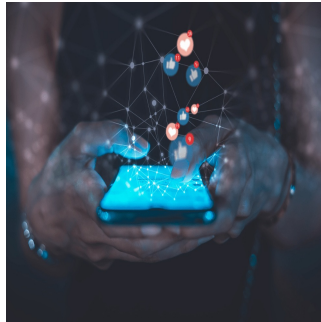

Understanding Digital Behaviour Change Interventions



Through wearable devices and mobile applications, digital behaviour change interventions (DBCIs) have emerged as effective tools for promoting healthier habits, particularly physical activity. HeartSteps II, a year-long micro-randomized trial, aimed to explore the factors influencing user engagement in these interventions. Engagement is a critical component of the success of DBCIs, as it directly impacts behaviour change. The HeartSteps II trial analysed the dynamic nature of engagement, applying a system identification approach to model individual behaviours and factors affecting engagement. By examining this dynamic process, researchers can gain insights into optimising DBCIs to sustain long-term user engagement and behaviour change.

Engagement in Digital Behaviour Change Interventions

The success of DBCIs relies heavily on user engagement, a multi-dimensional concept that includes cognitive, emotional, and behavioural components. Engagement can be measured both subjectively (how engaged users feel) and objectively (how frequently users interact with the app or wearable devices). According to the research from HeartSteps II, engagement is not a static process but a dynamic one that fluctuates based on various internal and external factors, such as psychological state, physical activity levels, and even environmental conditions like weather or time of day.

HeartSteps II leveraged this dynamic model to understand better how engagement evolves over time. The study utilized a fluid analogy model that applied mathematical principles to estimate the dynamic relationships between factors such as perceived motivation (both intrinsic and extrinsic), physical activity levels measured by Fitbit step counts, and engagement with the app measured through the number of page views. The aim was to identify patterns that could inform adaptive interventions, allowing the DBCI to adjust its strategy to meet the user's needs at specific times or in particular contexts, promoting sustained engagement.

The Role of Motivation in DBCI Engagement

HeartSteps II utilised the Self-Determination Theory (SDT) as a framework to examine how motivation impacts user engagement. SDT posits that motivation exists along a continuum from extrinsic (engaging in behaviour due to external pressures) to intrinsic (engaging in behaviour because it is inherently enjoyable or valuable). The HeartSteps II study modelled both intrinsic and extrinsic motivations to predict engagement behaviours over time.

For example, one participant in the study demonstrated a robust positive relationship between extrinsic motivation and app engagement, suggesting that external incentives or prompts significantly increased their interaction with the app. This positive impact was sustained over time, indicating the potential for external motivators to keep users engaged. Intrinsic motivation also played a role, but to a lesser extent, suggesting that while participants may initially rely on external motivators, the long-term goal of DBCIs should be to foster intrinsic motivation for sustained behaviour change.

These findings highlight the importance of tailoring DBCIs to individual motivations. For some users, frequent reminders and incentives might be necessary to drive engagement, whereas others may need interventions that foster a deeper, personal connection to the behaviour. By dynamically adjusting these motivational elements, DBCIs can potentially maintain higher levels of engagement and better outcomes in behaviour change.

Environmental and Contextual Factors Affecting Engagement

HeartSteps II also explored the influence of environmental and contextual factors on engagement, such as perceived busyness, weekend versus weekday, and environmental conditions like temperature. The study showed that these factors significantly impacted how participants engaged with the DBCI.

For instance, perceived busyness often negatively impacted app engagement, as participants were less likely to interact with the app or complete

their physical activity goals when they reported feeling busy. This relationship emphasises the need for DBCIs to adapt to the user's current context—delivering prompts when the user is less likely to be busy and more open to engaging with the app.

Interestingly, the study found that the weekend positively affected engagement for several participants, with users demonstrating higher levels of interaction and physical activity on weekends compared to weekdays. This suggests that users might have more time or be more motivated to engage with DBCIs during their leisure time, highlighting the potential for DBCIs to adjust the frequency and timing of prompts based on the day of the week.

Temperature also played a role, particularly for Hispanic/Latino participants, where higher temperatures were associated with increased engagement. Conversely, for non-Hispanic/Latino Whites, temperature hurt engagement. These findings point to the necessity of considering cultural or demographic factors in the design of DBCIs to ensure they are optimised for different populations.

Conclusion

The HeartSteps II study offers valuable insights into the dynamic nature of engagement in digital behaviour change interventions. By applying system identification methods and fluid analogy models, the researchers were able to capture the complex relationships between psychological, environmental, and contextual factors and their impact on engagement. Understanding these dynamics is crucial for designing effective DBCIs that can adapt to individual users' needs in real time, thereby promoting sustained engagement and long-term behaviour change.

The results of HeartSteps II underscore the importance of personalising DBCIs to account for fluctuations in motivation, environmental conditions, and individual user contexts. Adaptive interventions, such as Just-in-Time Adaptive Interventions (JITIs), which tailor support based on the user's current state, can significantly enhance the effectiveness of DBCIs. By leveraging the dynamic insights provided by studies like HeartSteps II, we can move closer to creating highly personalised, responsive interventions that support sustained health behaviour change.

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