Systematic Development of an AI Chatbot for Physical Activity Habit Formation in Prehypertension Individual Integrating Needs, Theories, and Evidence

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Abstract. Prehypertension, an early stage in the development of hypertension, impacts a substantial segment of the adult population worldwide. Addressing this issue, our study introduces HabitBot, an AI-driven chatbot tailored to encourage physical activity (PA) habits among individuals with prehypertension. HabitBot combines natural language processing with multidisciplinary approaches, drawing from both theoretical frameworks and empirical studies. The chatbot development followed a systematic, five-phase process: comprehensive needs assessment, literature review on behavior change theories, analysis for selecting effective behavior change techniques (BCTs), prototype design through intervention mapping, and refining the intervention based on user feedback. The outcome includes a prototype that integrates the Health Action Process Approach and Habit Formation Theory, utilizing twelve identified BCTs effective in fostering PA habits. User feedback further refined the chatbot across multiple dimensions such as user interface, content accessibility, and privacy. HabitBot exemplifies an innovative integration of behavior change strategies with advanced language model technology, paving the way for digital health interventions in chronic disease prevention. Future studies should assess its long-term efficacy in habit formation and explore its applicability to various demographic groups

Keywords. Prehypertension, mHealth, health behavior change, physical activity, chatbot, artificial intelligence

1. Introduction

Prehypertension is a critical phase in the progression towards hypertension, affecting a significant portion of the adult population globally [1]. Early intervention through lifestyle modifications, particularly physical activity (PA), is paramount [2]. However, maintaining consistent PA routines is challenging due to the neglect of PA habit formation. This study introduces HabitBot, an AI-driven chatbot, designed to foster PA habits among individuals with prehypertension, leveraging natural language processing and integrating multidisciplinary insights, theoretical frameworks, and empirical evidence.

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2.   Methods

HabitBot was developed through a systematic process encompassing five phases. Phase 1 involved a comprehensive needs assessment through multidisciplinary panel discussions. In Phase 2, we conducted a literature review to identify applicable theoretical foundations for behavior change. Phase 3 was dedicated to a comprehensive analysis to inform the selection of effective behavior change techniques (BCTs). During Phase 4, intervention mapping was utilized to design the prototype of the intervention. Finally, Phase 5 employed focus group interviews to collect user feedback and refine the intervention accordingly.

3.   Results

The development process yielded specific outcomes for each phase. Phase 1 resulted in the identification of eight prehypertension-specific user needs, highlighting the importance of personalized exercise recommendations and support. In Phase 2 we synthesized the Health Action Process Approach and Habit Formation Theory as the theoretical underpinning for the intervention. In Phase 3, twelve BCTs were identified as most effective for promoting PA habit formation. In Phase 4, the prototype chatbot was developed, applying the insights from the previous phases. Phase 5 involved collecting and analyzing user feedback, which led to significant refinements across six dimensions: user interface and interaction capacity, content and resource accessibility, chatbot characteristics, individualization and adaptability, privacy, and support and community.

4.   Conclusions

HabitBot represents a pioneering effort in integrating professional behavior change strategies with advanced LLMs technology in chronic disease prevention. Its development underscores the importance of a multidisciplinary approach, integrating theoretical insights and empirical evidence to design effective digital health interventions. Future research should focus on evaluating HabitBot's long-term impact on PA habit formation and its generalizability across diverse populations.

References

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