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**THE ROLE OF NEGATIVE AFFECT AND SELF-CONCEPT CLARITY IN  
PREDICTING SELF-INJURIOUS URGES IN BORDERLINE PERSONALITY  
DISORDER USING ECOLOGICAL MOMENTARY ASSESSMENT**

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Psychology

by

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## ABSTRACT

Borderline personality disorder is a prevalent and deadly disorder that is characterized by deficits in identity, affective instability, and frequent self-injurious and suicidal behavior. Deficits in identity as well as negative affect have been shown to predict self-injurious and suicidal behaviors. However, less is known about the interactive effects of these two predictors. The current study aims to examine the moderating effect of a particular component of identity, self-concept, on the relationship between negative affect and self-injurious/suicidal urges. The purpose of the present study is twofold. First, we aim to examine psychological processes that may serve as mechanisms involved in self-injurious behavior in BPD. More specifically, we are interested in the interplay of two specific features of BPD, negative affect and identity disturbance, as they relate to self-injury. Much of the research on suicide and self-injury has focused on identifying risk factors and correlates of these behaviors (e.g., family history of suicide, access to firearms, etc.). Although this is valuable research for identifying factors that may be associated with suicide and self-injurious behaviors and may indirectly help to reduce the prevalence or lethality of a suicide attempt or self-injury (e.g., removing firearms from the home of an individual who is suicidal), it does not tell us much about the actual psychological mechanisms that are involved in such behavior. Understanding the psychological mechanisms involved in self-injury in BPD is important because these mechanisms can serve as direct targets in therapy that, when addressed, may result in longer term change. A second aim of the present study is to utilize an ecological momentary assessment (EMA) approach to studying self-injury in the daily lives of individuals with BPD. As will be discussed later, utilizing an approach that can

capture the temporal dynamics observed in BPD is crucial for gaining a more valid understanding of psychological processes such as negative affect and identity, their relation to self-injury, and how these processes play out in one's daily life.

The present study utilizes an ecological momentary assessment (EMA) approach to study the role of negative affect and self-concept clarity in predicting self-injurious urges among 55 outpatients diagnosed with BPD or an anxiety disorder who completed randomly prompted surveys on smartphone devices over the course of 21 days. Expected results will be discussed in the context of a data analytic plan utilizing multilevel modeling (MLM).

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## Chapter 1

### INTRODUCTION

#### **Borderline Personality Disorder**

Borderline personality disorder (BPD) is a chronic, debilitating, and deadly disorder characterized by chaotic self-defeating interpersonal relationships, emotional lability, identity disturbance, poor impulse control, and angry outbursts (American Psychiatric Association, 2000). BPD is also associated with self-injury, which occurs in 69-75% of BPD patients (Kjellander, Bongard, & King, 1998), and a high risk of suicide (Black, Blum, Pfohl, & Hale, 2004; McGlashan, 1986; Paris & Zweig-Frank, 2001; Pompili, Girardi, Ruberto, & Tatarelli, 2005; Stone, 1983), with suicide completion rates ranging from 3-9.5%. Not only is BPD a highly lethal disorder, it is also highly prevalent. Prevalence rates are approximately 1-2% in the general population, 14% among psychiatric outpatients, and 20% among inpatients (Lenzenweger, Lane, Loranger, & Kessler, 2007; Lenzenweger, Loranger, Korfine, & Neff, 1997; Torgersen, Kringlen, & Cramer, 2001; Trull, Jahng, Tomko, Wood, & Sher, 2010; Zimmerman & Mattia, 1999; Zimmerman, Rothschild, & Chelminski, 2005). BPD is also commonly comorbid with other disorders that carry a suicide risk, such as major depression and substance use disorders (Zanarini et al., 1998), further increasing the risk of suicide (Kelly, Soloff, Lynch, Haas, & Mann, 2000).

Given the presence of frequent self-destructive behaviors, it is not surprising that BPD patients also tend to make use of healthcare services such as emergency rooms, outpatient clinics and inpatient units at high rates (Bongar, Peterson, Golann, & Hardiman, 1990; Zanarini & Frankenburg, 2001). Adding to the challenges these

individuals present, BPD patients are particularly difficult to treat, as they tend to make chaotic use of mental health services, drop out of treatment frequently, attend treatment erratically, and comply poorly with psychiatric medications (Dimeff, McDavid, & Linehan, 1999; Kelly, Soloff, Cornelius, & George, 1992). Thus, BPD is a highly prevalent, comorbid, deadly, and difficult to treat disorder that represents a serious public health concern worthy of research, particularly with regard to the more lethal features associated with the disorder (i.e., suicide and self-injurious behavior).

### **Suicide Risk in General**

Research focused on suicide risk more generally has indicated several important risk factors for suicide, including a family history of suicide (Lester, 2002; Roy, Segal, Centerwall, & Robinette, 1991), certain medical conditions (e.g., cancer, HIV) and pain (Ilgen et al., 2010), as well as access to lethal means to commit suicide (Yip et al., 2012). Another significant risk factor for suicide includes previous suicide attempts and a history of self-injury. Individuals with a history of self-injury are at a 10-30 times greater risk of suicide than those without such history and this risk is highest within the first 6 months following a self-injurious episode (Cooper et al., 2005; Gunnell & Frankel, 1994).

### **Suicide Risk in BPD**

Although nearly all mental disorders are associated with some degree of suicide risk and suicidal and self-injurious behavior can occur in other contexts, BPD is the only disorder in the *Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition* (DSM-5; American Psychiatric Association, 2013) to include *recurrent* suicidality and self-injurious behaviors as part of its diagnostic criteria. Therefore, individuals with BPD

represent a unique and ideal diagnostic group for studying suicidal and self-injurious behaviors.

### **Nonsuicidal Self-Injury**

Nonsuicidal self-injury (NSSI; Klonsky, May, & Glenn, 2013) involves direct, deliberate destruction of body tissue in the absence of lethal intent (Nock & Favazza, 2009; Nock, Wedig, Janis, & Deliberto, 2008) and can include such behaviors as cutting, burning, or damaging the skin or body in some other way. Although the DSM combines suicidal and NSSI into a single criterion for BPD and the behaviors frequently co-occur (Klonsky & Muehlenkamp, 2007; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Whitlock, Eckenrode, & Silverman, 2006), there is evidence to suggest that they have important differences. Specifically, NSSI is more prevalent than suicide attempts, with prevalence rates in the general population around 4% for NSSI and 2.7% for suicide attempts (Briere & Gil, 1998; Nock & Kessler, 2006). NSSI also tends to occur more frequently than suicide attempts (Favazza & Conterio, 1989; Soloff, Lis, Kelly, Cornelius, & Ulrich, 1994). Additionally, NSSI and suicide attempts often differ in terms of the methods used (cutting/burning with self-injury vs. self-poisoning/overdose with suicide attempts; Centers for Disease Control and Prevention, 2015; Favazza, 1998) and severity (NSSI is not usually as medically severe as a suicide attempt). Finally, NSSI and suicide attempts differ in terms of their function. Whereas the function of a suicide attempt is typically to end one's life, the function of NSSI varies widely and is thought to serve as a way to regulate affect, end dissociative episodes, create interpersonal boundaries and influence, punish oneself, and avoid an actual suicide attempt (see Klonsky, 2007 for review).

NSSI behaviors are particularly important for understanding the longer-term prognostic outlook for individuals with BPD. Although by definition BPD patients who engage in NSSI do not intend to commit suicide, the impulsive nature of these behaviors presents a risk for accidental suicide (Yen et al., 2004), with suicide completion rates among BPD patients with a history of NSSI being twice that of those without such a history (Stone, 1989). In an attempt to better understand and predict NSSI in BPD, a number of studies have sought to identify factors that may predict such behaviors.

In a sample of 101 women with BPD and a history of NSSI, Kleindienst et al. (2008) found that the primary motives for NSSI were to reduce aversive tension and unpleasant feelings or to punish oneself. Examining patients' reported emotional states before and after NSSI revealed a typical pattern that involved increased tension and feelings of emptiness, loneliness, guilt, depression, sadness, anger, disgust, and numbness prior to NSSI episodes and a decrease in these symptoms following NSSI episodes. Similar findings have been replicated in a laboratory setting among non-BPD self-injurers (Weinberg & Klonsky, 2012). Other studies with BPD patients also point to a reduction in aversive feeling states, such as anger, as a motive for NSSI (M. Z. Brown, Comtois, & Linehan, 2002; Hulbert & Thomas, 2010; Sadeh et al., 2014). In addition to reducing aversive feeling states, there is some evidence that NSSI may also be used as a way of expressing negative emotions, such as shame and self-punishment (M. Z. Brown, Linehan, Comtois, Murray, & Chapman, 2009; Kleindienst et al., 2008). Together, these findings suggest that there is an important relationship between the regulation and expression of heightened levels of negative affect and NSSI.

Although the relationship between negative affect and NSSI is fairly well-established, this relationship does not tell the whole story. For example, other disorders, such as anxiety and depressive disorders, are associated with high levels of negative affect (Watson, Clark, & Carey, 1988) but are not associated with self-injurious behaviors. Additionally, negative affect is not uncommon to experience in the absence of psychopathology and has not been shown to be associated with self-injury. Thus, other factors, in addition to negative affect, may contribute to NSSI in BPD. Another important, but less studied, component of BPD that may be important in predicting NSSI is identity disturbance, a core feature of BPD.

### **Identity Disturbance**

The concept of identity disturbance is defined in the DSM-5 as a markedly and persistently unstable self-image or sense of self (American Psychiatric Association, 2013). Similarly, Kernberg (1984) defines identity disturbance as the lack of a well-integrated sense of self and of others and it often manifests in chronic feelings of emptiness, contradictory and unstable self-perceptions, and impoverished perceptions of others. Identity disturbance in BPD has been characterized as a lack of a consistent view of self and others across time, difficulty making differentiations between self and other representations, and having more complex but unintegrated negative representations of themselves (Beeney, Hallquist, Ellison, & Levy, 2016) and the presence of identity disturbance in BPD has been shown to be predictive of self-injurious and suicidal behavior in general (Yen et al., 2004). However, most of the research in this area has focused on views of others with much less attention to views of self. Specifically, studies with BPD patients have shown that those who are more likely to engage in NSSI or

attempt suicide have more impaired views of relationships and less emotional investments in others (Kaslow et al., 1998), expect others to behave malevolently, express less investment in interpersonal relationships and more hostility and aggression toward others (Macewan, 2011; Whipple & Fowler, 2011).

Clinical theory suggests that deficits in both aspects of identity, views of self *and* views of others, are central features of BPD (Kernberg, 1984) and therefore, both should be considered when studying identity. The construct of self-concept clarity, which is conceptualized as the “extent to which self-beliefs are clearly and confidently defined, internally consistent, and stable,” (Campbell et al., 1996) is thought to tap into the self-aspect of identity. There is some evidence to suggest that deficits in self-concept are related to a greater frequency of suicidal and self-injurious behavior in general (Hawton, Kingsbury, Steinhardt, James, & Fagg, 1999; Santos, Saraiva, & De Sousa, 2009), though these studies did not assess for BPD in their samples.

In discussing identity disturbance, Kernberg (1984) also posits that one’s views of self and others are inherently linked to one’s emotional experience. Because relationship representations of self and others develop in the context of emotional experience and thus have an affective component, identity disturbance should moderate the relationship between negative affect and NSSI. For example, in the context of a stable and integrated identity, negative affect can be experienced while at the same time being able to maintain a consistent sense of self and others and to draw on knowledge about the self and others that can be soothing and adaptive. In contrast, when one’s identity is unstable and unintegrated, as in the case of individuals with BPD, negative affect is thought to be experienced very differently, the ability to draw on information about ones’ self and

others that is soothing is limited, and individuals may resort to less adaptive ways of soothing or regulating oneself, such as self-injury.

Given the research and theory described above, negative affect and components of identity such as self-concept may play an important role in predicting NSSI such that NSSI would be most likely to occur during times when an individual has particularly impoverished views of themselves and others as well as high levels of negative affect. However, the interplay between these factors, though central to theories of BPD, has yet to be demonstrated empirically and the present study aims to fill this gap in the literature. Before discussing the hypotheses of the present study, it would be wise to consider an important methodological concern in the literature that informs the approach to studying BPD that will be used in this study.

### **Instability in BPD**

Because BPD is characterized by a "...pervasive pattern of *instability* of interpersonal relationships, self-image, and affect, and marked impulsivity that begins by early adulthood and is present in a variety of contexts (emphasis added, American Psychiatric Association, 2000, p. 706), an important consideration when studying BPD is being able to capture the unstable nature of the characteristics associated with the disorder. Despite these characteristics, nearly all of the previously discussed research on factors associated with NSSI in BPD have utilized retrospective self-report and/or interview instruments that ask participants to recall episodes of self-injury and associated thoughts, behaviors, and motives, sometimes over the course of the past 6 months, 1 year, or beyond. This is problematic because retrospective reports aimed at addressing how individuals with BPD *typically* feel and behave might not be capturing the moment-to-

moment fluctuations that define the disorder (Hopwood & Morey, 2007). In fact, there is recent evidence to suggest that when providing retrospective reports, individuals with BPD may not recall even their most drastic mood changes (Solhan, Trull, Jahng, & Wood, 2009), calling into question the validity of the use of retrospective measurement in this population. Furthermore, previous studies have typically examined factors associated with NSSI in BPD cross-sectionally by looking at thoughts, feelings, behaviors, and motives around discrete episodes of self-injury, ignoring the temporal instability that is central to the definition of the disorder.

Ecological Momentary Assessment (EMA) involves the use of intensive repeated measurement of affective, behavioral, and/or contextual variables throughout the course of an individual's daily life and represents an important advance in measurement. Given the defining features of BPD, EMA appears to be particularly suited for capturing the interpersonal and affective dynamics of BPD. Researchers have begun utilizing EMA approaches to studying BPD and findings have been promising, despite some initial limitations and challenges associated with the approach (e.g., compliance, timing of assessments, etc.; see Santangelo, Bohus, & Ebner-Priemer, 2014). Research thus far has focused on understanding specific aspects of BPD in isolation such as affective instability (Jahng et al., 2011; Jahng, Wood, & Trull, 2008; Solhan et al., 2009; Trull et al., 2008), interpersonal disturbances (Russell, Moskowitz, Zuroff, Sookman, & Paris, 2007; Stepp, Hallquist, Morse, & Pilkonis, 2011), self-esteem (Tolpin, Gunthert, Cohen, & O'Neill, 2004), and suicidality (Links et al., 2007; Nisenbaum, Links, Eynan, & Heisel, 2010). Previous studies that examined suicidality (Links et al., 2007; Nisenbaum et al., 2010)

found that the intensity of negative mood was predictive of suicidal ideation but they did not examine self-injurious behaviors.

One final challenge associated with the study of self-injurious behaviors is that such behaviors typically occur at a low base rate, making it difficult to study on a momentary level (e.g., across a 21-day period). Thus, rather than examining the presence of *engagement* in self-injurious behavior across the study period, the present study examines self-injurious *urges*, in a similar vein as previous researchers have studied suicidal ideation. Furthermore, just as suicidal ideation precedes a suicide attempt, the urge to engage in self-injurious behaviors precedes engagement in such behaviors and therefore are meaningful and may inform our understanding of the psychological processes involved in self-injury.

### **Hypotheses**

With the above considerations in mind, the present study predicts that momentary negative affect will positively predict momentary self-injurious urges such that greater levels of negative affect will predict stronger urges to engage in self-injurious (H1). Similarly, momentary self-concept clarity will negatively predict momentary self-injurious urges such that lower self-concept clarity will predict stronger urges to engage in self-injurious behavior (H2). Finally, we predict that the relationship between negative affect and self-injurious urges will be moderated by self-concept clarity. Specifically, it is predicted that the strength of the positive relationship between negative affect and self-injurious urges will be greater when self-concept clarity is low (H3). Additional analyses will be aimed at exploring the possible moderating relationship of person-level variables, such as diagnostic group.

## Chapter 2

### METHOD

#### Participants

Participants include 55 patients with either a diagnosis of BPD or any anxiety disorder (ANX; BPD, n=35; ANX, n=20) who were recruited from a large community mental health center (CMHC). As shown in Table 1, the overall sample was predominately female (86%), heterosexual (69%), Caucasian (86%), and single (51%), and the average age was 30.58 (SD=10.08). Participants were recruited as part of a larger pilot study with broader aims than the present study through two different recruitment sources, CMHC Intake and CMHC Previous Studies (described below).

**CMHC Intake.** All scheduled intakes at a large community mental health center were eligible for screening for participation. Potential participants were approached by their intake evaluator during the initial intake assessment conducted as part of the standard procedures at the CMHC or by their therapist in the first or second session. Potential participants were asked if they would be interested in participating in a study on social functioning in daily life. If participants were interested, they were asked to provide their contact information and sign a release form to allow the research team to access their protected health information (PHI) for the purposes of determining eligibility. To be eligible for the study, patients had to have either a diagnosis of BPD or any anxiety disorder and could not have a history of schizophrenia, schizoaffective disorder, Bipolar I disorder, delusional disorder, delirium, dementia, amnesic disorder, or cognitive disorder NOS and they could not have active substance dependence. As shown in Figure 1 under

the “Clinic” column on the left side of the figure, of the 116 patients referred to the study from the CMHC, 53 patients did not meet the inclusion criteria.

Potential participants (n=58) who met diagnostic eligibility were contacted by the research team and further screened for characteristics that would interfere with a second phase of the study involving hormonal and physiological data collection that was part of the larger overall goals of the study but not relevant to the present analyses. Phase 2 exclusion criteria included visual impairment that could not be corrected to normal, endocrine disease, currently taking steroids or estrogen therapy, and irregular menstruation, lactation, or pregnancy within the last 6 months. As shown in Figure 1, of the 58 patients referred to the study, 0 were excluded due to not meeting criteria for phase 2, 7 were excluded because they no longer were interested in participating, and 6 patients were not enrolled after agreeing to participate because they didn’t show up for their scheduled appointment and did not respond to additional phone calls. The 45 remaining participants who were not excluded during this phase of recruitment were scheduled for an initial appointment (described below) and were enrolled in the study.

**CMHC Previous Studies.** An additional 57 patients with a BPD diagnosis were potentially eligible for the study and represent the second recruitment source for the study. These patients were initially recruited from the same CMHC as the patients described above but for a different study conducted previously and gave consent to be contacted for future research opportunities. Intake procedures for these patients were the same as the patients described above. As shown in Figure 1 under the “LevyLab” column on the right side of the figure, of the 57 eligible patients, 22 had up-to-date contact information and were able to be contacted by phone. Eight of these patients were

not interested in participating. Of the 14 patients who agreed to participate, 1 was not enrolled after agreeing to participate because they didn't show up for their scheduled appointment and did not respond to additional phone calls, and 1 was excluded during the phone screening process for phase 2 described above. The 12 remaining participants who were not excluded during this phase of recruitment were scheduled for an initial appointment (described below) and were enrolled in the study.

Thus, 45 individuals were enrolled from the CMHC Intake recruitment source and 12 individuals were enrolled from the CMHC Previous Studies recruitment source resulting in a sample of 57 patients. An additional 2 patients were excluded from the present study after being enrolled because it was determined that they did not actually meet diagnostic criteria for the study resulting in a final sample of 55 patients.

## **Measures**

**Semi-structured Diagnostic Interviews.** The Anxiety Disorders Interview Schedule for DSM-IV-PSU Version (ADIS-IV-PSU; T. A. Brown, Di Nardo, & Barlow, 1994) and the International Personality Disorders Examination (IPDE; Loranger, 1999) are semi-structured clinical interviews designed to assess for the presence of DSM-IV-TR Axis I and II pathology, respectively. The ADIS-IV-PSU and IPDE were given to all patients in the study during the initial intake assessment conducted during the recruitment phase. Based on these interviews, a Global Assessment of Functioning (GAF) rating was made which indicates an overall level of functioning. GAF scores range from 0 to 100 with higher scores representing better overall functioning.

***ADIS-IV-PSU.*** The ADIS-IV-PSU is a semi-structured clinical interview based on the original ADIS-IV, which is designed to assess for the presence and severity of

DSM-IV-TR anxiety disorders, but was modified to also include current and lifetime assessment for DSM-IV-TR mood, psychotic, substance use, eating and somatoform disorders. Responses from the ADIS-IV-PSU are coded to determine the presence/absence of each diagnosis as well as a severity rating made by the clinician. The ADIS-IV has been shown to be a reliable and valid interview for assessing DSM-IV-TR Axis I pathology (T. A. Brown, Di Nardo, Lehman, & Campbell, 2001).

***IPDE.*** The IPDE is a semi-structured clinical interview designed to assess for the presence of DSM-IV personality pathology. Responses from the IPDE are coded to provide a criterion score, from which a personality disorder diagnosis can be determined as well as a dimensional score for each personality disorder. The IPDE has been shown to be a reliable and valid interview for assessing DSM-IV Axis II pathology (A.W. Loranger et al., 1994).

**Baseline Assessment.** Baseline assessments consisted of a battery of self-report surveys including a number of measures relevant to the broader study but not used in the present study. For the present study, relevant baseline assessments included the McLean Screening Instrument for Borderline Personality Disorder (MSI-BPD; Zanarini, Vujanovic, Parachini, & Boulange, 2003), Self-Concept Clarity Scale (SCCS; Campbell et al., 1996), and the Affective Lability Scale (ALS; Harvey, Greenberg, & Serper, 1989). Baseline assessments were used for characterizing the samples but were not used as part of the analyses of theoretical interest.

**Ecological Momentary Assessment.** Electronic surveys were installed on a smartphone device (more details described later). The entire electronic survey battery consisted of series of questions aimed at assessing constructs relevant for the larger study

but not the current set of analyses (e.g., substance use, anxiety, stress, physical symptoms). For the current study, items assessing negative affect, self-concept clarity, and self-injurious urges were used. The presentation and order of items was the same for each completed survey. Negative affect items were presented before self-concept clarity items, which were presented before self-injurious urge ratings.

Negative affect (NA) was assessed by asking participants to rate the degree to which they felt *irritable*, *sad*, *frightened*, and *angry*. Responses were recorded using touch-point continuums, virtual analog scales on which participants slide a marker to a point on the scale that corresponds with their ratings. This answering format is thought to reduce anchoring from repeated completion of the same items. The touch-point continuums were quantified by a 0 to 100 scale with anchors for negative affect items at *not at all* and *extremely*. Responses were averaged to compute an overall NA score such that higher scores represent greater levels of negative affect and lower scores represent lower levels of negative affect.

Self-concept clarity (SCC) was assessed by asking 2 items from the Self-Concept Clarity Scale (SCCS; Campbell et al., 1996). The SCCS is a 12-item self-report measure used to assess the extent to which self-beliefs are clearly and confidently defined, internally consistent, and stable. The 2 items used in the current study include: *Right now, I have a clear sense of who I am and what I am*, and *Right now, I feel that I am not really the person that I appear to be (reverse scored)*. Responses were recorded using touch point continuums with anchors at *strongly disagree* and *strongly agree*. Responses were averaged to compute an overall SCC score such that higher scores represent greater SCC and lower scores represent less SCC.

Self-injury urges (SIU) were assessed with a single item asking participants whether they thought of engaging in direct self-harm since the last prompt. If participants answer yes to this item, they were asked to rate how strong or intense was their urge to self-harm. Responses were given using touch-point continuums with anchor points at *not at all* and *very intense* with higher scores representing a greater urge to engage in self-injurious behaviors and lower scores representing less of an urge to engage in self-injurious behaviors.

### **Procedures**

Following an initial training session (described below), participants were issued a Motorola Razr with Android operating system. The smartphone devices were programmed specifically for the purposes of the study by programmers at the Dynamic-Real-time Ecological Ambulatory Methodologies (DREAM) program at the Pennsylvania State University's Survey Research Center. The software was programmed to provide random prompts to participants during their waking hours (a 12-hour period between the hours of 6am-6pm, 8am-8pm, or 10am-10pm, selected by the participants during the initial training session). The software stratified this 12-hour period into six equal intervals and randomly selected a time within this interval to provide the prompt to the participant. When a prompt occurred a sound was emitted alerting participants that they needed to complete a prompted survey. Participants could then initiate the survey and answer the survey questions directly on the phone. All data were time-stamped to determine actual completion times for the surveys.

**Initial training session.** The initial training session consisted of a 1.5-hour individual meeting between a research assistant and the participant. During the session,

the participant provided informed consent, completed baseline assessments (described earlier) and listened to a presentation designed to orient them with the surveys and the smartphones. Each item on the smartphone survey was reviewed with participants to ensure they understood the questions and they listened to the prompted survey alert sound. Participants were encouraged to ask questions throughout this process. Additionally, compliance standards were reviewed with participants at this time. Participants who completed 85% of the randomly prompted surveys were given a monetary bonus. Once it was determined that they understood the questions and could demonstrate that they were able to access the surveys on the smartphone, they took the smartphone with them over the next 21-days.

**21-day burst.** Participants carried the smartphone with them over a 21-day study period and had the opportunity to respond to randomly prompted surveys 6 times per day. Participants started the 21-day period on different days of the week depending on their availability to attend the initial training session described earlier. All data were submitted electronically over a secure network, allowing researchers to check data daily for compliance to ensure participants were completing surveys consistently and to monitor for the presence of self-harm or suicidal thoughts or behaviors. If participants had 4 or fewer prompted surveys for 2 days in a row, they were contacted by a member of the research team and reminded about compliance standards. On average, participants completed 93.73 of the 126 possible prompted surveys over the course of 21 days resulting in an acceptable compliance rate (74%) that did not differ between diagnostic groups and is consistent with other EMA studies using similar procedures and samples

(Solhan et al., 2009; Tomko et al., 2014). These compliance rates resulted in 5155 observations on 55 patients.

### **Data Analytic Plan**

As stated earlier, the goal of the current study and analyses is to examine the relationship between negative affect, self-concept clarity, and their interaction on self-injurious urges. Multilevel modeling (MLM) techniques will be employed because they are best suited to address the questions proposed and the features of the data.

Specifically, because the data is structured such that repeated measurements are taken across time and within individuals, it will be important to account for dependencies in the data. In this case, SIU, SCC, and affect ratings on each prompted survey (Level 1) are nested within days (Level 2), which are nested within patients (Level 3). Thus, ratings given within the same day and within the same patient are expected to be correlated.

Variance in SIU ratings can be partitioned into 3 components: between surveys within days, between days within patients, and between patients. Given the structure of the data, in order to appropriately model the questions addressed by the proposed hypotheses, a 3 level model will be used.

All data analyses were conducted using R version 3.2.2 (R Core Team, 2015). Before conducting analyses, data were examined for normality. The SIU data violated normality assumptions with high positive skewness (skew=7.78), high kurtosis (kurtosis=63.34) and was zero-inflated. Figure 2 shows the density distribution of SIU ratings across the sample. Negative affect data had a slightly positive skew (skew=1.03) and normal kurtosis (kurtosis=.45) and self-concept clarity had normal skew (skew=-.47) and kurtosis (kurtosis=-.58).

The use of count-based statistical models (e.g., negative binomial, Poisson, hurdle) is recommended when analyzing non-normal and/or zero-inflated data (Wright, Pincus, & Lenzenweger, 2012). These approaches are useful for modeling rare but significant behaviors such as self-injury. However, the present study is specifically interested in modeling the momentary nature of self-injurious urges. In order to model this data as a count variable, a single value would need to be computed for each individual, comprised of the number of self-injurious urges across the 21-day study period. This would mean that self-injurious urges would be considered a “person-level” dependent variable and therefore would not be appropriate for analysis as a momentary (within person) variable. Thus, the present study does not use alternative approaches to modeling non-normal data. Because of this, it is possible that results may produce biased estimates due to violation of assumptions associated with linear regression based models (Cohen, Cohen, West, & Aiken, 2003). Furthermore, it may be difficult to detect a relationship that may truly exist given the highly positively skewed outcome variable and normally distributed predictor variables.

**Multilevel Models.** We began with an unconditional model that only includes random intercepts at each level and no predictor variables. This model was used to determine intraclass correlation coefficients (ICC), which are used to examine the amount of variance in outcomes present at each level of the model. The unconditional model is represented below in Equation (1):

$$\begin{aligned}
 \text{Level 1: } SIU_{tdp} &= \pi_{0dp} + e_{tdp} \\
 \text{Level 2: } \pi_{0dp} &= \beta_{00p} + r_{0dp} \\
 \text{Level 3: } \beta_{00p} &= \gamma_{000} + u_{00p}
 \end{aligned}
 \tag{1}$$

In Level 1,  $SIU_{tdp}$  is the SIU rating on prompted survey at time,  $t$ , on day,  $d$ , for person,  $p$ ,  $\pi_{0dp}$  is the mean SIU rating on day,  $d$ , for person,  $p$ , and  $e_{tdp}$  is the deviation between each of the momentary observations ( $SIU_{tdp}$ ) and each person's average SIU for that day ( $\pi_{0dp}$ ). At Level 2,  $\beta_{00p}$  is the mean SIU rating for person,  $p$ , taken over times and days and  $r_{0dp}$  is the deviation between the person's daily mean and his or her overall mean. At Level 3,  $\gamma_{000}$  is the grand mean SIU rating across all individuals and  $u_{00p}$  is the deviation between person  $p$ 's mean SIU score and the grand mean .

***Intraclass correlation coefficients.*** From these equations, error variances can be computed at each level yielding 3 variance estimates:  $\sigma^2$  (between surveys within days),  $\tau_{\pi}$  (between days within patient), and  $\tau_{\beta}$  (between patient). Utilizing estimates of these variance components, we computed the intraclass correlations (ICCs). The proportion of variance in SIU ratings that resides between surveys and within days and would be computed as shown in Equation (2):

$$\frac{\sigma^2}{\sigma^2 + \tau_{\pi} + \tau_{\beta}} \quad (2)$$

The proportion of variance in SIU ratings that resides between days and within patients is computed as shown in Equation (3):

$$\frac{\tau_{\pi}}{\sigma^2 + \tau_{\pi} + \tau_{\beta}} \quad (3)$$

The proportion of variance in SIU ratings that resides between patients is computed as shown in Equation (4):

$$\frac{\tau_{\beta}}{\sigma^2 + \tau_{\pi} + \tau_{\beta}} \quad (4)$$

The Level 1 ICC was .4466, indicating that 44.66% of the variance in SIU ratings resides between surveys and within days, the Level 2 ICC was .1302, indicating that 13.02% of the variance in SIU ratings resides between days and within patients, and the Level 3 ICC was .4232, indicating that 42.32% of the variance in SIU ratings resides between patients. These ICC values suggest that there is a non-trivial amount of variance in SIU ratings residing between surveys, days, and patients. Thus, the use of the proposed 3-level model is justified.

**Detrending.** Before examining the models that are of theoretical interest, we examine the data for the possibility of trends in SIU related to time (within days, across days). We examined day-level (Level 1) predictors including the survey number within day to determine whether there are trends in SIU within days (from morning until night) as well as day in the study to determine whether there are trends in SIU across the 21-day study period. There were no significant linear or quadratic time-related predictors of SIU so these predictors were not included in subsequent analyses.

**Three-level model with momentary predictors.** The model shown below in Equation (5) represents the conditional 3-level model including momentary predictors of negative affect (NA), self-concept clarity (SCC), and their interaction, and the outcome of self-injurious urge:

$$\text{Level 1: } \text{SIU}_{tdp} = \pi_{0dp} + \pi_{1dp}(\text{NA}_{tdp}) + \pi_{2dp}(\text{SCC}_{tdp}) + \pi_{3dp}(\text{NA}_{tdp}\text{SCC}_{tdp}) + e_{tdp}$$

$$\text{Level 2: } \pi_{0dp} = \beta_{00p} + r_{0dp}$$

$$\pi_{1dp} = \beta_{10p} + r_{1dp}$$

$$\pi_{2dp} = \beta_{20p} + r_{2dp}$$

$$\pi_{3dp} = \beta_{30p} + r_{3dp} \tag{5}$$

$$\text{Level 3: } \beta_{00p} = \gamma_{000} + u_{00p}$$

$$\beta_{10p} = \gamma_{100} + u_{10p}$$

$$\beta_{20p} = \gamma_{200} + u_{20p}$$

$$\beta_{30p} = \gamma_{300} + u_{30p}$$

In Level 1,  $\pi_{0dp}$  is the intercept, representing the mean SIU rating on day,  $d$ , for person,  $p$ , when NA and SCC are at their mean for person,  $p$ ,  $\pi_{1dp}$  represents the strength of the relationship between the NA rating and SIU rating on day,  $d$ , for person,  $p$ ,  $\pi_{2dp}$  represents the strength of the relationship between the SCC rating and SIU rating on day,  $d$ , for person,  $p$ ,  $\pi_{3dp}$  represents the the strength of the relationship between the NA\*SCC interaction and SIU rating on day,  $d$ , for person,  $p$ , and  $e_{tdp}$  represents the deviation of each of the momentary observations ( $SIU_{tdp}$ ) and each person's average SIU for that day ( $\pi_{0dp}$ ) when NA and SCC are at their mean for person,  $p$ . The Level 1 intercept ( $\pi_{0dp}$ ) is modeled at Level 2 as a function of a random intercept that varies across persons,  $\beta_{00p}$ , and the random error,  $r_{0dp}$ , of this intercept that varies across persons and days. The Level 1 slope associated with the relationship between NA and SIU ( $\pi_{1dp}$ ) is modeled at Level 2 as a function of a random slope that varies across persons,  $\beta_{10p}$ , and the random error,  $r_{1dp}$ , that varies across persons and days. The same applies for the slopes associated with the SCC and SIU relationship. The NA\*SCC relationship is modeled at Level 2 as a function of a common slope across days and within person,  $\beta_{30p}$ , and the random error of the slopes between days and within person,  $r_{3dp}$ . At level 3, each level 2 intercept and slope is modeled as a function of a fixed intercept ( $\gamma_{000}$ ) or slope ( $\gamma_{100}, \gamma_{200}, \gamma_{300}$ ) across persons and the random error of this intercept ( $u_{00p}$ ) or slope ( $u_{10p}, u_{20p}, u_{30p}$ ) across persons.

**Cross-level predictors.** The model shown below in Equation (6) represents the conditional model including a cross-level predictor. It is identical to the previous model with the exception of the addition of a Level 3 predictor of diagnostic group (BPD vs. ANX):

$$\text{Level 1: } \text{SIU}_{idp} = \pi_{0dp} + \pi_{1dp}(\text{NA}_{idp}) + \pi_{2dp}(\text{SCC}_{idp}) + \pi_{3dp}(\text{NA}_{idp}\text{SCC}_{idp}) + e_{idp}$$

$$\text{Level 2: } \pi_{0dp} = \beta_{00p} + r_{0dp}$$

$$\pi_{1dp} = \beta_{10p} + r_{1dp}$$

$$\pi_{2dp} = \beta_{20p} + r_{2dp}$$

$$\pi_{3dp} = \beta_{30p} + r_{3dp} \tag{6}$$

$$\text{Level 3: } \beta_{00p} = \gamma_{000} + \gamma_{010}(\text{dx}_p) + u_{00p}$$

$$\beta_{10p} = \gamma_{100} + \gamma_{110}(\text{dx}_p) + u_{10p}$$

$$\beta_{20p} = \gamma_{200} + \gamma_{210}(\text{dx}_p) + u_{20p}$$

$$\beta_{30p} = \gamma_{300} + \gamma_{310}(\text{dx}_p) + u_{30p}$$

In Level 3,  $\gamma_{010}$  represents the cross-level main effect between diagnostic group and SIU,  $\gamma_{110}$  represents the cross-level interaction between diagnostic group and NA on SIU,  $\gamma_{210}$  represents the cross-level interaction between diagnostic group and SCC on SIU, and  $\gamma_{310}$  represents the cross-level interaction between diagnostic group, NA, and SCC on SIU. The addition of these parameters allow for the examination of several questions including whether the mean level of SIU differs as a function of diagnostic group ( $\gamma_{010}$ ), the strength of the relationship between NA and SIU differs as a function of diagnostic group ( $\gamma_{110}$ ), the strength of the relationship between SCC and SIU differs as a function of diagnostic group ( $\gamma_{210}$ ), and whether the nature of the interaction between NA and SCC on SIU differs as a function of diagnostic group ( $\gamma_{310}$ ).

All continuous predictors were centered around the means for each patient (person-mean centered). This centering strategy removes any between person variance in NA and SCC. It serves to functionally equate all participants on average levels of NA and SCC. Missing data was handled by listwise deletion.

## Chapter 3

### RESULTS

#### Sample characteristics

Comparisons of demographic characteristics between the BPD and ANX are shown in Table 1. Individuals in the BPD and ANX groups did not differ on any demographic characteristics except for age. The BPD group ( $M=34.2$ ,  $SD=12.39$ ) was significantly older than the ANX group ( $M=26.95$ ,  $SD=7.76$ ),  $t(52.48)=2.67$ ,  $p<.05$ . Clinical characteristics are shown in Table 2. The average GAF score was 56.90 ( $SD=8.91$ ). As shown in Table 2, the BPD group had significantly lower GAF scores,  $t(50)=-3.57$ ,  $p<.01$ , and higher IPDE dimensional scores,  $t(48)=11.35$ ,  $p<.001$ , compared to the ANX group. Likewise, the ANX group consisted of a greater proportion of individuals with of Generalized Anxiety Disorder (GAD),  $\chi^2(1, n=55)=9.98$ ,  $p<.01$ , and Social Phobia,  $\chi^2(1, n=55)=7.86$ ,  $p<.01$ , compared to the BPD group. Finally, as shown in Table 3, retrospective self-report baseline assessments indicate that the BPD group had higher MSI-BPD scores,  $t(53)=2.48$ ,  $p<.05$ , lower self-concept clarity,  $t(53)=-2.06$ ,  $p<.05$ , and more affective lability,  $t(53)=-2.85$ ,  $p<.01$ , compared to the ANX group.

These differences in clinical characteristics are expected given the sampling procedures described earlier. None of the demographic (i.e., age), clinical, or baseline characteristics that differed between groups were related to self-injurious urges at significant or trend levels ( $p>.10$ ). Therefore, these variables were not included as covariates in subsequent analyses.

## Multilevel models

All models were fit using Restricted Maximum Likelihood (REML) estimation in the *nlme* package in R (Pinheiro, Bates, DebRoy, Sarkar, & Team, 2016).

**Momentary predictor models.** Results from the initial 3-level model, shown earlier in Equation (5), with NA, SCC, and the interaction between NA and SCC as Level 1 predictors of SIU, indicate that there was no fixed main effect of NA,  $t(3685)=1.57$ ,  $p=ns$ , or SCC,  $t(3685)=-.82$ ,  $p=ns$ , and there was a trend-level effect of the interaction between NA and SCC,  $t(3685)=-1.68$ ,  $p=.09$ . However, because of the longitudinal, within-person, nature of the data, it is likely that data points closer in time are more strongly correlated than data points further in time. This is referred to as autocorrelation. Failing to account for autocorrelation can lead to an underestimation of standard error and inflated  $t$  values. Thus, we fit an additional model adding a first-order autoregressive structure to the model and compared the revised model to the initial model to examine model fit.

The log-likelihood difference between the initial and revised model was 5.40 on 1 df. This difference was significant,  $p<.01$ , indicating that the revised model, with first-order autoregressive covariance structure imposed, is a better fit to the data than the initial model with uncorrelated error covariance. Examination of a model summary shows a Phi value of .09, which corresponds to the lag 1 correlation. Lag 2 correlation is  $.09^2$  or .008, and lag 3 correlation is  $.09^3$  or .0007. Thus, although the model was improved by specifying a first-order autoregressive structure, the degree of autocorrelation is very low.

Based on this revised model, we then examined whether a more parsimonious model could fit the data better by fixing slopes associated with predictors sequentially across subjects (Level 3) and days (Level 2). All of the more parsimonious models resulted in poorer model fit. Thus, we retained the revised model. Results from the final retained model are shown in Table 4. As shown in Table 4, results from the final retained model indicated that there was no fixed main effect of NA,  $t(3685)=1.51$ ,  $p=ns$ , no main effect of SCC,  $t(3685)=-.73$ ,  $p=ns$ , and a trend-level effect of the interaction of NA and SCC,  $t(3685)=-1.71$ ,  $p<.08$ .

In order to explore the nature of the trend-level interaction between NA and SCC on SIU, we examined simple effects. Given that we conceptualized SCC as a moderator of the relationship between NA and SIU, we ran two additional models, both the same as our final retained model but with SCC centered at one standard deviation above and below the person-mean. This approach allowed us to examine the strength and direction of the relationship between NA and SIU at different levels of SCC. As seen in Figure 3, the strength of the relationship (the slope) between negative affect and self-injurious urges is higher when negative affect is high and self-concept clarity is low, compared to when negative affect is high and self-concept clarity is high. This pattern of results is consistent with hypotheses that SCC is a moderator of the relationship between NA and SIU.

**Exploratory cross-level predictors model.** Although we did not have specific predictions about whether there would be differences between diagnostic groups (DX) in the relationships between momentary NA, SCC, and SIU, we conducted an exploratory analysis by adding DX to the retained model as a person-level (Level 3) variable, as seen

in Equation (6) earlier. Results indicated that there was no cross-level main effect of DX,  $t(52)=-.073$ ,  $p=ns$ , there was no cross-level interaction between DX and NA,  $t(3685)=-.743$ ,  $p=ns$ , DX and SCC,  $t(3685)=.030$ ,  $p=ns$ , and there was no significant 3-way cross-level interaction between DX, NA, and SCC,  $t(3682)=-.064$ ,  $p=ns$ .

## Chapter 4

### DISCUSSION

The present study sought out to examine psychological processes that are thought to serve as mechanisms involved in self-injurious behavior in BPD. Specifically, we sought to examine the role of negative affect, self-concept clarity in predicting the urge to engage in self-injurious behavior in BPD. It was hypothesized that higher levels of momentary negative affect and lower levels of self-concept clarity would be associated with self-injurious urges. Additionally, we hypothesized that negative affect and self-concept clarity would interact to predict self-injurious urges, such that the positive relationship between negative affect and self-injurious urges would be greater when self-concept was low.

We found that negative affect and self-concept clarity did not predict self-injurious urges on their own. However, when examining the interaction between negative affect and self-concept clarity there was a trend-level effect on self-injurious urges. More specifically, there was a tendency for self-injurious urges to be higher when negative affect was high but only when self-concept clarity was low. When self-concept clarity was high, self-injurious urges tended to be lower, even when negative affect was high. Although this finding should be interpreted with caution because it did not reach significance and the magnitude of the effect was small, the nature of the interaction is consistent with predictions and previous theory (Kernberg, 1984). Specifically, it seems that self-concept clarity may play a protective role in that strong levels of negative affect are less likely to result in the urge to self-injure when one has a clear and coherent sense of themselves.

No studies to date have examined both negative affect and self-concept clarity in predicting self-injury on a momentary level. However, previous research has shown that individuals with BPD are characterized by low levels of self-esteem and high levels of negative affect and that the interaction between these factors predicts reactivity to daily events (Stein, 1995; Zeigler-Hill & Abraham, 2006). These findings mirror our finding that low levels of self-concept and high levels of negative affect are associated with self-injury. Although we did not include contextual variables that would allow us to examine the role of daily events in the present study, it is possible that daily events may serve as an intervening variable between affect, self-concept and self-injury.

The lack of main effects for negative affect and self-concept clarity on self-injurious urges is inconsistent with previous work that has typically found such relationships. For example, EMA studies have generally found that high levels of negative mood across a multi-week sampling period predict daily suicidal ideation (Links et al., 2007) and that individuals who have a history of suicidal behavior show different growth patterns in mood over time (Nisenbaum et al., 2010). It is possible, given research suggesting that there are important differences between suicide and self-injury (Klonsky, 2007), that negative affect and self-concept clarity do not predict self-injury in the same way that they do suicide. However, this is unlikely given the extant research showing such a relationship using retrospective self-report assessments (Hawton et al., 1999; Santos et al., 2009). Another possibility is that low base-rates of self-injurious urges in our study limited the ability to detect a relationship between our predictors and self-injurious urges. Previous EMA studies that examined suicidal ideation/behavior specifically recruited samples of individuals who had a history of suicide and thus, may

have been able to capture such behavior at higher rates than we were able to in the current study.

The present study has several strengths. First, this study utilized an EMA approach to studying self-injury in BPD. This is particularly important because of the temporal dynamics in variables such as negative affect, self-concept clarity and self-injury in BPD and the problems associated with retrospective recall. The present study's use of an EMA approach allowed for the opportunity to model negative affect, self-concept clarity and self-injury at a momentary level through collected data at several time points throughout the day across 3 weeks. This is important because it allows for the examination and modeling of psychological processes as they occur at a much more fine-grained level. Another strength of the current study is the use of multilevel modeling in the analysis of data. This is important and necessary due to the nested nature of the data and it allows us to decompose variance in self-injurious urges that occurs between people, within people between days, and within days between surveys. This is crucial because a non-trivial level of variance was found to occur at each level of analysis. Finally, the fact that nearly 45% of the variance in self-injurious urges occurred at the momentary level in the present study speaks to the importance of an EMA approach to collect such data and data analytic approaches such as multilevel modeling for analyzing such data.

Limitations of the current study include the challenges associated with the low-base rates of momentary self-injurious urges. The rare occurrence of self-injurious urges across the 21-day sampling period resulted in highly skewed, non-normal, zero-inflated distribution. This is problematic because results may produce biased estimates due to

violation of assumptions associated with linear regression based models (Cohen et al., 2003) and it may limit the power to detect relationships between variables. One possible solution would be to recruit samples that are more likely to have self-injurious urges. Because the current study utilized a sampling approach that was part of a larger study with different goals, we were not able to do this. Another limitation is the use of assessment as usual to derive diagnostic data for participants in the present study, though this represents a strength of the larger study. Given the naturalistic nature of the assessments that were conducted as part of the normal procedures of the CMHC from which participants were recruited, it is not possible to determine the reliability and validity of diagnoses. It is possible that this may have limited our ability to detect group differences in self-injurious urges based on diagnostic group.

Future directions for research may include examination of additional factors that may be involved in self-injurious behaviors, such as impulsivity, which has been shown to play a role in suicidal behavior in combination with other features of BPD (McGirr, Paris, Lesage, Renaud, & Turecki, 2007) . Another aspect that is important to consider in future research is the context in which self-injurious behaviors occur. The use of EMA approach is ideal for assessing contextual factors, daily stress and interpersonal interactions which likely are likely to impact one's emotional state and mood, views about themselves and other people and the occurrence of self-injurious behaviors.

## **Conclusion**

Findings from this study indicate that factors such as negative affect and self-concept may play a role in predicting self-injurious urges in the daily lives of individuals with BPD. This study also makes a unique contribution to the current literature by

studying self-injurious urges at a momentary level through the use of an EMA approach and informs future research in this area to further build knowledge of the underlying pathology that characterizes BPD.

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## APPENDIX A

## Tables

Table 1  
*Demographic characteristics as a function of study group*

	BPD (n=35)		ANX (n=20)		t-value
	M	SD	M	SD	
Age	34.20	12.39	26.95	7.76	2.67*
	N	%	N	%	$\chi^2$
Sex					
Women	32	91	15	75	2.76
Men	3	9	5	25	
Sexual Orientation					
Heterosexual	23	66	15	75	3.67
Homosexual	3	9	3	15	
Bisexual	9	26	1	5	
Ethnicity					
Caucasian	32	91	15	75	2.76
Other	3	9	5	25	
Relationship Status					
Single	15	43	13	65	5.68
Dating	8	23	1	5	
Married	6	17	5	25	
Divorced	5	14	1	5	
Separated	1	3	0	0	

*Notes.* This table compares demographic variables between participants in the Borderline Personality Disorder group (BPD; n=35) and the Anxiety group (ANX; n=20). \*p<.05

Table 2  
*Clinical characteristics from initial intake assessments as a function of study group*

	BPD (n=35)		ANX (n=20)		$\chi^2$
	N	%	N	%	
<b>Current Axis I Diagnoses</b>					
MDD	14	40	12	60	2.04
Other Mood Disorders	5	14	2	10	.21
GAD	4	11	10	50	9.98**
PTSD	5	14	4	20	.30
Social Phobia	3	9	8	40	7.86**
Other Anxiety Disorders	8	23	3	15	.49
Alcohol & Substance Use	3	9	1	5	.24
Eating Disorders	3	9	1	5	.24
Somatoform Disorders	4	11	1	5	.64
<b>Current Axis II Diagnoses</b>					
Paranoid PD	2	6	0	0	1.19
Antisocial PD	3	9	0	0	1.81
Histrionic PD	3	9	0	0	1.81
Narcissistic PD	2	6	0	0	1.19
Avoidant PD	4	11	1	5	.64
Obsessive-Compulsive PD	1	3	2	30	1.26
PD NOS	1	3	2	30	1.26
	M	SD	M	SD	t-value
IPDE Dimensional Score	12.63	3.00	3.17	2.48	11.35***
GAF	52.44	8.11	61.35	9.71	-3.57**

*Notes.* This table compares clinical characteristics between the BPD (n=35) and ANX (n=20) groups. GAF=Global Assessment of Functioning; IPDE=International Personality Disorder Examination; Rates of Borderline Personality Disorder not shown because by definition all patients in the BPD group had a diagnosis of BPD and all patients in the ANX group could not have a BPD diagnosis. \*p<.05, \*\*p<.01, \*\*\*, p<.001

Table 3.  
*Baseline characteristics on retrospective self-reports as a function of study group*

	BPD (n=35)		ANX (n=20)		<i>t</i> -statistic	<i>d</i>
	M	SD	M	SD		
MSI-BPD	5.66	2.92	3.75	2.40	2.48*	.72
SCCS	2.69	.85	3.18	.87	-2.06*	.57
ALS <sup>^</sup>	16.90	4.37	20.24	3.82	-2.85**	.81

*Notes.* This table compares the baseline characteristics, collected during the baseline and training session, between the BPD (n=35) and ANX (n=20) groups. MSI-BPD=McLean Screening Instrument for Borderline Personality Disorders; SCCS=Self-Concept Clarity Scale; ALS=Affect Lability Scale; <sup>^</sup>The ALS is coded such that lower scores corresponded with greater affective lability; \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.

*Estimates of fixed and random effects and model fits for initial and revised/final model.*

	Model 1 (Initial)		Model 2 (Final)	
	Estimate	SE	Estimate	SE
<b>Fixed Effects</b>				
Intercept	2.048	.949	2.054	.946
NA	0.024	.016	0.023	.015
SCC	-0.015	.018	-0.012	.017
NA*SCC	-0.002	.001	-0.002	.001
<b>Random Effects</b>				
Level 3 variance ( $\tau_\beta$ )				
Intercept	47.11		46.70	
NA	.005		.004	
SCC	.008		.006	
NA*SCC	.00003		.00003	
Level 2 variance ( $\tau_\pi$ )				
Intercept	2.59		1.71	
NA	.033		.036	
SCC	.037		.037	
NA*SCC	.0001		.0001	
Level 1 variance ( $\sigma^2$ )	42.510		43.296	
Model fit -2 log-likelihood	-15999.97		-15994.57	

*Notes.* NA=negative affect, SCC=self-concept clarity. Level 3 variance,  $\tau_\beta$ , represents variance between persons, Level 2 variance,  $\tau_\pi$ , represents variance between days, and Level 1 variance,  $\sigma^2$ , represents variance between surveys

## APPENDIX B

## Figures

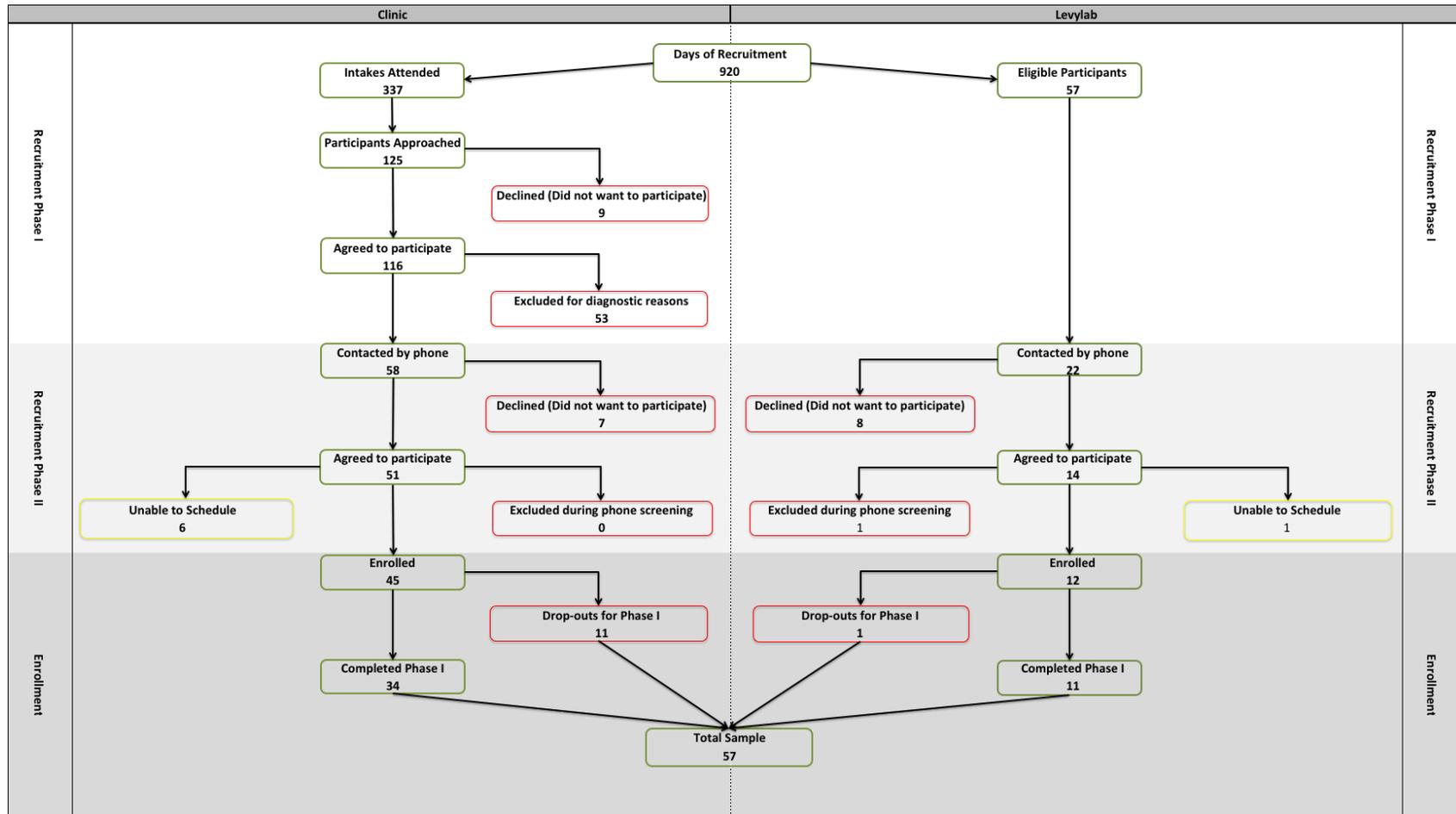


Figure 1. *Study recruitment flowchart.* This figure shows the flow of participants through each phase of recruitment (Phase I, Phase II, Enrollment), from each recruitment source (Clinic, LevyLab), for the overall study (n=57). “Drop-outs for Phase I” include individuals who did not complete the full 21-day study period but who provided data that was used in analyses.

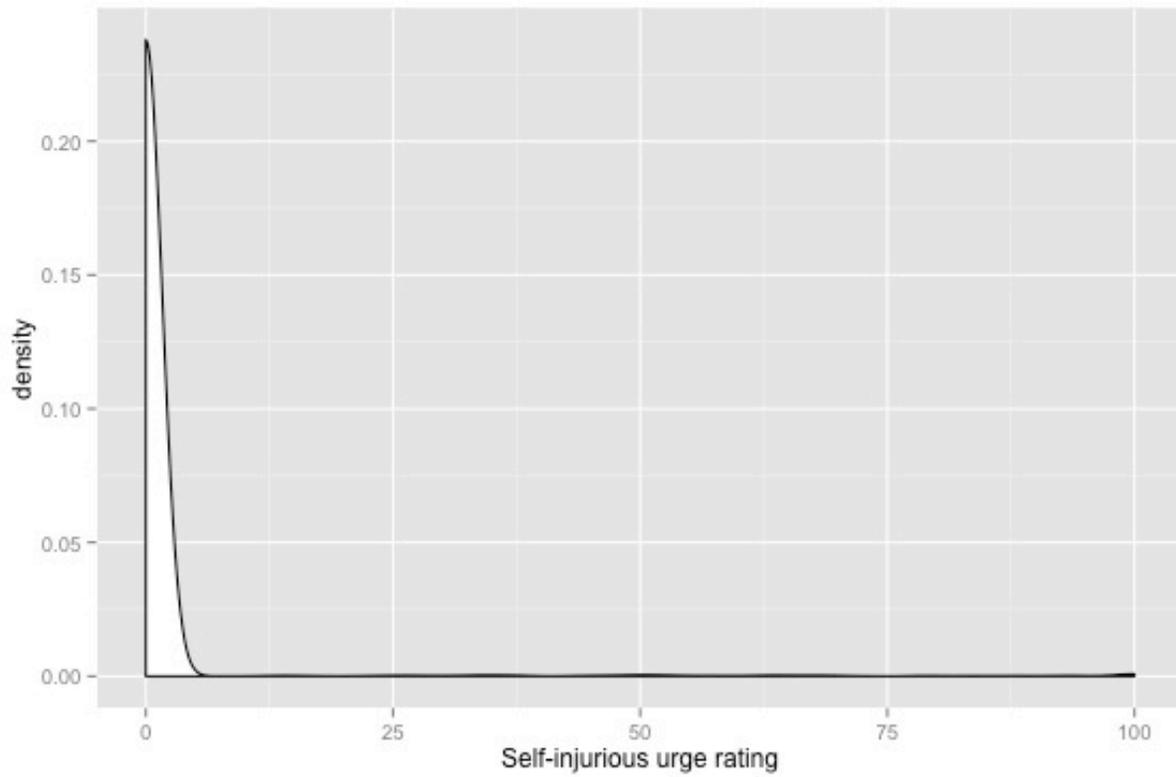


Figure 2. *Density plot of self-injurious urge ratings.* This figure shows the positively skewed nature of self-injurious urge ratings.

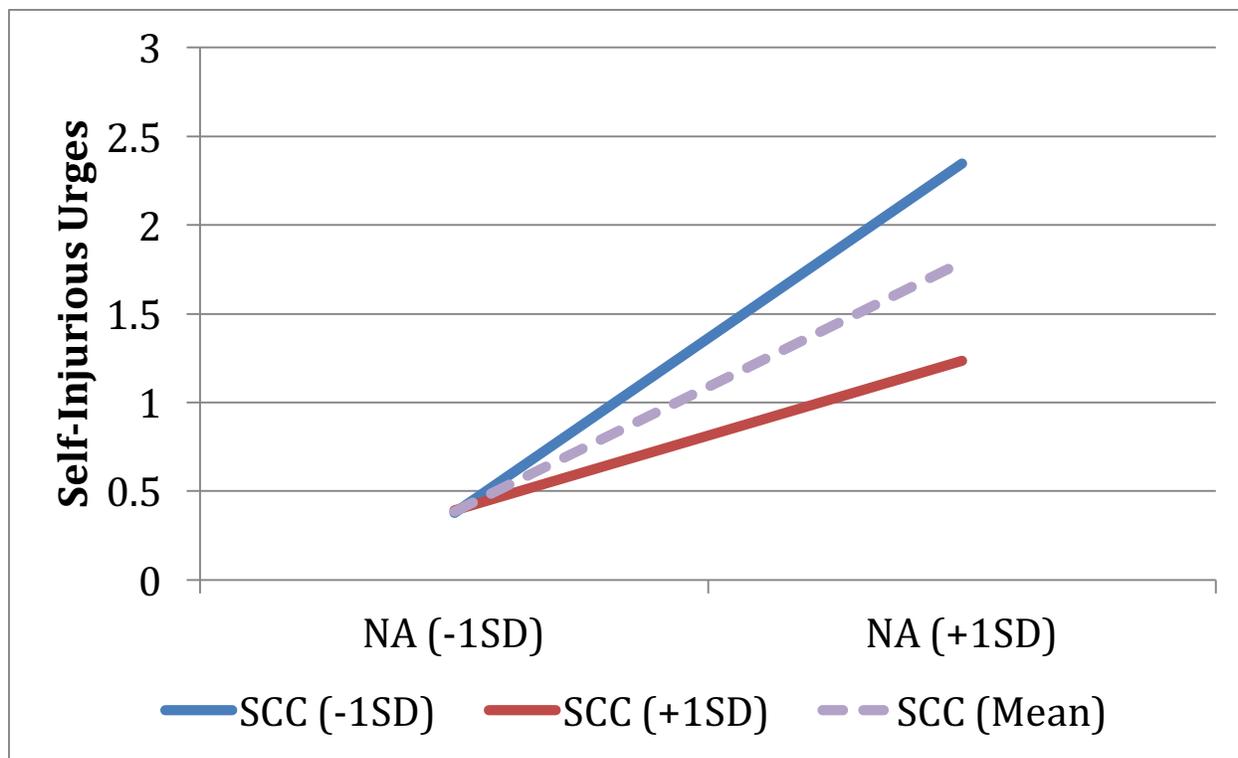


Figure 3. *Line graph of the interaction between momentary negative affect (NA) and self-concept clarity (SCC) on momentary self-injurious urges (SIU).* Interpretation of the interaction suggests that there is a trend for self-injurious urges to be greater in the context of high levels (+1SD above the mean) of negative affect and low levels (-1SD below the mean) of self-concept clarity,  $t(3685)=-1.71$ ,  $p<.01$ .