

# The Road to hGraph

Designing an open system for visualizing personal health metrics

Juhan Sonin

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[goinvo.com](http://goinvo.com)  
Design Studio



MIT  
2.009 Product Design





Your health data is going digital.

Your pets' health data is digital.



# Your pests' health data is digital.



## How did I get into the Design of Health?

I didn't have a pulse on my health, let alone the data.

Cholesterol Check in 2006



A wooden cutting board featuring a variety of cured meats and cheeses. In the foreground, there are several thick slices of salami with visible fat marbling. Behind them, a long, thin strip of dried meat like prosciutto or jamón is sliced into thin strips. To the right, a wedge of white cheese with a crumbly texture sits next to a slice of bread. A large wedge of yellow cheese is visible on the left edge. The board has a rustic, weathered appearance.

Total Cholesterol in 2006

370

Cheese and salami was coursing through my blood stream (based on a meal the night before the cholesterol test...)

I had no clue what my health metrics were.  
I had a better pulse on the health of my car.



# and the Problem is...

Increasingly complex systems

- Tool and Methodology gap

Decision makers are swamped with conflicting data

- Our work is increasingly multi-dimensional (not a flat-decision space)

Artifacts driving decisions need to be coordinated, presented

Minimal transparency into key health metrics

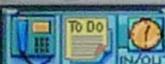
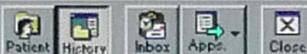
How do I (as a patient, nurse,  
doctor, proxy) **make quicker,**  
**more accurate decisions?**

# FIND THE PATIENT GAMESHOW



ARLINGTON OFFICE

DAVID CURTIS, MD



HOME  
CC / HPI  
Histories  
R.O.S.  
Tech Exam  
Provider Start  
Examination  
Impression/Plan  
Coding  
Sticky Note

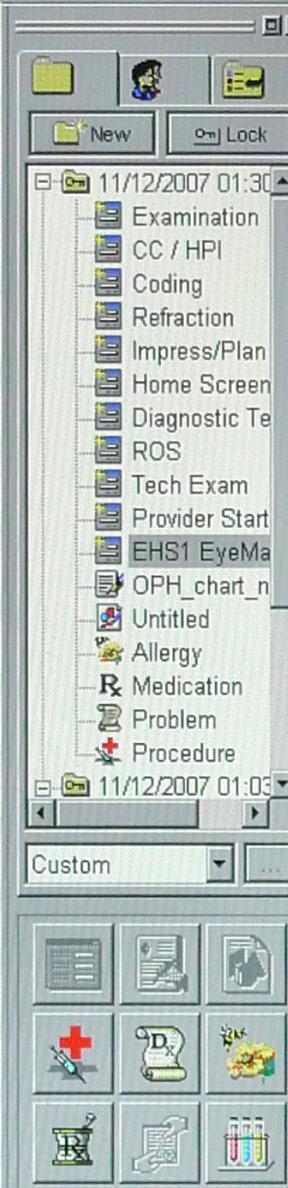
Special Exams

Post-Op Exam  
CL Evaluation  
LASIK Eval  
IOP Check  
Rx Check  
Procedures  
Office px

Alerts

Diagnostics  
Test Interp

|   |                      |  |  |   |   |                 |         |               |
|---|----------------------|--|--|---|---|-----------------|---------|---------------|
| History Taken By: TONY DAVIES   |                      | Chart Update   |  |   |   |                 |         |               |
| Comments:   |                      | Update Notes:  |  |   |   |                 |         |               |
| Glasses wearer <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No CL wearer <input type="checkbox"/> Yes <input type="checkbox"/> No                                     |                      | Allergies <input type="checkbox"/> No Known Allergies Noted  |  |   |   |                 |         |               |
| Ocular Medications <input type="checkbox"/> No Ocular Meds at This Time   |                      | Allergy Comment Reaction   |  |   |   |                 |         |               |
| Brand Name  | *                    | Dose   | Sig Codes  | Start   | Refilled  | EGG             |         |               |
| ARTIFICIAL TEARS  | N                    |  |  | / /   | / /   | PENICILLINS     |         |               |
| PILOCARPINE HCL   | N 2%                 | qid  |  | / /   | / /   | DORZOLAMIDE HCL | TRUSOPT | Muscular pain |
| Systemic Medications <input type="checkbox"/> No Systemic Meds at This Time   |                      | <input type="checkbox"/> Patient taking unknown cardiac meds.<br><input type="checkbox"/> Patient taking unknown high blood pressure med.<br><input type="checkbox"/> Patient taking unknown diabetic meds.<br><input type="checkbox"/> Patient taking unknown cholesterol meds.<br><input checked="" type="checkbox"/> Patient taking other unknown meds. |  |   |   |                 |         |               |
| Brand Name  | Generic Name         | Sig Codes  | *  | Stopped   |   |                 |         |               |
| ARTIFICIAL TEARS  | DEXTRAN              |  | N  | / /   |   |                 |         |               |
|   | 70/HYDROMELLOSE      |  |  |   |   |                 |         |               |
| PILOCARPINE HCL   | PILOCARPINE HCL      | qid  | N  | / /   |   |                 |         |               |
| Past Ocular History <input type="checkbox"/> No past ocular history noted <input type="checkbox"/> Pt has prosthetic <input type="checkbox"/> Right eye <input type="checkbox"/> Left eye |                      |  |  |   |   |                 |         |               |
| Category  | Disease              | DiseaseSide  | Year Dx  | SurgeryTextHold   |   |                 |         |               |
| Cataract  | Nuclear Sclerosis    | OU   |  |   |   |                 |         |               |
| Glaucoma  | Glaucoma suspect     | OU   |  |   |   |                 |         |               |
| Retina  | ARMD Drv             | OU   | 2001   | PL laser  |   |                 |         |               |
| Past Systemic History <input type="checkbox"/> Detailed <input checked="" type="checkbox"/> Reviewed <input type="checkbox"/> Unobtainable  |                      |  |  |   |   |                 |         |               |
| Disease   | Year Dx              | Sx Procedure   | Year Px  | Outcome   |   |                 |         |               |
| Rhinitis  |                      |  |  |   |   |                 |         |               |
| Osteoporosis  |                      |  |  |   |   |                 |         |               |
| Anemia, unknown cause   |                      |  |  |   |   |                 |         |               |
| Family History <input type="checkbox"/> Detailed <input checked="" type="checkbox"/> Reviewed <input type="checkbox"/> Unobtainable   |                      | Social History <input type="checkbox"/> Detailed <input checked="" type="checkbox"/> Reviewed <input type="checkbox"/> Unobtainable  |  |   |   |                 |         |               |
| Relation  | Diagnosis            | Add  | Smoke Y/N?   | Drinks alcohol Y/N?   | Caffeine Y/N?   |                 |         |               |
|   |                      |  | <input type="radio"/> Yes <input checked="" type="radio"/> No <input type="radio"/> Formerly | <input type="radio"/> Yes <input checked="" type="radio"/> No | <input type="radio"/> Yes <input checked="" type="radio"/> No |                 |         |               |
| Family Member   | Diagnosis            |  | Amount   | Amount Per Day  |   |                 |         |               |
| Father  | Glaucoma             |  |  |   |   |                 |         |               |
| Mother  | Macular Degeneration |  |  |   |   |                 |         |               |
| Recreational Drugs Y/N? <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Formerly   |                      |  |  |   |   |                 |         |               |
| Frequency   |                      |  |  |   |   |                 |         |               |





ARLINGTON OFFICE

DAVID CURTIS, MD



Age [ ]

HOME

CC / HPI

Histories

R.O.S.

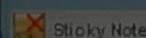
Tech Exam

Provider Start

Examination

Impression/Plan

Coding



Special Exams

Post-Op Exam

CL Evaluation

LASIK Eval

IOP Check

Rx Check

Procedures

Office px

Alerts

Diagnostics

Test Interp

History Taken By: TONY DAVIES

Comments: [ ]

Chart Update [ ]

Update Notes: [ ]

Glasses wearer  Yes  No CL wearer  Yes  NoOcular Medications  No Ocular Meds at This Time

| Brand Name       | *    | Dose | Sig Codes | Start | Refilled |
|------------------|------|------|-----------|-------|----------|
| ARTIFICIAL TEARS | N    |      |           | / /   | / /      |
| PILOCARPINE HCL  | N 2% | qid  |           | / /   | / /      |

Allergies  No Known Allergies Noted

| Allergy         | Comment | Reaction      |
|-----------------|---------|---------------|
| EGG             |         |               |
| PENICILLINS     |         |               |
| DORZOLAMIDE HCL | TRUSOPT | Muscular pain |

Systemic Medications  No Systemic Meds at This Time

| Brand Name       | Generic Name    | Sig Codes | * | Stopped |
|------------------|-----------------|-----------|---|---------|
| ARTIFICIAL TEARS | DEXTRAN         |           | N | / /     |
|                  | 70HYPMELLOSE    |           |   |         |
| PILOCARPINE HCL  | PILOCARPINE HCL | qid       | N | / /     |

- Patient taking unknown cardiac meds.
- Patient taking unknown high blood pressure med
- Patient taking unknown diabetic meds.
- Patient taking unknown cholesterol meds.
- Patient taking other unknown meds.

Past Ocular History  No past ocular history noted  Pt has prosthetic  Right eye  Left eye

| Category | Disease           | DiseaseSide | Year Dx | SurgeryTextHold |
|----------|-------------------|-------------|---------|-----------------|
| Cataract | Nuclear Sclerosis | OU          |         |                 |
| Glucoma  | Glucoma suspect   | OU          |         |                 |
| Retina   | ARMD Drv          | OU          | 2001    | PL laser        |

Past Systemic History  Detailed  Reviewed  Unobtainable

| Disease               | Year Dx | Sx Procedure | Year Px | Outcome |
|-----------------------|---------|--------------|---------|---------|
| Rhinitis              |         |              |         |         |
| Osteoporosis          |         |              |         |         |
| Anemia, unknown cause |         |              |         |         |

Family History  Detailed  Reviewed  Unobtainable

| Relation      | Diagnosis            | Add |
|---------------|----------------------|-----|
| Family Member | Diagnosis            |     |
| Father        | Glaucoma             |     |
| Mother        | Macular Degeneration |     |

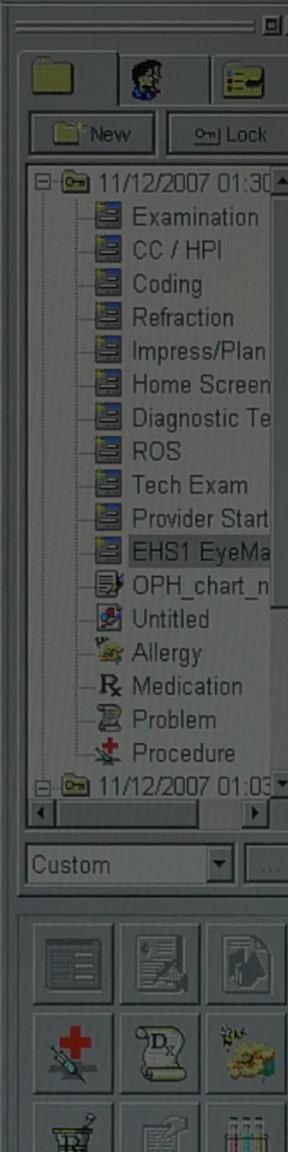
Social History  Detailed  Reviewed  Unobtainable

Smoke Y/N?  Yes  No  Formerly      Drinks alcohol Y/N?  Yes  No  Formerly      Caffeine Y/N?  Yes  No

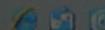
Amount [ ] Amount Per Day [ ]

Frequency [ ]

Recreational Drugs Y/N?  Yes  No  Formerly



Ready



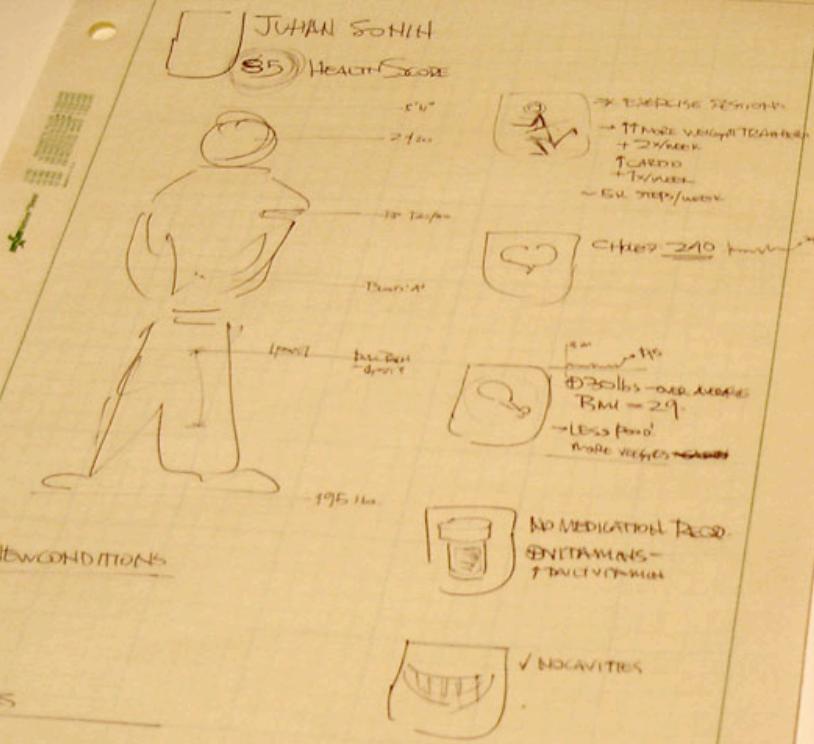


*Body Mass Index*  
**29**

**240** Total  
**167** LDL  
**54** HDL

**Started collecting  
and designing the  
basics...**

**Weight,  
Waist circumference,  
Cholesterol,  
Exercise,  
Food intake...**



# From sketch to digital



**Risks:**

**LUNG CANCER**  
2 WATERSHEDS

**HEART DISEASE**  
DETERIORATING STRENGTH

**KNEE ARTHRITIS**  
TERRIFIED 2 YRS AGO

**HEALTH STRESS JOB**  
ARUNTING HEIGHT, MA

↑ COLON CANCER - 75%

**DNA/HISTORY**

↑ COLON CANCER

- FATHER (LCF RESUME)
- FATHER → FATHER

**F DIABETES**

- MOTHER'S BROTHER (400 mg/dL)

# Early health card designs



**Got a checkup.**

**First time in 6 years.**

But...

The doctor's back was to me while he asked me questions (and then he typed the answers into the computer),

zero questions about Life outside of traditional health info,

no physical or emailed takeaways of next steps from the exam...

How do I become an informed  
and empowered patient?

# HealthCard was born

Prototyped with  
doctors, nurses,  
emergency  
responders...  
and oh yea, with  
patients.

**HealthCard**

1 Mar, 1972

PERSONAL HEALTH CARD



**SONIN**  
JUHAN  
22 SURRY RD  
ARLINGTON, MA  
02476  
617.504.3390  
JUHAN@MIT.EDU

SEX HGT WGT BTYP VISION  
M 5-10 208 A+ 20/15

DOB  
**1.MAR.1972**  
SS#  
**022 66 4325**

LAST MD VISIT LANGUAGE  
**23.JUN.2010 ENGLISH, ESTONIAN**

HEALTHPLAN  
**ANTHEM BLUE CROSS**

PRIMARY CARE PHYSICIAN  
DAVID IVES, MD

MEDICATION  
MULTI-VITAMIN  
1x/DAY

MEDICAL HISTORY  
BICEP TENDON SURGERY, 11.DEC.08 BY ARUN RAMAPPA MD

ALLERGIES  
NONE

WGT  
**208** lbs GOAL 180 to 195

BMI  
**29.8** kg/m<sup>2</sup> less than 25

WAIST CIRCUMFERENCE  
**36** inches less than 40

BP  
**117/79** mmHg less than 120/80

CHOLESTEROL  
Total **230** mg/dl 100 to 199  
LDL **128** mg/dl 40 to 130  
HDL **38** mg/dl 40 to 70

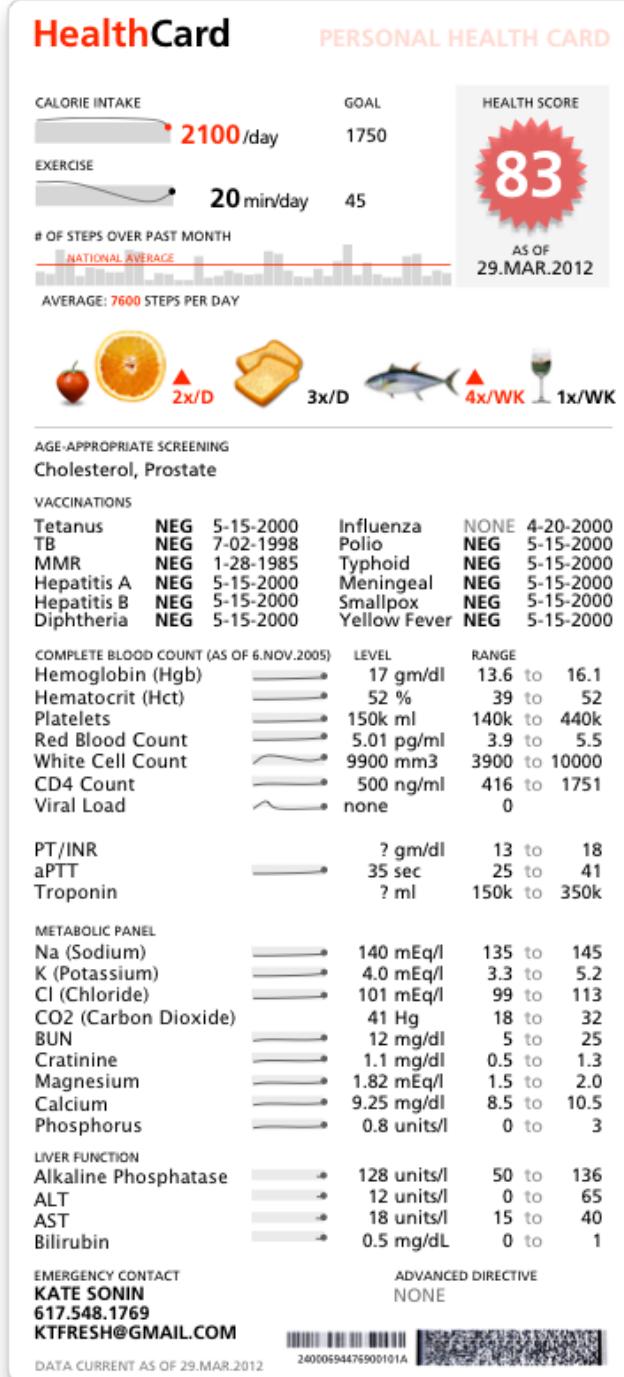
TRIGLYCERIDES  
**270** mg/dl 70 to 172

GLUCOSE  
**101** mg/dl 72 to 137

ALCOHOL  
Beer **1** # PER WEEK ILLICIT DRUGS # PER WEEK NONE

TOBACCO  
NONE # PER WEEK

HEALTH SCORE **83**



Used real data... my own data

# Design with fake data = fake design

Real data:

- needs to be grokked by you
- has min/max values, outliers
- needs amplification, cleanup
- begets real feedback + forces people to make real decisions

|  |  |  |  |  |  |   |  |
|--|--|--|--|--|--|---|--|
| <br>Juhan Sonin<br>40 years old<br>1.Mar.1972<br>Male<br><br>5' 10"<br>208 lbs<br>36" waist<br><br>20/15 vision<br>A+ blood type<br>117/79 BP<br>220 cholesterol | <br>Katie Sonin<br>40 years old<br>22.Jun.1971<br>Female<br><br>5' 4"<br>110 lbs<br>25" waist<br><br>20/30 vision<br>O+ blood type<br>120/85 BP<br>155 cholesterol | <br>Udo Sonin<br>5 years old<br>17.Mar.2007<br>Male<br><br>4' 1"<br>39 lbs<br>16" waist<br><br>O+ blood type | <br>Viggo Sonin<br>1 year old<br>11.Aug.2010<br>Male<br><br>2' 8"<br>26 lbs<br>12" waist<br><br>O+ blood type | <br>Epp Sonin<br>65 years old<br>9.Jun.1946<br>Female<br><br>5' 0"<br>129 lbs<br>31" waist<br><br>20/30 vision<br>AB+ blood type<br>122/81 BP<br>200 cholesterol | <br>Aldo Sonin<br>33 years old<br>15.May.1979<br>Male<br><br>6' 0"<br>205 lbs<br>34" waist<br><br>20/20 vision<br>AB+ blood type<br>115/70 BP<br>215 cholesterol | <br>Agnes Morrison<br>89 years old<br>31.Mar.1921 to<br>12.Nov.10<br>Female<br><br>5' 0"<br>110 lbs<br>28" waist<br><br>30/30 vision<br>A+ blood type<br>135/86 BP<br>195 cholesterol | <br>Ain Sonin<br>73 years old<br>24.Dec.1937 to<br>21.Aug.10<br>Male<br><br>5' 9"<br>142 lbs<br>32" waist<br><br>20/30 vision<br>O+ blood type<br>140/90 BP<br>162 cholesterol |
| Repaired bicep tendon, right arm<br>Surgery on 11.Dec.09   | Appendicectomy<br>Surgery on 28.Feb.93   | No history   | No history   | No history   | No history   | Dementia<br>3 more conditions   | Dementia<br>Alzheimers (stage 2)   |
| No allergies   | No allergies   | No allergies   | No allergies   | No allergies   | No allergies   | No allergies  | No allergies   |
| Megavitamin, 1/day   | Megavitamin, 1/wk  | No medications   | No medications   | Megavitamin, 1/day<br>Aspirin, 81mg/day<br>Zocor, 10mg/day   | No medications   | Galantamine, 20mg/day<br>2 more meds...   | Donepezil, 10mg/day<br>5 more medications..  |
| Fluent in English,<br>Estonian<br><br>22 Surry Rd<br>Arlington, MA<br>02476<br><br>Kate Sonin (wife), 40<br>Udo Sonin (son), 5<br>Viggo Sonin (son), 1   | Fluent in English,<br>Russian<br><br>22 Surry Rd<br>Arlington, MA<br>02476<br><br>Juhan Sonin<br>(husband), 40<br>Udo Sonin (son), 5<br>Viggo Sonin (son), 1   | 22 Surry Rd<br>Arlington, MA<br>02476<br><br>Juhan Sonin<br>(father), 40<br>Kate Sonin<br>(mother), 40   | 22 Surry Rd<br>Arlington, MA<br>02476<br><br>Juhan Sonin<br>(father), 40<br>Kate Sonin<br>(mother), 40   | Fluent in English,<br>Estonian<br><br>104 Follen Rd<br>Lexington, MA<br>02476<br><br>Ain Sonin (husband),<br>74 (deceased)<br>Juhan Sonin (son), 40<br>Aldo Sonin (son), 33  | 1205 Embarro Dr<br>San Mateo, CA<br>92005<br><br>Single<br>Juhan Sonin<br>(brother), 40  | Fluent in English,<br>Estonian, French,<br>German<br><br>820 Mass Ave, #410<br>Arlington, MA<br>02476<br><br>Anthem Blue Cross<br>XDX231A60874<br>800.627.8797  | Fluent in English,<br>Estonian, Swedish<br><br>42 Mall Rd<br>Atria LongMeadow<br>Apt #110<br>Burlington, MA<br>02152<br><br>Epp Sonin (wife), 65<br>Juhan Sonin (son),<br>40<br>Aldo Sonin (son), 33   |
| Anthem Blue Cross<br>XDX231A60874<br>800.627.8797<br><br>David Ives, MD<br>Arun Ramappa, MD<br>Krista Manikas, DMD<br>last visit: 13.May.10  | Anthem Blue Cross<br>XDX231A60874<br>800.627.8797<br><br>Beth Hardiman,<br>OB/GYN<br>Beth Goldman, MD<br>Krista Manikas, DMD<br>last visit: 7.Feb.11   | Joyce, MD<br>last visit: 29.Jan.12   | Joyce, MD<br>last visit: 22.Mar.12   | Network Blue<br>BCB23557621<br>800.538.5200<br><br>William Ruth, MD<br>MIT clinic DMD<br>last visit: 3.Dec.10  | Medicare<br>MDCS5869AM51411<br>800.302.1212<br><br>Tech Engineer<br>Gallaway Satellites  | Widower<br>Epp Sonin<br>(daughter), 64<br><br>No docs listed<br>last visit: 29.Aug.07   | Vincent Perrelli, MD<br>Ronald Defallippa,<br>MD<br>last visit: 5.Nov.10<br><br>Michael Cane, MD<br>Yuval Zabar, MD<br>MIT clinic DMD<br>last visit: 15.Aug.10   |
| Creative Director<br>Involution Studios,<br>MIT  | Designer<br>Self-employed  | Alerts<br>Account  | Alerts<br>Account  | Director of Lexington<br>Music School,<br>Musician   | Alerts (2)<br>Account  | Retired Healthcare<br>Policy and Financial<br>Officer   | Retired MIT<br>Professor   |
| Alerts (8)<br>Account  | Alerts (2)<br>Account  |  |  | Alerts (17)<br>Account   |  | Alerts (63)<br>Account  | Alerts (98)<br>Account   |

## System view of my family's health

# Followed doctors and nurses at several Boston hospitals to SEE Healthcare in action.



Partner in crime, Rob McCready watching surgery.



# Our forecast

**Designing a beautiful and  
clinically relevant  
experience without  
beautiful data =  
recipe for disaster.**

So we got into the data + standards game:



[projectlaika.org](http://projectlaika.org)

Open source software has become part of the  
CCHIT certification

Laika is responsible for automating data  
interoperability testing of Electronic Health  
Record systems

HITSP Specs on Continuity of Care  
IHE specs on Document Exchange

# hData

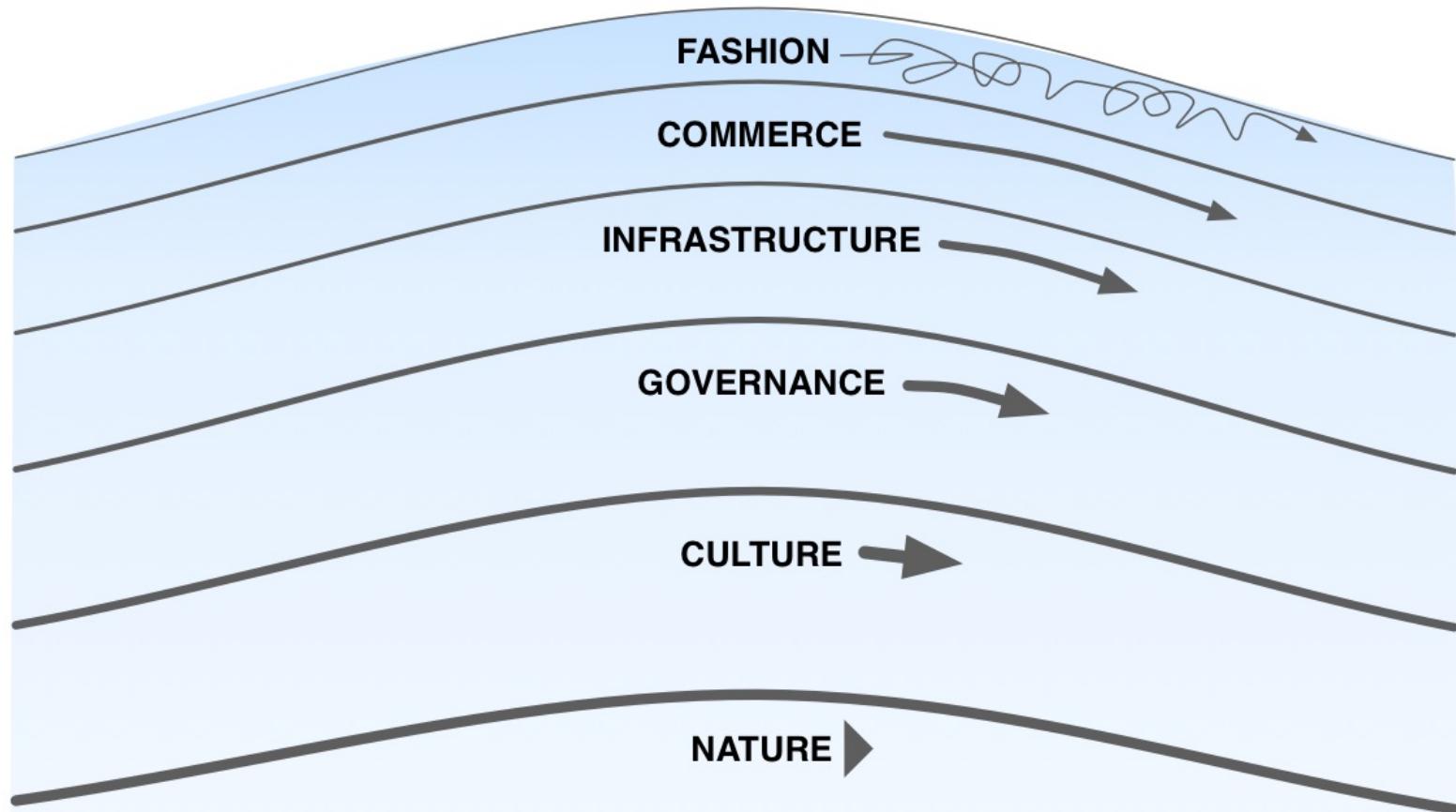
[projecthdata.org](http://projecthdata.org)

hData is a method of storing and exchanging health  
information

Goal: Influence/create Health IT standards to ease  
implementation and speed adoption

Why? Complexity and design of current standards  
are a huge barrier to adoption and effective usage

# Pace Layering

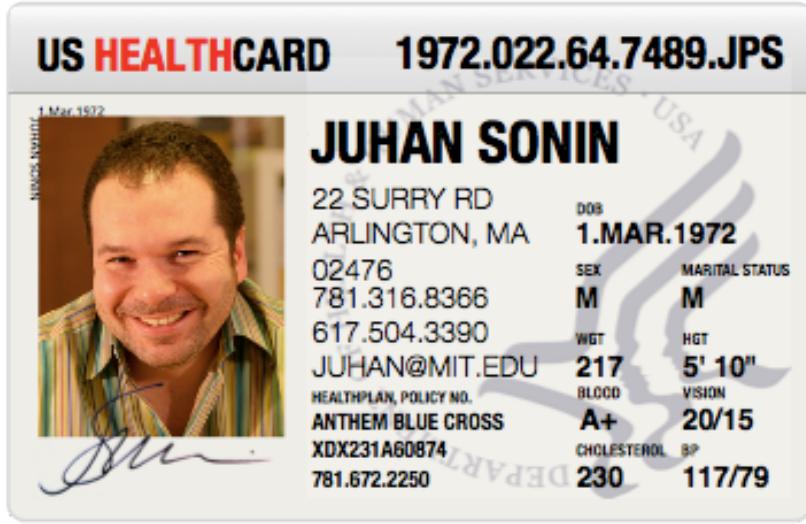


**The fast parts learn, propose, and absorb shocks.  
The slow parts remember, integrate, and constrain.**

**The fast parts get all the attention.  
The slow parts have all the power.**

- Stewart Brand

# US Healthcard



Smartcard to standardize the healthcare “entry point” transaction

Prototype US Healthcard data model, design, and explore HHS adoption

# Why not a 1040-HC?

## Form 1040-HC U.S. Individual Health Report 2012

Department of Health and Human Services

For the year Jan. 1 - Dec. 31, 2011

**Label**  
(See instructions on page 14.)  
Use the HHS label.  
Otherwise, please print or type.

|  |  |           |  |                                   |
|--|--|-----------|--|-----------------------------------|
| Your first name and initial  |  | Last name |  | HHS No. 1-0069                    |
| If married, spouses' first name and initial  |  | Last name |  | Your social security number       |
| Home address (number and street). If you have a P.O. box, see page 14.   |  | Apt. no.  |  | Spouse's social security number   |
| City, town or post office, state, and ZIP code. If you have a foreign address, see page 14.  |  |           |  | You must enter your SSN(s) above. |
| Email  |  |           |  |                                   |
| Marital Status   |  |           |  |                                   |
| <input type="checkbox"/> Single <input type="checkbox"/> Married<br><input type="checkbox"/> Cohabiting <input type="checkbox"/> Separated<br><input type="checkbox"/> Divorced <input type="checkbox"/> Widowed |  |           |  |                                   |

**Sex** 1  Female  Male  Transexual  Intersexual  Unsexable

|   |                              |    |                                      |
|---|------------------------------|----|--------------------------------------|
| 2 | Age                          | 9  | Blood pressure (mmHg)                |
| 3 | Date of birth                | 10 | Cholesterol Total (mg/dl)            |
| 4 | Height (feet, inches)        | 11 | LDL (mg/dl)                          |
| 5 | Weight (pounds)              | 12 | HDL (mg/dl)                          |
| 6 | Blood type                   | 13 | Triglycerides                        |
| 7 | Vision                       | 14 | Glucose                              |
| 8 | Waist circumference (inches) | 15 | Body mass index (kg/m <sup>2</sup> ) |

|    |                                  |                                    |   |                                     |   |
|----|----------------------------------|------------------------------------|---|-------------------------------------|---|
| 16 | <input type="checkbox"/> Corn    | <input type="checkbox"/> Sesame    | <input type="checkbox"/> Anti-convulsants | <input type="checkbox"/> Latex      | <input type="checkbox"/> No known allergies |
|    | <input type="checkbox"/> Dairy   | <input type="checkbox"/> Shellfish | <input type="checkbox"/> Asthma           | <input type="checkbox"/> Novocain   |   |
|    | <input type="checkbox"/> Gluten  | <input type="checkbox"/> Soy       | <input type="checkbox"/> Hay fever        | <input type="checkbox"/> Penicillin |   |
|    | <input type="checkbox"/> Eggs    | <input type="checkbox"/> Sulfites  | <input type="checkbox"/> Insulin preps    | <input type="checkbox"/> Sulfa      |   |
|    | <input type="checkbox"/> Fish    | <input type="checkbox"/> Tree nuts | <input type="checkbox"/> Insect venom     | <input type="checkbox"/> Other      |   |
|    | <input type="checkbox"/> Peanuts | <input type="checkbox"/> Wheat     | <input type="checkbox"/> Iodine           |                                     |   |

|                               |                |                                  |             |
|-------------------------------|----------------|----------------------------------|-------------|
| Name of medicine and strength | What's it for? | Dosage, how often, and what time | Refill date |
| 17a                           |                |                                  |             |
| b                             |                |                                  |             |
| c                             |                |                                  |             |
| d                             |                |                                  |             |
| e                             |                |                                  |             |
| f                             |                |                                  |             |

|                         |     |                 |    |                 |
|-------------------------|-----|-----------------|----|-----------------|
| Alcohol, Smoking, Drugs | 18a | Amount per week | 19 | Amount per week |
| b                       |     |                 |    |                 |
| c                       |     |                 |    |                 |
|                         |     |                 | 20 | Amount per week |
|                         |     |                 |    |                 |

|           |     |                    |     |   |
|-----------|-----|--------------------|-----|---|
| Insurance | 21a | Insurance provider | 21b | <input type="checkbox"/> You do not currently have insurance. |
|           | 22  | Policy ID          |     |   |
|           | 23  | Phone number       |     |   |

|              |    |                |
|--------------|----|----------------|
| Primary Care | 24 | Physician name |
|              | 25 | Phone number   |
|              | 26 | Email          |
|              | 27 | Dentist name   |
|              | 28 | Phone number   |
|              | 29 | Email          |

## Form 1040-HC (2012)

|   |   |   |  |
|---|---|---|--|
| 30  | <input type="checkbox"/> Cancer               | <input type="checkbox"/> HIV                    | Previous surgeries                     |
|   | <input type="checkbox"/> Circulation Problems | <input type="checkbox"/> Lung Disease           | Date                                   |
|   | <input type="checkbox"/> Diabetes             | <input type="checkbox"/> Ulcers                 |  |
|   | <input type="checkbox"/> Heart Disease        | <input type="checkbox"/> Other _____            |  |
|   | <input type="checkbox"/> Hepatitis            | <input type="checkbox"/> Other _____            |  |
|   | <input type="checkbox"/> High blood pressure  |   |  |
| 31a   |   |   |  |
| b   |   |   |  |
| c   |   |   |  |
| d   |   |   |  |
| Inoculation Date  |   |   |  |
| Vaccinations 32   |   |   |  |
|   | <input type="checkbox"/> Diphtheria           | <input type="checkbox"/> Polio                  |  |
|   | <input type="checkbox"/> Hepatitis A          | <input type="checkbox"/> Smallpox               |  |
|   | <input type="checkbox"/> Hepatitis B          | <input type="checkbox"/> TB                     |  |
|   | <input type="checkbox"/> Influenza            | <input type="checkbox"/> Tetanus                |  |
|   | <input type="checkbox"/> Meningeal            | <input type="checkbox"/> Typhoid                |  |
|   | <input type="checkbox"/> MMR                  | <input type="checkbox"/> Yellow Fever           |  |
| Inoculation Date  |   |   |  |
| Dental 33   |   |   |  |
| Months since last appointment and cleaning _____  |   |   |  |
| You suffer from:  |   |   |  |
| 34  | <input type="checkbox"/> Periodontitis        | <input type="checkbox"/> Gingivitis             | <input type="checkbox"/> Bleeding gums |
|   | <input type="checkbox"/> Bad breath           | <input type="checkbox"/> No known gum disease   |  |
| Activity 35   |   |   |  |
| a   | Vigorous activity (min/day)                   | b   | Steps per day                          |
| c   | Calorie intake per day                        | d   | TV viewing (hrs/day)                   |
| 36 Point of contact's name _____  |   |   |  |
| Emergency Contact   |   |   |  |
| Home address (number and street). If you have a P.O. box, see page 14.  |   |   |  |
| City, town or post office, state, and ZIP code. If you have a foreign address, see page 14.   |   |   |  |
| Email   |   | Phone number                                    |  |
| Directives 37a  |   |   |  |
| a   | <input type="checkbox"/> Organ donor          | b   | <input type="checkbox"/> DNR           |
| Sign Here   |   |   |  |
| Under the penalties of perjury, I declare that I have examined this report and accompanying statements, and to the best of my knowledge and belief, they are true, correct, and complete. Declaration of the preparer (other than the patient) is based on all information of which preparer has any knowledge. |   |   |  |
| Keep a copy for your records.   |   |   |  |
| Your signature  |   | Date  | Your occupation                        |
| Preparer's signature  |   | Date  | Daytime phone number                   |
| Paid Preparer's Use Only  |   | Check if self-employed <input type="checkbox"/> | Preparer's SSN                         |
| Practice's name (or yours if self-employed), address, and ZIP code  |   | EIN   |  |
|   |   | Phone number                                    |  |

Form 1040-HC U.S. Individual Health Report 2012 Department of Health and Human Services

HHS Use Only – Do not write or staple in this space.

**Label**

(See instructions on page 14.)

**Use the HHS label.**

Otherwise, please print or type.

|   |   |           |          |  |
|---|---|-----------|----------|--|
| L<br>A<br>B<br>E<br>L<br><br>H<br>E<br>R<br>E | For the year Jan. 1 - Dec. 31, 2011   |           |          |  |
|   | Your first name and initial   | Last name |          | HHS No. 1-0069                         |
|   | If married, spouses' first name and initial   | Last name |          | <b>Your social security number</b>     |
|   | Home address (number and street). If you have a P.O. box, see page 14.                      |           | Apt. no. | <b>Spouse's social security number</b> |
|   | City, town or post office, state, and ZIP code. If you have a foreign address, see page 14. |           |          |  |
|   | Email   |           |          | You must enter your SSN(s) above.      |

**Marital Status**

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| <input type="checkbox"/> Single       | <input type="checkbox"/> Married   |
| <input type="checkbox"/> Cohabitating | <input type="checkbox"/> Separated |
| <input type="checkbox"/> Divorced     | <input type="checkbox"/> Widowed   |

**Sex**

- 1  Female  Male  Transexual  Intersexual  Unsexable

**Baseline**

- |   |                              |  |    |                                      |  |
|---|------------------------------|--|----|--------------------------------------|--|
| 2 | Age                          |  | 9  | Blood pressure (mmHg)                |  |
| 3 | Date of birth                |  | 10 | Cholesterol Total (mg/dl)            |  |
| 4 | Height (feet, inches)        |  | 11 | LDL (mg/dl)                          |  |
| 5 | Weight (pounds)              |  | 12 | HDL (mg/dl)                          |  |
| 6 | Blood type                   |  | 13 | Triglycerides                        |  |
| 7 | Vision                       |  | 14 | Glucose                              |  |
| 8 | Waist circumference (inches) |  | 15 | Body mass index (kg/m <sup>2</sup> ) |  |

**Allergies**

- |    |                                  |                                    |   |                                     |   |
|----|----------------------------------|------------------------------------|---|-------------------------------------|---|
| 16 | <input type="checkbox"/> Corn    | <input type="checkbox"/> Sesame    | <input type="checkbox"/> Anti-convulsants | <input type="checkbox"/> Latex      | <input type="checkbox"/> No known allergies |
|    | <input type="checkbox"/> Dairy   | <input type="checkbox"/> Shellfish | <input type="checkbox"/> Asthma           | <input type="checkbox"/> Novocain   |   |
|    | <input type="checkbox"/> Gluten  | <input type="checkbox"/> Soy       | <input type="checkbox"/> Hay fever        | <input type="checkbox"/> Penicillin |   |
|    | <input type="checkbox"/> Eggs    | <input type="checkbox"/> Sulfites  | <input type="checkbox"/> Insulin preps    | <input type="checkbox"/> Sulfa      |   |
|    | <input type="checkbox"/> Fish    | <input type="checkbox"/> Tree nuts | <input type="checkbox"/> Insect venom     | <input type="checkbox"/> Other      |   |
|    | <input type="checkbox"/> Peanuts | <input type="checkbox"/> Wheat     | <input type="checkbox"/> Iodine           |                                     |   |

02895-100

MANUFACTURED BY

**Welch Allyn®**

LOT# 492006



PROBE WELL KIT OEM RECTAL 9"

7420 Carroll Road  
San Diego, CA 92121  
AW71283-0000D



H13002895-10007

**Health devices are getting cheaper...  
Costs approaching zero.**

**The cost of data is also approaching zero.**

**Now we are getting  
tons of data.**

**Most of it isn't  
yours... for now.**

**But we're getting  
there.**

**GIVE ME MY**

**DATA!**



# Body Probes



Torn bicep





# Daily activity dashboard

Using 4 years  
(0.999 human  
“uptime”)

## Wireless, self-syncing devices

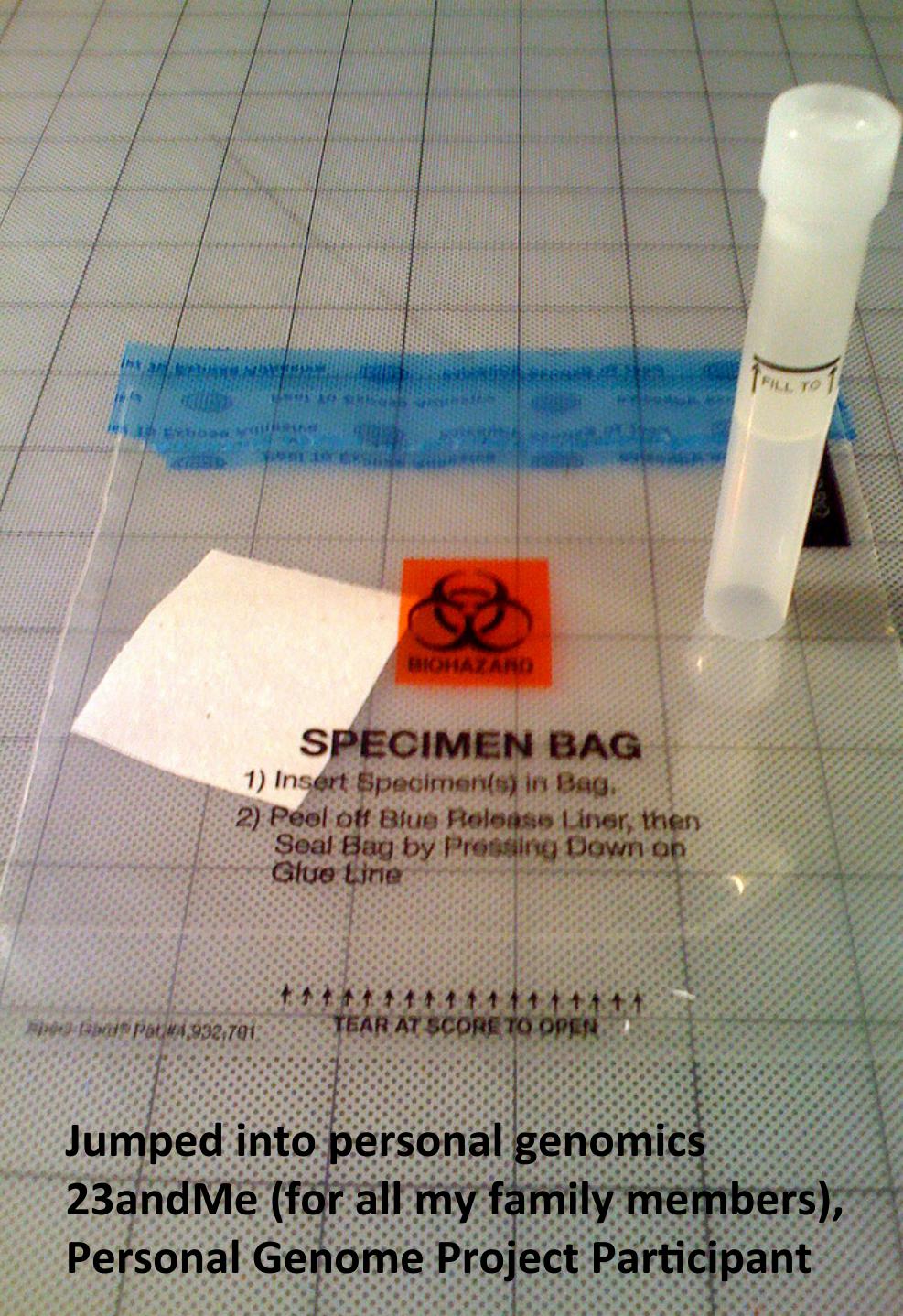




Part of my daily routine  
At work...

# Monthly Cholesterol and glucose self testing





**Jumped into personal genomics  
23andMe (for all my family members),  
Personal Genome Project Participant**

# 23andme.com

Show results for **Juhan Sonin**

[See new and recently updated reports »](#)

✖ 23andWe Discoveries were made possible by 23andMe members who took [surveys](#).

## Elevated Risk

| Name  | Confidence | Your Risk | Avg. Risk | Compared to Average   |
|---|------------|-----------|-----------|---|
| Age-related Macular Degeneration            | ★★★★       | 55.7%     | 7.0%      | 7.95x  |
| Atrial Fibrillation                         | ★★★★       | 33.9%     | 27.2%     | 1.25x  |
| Type 2 Diabetes                             | ★★★★       | 29.6%     | 23.7%     | 1.25x  |
| Psoriasis                                   | ★★★★       | 14.0%     | 11.4%     | 1.23x  |
| Lung Cancer                                 | ★★★★       | 11.6%     | 8.5%      | 1.37x  |
| Rheumatoid Arthritis <a href="#">update</a> | ★★★★       | 4.0%      | 2.4%      | 1.69x  |
| Restless Legs Syndrome                      | ★★★★       | 2.5%      | 2.0%      | 1.25x  |

## Decreased Risk

| Name                                      | Confidence | Your Risk | Avg. Risk | Compared to Average   |
|---|------------|-----------|-----------|---|
| Melanoma                                  | ★★★★       | 1.1%      | 2.9%      | 0.40x  |
| Exfoliation Glaucoma                      | ★★★★       | 0.6%      | 0.7%      | 0.79x  |
| Esophageal Squamous Cell Carcinoma (ESCC) | ★★★★       | 0.3%      | 0.4%      | 0.80x  |
| Multiple Sclerosis                        | ★★★★       | 0.2%      | 0.3%      | 0.69x  |
| Stomach Cancer (Gastric Cardia)           | ★★★★       | 0.2%      | 0.2%      | 0.77x  |









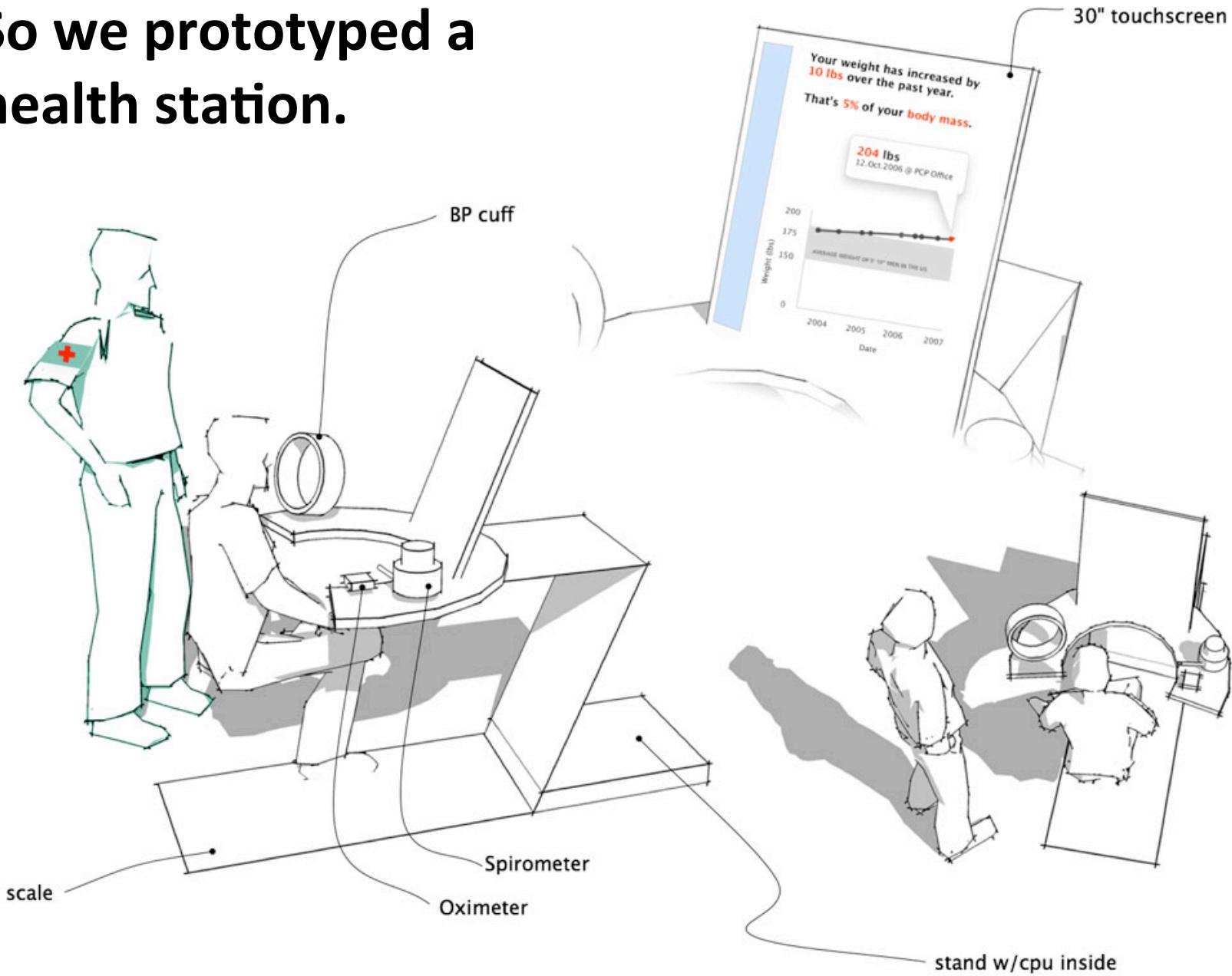


**Enable online clinic for the “practice of medicine”**

**Evolve the FOSS “Healthcare as a software service” model**

**School nurse at first;  
evolve to state-of-the-art ambulatory screen clinic  
(diabetes, obesity, cardiovascular, asthma, allergies)  
in 2 years**

# So we prototyped a health station.



## Patient Health Situational Awareness

Patient Health Situational Awareness is a new way to view patient information. It provides a quick overview of a patient's health status and allows healthcare providers to make informed decisions.

Patient Health Situational Awareness



# HealthStation

# **Self-service health kiosk**

Brief engagement to assess current health

Simple and minimally invasive

Get a health snapshot or monitor changes over time

## **Open platform**

Can add additional measurement devices

Bluetooth, Wifi, and web accessible

Accessible API for building home grown apps

## **Measurements**

Blood pressure

Weight

Body composition

Hydration

Pulse

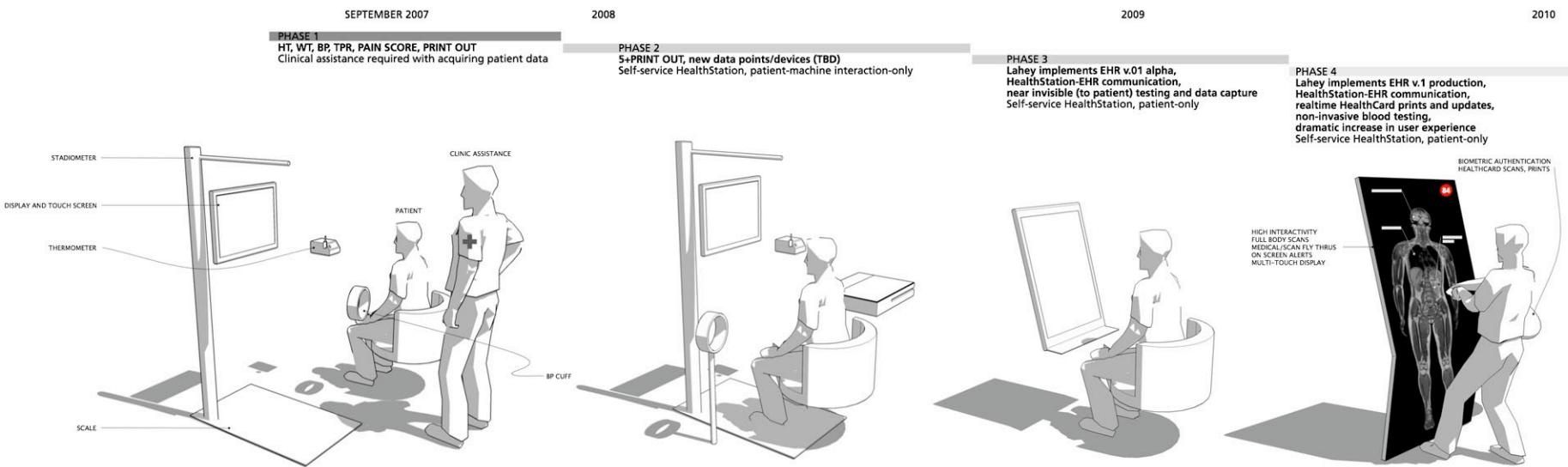
Temperature

Eyesight

Hearing

Respiration

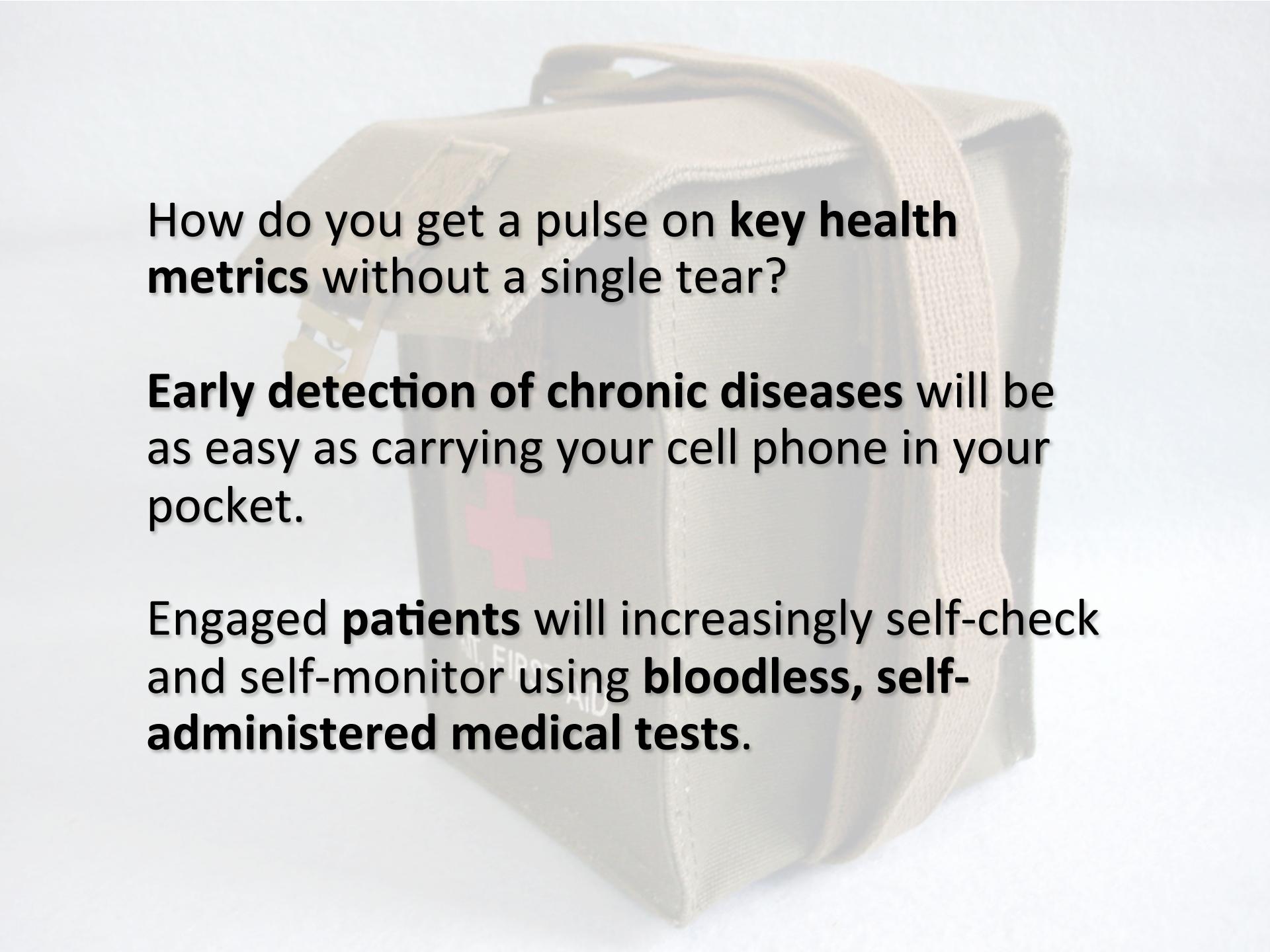
# Evolve from nurse-attended to self-service health experience







Dunbar  
ARCHIVES



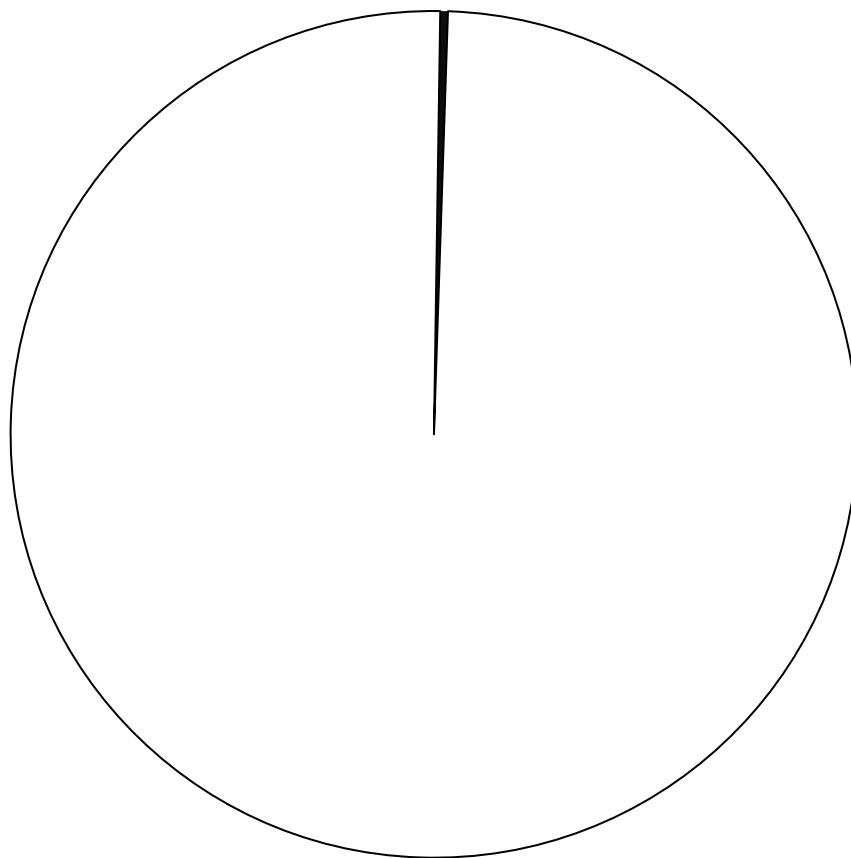
**How do you get a pulse on key health metrics without a single tear?**

**Early detection of chronic diseases will be as easy as carrying your cell phone in your pocket.**

**Engaged patients will increasingly self-check and self-monitor using bloodless, self-administered medical tests.**



**5 million doctors**



**7 billion patients**

#### NUMBER OF INHABITANTS PER DOCTOR



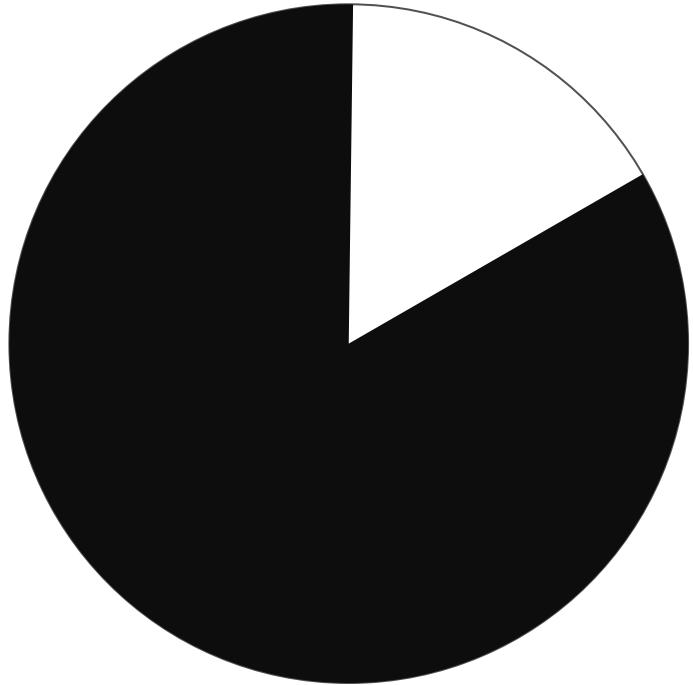
Source : The World Health Report 2006



Not everybody in this world can see a doctor when in need. This is even more so in areas where people suffer from famine, war and diseases. Doctors of the world aims to provide everybody in this world with at least the most essential medical care. Help the people the world is slowly forgetting.

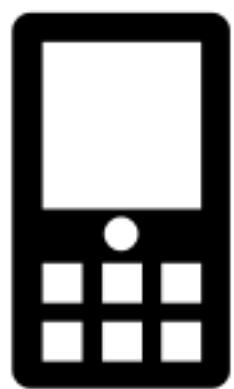


[www.doctorsoftheworld.nl](http://www.doctorsoftheworld.nl)



**5.5 billion  
mobile  
subscribers**

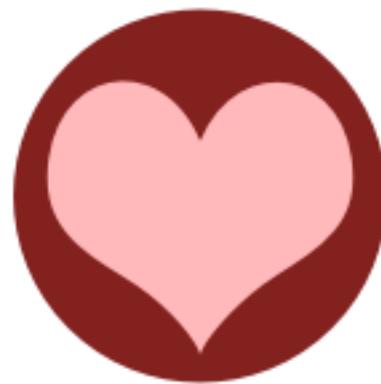
**7 billion patients**



+



=



patients

scale

## mHealth Axioms

Bring the examination room to the patient

Bring the collective expertise of the practice, the standard of care, to the patient's bedside or home

Migrate from a system of episodic evaluation to a system of continuous assessment

Expect patients and their families to be their own primary care provider (key member of the care team)



○ ○ ○ ○ ○ | ○ ○  
100 %

PHILIPS

iTunes

Search Store

LIBRARY

- Music
- Movies
- TV Shows
- Podcasts
- Apps
- Ringtones
- Radio

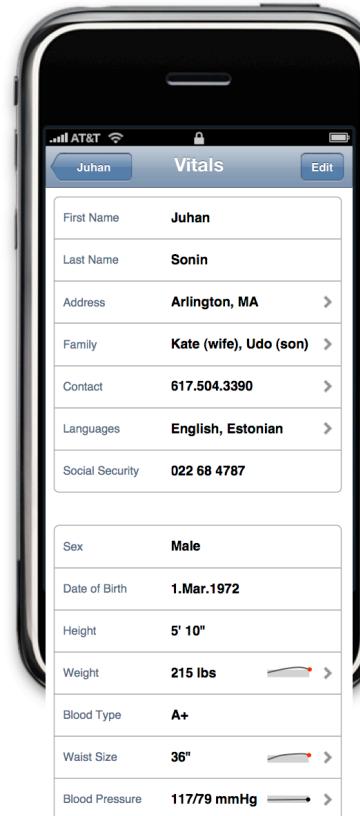
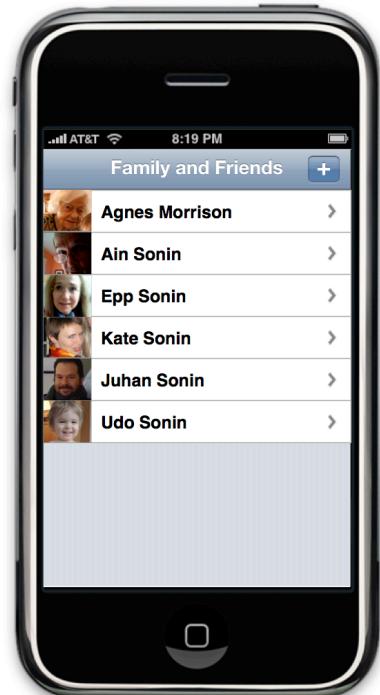
STORE

- iTunes Store**
- Purchased
- GENIUS
- PLAYLISTS

## Top Healthcare & Fitness Paid Software

Sort By: Best-sellers

|   |   |   |   |  |
|---|---|---|---|--|
| 1.  All-in Fitness Pedometer       | 2.  iFitness                           | 3.  Tap & Track -Calorie Counter      | 4.  Go Pedometer                   | 5.  C25K (Couch to 5K)        |
| Healthcare & Fitness<br>Updated May 28, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated May 27, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated May 25, 2010<br>\$3.99 BUY  | Healthcare & Fitness<br>Updated May 19, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated Feb 11, 2010<br>\$2.99 BUY   |
| 6.  Sleep Cycle alarm clock        | 7.  Period Tracker Deluxe              | 8.  Calorie Tracker - Accurate        | 9.  Calorie Counter PRO            | 10.  Hundred PushUps          |
| Healthcare & Fitness<br>Updated Feb 24, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated Mar 03, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated May 24, 2010<br>\$2.99 BUY  | Healthcare & Fitness<br>Updated May 24, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated May 19, 2010<br>\$1.99 BUY   |
| 11.  Poo Log                       | 12.  Sleep Machine                     | 13.  Nutrition Menu - Calorie Counter | 14.  Footsteps - Pedometer         | 15.  Pregnancy Companion      |
| Healthcare & Fitness<br>Released Aug 04, 2009<br>\$0.99 BUY   | Healthcare & Fitness<br>Updated Apr 02, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated Feb 18, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated Apr 26, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Released May 27, 2010<br>\$0.99 BUY  |
| 16.  Cyclemeter GPS Cycle Computer | 17.  Men's Health WORKOUTS             | 18.  Fast Food Calorie Counter        | 19.  FoodScanner - Calorie Counter | 20.  RunKeeper Pro            |
| Healthcare & Fitness<br>Updated May 22, 2010<br>\$4.99 BUY  | Healthcare & Fitness<br>Updated Feb 08, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated May 20, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 25, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 23, 2010<br>\$9.99 BUY   |
| 21.  Couch to 5k                   | 22.  iPeriod Ultimate (Period Tracker) | 23.  Ambiance                         | 24.  SixPack App PRO - Abs         | 25.  White Noise              |
| Healthcare & Fitness<br>Updated May 18, 2010<br>\$2.99 BUY  | Healthcare & Fitness<br>Updated Apr 14, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated Oct 12, 2009<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated Mar 02, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 19, 2010<br>\$1.99 BUY   |
| 26.  Runmeter GPS Running         | 27.  Walkmeter GPS Walking            | 28.  iTreadmill:Pedometer            | 29.  Eat This? for health         | 30.  Two Hundred Situps      |
| Healthcare & Fitness<br>Updated May 22, 2010<br>\$4.99 BUY  | Healthcare & Fitness<br>Updated May 22, 2010<br>\$4.99 BUY  | Healthcare & Fitness<br>Updated Apr 28, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 26, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated Dec 08, 2009<br>\$1.99 BUY   |
| 31.  Get Running (Couch Potato)  | 32.  Pedometer                       | 33.  dLife                          | 34.  Pocket Yoga                 | 35.  Navy SEAL Fitness      |
| Healthcare & Fitness<br>Updated Apr 22, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated Mar 11, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated Apr 18, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 13, 2010<br>\$2.99 BUY  | Healthcare & Fitness<br>Updated May 14, 2010<br>\$1.99 BUY   |
| 36.  Abs Diet Smoothie           | 37.  Track Your Weight               | 38.  Brain Wave - 22 Binaural Beats | 39.  Women's Health WORKOUTS     | 40.  Water Your Body        |
| Healthcare & Fitness<br>Updated Nov 25, 2009<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 20, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 28, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated Dec 07, 2009<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated Jan 18, 2010<br>\$0.99 BUY   |
| 41.  iWatchr                     | 42.  Zen Timer - Meditation          | 43.  Yoga STRETCH                   | 44.  iPregnancy                  | 45.  Army Survival for iPad |
| Healthcare & Fitness<br>Updated Mar 17, 2010<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 19, 2010<br>\$1.99 BUY  | Healthcare & Fitness<br>Updated Nov 25, 2009<br>\$0.99 BUY  | Healthcare & Fitness<br>Updated May 27, 2010<br>\$4.99 BUY  | Healthcare & Fitness<br>Updated Apr 09, 2010<br>\$1.99 BUY   |

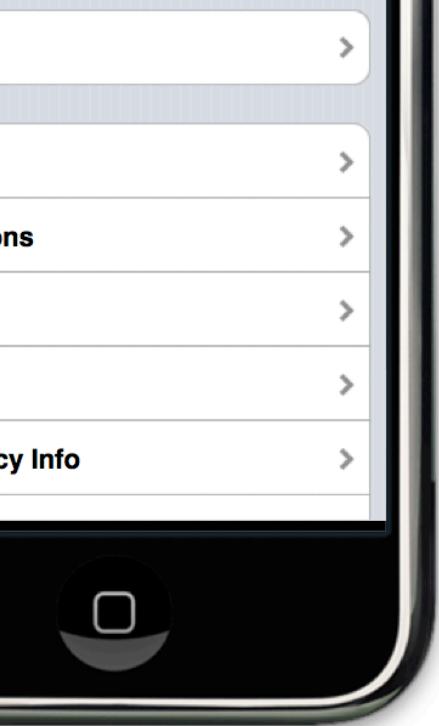


#### Cholesterol

|       |           |   |
|-------|-----------|---|
| Total | 220 mg/dl | ↗ |
| LDL   | 128 mg/dl | ↗ |
| HDL   | 38 mg/dl  | ↗ |

|                |              |
|----------------|--------------|
| Triglycerides  | 270 mg/dl    |
| Glucose        | 101 mg/dl    |
| Alcohol        | 1 drink/week |
| Tobacco        | 0            |
| Blood Type     | A+           |
| Waist Size     | 36"          |
| Blood Pressure | 117/79 mmHg  |

Sonan Sonin



|                 |                                 |
|-----------------|---------------------------------|
| Last Name       | <b>Sonin</b>                    |
| Address         | <b>Arlington, MA</b> >          |
| Family          | <b>Kate (wife), Udo (son)</b> > |
| Contact         | <b>617.504.3390</b> >           |
| Languages       | <b>English, Estonian</b> >      |
| Social Security | <b>022 68 4787</b>              |

|                |                      |
|----------------|----------------------|
| Sex            | <b>Male</b>          |
| Date of Birth  | <b>1.Mar.1972</b>    |
| Height         | <b>5' 10"</b>        |
| Weight         | <b>215 lbs</b> >     |
| Blood Type     | <b>A+</b>            |
| Waist Size     | <b>36"</b> >         |
| Blood Pressure | <b>117/79 mmHg</b> > |

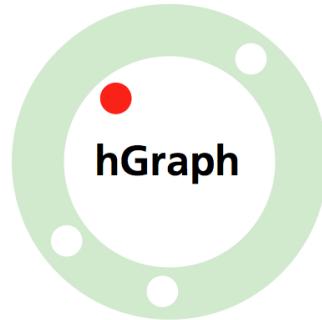
### Cholesterol

|       |                    |
|-------|--------------------|
| Total | <b>220 mg/dl</b> > |
| LDL   | <b>128 mg/dl</b> > |
| HDL   | <b>38 mg/dl</b> >  |

|               |                  |
|---------------|------------------|
| Triglycerides | <b>270 mg/dl</b> |
|---------------|------------------|







## Clinical and Patient Software

Compelling, standardized visual representations of a patient's health status...on the celltop

Designed to increase awareness of the individual's factors that can affect one's health

Open source healthcare application

Created for mobile devices, starting with the iPhone and iPad

## Your health in one picture

Users provide, view, share, and understand a holistic view of their health

Based on an individual's health data, identifies *where an individual's health numbers are, and where they should be*

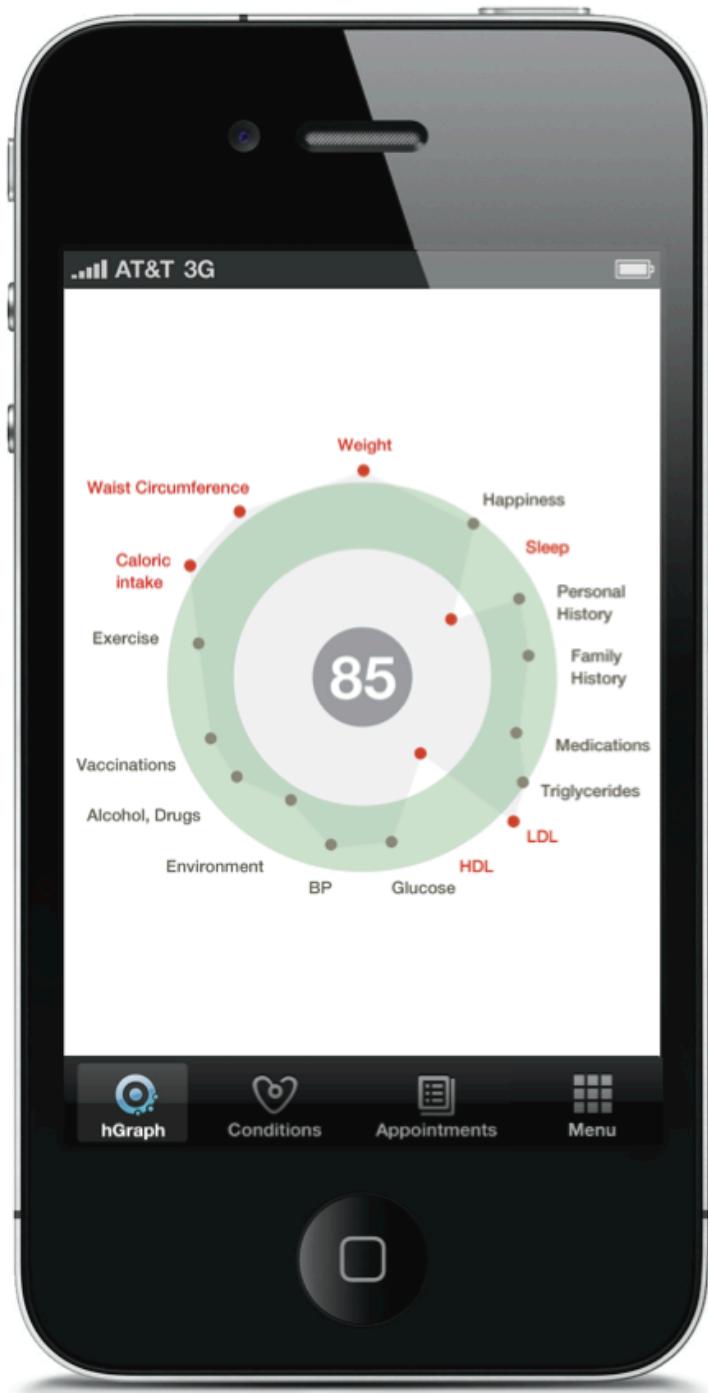
Patient focused, with professional clinical relevance

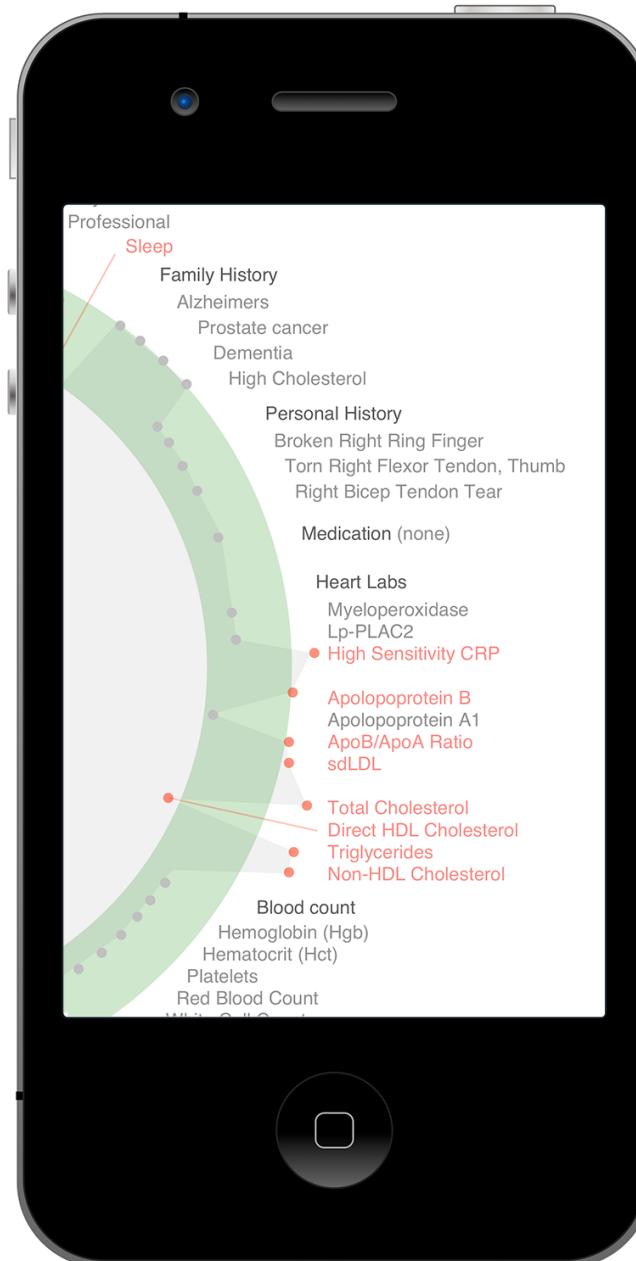
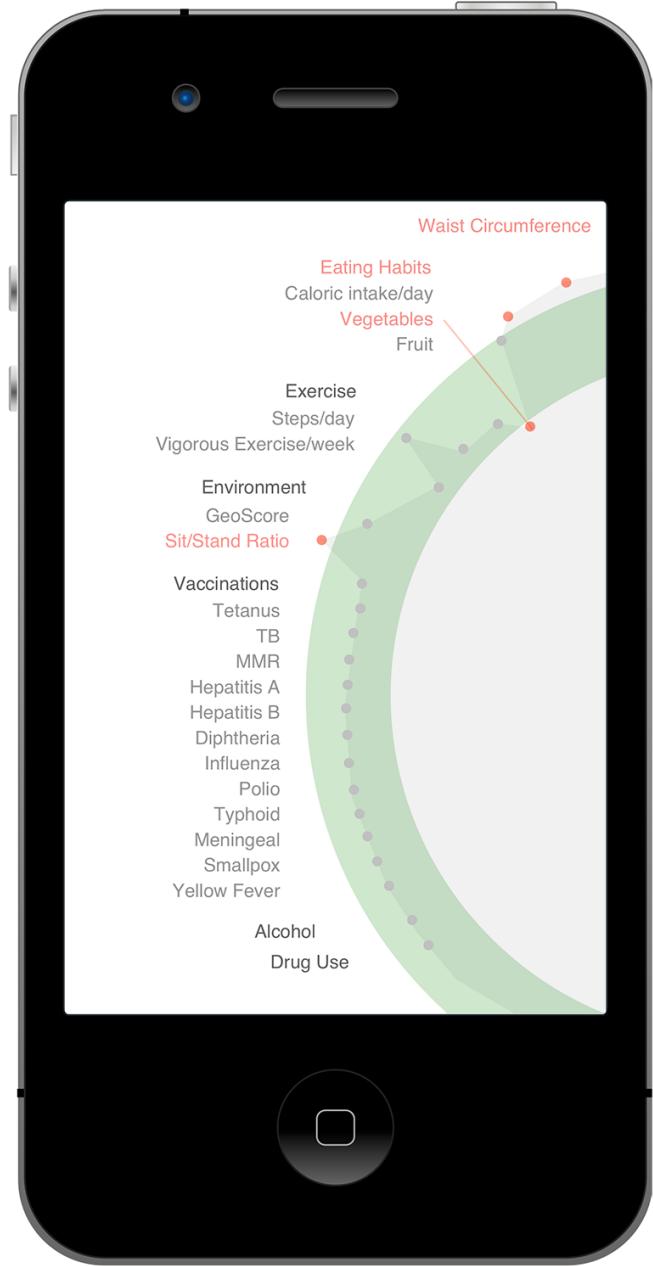
## hScore

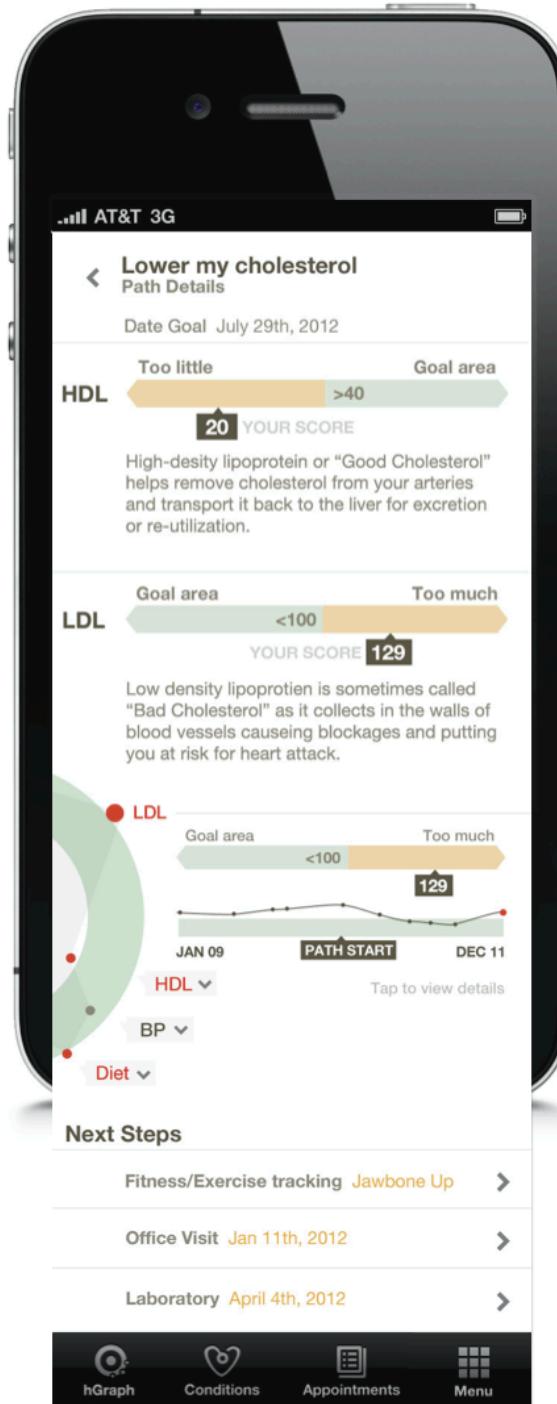
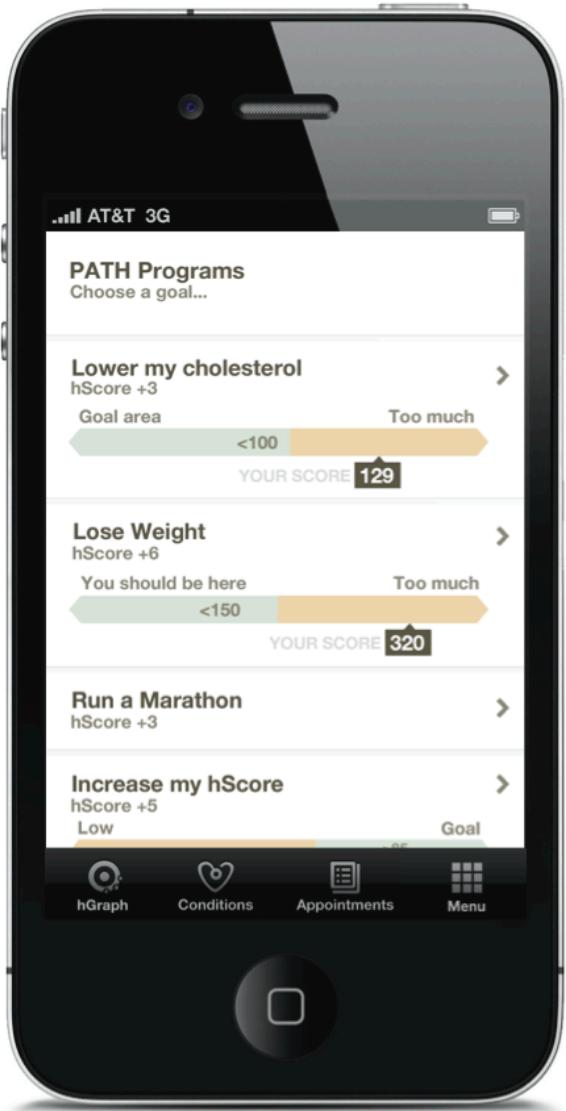
Single aggregated number ranging from 1-100 that represents best knowledge status of an individual's health

Experimental measure correlated with statistical data from open sources









AT&T 3G

## Lower my cholesterol

Details

Date Goal July 29th, 2012

HDL

Too little      Goal area

>40

20 YOUR SCORE

High-density lipoprotein or "Good Cholesterol" helps remove cholesterol from your arteries and transport it back to the liver for excretion or re-utilization..

200  
180  
160  
140  
120  
100

146mg/dl  
13.Sep 08

### Total Cholesterol

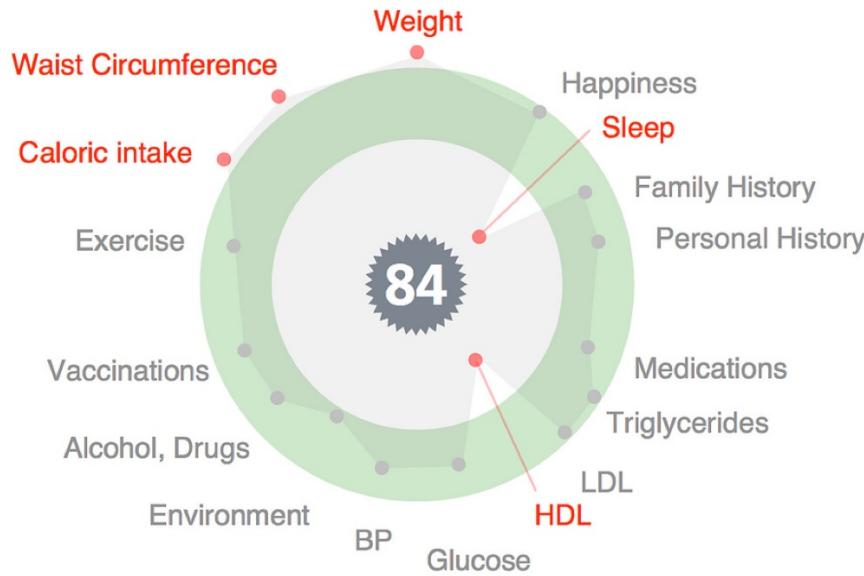
Your Cholesterol is high (229) >  
Start managing your cholesterol

Start a Conquering Cholesterol path. >  
Six months to a healthier heart.

Move more. Eat less. >  
Jumpstart a more healthy lifestyle.

hGraph   Conditions   Appointments   Menu

Juhan Sonin, 40



Epp Sonin, 65



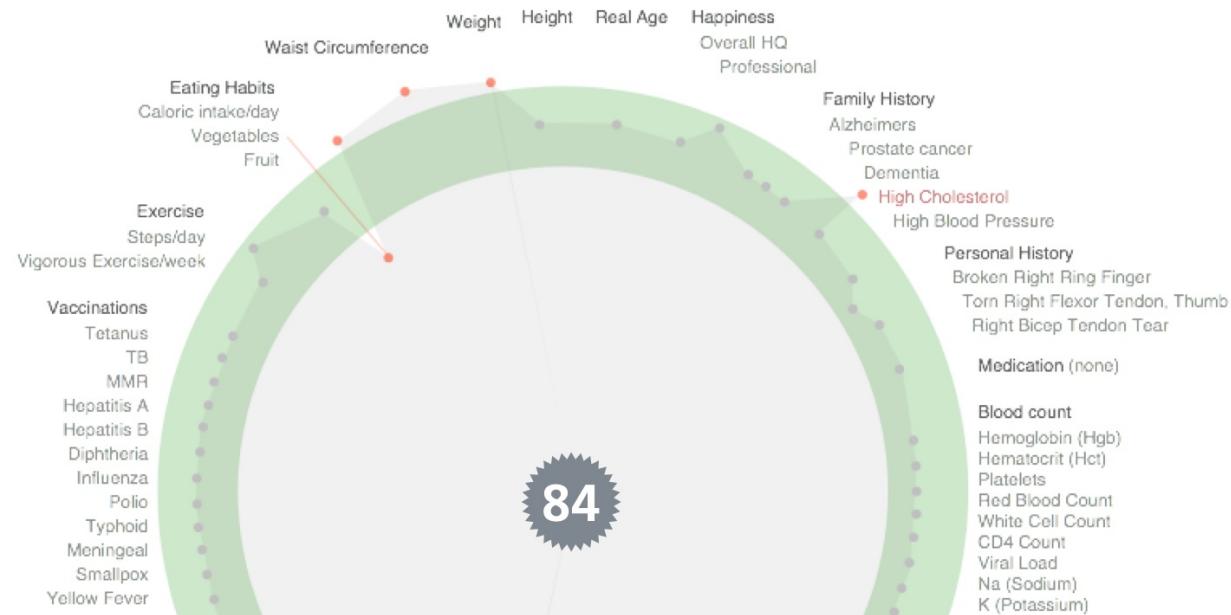
Kate Sonin, 40



Udo Sonin, 5



## Juhan Sonin, 40



## Epp Sonin, 65



## Kate Sonin, 40



## Udo Sonin, 5





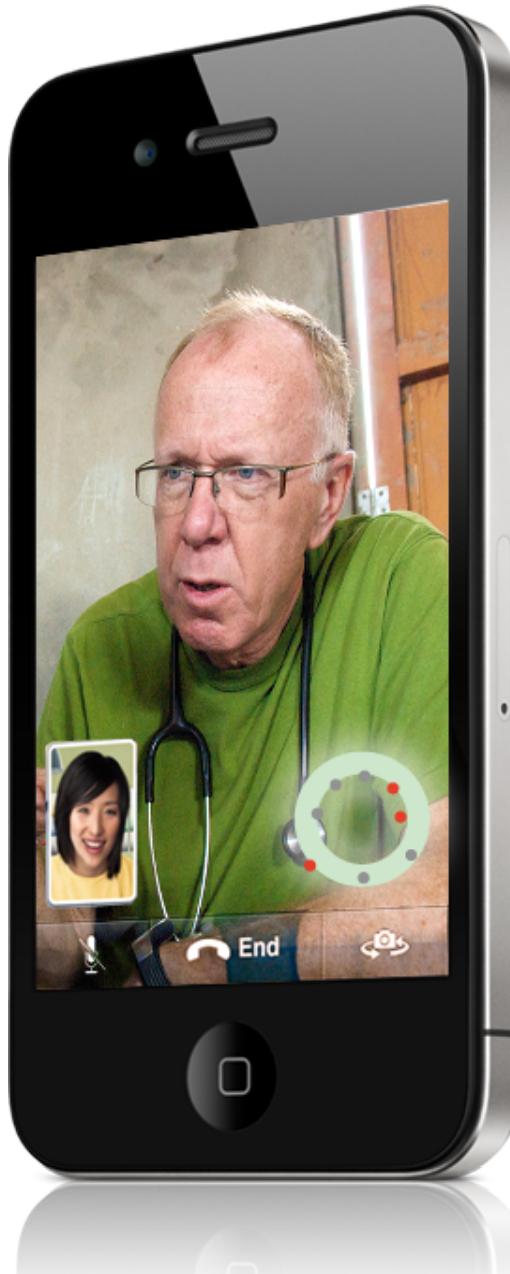
# hGraph

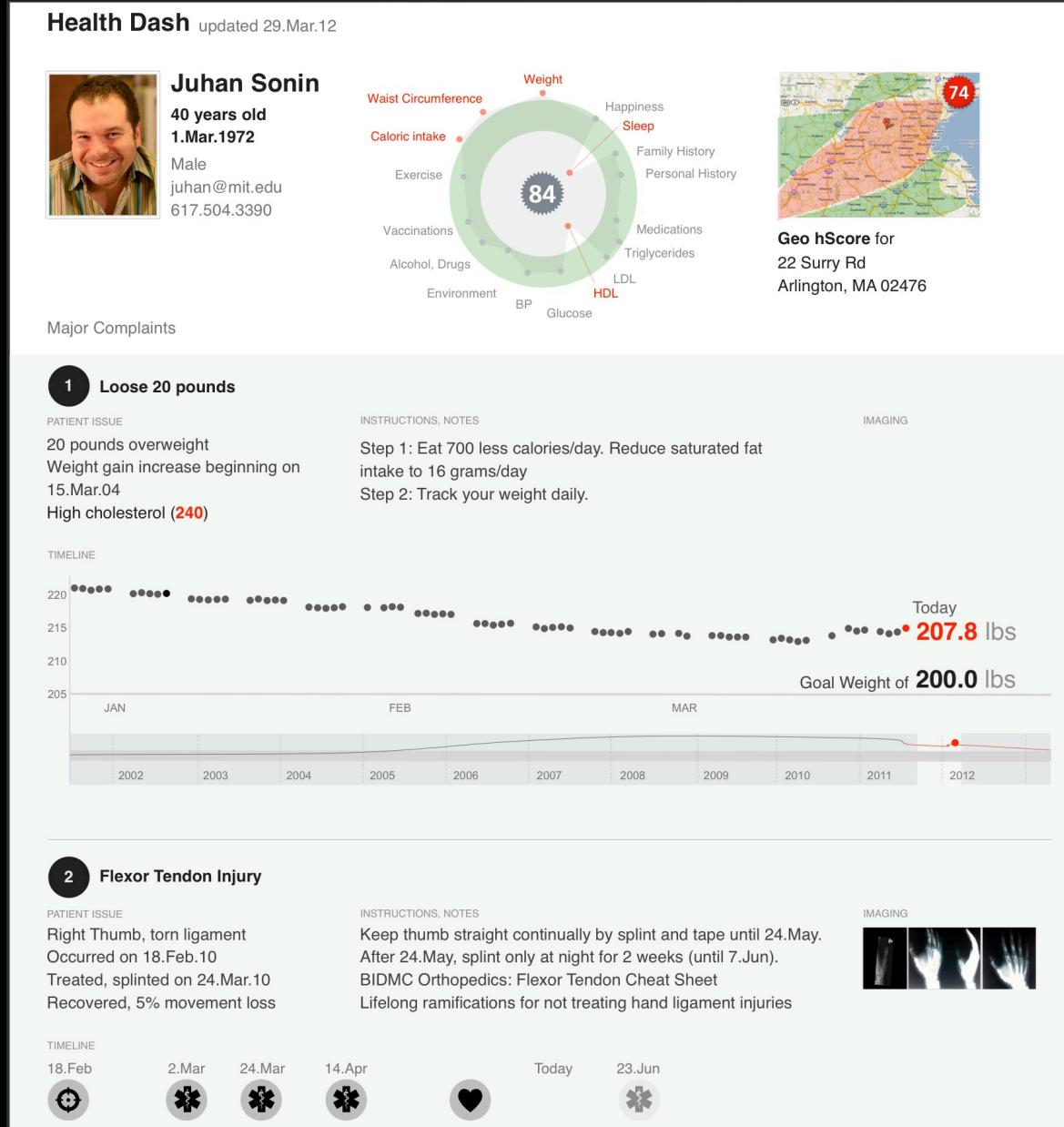
Used as status indicator for current plan of care

Recent updates can trigger “just in time” healthcare consults

Additional mHealth monitors augment hGraph scope and real-time nature

Live consults with healthcare professionals





# hGraph Target Ranges

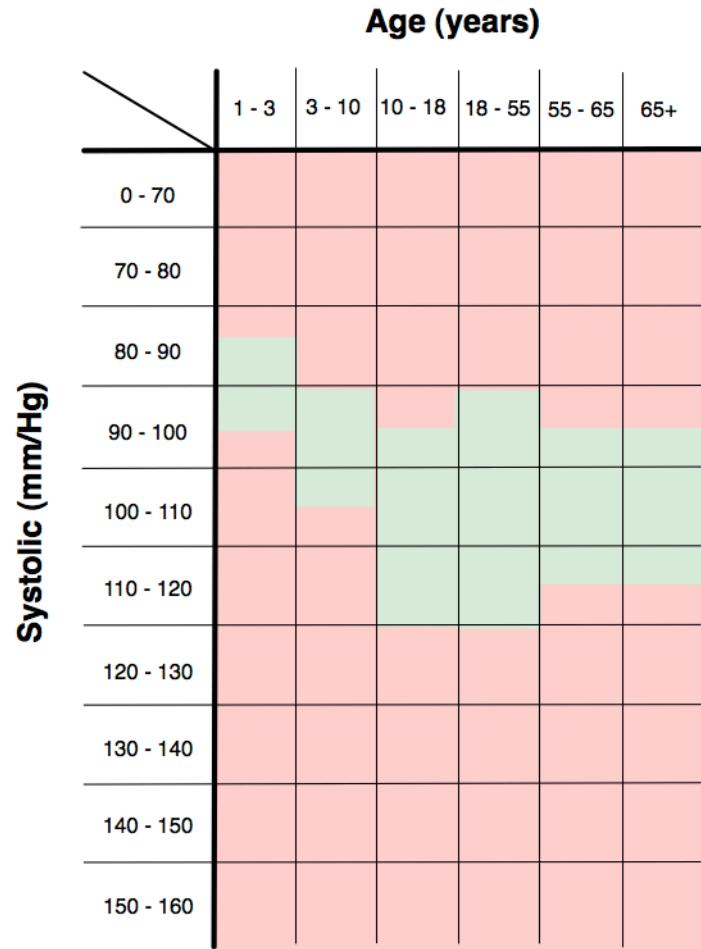
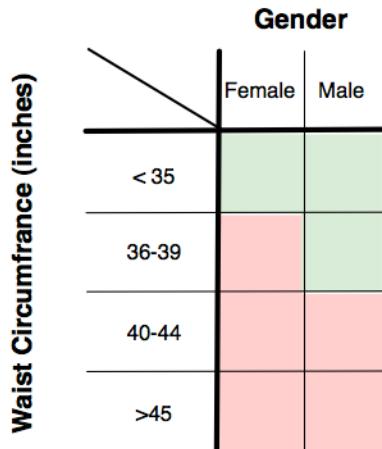
Guidance for the individual health measures are based on citations from trusted healthcare experts



**International Center for Alcohol Policies**  
Analysis. Balance. Partnership.



# hGraph Target Range “Algorithms”





Primary care on  
corporate campuses

Doctor as Life Coach  
philosophy

Founders = open  
source and design  
nuts





**PROFILE****MY TEAM****MESSAGES** (3)**GOALS****ACTIVITIES****GUIDANCE****PRESCRIPTIONS****CALENDAR** (2)**SETTINGS**

ACTIVE

30%



Use the Stairs



Drink a cup o



Have a bowl



Take a 20min

**VIDA-XO**

**John Doe**  
**Apprentice**  
"keep it up!"

CURRENT STREAK



ACTIVE

30%



Use the Stairs vs. Elevator

NUTRITION

80%



Drink a cup of water

HGRAPH

85



Have a bowl of Oatmeal



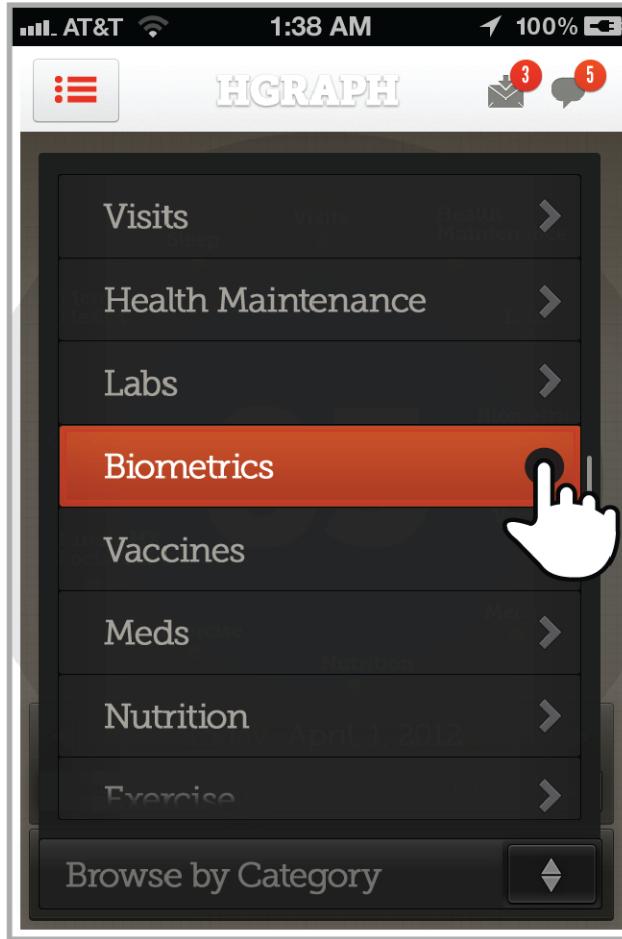
Take a 20min Walk

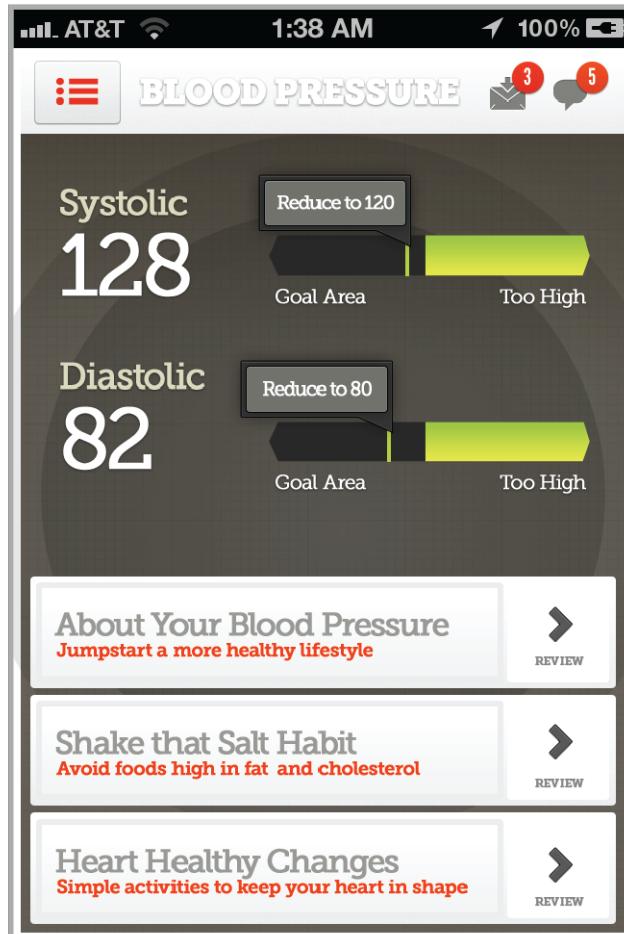
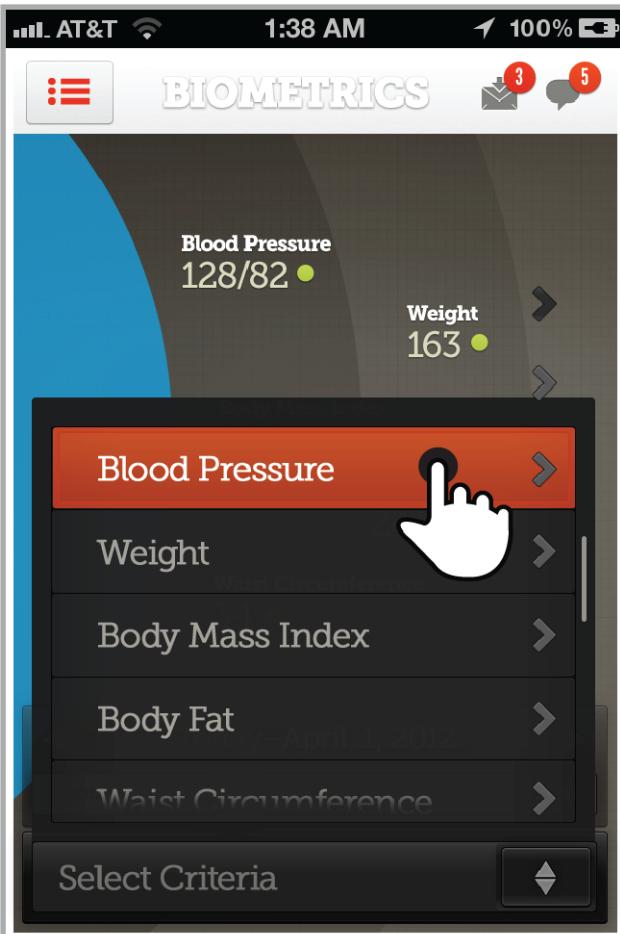
active +8

hydrate +3

nutrition +3

active +5





## Level 3 Zoom / Current Day



# Data Inputs, Outputs

Health Risk Assessments

Clinic Annual Check-ups

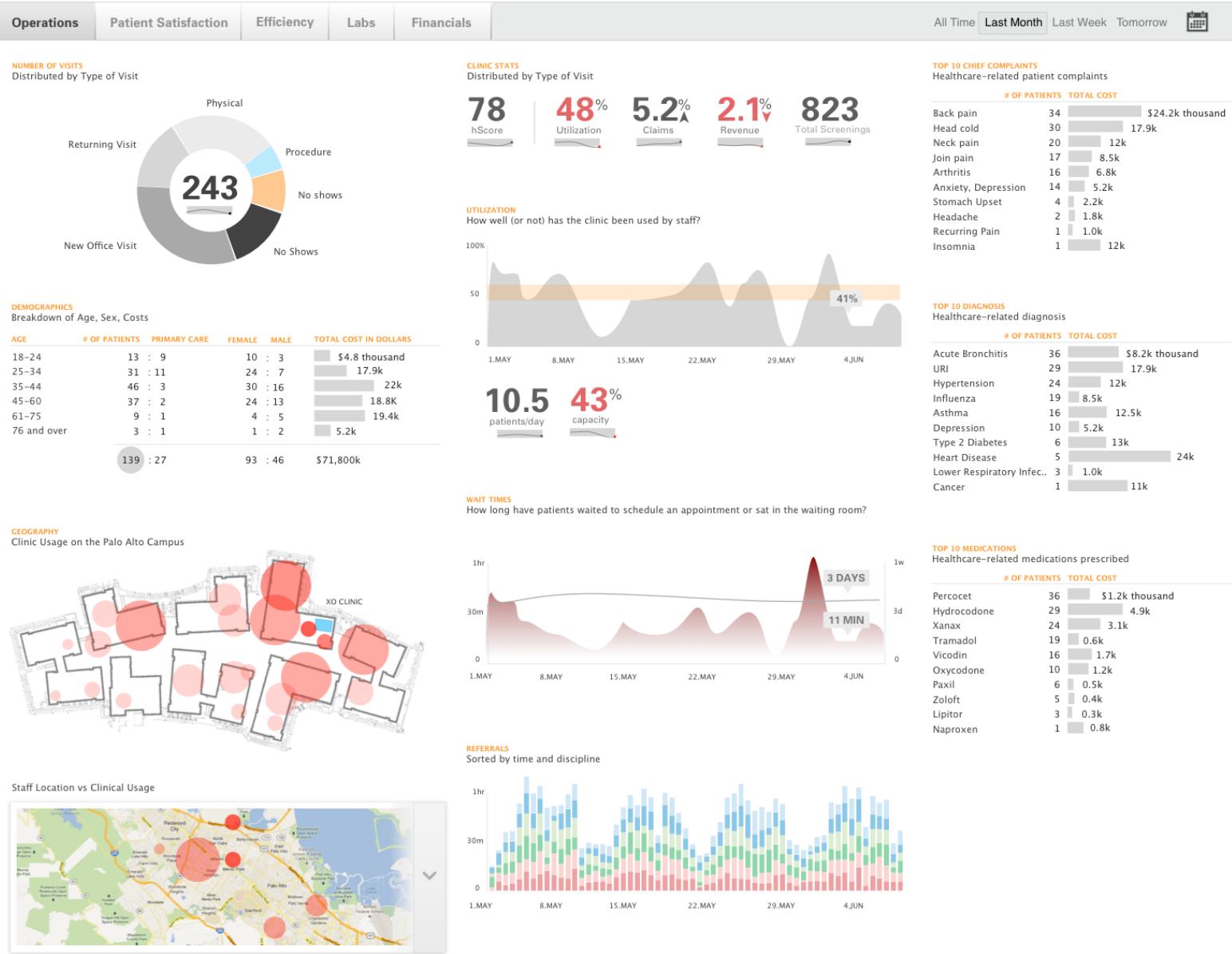
Blood Tests

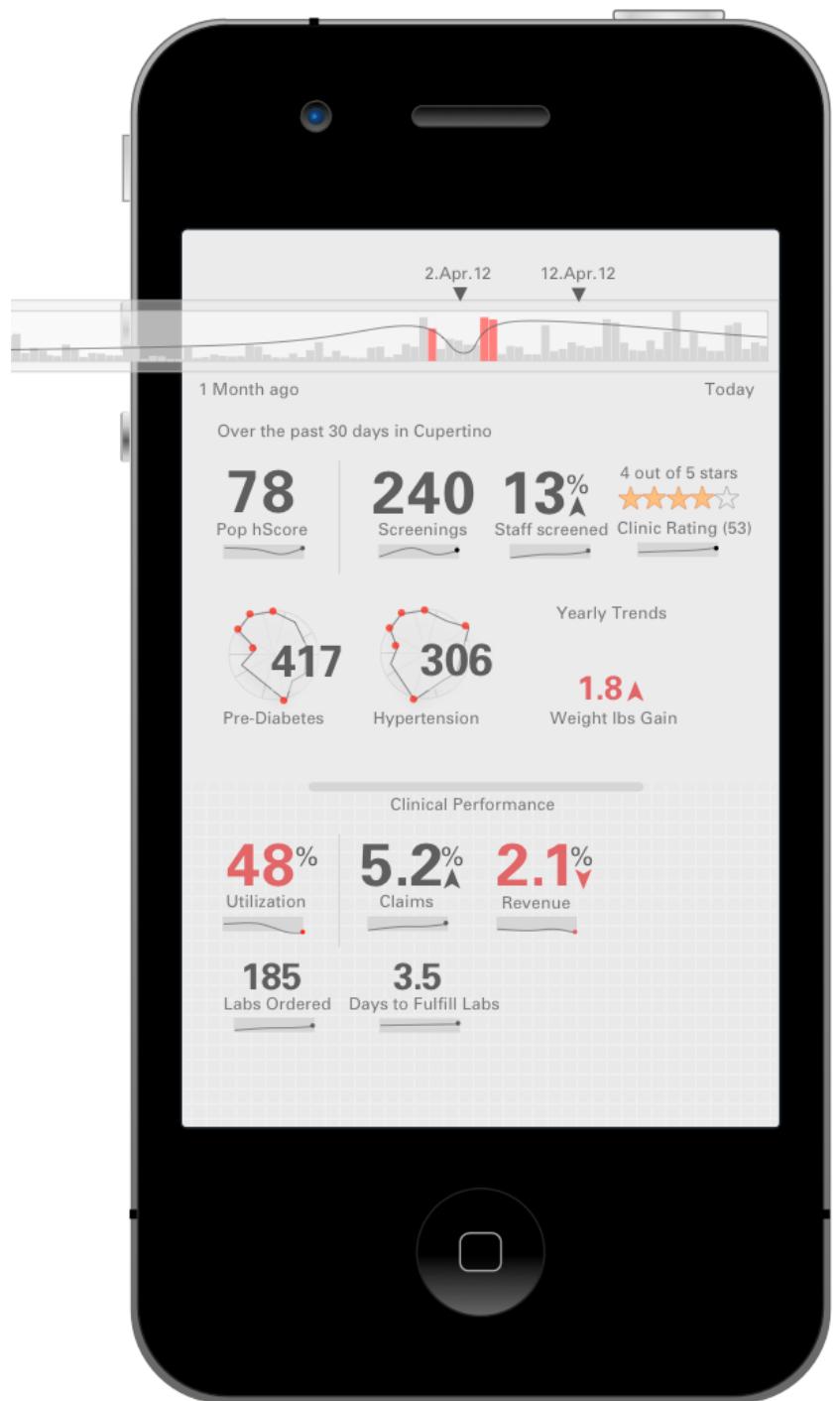
Self-Service hPods (2013)

CCD-based EMRs

Patient Portal

Patient health stream (devices, services, manual input)





# **Next Up for hGraph...**

# hGraph Tasks

Prototype v.1

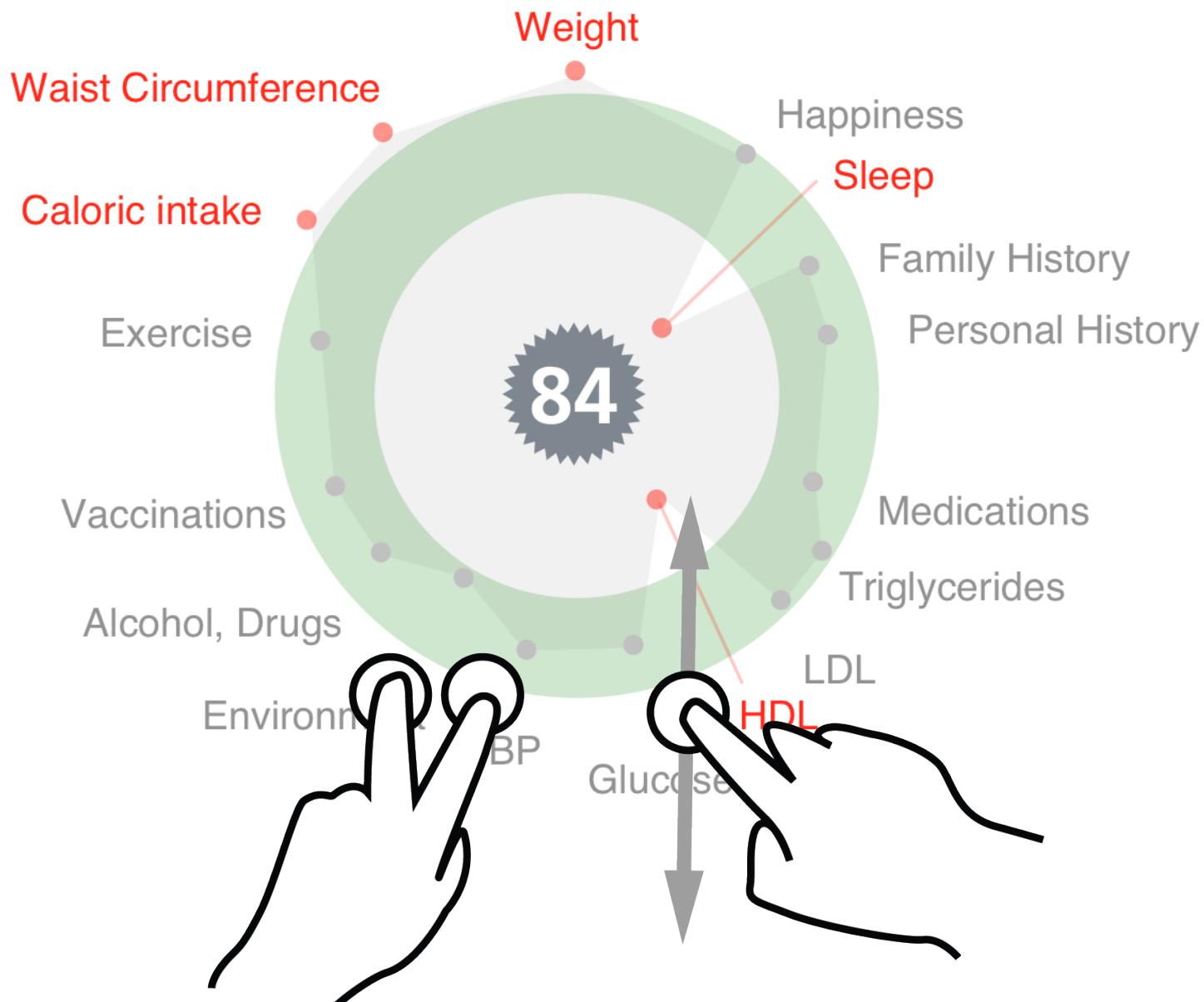
hData (<http://www.projecthdata.org>)

RESTful Health Exchange (HREx,  
<http://wiki.siframework.org/RHEx>)

31.Jan.13, view data, explore, 3 zoom levels

28.Feb.13, input basic data

28.Mar.13, proxy access, CCD/CDA





# Juhan Sonin

23 more feelings      Temperature of 103°      Sluggish and tired      I feel like...  
Past Decade Year Month Week Today Tomorrow Next Week Month Year Decade

## Diabetes



Insulin  
3x Daily



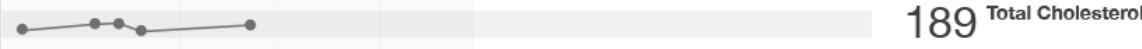
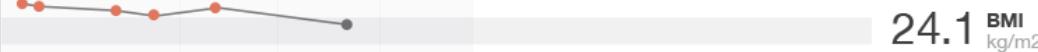
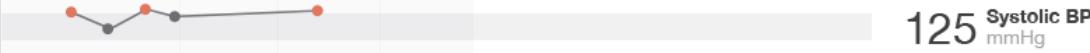
Diet Journal  
3x Daily



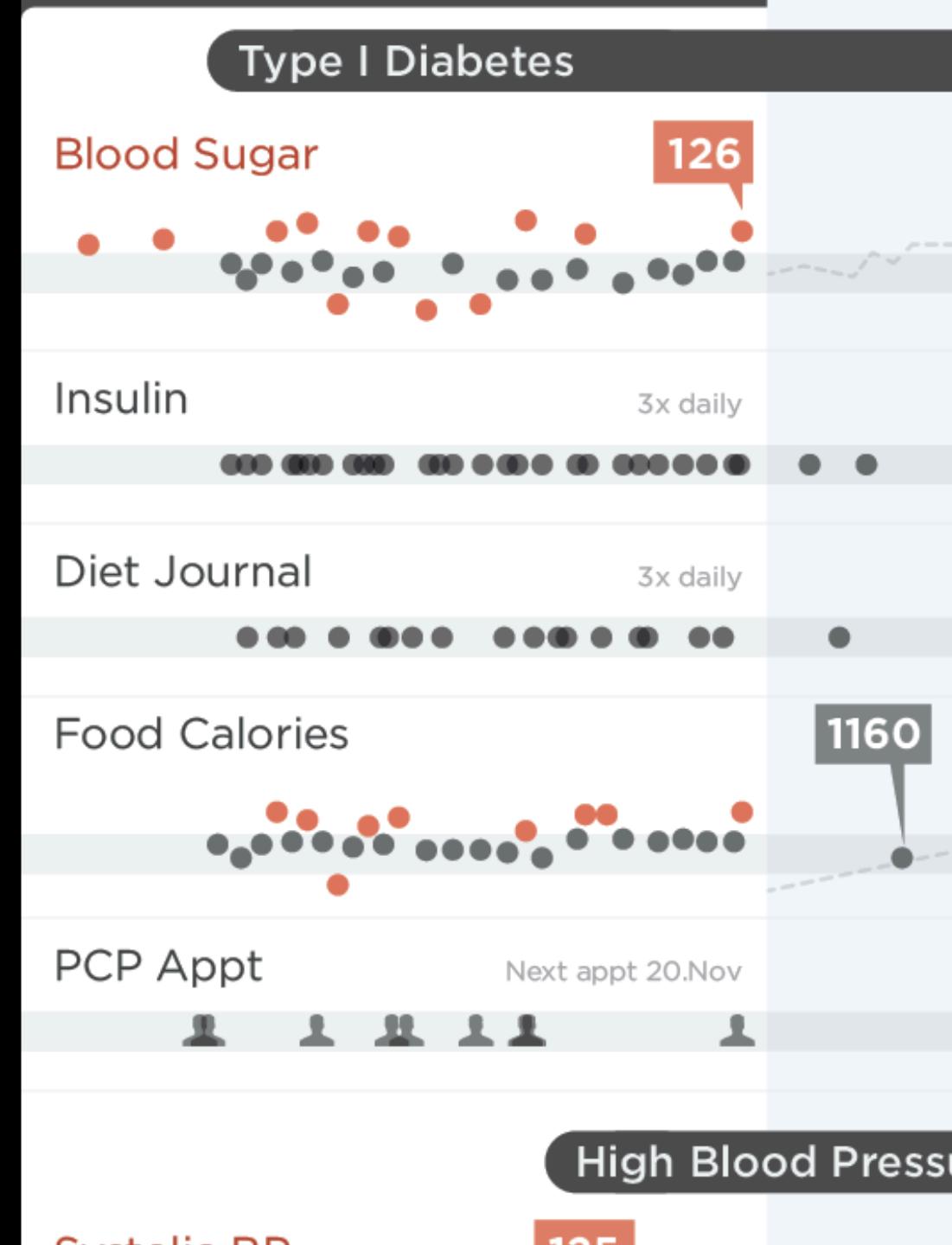
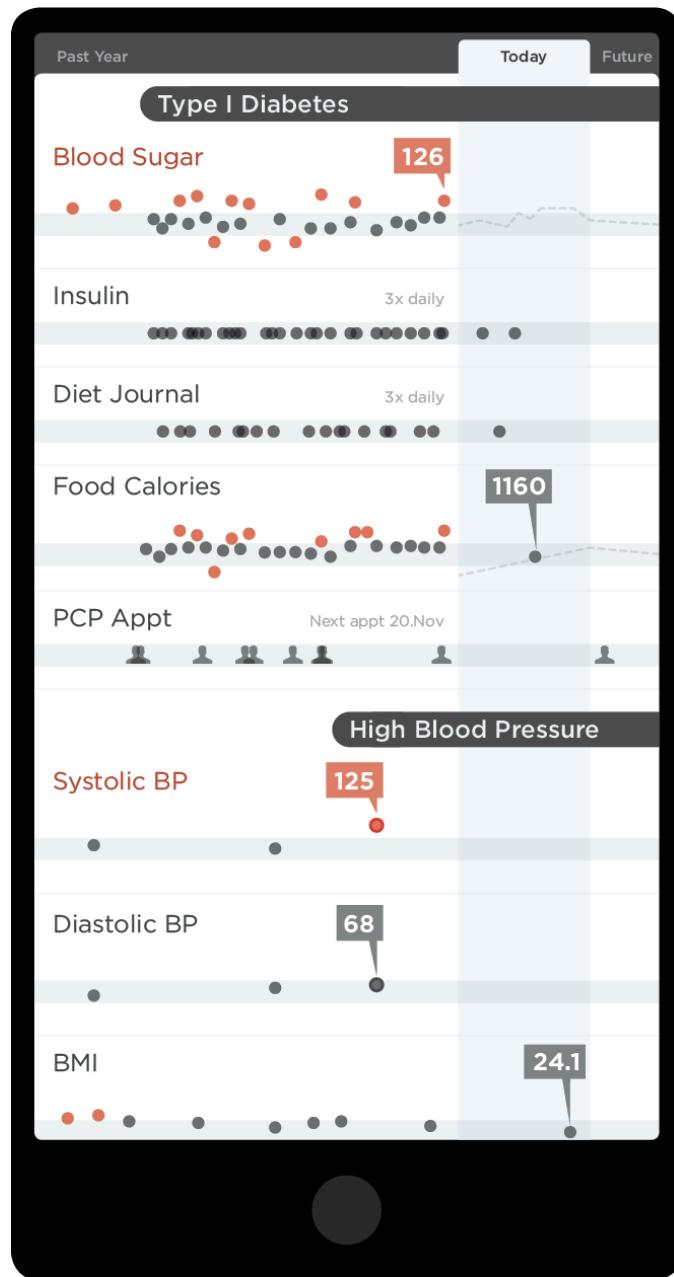
PCP Appointment  
Next Appt 20.Nov



## High Blood Pressure



## Flexor Tendon Injury





**The near future...**

**Symptom Tracker**  
+  
**Expert Patient Data, Experiences**  
+  
**Corporate Mini Clinics**  
+  
**Dr Watson**  
+  
**Open Source CDSS**

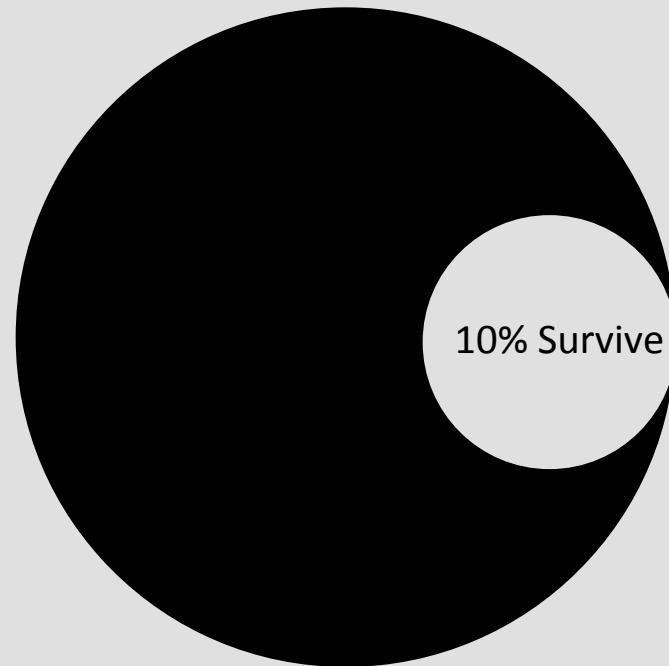


85% of  
adults  
have a  
cellphone  
today...

# The Future: Stage zero detection



Early stage detection



Late stage detection

# **hGraph.org**

**Designing an open system for visualizing  
personal health metrics**

Juhan Sonin

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