Imminent Transformations in Health

Ramesh Jain
With Several Collaborators
jain@ics.uci.edu
The most important thing in human life is least affected by progress in technology.
Disruption in Healthcare

What is the most important problem in health?

Today: Health = Disease

Let’s Change: Health = Health
Medicine or Health!

Today: Medicine
• Reactive
• Broad demographic models
• Medicine based cure
• Real time only in ICU
• Anecdotal patient data
• Doctor knows the best

Tomorrow: Health
• Predictive and Preventive
• personalized and Precise
• Lifestyle + medicine
• Real time: Womb to Tomb
• 24/7 data collection
• Patient knows the best
Important Revolution in Health

In the mid-20th century, the primary causes of death worldwide shifted from infections to chronic conditions.

Figure 1. Life Expectancy at Birth, by Sex: 1900 to 2003.


### Diabetes

<table>
<thead>
<tr>
<th>Year</th>
<th>1994</th>
<th>2000</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Data</td>
<td>&lt;4.5%</td>
<td>4.5-5.9%</td>
<td>6.0-7.4%</td>
</tr>
<tr>
<td>6.0-7.4%</td>
<td>7.5-8.9%</td>
<td>&gt;9.0%</td>
<td></td>
</tr>
</tbody>
</table>

### Obesity (BMI ≥30 kg/m²)

<table>
<thead>
<tr>
<th>Year</th>
<th>1994</th>
<th>2000</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Data</td>
<td>&lt;14.0%</td>
<td>14.0-17.9%</td>
<td>18.0-21.9%</td>
</tr>
<tr>
<td>14.0-17.9%</td>
<td>18.0-21.9%</td>
<td>22.0-25.9%</td>
<td></td>
</tr>
<tr>
<td>18.0-21.9%</td>
<td>22.0-25.9%</td>
<td>&gt;26.0%</td>
<td></td>
</tr>
</tbody>
</table>
The Effect of Chronic Diseases, 2016*

7 of 10 Deaths
Due to chronic diseases

86% of Costs
Driven by treating chronic diseases

* Source: CDC
Today’s model is built for INFECTIOUS DISEASES

ILLNESS OCCURS

CARE

TEST & DIAGNOSIS

$3.15 Trillion

• High fixed costs (hospitals, equipment)
• Hotel model of occupancy for revenue
• Relies on intuitive medicine for diagnosis – REACTIVE

Today’s reality is based on CHRONIC DISEASES

Heart Disease
Cancer
Type 2 Diabetes

Brain Diseases
Lung Diseases
Bone Diseases

• Outpatient model is better suited
• Extremely expensive to care for a patient in an infectious disease care model – THAT IS WHAT WE DO TODAY
Needed: Medical Emancipation

Doctor Knows the Best.

Patient Knows the Best.
IFH leverages the power of six rapidly converging technologies.

Smaller, cheaper, effective devices that integrate with smartphone platforms – continuous glucose monitoring

Cybernetics and AI change the nature of analytics in healthcare

Full genome sequencing to reach sub $100 level within next few years – smartphone sequencing

Use mobile devices to collect and deliver right information, at right time, at right place, and in right way.

Model each individual using their data and use these models to guide them in maintaining health

All medical, societal, environmental, and facilities knowledge is connected and available
Cybernetics Health

Key Components:
- Personal Model
- Perpetual Observations
- Navigation and Guidance
Challenges

1. Personal Model: Each person is unique.

2. Observations: Knowing the State of the person.

3. Guidance: Help is always with the person.
Individual Model

- Rule based modeling of events in different data streams.
- An individual is modeled as a collection of rules.
- The Model has long term and short term components.
Perpetual Observations: Personal Event Streams

Health Score = F (Food, Activity, Emotion, Medical, Environment)
Can you drive without Navigation Systems?
Life Navigation

Different Models: General to Individual

Scores: Food, Activity, Emotion, Medical, Environment, Daily Activity

Current Situation

Guidance
Future Health: Personalized, Predictive, Precise, Persuasive, and Preventive

P^5 Cybernetic Health

Right Moment, Right Place, Right Decision, Right way.

Personalized

Prevent

Persuade

Precise

Predict

event mining + scientific knowledge base

detect evolving situations

feedback

optimal acutation

best known specific solutions
Your food and activity scores for the last 3 days are on low side.

Health Butler
Current Status

• Institute for Future Health
• Event Framework getting ready
• First Application is Diabetes
  – Next Alzheimer
  – Next Cardiovascular and Asthma
• Expect to release first version of Health Butler in 3rd quarter, 2017.
Invitation

Please join us in bringing Future Health.

Health is the most important aspect of life.
Thanks.

jain@ics.uci.edu