



# Mobile Technologies in Medicine

Massive increase in mobile technology and it's effects  
in healthcare

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# What's Addressed Today

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- ▶ Set terms- eHealth vs mHealth
- ▶ Growth of the Mobile industry
- ▶ The Influence of Mobility in Healthcare
- ▶ Examples of some Mobile APPs for medical students
- ▶ The IBM “Watson” Invention
- ▶ Regulatory Requirements.



# Set our Terms

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## **Computerized systems used in a clinical investigation**

Any computer system used to generate, maintain, store, or retrieve electronic source data and documents.

## **mHealth**

An umbrella term for wireless devices that are used in healthcare. It includes mobile monitors worn by patients as well as smartphones that physicians and nurses use to obtain and disseminate information





eHealth , mHealth ?



# mhealth VS. ehealth

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- ▶ Accessibility - Overall, more people have access to mobiles
- ▶ Lower income populations - Desktop web access is more common among more educated, more affluent people, while for mobile, an inverse-relationship exists there.
- ▶ Difficulty - mHealth apps or services are more difficult to setup (develop and create) than web services.
- ▶ Telecommunications- invest in mhealth
- ▶ Source of Innovation- mHealth, a lot of the innovation is coming out of India, China, South America and Mexico.
- ▶ Personal - mHealth is more personal and easy to use

# eHealth vs mHealth Architecture

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- ▶ eHealth architectures are typically designed by two broad groups:

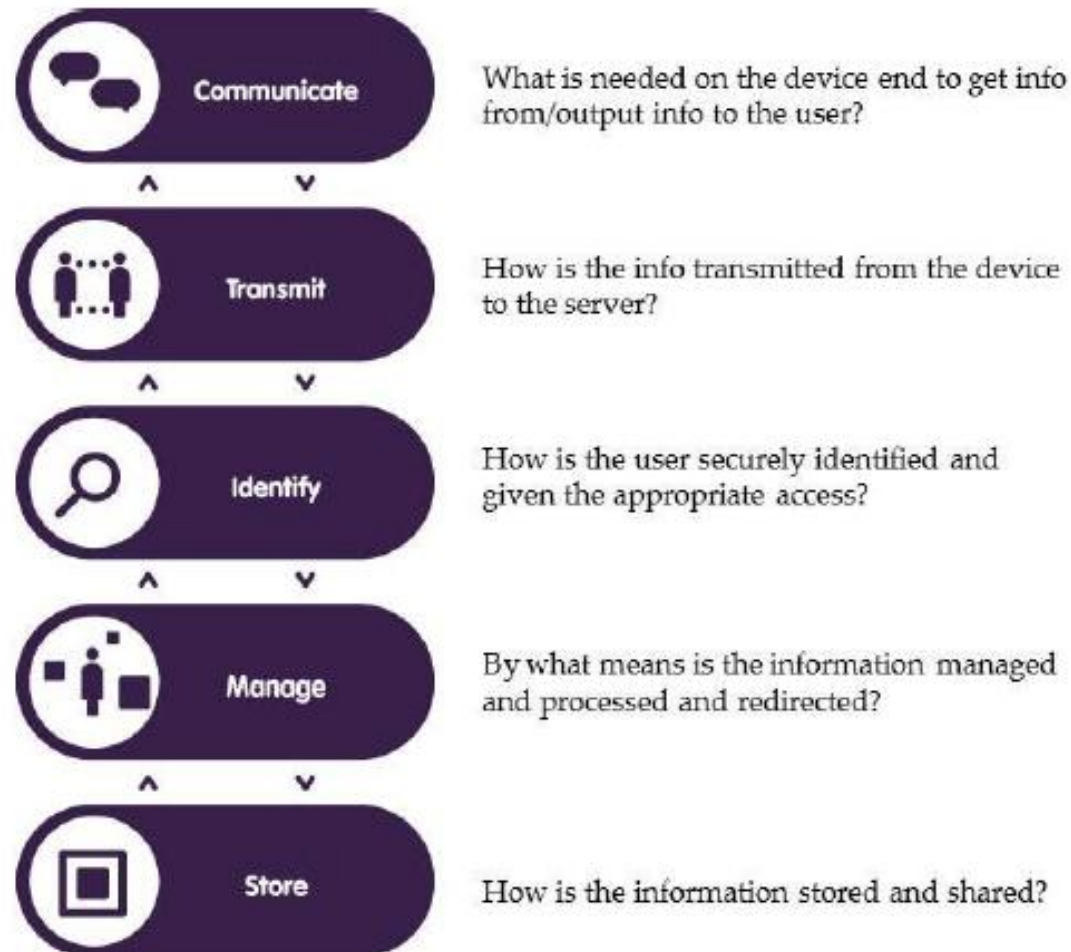
- a) Government national health IT bodies – which have public health and disease surveillance as the critical need and the citizen as the critical stakeholder.
- b) EMR solution providers – which typically have the automation of healthcare delivery processes as the critical need and the healthcare professional as the critical stakeholder.

“Central to both is the importance of the single longitudinal health record and the different ways in which this record is used and populated”

- ▶ In contrast to the above, mHealth architectures have typically focused on the mobile channel of delivery and assorted ways in which health can be delivered through that channel

# Categorisation of Key Technical Issues for Mobile Health Roll-Out

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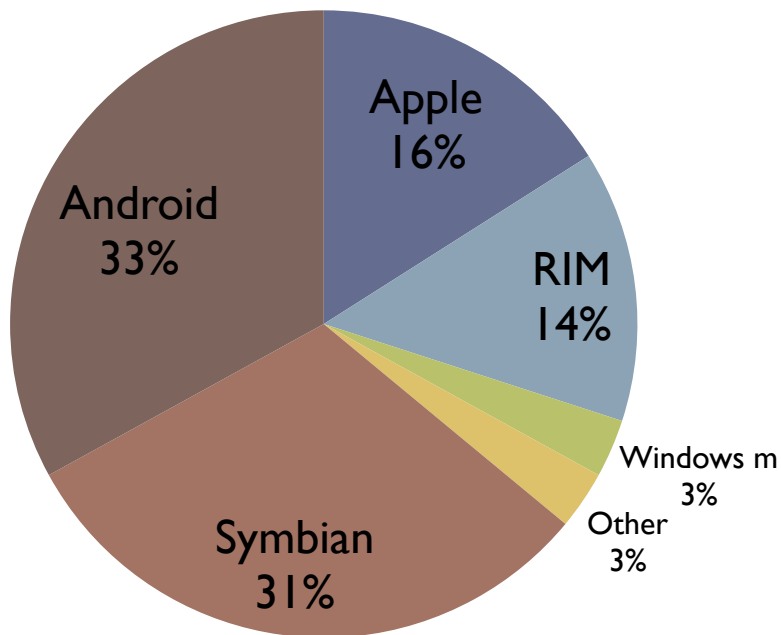
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# Growth of the Mobile Industry



# Growth of Mobile users and Phones

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- Exploding growth in developing countries
  - 752 million users in India (Jan 2011)
  - 842 million users in China
  - 96 million new users in Africa in 1 year
  - Adding 30 mm subscribers monthly in India, China
- Worldwide penetration – 76% in 2010 to grow to 85% in 2013
- 500 mm PC, 5.25 billion cell phones, 50+ billion devices with data ports
- Smartphones : 1 billion in use globally by 2014. 296 million sold in 2010
- 10% increase in mobile phone adoption results in 0.8% increase in GDP per person

# Growth of Mobile Devices in Healthcare

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- 72 percent of U.S. physicians use Smartphones
  - Up from 50 percent in 2007
- The number of physicians using Smartphones in 2009 doubled
- Physicians access some medical apps 15 to 20 times a day
- 53% of chronic disease patients have cell phone access
- 60 million people to be benefited using remote Patient Monitoring devices by 2013
- 75-80% of adult internet users seek medical data online
- Healthcare, Retail and Education fast growing industry users of Tablet devices

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# The Influence of Mobility in Healthcare



# Mobile Solutions for Healthcare –Changing

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## To Date

- ▶ Independent medical devices for each function
- ▶ No full data integration with hospital systems
- ▶ Manual data collection and analysis
- ▶ Care limited to hospitals and healthcare providers
- ▶ Limited wireless coverage in hospitals

## Moving Towards

- ▶ Better connectivity and communication
- ▶ Seamless Device integration
- ▶ Transition of care beyond hospitals and doctors to patient's home
- ▶ Disease Management and Monitoring
- ▶ mHealth and Telemedicine
- ▶ Analytical tools for Healthcare

# Solutions Across the Healthcare Spectrum

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## **Education and Awareness**

SMS/Text Messaging in support of health programs

## **Data Collection and Record Access**

Applications to enter and access patient data

## **Monitoring and Medication Compliance**

Maintain care-giver appointments, Medication regime

## **Disease and Emergency Tracking**

Use mobile devices to send and receive disease incidence

## **Health and Administrative Systems**

Allow access to mHealth and public health systems

## **Analysis, Diagnosis and Consultation**

Access to staff or information via mobile devices for diagnosis



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# Examples in Healthcare Using Mobile Solutions

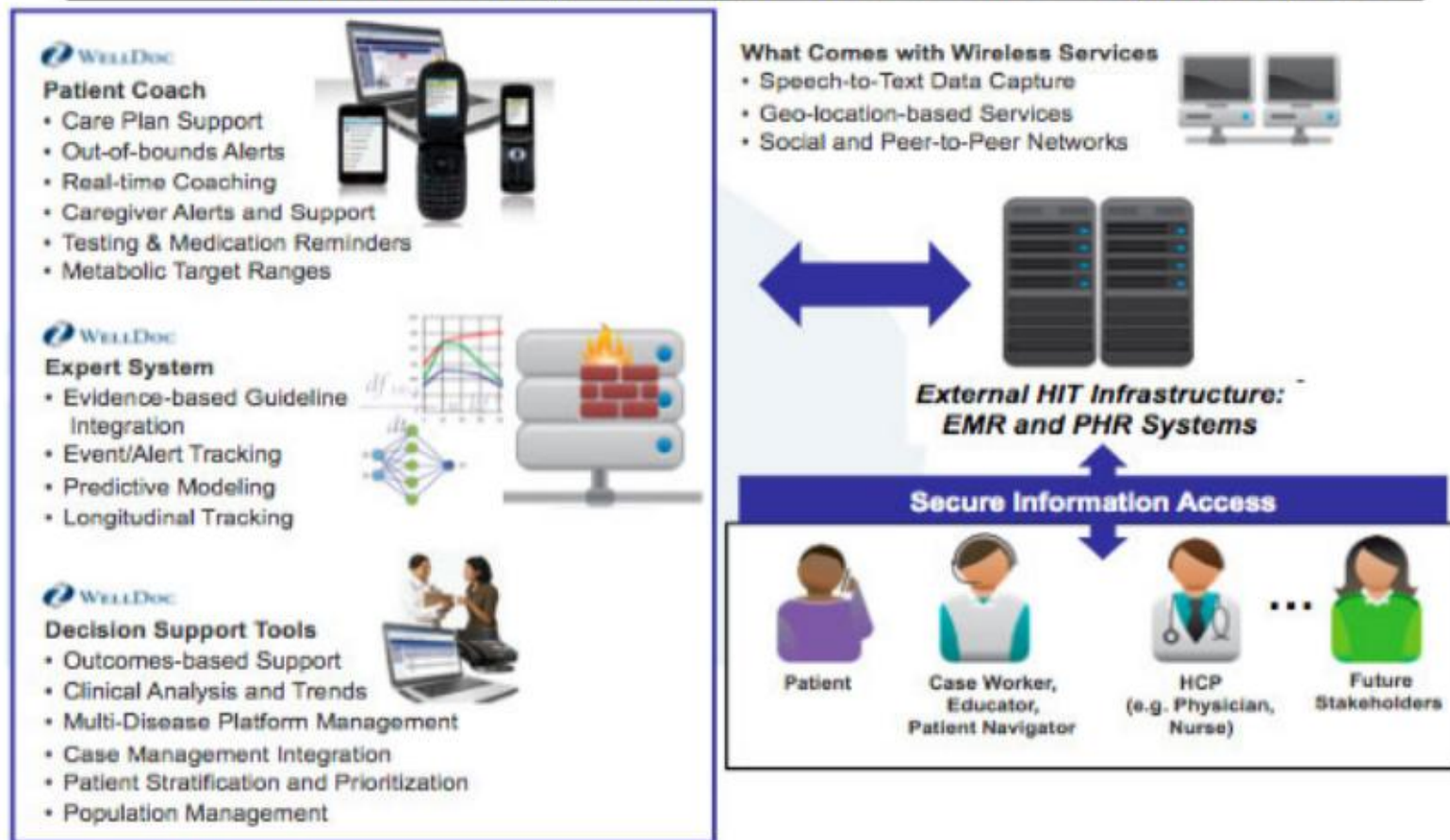


# WellDoc, Inc – Mobile Health Platform



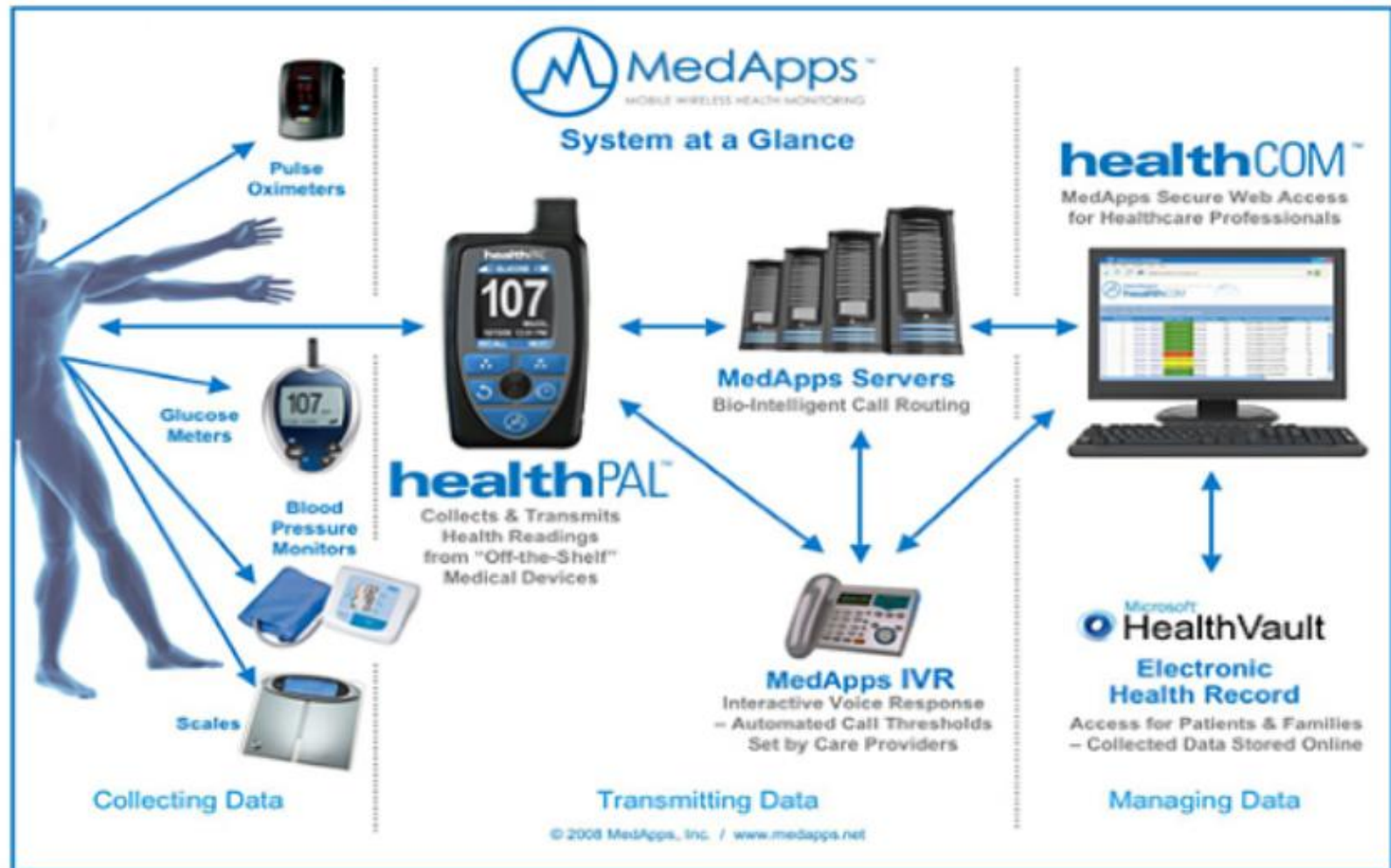
## WellDoc's Health Platform

Information visibility, accuracy, relevance, context – Anytime, Anywhere



WellDoc's system includes three core components: Patient Coach, Decision Support Tools and an Expert System.

# MedApps – Health Anywhere Using Personal Health Devices (PHD)



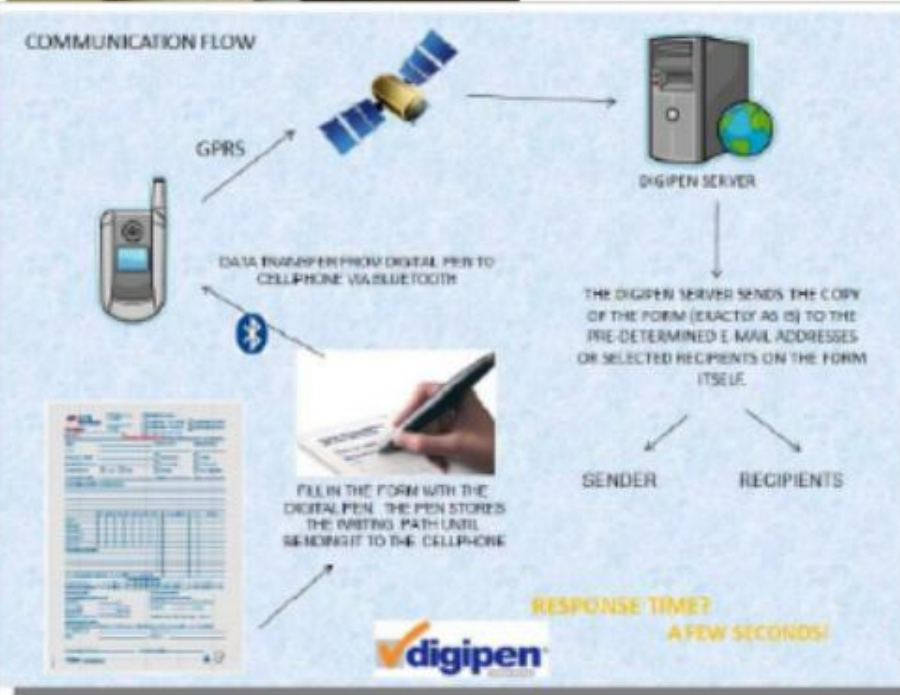
# Applications – Medical Record Capture



Digipen technology manipulates and converts the handwritten medical records into any digital format, bringing in control and efficiency to “daily” on the move reporting for medical staff.

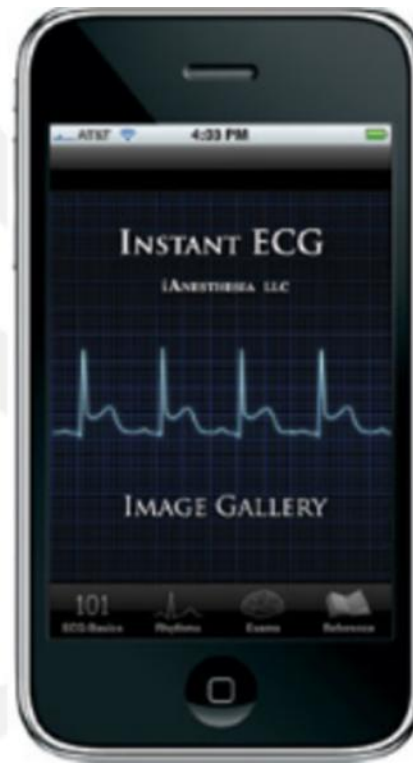
Once the form is handwritten and completed, it only takes a few minutes for the information to be converted and sent to medical servers securely while mobile user is on move.

Digipen technology reduces operating cost, speeds up processes, prevents valuable data being lost or altered giving medical records as a true reflection of what is being captured at the site.



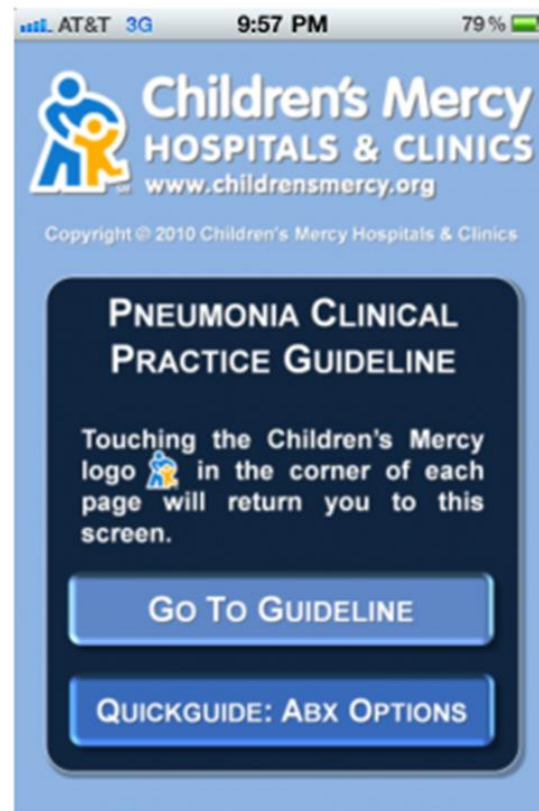
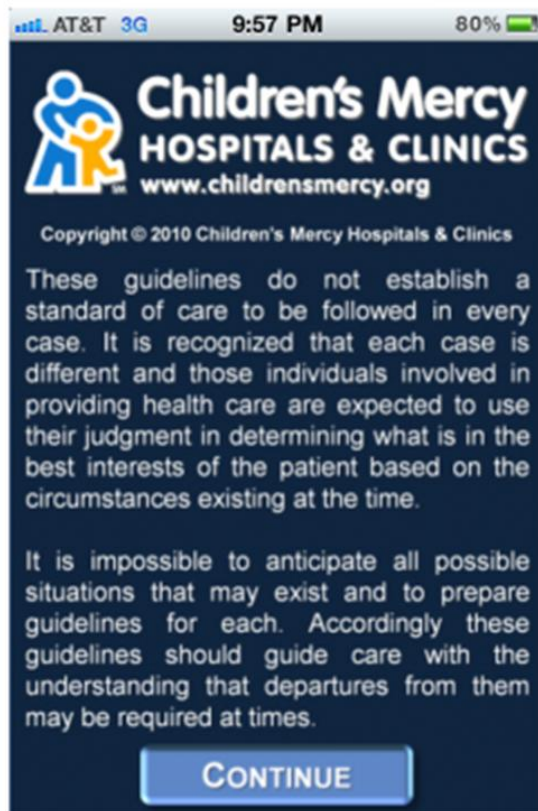
**ENDEAVOUR**  
THE MOBILITY COMPANY

# Smartphone APPs



# Pediatric Community-acquired Pneumonia (CAP)

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# Pediatric Community-acquired Pneumonia (CAP)

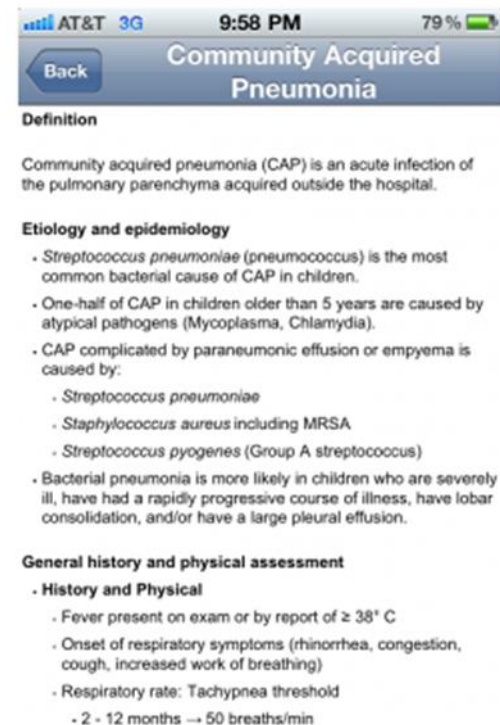
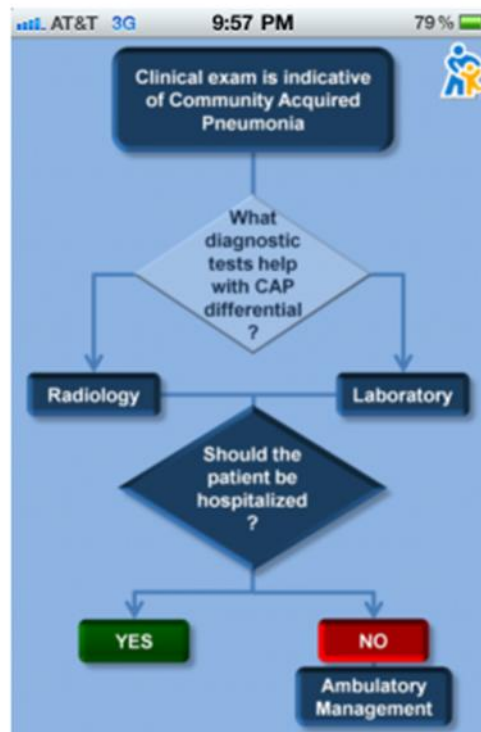
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## What's special about it?

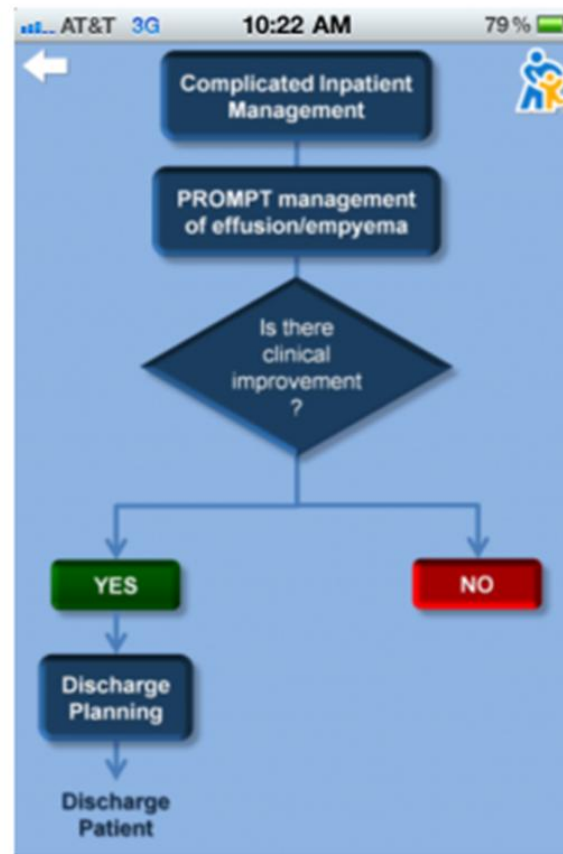
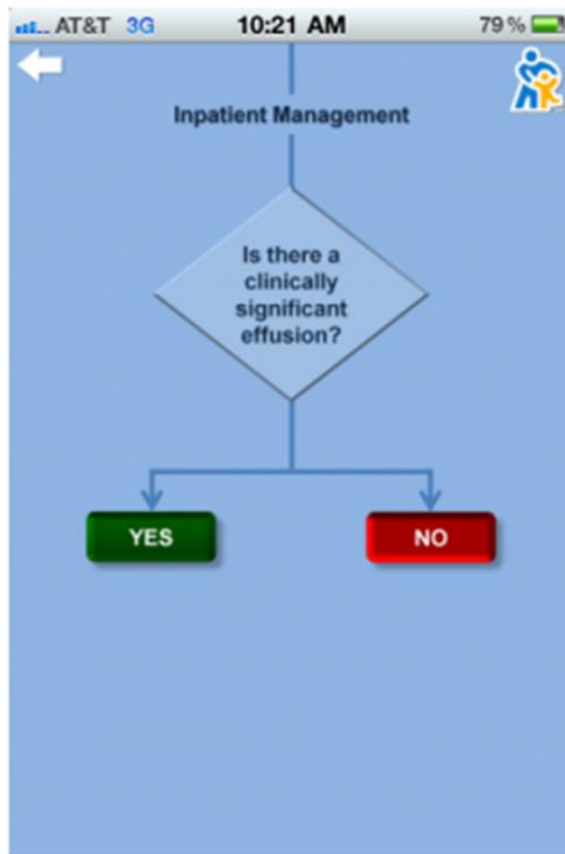
A second-year medical student - Josh-took the initiative to create it in conjunction with a teaching hospital

- ▶ The Hospitals established guidelines for the management of pediatric CAP in 2007 and placed them on the hospital website.
- ▶ Josh made these guidelines more accessible to users by creating an interactive app for mobile devices that included these guidelines.

# Snap shots



# Flow chart for inpatient Management



## The Agency for Healthcare Research and Quality's electronic Preventive Services Selector (AHRQ ePSS)

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- ▶ Designed by the US Department of Health and Human Services to assist primary care clinicians in identifying what screening, counseling, and preventive services are appropriate for their patients.
- ▶ AHRQ ePSS allows the input of a patient's age and other demographic variables, generating the appropriate screening and counseling guidelines for the patient.

# Snap Shots

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[Reset](#) **Search** [Start >](#)

Enter the following information to retrieve recommendations from the USPSTF Preventive Services Database.

**Age:**  Years

**Sex:** [Both](#) [Female](#) [Male](#)

**Pregnant:** [No](#) [Yes](#)

**Tobacco User:** [N/A](#) [No](#) [Yes](#)

**Sexually Active:** [N/A](#) [No](#) [Yes](#)

[Search](#) [Browse](#) [Tools](#) [Update](#) [More](#)

[Back](#)

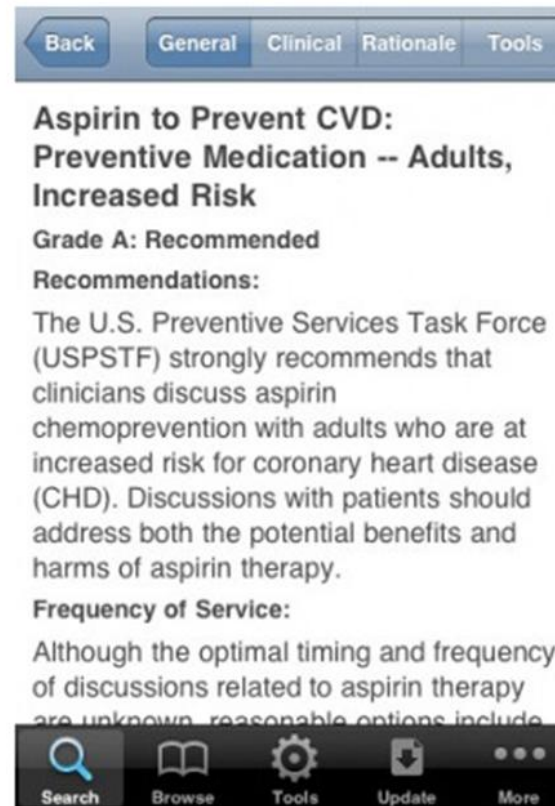
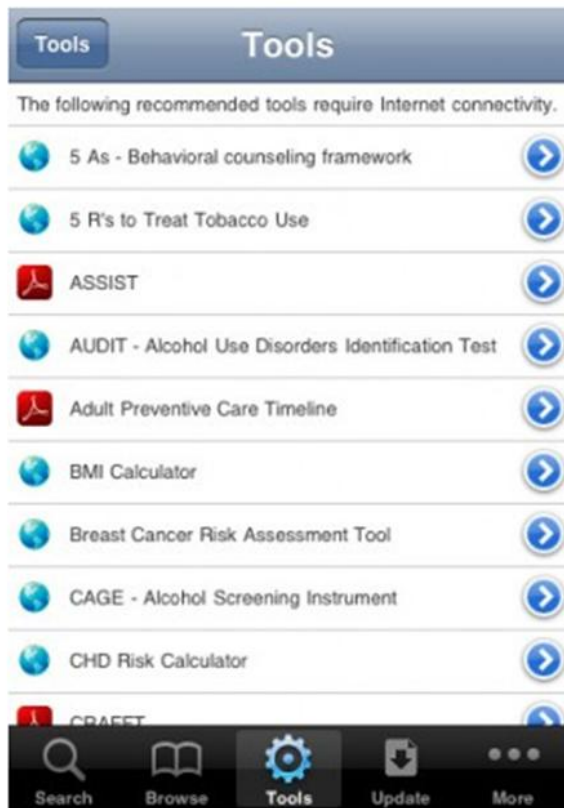
**Aspirin to Prevent CVD: Preventive Medication -- Adults, Increased Risk**

[Recommendation](#)

[Risk Factor Information](#)

[Search](#) [Browse](#) [Tools](#) [Update](#) [More](#)

# Snap Shots



# Top five medical apps at Harvard Medical School

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So which apps are most popular with HMS students? The school's CIO just conducted a survey to find out.

- ▶ [Dynamed](#) – Students and physicians can use this clinical reference tool created by physicians for point-of-care situations
- ▶ [Unbound Medicine uCentral](#) – This app serves as a portal bringing popular medical publications to students' iPad with the tap of the screen. The app includes 5 Minute Clinical Consult, A to Z Drug Facts, Drug Interaction Facts, and others.
- ▶ [VisualDx Mobile](#) – VisualDx provides physician-reviewed clinical information with thousands of medical images showing the variation of disease presentation through age, stage, and skin type.
- ▶ [Epocrates Essentials](#) – The app is an all-in-one mobile guide to drugs and disease with an integrated disease database with conditions, plus over-the-counter medications and hundreds of diagnostic and laboratory tests.
- ▶ [iRadiology](#) – A learning tool for medical students and residents, iRadiology provides quick reviews of classic radiology cases and images.

# IBM's Watson supercomputer to give instant medical diagnoses

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# IBM Watson

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Watson has tremendous potential for applications that improve the efficiency of care and reduce wait times for diagnosis and treatment by enabling clinicians with access to the best clinical data the moment they need it

One Jeopardy! question can take **2 hours on a single 2.6Ghz Core**  
Optimized & Scaled out on 2880-Core IBM workload optimized  
POWER7 HPC using UIMA-AS,  
*Watson* answers in 2-6 seconds.



**Question**

Multiple Interpretations

100s sources

100s Possible Answers

1000's of Pieces of Evidence

100,000's scores from many simultaneous Text Analysis Algorithms

Question & Topic Analysis

Question Decomposition

Hypothesis Generation

Hypothesis and Evidence Scoring

Synthesis

Final Confidence Merging & Ranking

Hypothesis Generation

Hypothesis and Evidence Scoring

**Answer & Confidence**

built on **UIMA** for interoperability

built on **UIMA-AS** for scale-out and speed

# Regulatory Requirements

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- Specific Compliance Needs for Healthcare Applications
  - HIPPA Compliance
  - CIA, HITECH Compliance and GXP
- FDA Approval for medical applications
  - Disease Management, Patient Care
  - eHealth and mHealth applications
- Accessibility to disabled, visually impaired, other users
  - Section 508 compatibility
  - Using Device Settings (iPhone Voiceover, Blackberry)
  - Text phones for the deaf and 100 Voiceover Apps
- Servers, web sites and mobile devices are HIPPA compliant and employees certified on HIPAA
- Personal information protected using Secure Sockets Layer (SSL) technology.
- Messaging Center Content Privacy
  - The company will not read or disclose to third parties private messaging center communications that are transmitted using Application Services.



# Resources Available

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Provide up to date information and accessible to students

- ▶ Medscape
- ▶ Saudi Digital Library -SDL



# Nice Articles

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Useful medical apps for med students on their clinical rotations

<http://www.imedicalapps.com/2011/05/useful-medical-apps-med-students-third-year-clinical-rotations/>

Grand Rounds, “Dr. Watson” edition, artificial intelligence and medicine, physician perspective

<http://www.imedicalapps.com/2011/04/doctor-watson-artificial-intelligence-medicine/>

