mHealth Programs Designed by Patients & Providers for Chronic Disease Management

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Objectives

1. Why does South Carolina need mHealth?
2. Why use theory guided, user centered iterative design process?
3. Provide example of this process in devpt of mHealth solution for leading obstacle in chronic disease management: med nonadherence

- Series of 3 iterative design based RCTs involving uncontrolled EHs:
  - Kidney transplant patients
  - FQHC Hispanic migrant farmers
  - FQHC African Americans
Obj.#1: Why does South Carolina need mHealth?

- Escalating growth of chronic disease patients:
  - premature mortality (46th)
  - obesity (45th)
  - stroke (40th) --cancer (36th) --CVD (35th) --diabetes(46th)

- Continued escalation of healthcare costs:
  - 2003 ($5.5B) & 2023 ($20B) for chronic disease management

- Patient /Provider Access Issues:
  - 40% live in rural areas (twice the national average)
  - 46 of 47 counties have federally qualified health centers
  - Shortage of PCPs, especially in rural areas
Obj.#1: Why SC Needs mHealth cont.

SC is responding to increasing healthcare costs, shrinking budgets & large rural underserved areas

- Proviso 33.34 (partnerships of FQHCs, free clinics and hospitals in care of uninsured, chronically ill, frequent ED users)

- SC’s Telemedicine Initiative (e.g., reaching rural hospitals & schools - hub & spoke model; effective day to day management solutions needed)

- mHealth offers potential to lower costs, enhance clinical outcomes & reach our underserved at risk populations
Preamble to Obj.#2
100,000 mHealth apps: What’s A Doc To Do?

- ~100,000 chronic disease & health/wellness apps;
  (Apple Marketplace: 95 HTN; 242BP)
- “Many apps have misleading medical claims & quality & safety concerns are a topic of inquiry.” Bakul Patel, F.D.A. policy adviser

- Majority NOT developed using:
  - evidence based guidelines,
  - behavioral change theories,
  - Patient & provider perspectives
  - empirically validated
- Healthcare providers seek validated effective programs
Obj.#2: Why Use Theory Guided, User Centered, Iterative Design Process?

Hospital & health plan execs & PCPs need:
Evidence based solutions, empirically validated, sustainable & cost effective ACCOMPLISHED using:

• iterative design process guided by patient & provider input
• behavioral & technology application theories (foster patient self efficacy & intrinsic motivation to sustain adherence to medical regimen)
• Empirical evaluations & repeated refinements establishing usability, efficacy, effectiveness & sustainability
• Development of personalized, sustainable, effective, patient & provider-centered solutions
Patient & Provider Centered Iterative Design

- Engages all stakeholders from generation of the clinical need through all iterative design phases

- methods include:
  - key informant interviews
  - focus groups
  - formal surveys
Iterative Design Process

1. User Needs
   - Content/Function
     - Focus groups
     - Interviews

2. Qualitative Analysis

3. Prototype Development

4. Usability Testing
   - Focus groups

5. Further Development

6. User Surveys

7. Refine prototype

Clinical Trials

Proof of Concept

Efficacy/Effectiveness

Dissemination

Design Team

Researchers

Post Trial Focus Groups

MUSC
COLLEGE of NURSING

TACHL
Technology Applications Center for Healthful Lifestyles

MUSC
COLLEGE of MEDICINE
Obj.#3: Example of mHealth in chronic disease management

Leading obstacle in effective chronic disease management: patient non-adherence to medication regimens

- Med Adherence: extent prescribed dose, frequency & timing of regimen followed
  - 25% of initial prescriptions never filled
  - ~50% of patients with chronic disease(s) adhere to medication regimens
Obj.#2: Example of mHealth in chronic disease management

- Med nonadherence responsible for:
  - 10% of hospitalizations
  - reduced work force productivity
  - suboptimal clinical outcomes (~125,000 deaths/yr)
  - increased healthcare costs $100-300 B/yr

What is take away message?
- Theory based, patient & provider centered, empirically validated, mHealth self management programs are viable solutions
Obj.#3: Devpt. of mHealth Medication Adherence & BP Control Program Among Kidney Transplant Patients
Background

• Despite advances in medical/surgical care of kidney transplant recipients, 3-year graft survival is ~ 81% & graft half-life is only ~9 years.
• Medication non-adherence is a key contributor to premature graft loss.
• Minor degrees of non-adherence are associated with poorer outcomes even in the absence of rejection.
Rationale

- ~35% of renal transplant patients are non-adherent; ~70% if time constraint instituted
- Non-adherence contributes to graft loss by allowing for immune mediated rejection and the deleterious effects of poorly controlled comorbid conditions (i.e., HTN)
Iterative Development of mHealth Prototype System

- Individual interviews conducted to determine:
  - healthcare providers’ needs for following KDIGO & MUSC stepped care guidelines & perspectives on premature graft loss
  - patients’ functional health literacy, attitudes toward, willingness and ability to use mHealth
Iterative Development of mHealth Prototype System

- Prototype mHealth system developed (SMASH) & usability tested
- 99 patients surveyed after being given a demonstration of SMASH mHealth system
- Further SMASH Refinement
- Proof of Concept RCT conducted
- Post RCT interviews & further refinement
Survey Results of mHealth prototype: SMASH

• 90% cell phones; 52% had smart phone access
• 61% texted; 38% surfed web
• 34% downloaded apps
• Only 7% had heard of mHealth/Telehealth
• 79% very willing to use mHealth
• 87% very confident mHealth would increase communication with physician
• 84% felt doctor would make quicker med changes

McGillicuddy et al. (2014) Journal Medical Internet Research
SMASH System

Medication Reminder Device

MedMinder reports when medicine is taken

Fora BP and Glucose Monitor

Automated Personalized Motivational Messages

Weekly Summary Reports

Data Center

Patient with Smart Phone

Physician changes regimen as needed

Provider
Identification of Personalized Motivational Message Content

1. Do you want to be there for them while they grow up?
2. Do you worry about being a burden on your children if you have poor health?
3. Do you want to see your children marry and have your grandchildren? Yes
Personalized Motivational Message Example

Background: 55 yr.-old single with EH & T2D. Family history: parents with EH, T2D & ESRD.

Life goals & personal values: religious, desires to spend more time with family, worries about dying young from kidney disease or a stroke like his parents

Medication dose(s) taken correctly:

   Great, Frank! You’re taking your medicine on time! Your family history does not have to be your future!

Missed medication dose(s):

   Frank, try and remember to take your medicine on time every day! God has blessed you, take care of His gift of life!
Med Adherence in Transplant Patients With Co-Morbidities (hypertension, diabetes, etc.)

McGillicuddy et al. (2013a,b) *Journal of Assn. Computing Machinery* & *Journal of Medical Internet Research*
BP Changes Among Kidney Transplant Recipients

One Year Follow-up Clinic BP Among Kidney Transplant Recipients

McGillicuddy et al. (under review; Progress in Transplant)
Obj.#2: mHealth (SMASH) & Hispanic Uncontrolled Hypertensives

Focus groups & surveys led to SMASH prototype refinement

- 81% cell phone; 39% smart phone
- 78% texted; 48% downloaded apps
- 19% had heard of mHealth
- 94% very willing to use mHealth
- 76% had complete trust in privacy of data
- 85% very confident mHealth would increase communication with physician

Price et al. (2013) *Journal Medical Internet Research*
BP Changes & Med Adherence Among Hispanic FQHC Uncontrolled Hypertensives

SMASH med adherence ~97% across 3 mths

Sieverdes et al. (2013) Mobile Health Telecare
Obj.#3: SMASH & African American FQHC
Uncontrolled Hypertensives

McGillicuddy et al. (in press) Progress in Transplantation

Average ED visit Cost: $5,923
ED/Patient/Year Rate: 1.05

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<thead>
<tr>
<th>ED Visits and Associated Costs</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>SMASH (n=8)</td>
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<tr>
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<td># ED Visits</td>
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<tr>
<td>Difference</td>
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SMASH – Just The Beginning!

Tension Tamer App

LOVED

DK 098777
9/12-7/17

Preterm Birth Prevention

Pediatric Asthma SAMS

Recovering Alcoholics Monitoring System RAMS