Testing the structure of SMS messages for use in an artificial intelligence (AI)-driven SMS antihypertensive adherence support tool

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Background: Up to half of all patients do not take medications as prescribed, contributing to nearly 100,000 premature deaths yearly and $290 billion in healthcare costs. While forgetfulness is one major challenge, medication non-adherence can be intentional due to concerns about medications or beliefs about the condition. Many patients report multiple reasons for non-adherence, and those reasons can change over time. Mobile Health (mHealth) interventions such as text messaging or SMS can deliver frequent patient contact to improve adherence, and randomized trials suggest that SMS interventions can improve medication adherence. To be more effective, mHealth services need to adapt to each patient's unique needs over the long-term.

Purpose: The purpose of this study was to evaluate the public's perspectives of expert-developed text messages addressing four medication adherence barriers. Messages were evaluated using an iterative, card-sorting methodology. These messages will be used in a study aimed at improving adherence to anti-hypertensive medications using a reinforcement-learning (a form of artificial intelligence) text messaging service.

Methods: Our theoretical framework recognizes disease beliefs, medication necessity beliefs, medication concern beliefs and forgetfulness as key barriers to medication adherence. We developed messages addressing these barriers and used two waves of card-sorting validation studies to confirm the extent to which messages reflected the adherence barriers as intended. In the first wave, 40 participants comprised of university staff and student pharmacists placed 32 adherence messages into categories. Participants were asked to group the messages based on how the content of the messages related to each other, and then label each group. We used similarity and cluster analyses to examine the consistency in categorization across participants. The hierarchical clustering used average linkage, and spatial relationships were indicated visually with the first two principals coordinates. After analyzing the initial relationship among messages, we deleted some messages and modified others, and the process was repeated with 37 new participants grouping 36 messages. Messages about positive reinforcement of adherence were also added in wave 2.

Results: In the first round, participants grouped messages into between 2 and 13 separate categories. A similarity analyses showed four groupings of messages, as expected, with disease beliefs and adherence strategies having the highest agreement. The first four principal components explained 94% of the variability in card sort agreement. However, seven messages did not correlate with their intended groups, and revisions were made. In the second wave of card sorting, participants grouped the messages into between 4 and 9 categories. The similarity analysis showed that five types of messages were identifiable, as expected, and reinforcement message, medication concerns and adherence strategies had the highest agreement across participants. The 36 messages were also confirmed in five clusters, and the first five principal components explained 98% of the variability.

Conclusion: Participants in a card sorting activity confirmed the structure of expert-developed SMS messages about reasons for medication non-adherence, illustrating a systematic strategy for developing SMS behavior change messages. Future work should include subjects reporting medication non-adherence to specific medications.