physician is seeing a patient, she just punches the data in as she normally would," explained Dr. Mark Dente, Chief Medical Informatics Officer for GE Healthcare IT. "The real work happens behind the scenes."

Once the data is entered, it's de-identified and transmitted to an archive where it's measured against a disease profile and, where a suitable match is found, the relevant alert is issued and appears on the doctor's EMR (Electronic Medical Record) display without so much as an extra keystroke.

"Our first use case explores foodborne illness—and CDC estimates there are 48 million cases of it in the US alone each year," explained Dente. "As symptoms are captured by the computer, CDC matches them



# The Problem



## The NEW ENGLAND JOURNAL of MEDICINE

### Escaping the EHR Trap — The Future of Health IT

Kenneth D. Mandl, M.D., M.P.H., and Isaac S. Kohane, M.D., Ph.D.

It is a widely accepted myth that medicine requires complex, highly specialized information-technology (IT) systems. This myth continues to justify soaring IT costs, burdensome physician workloads, and stagnation in innovation — while doctors become increasingly bound to documentation and communication products that are functionally decades behind those they use in their “civilian” life.

Even as consumer IT — word-

processing programs, search engines, social networks, e-mail systems, mobile phones and apps, music players, gaming platforms — has become deeply integrated into the fabric of modern life, physicians find themselves locked into pre-Internet-era electronic health records (EHRs) that aspire to provide complete and specialized environments for diverse tasks. The federal push for health IT, spearheaded by the Office of the National Coordinator for

Health Information Technology (ONC), establishes an information backbone for accountable care, patient safety, and health care reform. But we now need to take the next step: fitting EHRs into a dynamic, state-of-the-art, rapidly evolving information infrastructure — rather than jamming all health care processes and workflows into constrained EHR operating environments.

We believe that EHR vendors propagate the myth that health





ORIGINAL CONTRIBUTION

# Current stage technologies: No data in or out, no communication

## Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors

Ross Koppel, PhD

Joshua P. Weitzel, MD, PhD

Miguel Cohen, PhD

Steve Nadelink, BS

L. Russell Lomas, JD, MPH, MEd

Stephen T. Kinnaird, MD, MACE

Brian J. Hayes, MD, MPH

**A** DRUG-RELATED EVENTS (DREs) are estimated to injure or kill more than 770,000 people in hospitals annually.<sup>1</sup> Prescribing errors are the most frequent source.<sup>2,3</sup> Computerized physician order entry (CPOE) systems are widely viewed as crucial for reducing prescribing errors<sup>4,5,6,7,8</sup> and saving hundreds of billions in annual costs.<sup>9,10</sup> Computerized physician order entry system advocates include researchers, clinicians, hospital administrators, pharmacists, business councils, the Institute of Medicine, state legislatures, health care agencies, and the lay public.<sup>11,12,13,14,15,16,17</sup> These systems are expected to become more prevalent in response to existing working-hour limitations and reduced care discontinuities<sup>18</sup> and will supposedly offer safety (eg, job demarcation) and efficiency

**Context:** Hospital computerized physician order entry (CPOE) systems are widely regarded as the technical solution to medication ordering errors, the largest identified source of preventable hospital medical error. Published studies report that CPOE reduces medication errors up to 81%. Few researchers, however, have focused on the existence or types of medication errors facilitated by CPOE.

**Objective:** To identify and quantify the role of CPOE in facilitating prescription error risks.

**Design, Setting, and Participants:** We performed a qualitative and quantitative study of house staff interaction with a CPOE system at a tertiary-care teaching hospital (2002-2004). We surveyed house staff (N=267; 88% of CPOE users), conducted 5 focus groups and 30 in-person one-on-one interviews with house staff, information technology leaders, pharmacy leaders, attending physicians, and nurses; shadowed house staff and nurses, and observed them using CPOE. Participants included house staff, nurses, and hospital leaders.

**Main Outcome Measures:** Examples of medication errors caused or exacerbated by the CPOE system.

**Results:** We found that a widely used CPOE system facilitated 22 types of medication error risks. Examples include fragmented CPOE displays that prevent a coherent view of patients' medications, pharmacy inventory display mistakes for dosage guidelines, ignored antibiotic renewal notices placed on paper charts rather than in the CPOE system, separation of functions that facilitate double dosing and incompatible orders, and inflexible ordering formats generating wrong orders. Three quarters of the house staff reported observing each of these error risks, indicating that they occur weekly or more often. Use of multiple qualitative and survey methods identified and quantified error risks not previously considered, offering many opportunities for error reduction.

**Conclusions:** In this study, we found that a leading CPOE system often facilitated medication error risks, with many reported to occur frequently. As CPOE systems are implemented, clinicians and hospitals must attend to errors that these systems cause in addition to errors that they prevent.



## As per the National Coordinator . . .

- New England Journal of Med 2008: Low uptake of HIT in ambulatory setting
- New England Journal of Med 2009 Low uptake in of HIT in hospitals

**Conclusion: \$48B  
investment, pushing  
the technology**



### Medicare Meaningful Use Incentive Payment Schedule

Calendar Year	First Calendar Year in which the Eligible Professional Receives an Incentive Payment				
	2011	2012	2013	2014	2015 +
2011	\$18,000	-----	-----	-----	-----
2012	\$12,000	\$18,000	-----	-----	-----
2013	\$8,000	\$12,000	\$15,000	-----	-----
2014	\$4,000	\$8,000	\$12,000	\$12,000	-----
2015	\$2,000	\$4,000	\$8,000	\$8,000	\$0
2016	-----	\$2,000	\$4,000	\$4,000	\$0
<b>TOTAL</b>	<b>\$44,000</b>	<b>\$44,000</b>	<b>\$39,000</b>	<b>\$24,000</b>	<b>\$0</b>

Cap applies for any eligible professional with at least \$24,000 in Medicare Part B allowable charges in each payment year





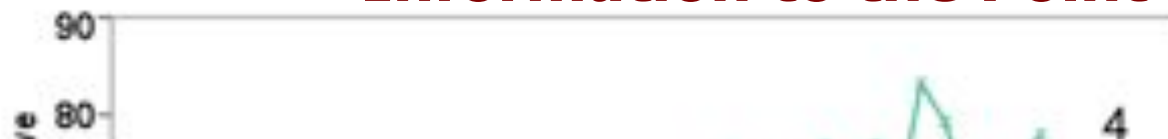
## **Illustration: An Innovator who cannot reach scale**

Med-tastic is a well-funded NewCo which has developed an elegant medication list application that has physician and consumer facing functionality

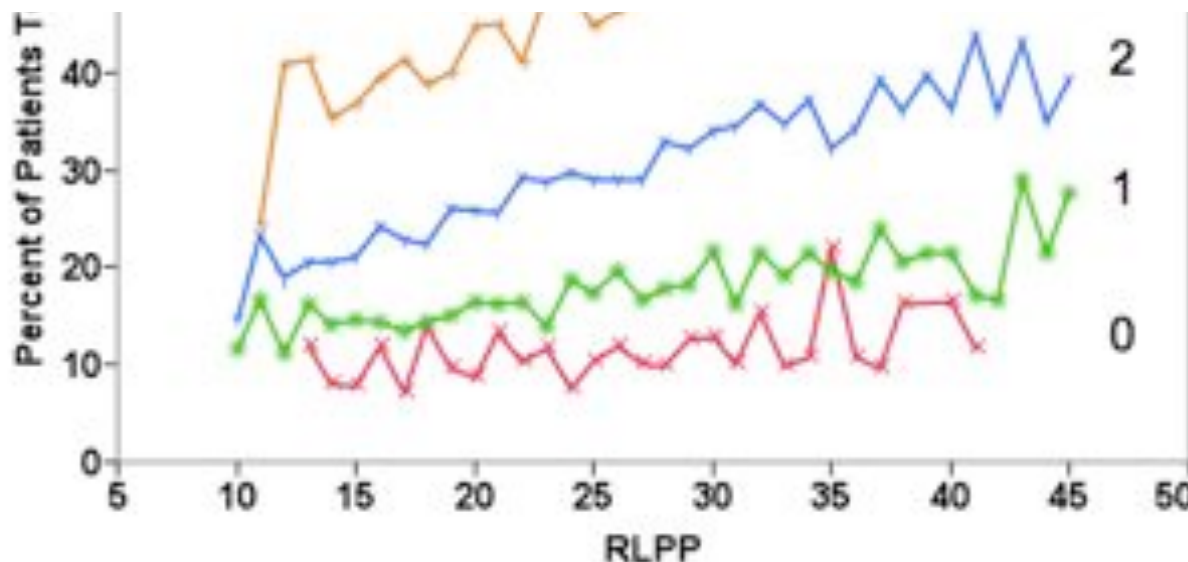
To work, Med-tastic needs

- 👉 Prescribing history
- 👉 Dispensed medication history
- 👉 Allergies
- 👉 Problem list diagnoses

## Use Case 2: Delivering Context Sensitive Information to the Point of Care



# “Reverse Biosurveillance”



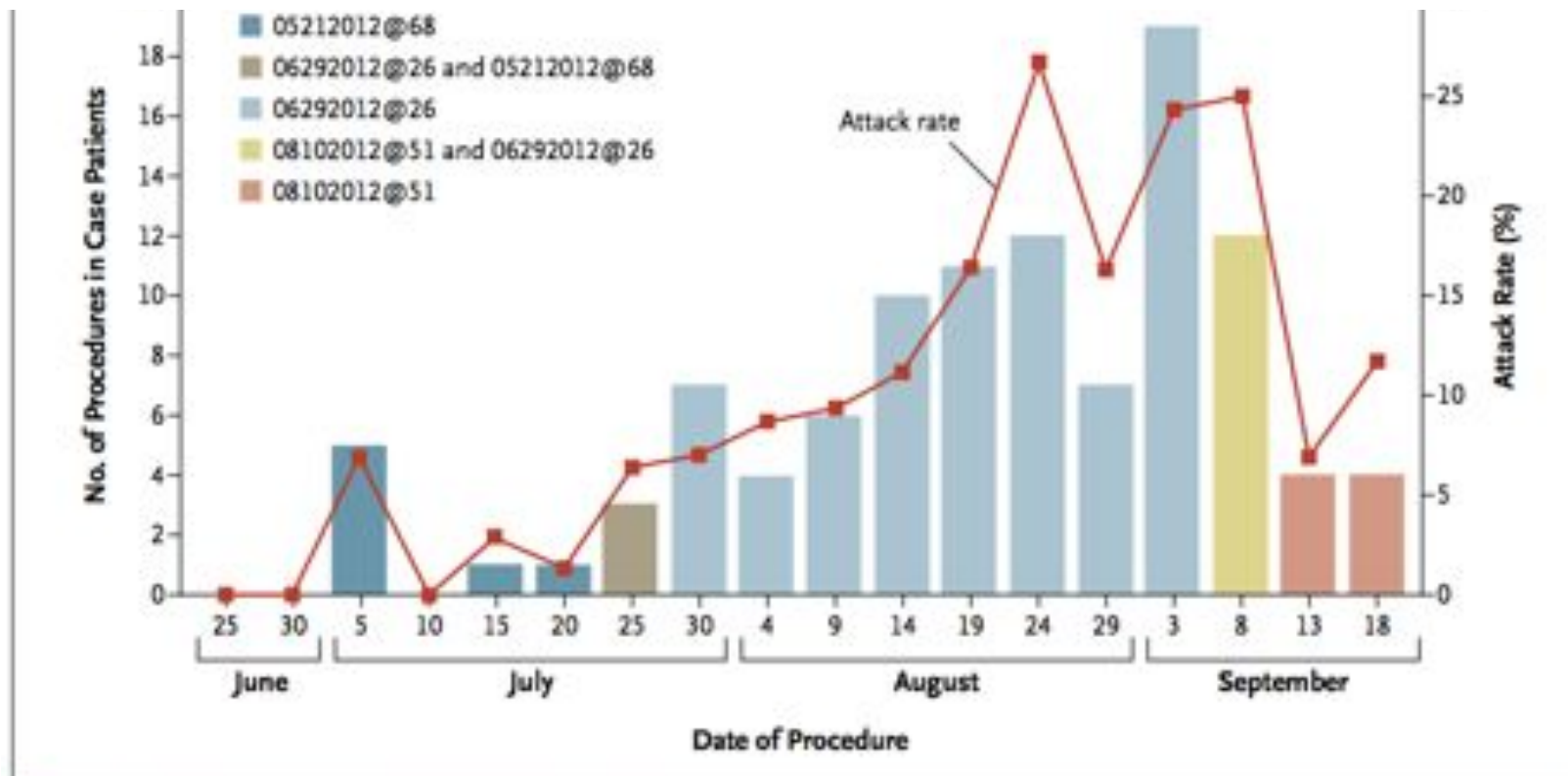
Annals of Internal Med 2011



## Use Case 3: Case Identification and Reporting



## Use Case 4: Context sensitive Information in a Crisis

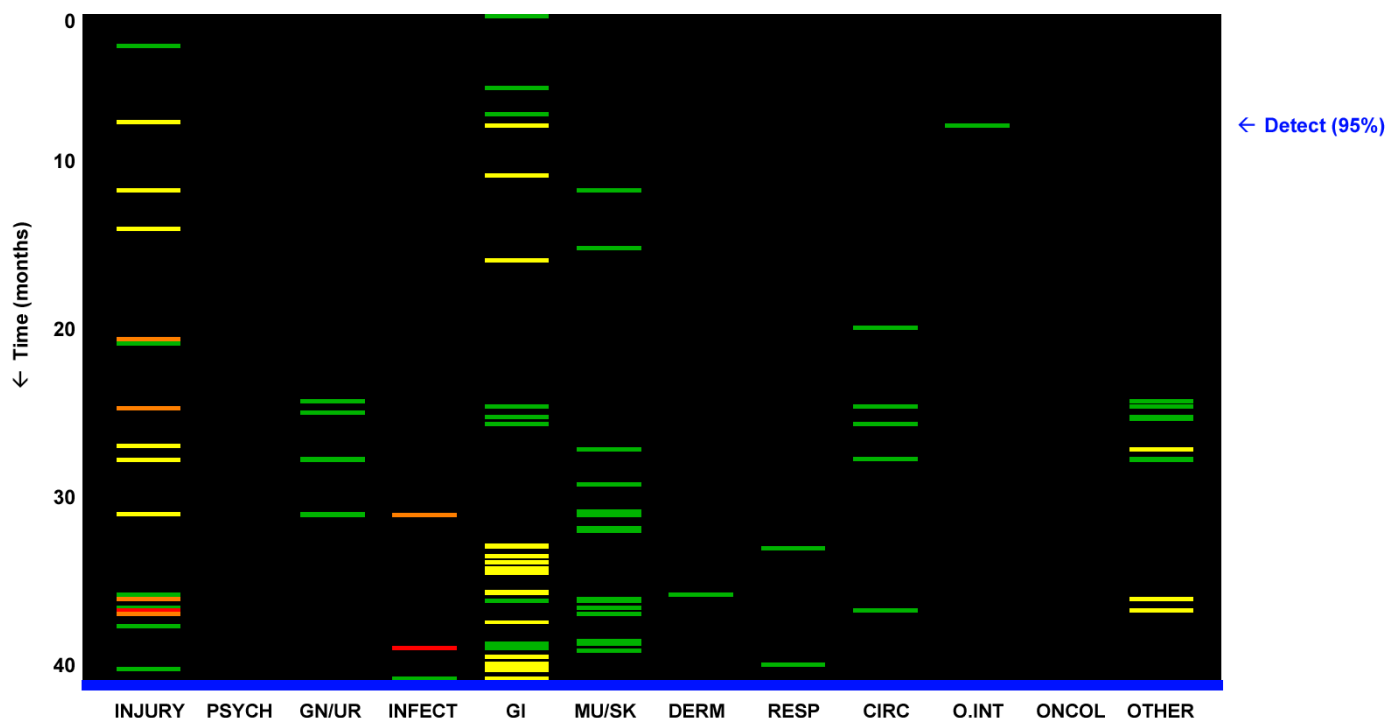


**Figure 1.** Number of Epidural and Paraspinal Glucocorticoid Injections and Attack Rate.

Shown are the number of epidural and paraspinal glucocorticoid injection procedures performed in case patients, as well as the attack rates among persons who received methylprednisolone acetate from the implicated lots during

# Use Case 5: Predictive Medicine/ Public Health Screening

## Domestic Violence



**British Medical Journal**

## **Use Case 6: CDC Updates immunization schedule updated**





# Use Case 7—Direct Patient Engagement

tudabetes.org\*  
A community of people inspired by diabetes, led by the Diabetes Health Foundation

TuAnalyze  
Show Settings

Learn more about TuAnalyze. Click Show more

MY PROFILE    MY SURVEY    ABOUT

## Hypoglycemia Survey

Save & Exit

Answers #1-3 (total 20)

Q. How much of a problem is low blood sugar (hypoglycemia) for you?

- Surveys just once
- Continuing health problem
- Worries me a lot
- Major problem
- Not a problem

Q. Do you feel there is a pattern to your low blood sugars that helps you manage and prepare for them?

- Yes
- No

Q. Do you currently use a continuous glucose monitoring system?

- Yes
- No

Previous    Next

tudabetes.org\*  
A community of people inspired by diabetes, led by the Diabetes Health Foundation

Published results from the TuAnalyze Hypoglycemia survey!

Presented by TuAnalyze Session January 6, 2014 at 10:00am - All Good Images - Free Blog

Thank you to everyone who has taken the TuAnalyze hypoglycemia survey! We presented results from the survey at the International Society for Disease Surveillance meeting this past December.

At the meeting, we reported on the frequency of severe hypoglycemia and the experience of harms related to low blood sugar in the TuDiabetes community (if you would like to read the full abstract that accompanied the presentation, you may find it here). We found that more than one quarter (28%) of TuDiabetes users have had at least one episode of severe low blood sugar in the past 12 months (defined as a time when they lost consciousness, had a seizure, needed glucagon or medical treatment or help of other people due to low blood sugar). In addition, 10% of respondents had ever had a vehicle accident or serious injury related to hypoglycemia. 42% also reported that worry about low blood sugar affects their daily life.

The chart below shows the percentage of hypoglycemia survey respondents who report that they limit/avoid these daily activities in order to avoid low blood sugar and related consequences.

### Behaviors to avoid hypoglycemia and related consequences

Behavior	Percentage
Driving	35.4%
Working	22.5%
Exercise	56.2%
Traveling	19.7%



## An Integrated Public Health and Health Care System

- How do we get public health to the point of care?
  - ✓ Deliver Alerts
  - ✓ Provide contextualized information to guide treatment
  - ✓ Automatically identify and report cases
  - ✓ Drill down into history while the patient is present
  - ✓ Nimble update decision support rules



# The New York Times



**“There’s no way small practices can effectively implement electronic health records on their own.”**

**“This is not the iPhone.”**



# The NEW ENGLAND JOURNAL of MEDICINE

## No Small Change for the Health Information Economy

Kenneth D. Mandl, M.D., M.P.H., and Isaac S. Kohane, M.D., Ph.D.

The economic stimulus package signed by President Barack Obama on February 17 included a \$19 billion investment in health information technology. How can we best take advantage of this unprecedented opportunity to computerize health care and stimulate the health information economy while also stimulating the U.S. economy? A health care system adapting to the effects of an aging population, growing expenditures, and a diminishing primary care workforce needs the support

of a flexible information infrastructure that facilitates innovation in wellness, health care, and public health.

Flexibility is critical, since the system will have to function under new policies and in the service of new health care delivery mechanisms, and it will need to incorporate emerging information technologies on an ongoing basis. As we seek to design a system that will constantly evolve and encourage innovation, we can glean lessons from large-scale information-

technology successes in other fields. An essential first lesson is that ideally, system components should be not only interoperable but also substitutable.

The Apple iPhone, for example, uses a software platform with a published interface that allows software developers outside Apple to create applications; there are now nearly 10,000 applications that consumers can download and use with the common phone interface. The platform separates the system from the functional-



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# The App Store for Health



SMART

**ONC Funded Research \$15M Project under the  
"SHARP" program**





**Can EMRs behave  
like iPhones or  
Androids in that  
innovators  
readily create and  
widely distribute  
apps across  
thousands of  
installs?**



## The Core Team

- Co-Directors, PI's
  - ✓ Isaac Kohane, Ken Mandl
- Principal Architect
  - ✓ Joshua Mandel
- Lead Developer
  - ✓ Nikolai Schwertzner
- Executive Director
  - ✓ Rachel Ramoni
- Executive Committee
  - ✓ Shawn Murphy
  - ✓ Elmer Bernstam
  - ✓ Mike McCoy
  - ✓ Griffin Weber
- Advising Architect
  - ✓ Ben Adida
- Business Consultant
  - ✓ David Kreda
- External Evaluator
  - ✓ Patti Brennan



- Clayton Christensen
  - ✓ Harvard Business School
- David Clark
  - ✓ MIT CSAIL
- James Daniel
  - ✓ ONC
- Jim Hansen
  - ✓ Dossia
- Mark Frisse
  - ✓ Vanderbilt University
- John Glaser
  - ✓ Siemens Health Services Business Unit
- Ron Gutman
  - ✓ HealthTap
- John Halamka
  - ✓ HITSP, HIT Standards Committee
- Regina Herzlinger
  - ✓ Harvard Business School

## Advisory Committee

- David Kibbe
  - ✓ Kibbe Consulting
- Timothy Kurth
  - ✓ CVS/CareMark
- Ken Majkowski
  - ✓ Surescripts
- David McCallie
  - ✓ Cerner
- Sean Nolan
  - ✓ Microsoft Health Solutions Group
- Ed Park
  - ✓ Athena Health
- Doug Solomon
  - ✓ IDEO
- Ann Waldo
  - ✓ Oldaker, Belair, and Wittie, LLP



## Substitutability

- Substitutable apps. The purchaser of an application can replace one for another without being technically expert
- Substitutable containers. The application can run on any platform that has implemented the API

Substitutability is an overarching principle to drive interoperability—the data must be presented in the same precise format by the “container” each time

In a sense, there is a virtuous cycle in which good standards (or when necessary, new standards) become used to support apps, and successful apps then reinforce the standards (or create *de facto* new standards)

## Our vocabulary

- **Data Sources**

Managed by containers

- **Containers**

Present data from data sources to apps in a uniform fashion

- **Apps**

Completely substitutable

## UI

Standards-based integration (HTML5)

## Data

Context (container, user, patient)

Medical (Problems, Allergies, etc.)

## API

Resource oriented, everything gets a **URL**

## Authentication

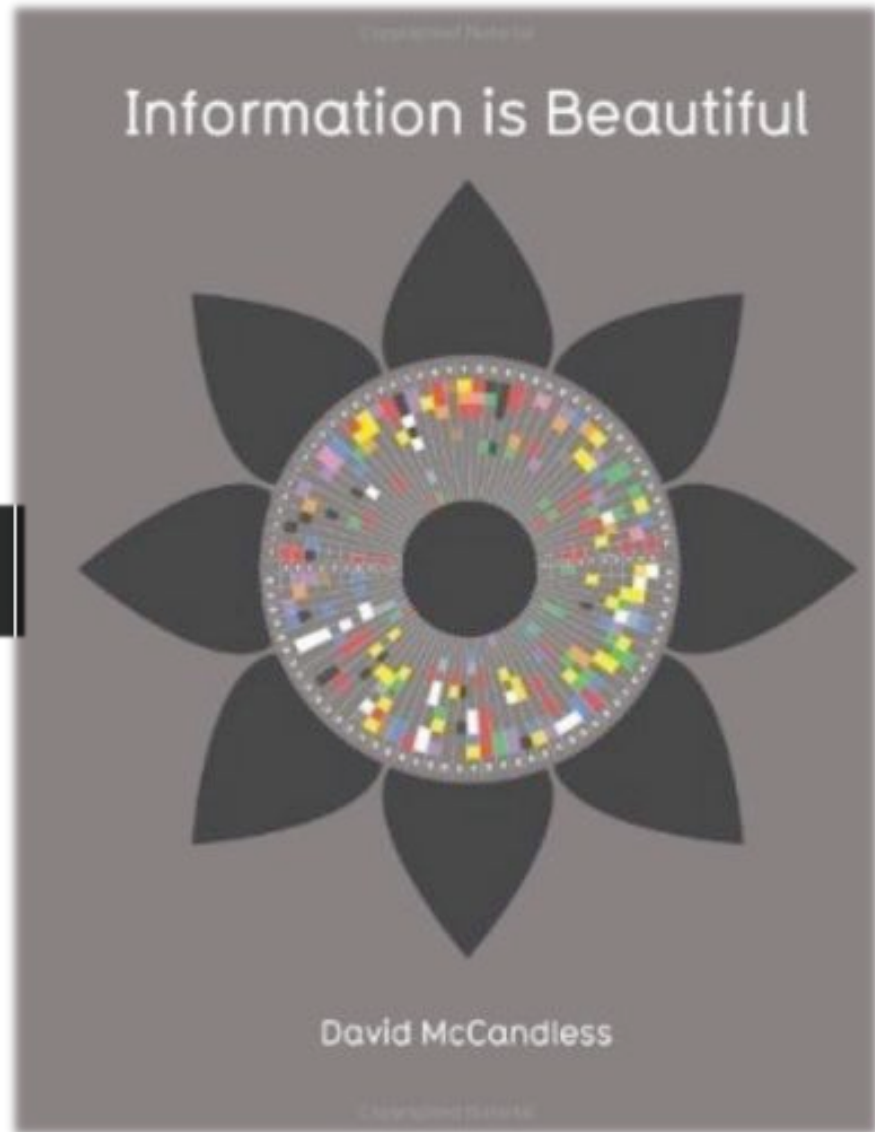
Consistent delegation with Web standards (OAuth)

*Inspired by a*

**WIRED**

18.12 Issue

*Design Challenge*







# State-of-the-Art ???

<input checked="" type="checkbox"/> ALIGN HERE		SEND TO			
PATIENT NAME DOE, JOE			PATIENT ID NO. NOT GIVEN		DATE COLLECTED 06/11/2010
ACCESSION NO. 36904447	BIRTH DATE 55	GENDER MALE	SAMPLE ID NO. NOT GIVEN	OTHER ID NO.	TIME 09:41
REMARKS SAMPLE REPORT, NO SAMPLE SENT			REFERRING PHYSICIAN		REPORTED 06/11/2010 10:00
					STATUS FINAL

TEST	RESULT (+ = OUT OF RANGE)	UNITS	REFERENCE RANGE
Cardio CRP		0.4 mg/L	
For Ages > 17 Years:			
CCRP mg/L	Risk According to AHA/CDC Guidelines		
<1.0	Lower Relative Cardiovascular Risk.		
1.0-3.0	Average Relative Cardiovascular Risk		
3.1-10.0	Higher Relative Cardiovascular Risk. Consider retesting in 1 to 2 weeks to exclude a benign transient elevation in the baseline CRP value secondary to infection or inflammation.		
>10.0	Persistent elevations upon retesting, may be associated with infection and inflammation.		



An Inspired Design from Dave McCandless (cc license)

### Bloodwork Cardiology Result



ORDERED BY: Dr Francis Pulaski

#### Patient info

NAME: John Doe

GENDER M AGE 49 DOB 01/10/1961

BeBeve Medical Centre

lamx.d@bactamed.edu

803) 555-54321 x1523

COLLECTED: 11/02/2010, 10:40 a.m.

RECEIVED: 11/02/2010, 1:03 p.m.

#### 1 About this test

This report evaluates your potential risk of heart disease, heart attack, and stroke.

#### 2 Your results

##### CRP level test

3.3 your level of a specific protein in the blood linked to inflammation of blood vessels



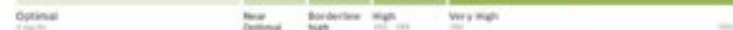
##### Total cholesterol level

265



##### LDL "bad" cholesterol

233



##### HDL "good" cholesterol

32



#### 3 Your risk You show an elevated risk of cardiovascular disease

If you're a smoker with normal blood pressure, (130 mm/Hg) but family history of heart attack before age 60 (one or both parents) your risk over 10 years is:

15%

Your risk would be lowered to

12% if your blood pressure were 120mm/Hg

10% if you quit smoking

6% if you reduced cholesterol to 160mg/DL

Use your CRP results and cholesterol level to calculate your 10 year risk of a cardiovascular event at [ReynoldsRisk.org](http://ReynoldsRisk.org)

#### 4 What now?



Diet & exercise - can improve your cholesterol levels



Quitting smoking - can decrease your heart disease risk by 50% or more



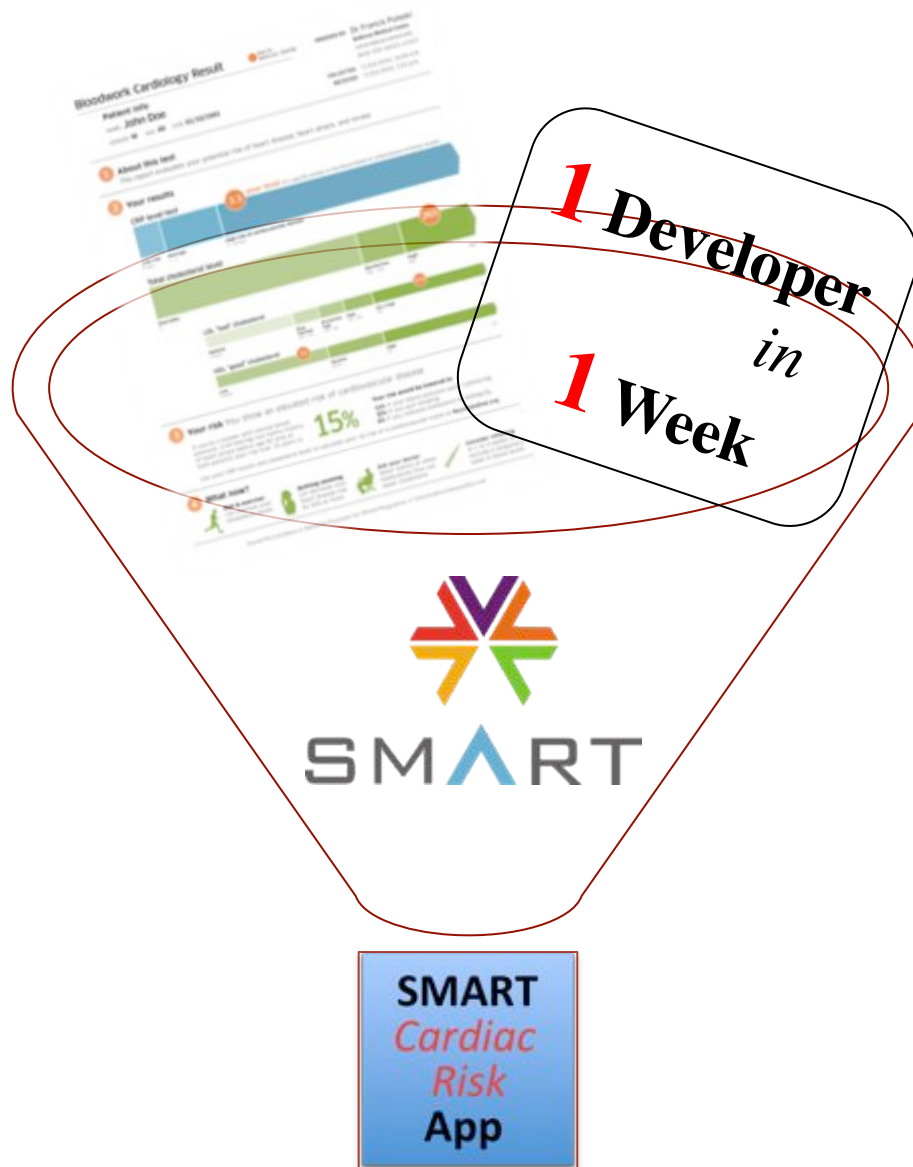
Ask your doctor about statins or other medications that can lower cholesterol



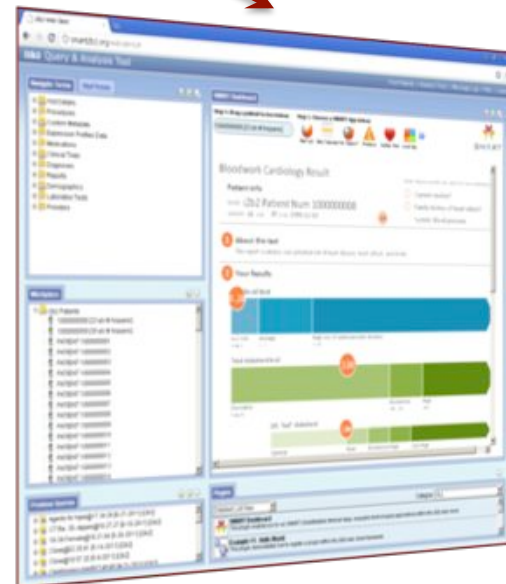
Consider retesting in 1 to 2 weeks to exclude a temporary spike in blood levels



# 1 Design + 1 Developer + 1 Week



# 1 SMART App in 3 SMART Systems





## Well-publicized

The screenshot shows a webpage from the White House administration. At the top, it says "the WHITE HOUSE PRESIDENT BARACK OBAMA" with a logo of the White House. Below that is a navigation bar with links for "BLOG", "PHOTOS & VIDEO", "BRIEFING ROOM", "ISSUES", and "the ADMINISTRATION". The main content area has a blue header with the text "Open Government Initiative" and the subtext "TRANSPARENCY + PARTICIPATION + COLLABORATION". Below this is a navigation bar with links for "About Open Government", "Open Gov Blog", "Around the Government", and "Innovations Gallery". The main article title is "SMart Prize for Patients, Physicians, and Researchers" in a large, bold, red font. To the right of the title is a "Subscribe" button. Below the title, it says "Posted by Anesh Chopra on March 10, 2011 at 03:02 PM EDT". The article text begins with "This week a research team at Children's Hospital of Boston and Harvard Medical School [launched a prize](#) to encourage innovative app developers to build new products and services that benefit patients and providers. The prize was created with funding from the [Office of the National Coordinator for Health IT](#) within the Department of Health and Human Services, and constitutes just the latest in a growing number of examples of the Federal government fostering R&D collaboration through open innovation." The text is partially cut off at the bottom.





SMART

< Alex Lewis >

Med List

**Meducation**  
www.meducation.com

Pharmacy  
Holt & Wolff  
Polygit Systems, Inc.  
2000 Aerial Center Parkway  
Morrisville, NC 27560  
(919) 853-4392

Coumadin Tablet 5 mg

How to take medicine  
Take the medicine by mouth once a day

☀️ 🌙

< Alex Lewis > Challenge Judge

Med List

**Meducation**  
www.meducation.com

Pharmacy  
Holt & Wolff  
Polygit Systems, Inc.  
2000 Aerial Center Parkway  
Morrisville, NC 27560  
(919) 853-4392

Coumadin Tablet 5 mg

Cómo tomar el medicamento  
Tome el medicamento por la boca una vez al día

☀️ 🌙

Tome una (1) pastilla cada día.  
Tómela por la boca.

Medicaciones  
Tome el medicamento sin alimentos o después.  
Este medicamento se puede tomar con o sin alimentos.

Indivohealth™ for John Smith

SETTINGS LOGOUT

Mary | John S. Smith | Joshua Lewis

Med List

**Meducation**  
www.meducation.com

Pharmacy  
Holt & Wolff  
Polygit Systems, Inc.  
2000 Aerial Center Parkway  
Morrisville, NC 27560  
(919) 853-4392

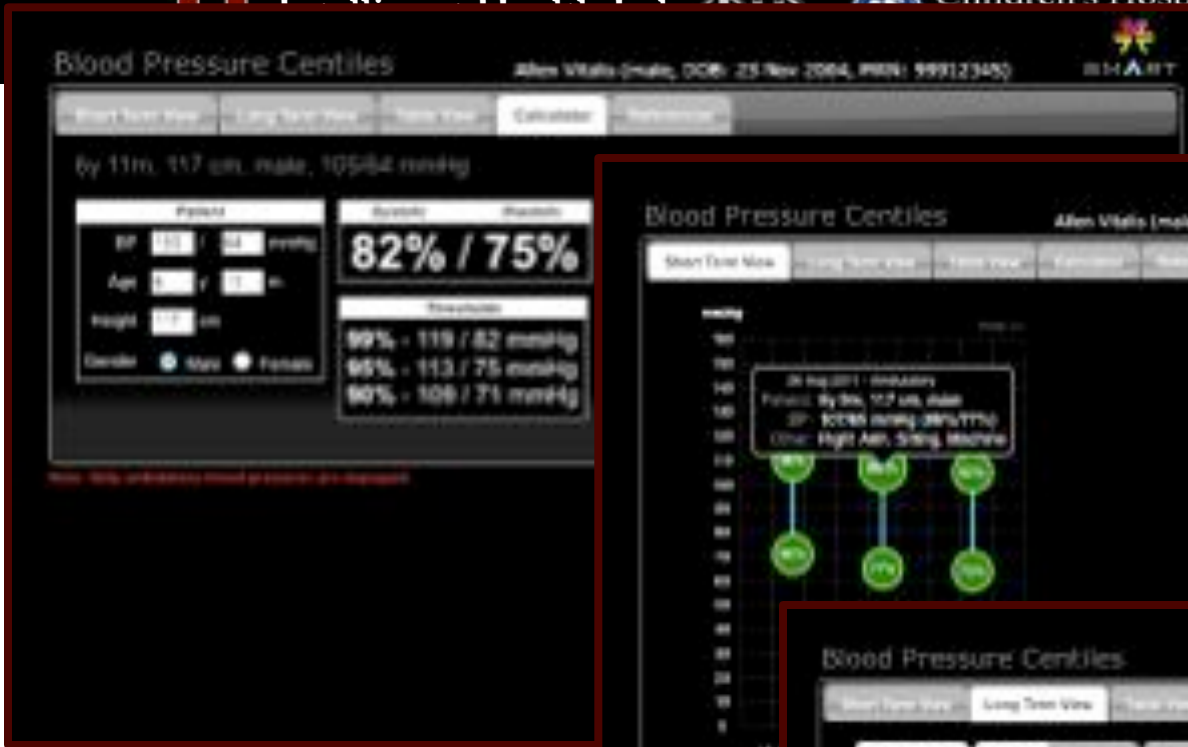
Coumadin Tablet 5 mg

Cómo tomar el medicamento  
Tome el medicamento por la boca una vez al día.  
Tome la medicina por la boca una vez al día.

☀️ ☀️ 🌙

Desayuno Almuerzo Comida Al acostarse





**SMART  
BP Centiles App  
Running on Cerner**



SYSTEMTESTONLY, BARBARA M - 214-17-59 Opened by NGRIN MD, DANIEL J

Task Edit View Patient Chart Links Notifications Navigation Help

Schedule View Message Center Patient List Patient Sign Out Patient Access List Discharge Dashboard Alice

CHB Home CH Menu CHWPS Help UpToDiabe LeoConso Indivo Historical Labs Radiology Images SERS NeoFax Phone/Pa

Tear Off Attach E Communicate Change

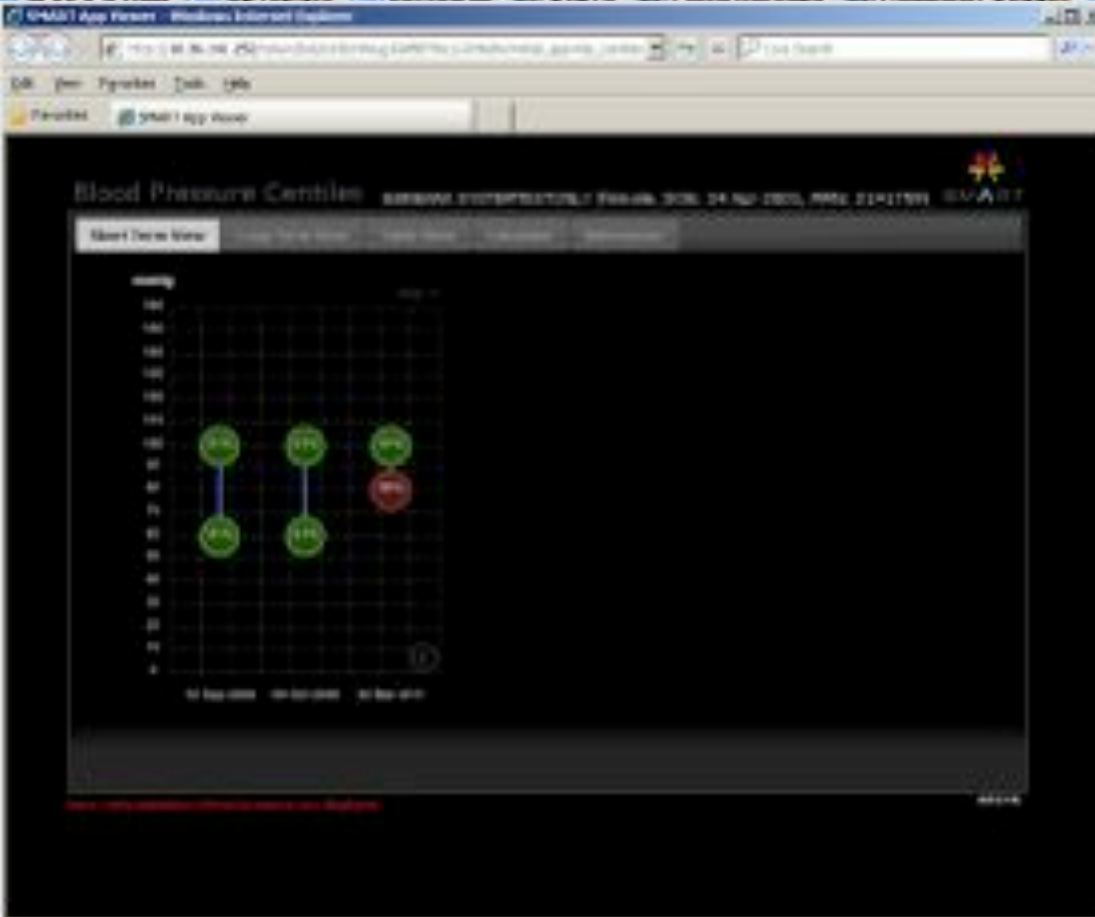
SYSTEMTEST... X

SYSTEMTESTONLY, BARBARA M

ALLERGIES Precautions

Menu - Ambulatory

- ViewPoint
- Orders
- Medication List
- NAR
- Allergies
- Problems and Diagnoses
- Outpatient Specialty View
- Ambulatory BP Centiles**
- Lab
- Micro
- Lab Followup
- Diagnostic Studies View
- Documents
- Document Viewing



214-17-59 Loc: Admitting : :  
Sex: Female  
(2012 00:00 - 05:00/2012 23:00)

BARBARA M

# Medication adherence



## Medication Possession Ratio Monitor



Home

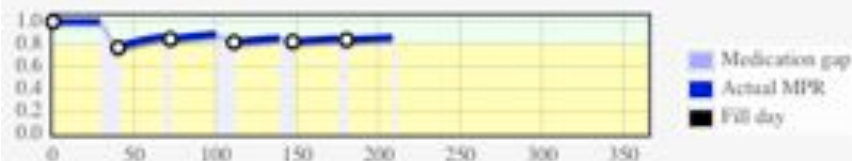
About

Med details

All meds

### DRUG CLASS: ANTIHYPERTENSIVES

#### ✓ Furosemide 20 MG Oral Tablet



**Predicted 1-year adherence level: Good**

Actual MPR on day of last pill (day 210) is 0.857142857143

First fill date: Feb. 5, 2009; last fill date: Aug. 4, 2009

#### ✓ Ramipril 10 MG Oral Capsule

**JAMIA**



Intake unique <small>accept / reject remaining</small>	Intake similar <small>accept / reject remaining</small>	Identical <small>accept / reject remaining</small>	Hospital similar <small>accept / reject remaining</small>	Hospital unique <small>accept / reject remaining</small>
Neulium PO daily 40mg		Toprol-XL PO daily 25 mg		Folic acid PO daily 1 mg
Piavek PO daily 25mg		Enalapril PO BID 20 mg		
Tylenol PO tabs 325mg		Amiodarone PO tabs at 200 mg		
		Aspirin PO daily 325 mg		
		Isosorbide dinitrate PO TID 30 mg		
		Amlodipine PO BID 2.5 mg		
	Lipitor PO daily 40mg		Lipitor PO HS 40 mg	
	Nitroglycerin SL tabs 0.4mg		Nitroglycerin SL PRN 0.4 mg	

**Detail** Nothing to display.

















Patient: Jose Martinez

11/21/2011

**Medicines you need to take every day:**

		 Morning	 Noon	 Evening	 Bedtime	
Diovan Tablet 160 mg		1				This medicine is used to treat high blood pressure.
Aspirin Tablet 81 mg		1				This medicine helps to reduce blood clots.
Actos Tablet 30 mg		1				This medicine is used to control blood sugar.
Lasix Tablet 40 mg		1/2		1/2		This medicine is used to help treat a weak heart.
Glucophage Tablet 1000 mg				1		This medicine is used to control blood sugar.
Lipitor Tablet 40 mg					1	This medicine is used to control cholesterol in the blood.
Advair Diskus 100/50 Inhaler		1 puff		1 puff		This medicine is used to treat asthma.
Potassium Chloride Powder 20 mEq/packet		1 packet				This medicine is used to replace potassium in the body.

**Medicines you should take as needed:**

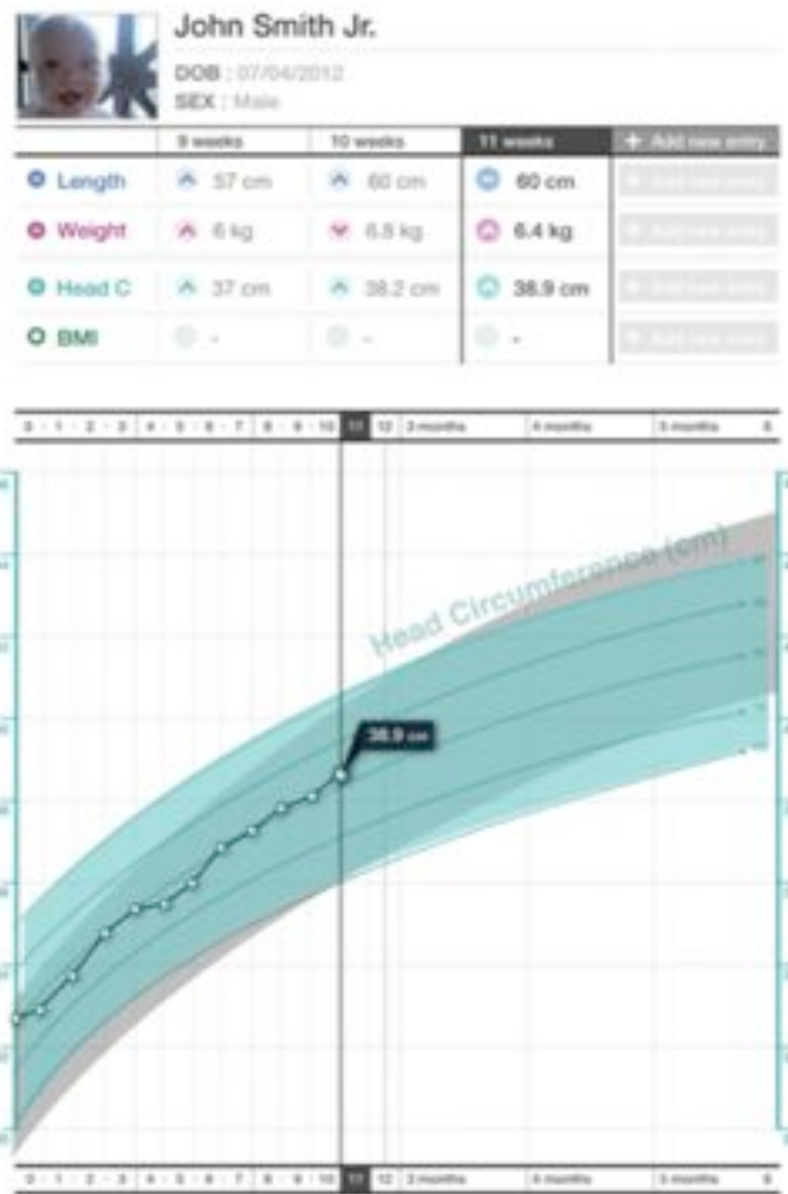
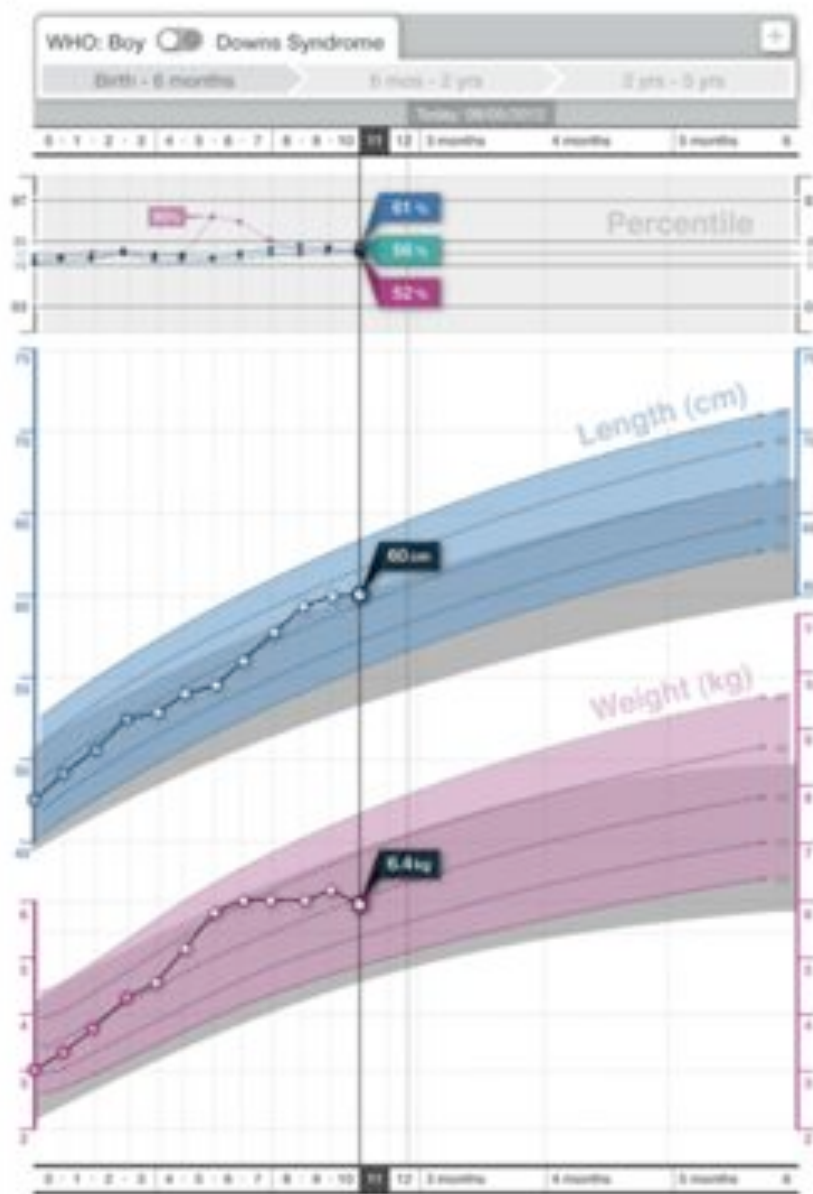
Vicodin Tablet		Take the medicine by mouth every 6 hours. Take one (1) pill each time.	This medicine is used to relieve pain.
----------------	---	--	--



If you take any medicine that is not on this list, please tell your healthcare provider.

If you have questions about your medicines, please call 1-800-555-2422.

To view, update, or print your medication list, please go to [www.dcinstructions.com](http://www.dcinstructions.com). You will need the document ID and password (shown above).







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# BUILDING BLOCK APPS

# Mashups: e.g., Genomic Medicine: There's an App for that

- Linkage to external decision support services
  - ✓ Pharmacogenomic rule sets
  - ✓ Decision support for doctors—associations







# Decision Support Integration e.g., Immunization Forecasting

< Amy Shaw > Neelima Karpineni - Logout

### Immunization Record SMART Application

- Patient List
- Alerts
- API Playground
- API Verifier
- BP Centiles
- Direct Messages
- EMR View (Cdev)
- Med List
- My App
- Problems
- Manage Apps

CHP - HMS - © 2012

Immunizations
References

Child
Add
Administered
Due
Recommended
Not Recommended
Optional

**Amy Shaw (female, DOB: 2007-03-20)** [Show Allergies](#)

Vaccine	Due	Doses			
ROTAVIRUS	5/1/12	5/24/07			
DTAP	3/1/12	9/22/07			
HepB	1/2/12 - 3/1/12	9/22/07			
POLIO	3/1/12	9/22/07	1/27/11	5/27/11	
HPV	1/1/23 - 1/1/24				
MMENING	1/1/23 - 1/1/24				
HepA	1/1/13 - 7/1/13				
ZOSTER	Not indicated - Patient not yet indicated for ZOSTER vaccine				
VARICELLA	1/1/13 - 4/1/13				
MMR	3/1/12				
MMR	1/1/13 - 4/1/13				
PneumoPCV	3/1/12 - 4/1/12				
FLU	Not indicated - Current date is not within influenza season				



# Monograph app e.g., Diabetes

**SMART**

- Patient List
- Alerts
- API Playground
- Diabetes Monograph
- DM Clone
- Problems

**BP goal = 130/80**

**Last Known Values**

SBP	27	33
DBP	16	12
Chol	548	334
Tot	332	160
HDL	33	32
LDL	49	73
BUN	8.6	8.6
Cre	0.84	0.8
Glucose	256	148
A1C	8.6	10.4

**LBL goal = 100**

**Other Tests**

weight 110 01/01/09  
height 48 09/09/11  
last pneumonia  
last flu shot

**Major CV Comorbidities**

- Coronary atherosclerosis
- Benign essential hypertension
- Post-infarction syndrome
- Essential hypertension
- Chest pain
- Coronary atherosclerosis
- Chest pain

**Other Problems**

- Diabetes mellitus type 2
- Hypertension
- Asthma
- Unspecified sleep apnea
- Hypokalemia
- Coronary atherosclerosis
- Benign essential hypertension
- Post-infarction syndrome
- Essential hypertension
- Chest pain
- Coronary atherosclerosis
- Pure hypercholesterolemia
- Acute bronchitis
- Chest pain
- Acute bronchitis

**A1C goal = 7**

**Recommendations**

**glycemia** Consider checking A1C today  
Last A1C (8.6%) done on 02/14/11 (13 months ago) out of target range (less than 7%).

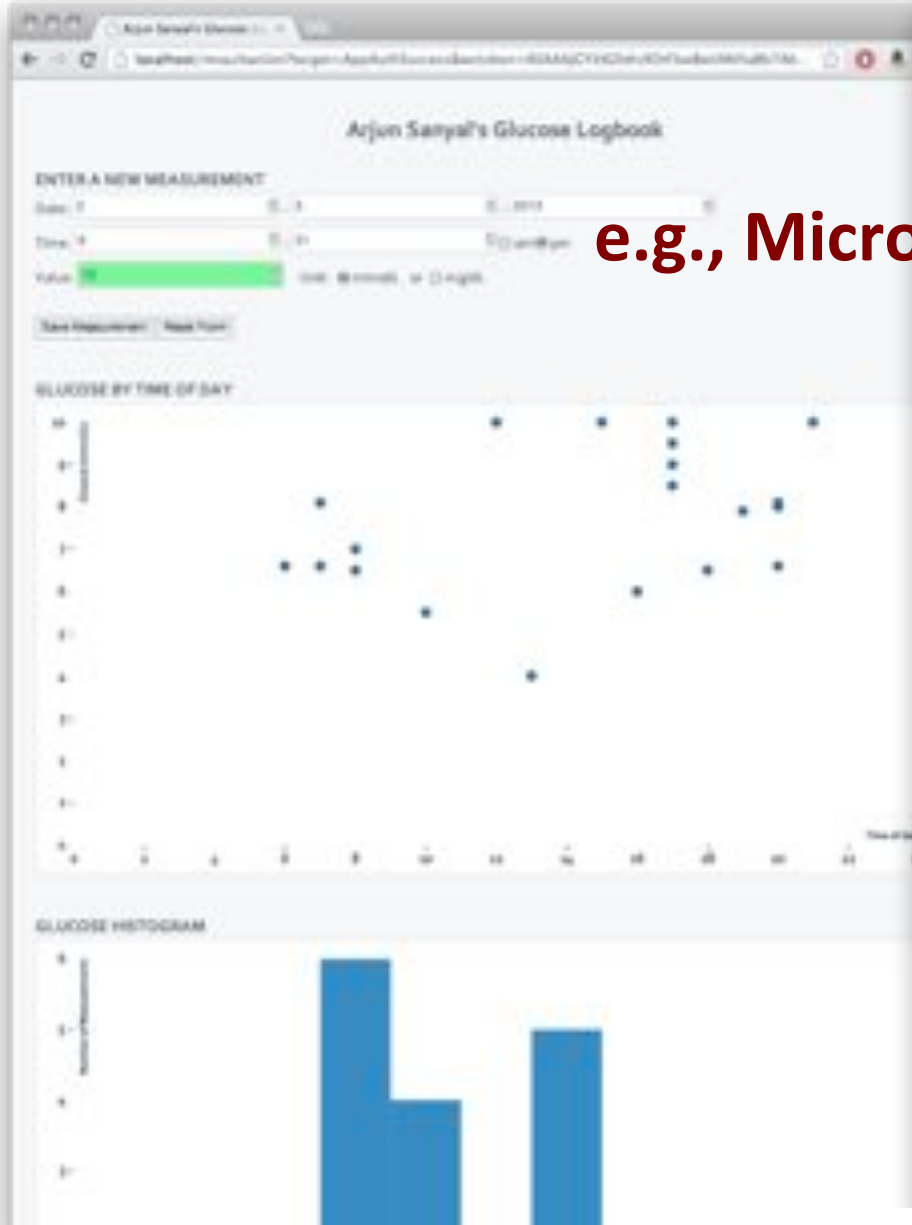
**lipids** Consider checking lipids today  
Last LDL (69mg/dL) done on 10/04/11 (7 months ago) within target range (less than 100mg/dL).

**Allergies**

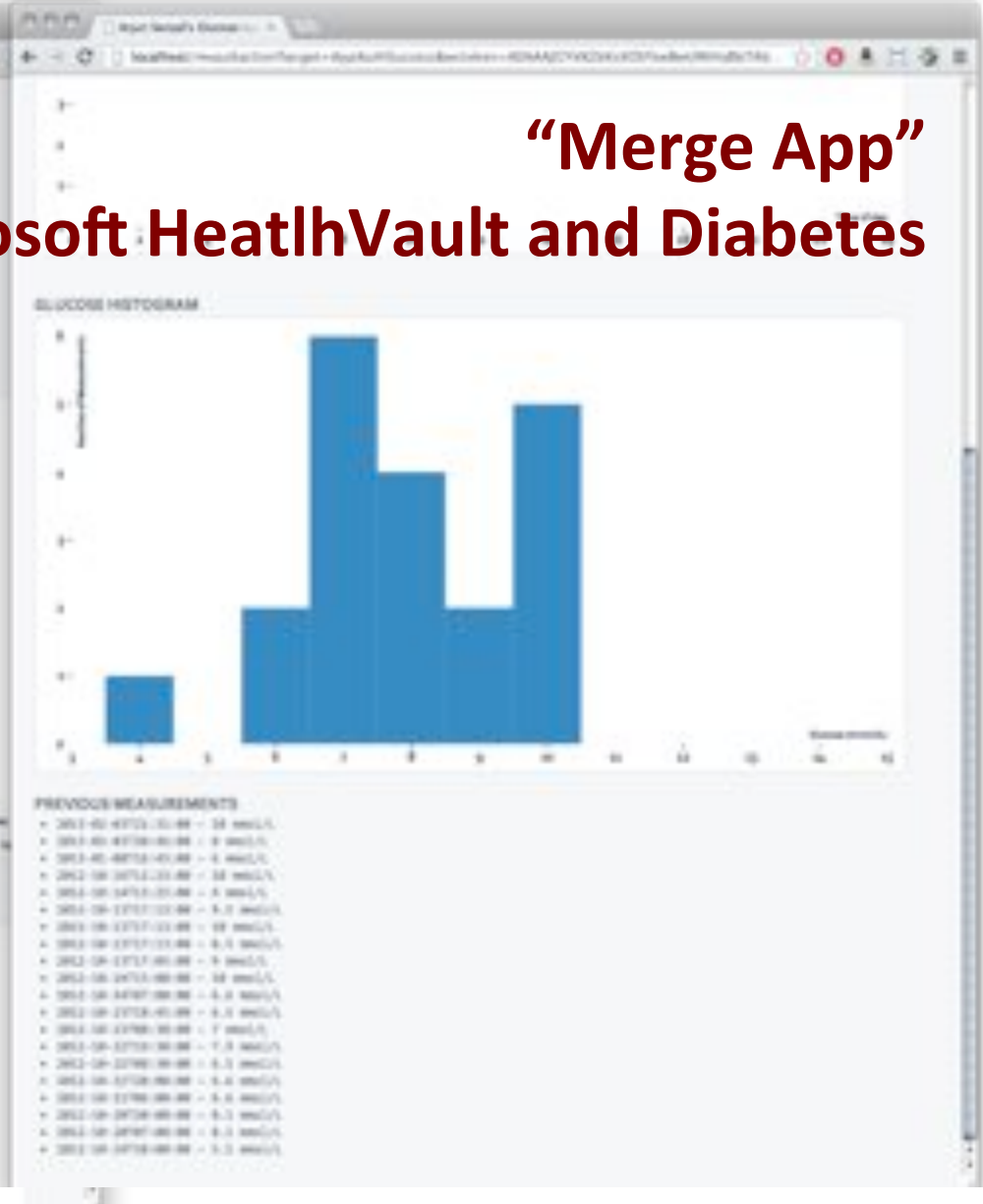
No known allergies.

**Medications**

- rosuvastatin 10 MG Oral Tablet [Crestor] | qhs.
- Chantix First Month of Therapy Pack | daily.
- Simvastatin 40 MG Oral Tablet | qhs.
- Clarithromycin 500 MG Extended Release Tablet | bid.
- Atenolol 50 MG Oral Tablet | daily.
- Ramipril 10 MG Oral Capsule [Altace] | daily.
- Simvastatin 80 MG Oral Tablet | qhs.
- clopidogrel 75 MG Oral Tablet [Plavix] | daily.
- pentopril 40 MG Enteric Coated Tablet | daily.
- Pravastatin 5.8 MG Oral Tablet [Pravastatin] | bid.
- Ramipril 10 MG Oral Capsule | daily.
- Niacin 500 MG Extended Release Tablet [Niaspan] | qhs.
- montelukast 10 MG Oral Tablet [Singulair] | daily.
- glimepiride 6 MG Oral Tablet | daily.
- Nitroglycerin 0.4 MG Sublingual Tablet | qd (prior x3 per angina).
- Doxycycline 100 MG Oral Capsule | bid.
- glimepiride 2 MG Oral Tablet | daily.
- Metformin 750 MG Extended Release Tablet | bid.
- celecoxib 200 MG Oral Capsule [Celebrex] | daily.
- Niacin 1000 MG Extended Release Tablet [Niaspan] | qhs.
- Chantix Continuing Months Of Therapy Pack | daily.




**“Merge App”**  
e.g., Microsoft HealthVault and Diabetes





# Coming Soon—reporting—automated + manual

Effective July 2008



## COMMUNICABLE AND OTHER INFECTIOUS DISEASES REPORTABLE IN MASSACHUSETTS TO LOCAL BOARDS OF HEALTH

Note: If these diseases are initially reported to MDPH, local boards of health will be notified.

**INITIATE INVESTIGATION IMMEDIATELY FOR BOTH  
SUSPECT AND CONFIRMED CASES AND NOTIFY MDPH!**

Telephone: (617) 983-6800

• **INITIATE INVESTIGATION AND COMPLETE CASE REPORT  
AS SOON AS POSSIBLE.**  
(This may include both suspect and confirmed cases.)  
Confidential Fax: (617) 983-6813

<ul style="list-style-type: none"> <li>• Amebiasis (<i>Entamoeba histolytica</i>)</li> <li>• Anaplasmosis (<i>Anaplasma phagocytophilum</i>)</li> <li>• Any case of an unusual illness</li> <li>• Any cluster/outbreak of illness, including but not limited to foodborne illness</li> <li>• Anthrax (<i>Bacillus anthracis</i>)</li> <li>• Babesiosis (<i>Babesia</i> sp.)</li> <li>• Botulism (<i>Clostridium botulinum</i>)</li> <li>• Brucellosis (<i>Brucella</i> sp.)</li> <li>• Campylobacteriosis (<i>Campylobacter</i> sp.)</li> <li>• Chagas disease (<i>Trypanosoma cruzi</i>)</li> <li>• Cholera (<i>Vibrio cholerae</i>)</li> <li>• Creutzfeldt-Jakob disease (CJD) and variant CJD</li> <li>• Cryptococcosis (<i>Cryptococcus neoformans</i>)</li> <li>• Cryptosporidiosis (<i>Cryptosporidium</i> sp.)</li> <li>• Cyclosporiasis (<i>Cyclospora cayentanensis</i>)</li> <li>• Dengue</li> <li>• Diphtheria (<i>Corynebacterium diphtheriae</i>)</li> <li>• Eastern equine encephalitis</li> <li>• Ehrlichiosis (<i>Ehrlichia</i> sp.)</li> <li>• Encephalitis, any cause</li> <li>• Escherichia coli O157:H7, and other shiga-toxin producing E. coli</li> <li>• Food poisoning and toxicity (includes poisoning by ciguatera, scombrototoxin, mushroom toxin, tetrodotoxin, paralytic shellfish and amnesic shellfish)</li> <li>• Giardiasis (<i>Giardia</i> sp.)</li> <li>• Glanders (<i>Burkholderia mallei</i>)</li> <li>• Group A streptococcus, invasive</li> <li>• Group B streptococcus, invasive</li> <li>• Haemophilus influenzae, invasive</li> </ul>	<ul style="list-style-type: none"> <li>• Listeriosis (<i>Listeria</i> sp.)</li> <li>• Lyme disease (<i>Borrelia burgdorferi</i>)</li> <li>• Lymphocytic choriomeningitis</li> <li>• Malaria (<i>Plasmodium falciparum</i>, <i>P. malariae</i>, <i>P. vivax</i>, <i>P. ovale</i>)</li> <li>• Measles</li> <li>• Melioidosis (<i>Burkholderia pseudomallei</i>)</li> <li>• Meningitis, bacterial, community acquired</li> <li>• Meningitis, viral (aseptic), and other infectious (non-bacterial)</li> <li>• Meningococcal disease, invasive (<i>Neisseria meningitidis</i>)</li> <li>• Monkeypox or other orthopox virus</li> <li>• Mumps</li> <li>• Norovirus</li> <li>• Pertussis (<i>Bordetella pertussis</i>)</li> <li>• Plague (<i>Yersinia pestis</i>)</li> <li>• Pneumococcal disease, invasive (<i>Streptococcus pneumoniae</i>)</li> <li>• Polio</li> <li>• Psittacosis (<i>Chlamydia psittaci</i>)</li> <li>• Q fever (<i>Coxiella burnetii</i>)</li> <li>• Rabies in humans</li> <li>• Reye syndrome</li> <li>• Rheumatic fever</li> <li>• Rickettsialpox (<i>Rickettsia akari</i>)</li> <li>• Rocky Mountain spotted fever (<i>Rickettsia rickettsii</i>)</li> <li>• Rubella</li> <li>• Salmonellosis (<i>Salmonella</i> sp., non typhi)</li> <li>• Severe acute respiratory syndrome (SARS)</li> <li>• Shiga-toxin producing organisms</li> <li>• Shigellosis (<i>Shigella</i> sp.)</li> <li>• Smallpox</li> <li>• Tetanus (<i>Clostridium tetani</i>)</li> <li>• Toxic shock syndrome</li> </ul>
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## Collaborators and Implementers

- EMR Vendors: Cerner, Allscripts, Siemens, VA World Vist, OpenMRS, Microsoft
- Major payors
- Pharma
- Major tech companies



Intelligent Health Lab



Children's Hospital  
Informatics Program



Harvard  
Medical School







Contributor's Foreword  
"Clayton Christensen has done it again, writing yet another book full of valuable insights. . . .  
The Innovator's Prescription might just mark the beginning of a new era in healthcare."  
—MICHAEL SUDOMBERS, Mayo, New York City

# The Innovator's Prescription

*A Disruptive Solution for Health Care*



**Clayton M. Christensen**

BESTSELLING AUTHOR OF *THE INNOVATOR'S DILEMMA*  
Jerome H. Grossman, M.D. & Jason Hwang, M.D.





## Will disruptive innovation be fostered in healthcare





## Diffusion Strategy

- 1. EHR Integration
- 2. "Side car" Strategy
- 3. Meaningful Use 2 and data liquidity





Intelligent Health Lab



Children's Hospital  
Informatics Program



Harvard  
Medical School



SMART

[www.smartplatforms.org](http://www.smartplatforms.org)

[informaticstraining.hms.harvard.edu](http://informaticstraining.hms.harvard.edu)