

Title: The Autonomic Craving Signature: a pattern of physiological signals associated with craving in daily life among tobacco, alcohol and cannabis users with Substance Use Disorder

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Aim: Among the 11 DSM-5 SUD symptoms, craving, a strong urge to use, is the most central, discriminant and prevalent. Fluctuations of craving intensity have been prospectively associated with use, making it a target for treatment. However, to be examined, craving needs to be self-reported, which limits long-term monitoring and requires cognitive abilities that may be impaired. Ecological momentary assessment (EMA) overcomes memory bias by repetitive assessment on smartphones in daily life. Cue reactivity Laboratory studies have shown that craving is associated with physiological variations that can now be continuously monitored in daily life. The aim was to identify craving through the analysis of physiological signals captured in daily life, opening the way to biomarkers of craving.

Methods: In a 14-day observational mixed methods study in daily life among individuals with a variety of SUD we combined wearable sensors (Blood Volume Pulse, Electrodermal Activity, skin temperature, accelerometry) with EMA for signal- (4 times/day) and event-contingent (triggered by the participant) surveys. We used principal component analysis (PCA) to reduce dimension space of features extracted, machine learning algorithms to discriminate craving from no-craving periods and permutation test.

Results: 45 subjects were included. EMA completion rate was 85.8% (n=2,017) and 5,512 hours of physiologic data were captured over the course of 14 EMA-days. 384 samples of "craving" (n=192) and "no-craving" (n=192) were analyzed by PCA in which 31 principal components explained 98.8% of variance data. We tested 3 different classification algorithms with which we reached between 58.3% and 73.6% of accuracy.

Conclusions: Performance of our binary classification model was better than a random binary classifier (i.e.: AUC-ROC > 0.55) and this set of features forms a physiological pattern that can distinguish craving from no-craving states and that we labeled *the autonomous craving signature (ACS)*.

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Conflicts of interest: none

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