Research report

Ecological momentary assessment of affect and craving in patients in treatment for prescription opioid dependence

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ABSTRACT

Low positive affect (PA) is likely to contribute to risk of relapse; however, it has received relatively little attention in clinical research. This study examined the associations among positive affect, negative affect (NA), and craving in medically withdrawn patients using ecological momentary assessment (EMA). Participants ($n = 73$) provided reports of their PA, NA, and craving 4 times a day for an average of 10.47 (SD = 3.80) days. Person- and day-level associations between PA, NA, and craving were examined using multilevel models. A significant interaction emerged between person- and day-level PA such that PA on the day level was negatively associated with craving for individuals experiencing low mean PA throughout the study. No significant interaction emerged between person- and day-level NA. The main effects for both person- and day-level NA were significant. Individuals experiencing high NA throughout the study experienced higher craving overall and on days when NA was higher than usual, craving was also higher. Results suggest that high person- and day-level NA may directly contribute to the risk for relapse via increased craving, whereas low day- level PA may contribute to risk for relapse among individuals exhibiting low person-level PA via increased craving on days with lower than average levels of PA for those individuals. Given that there is a paucity of research relating low PA to craving, continued investigation into how and when low PA creates risk for relapse is warranted.

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1. Introduction

Prescription opiate dependence is a serious problem in the United States, with approximately 1.9 million people suffering from substance use disorders associated with opioid analgesics (SAMHSA, 2013). Treatment admissions for the primary abuse of opiates other than heroin have increased from one percent of all admissions in 1997, to 10% in 2012 (SAMHSA, 2014). In addition, there is growing evidence that a relationship exists between prescription opiate dependence and subsequent heroin abuse, further exacerbating the opioid epidemic (SAMHSA, 2013). Prescription opiate dependence, like dependence on other drugs of abuse, is a disorder of chronic relapse; as such, there is a pressing need to address factors that identify and attenuate the risk of relapse (O'Brien et al., 1998; Tkacz et al., 2012). The primary purpose of the current study was to investigate the relationship between a relatively understudied construct, low positive affect (PA), and craving in a sample of prescription opiate dependent patients in residential treatment. Ecological momentary assessment (EMA) data were used to predict craving from both person-levels and day-levels of PA, as well as their interaction. The associations between negative affect (NA) and craving were also examined to evaluate potential differences in the relationship of NA to craving relative to PA, as well as to ensure that the results for PA and craving were independent of levels of NA.

Deficits in the experience and expression of emotion have been linked to substance use disorders (SUDs) even in the absence of affective psychopathology, emphasizing the need to better understand the role of affect in SUDs (Cheetham et al., 2010; Goldstein and Volkow, 2011). Such research may help clarify how risk is conferred, and how addictive behaviors are maintained, thereby

facilitating better treatments and attenuating relapse (Cheetham et al., 2010). Dysregulated affect, including anhedonia, irritability, anxiety, and dysphoric mood, as well as increased reactivity to stress and craving, are common symptoms of the abstinence symptomatology observed in post-withdrawal state from opiates (Koob and LeMoal, 2001; Martin et al., 1973). Similar abstinence symptomatology has been described in alcohol, cocaine, cannabis, stimulants, (Bovasso, 2001; Gawin and Ellinwood, 1988; Gawin and Kleber, 1986; Heinz et al., 1994; Miller et al., 1993), and polysubstance abuse (Martinotti et al., 2009). These symptoms are thought to increase vulnerability to relapse in the early stages of abstinence and beyond, into the phase of protracted withdrawal (Heilig et al., 2010). Little is known, however, about the role of low PA as it relates to craving and relapse in the early stages of prescription opiate dependence. This lack of knowledge stems from fewer studies that evaluate the role of low PA as it contributes to craving and relapse in early abstinence, relative to studies that examine the role of NA (Cheetham et al., 2010).

One reason that low PA may have been overlooked is that many investigators (tacitly) ascribe to a circumplex model of affective space; within this model PA and NA are conceptualized as opposite ends of a continuum, rather than as independent neural systems with separate neurophysiological underpinnings (Ameringer and Leventhal, 2010; Bujarski et al., 2015). As such, many investigators focus on NA and stress response systems to the exclusion of the PA system. Indeed, NA, or dysphoria, is regularly cited as a persistent symptom of withdrawal from opiates that contributes to risk of relapse (Nestler, 2001; De Vries and Shippenberg, 2002; Epstein et al., 2009; Moore et al., 2013). However, there is considerable evidence that NA and PA are indeed relatively independent, and may function together or independently (Cacioppo and Berntson, 1994; Cacioppo et al., 1999; Norman et al., 2011).

Recent research suggests that low PA, independent of NA, may be associated with increased craving, putting patients at greater risk for relapse. A recent study using inventory measures of affect and craving found that PA moderated the association between stress and NA such that individuals with higher levels of PA exhibited a weaker associations between stress and NA in treatment-seeking alcohol-dependent outpatients (McHugh et al., 2013). Importantly, however, PA was negatively associated with alcohol craving. Short term increases in PA have also been associated with a decreased risk for smoking lapse, suggesting PA may play a protective role in early nicotine abstinence (Ferguson et al., 2006). Bujarski et al. (2015) also found that PA was negatively correlated with craving, whereas the level of withdrawal/NA was positively associated with craving. However, the temporal dynamics were different, demonstrating the independent role of PA in nicotine abstinence over and above that of NA.

Similar results have been found with regards to a related construct, anhedonia. Defined as the impaired capacity to experience pleasure, or the inability to experience pleasure in response to rewarding stimuli (Snaith, 1993), anhedonia can be conceptualized as either a state symptom or a personality trait. As a trait, anhedonia varies widely in the population, lies on a continuum, and can be distinguished psychometrically from similar constructs such as sadness, flattened affect, and avolition (Leventhal et al., 2006; Loas et al., 2008, 1994). Anhedonia has frequently been described in substance dependent populations, especially as part of the abstinence syndrome (Hatzigiakoumis et al., 2011). Although it plays a critical role in theoretical models of relapse (e.g., Koob and Le Moal, 2001; Volkow et al., 2002), several investigators describe anhedonia as underrepresented in the literature (Garfield et al., 2014; Hatzigiakoumis et al., 2011; Martinotti et al., 2012; Sussman and Leventhal, 2014). Consistent with the findings with regard to low PA, Janiri et al. (2005) demonstrated that craving was positively associated with anhedonia levels in an opiate-dependent patient population, whereas craving was negatively associated with hedonic capability. Anhedonia has also been shown to have a positive correlation with craving in recently withdrawn alcohol- dependent (Martinotti et al., 2008a,b), opioid- dependent patients (Martinotti et al., 2008a), and recently abstinent tobacco smokers (Cook et al., 2004; Leventhal et al., 2009). Although low PA and anhedonia are empirically related when each is measured with a trait-style questionnaire (Pearson's correlations ranging from .20 to .43; Cook et al., 2007; Franken et al., 2007; Leventhal et al., 2009), they are not identical constructs (Ameringer and Leventhal, 2010). Whereas an individual with low PA may have a sustained period of boredom, disinterest, and attenuated pleasure, they are able to experience pleasure in response to a rewarding stimulus should they encounter one in their environment. The anhedonic individual, in contrast, does not experience pleasure or experiences significantly attenuated pleasure in response to putatively rewarding stimuli. Whereas there may be overlap between these two constructs, there is good reason to study low PA versus the trait of anhedonia.

The current study investigated associations between daily levels of craving—perhaps the most proximate intrapersonal state trigger for relapse—and both the person-level and day-level means of PA and NA. This level of analysis was motivated, in part, by the observation that individuals have been shown to have difficulty accurately evaluating the intensity of their own emotional ratings across time (Fredrickson and Kahnemann, 1993; Kahnemann et al., 1993; Redelmeier and Kahnemann, 1996). Research suggests that retrospective evaluations of affective experiences appear to be determined by a weighted average of the actual affective experiences. For example, Thomas and Diener (1990) have shown that, when asked to recall emotional intensity across a time span (e.g., 3–6 weeks), people tend to overestimate their emotional intensity relative to their actual daily ratings, and underestimate the frequency of their positive affect vs. their negative affect. Consequently, trait ratings of emotional intensity (e.g., like those used in questionnaire measures of anhedonia), are more likely to reflect the influence of the individual's overall conceptualization of who they think they are, rather than their actual daily experiences of mood (Pennebaker, J.W., personal communication, April, 2000). Whereas trait ratings have important predictive validity, accurate assessment of mood states are expected to provide additional insights into the relationship between low PA, NA and craving.

EMA serves as a more accurate method for participants to report their subjective experiences (Freedman et al., 2006). During EMA, participants take a brief survey several times a day to capture total mood, diurnal changes in mood, and changes in mood over an extended period of time. The use of EMA provides a robust assessment of PA that can help reduce the systematic influences stemming from participant response bias, in part by measuring the events close in time to the actual moods (Moskowitz and Young, 2006). Summing across these multiple assessments also provides increased reliability relative to single time-point or retrospective reports (Bolger and Laurenceau, 2013). As such, EMA is expected to add to our understanding of the relationship between low PA and craving

Beyond EMA's methodological capacity to increase reliability by collecting data on emotional states and experiences closer to the time when they are experienced, EMA provides data that can allow analyses to consider the within-person nature of the interrelationships between causes and effects. In the current study, analyses leveraged within-person assessments of affective states and craving to evaluate both within-day associations between craving and affect, as well as to evaluate how person-level averages (i.e., a given person's average level) of positive and negative affect interact with day-levels (i.e., that person's level on a given day) of these same affective states to influence daily experiences of craving. For example, if an individual typically reports low PA on a consistent basis,