



Beth Israel Deaconess  
Medical Center



HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL

# Mobile Connected Health and Behavioral Change

Yuri Quintana, PhD

Director of Global Health Informatics  
Division of Clinical Informatics,  
Beth Israel Deaconess Medical Center

Assistant Professor of Medicine,  
Harvard Medical School

# Outline

- Behavioral Health Challenges
- Methods
- Applications

# Mental Health

- Suicide is the **10<sup>th</sup>** leading cause of death in the US
- Suicide costs the US \$ 44 Billion annually
- Suicide is the **SECOND** leading cause of death for ages 10-24. (2014 CDC WISQARS)
- Suicide is the **SECOND** leading cause of death for college-age youth and **ages 12-18**. (2014 CDC WISQARS)
- More teenagers and young adults die from suicide than from cancer, heart disease, AIDS, birth defects, stroke, pneumonia, influenza, and chronic lung disease, **COMBINED**.
- In the United States, suicide outranked war, cancer, heart disease, homicide, transportation accidents and other causes as the leading killer, accounting for about three in 10 military deaths during 2009-2014 (Source: Armed Forces Health Surveillance Center)

# Global Medication Adherence Trends



## Some World figures...

- ❑ [WHO]<sup>2</sup>: “More health benefits worldwide would result from improving adherence to existing treatments than developing any new medical treatment.”
- ❑ **50%** of patients do not take their medications as prescribed
- ❑ **\$390 to \$500 Billion (€375 billion)** unnecessary annual healthcare spending [MediMedia → IMS Study]<sup>2,3</sup>



315 Mh

- ❑ **50%** of the 3.2 billion annual prescriptions dispensed in the US are not taken as prescribed
- ❑ Approximately **125,000 deaths per year** in the US are linked to medication non-adherence<sup>4</sup>
- ❑ Total cost is ranging from **\$177 to \$213 billion (€158 billion)** each year<sup>5</sup>



504 Mh

- ❑ **50%** of patients don't take their medicine properly
- ❑ Approximately **200,000 premature deaths** in Europe
- ❑ Total cost estimated to **\$172 billion (€125 billion)** each year<sup>6</sup>



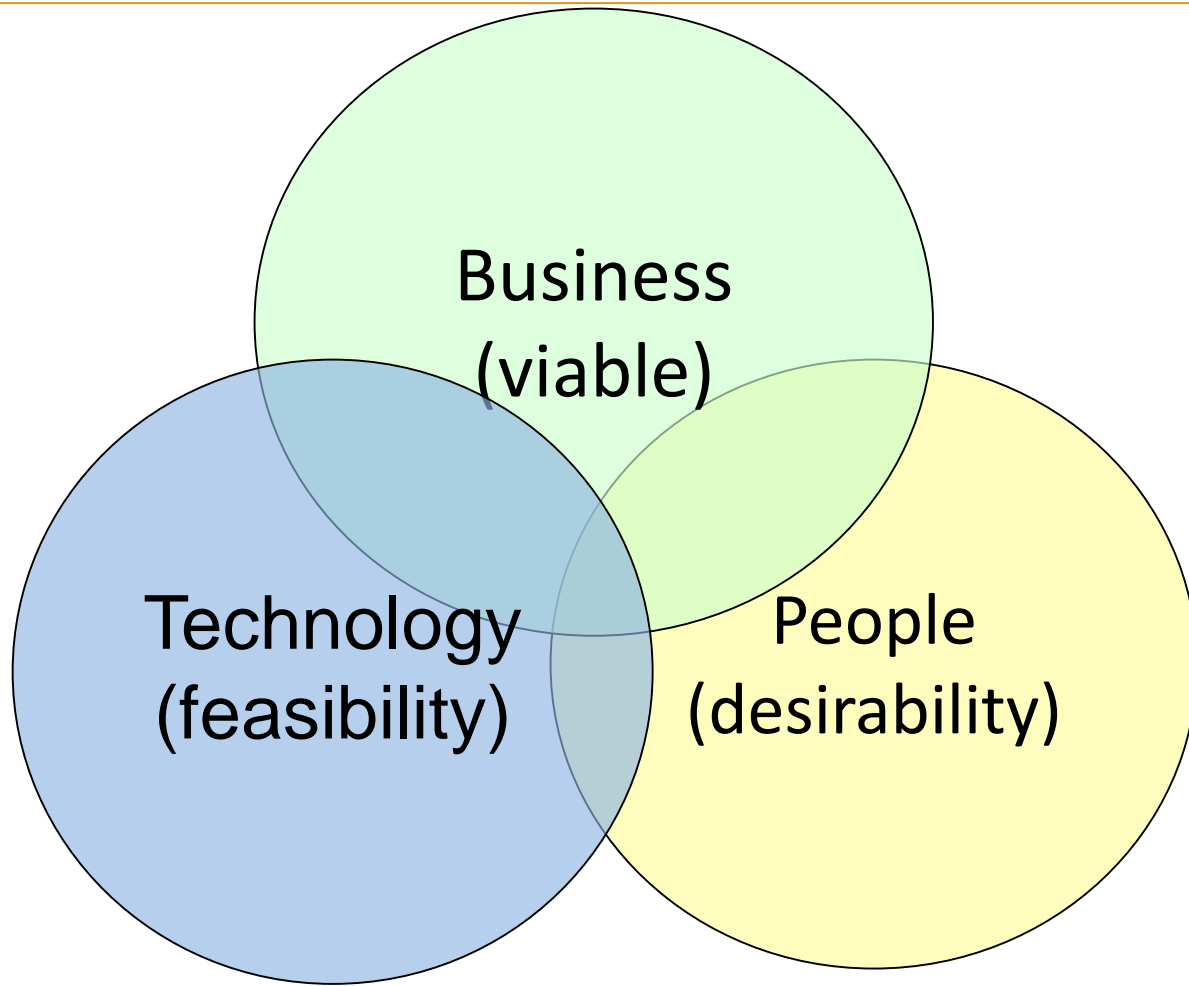
63 Mh

- ❑ **20%** of patients do not even buy prescribed medicines in France<sup>7</sup>
- ❑ Approximately **8,000 deaths per year** and 1.1 million hospital days<sup>8</sup>
- ❑ Total cost estimated to **\$26 billion (€19 billion)** each year

Source: Economic aspect of medication adherence using mobile medication reminder in French Health System  
[http://www.medetel.lu/download/2014/parallel\\_sessions/presentation/day2/Economic\\_aspect\\_of\\_medication.pdf](http://www.medetel.lu/download/2014/parallel_sessions/presentation/day2/Economic_aspect_of_medication.pdf)

# Design Methods

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# Transtheoretical Model (TTM)

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Prochaska & DiClemente, 1983

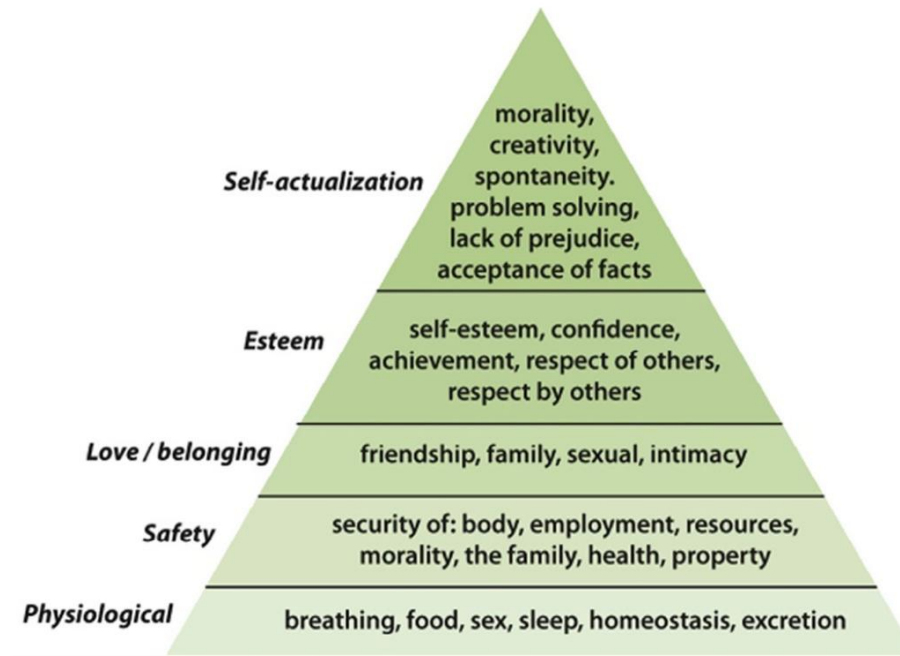
# Health Belief Model

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- Perceived Susceptibility
- Perceived Severity
- Perceived Benefits
- Perceived Barriers
- Cues to Action
- Self-Efficacy

# Maslow's Hierarchy of Needs

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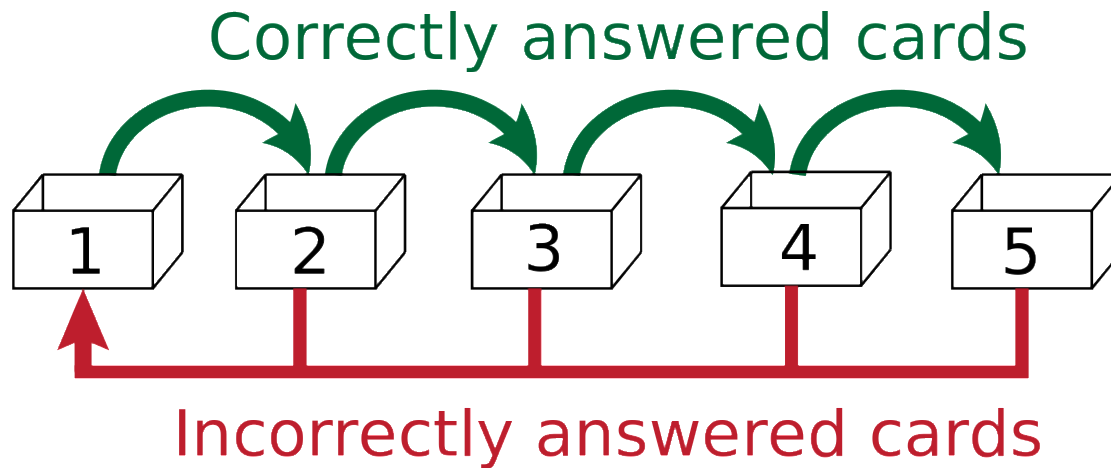


Source: Maslow's Hierarchy of Needs. Image from Wattanasoontorn 2013.



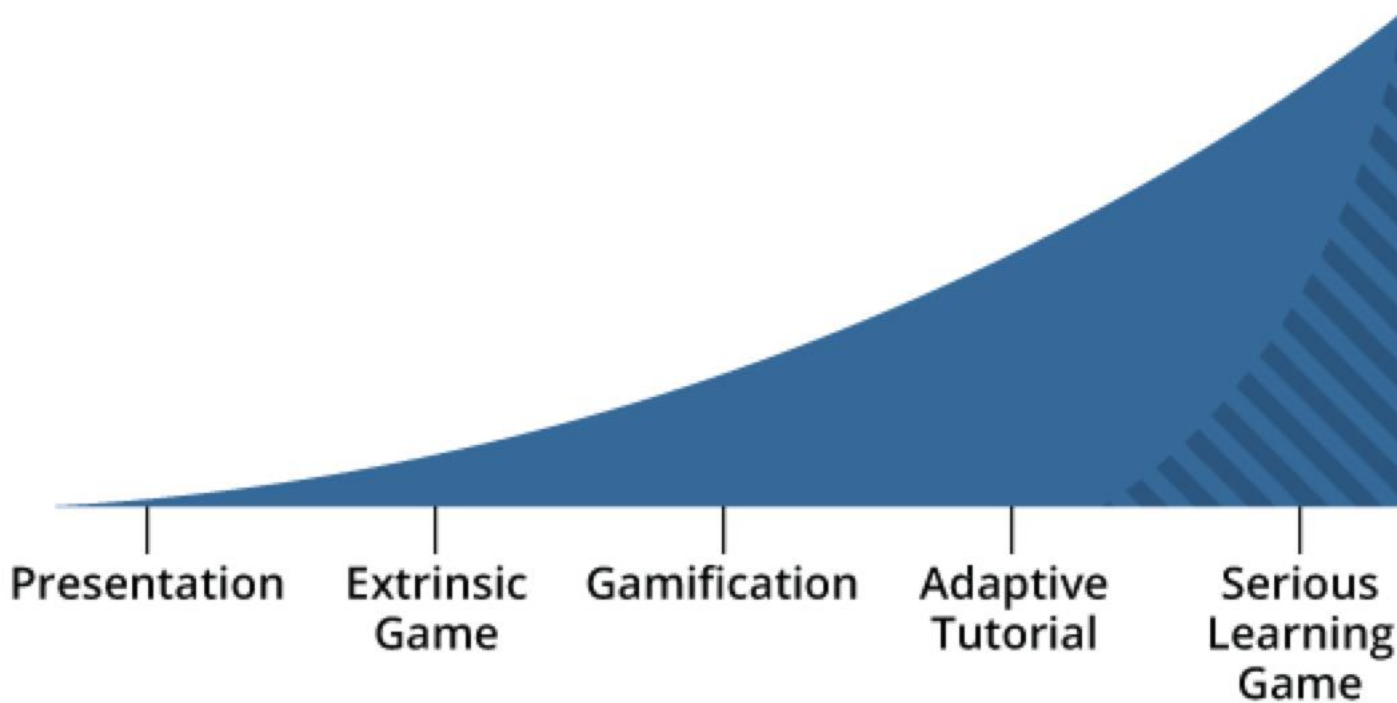
# Spaced Learning

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works by displaying more often questions that a student has previously gotten wrong.

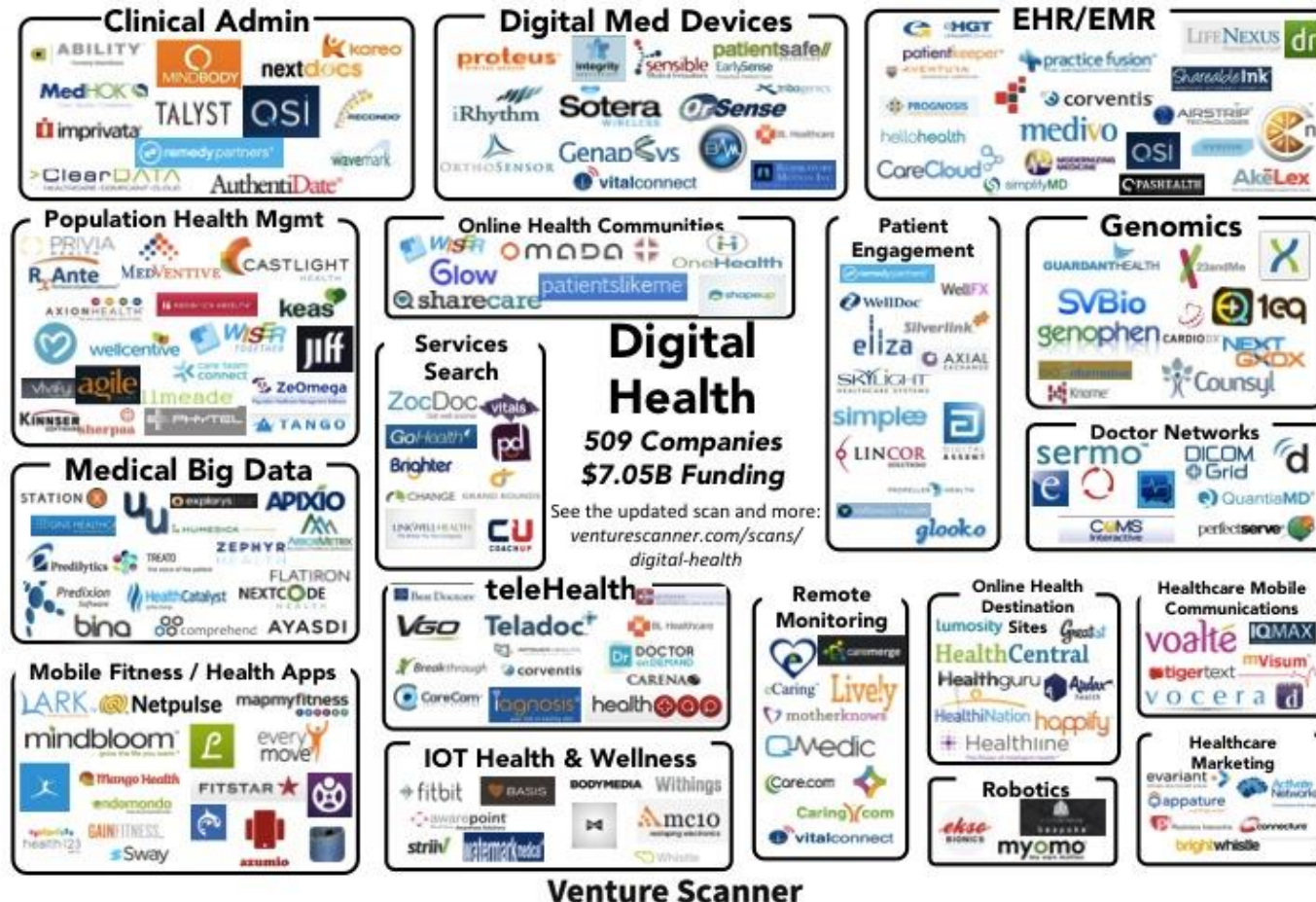
# Gamification



# Global e-Health Systems

- The global E-health market is expected to grow at a CAGR of 14.56% from the estimated size of \$94.12 billion in 2014, and to reach \$212.76 billion by the end of 2020

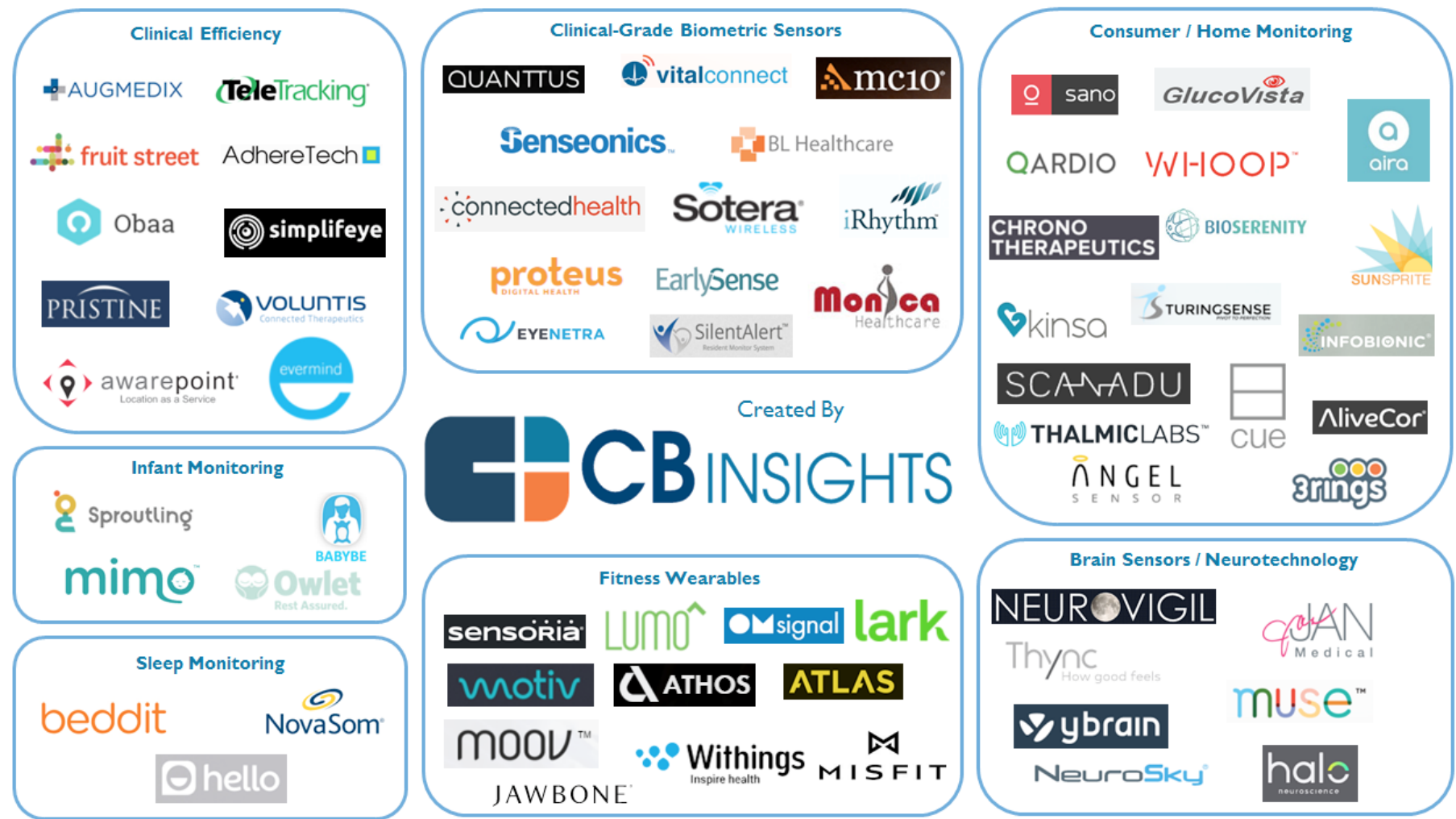
[http://www.mordorintelligence.com/industry-reports/e-health-market?gclid=CM\\_5\\_4PJnMwCFcdehgodno8Efv](http://www.mordorintelligence.com/industry-reports/e-health-market?gclid=CM_5_4PJnMwCFcdehgodno8Efv)



Source: venturescanner.com

# IoT e-Health Systems

## The Healthcare Internet of Things (IoT) Market Map

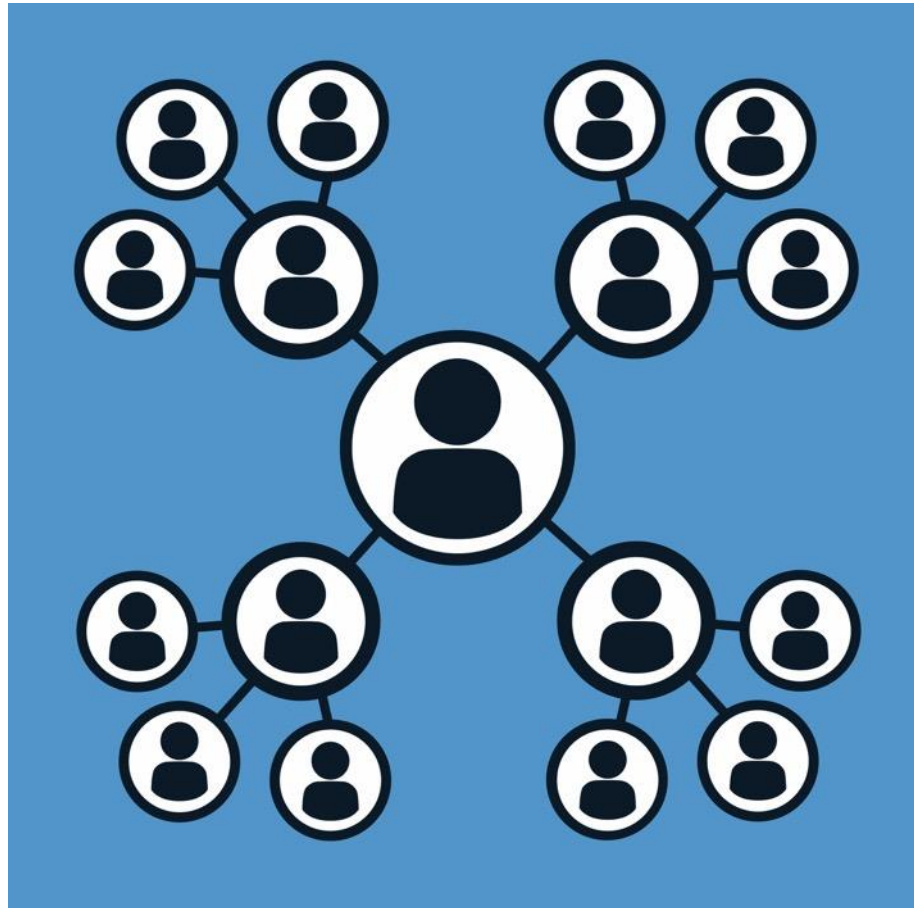


Source: 64 Healthcare IoT Startups In Patient Monitoring, Clinical Efficiency, Biometrics. <https://www.cbinsights.com/blog/iot-healthcare-market-map-company-list/>

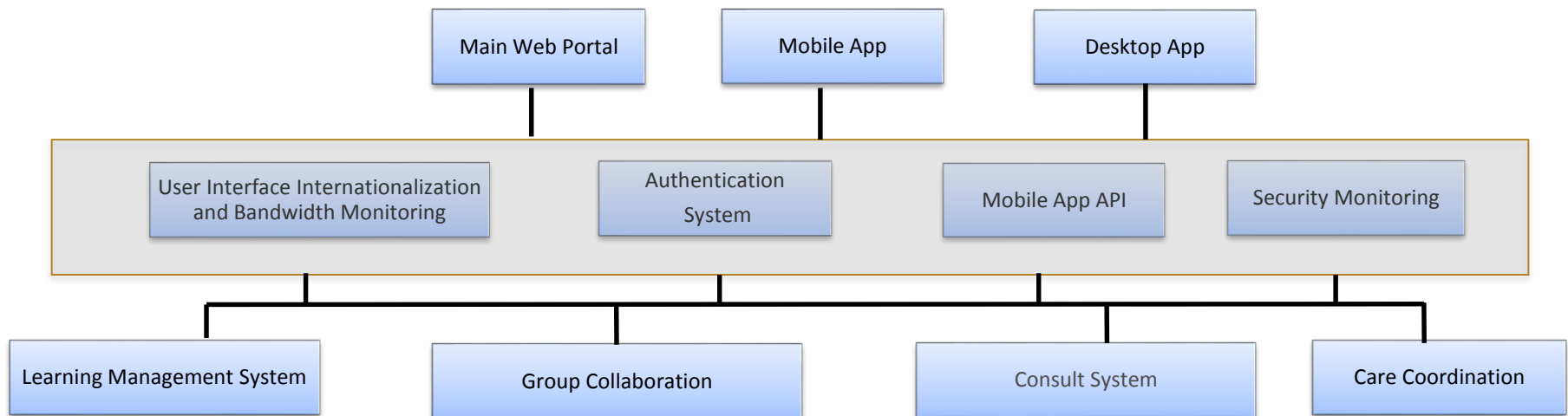
[www.cbinsights.com](http://www.cbinsights.com)

# Who are we trying to connect?

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# Alicanto™ - Integrated eCare System



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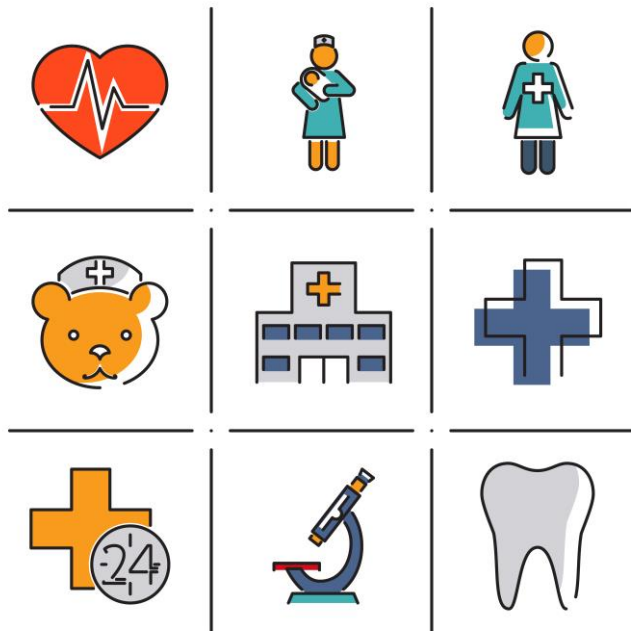
# OpenPediatrics.org

## Boston Children's Hospital

The screenshot shows the OpenPediatrics.org website. At the top, there's a dark blue header with the logo "OPENPEDIATRICS™" and the tagline "The world's best practices, shared worldwide." Navigation links include "MY OP", "LIBRARY", "LEARNING", "COMMUNITY", "SUPPORT US", and "ABOUT US". A "Site Search" bar is on the right. Below the header is a large banner image of a signpost with arrows pointing to various cities: BAKI (1756 KM), AMSTERDAM, TEHRAN (2040 KM), ROME (1377 KM), MOSKOW, BABYLON, PARIS (2258 KM), BERLIN (1740 KM), and LYON (3015 KM). Text on the banner says "Join the global conversation. Monthly World Shared Practice Forums for physicians and nurses." with a "Learn More" button. Below the banner is a "FEATURED RESOURCES" section with five cards: 1. "Pulmonary Vascular Resistance (PVR)" with a calculator interface. 2. "Update on Mechanical Ventilation of the Child: ..." featuring a man speaking. 3. "Abusive Head Trauma" featuring a woman speaking. 4. "Update on Mechanical Ventilation of the Child: ..." with a graph. 5. "Introduction to Mechanical Ventilation" with a diagram of a ventilator circuit.

# Maternal Health Apps

- Design of systems for coordination of care and communication
- How to design systems that are locally and culturally appropriate



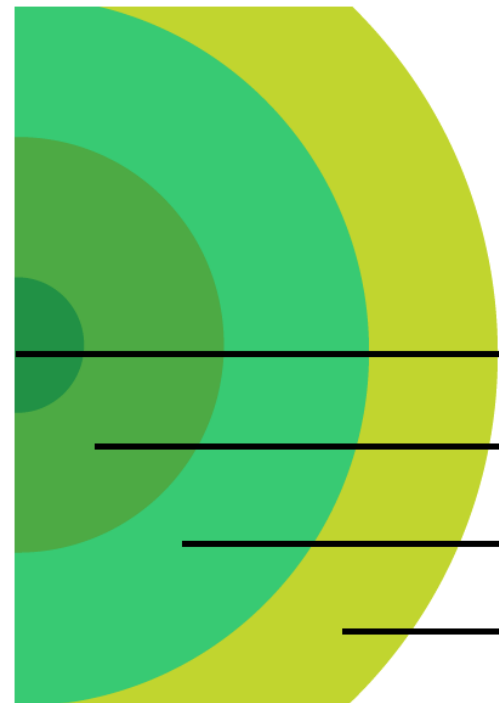
Maternal Health Apps: Text4baby, Quit4Baby



InfoSAGE, short for '**Information Sharing Across Generations**,' is an innovation and research program created to help elderly people and their families more easily find resources and better coordinate care with one another and with clinicians. The program was created by researchers and specialists in health information from **Harvard Medical School**, and the project funded is funded through a grant from the **US Department of Health and Human Services**.



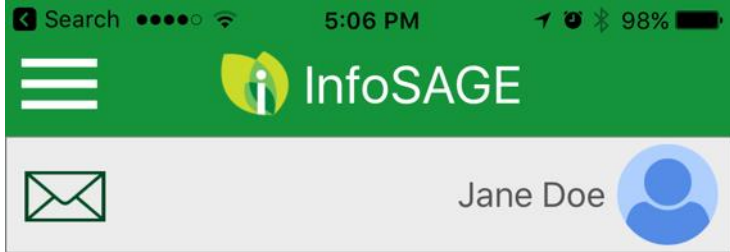
# Design of InfoSAGE™




Keystone  
Proxy  
Caregiver  
Participant

Build Network	Edit Medications	View Medications	Add Help List Tasks	Volunteer For Tasks	Communication
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓
		✓	✓	✓	✓
			✓	✓	

InfoSAGEHealth.org



**Add New Medication** 

**Show Medication Interactions**

SEARCH FOR MEDICATION'S NAME

BRAND

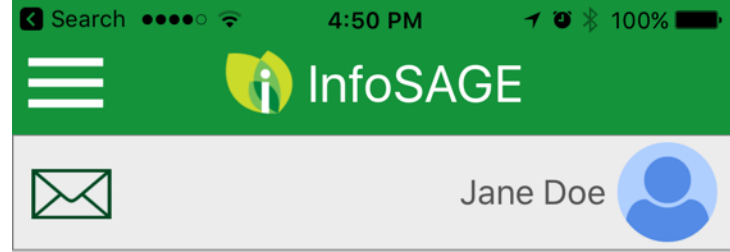
MEDICATION FORM

DOSE




DOSE (UNIT OF MEASURE)

FREQUENCY

☐ As Needed




**Medications** **Sort by: Name**

 **Add**  **Email**  **Print**

Last Edit: Thu, Feb 16, 2017 4:44 PM

**Show Medication Interactions**

**Active** **Inactive** **Collapse All**





**Aspir-low** 

**Name:** Aspir-low

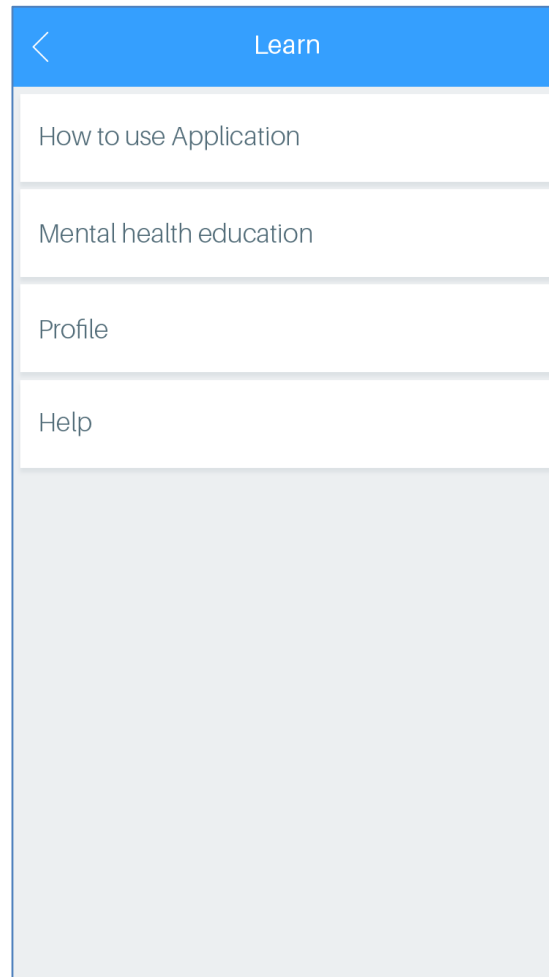
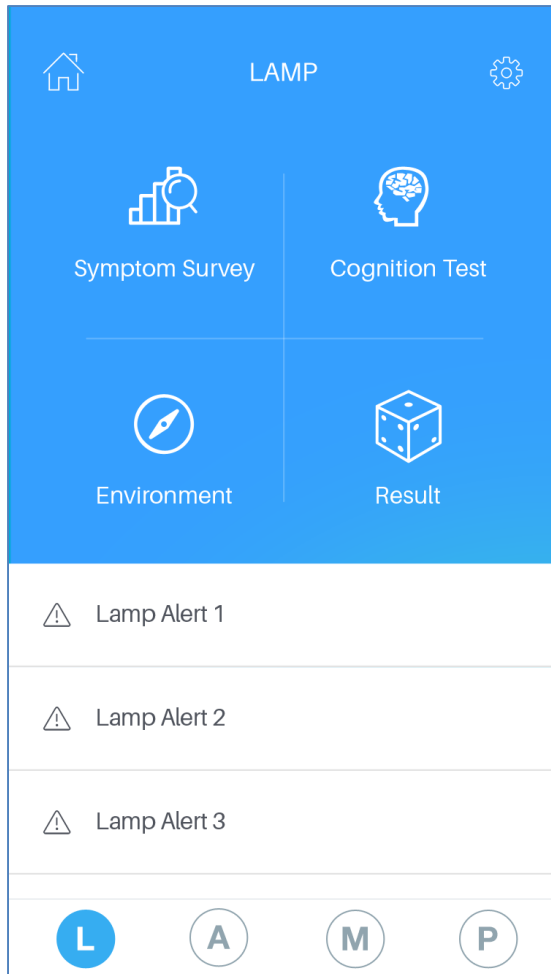
**Dose:** I am not sure

**Frequency:** Daily

**Reason:** I am not sure

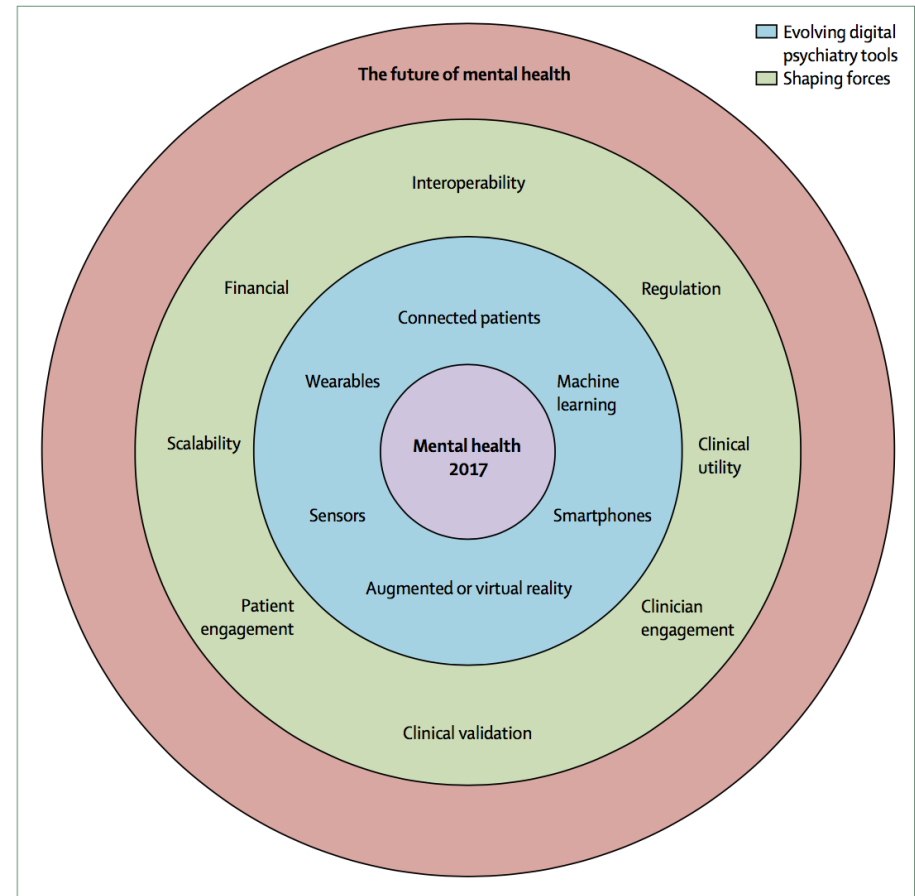
 **Share**  **Active**  **Details**  **Edit**

# LAMP PROJECT – John Torous



# Review

- Potential
  - Apps for Active / Passive
  - Digital Phenotyping
- Context / App Rating
  - Safety / Privacy
  - Evidence
  - Usability
  - Inoperability
- Current App Research in Schizophrenia



Bhugra D, Tasman A, Pathare S, Priebe S, Smith S, Torous J, Arbuckle MR, Langford A, Alarcón RD, Chiu HF, First MB. The WPA-Lancet Psychiatry Commission on the Future of psychiatry. The Lancet Psychiatry. 2017 Oct 31;4(10):775-818.

# Road Ahead

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- Need to clearly define the **who is in the network** (stakeholders)
- Need to understand **communication** preferences
- Need to provide **educational** strategy
- Need to provide **motivational** strategy
- Need to collect **data that is accurate**, consistent and reliable
- Need to understand comprehensive care **coordination**
- Need to plan for **scalability and sustainability**

# Selected Yuri Quintana Publications

Quintana Y, Safran C. eCare at a Distance: Opportunities and Challenges. Research on the use of Information and Communication Technologies in Brazilian health facilities - Health ICT 2014. Pgs 167-177. August 20, 2015. <http://bit.ly/1lryi1J>

Quintana Y, Safran C. Global Health Informatics—An Overview. In Heimar de Fátima Marin, Eduardo Massad, Marco Antonio Gutierrez, Roberto J. Rodrigues and Daniel Sigulem, editors: Marin-Global Health Informatics, Oxford: Academic Press, 2016 , pp. 1 - 13.

<https://www.elsevier.com/books/global-health-informatics/marin/978-0-12-804591-6>

Quintana, Y. Challenges to Implementation of Global Translational Collaboration Platforms. MOJ Proteom Bioinform. 2015;2(6):65. PubMed PMID: 26798845; PubMed Central PMCID: PMC4717481

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4717481/>

Quintana Y, Safran C. Global Challenges in People-Centered E-Health. MEDINFO 2015 Congress. ISO Press: Stud Health Technol Inform. 2015;216:977. PubMed PMID: 26262279.

<http://ebooks.iospress.nl/publication/40437>

Quintana Y, Patel AN, Arreola M, Antillon FG, Ribeiro RC, Howard SC. POND4Kids: A Global Web-based Database for Pediatric Hematology and Oncology Outcome Evaluation and Collaboration. Stud Health Technol Inform. 2013;183:251-6. PMID: 23388293)

More at [https://www.researchgate.net/profile/Yuri\\_Quintana](https://www.researchgate.net/profile/Yuri_Quintana)



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An Academic Division of the Dept of Medicine  
at Harvard Medical Faculty Physicians at BIDMC, Inc.

Yuri Quintana, PhD

[yquintan@bidmc.harvard.edu](mailto:yquintan@bidmc.harvard.edu)

Assistant Professor of Medicine,  
Harvard Medical School

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