

**Design & Health**

7<sup>TH</sup> WORLD CONGRESS & EXHIBITION

# **HEALTHCARE TRANSFORMATION**

**The Power of Convergence:  
Technology Informed Healthcare Planning & Design**

**Session 4: Research Based Design –  
An Evaluation Tool for Improving Healthcare**

**July 7, 2011**

**RATCLIFF**



# Presenters



## Steven Steinberg, AIA

### Principal, Healthcare

- BA in Fine Arts from Hofstra University
- Bachelor of Architecture from Pratt Institute
- Healthcare and Biomedical Planning
- Principal of Healthcare with RATCLIFF



## Donald E. Kinser, PE, MBA

### President & CEO

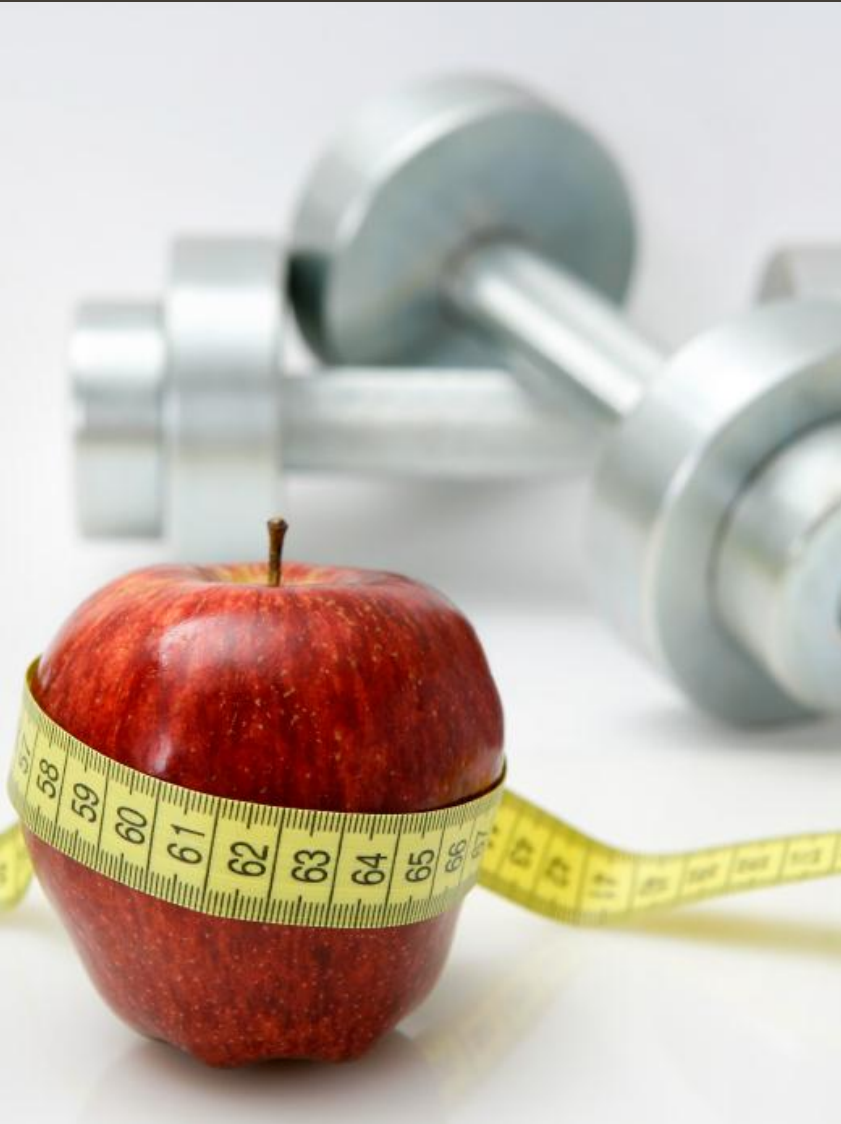
- Bachelor of Mechanical Engineering from GA Tech
- MBA from Georgia State
- Registered Professional Engineer in 6 states
- NCEES National Council Record
- Founder of EDI, Ltd.

# Issues



- **Aging** populations  
(aging in place/healing at home)
- Increasing incidence of **chronic conditions**
- **Government** regulations
- Empowered consumers

# Solutions



- **Wellness** model
- Lifestyles and **prevention**
- Condition management
- Access to **personal health** solutions / proactive
- **Education** / health intelligence
- Measure / manage and monitor

**transformation** will require a shift  
from *reactively* treating disease  
to *pro-actively* providing the information,  
treatment, and services to help people stay healthy  
*“any transformative solution requires  
disruptive innovations that leverage technology”*

*Microsoft, “IT empowers Health and Wellness”, Oct. 2010*

# Why do we need to TRANSFORM?

The global health ecosystem faces a daunting set of challenges

- Runaway **costs**
- Poor **outcomes** and results
- Misalignment of **incentives**
- Lack of **transparency**
- Lack of performance **measurements** and metrics
- An **unsustainable** situation

# Healthcare Costs in U.S.



**1970:** \$75 billion (\$356/resident)

**2007:** \$2.259 trillion (16% of GDP) <sup>1</sup>

**2009:** \$2.5 trillion+ (17.6%) or  
\$8,160/resident <sup>2</sup>

In the U.S., total spending on  
healthcare will rise from  
16% of GDP in 2007, to 25% in 2025,  
37% in 2050, 49% in 2082

# Cost of Healthcare



The WHO estimates that China, India, and Russia could lose \$200B to \$550B in their GDP during the next 10 years because of heart disease, stroke, and diabetes.

Chronic disease in the U.S. accounts for over 75% of the nation's \$2 Trillion in medical care costs.

# Sub Par Results

- **Life expectancy**
  - U.S.: 77.99 yrs. #6 in world. (*highest in Australia*)
  - Cuba: 78.26 yrs. (spends \$251/person)
- **Infant Mortality:** U.S. #6 in world (*lowest in Germany*)
- **Obesity:** U.S. #6 in world with 32% of population (*lowest in Germany*)
- **Avoidable Deaths:** U.S. #6 in world (*lowest in Australia*)
- **Health Expenditures:** U.S. #1, followed by UK, New Zealand, Germany, Canada, Australia

# Elements of Healthcare Transformation



**Cost shifting from unnecessary acute interventions to self-care prevention.**

- **Alignment of incentives**
- **Connectivity among caregivers and patients**
- **Leadership assessment and development**
- **Business plans and models**
- **Metrics and evaluation**
- **Medication management**
- **In-home care**

*\* from Healthcare Transformation Institute*

*“health value means  
improved care  
for more individuals  
at less cost”*

# Enablers of this Required TRANSFORMATION

- **Healthcare IT/HIT**
- Improved clinical **work flow** efficiencies
- Streamlined patient pathways
- Increased patient **safety** with better care coordination
- Integrated and inter-operative systems
- Consumer directed quality and price transparent knowledge-driven healthcare delivery system

“Shift left” refocusing of efforts away from acute based healthcare services to consumer focused, personalized technologies

# Technology Available Today



- **Nanotechnology**
- **Smart prescription bottles**
- **Medical home model**
- **Home healthcare**
- **Use of Internet and PDAs**
- **Sharing of information**

# Technology Available Today



**IPv6, Internet Platform, everything connected, augmented reality, surface technology: all existing technologies that could have a positive impact on the cost of delivering quality medical services in the future.**

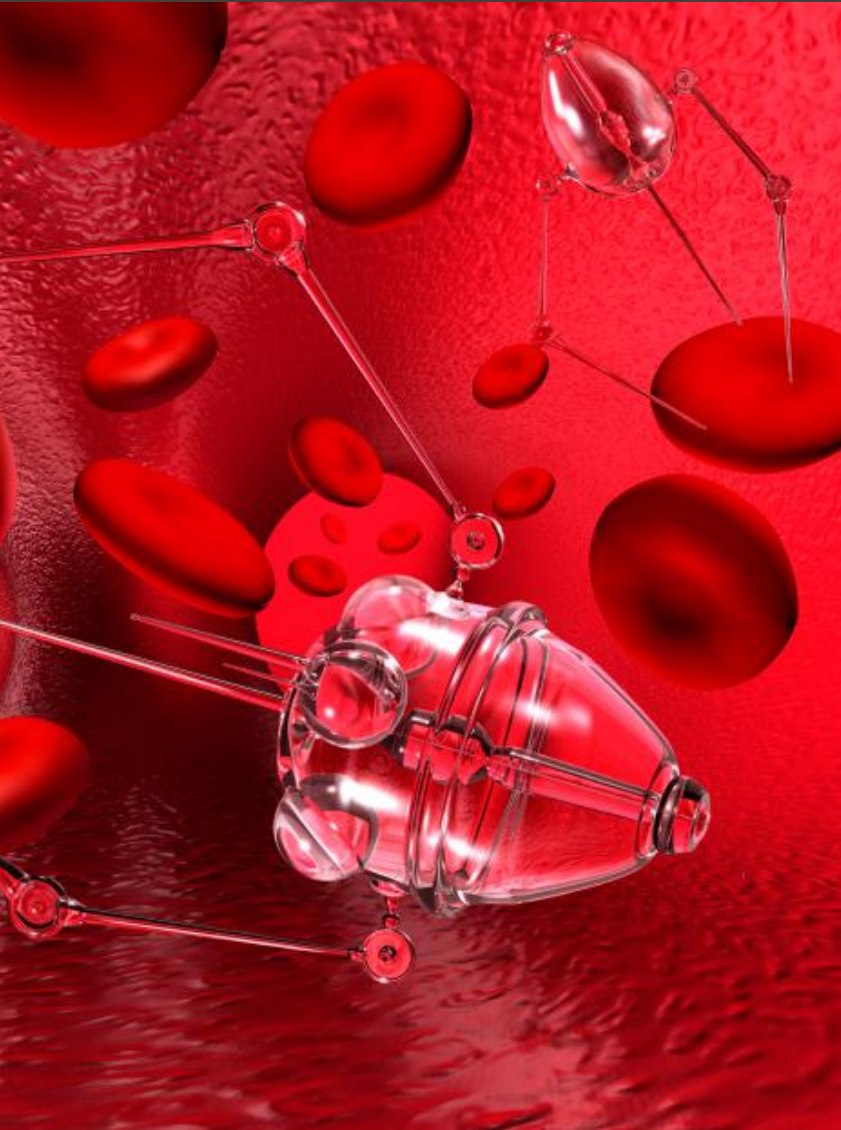
# Technology Available Today

**Technology is foundational to sustainability:**  
monitoring, measuring, predicting, collecting,  
aggregating information.

*“If you can’t measure it, you can’t improve it.”*

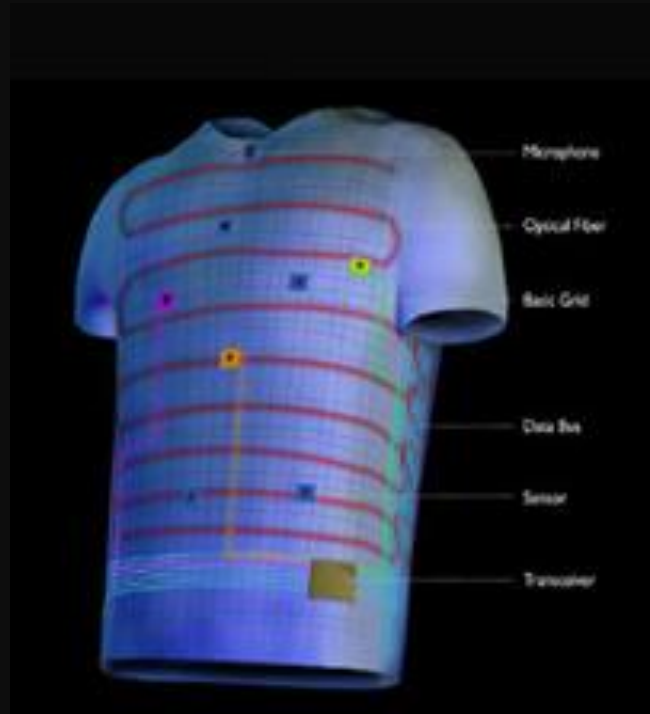
Lord Kelvin

# Nanotechnology



- **Nanovectors: nanoparticles loaded with drugs or imaging agents (targeted to tumors)**
- **Nanosensors: devices for detecting the biological signatures of cancer**
- **Therapeutic and diagnostic aspects of cancer nanotechnology**
- **Power shirt and clothing**
- **Improved accuracy in diagnosing medical problems**
- **Automated monitoring and treatment**

# Nanotechnology



- **Clothing:** imbedded with portable electronic devices
- **Connectivity:** patient to physician/caregivers
- **Clothing to capture energy:** harvest energy from physical movement (wearable power source) <sup>1</sup>

<sup>1</sup> *Zhong Lin Wang, Regents professor, Georgia Institute of Technology*

# Cancer

- **2.3 million in U.S. will have cancer in 2030 (*compared to 1.6 million in 2010*)**
- **Among minorities in U.S.: will double over next 20 years**
- **Among elderly and minorities: 45% overall increase in cancer cases**
- **Annual costs for cancer: \$107 billion (breast, lung, and prostate cancers account for over 50% of the direct medical costs)**

# Smart Prescription Bottles and Packaging



- Embedding **wireless chip** into Rx packaging: \$5.00 cost
- Powerful behavioral feedback loops: **GlowCap™, internet – connected pill cap**
- Alarm time (to take pill)
- If you miss a dose, cap pulses with light
- One hour later, cap plays ringtone every 5minutes
- After several hours, you receive an automated phone call

# Chips in Pills



- Networked drugs
- Proteus BioMedical in Redwood City, CA: developing ingestible chips that can be embedded in pills
- Pills becoming **networked digital drugs**
- Reduce chance of missing a dose
- Activated by stomach fluids sending message to a band-aid size computer worn on the body
- Uses **Bluetooth wireless technology** to communicate with patients and caregivers via mobile phones, tracking the intake of drugs

# Healthcare Implications: Feedback Loops

- **Wireless data collection: extending information feedback loops to your physician (progress reports)**
- **Extending loop to family: social support, email reports generated weekly**
- **Rewards positive behavior: sharing of good news**
- **Wellness focused**
- **Potential for lowering your cost of insurance**
- **Cost of technology: drug manufacturers/pharmacies**
- **A Smart DEFAULT <sup>1</sup>**

<sup>1</sup> *Richard Thaler, “Nudge: Improving Decisions about Health, Wealth & Happiness”*

# Use of Internet and PDAs



## Computer World Reports

- 500 million users of mobile healthcare apps by 2015
- 1.4 billion smart phone users by 2015
- 1/3 will have health-related apps
- 17,000 mobile health apps in major stores today  
(43% for HC Professionals / 26% at no cost to users)

## Research2Guidance Reports

- 46% of industry revenue will come from health-related services
- 14% from app downloads

# Disruptive Innovations that Involve Technology



## Mobile Phone Usage:

- Connected care: technology-enabled care at home
- Access to healthcare services
- Reduced costs
- Improved quality and integration

## Healthcare Apps:

- In-home monitoring
- Care management programs
- Chronic disease management
- Post-acute discharge monitoring

# Information Super-Highways

- Information super-highways to facilitate care at home or through personal health record platforms in cell phones
- Ubiquitous potential of information

## Potential Impact:

- Increased medication adherence
- Reduced avoidable post-acute complications
- Improved self-care management of chronic conditions
- Net result is a potential annual savings of 20% or more, a \$400 billion savings to the U.S. healthcare system <sup>1</sup>

<sup>1</sup> Deloitte, "Connected Care", 2008

# Deloitte's "Connected Care" Report 2008

## Trends support technology-enabled connected care

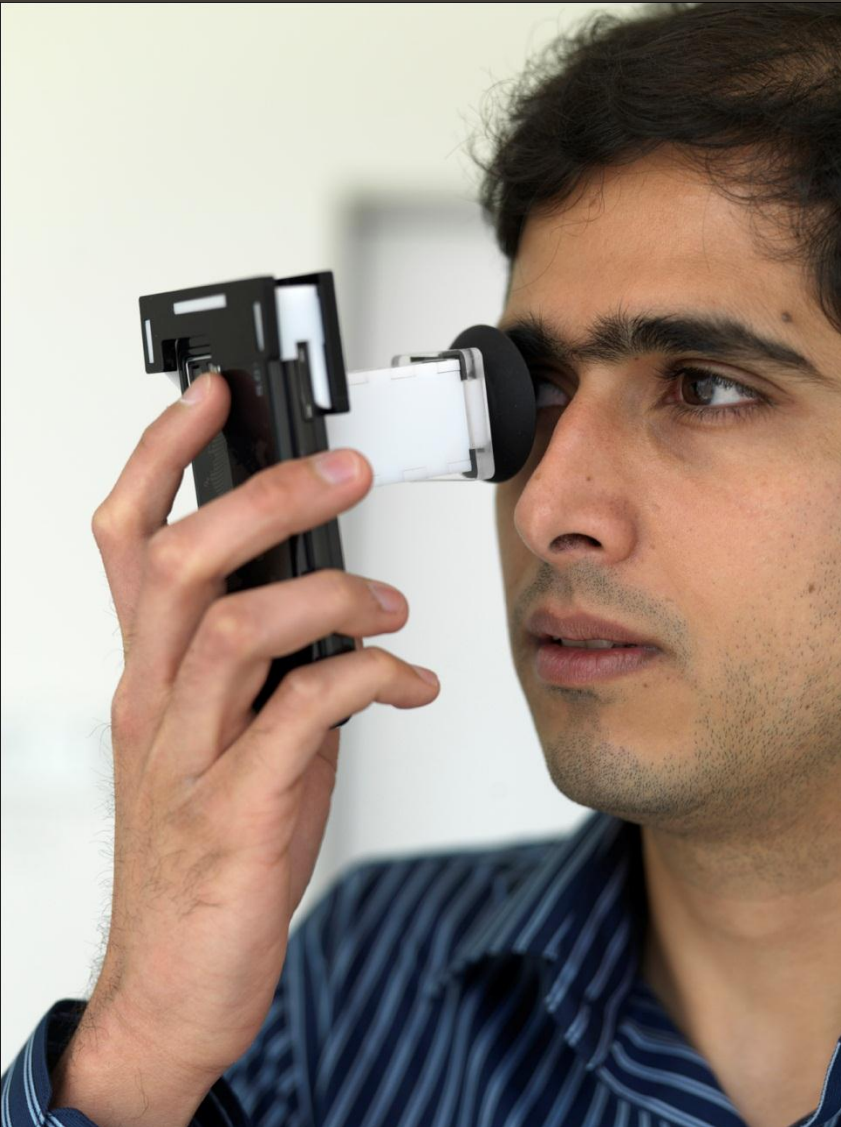
- Technology costs are declining
- New technologies are becoming commodities
- Advancements in device processing power (Moore's Law: processing speed will tend to double every 2 years)
- Consumer acceptance
- Aging population needs self-care technologies and programs

# Healthcare APPS: NETRA



- **MIT Media Lab: Third World Country Blindness suitable for remote, developing-world locations that lack these expensive systems**
- **Two billion people have refractive errors**
- **Uncorrected refractive errors are the world's second-highest cause of blindness, affecting some 2% of the world's population**

# Healthcare APPS: NETRA



## The technology

- Resolution of digital displays
- Widespread proliferation on cell phones
- Even in some of the world's poorest countries
- There are now some 4 billion cell phones in the world

## All that's needed

- Snap-on plastic device
- Produced at a cost of about \$1 to \$2 today
- Could cost only a few cents in large quantities

# Project in Haiti



- St. Therese Hospital, Hinche, Haiti
- Lack of basic infrastructure
- We're essentially "off grid" for all services
- People live on \$1.50/day
- BUT it appears everyone has a cell phone (donated efforts)
- Connectivity to teaching hospital 2-4 hours away



# Implications

- Telecom and mobile phones will provide **“borderless” linkages**
- **eHealthcare Strategy** and trends will allow for multiple centers of healthcare in remote areas via Internet
- **Telemedicine**: increase access and quality in remote areas of the world
- Internet is totally transforming the way healthcare is managed and delivered, significantly reducing costs while building strong relationships
- **Social networking**: Twitter: 50,000 people enrolled/day, at Facebook: over 400 million users: a powerful tool

# Why Convergence

## convergence:

- An act, process, or instance of coming together from different directions – meeting
- Achieving union or a common conclusion or result

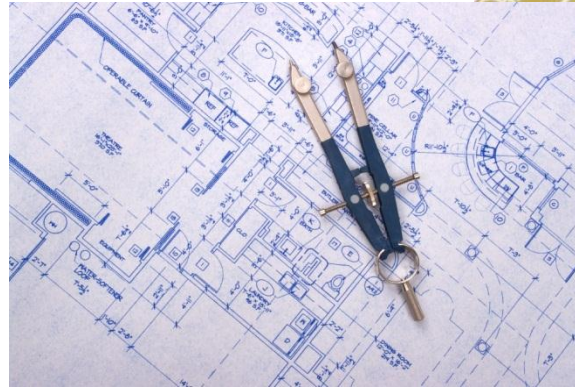
*“convergence has the potential to empower the individual to have a greater say in his care”*

# Convergence Impact on DESIGN

Convergence of healthcare IT and communications technologies occurs on four basic levels:

- Infrastructure
- Network
- Data
- Operational

*Designers impact all of these levels to varying degrees*



# Life Critical Systems



## Designers must understand

- IT is now an integral part of clinical care
- Clinical workflows and care rely increasingly on availability of data and sophisticated communication technologies
- Impact to facility's infrastructure and budget is profound
- BUT – patients' lives now depend on accurate and timely data flow

*FOCUS must always be patient safety*

# redundant ... resilient ... reliable

- IP communications is the enabling technology that allows convergence
- At its core is the *network*
- Lives depend on the *network* to be redundant, resilient, and reliable
- *“2010 FGI Guidelines for the Design and Construction of Healthcare Facilities<sup>1</sup>”* addresses technology design requirements of today’s modern healthcare facility

<sup>1</sup> <http://www.fgiguideines.org/2010guidelines.html>

# Convergence in Action

## The Smart Patient Room



- **Convergence in action on all four levels**
- **Incorporates technology and workflow solutions**
- **Improves patient care**
- **Clinical efficiency**
- **Patient safety**
- **Satisfaction**

# Smart Patient Room – *CORE REQUIREMENTS*

## Robust wired and wireless network infrastructure

- 14+ wired data outlets
- Advanced AV display technology
- Real time location system (RTLS) technologies
- Smart medical equipment
- Advanced software integration

