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Ambulatory measurement of emotional dysfunction in borderline personality disorder

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Empirical research has used many methods and measures to study emotional dysfunction in borderline personality disorder (BPD) in controlled laboratory settings. Equally important, however, is the need to use externally valid laboratory and field methods to understand the real-world, personally relevant contexts in which difficulties with emotional functioning occur in BPD. Prospective and longitudinal methods using mobile technologies, such as ecological momentary assessment and ambulatory behavioral and psychophysiological measurement, allow researchers to investigate emotional and behavioral processes over time and in relevant contexts. Researchers in recent years have begun to use these methods to better understand emotional processes in the daily lives of individuals with BPD. The two primary purposes of the present review are to, firstly, provide an overview of several advances in ambulatory methods used to investigate emotional functioning in BPD and, secondly, offer suggestions for next steps in this area of research.

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Introduction

Borderline personality disorder (BPD) is a chronic and severe psychiatric disorder characterized by symptoms reflecting impairments across interpersonal, cognitive, behavioral, and emotional functioning [1]. Despite the heterogeneity of symptoms, difficulties with emotional functioning have been identified as a core area of dysfunction underlying BPD (along with behavioral dyscontrol and disturbed interpersonal relations; [2]). Recent years have seen increased efforts to characterize the nature of emotional dysfunction in BPD, with the hope that precise elucidation of underlying neurobehavioral mechanisms will lead to the development of novel, efficient, and efficacious pharmacological and behavioral interventions.

Empirical research has used many methods and measures to study emotional dysfunction in BPD in controlled laboratory settings (for reviews see [3–8,33]). Theory-guided translational laboratory research with high internal validity is necessary in order to identify and precisely specify candidate processes of emotional dysfunction in BPD [7]. Equally important, however, is the need to use externally valid laboratory and field methods to understand the real-world, personally relevant contexts in which difficulties with emotion regulation arise in BPD. As such, in addition to translational laboratory research, it is critically important to study difficulties with emotion regulation over time, outside the laboratory or clinic. Introduced in psychology research in the 1960s [34], intensive longitudinal methods, such as ambulatory and ecological momentary assessment, allow researchers to investigate emotional and behavioral processes over time and in relevant contexts. Researchers in recent years have begun to use these methods to clarify emotional processes in the daily lives of individuals with BPD. Therefore, the two primary purposes of the present review are to, firstly, provide an overview of several advances in ambulatory methods used to investigate emotional functioning in BPD and, secondly, offer suggestions for next steps in this area of research.

Characterized by the real-time assessment of phenomena occurring in daily life, ambulatory methods have particular promise for addressing limitations in extant research on BPD and emotional functioning. Historically, most research examining emotional functioning in BPD has relied on retrospective self-report methods (e.g., [9]), which are vulnerable to memory, impression management, and other sources of bias, notably including negative recall bias (e.g., Ebner-Priemer *et al.* [35]). Further, cross-sectional self-report methods do not allow for the examination of prospective relationships among variables, or of the possible interplay of emotions, behavior, and context in BPD.

Recent advances in ambulatory methods have improved the assessment of emotional processes in BPD. Earlier ambulatory research on BPD and other personality disorders relied

on repeated pen-and-paper assessment over time [10,11]. More recent studies have used computerized assessments with prospective measures of subjective (e.g., ecological momentary assessment [EMA]; experience sampling) and objective (e.g., changes in heart rate) indices of emotion over time (for reviews, see [12,13]). Within the next section, we discuss the findings of a sampling of these studies.

Ambulatory studies of emotional processes in BPD

Several studies have used ambulatory, computerized methods to clarify emotional processes in BPD. The majority of this work has focused on the study of emotional intensity, frequency, and instability (e.g., [14•,15–17]). Collectively, this work has increased the precision of our understanding of the emotional experiences that occur naturalistically among individuals with BPD.

Frequency and intensity of negative emotions

Using an EMA design, Glaser *et al.* [16] found that individuals with BPD reported higher levels of negative emotions in response to daily stressful events compared to healthy controls and a clinical control group of adults with psychotic disorders. Similarly, using an EMA approach over 24 h, Ebner-Priemer *et al.* [15] reported that individuals with BPD experienced fewer positive and more negative emotions compared to a sample of healthy controls.

In addition to evidence of increased frequency of negative emotions, there is also evidence of higher intensity of negative emotions in BPD. Ebner-Priemer *et al.* [15] found that over a 24-h period of repeated assessments, individuals with BPD reported a higher intensity of negative emotions compared to sample of healthy controls. More recently, Coifman *et al.* [18•] used an EMA approach over 21 days and reported that individuals with BPD were more likely than healthy controls to report fluctuations between highly intense positive and negative emotional experiences. Further, heightened emotions predicted subsequent impulsive behaviors. Although more studies are needed with clinical comparison groups, these findings are consistent with Linehan's biosocial model of BPD, which suggests that BPD criterion behaviors are likely to proximally precede or follow acute negative emotions [36].

Instability of emotions

A few studies have examined emotional instability in BPD. Trull *et al.* [17] found that individuals with BPD demonstrated greater instability (defined by larger fluctuations in these emotions) of hostility, sadness, and fear over one month of EMA measurement compared to those with depressive disorders, but did not evidence higher mean levels of these negative emotions over time. Most recently, Santangelo *et al.* [19•] recently used EMA over 24 h to compare individuals with BPD to those with post-traumatic stress disorder, bulimia nervosa, and a healthy control group in terms of affective instability. Raising the possibility that heightened affective instability may be a transdiagnostic problem, Santangelo *et al.* [19•] reported no differences over time in those with BPD compared to the other clinical control groups.

Differentiation of emotional states

Other studies have examined differentiation of discrete emotional states from those of similar valence, such as between anger and shame. Instead of identifying distinct emotions, individuals with BPD tend to endorse broad, non-specific emotions (e.g., 'aversive inner tension,' [20]). In addition, individuals with BPD demonstrate lower emotional granularity (i.e., difficulties differentiating between similar emotions) relative to controls [21]. Using an experience sampling approach over 21 days, Zaki *et al.* [22•] reported that greater differentiation of negative emotional states was associated with reduced non-suicidal self-injury among individuals with BPD. Similarly, Dixon-Gordon *et al.* [23•] used an EMA approach and found that greater differentiation of positive emotions was associated with lower urges to self-injure among individuals with high BPD features. Because self-injury can function to reduce negative emotions among those with BPD [24,25], the findings from Zaki *et al.* [22•] and Dixon-Gordon *et al.* [23•] suggest that enhanced differentiation of emotional states in those with BPD may help inhibit maladaptive responses when acutely emotionally aroused.

Specific emotions

Whereas many studies have used ambulatory methods to explore emotional dysfunction in general in BPD, other studies have examined the course of specific emotional states in the daily lives of those with BPD. For example, Reisch *et al.* [26] used an EMA approach to investigate sequences of emotions and found that individuals with BPD experienced longer persistence of anxiety and sadness, compared to healthy controls. They also found that reported anger frequently followed anxiety in BPD, relative to controls [26]. Berenson *et al.* [14•] used an EMA approach and found that intense anger (i.e., rage) among individuals with BPD was predicted prospectively by interpersonal rejection during the course of several weeks. Such research holds much promise by enhancing the specificity both of the contexts in which emotions may be elicited and the responses that may follow the onset of these emotions.

Psychophysiological measures of emotion

Although most studies using ambulatory measures to study emotional functioning in BPD have used repeated self-reports in the context of EMA methods, research also has been conducted using ambulatory psychophysiological measures of emotional arousal. For example, an EMA investigation of neurobiological emotional arousal, which