Using Mobile Technology to Enhance Patient Outcomes

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Learning Objectives

• Explain key functionality available through mobile apps
• Describe importance and key features of user centered design in designing health IT interventions
• Identify resources at BU and BMC to develop and implement mobile health technology for research and operational needs
Key Smartphone Technology Domains

• Users
• Hardware
• Software
• Infrastructure
• Backend
Key Domains: Users

• Clinicians
• Patients
• Allied Health Professionals
• Nurses, Counselors, Pharmacists, Patient Navigators, Case Managers, etc.
Software Functionality:

• Inform re: health risks, healthy behaviors, & resources;
• Train new behaviors: provide text messages, calls, pictures, or videos that model desired behaviors;
• Real-time behavior monitor: unobtrusive, automatic to reduce self-monitoring burden;
• Shape healthy behaviors via real-time monitoring: feedback, prompts, reminders, encouragement, & rewards
• Support development & maintenance of healthy behavior routines via linkage to peers, friends, family, or healthcare workers for social support & instrumental support services;
• Link to healthcare or diagnostic test results.
Key Domains: Hardware

• Native
  • Touch Screen / GUI
  • Camera / Light / Light sensor
  • Audio (Speaker / Microphone)
  • Phone / Broadband
  • Biometric Sensors
  • GPS / Accelerometer

• Add on (Plugin module/ USB Wired)
  • Electrodes / Glucometer / Sphygmomanometer

• External (Wireless/Bluetooth)
  • E.g. Scale
Key Domains: Software

- ~165,000 health-related apps (Apple iOS & Google's Android).
- PwC, a consulting firm, predicted by 2017 such apps will have been downloaded 1.7 billion times. Mar 10, 2016
Key Domains: Infrastructure

- Wireless (Cellular Broadband)
- Bluetooth
- Hardwired (USB, etc.)
- NFC (Near Field Communication)
Key Domains: Backend

• Databases
  • Private & Public
  • Real-time
• Rules engines (algorithms)
• Secure communication interfaces
Users: Health Care Professionals

- **Time Management**
  - Schedule appointments / meetings

- **Information Capture & Management (Personal & EHR)**
  - Notes (Write / Dictate / Exams)
  - Audio / image capture

- **Communications**
  - Voice / Video / Texting / E-mail / Video conf. / Social networking
  - eConsultation

- **Reference & CME**
  - Medical literature / Literature search portals
  - Clinical Decision Support Tools & Calculators
  - Treatment guidelines / Differential diagnosis aids
  - Laboratory test interpretation
  - Med Ed & Training / CME / Board prep / Assessment
  - Simulation / Skill assessment
Design & Develop a mHealth Application

• Identify a problem that needs to be solved
  • define problem being solved, know why an mHealth app best way to solve it.
  • Must add value

• Know Target Audience
  • Must know who will use this new app, and why.

• Design for simplicity, scalability and sustainability
  • Usable, supportable, and upgradable
  • Use existing models/frameworks then modify as needed, Use what worked before.
  • Ensure seamless Integration with other apps or portals,
  • Don’t change workflow or daily routine adversely.
  • Understand what people are already using.
  • Provide upgrades & new services at back end, through a dynamic interface.

• Test. Test. Test. Test.
• Get app reviewed by privacy & security experts
• Make app accessible to encourage widespread use (optional)
(End-)User Centered Design

• Directly impacts implementation success, utility and effectiveness
  • Decrease development time
  • Increase transparency to design process
  • Ensure end product reflects operational processes

• Early in design phase

• 5 Considerations (from the 5 Rights of Clinical Decision Support)
  • Right Information
  • To the right Person
  • In the right Intervention format
  • Via the right Channel
  • At the right Time in the Workflow
Quantitative and qualitative user centered design processes\textsuperscript{ref}

- Agile rapid-cycle design
- End-user testing: record, transcribe, code, analyze
  - Surveys
  - Interviews
  - Think-aloud: ease of use
  - Near live: workflow, adoption
  - Live: workflow, adoption
- Coding categories
  - Usability
  - Visibility
  - Workflow
  - Content
  - Understand-ability
  - Practical Usefulness
  - Medical Usefulness
  - Navigation
Fig. 6 Rapid cycle iterative designs – evolution of the dashboard and data view
Fig. 4 Phase 2 Usability Interview Design


BU and BMC Resources for Development, Implementation

- Involve IT resources early and often
  - Identify technical possibilities and resources (FTE)
  - Budget for IT development, testing, implementation in grant
- Mobile and Electronic-Health ARC
  - Mobile app development resources – BU Spark! (http://www.bu.edu/spark/about/)
- Center for Implementation and Improvement Sciences
- BMC-based implementation
  - BMC IT
    - CMIO office (Rebecca Mishuris)
  - Align with hospital, departmental, clinical goals
  - Engage consultants for grant-related IT work
Mobile and Electronic Health-ARC

Belinda Borrelli, PhD, ARC Principal Investigator & Director
Professor, Boston University, Henry M. Goldman School of Dental Medicine

Lisa Quintiliani, PhD, ARC Co-Director
Assistant Professor, Boston University School of Medicine

Sponsored by:
• BU Evans Center for Interdisciplinary Biomedical Research
• BU Interdisciplinary Biomedical Research Office (IBRO)
Mission of Mobile and Electronic Health-ARC (ME-ARC)

To conduct state of the art research and training in mobile and electronic health to improve health across the lifespan with an emphasis on underserved and vulnerable populations.
ME-ARC (Purpose)

- To foster interdisciplinary collaboration among researchers across BU who strive to improve health outcomes through digital research and scholarship:
  - Medical informatics
  - Behavioral and clinical sciences
  - Biomedical engineering
  - Computer Science
  - Implementation Science
  - Global Health
  - Health literacy/disparities
- Develop a scientific vision and strategy for digital health at BU
- To provide training and mentorship in the area of e-Health and m-Health
- To serve as a resource for the Boston University community

- Enhance integration
- Foster innovation
- Build on multidisciplinary strengths
- Poised to answer major funding calls for grants
Activities of the ME-ARC

- Annual mobile and electronic health symposium
- Collate BU’s existing strengths in digital health
  - Website
  - Online assessment of current capacities
- Monthly seminars
- Two pilot projects
- Training for NIH K mentees & post-doctoral fellows
- Collaboration with other BU ARCs

http://sites.bu.edu/me-arc/
Mobile & Electronic Health Affinity Research Collaborative (ME-ARC)

The mission of the Mobile and Electronic Health-ARC (ME-ARC) is to conduct state-of-the-art research and training in mobile and electronic health to improve health and well-being, with a focus on underserved populations, across the lifespan. The ARC is transdisciplinary, consisting of a steering committee, external advisory board, trainees, and over 80 member affiliates across numerous schools at Boston University. Steering committee members have expertise in implementation science, behavioral science, medicine, informatics/bioinformatics, software development, health literacy, engineering, and global health.

Since January 2016, the ME-ARC has hosted invited speakers at monthly seminars, and has held a yearly ME Health symposium. The ME-ARC coalesces mobile health resources and researchers at Boston University, and conducts state of the art mobile
Director & PI: Belinda Borrelli
Co-Directors: Lisa Quintiliani

Cross-cutting Cores/Steering committee:
Resources for mHealth and eHealth Projects

- Center for Implementation and Improvement Sciences (Walkey)
- Behavioral Science Intervention Research (Borrelli, Quintiliani, Keysor, Paffai)
- Medical Informatics (Mishuris, Paschalidis, Adams, Shanahan)
- Mobile app development (Lapets, Jansen)
- Community-based Participatory Research and Health Disparities (Borrelli, Quintiliani)
- Health Literacy (Paasche-Orlow)
- Engineering (Klapperich, Paschalidis)
- Global Health (Don Thea)

Member Affiliates
Those who are not directly involved in the projects but benefit by, and contribute to, the ARC.

Resources for Members, Affiliates and BU Community
- Symposia/lectures
- Grant reviews
- Consultation
- mHealth registry
- Networking

External Advisory Board
- David Felson
- Sandro Galea
- Azer Bestavros

Post-docs/K Mentees
Romano Endrighi, PhD
Jacqueline You
Alaa Qari, DMD
Deepak Kumar, PhD
Brenda Heaton, PhD

Project 1
Pl: Borrelli
Co-I’s: Endrighi, Quintiliani, Keysor, G5DM dental faculty (TBN)

Project 2
Pl: Quintiliani
Co-I’s: Borrelli, Keysor, Oshry

Feasibility Study
Pl: Keysor
Co-I’s: Baker, Borrelli, Quintiliani

mHealth Registry
Pl: Quintiliani