HELPING ATRIAL FIBRILLATION PATIENTS WITH ADHERENCE TO ANTICOAGULATION THERAPY: DESIGN FRAMEWORK AND INTERVENTIONAL STRATEGIES

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Therapy Adherence

Adherence: following therapeutic advices and recommendations from a provider

- Patients' non-adherence leads to worsening health condition, diminished well-being, and increased healthcare costs (in the US alone 100-300 billion USD annually)

Motivation and Goal

- Non-adherence is prevalent: 20-30% for short-term treatment, 50% for long-term, and 70-80% for lifestyle changes [Jin et al., 2008]
- Interventions improving adherence have far greater impact on patient outcomes than those improving therapies [Haynes et al., 2008]
- Successful interventions combine patient education and behavior modification [Benjamin, 2012]

Our long-term goal: to develop a versatile system (MPA) that delivers personalized interventions to help patients follow prescribed therapies

Atrial Fibrillation (AFib)

Canadian Cardiovascular Society
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- AFib is one of the most prevalent types of cardiac arrhythmias, it accounts for about 30% of hospitalizations for arrhythmias
- Independently living older adults with atrial fibrillation are prescribed anticoagulation therapy (vitamin K antagonists (VKA) or direct oral anticoagulants (DOAC)) for primary stroke prevention
- Less than half of patients adhere to prescribed anticoagulation therapy [Castellucci et al., 2015]
- Adherence remains low with introduction of the DOACs [Jackevicius et al., 2017]
- Limited support for patients to help with their adherence

Motivational Patient Assistant (MPA)

- Delivers behavioral interventions that are patient-tailored
- Interventions are grounded in health behavior theories
- Interventions delivered via the platform that is most suitable for patient needs
  - Mobile
  - Web-based
  - TV

MPA Framework

1. Data-driven
   - Identification of **psychobehavioral targets** → patterns in patient's psychological characteristics and behaviors that affect adherence
   - Application of dominance-based rough set approach (**DRSA**) [Greco et al., 2001] to induce rules that capture patterns associated with adherence levels

2. Expert-driven
   - Construction and selection of **psychobehavioral interventions** → systematic plans of actions that affect patients' behaviors and psychological stance
   - Application of predefined categories of generic interventions [Abraham, Michie, 2008] and domain knowledge

3. Technology-driven
   - Versatile decision support system tailored to patient's socio-economic status and possibly level of health literacy

Dominance-Based Rough Set Approach (DRSA)

- Data analysis and knowledge discovery technique suitable for *mining* imperfect (incomplete, inconsistent) data to determine behaviors that impact adherence
- Objects categorized into ordered classes (from worst to best) and described using features with (possibly) ordered values
- Classification- and **intervention-oriented** perspectives associated with decision rules derived from (patient) data

A *intervention-oriented* rule defines the psychobehavioral target and specifies the expected change in categorization (adherence level)

Behavioral foundations

Transtheoretical model (TTM) – classifies the patient according to their readiness for change and helps with understanding behavior modification [Norcross et al., 2011]

Self-determination theory (SDT) – evaluates the patient's level of autonomous (or intrinsic) motivation [Ryan et al., 2017]

Fogg's Behavioral Model (FBM) – ties behavioral change to a cue or cyclical event [Fogg, 2009]

- Behavior modification techniques used in interventions derived from Abraham and Michie [Abraham, Michie, 2008]

Identification of Psychobehavioral Targets

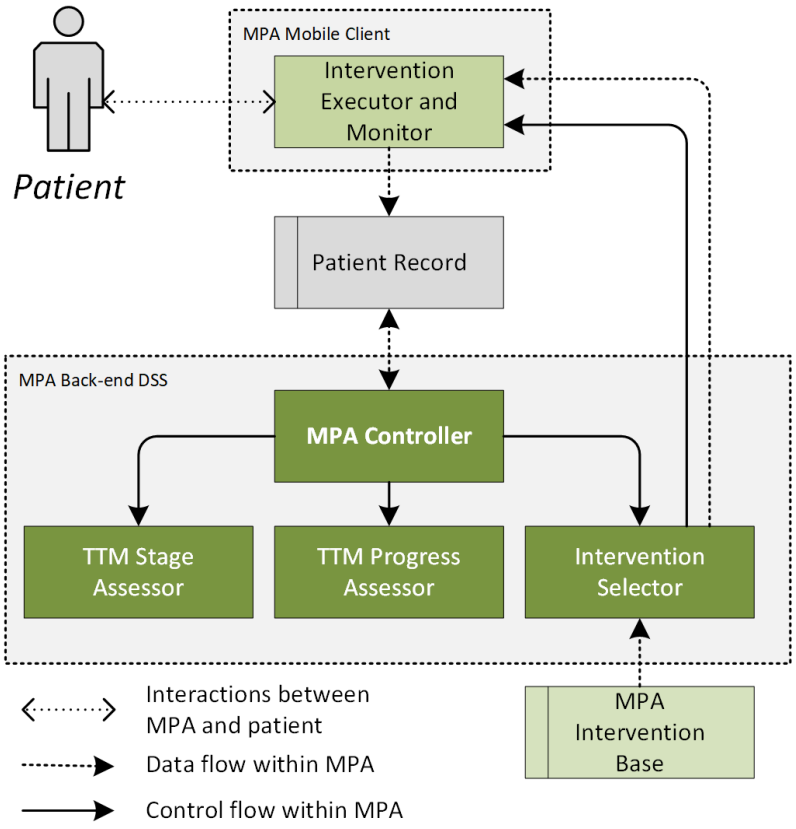
- Patients described using sociodemographic, psychological and behavioral features [IOM, 2015]
  - Interventions are applied only to the latter two (→ psychobehavioral features)
- DRSA applied to induce intervention-oriented decision rules
- Achievement and maintenance psychobehavioral targets associated with improving or maintaining adherence

Psychobehavioral Interventions

- Have two major components: **educational** and **behavior change** actions
- Educational actions
  - Educate on AFib, prognosis and risk of stroke
  - Provide information about behavior-health links (benefits of a proper behavior and consequences of improper one)
  - Emphasize the key role of the patient in a successful therapy
- Behavior change actions
  - Engage in goal setting
  - Provide feedback on goal attainment
  - Encourage positive behavior

Engagement and readiness to change are key assumptions

MPA Architecture



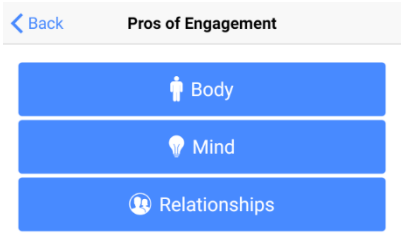
MPA Components

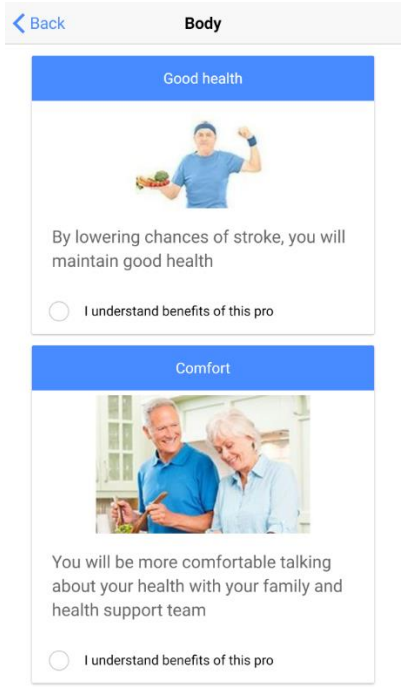
- *Intervention Base*: Stores interventions modelled with *applicability condition*, *activities* defining intervention, *success condition*
- *Controller*: Controls MPA, invokes components, and monitors for the changes in patient's behavior
- *TTM Stage Assessor*: Infers patient's baseline TTM stage from patient record
- *TTM Progress Assessor*: Determines possibility of moving to the next TTM stage by checking success condition(s) of interventions
- *Intervention Selector*: Selects interventions from the intervention base
- *Intervention Executor and Monitor*: Delivers interventions related to achievement and maintenance targets and monitors patient's interactions

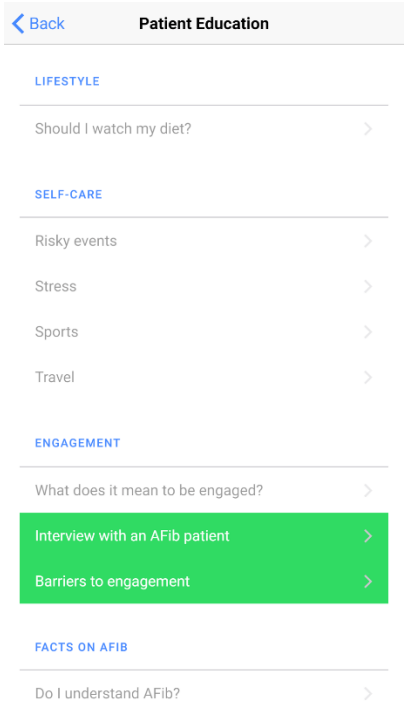
System implemented as a thin client and back-end decision support

Personalized Interventions: MPA-AFib

- Patient education



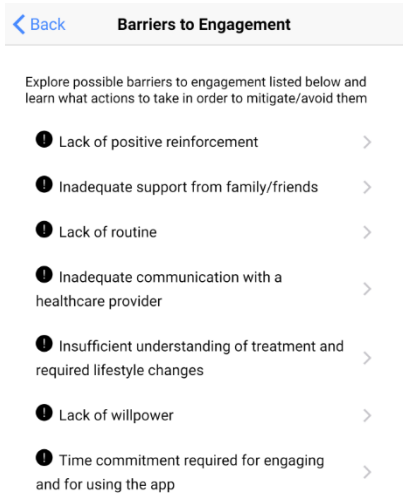


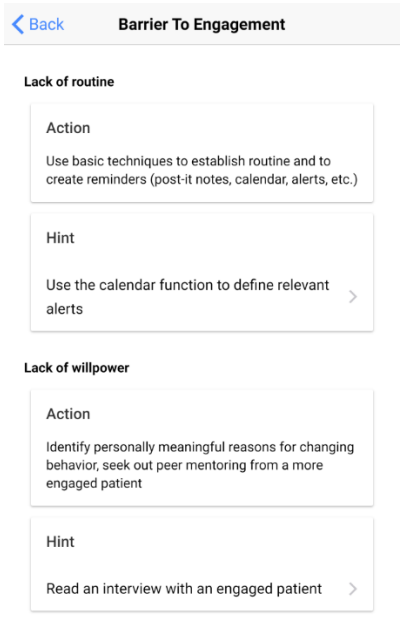


Personalized Interventions: MPA-AFib

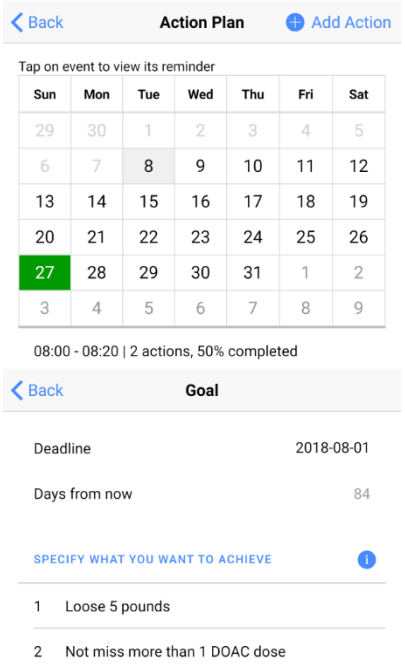
- Patient engagement

Barriers to engagement





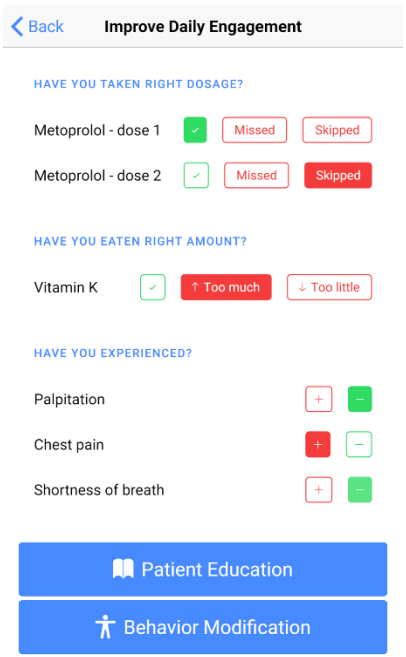
Action planning and goal setting



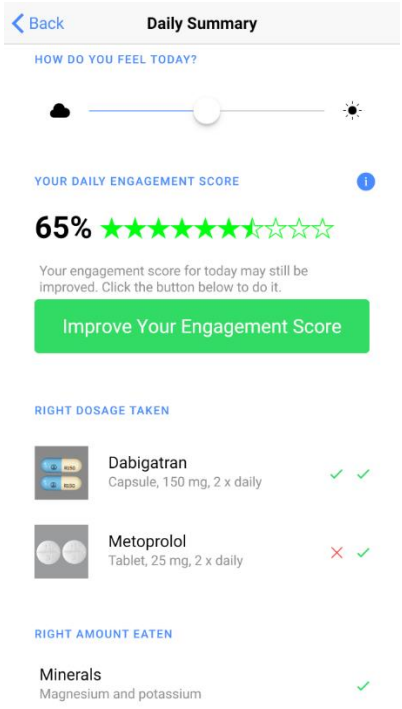
Personalized Interventions: MPA-AFib

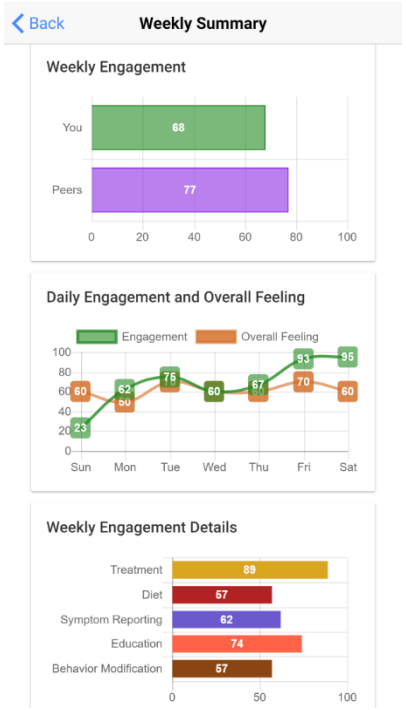
- Behavior modification

Reporting



Daily and weekly summaries





Conclusions

- A framework for delivering patient-tailored psychobehavioral and educational interventions
  - Generic system architecture designed for chronic conditions
  - Combination of data-, expert-, and technology-driven elements
- MPA-AFib
  - A specialized version aimed at adherence to oral anticoagulation therapy
  - Will undergo a prospective study involving patients.

Ultimate goal is to use technology to deliver comprehensive and personalized interventions at the most appropriate time and on most appropriate device.

"Nurse, get on the internet, go to SURGERY.COM, scroll down and click on the 'Are you totally lost?' icon."

Thank you for your attention

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