Do Digital Behaviors Describe Individual Differences in Emotion Regulation? Using Smartphone Data to Characterize Physiological and Subjective Responses to Sadness

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The proposed research seeks to advance the validity and assessment of emotion regulation by examining the correlates of subjective, physiological, and digital behavior. The ability to effectively regulate negative affect is fundamental to well-being and mental health disorders. Although emotion regulation, or the effortful and automatic processes that impact the strength, frequency, and duration of emotional responses (Gross, 2014), has an impressive body of research, the majority of research on emotion regulation has been confined to controlled laboratory settings and is limited by an exclusive reliance on participants' self-report of their emotional experiences. Improved assessment of emotion regulation will lead to a more precise understanding of emotion regulation deficits necessary for personalized intervention. A complete understanding of emotion regulation requires an unobtrusive ecologically valid assessment emotion regulation as it occurs in the environment. Digital sensors in smartphones enable the collection of data from individuals in their naturalistic settings, and with high accuracy (Onnela & Rauch, 2016). Digital phenotyping, or moment-by- moment quantification of individual level human behavior using data from smartphone sensors (Torous & Onnela, 2016), is a novel method for evaluating human behavior in naturalistic settings.

The proposed research will harness naturally occurring smart phone data to advance the construct validity of emotion regulation by evaluating the digital behavior correlates of self-reported emotion regulation (Aim 1), the digital behavior correlates of mood-mediated psychophysiological regulatory responses (Aim 2), and whether trait emotion regulation interacts with physiological activity to predict digital behavior (Exploratory Aim). Using a multimethod, multidisciplinary approach that bridges psychology, physiology, and computer science, adults from the general population (N = 110) will complete a laboratory session consisting of self- report questionnaires and a negative mood induction while psychophysiological data is recorded. Participants will then complete the EMA/digital phenotyping portion of the study which involves installing an application on their smartphone that will collect passive data and pushes periodic self-report surveys over a 7-day period. A supervised machine learning approach using generalized linear mixed models (GLMM) will be used to identify and evaluate patterns in the smartphone sensor data and how they are associated with different levels trait emotion regulation and psychophysiological regulatory functioning. It is expected that the results of this project will provide initial validation of digital behaviors as a measure of emotion regulation. These findings will create new knowledge and advance the validity and assessment of emotion regulation and will increase our ability to identify and target deficits in emotion regulation, improving outcomes for the treatment of mood disorders.

Keywords: emotion regulation, negative affect, digital phenotyping, psychophysiology, assessment