PreLapse Prototype Software Development for Opioid Use Disorder Patients

Jacob Schmieder[1*], Scott Pappada, PhD[2], Solomon Teye-Lartey[1], Saurav Basaula[1], Hilarion Amedzekor[1], Earshed Al Mamun[1]

[1]College of Medicine and Life Sciences, The University of Toledo, Toledo, OH 43614
[2]Associate Professor and Director of Research for the Department of Anesthesiology, The University of Toledo, Toledo, OH 43614

*Corresponding author: jschmie3@rockets.utoledo.edu

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Background: For those who had opioid use disorder, staying sober and avoiding relapse is a challenge. Stressors in an individual's life can contribute towards relapse events but can often be difficult to identify prior to the relapse (1). Better recognition of accumulating stress in recovering opioid use disorder patients allows for them to address the causes of their stress, take evasive actions to mitigate the source of their stress, and ultimately avoid relapse.

Objectives: The PreLapse technology aims to develop a functional wearable device that identifies stress in an individual's life. Using metrics such as heart rate, heart rate variability, sleep quality, and daily routine metrics, stress and relapse risk can be identified in opioid use disorder patients. By sending notifications to a connected phone, these patients will be informed of potential stress episodes and can then take action to lessen the stress and avoid relapse.

Methods: The wearable device transmits three axis acceleration, blood volume pulse, and electrodermal activity to the software package within the device. Sensor outputs and signal processing algorithms are then used to develop metrics related to stress and activity. Physical state detection identifies the state of the wearer and is used to determine their overall activity level and daily routines. The daily patterns are used to identify deviation from a typical day for the wearer. Large, consistent deviations from a typical day can lead to a push notification about relapse risk. Further, state detection identifies sleep, and by using heart rate and electrodermal activity, it is able to identify sleep and sleep quality. The blood volume pulse is used to determine heart rate and heart rate variability. Both heart rate and heart rate variability can also be used to determine stress level, as low variability in heart rate is found during stress. Electrodermal activity is a measurement of sweat and temperature levels within the skin; in stressful situations, electrodermal activity is higher. Together, these metrics aid in identifying a potential risk of relapse.

Results: Current results are the prototypes of various functional modules for the wearable device's software. The functional modules are heart rate, heart rate variability, state detection, pattern detection, sleep quality, and stress. The heart rate and heart rate variability functionally detect the wearer's heart rate and the average beat-to-beat variability in heart rate. State detection deciphers between physical states such as sitting, sleeping, walking, and an active state. Pattern detection recognizes day-to-day and week-to-week differences in physical states, measuring consistency between daily and weekly schedules. The sleep quality module assesses various sleep metrics to assess

overall quality of sleep, including latency and awakenings. Electrodermal activity and heart rate variability assess for stress in inactive and walking physical states.

Conclusion: The initial prototype software for the PreLapse wearable retroactively identifies the outputs of the given functions, assessing risk factors for potential opioid relapse.

