



Reinforcement Learning to Increase Physical Activity in People with Diabetes and Depression

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Problem

- Depression and Diabetes are highly **comorbid** but interventions are **siloed**
- Mobile health interventions need to be:
 - 1) *Personalized*
 - 2) *Integrated into care*
 - 3) *Developed with vulnerable populations*

Potential Solution

Increase physical activity via:

- Smartphone Passive Sensing of steps
- Personalized messaging using a **reinforcement learning algorithm**
 - Target individuals specific motivators
- Clinician support

Aims

- Increase step counts
- Decrease Hba1c (diabetes)
- Reduce PHQ-9 (depression)

Clinical Trial Design

Participants & Setting

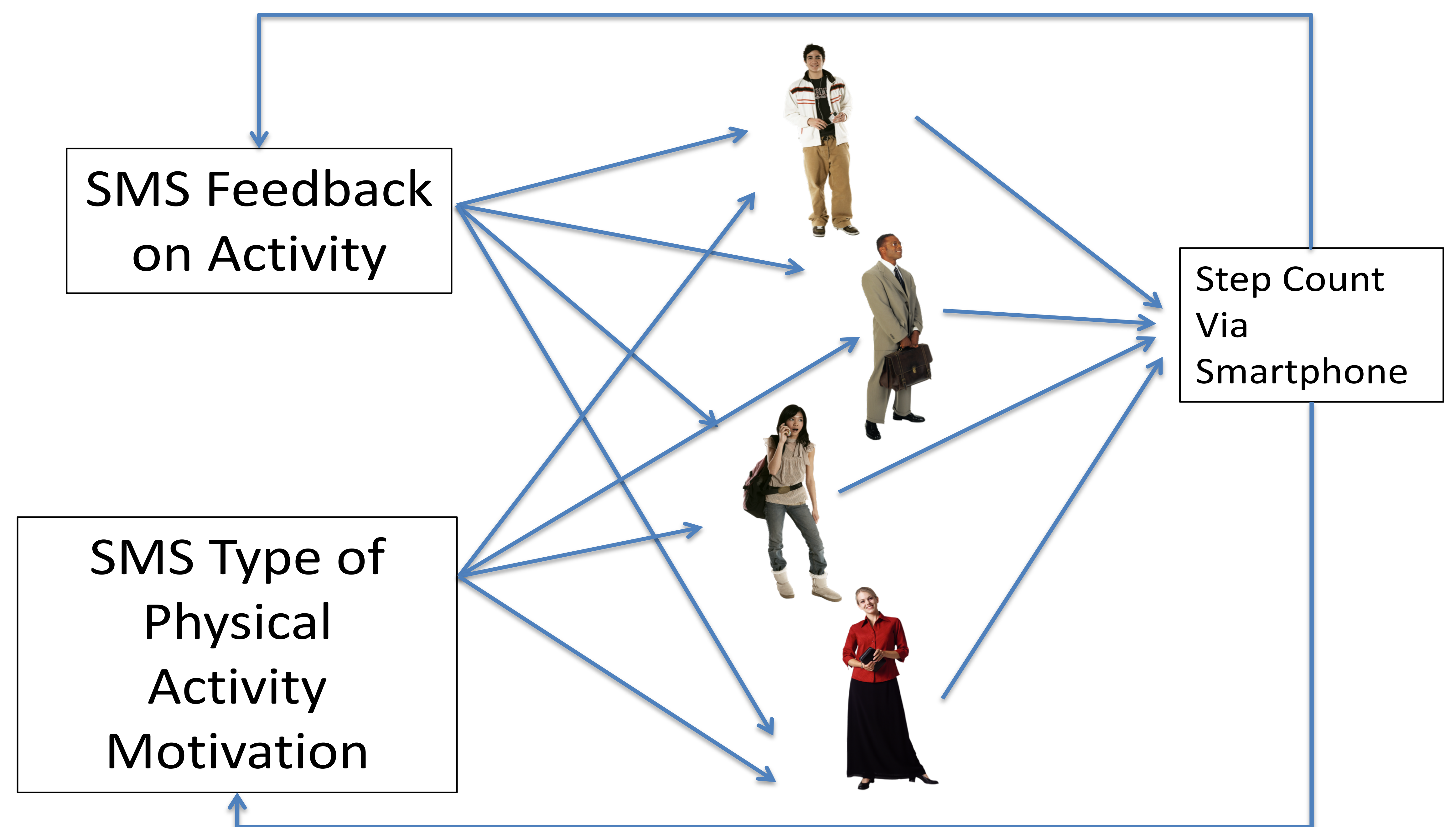
- 300 low-income patients from San Francisco General Hospital (SFGH)
- English or Spanish speakers

Procedure

- Patients assigned to receive either:
 - Static Messaging Intervention
 - OR
 - Reinforcement Learning interventions

Reinforcement Learning Algorithm

Messaging Algorithm Flow



Sample Messages

	Activity Message Example	Weekly Summary Message
<i>Informational - negative</i>	You have reached N% of your goal. You need to exercise to reach your goal. Make a plan to exercise tomorrow to get back on track.	You failed to reach your activity goal on 5 of the 7 days this past week. You need to get moving to improve your health.
<i>Self-confidence</i>	You have so far achieved N% of your weekly activity goal. Your exercise level is in accordance with your plan. Keep up the good work".	Over the past week, you were a superstar. You reached your highest step count to date!
<i>Peer feedback (relative to others in the study)</i>	You have so far achieved N% of your weekly activity goal. You are exercising more than the average person in your group.	Last week you increased your activity more than most people in the study.
<i>Social family-themed messages</i>	You have achieved N% of your weekly activity goal. Remember that you want to be healthy for your family.	Over the past week you had more activity than the previous week. Your continued improvement will allow you to be there for your family.