Learning objectives

- Define the Internet of Things
- List at least two reasons that consumers are interested in technology enabled health care
- Describe the potential of smart home devices to impact the location of health care
- Discuss 1 – 2 opportunities to empower patients living with chronic and serious illnesses with digital tools and emerging technologies

The Internet of Things

_noun_

interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.

abbreviation: IoT

Internet of Things: evolving methods for interacting

The Internet of Medical Things

_noun_

the collection of medical devices and applications that connect to healthcare IT systems through online computer networks.

abbreviation: IoMT
Technology-enabled health care: survey findings

Consumers are interested in using technology-enabled care. ~7 in 10 consumers are likely to use at least one technology presented. Telemedicine is most popular - 50% of respondents expressing interest. Respondents most interested in using for post-op care and chronic disease monitoring.

Pay attention to subgroups - some are keen on technology-enabled care. Especially those with chronic diseases, millennials for telemedicine, and seniors for remote monitoring.

Caregivers are key audience - most consumers report they are likely to use sensor technology when caring for others rather than for themselves. Experienced caregivers are more likely to use telemedicine and remote monitoring technology than non-caregivers.

User experience demands - seamless and secure are important. Consumers demand high quality, personalized care and want assurance that their personal information will be safe.

Source: Deloitte 2016 Survey of US Health Care Consumers

Tech for health and fitness lagging behind other uses

The Connected Home...

Opportunities / Expectations:

- Seamless connections
- Increased convenience
- Enable self-care management
- Greater control
- Peace of mind
- Integrated sensors for caregivers

Issues / Challenges

- Cost
- Complexity of use
- Coordination of various devices
- Connectivity to providers
- Lack of standards for interoperability
- Security
- Broadband / wireless capability

The Connected City...Louisville

Study Participants

- 1,147 citizens of Louisville
- 85% with uncontrolled asthma

Combined Data From Many Sources

- 1.2 m sensor data points with 251,000 medication puffs
- 3.4 m environmental data points from around Louisville (weather, air quality, asthma “hot spots”)

Participants progress on goals

- 61% Feeling more control of asthma
- 50% Knowing more about triggers
- 56% Having fewer attacks
- 47% Feeling more confident taking medication on time
- 38% Not having to go to ER

Community Impact

- Increased city-wide awareness
- Policy changes about “no smoking/vaping” areas
- Redirected truck traffic to reduce exhaust exposure
- Increased distribution of tree planting in risk areas
- Influencing city planning to focus on health-centric zoning laws

PatientsLikeMe: Case Examples
PatientsLikeMe: early Internet-based disruptor
Create value from knowledge derived from shared real-world experiences and outcomes

- Founded in 2004 as a direct response to a family’s experience with chronic disease
- Online, open, patient-facing community for patients with life changing conditions
- Started in ALS and expanded to all conditions in 2011
- Deep patient data and experience in 40-50 life-changing conditions
- Free to join and free of advertising
- 530,000+ patients
- 2,700+ conditions
- 40+ million structured data points
- 3+ million free-text posts
- 15+ PROMs
- Free to join and free of advertising
- 40+ million structured data points
- 3+ million free-text posts
- 15+ PROMs
- Free to join and free of advertising
- 100+ peer-reviewed publications
- Patient generated biomarkers
- FDA Research Collaboration
- iCarbonX Alliance / DigitalMe

PatientsLikeMe: a decade of empowering patients with data
Given my status what’s the best outcome I can hope to achieve and how do I get there?

Patient centric engagement model
Collect
- Give voice to a person’s story
Measure
- Transform story into meaningful data
Aggregate
- Illuminate community trends & outliers
Analyze
- Generate new insights and knowledge
Translate
- Share knowledge to improve lives

Use of wearable and remote sensor in serious illness care

- We wanted to understand whether idiopathic pulmonary fibrosis (IPF) patients would be willing to use consumer grade devices to measure their health
- PLM deployed a Bluetooth LE pulse oximeter and an activity monitor Fitbit to a pilot group of patients
- Patients expressed a high degree of interest in wearables. A comprehensive engagement program enabled a large volume of data to be collected
- Impact: the methodology of deploying wearables now enables rapid testing of emerging technologies in any population within PatientsLikeMe community

Engaging patients with chronic disease in novel diagnostics

- Collected voice recordings, linked to self-reported outcomes and safety analyzed in a distributed competition to validate the use of health sensors in diagnostic and biomedical research
- 3 methods: PRO collection, mass collection of voice samples, and reproducible collaborative data analysis on Synapse
- Collaborated in collecting audio samples from 500 patients with an aim to developing a cheap and simple tool to detect Parkinson’s disease with 99% accuracy
- Impact: Proof-of-concept in bringing crowdsourced researchers to analyze data

Connecting patients with Parkinson’s disease specialists

- Characterize feedback to patients when participating in telemedicine visit.
- Visit consisted of hx, neuro exam and recommendations.
- Midway through patients did online satisfaction survey
  - It was great not having to drive 2 hours; pay for gas and parking or needing to miss work.
  - The interaction felt personal despite the 3000 mile distance.
  - Concern that MD didn’t have complete information.
- Impact: High satisfaction among patients with having access to specialists via telemedicine.

Can digital technology enable patients to live as well as possible with illness?
Health…1946

Health is a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity.

Source: World Health Organization

Health…2011

The ability to adapt and to self-manage in the face of social, physical and emotional challenges in the context of:

• Physical functioning
• Mental well-being
• Social participation
• Daily functioning
• Meaningfulness
• Quality of life

Source: Huber, et al. BMJ

Patient perspective on...

Health
How well my body and mind are doing.

Thrive / Well-being
How well I’m living the life I want.

Source: PatientsLikeMe members 2017

Empowering technology enabled personalized health

Connect all of me - my experiences, environment, goals, DNA, ‘omics.
Measure my health, disease, and aging in states over time.
Integrate within a person-centric real time learning system.
Aggregate my data with others to increase knowledge driven options.
Create a personalized path for thriving that evolves with me on my journey.

Imagine... your journey
Perhaps it would be a good idea, fantastic as it sounds, to muffle every telephone and halt all activity for an hour some day, to give people a chance to ponder for a few moments on what it is all about, why they are living, and what they really want.

James Truslow Adams 1878 - 1949

Thank you...

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