UNIVERSITAT DE BARCELONA

# The role of Emotion Dysregulation in Non-Suicidal Self-injury and Borderline Personality Disorder: Predictors and Mechanism-Based Treatment Approach

Carlos Schmidt Gómez

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# The role of Emotion Dysregulation in Non-Suicidal Self-injury and Borderline Personality Disorder: Predictors and Mechanism-Based Treatment Approach

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Prof. Dr. Daniel Vega Moreno and Prof. Dr. Joaquim Soler Ribaudi certify that they have supervised and guided the doctoral thesis entitled "**The role of Emotion Dysregulation in Non-Suicidal Self-injury and Borderline Personality Disorder: Predictors and Mechanism-Based Treatment Approach"** presented by Carlos Schmidt Gómez. They hereby assert that this doctoral thesis fulfils the requirement to be defensed.

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A mi esposa Aby y a mis hijas Dominga y Amalia

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Aunque es otro el sentimiento que actualmente me invade y creo que es la gratitud. Imagino a una comunidad de personas que me han, consciente e inconscientemente, sostenido hasta hoy en día.

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*Residir en la vacuidad significa*
*habitar plenamente el espacio encarnado*
*de la propia experiencia sensorial,*
*pero de una manera que ya no está determinada*
*por nuestra reactividad habitual.*
**Stephen Batchelor**

*¿Quieres cultivar la habilidad para encontrar la calma?*
*primero mira con perspectiva*
*el inicio y el cese de tu reactividad emocional,*
*identifica donde la sientes en tu cuerpo*
*y luego acepta que la reactividad ha surgido en ti.*
**C. S**

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## Abstract

Emotion regulation refers to the ability to modulate one's emotional responses effectively, while emotion dysregulation reflects a persistent difficulty in managing emotions, often leading to maladaptive coping strategies, such as non-suicidal self-injury (NSSI). NSSI is defined as the direct and deliberate harm to one's body tissue without suicidal intent, and presents a significant public health challenge. Its strong association with mental health problems, particularly in young people, and its prevalence in borderline personality disorder (BPD) underscore the need for effective interventions. While emotion dysregulation is strongly implicated in both NSSI and BPD, the specific dimensions of emotion dysregulation that characterize high-risk NSSI subgroups remain unclear. In addition, mindfulness skill training, a core component of Dialectical Behavior Therapy (DBT), shows promise in enhancing emotion regulation for individuals with BPD, yet the mechanisms driving its effectiveness require further investigation. This research project comprising five studies aimed to address these gaps, exploring the complex interplay between emotion dysregulation, NSSI, and BPD.

The initial two studies focused on characterizing NSSI and identifying risk factors. Study 1 revealed a direct link between non-acceptance of emotions and the function of NSSI, while a lack of emotion regulation strategies was associated with NSSI frequency. Study 2 identified a subgroup characterized by severe NSSI, heightened emotion dysregulation, and low perceived social support. This profile was associated with a greater risk for psychopathology both at baseline and at the two-year follow-up. These findings highlight the heterogeneous nature of NSSI and the need for personalized treatment approaches.

The subsequent studies examined the mechanisms of change underlying mindfulness-based DBT skill training. Study 3 demonstrated that mindfulness skill training reduced borderline symptoms by enhancing decentering—the ability to observe thoughts and feelings non-judgmentally—which, in turn, led to decreased emotion dysregulation. Studies 4 and 5 further explored the dynamic relationship between mindfulness skills and emotion regulation in BPD. Commitment to mindfulness skill practice was associated with reduced emotion dysregulation, with a minimum effective dose of ≥ 3 days and more than 30 minutes in total per week, identified as crucial (Study 4). Notably, greater within-person effects of nonjudging the inner experience and body awareness at a given week predicted subsequent improvements in emotion regulation at the following week. Decentering moderated this associations, with stronger effects observed in those with higher decentering capacity (Study 5). Importantly, a bidirectional relationship between mindfulness practice, the proposed mechanisms of change, and emotion dysregulation was consistently observed.

This research program provides valuable insights for both research and clinical practice. By identifying specific emotion regulation difficulties associated with NSSI and highlighting high-risk profiles, this work informs more targeted prevention and intervention strategies. Additionally, by elucidating the mechanisms through which mindfulness-based DBT skills training impacts emotion regulation – particularly the roles of decentering, non-judgmental awareness, and body awareness – this research offers clinicians valuable tools for optimizing treatment protocols. Lastly, the identification of a minimum effective dose of mindfulness practice and the recognition of a bidirectional relationship between mindfulness practice and emotion dysregulation underscore the need for flexible and individualized treatment approaches.

# Chapter I

## Introduction

## 1. Emotion Regulation

Emotion regulation, a fundamental human capacity, encompasses the ability to effectively manage emotional responses. This complex and continuous process, vital for mental health and well-being, begins in early childhood and evolves throughout life, influencing interpersonal relationships, academic success, and various other domains. The development of emotion regulation is multifaceted, shaped by a complex interplay of biological factors like neurodevelopment and social-environmental influences, including early caregiver interactions, interpersonal dynamics, cultural norms, and individual life experiences. Given its close ties to psychopathology, emotion regulation has emerged as a crucial area of research in psychology (Gross, 2002).

The emotion regulation strategies we acquire throughout development are key to successfully managing and expressing our emotions. These strategies are dynamic and multifaceted, encompassing a range of complex cognitive processes. For instance, individuals engaging in self-regulation can consciously choose to shift their thoughts and elicit a desired emotional state in a given situation (e.g., planning to appear confident during a job interview). Alternatively, emotion regulation may occur automatically (e.g., trying to control anxiety during a job interview). Individuals can also utilize both internal (e.g., deep breathing to induce calm) and external strategies (e.g., seeking social support) to modulate their emotional experiences. Furthermore, some strategies are more adaptive, increasing the likelihood of a favorable outcome (e.g., focusing on problem-solving despite feeling anxious), while others are less adaptive and may lead to less desirable outcomes (e.g., avoiding a problem due to anxiety).

Interestingly, various psychotherapeutic models incorporate emotion regulation training to provide individuals with deficits in this area with essential skills. These skills involve the ability to identify, understand, and effectively manage emotions to achieve a desired emotional response. Skills like problem-solving, engaging in behaviors that counter unwanted emotions, distress tolerance, and mindfulness are key to enhancing emotion regulation (Linehan, 1993; 2014).

This dissertation contributes to the understanding of emotional dysregulation by examining its links to psychopathology and maladaptive coping. In addition, it explores the potential of mindfulness-based training to improve emotional regulation, with an emphasis on investigating the underlying mechanisms of change.

### 1.1. Understanding Emotion Regulation and Dysregulation

Emotion regulation is a multifaceted construct encompassing the conscious and unconscious processes individuals employ to understand, manage, and modulate their emotional experiences (Gross, 2002). It involves not merely suppressing or avoiding unwanted emotions but actively shaping their trajectory—influencing their frequency, intensity, duration, and expression (Gross, 2015; Ochsner et al., 2009). This intricate process draws upon a range of cognitive and attentional capacities, including cognitive control, attention regulation, and the modulation of emotional reactivity.

In addition, effective emotion regulation encompasses several key facets: emotional awareness (accurately perceiving and identifying one's emotions), emotional clarity (understanding the nature and triggers of one's emotions), and the ability to modulate emotional responses adaptively, particularly when faced with negative or challenging

emotions (Gratz & Roemer, 2004). Crucially, it also involves the ability to accept one's emotional experiences without judgment, recognizing all emotions, even unpleasant ones. The capacity for adaptive emotion regulation is fundamentally linked to well-being and psychological health (Menefee, 2022; Tamir et al., 2023). Individuals with adaptive emotion regulation strategies possess a greater capacity to effectively manage emotionally challenging situations, particularly during periods of heightened stress. For instance, individuals with a diverse range of adaptive emotion regulation strategies are more likely to reappraise negative thoughts, engage in more adaptive behaviors, and effectively reduce the intensity of emotional states. This, in turn, fosters a greater sense of agency and self-efficacy (Spitzen et al., 2022). Given its profound impact on well-being, fostering the development of adaptive emotion regulation strategies is a crucial focus for promoting mental health.

In contrast to adaptive emotion regulation, emotion dysregulation reflects a breakdown in the ability to effectively manage and modulate emotional responses (Gross, 2015; Neacsiu et al., 2014). It encompasses both a deficit in adaptive emotion regulation skills and a propensity to utilize maladaptive strategies that ultimately exacerbate emotional distress. Individuals who engage in maladaptive emotion regulation strategies often find themselves trapped in a cycle of negative affect, which may involve an increasing vulnerability to develop psychopathology (Mennin & Fresco, 2010). Nowadays, emotion dysregulation has been recognized as a transdiagnostic phenomenon that contributes (negatively) to a wide range of mental disorders across the lifespan (Boemo et al., 2022). Addressing emotion dysregulation, therefore, is essential for both the prevention and treatment of a variety of mental health concerns.

### 1.2. Emotion Dysregulation and Psychopathology

The field of emotion regulation represents a crucial frontier in contemporary evidence-based psychology. Researchers and clinicians are increasingly recognizing the pivotal role of emotion dysregulation in the development and maintenance of various mental health conditions (Gross, 2014; Sheppes et al., 2015). Indeed, emotional dysregulation is now considered a potential transdiagnostic mechanism, underlying a wide spectrum of psychopathologies (Miu et al., 2022).

While the mechanisms driving this relationship are complex, the literature consistently points to a robust association between maladaptive emotion regulation strategies and an increased risk of psychopathology. The seminal meta-analysis by Aldao et al. (2010) elucidated this intricate relationship. Their findings revealed that maladaptive strategies, such as thought suppression or rumination, were strongly and consistently associated with heightened psychopathology. In contrast, the relationship between adaptive strategies, like cognitive reappraisal or problem-solving, and psychopathology was more nuanced, suggesting that the efficacy of these strategies might be contingent on several factors. According to the authors, these factors could include: (i) context-dependence (some strategies might be helpful in certain contexts but not others); (ii) effective implementation (some skills require conscious effort for successful deployment); and (iii) individual differences (personality traits, varying response styles).

More recently, the meta-analysis by Boemo et al. (2022), focusing specifically on clinical populations, provided further support for the critical link between emotion regulation strategies and psychopathology. The authors found that engaging in maladaptive strategies (e.g., rumination and emotional suppression) predicted subsequent increases in negative

affect, while utilizing adaptive strategies (e.g., cognitive reappraisal) predicted increases in positive affect. Interestingly, although adaptive strategies predicted greater positive affect, they were not found to decrease negative affect. This suggests a complex and potentially independent interplay between specific emotion regulation strategies and their impact on affective experience, highlighting the need for targeted interventions that not only cultivate adaptive strategies but also address the unique challenges of mitigating negative emotions.

These findings underscore the critical role of fostering adaptive emotion regulation in the context of mental health. Interventions that cultivate effective emotion regulation skills in individuals and reduce reliance on maladaptive strategies hold great promise for therapeutic interventions. Continued research in this field is essential to determine which specific strategies are most effective in promoting positive affect and mitigating negative affect.

### *1.2.1. Emotion dysregulation and Non-Suicidal Self-injury*

Maladaptive coping behaviors are strongly linked to emotion dysregulation (Wolff et al., 2019). Individuals struggling with difficult and intense emotions often experience prolonged and intense emotional distress (Boemo et al., 2022). This can lead them to utilize maladaptive strategies, such as such as non-suicidal self-injury (NSSI), to cope with overwhelming emotional states (Santangelo et al., 2014). NSSI is defined as the direct and deliberate destruction of one's own body tissue without suicidal intent and includes methods such as skin cutting, scratching, beating and burning (Klonsky & Glenn, 2009; Nock, 2010).

NSSI typically emerges during early adolescence (Plener et al., 2015) or early adulthood (Gandhi et al., 2018). Prevalence rates in community samples range from 13% to

32% (Muehlenkamp et al., 2012; Swannell et al., 2014). Currently, NSSI is a growing public health concern due to its increasing prevalence and potential negative consequences (Vega et al., 2018) and has been linked to academic and interpersonal difficulties (Kiekens et al., 2016). Individuals who engage in NSSI are at higher risk for future suicide attempts and mental health problems (Daukantaitė et al., 2021). NSSI may even serve as an early indicator of greater psychopathological severity in adulthood (Ghinea et al., 2020; Nakar et al., 2016).

Research has consistently found a strong link between emotion dysregulation and NSSI (Wolff et al., 2019; Fox et al., 2015). Individuals who engage in NSSI often exhibit poor emotion regulation skills compared to those who do not (Taylor et al., 2018). Moreover, the severity of emotion dysregulation is correlated with the frequency of NSSI behaviors indicating that a poor capacity for emotional regulation favors the maintenance of NSSI (Andover & Morris, 2014). This behavior can provide temporary relief from overwhelming emotions, reinforcing the behavior and making it more likely to occur in the future (Vega et al., 2018). As such, a loop may develop in which individuals with poor emotional regulation skills engage in NSSI, which in turn exacerbates their underlying emotional difficulties (Selby et al., 2009).

Previous research has focused on understanding the motivations (or functions) underlying NSSI. While the primary function of NSSI is widely reported to be coping with emotional distress (Chapman et al., 2006; Klonsky & Glenn, 2009), interpersonal motives (e.g., social influence) also play a role in the motivation to self-injury (Taylor et al., 2018). In this regard, a two-factor higher-order model has been proposed to explain the functions of NSSI. Intrapersonal functions involve motivations associated with changes in one's internal state, such as an emotional state or thoughts (e.g., affect regulation), while interpersonal

functions involve motivations associated with changes in the external environment (e.g., communicate distress) (Klonsky et al., 2015). Intrapersonal functions are the most commonly reported and are associated with high emotional reactivity and poor emotion regulation skills, while interpersonal functions are primarily linked to social difficulties (Turner et al., 2012).

Furthermore, individuals engaging in NSSI not only exhibit difficulties in emotion regulation but also report a lack of social support (from both family and friends) (Muehlenkamp et al., 2013). Perceived social support refers to the perception of being cared for, valued, and assisted by one's social network when needed (Barrera, 1986). Individuals who engage in self-injury often experience difficulties regulating their emotions, leading to increased emotional distress. When this emotional vulnerability is coupled with limited social support, they lack the opportunity to feel understood and supported by their network—a crucial need for adolescents and young adults (Guérin-Marion et al., 2020). Consequently, NSSI may serve not only as a maladaptive coping strategy to alleviate emotional suffering, but also to reduce feelings of isolation (Wang et al., 2020). Thus, the interplay between emotional dysregulation and low social support can create a vicious cycle, where individuals who self-injure may experience greater social isolation, exacerbating their emotional difficulties (Gandhi et al., 2018) and increasing the likelihood of future self-harm (Kiekens et al., 2019).

These findings highlight the critical importance of early intervention and the development of adaptive emotion regulation skills for individuals who engage in NSSI, as this could potentially mitigate the risk of developing more severe and enduring mental health difficulties. For instance, NSSI is strongly associated with severe mental disorders,

particularly BPD (Glenn & Klonsky, 2013). The prevalence of NSSI in BPD is alarmingly high, with estimates suggesting that 70-90% of individuals with this disorder engage in NSSI behaviors (Zanarini et al., 2004). Longitudinal studies have shown that recurrent self-injury during adolescence is a significant risk factor for developing borderline features in young adulthood (Daukantaitė et al., 2022; Stead et al., 2019). Therefore, a comprehensive understanding of the interplay between emotional dysregulation, NSSI, and BPD is essential for developing effective therapeutic interventions for individuals who engage in self-injury and/or exhibit borderline features.

### *1.2.2. Emotion Dysregulation and Borderline Personality Disorder*

Borderline Personality Disorder (BPD) is a severe mental disorder affecting an estimated 2.7% of the general population, which increases significantly to 15-28% in psychiatric hospital settings (Trull et al., 2010). BPD typically emerges during adolescence or early adulthood, and is frequently linked to severe occupational and psychosocial impairment (Leichsenring et al., 2024). The disorder is characterized by a pervasive pattern of instability in interpersonal relationships, self-image, and affect (American Psychiatric Association, 2013). Given Emotion dysregulation is a core feature of BPD (Glenn & Klonsky, 2009), individuals with this diagnosis often experience heightened emotional sensitivity, intense emotional responses, and difficulty modulating these responses (Santangelo et al., 2017). This lack of emotional regulation may cause people with BPD to adopt maladaptive coping mechanisms when faced with emotionally challenging circumstances (Bohus et al., 2021).

Interestingly, NSSI is strongly associated with BPD (Glenn & Klonsky, 2013). The prevalence of NSSI in BPD is alarmingly high, with estimates suggesting that 70-90% of

individuals with this disorder engage in NSSI behaviors (Zanarini et al., 2004). Longitudinal studies have shown that recurrent self-injury during adolescence is a significant risk factor for developing borderline features in young adulthood (Daukantaitė et al., 2022; Stead et al., 2019). The intense emotional reactivity and instability inherent in BPD can leave individuals feeling overwhelmed and desperate for relief, increasing their vulnerability to NSSI as a way to cope with emotional pain. This often creates a detrimental cycle, where NSSI provides temporary relief but ultimately exacerbates emotional distress and perpetuates dysregulation in BPD.

Therefore, a comprehensive understanding of the interplay between emotional dysregulation, NSSI, and BPD is essential for developing effective therapeutic interventions for individuals who engage in self-injury and/or exhibit borderline features.

### *Linehan's biosocial theory: An explanatory model of Borderline Personality Disorder*

Linehan's biosocial theory (1993) offers a comprehensive framework for understanding the role of emotion dysregulation in psychopathology, particularly in the development of BPD. This theory posits that BPD arises from a complex interplay between biological vulnerabilities and invalidating environmental experiences. According to Linehan's theory, the combination of biological vulnerabilities and invalidating environments leads to the development of emotion dysregulation and adopt maladaptive coping mechanisms (see figure 1).

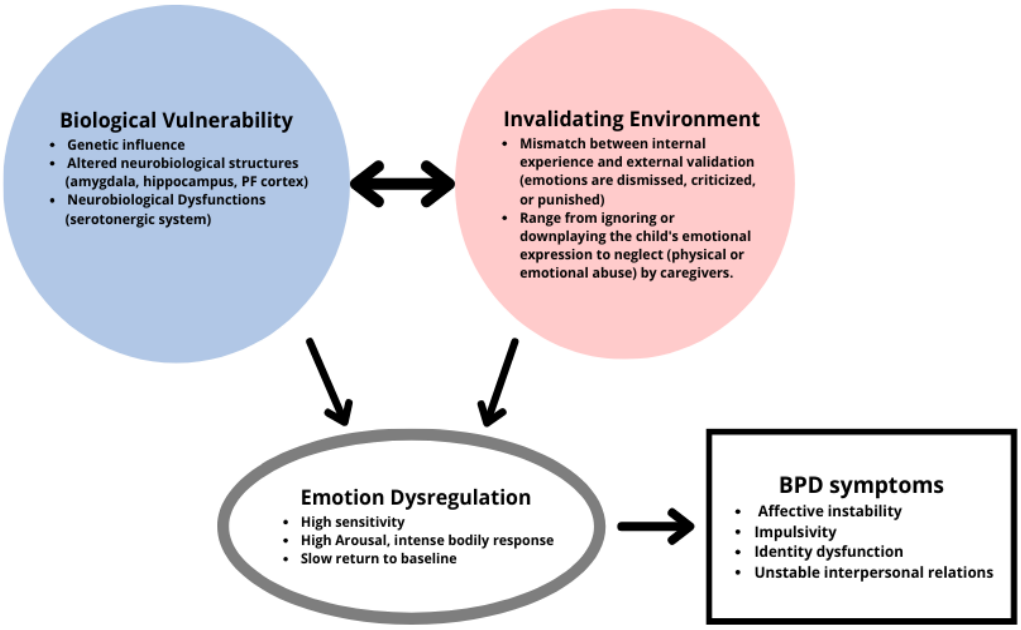



**Figure 1.** Adapted from Linehan's transactional model of biosocial theory (Linehan, 1993).

In Linehan's theory, the emotional vulnerability refers to inherent predispositions that make individuals more susceptible to borderline features. These may include genetic factors, neurobiological differences, or physiological irregularities (Leichsenring et al., 2024). More specifically, individuals with BPD may exhibit biological predispositions (e.g., reduced amygdala volume and gray matter in the anterior and posterior cingulate gyrus) which contribute to: (i) heightened emotional sensitivity; (ii) extreme and intense emotional reactions, and (iii) slow return to emotional baseline (Linehan, 1993).

The environmental factors, in interaction with biological vulnerability, play a crucial role in shaping the development of BPD. Linehan's theory emphasizes the importance of invalidating family environments, characterized by inadequate or inconsistent responses to emotional needs, including experiences of emotional invalidation, rejection, and even trauma events (e.g., physical, emotional and/or sexual abuse) (Beauchaine et al., 2009). In an

invalidating environment the emotional control is often reinforced (e.g., emotional suppression) or the emotional expression is often ignored or punished (Crowell et al., 2009). This dynamic hinders the development and use of adaptive strategies of emotion regulation, as well as making it difficult to learn new strategies.

Interestingly, evidence from genetic studies supports Linehan's biosocial model, demonstrating the significant heritability of BPD and its association with emotional dysregulation (Leichsenring et al., 2024). For instance, a large-scale twin study in Norway (Reichborn-Kjennerud, 2013) found that genetic factors accounted for 55% of the variance in BPD symptoms, highlighting a strong heritable component specifically related to emotion dysregulation. This finding is consistent with other studies reporting similar heritability estimates (e.g., Kendler et al., 2011; Distel et al., 2011). However, while genetic factors play a significant role, it is crucial to emphasize that gene-environment interactions are central to understanding the development of BPD. Longitudinal research indicates that individuals genetically predisposed to borderline traits are more likely to develop BPD when exposed to adverse environments, such as chronic family dysfunction. For instance, a 12-year longitudinal study of a twin cohort (n = 1116) found that children with high heritability for borderline traits who had been exposed to a chronically invalidating family environment developed borderline personality characteristics by age 12 (Belsky et al., 2012). In conclusion, these findings support the hypothesis that both genetic and environmental risk factors for mental health make independent contributions, but collectively explain emotion dysregulation and the course of borderline personality disorder (Carpenter et al., 2013; Leichsenring et al., 2024).

Together, these previous findings provide support for the emotional dysregulation features in BPD. As Linehan (2014) posits, this difficulty in managing emotions often leads to an overreliance on maladaptive coping strategies, paired with a notable deficit in adaptive ones. This pattern is consistently corroborated by meta-analytical research, revealing a higher propensity among individuals with BPD to engage in maladaptive mechanisms like thought suppression, rumination, and self-criticism; conversely, they often struggle to utilize more adaptive strategies such as cognitive reappraisal, problem-solving, acceptance, and mindfulness (Daros et al., 2019; Sorgi-Wilson & McCloskey et al., 2022). This imbalance in coping mechanisms can have profound consequences for individuals with BPD. While maladaptive strategies may provide temporary relief from emotional pain, they often exacerbate symptoms and lead to further distress in the long term. On the other hand, adaptive strategies, though challenging to implement initially, offer healthier and more sustainable ways of managing difficult emotions.

Therefore, interventions aimed at improving emotional regulation skills are critical in the treatment of BPD. By providing individuals with a broader repertoire of adaptive coping mechanisms, they can better cope with emotional challenges and reduce reliance on maladaptive behaviors (Linehan, 1993). In this context, early intervention strategies targeting both biological vulnerabilities and environmental risk factors are crucial to mitigate the severe emotional regulation difficulties in this disorder.

## 1.3. Therapeutic Approach of Emotion Dysregulation

The growing recognition of emotion regulation's pivotal role in mental health has led to its integration into various psychotherapeutic models (e.g., Hayes et al., 1999; Linehan, 1993; Mennin & Fresco, 2009). These interventions, designed to train individuals with the capacity to understand, manage, and navigate their emotional experiences effectively, hold immense promise for alleviating distress, and enhancing overall well-being across a spectrum of mental health challenges. However, while the importance of emotion regulation is well-established, a significant gap exists in our understanding of the specific emotional regulation processes and strategies that are most efficacious in addressing complex challenges, particularly NSSI and severe BPD symptoms.

### *1.3.1. Dialectical Behavior Therapy*

Dialectical Behavior Therapy (DBT) has emerged as an empirically supported treatment for BPD (Bohus et al., 2021). DBT is a comprehensive cognitive-behavioral treatment designed to address the complex symptoms of BPD, including emotional dysregulation, impulsivity, and interpersonal difficulties (Linehan, 1993; 2014). This multifaceted intervention encompasses four modalities: individual therapy, consultation teams for therapists, telephone coaching and group skills training.

Individual therapy follows a phased approach, prioritizing the reduction of risk behaviors and emotional dysregulation. Initial interventions (stage 1) focus on stabilizing the individual by decreasing harmful behaviors like NSSI and building foundational skills for managing intense emotions. Once a level of behavioral and emotional stability is achieved, therapy moves on to address the underlying emotional difficulties, including trauma,

depression, or anxiety (stage 2). As emotional regulation improves and emotional distress diminishes, treatment progresses to focus on goals centered on building a values-based life (stages 3 & 4). This phase involves helping the individual identify their core values and develop a life plan aligned with those values, fostering a sense of meaning and purpose.

Consultation teams for therapists consist of clinical meetings with a team of other DBT-trained clinicians to provide each other support, case consultation, and help maintain their own DBT skills and motivation. In addition, an important objective of consultation teams is to prevent burnout in the therapists and ensure adherence to DBT principles.

Telephone coaching consists of providing therapeutic support to patients outside the consultation room when they are in an emotional crisis situation. This therapeutic resource seeks to increase generalization of skills effectively from therapy to daily life. An important role in telephone coaching is that the client should use the resource before engaging in problem behavior and not after, with the goal of positively reinforcing the use of skills rather than dysfunctional behaviors.

Group skills training is another essential component of DBT, providing a structured environment where individuals can learn and practice specific emotion regulation skills. Group skills training typically involves a 24-week program, with weekly group sessions (2-2.5 hour) and includes four modules: mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness. Each module follows the following format: (i) psychoeducation, the group leader provides instruction and explanation of the specific skills within each module; (ii) skill practice, individuals engage in in-session exercises and role-playing to practice applying the skills in simulated situations; (iii) homework assignments, participants

are encouraged to apply the skills in their daily lives and report back to the group on their experiences; and (iv) group discussion and support, members share their experiences, challenges, and successes in applying the skills, providing mutual support and encouragement.

The combination of these therapeutic modalities is essential for the success of DBT. Individual therapy allows for a deep exploration of individual issues and the development of a strong therapeutic relationship while group therapy provides opportunities for peer support and skill practice in a safe and supportive environment. The following is a brief explanation of each module. Subsequently, we will develop more in depth the mindfulness module, which is part of the study objective of this work:

a. **Mindfulness.** The main purpose is to cultivate awareness of the present moment without judgment, helping individuals observe their emotions and thoughts without being overwhelmed by them. This skill is fundamental to all other DBT skills.
b. **Emotion regulation.** Learning to identify, understand, and manage emotions effectively. This module teaches strategies for reducing emotional vulnerability, changing unhelpful emotional responses, and increasing positive emotional experiences.
c. **Distress tolerance.** Developing skills to cope with crisis situations and overwhelming emotions without resorting to maladaptive behaviors, like NSSI. This module emphasizes acceptance of current distress, distraction techniques, and self-soothing strategies.
d. **Interpersonal effectiveness.** Improving communication and relationship skills to build healthy relationships and achieve interpersonal goals assertively. Individuals

learn how to navigate interpersonal conflict, communicate their needs effectively, and maintain healthy boundaries.

Group skills training offers a supportive environment for learning, practicing, and receiving feedback on these skills, fostering a sense of community and shared experience that can enhance motivation and promote generalization of skills to real-life situations (Chapman & Owens, 2020).

### *1.3.2. Efficacy of Dialectical Behavior Therapy*

Research has consistently demonstrated the efficacy of DBT for individuals with BPD, leading to the recommendation of DBT-based psychotherapy as the gold standard treatment for this complex disorder (Bohus et al., 2021). Meta-analyses of numerous randomized controlled trials have provided compelling evidence for DBT's effectiveness in reducing a wide range of BPD symptoms and improving overall quality of life. For instance, meta-analyses by Stoffers et al. (2012) and Storebø et al. (2020) revealed that, compared to control conditions, DBT significantly reduces suicidal and self-harm behaviors, decreases anger and impulsivity, improves interpersonal functioning, and enhances emotion regulation abilities.

Studies focused exclusively on DBT skills training has been shown to be effective in decreasing anxiety, depression, in reducing suicide attempts, NSSI, and in improving anger control (Linehan et al., 2015; Neacsiu et al., 2010; Soler et al., 2009). Furthermore, several studies highlight that specific DBT skill training factors are linked to teaching and promoting emotion regulation skills, especially mindfulness (Mehlum, 2021; Wyatt et al., 2023). Studies emphasize that the practice of behavioral skills, particularly when used effectively, improves

emotional regulation difficulties in individuals with BPD (Southward et al., 2023). This leads to individuals increasing their repertoire of adaptive strategies while decreasing maladaptive ones. While the precise mechanisms underlying DBT's effectiveness are still being explored, several key factors are believed to contribute to the efficacy of DBT (Chapman & Owens, 2020; Mehlum, 2021):

a. **Multimodal approach.** DBT's comprehensive and integrated approach, encompassing individual therapy, group skills training, phone coaching, and therapist consultation team meetings, provides a robust support system that addresses multiple facets of BPD.
b. **Focus on skill development.** DBT equips individuals with concrete skills for managing emotional distress, tolerating difficult situations, and navigating interpersonal relationships effectively. These skills empower individuals to cope with challenges more adaptively, reducing engagement in maladaptive behaviors.
c. **Validation and acceptance.** DBT therapists validate the individual's experiences and emotions while simultaneously encouraging change. This balance of acceptance and change creates a therapeutic environment that fosters trust and facilitates motivation for growth.
d. **Emphasis on mindfulness.** The core mindfulness skills taught in DBT foster present-moment awareness and nonjudgmental acceptance, helping individuals detach from intense emotional experiences and reduce impulsive reactions that often lead to self-harm.

### *1.3.3. Mechanism of Change in Dialectical Behavior Therapy*

Uncovering the mechanisms of change within psychotherapy is paramount to optimize treatment efficacy and personalize interventions. Understanding how and why a therapy works allows for refinement of techniques and a more targeted approach to specific symptoms and individual needs (Kazdin, 2014). This mechanism-focused approach to clinical research illuminates the active ingredients of therapy, revealing which cognitive, behavioral, or emotional processes are most impacted by the intervention and ultimately contribute to desired outcomes (Holmes et al., 2018). One way to investigate mechanisms of change is to assess putative mediators and outcomes through repeated measures during a given intervention (i.e., session by session) and explore a temporal precedence between changes in the proposed mechanism and changes in outcome (Kazdin, 2007). In addition, disaggregating within- and between-person effects of the putative mechanisms provides a deeper understanding of individual changes over time (Wang & Maxwell, 2015).

In line with understanding the mechanisms of change in psychotherapy, research has focused on elucidating how DBT, especially skills training, achieves its therapeutic effects. A central question is how DBT skills training enhances emotional dysregulation in BPD (Chapman & Owens, 2020). To date, research suggests that enhanced mindfulness and emotion regulation are key potential mechanisms of change in DBT (Hood et al., 2024; Lynch et al., 2006). In addition, studies also suggest that a primary mechanism of change is the increased use of behavioral skills learned during DBT skills training, which mediates reductions in emotion regulation difficulties (Asarnow et al., 2021; Neacsiu et al., 2014). Specifically, studies examining within-person effects have found that greater use of behavioral skills (e.g., mindfulness and distress tolerance) predicts improvements in emotion

dysregulation (Southward et al., 2023; Wyatt et al., 2023) as well as reductions in NSSI (Barnicot et al., 2016) following a DBT skill training. Interestingly, these changes are not explained by common factors of effectiveness in psychotherapy such as treatment credibility and the therapeutic alliance.

These results underscore the crucial role of learning and effectively utilizing emotional regulation strategies to disengage from maladaptive coping mechanisms. By acquiring and implementing new ways of managing emotions, individuals can disrupt the cycle of emotional distress and behavioral dysregulation. For example, learning to recognize and accept one's current emotional state, a core component of mindfulness, can diminish reliance on experiential avoidance, a common dysfunctional strategy in BPD. As individuals cultivate a greater capacity for mindful awareness and acceptance, they become less likely to engage in avoidant behaviors aimed at suppressing or escaping from unwanted emotions. This shift towards adaptive emotion regulation fosters greater emotional stability and reduces reliance on maladaptive coping mechanisms.

### *1.3.4. Mindfulness Skill Training*

Mindfulness skill training stands as a cornerstone of DBT (Linehan, 1993). Mindfulness is characterized by a present-centered awareness with an attitude of acceptance and openness as opposed to a tendency to judge experience (Linehan, 2014). Mindfulness skills have been proposed as a key mechanism driving DBT's effectiveness in improving emotion regulation in BPD (Chapman & Owens, 2020; Linehan, 1993). DBT encourages individuals to approach their emotions with acceptance and non-judgment, fostering a more balanced and adaptive approach to emotional experiences. This approach has proven

effective as a self-regulatory strategy for reducing maladaptive behaviors, such as NSSI, often employed by individuals with BPD to cope with intense emotions (Linehan et al., 2015).

Mindfulness in DBT encompasses three primary skills: "What" skills, focusing on objectively observing and describing internal experiences; "How" skills, emphasizing fully engaging in the present moment without judgment; and "Wise Mind" skills, facilitating access to a balanced state of mind integrating reason and emotion (Linehan, 2014). Through consistent practice of these skills, individuals with BPD can learn to detach from distressing thoughts and emotions, reduce impulsive reactions, and develop a more compassionate relationship with themselves and their experiences.

Mindfulness skill training has demonstrated substantial promise in ameliorating the complex symptomatology of BPD. Empirical research suggests that even when implemented independently of other DBT modules, mindfulness training yields significant therapeutic benefits. For instance, Elices et al. (2016) observed a marked reduction in overall BPD symptomatology following mindfulness skill training. This ameliorative effect extends to core challenges characteristic of BPD, including impulsivity, which has been found also to decrease following mindfulness skill training (Carmona I Farrés et al., 2019; Soler et al., 2016). Furthermore, mindfulness practice appears to facilitate the development of adaptive emotion regulation strategies, addressing a critical deficit within this clinical population (Wyatt, 2023).

### *1.3.5. Mechanism of Change in Mindfulness Skills Training*

Studies investigating the effects of Dialectical Behavior Therapy (DBT) skills training on borderline symptoms and NSSI frequency often point to increased mindfulness skills as a key driver of change (Krant et al., 2018; Zeifman et al., 2020). However, the specific mechanisms by which mindfulness skills training leads to these positive outcomes remain unclear. To date, research has not empirically evaluated these mechanisms within the context of DBT. This research project aims to address this critical gap in the literature by investigating the specific mechanisms underlying the effectiveness of mindfulness-based DBT skills training. The broader literature on mindfulness-based interventions has proposed several key mechanisms (Hölzel et al., 2011; Tang et al., 2015). These potential mechanisms serve as a theoretical framework for the present work:

a. **Decentering.** This ability involves a change of perspective towards one's own experiences and is a key mechanism of change in mindfulness-based interventions, (Maloney et al., 2024). It is characterized by a disidentification from mental contents (thoughts, feelings, sensations) that are typically experienced as defining the self (Carmody et al., 2009). This metacognitive capacity, often described as a form of meta-awareness, allows individuals to observe their thoughts and emotions with a sense of non-attachment, thereby reducing reactivity to their mental content (Bernstein et al., 2015). Some research on emotion regulation therapy has implicated decentering as a mechanism through which anxious-depressive symptoms are reduced (O'Toole et al., 2019). Furthermore, decentering has been posited to function as a moderator, attenuating the association between other psychological processes (e.g., rumination) and psychopathology (Wu et al., 2022). Given its metacognitive

nature, decentering appears to be a valuable therapeutic strategy for reducing fusion with negative self-referential content, ultimately fostering greater emotional regulation and psychological flexibility (Berstein et al., 2019).

b. **Non-judgment of inner experience.** is a crucial ability cultivated in mindfulness-based interventions, and it holds particular relevance for individuals with BPD, who often struggle with self-criticism and judgmental thoughts (Linehan, 2014). This capacity to approach one's internal experiences with an attitude of openness and acceptance, rather than criticism, has been linked to lower levels of psychopathology (Carpenter et al., 2019). For individuals with BPD, characterized by a heightened tendency to judge their internal experiences, fostering non-judgment is essential for developing healthier emotion regulation strategies (Wupperman et al., 2009). The importance of non-judgment is further underscored by research demonstrating its role as a mediating mechanism in DBT. Studies have shown that increased non-judgment over time predicts reductions in borderline symptoms (Zeifman et al., 2020). For example, among women with BPD features, cultivating a greater capacity for non-judgment predicted fewer borderline symptoms over time (Eisenlohr-Moul et al., 2016).

c. **Body awareness.** This capacity involves directing attention to internal bodily sensations, such as tension or relaxation, and recognizing the emotions associated with these sensations. Rather than avoiding or suppressing bodily experiences, body awareness emphasizes cultivating a mindful and accepting awareness of the body (Price & Thompson, 2007). This focus on internal bodily sensations is a common element of mindfulness meditations and is developed through the practice of

observing inner experience without judgment (Carmody & Baer., 2008). Research suggests that individuals with BPD often exhibit lower levels of body awareness compared to healthy controls, a deficit linked to emotion dysregulation (Schmitz et al., 2021). This highlights the importance of cultivating body awareness as a therapeutic target in BPD treatment (Hölzel et al., 2011). By learning to tune into their bodily sensations and recognize the emotional information they convey, individuals with BPD can develop a more grounded and embodied sense of self, facilitating greater emotional regulation and self-awareness.

d. **Attention awareness.** It consists of cultivating a focused present-moment awareness. Mindfulness meditation, for example, often involves directing attention to a specific object, such as the breath, noticing when the mind wanders, and gently guiding attention back to the chosen object (Lutz et al., 2008). This practice in regulating attention is particularly relevant for individuals with BPD, who often struggle with emotion dysregulation and impulsivity. By learning to observe their present-moment experience without clinging to or avoiding any particular content, individuals with BPD can develop greater emotional stability and impulse control (Linehan, 2014). Despite the theoretical relevance of attention awareness for improving emotion regulation in BPD, research directly examining this mechanism within a mindfulness training context remains limited.

Exploring whether each of these potential mechanisms of change contributes to improved emotion regulation in individuals with BPD could provide valuable insights into why and how mindfulness skills training works.

## 1.4. Summary

The capacity for adaptive emotion regulation is fundamentally linked to positive mental health outcomes. Individuals who possess and utilize effective emotion regulation strategies are better equipped to manage emotionally demanding situations. Conversely, emotion dysregulation—characterized by persistent difficulties in modulating emotional responses—is associated with an increased risk for developing psychopathology.

As discussed previously in the introduction, there is a strong and well-documented link between NSSI and borderline features, with emotion dysregulation representing a common underlying mechanism. However, the specific dimensions of emotion dysregulation most relevant to self-harming behaviors, as well as the characteristics of NSSI subgroups at heightened risk for psychopathology, remain unclear. A deeper understanding of how emotion dysregulation contributes to both NSSI and borderline symptoms is essential for developing effective prevention and intervention strategies.

Mindfulness skills training has been proposed as a recommended intervention for improving emotion regulation in BPD and reducing maladaptive behaviors associated with NSSI. However, the specific mechanisms by which mindfulness skill training impacts emotion dysregulation and BPD-related outcomes remain unclear. Clarifying these mechanisms is critical for developing more targeted interventions and improving treatment protocols for individuals struggling with emotion dysregulation and NSSI.

# Chapter II

## Dissertation Aims and Hypotheses

# 2. Aims and Hypotheses

This thesis is divided into two main sections: (i) the first section evaluates the predictive role of emotion dysregulation in identifying high-risk subgroups for NSSI; (ii) the second section explores the underlying mechanisms involved in the emotion regulation improvement after a Mindfulness-Based DBT skill training in individuals with BPD.

## 2.1. General aims Study 1 & 2: Emotion Dysregulation and Non-suicidal self-injury

(1) To evaluate the predictive role of emotion dysregulation in identifying high-risk subgroups for NSSI.

***Specific aims***

i. Compare three groups (BPD with NSSI, Non-clinical group with NSSI, and a Healthy control group) on measures of clinical severity and dimensions of emotion dysregulation.
ii. Evaluate the differential association between distinct dimensions of emotion dysregulation and the functions and frequency of NSSI.
iii. To explore distinct subgroups based on NSSI features, emotion dysregulation, and perceived social support using Latent Profile Analysis.
iv. To compare the NSSI subgroups on measures of psychopathological risk at baseline and at a two-year follow-up.

## 2.2. Hypotheses Study 1 & 2: Emotion Dysregulation and Non-suicidal Self-injury

1. Individuals engaging in NSSI would exhibit greater clinical severity and more pronounced difficulties in emotion regulation.
2. Specific dimensions of emotion dysregulation (e.g., lack of strategies) would demonstrate a strong association with the intrapersonal functions of NSSI (i.e., affect regulation) and higher frequency of NSSI.
3. A Latent Profile Analysis of young adults with a history of NSSI would reveal distinct subgroups characterized by differences in NSSI features, level of emotion dysregulation, and perceived social support.
4. The subgroup of individuals with more severe NSSI features, greater emotional dysregulation, and low perceived social support would present more severe symptoms at baseline and at 2-year follow-up.

## 2.3. General aim studies 3, 4 & 5: Mechanisms of Change and Emotion Dysregulation

(1) To explore the mechanisms through which mindfulness-based DBT skills training reduces emotion dysregulation in individuals with BPD.

***Specific aims***

i. To examine whether the effects of mindfulness-based DBT skills training on borderline symptoms are mediated by a unidirectional pathway through increased decentering, leading to decreased emotion dysregulation.

ii. To explore whether a greater commitment to mindfulness skills practice is associated with improved emotion dysregulation within a mindfulness-based DBT skills training.

iii. To examine the bidirectional temporal relationship between weekly mindfulness practice and emotion dysregulation.

iv. To explore the potential mechanisms of change (i.e., decentering, nonjudging the inner experience, body awareness, and attention awareness) within mindfulness-based DBT skill training.

v. To explore the bidirectional temporal relationship between proposed mechanisms and emotion dysregulation.

vi. To explore the moderating role of decentering. Specifically, we would examine whether the association between nonjudging, body awareness, attention awareness and emotion dysregulation is stronger among participants with higher levels of decentering.

### 2.4. Hypotheses study 3, 4 & 5: Mechanisms of Change and Emotion Dysregulation

1. The effects of mindfulness-based DBT skills training on borderline symptoms would be mediated through a unidirectional pathway; via increased decentering, which in turn would decrease emotion dysregulation.
2. A greater commitment to mindfulness skills practice would be associated with a more significant reduction in emotion dysregulation within mindfulness-based DBT skill training.
3. A bidirectional temporal relationship between weekly practice and emotion dysregulation is expected.
4. The within-person effect of proposed mechanisms (i.e., decentering, nonjudging of inner experience, body awareness, and attention awareness) would be associated with changes in emotion dysregulation.
5. A bidirectional temporal relationship between the proposed mechanisms and emotion dysregulation is expected.
6. The association between nonjudging of inner experience, body awareness, attention awareness, and emotion dysregulation would be stronger among participants with a greater capacity for decentering (i.e., moderating role).

## 3. General Methods and Procedures

Studies 1 and 2 include a large sample composed of college students (n = 854) and outpatients (n= 50). Of this sample, we divided participants into three groups: (i) a group of BPD patients with NSSI; (ii) a non-Clinical group formed by students with NSSI; (iii) a Healthy Control Group. Study 2 included only college students with NSSI history (n = 259). All participants were screened by an experienced psychiatrist and psychologist specializing in BPD diagnosis and the identification of NSSI behaviors. Additionally, participants underwent a double diagnostic interview conducted by independent evaluators trained in administering the Structured Clinical Interview for DSM-IV Axis II Disorders (SCID-II) (First et al., 1997) and the Diagnostic Interview for Borderlines-Revised (DIB-R) (Barrachina et al., 2004).

Studies 3, 4, and 5 include a large sample of outpatients diagnosed with BPD (n = 149). All participants underwent initial interviews conducted by a psychiatrist and a psychologist experienced in BPD diagnosis and treatment. Two independent evaluators conducted diagnostic interviews using the SCID-II (First et al., 1997) and the DIB-R (Barrachina et al., 2004). Two psychologists specializing in DBT and BPD treatment delivered the interventions (To see DBT Skill Training, please refer to the Annex Section).

All procedures were approved by the corresponding Clinical Research Ethics Committee, and the study was conducted in accordance with the Declaration of Helsinki. Detailed information regarding procedures, inclusion criteria, assessments, intervention protocols, and data analysis plans is provided in the Method sections of the respective papers, which are presented in the following section.

# Chapter III

## Emotion Dysregulation and Non-Suicidal Self-injury

### Study 1. Predictor of Non-Suicidal Self-injury

Schmidt, C., Briones-Buixassa, L., Nicolaou, S., Soler, J., Pascual, J. C., & Vega, D. (2023). Non-suicidal self-injury in young adults with and without borderline personality disorder: the role of emotion dysregulation and negative urgency. *Anales de Psicología / Annals of Psychology*, *39*(3), 345–353. https://doi.org/10.6018/analesps.492631

### Study 2. High-risk Non-Suicidal Self-injury subgroups

Schmidt, C., Nicolaou, S., Pascual, J. C., Puntí, J., Lara, A., Sintes, A., Méndez, I., Romero, S., Briones-Buixassa, L., Santamarina-Perez, P., Soler, J., & Vega, D. (2024). Identifying High-Risk Subgroups of College Students with Non-Suicidal Self-Injury: A Latent Profile Analysis and Two-Years Follow-up Study. *Journal of youth and adolescence*, *53*(6), 1370–1382. https://doi.org/10.1007/s10964-024-01970-3

# 4. Non-suicidal self-injury in young adults with and without borderline personality disorder: the role of emotion dysregulation and negative urgency.

## 4.1. Introduction

Non-suicidal self-injury (NSSI) is broadly defined as the self-inflicted destruction of body tissue in the absence of suicidal intent (Nock, 2010). It affects between 13% and 32% of adolescents and young adults in community samples (Muehlenkamp et al., 2012; Swannell et al., 2014), becoming a growing public health concern. Alarmingly, NSSI has been associated with interpersonal difficulties, high levels of psychological suffering, and high risk for suicide (Ribeiro et al., 2016; Vega et al., 2018). While growing research has significantly increased knowledge about NSSI, the factors involved in the motivations of this high-risk behavior (i.e., functions of NSSI) have yet to be fully elucidated.

Previous studies have supported a two-factor higher-order model to explain functions of NSSI. On the one hand, intrapersonal NSSI-functions involve motivations associated with changes in one's internal state, such as an emotional state or thoughts (e.g., affect regulation) and, on the other hand, interpersonal functions involve motivations associated with changes in the external environment (e.g., interpersonal influence) (Klonsky et al., 2015; Turner et al., 2012). Among the wide range of NSSI functions commonly reported by people who engage in self-injury, intrapersonal functions are the most prevalent, indicating that individuals typically engage in self-injury to cope with inner tension (Taylor et al., 2018). Consistently, previous results show that intrapersonal functions are related to high emotional reactivity as well as poor emotion regulation skills, while interpersonal functions are mainly associated with social difficulties (Andover, 2014; Turner et al., 2012). For example, in a

sample of college students, individuals with high levels of emotion dysregulation reported that they engaged in NSSI mainly with an intrapersonal motivation, whilst those reporting greater difficulties in social relationships incurred in NSSI more commonly with an interpersonal motivation (Vega et al., 2017).

Although emotion dysregulation is considered an important transdiagnostic risk factor for a wide range of psychopathology in adolescents and adults (Aldao et al., 2010; Sheppes et al., 2015), previous work has reported a specific robust association between emotion (dys)regulation and NSSI (Fox et al., 2015; Wolff et al., 2019). In this regard, individuals who incur in NSSI exhibit poor emotion regulation compared to non-NSSI individuals (Taylor et al., 2018), and the degree of emotion dysregulation is correlated with the frequency of NSSI (Andover, 2014).

It is therefore not surprising that NSSI is strongly related to emotional disorders such as Borderline Personality Disorder (BPD) (Glenn & Klonsky, 2013). Affective dysregulation and poor emotion regulation skills are principal characteristics of BPD (Linehan, 1993). The emotional cascade model suggests that individuals with BPD experience intense negative affect and excessive rumination that may motivate engaging in dysregulated behaviors (e.g., self-injury) to reduce emotional arousal (Selby & Joiner, 2009).

Closely related to emotion dysregulation, negative urgency is an impulsivity trait that is conceptualized as a disposition or a proclivity to act rashly when experiencing strong negative emotions (Cyders & Smith, 2008). Most importantly, negative urgency is implicated in NSSI (Peckham et al., 2020). Engaging in NSSI has been associated with higher scores in negative urgency (Bresin et al., 2013), indicating a difficulty to control the urge to hurt

oneself when experiencing negative emotions. In addition, a prospective study revealed that adolescents with baseline negative urgency are more vulnerable to later engagement in NSSI (You et al., 2016).

While negative urgency has been identified as the impulsivity measure that is most robustly associated with NSSI (Hamza et al., 2015), some dimensions of emotion dysregulation have also been established as more relevant for NSSI than other dimensions. For example, a meta-analysis concluded that limited access to emotion regulation strategies, followed by nonacceptance of emotions, were most robustly associated with NSSI engagement (Wolff et al., 2019). Additionally, a recent study has reported that adolescents with severe NSSI show higher negative affect, less emotion regulation strategies, and more difficulties with impulse control, relative to their less severely affected counterparts (Chen & Chun, 2019). Collectively, these findings highlight the importance of considering measures of both emotion dysregulation and impulsivity to better characterize NSSI behavior.

Notwithstanding the above, there is a dearth of literature exploring the role of specific dimensions of emotion regulation in the engagement of NSSI and with regards to the motivation (intrapersonal vs. interpersonal function) of NSSI. A better understanding of this relationship, both in clinical and nonclinical samples, may help refine interventions for individuals who engage in self-injury. To bridge the gap in extant literature, the current study aimed to investigate the association of specific dimensions of emotion dysregulation with the functions and frequency of NSSI, in a sample of young adults. Innovatively, we included both a clinical group of patients with BPD and NSSI and a subclinical group of college students with NSSI.

Based on prior research suggesting that NSSI is associated with poor emotion regulation skills (Taylor et al., 2018; Wolff et al., 2019; Fox et al., 2016), it was hypothesized that participants with NSSI (both the clinical and subclinical groups) would present more clinical symptoms and more difficulties with emotion regulation relative to the healthy control group. In turn, this would indicate that NSSI is associated with a worse clinical status and higher emotion dysregulation (hypothesis 1). Second, it was predicted that emotion (dys)regulation (assessed by DERS subscales) would show a strong positive association with intrapersonal functions of NSSI and a weaker or no association with interpersonal functions of NSSI. Specifically, given recent meta-analytic findings (Wolff et al., 2019), it was postulated that limited access to emotion regulation strategies and non-acceptance of emotions would be more strongly associated with intrapersonal (i.e., affect-regulating) functions of NSSI and frequency of NSSI (hypothesis 2). Lastly, given prior findings portraying negative urgency as a vulnerability factor for self-harm (You et al., 2016), it was anticipated that negative urgency would predict NSSI frequency (hypothesis 3). Given no prior research regarding the role of negative urgency in motivations for self-harm, exploratory analyses were conducted to explore whether this impulsivity construct would predict intrapersonal or interpersonal NSSI-functions.

## 4.2. Methods

### *Participants and procedures*

The sample consisted of 86 young adults (aged 18 to 33 years old), divided into three groups: (i) 30 college students with NSSI (ST-NSSI group), (ii) 25 patients with BPD and NSSI (BPD-NSSI group), and (iii) 31 healthy controls with no history of any mental disorder

or NSSI (HC group). Participants were recruited from different sources. All participants underwent the Structured Clinical Interview for DSM IV Axis II Disorders (SCID-II) (First et al., 1997) and the Diagnostic Interview for Borderlines-Revised (DIB-R) (Barrachina et al., 2004). Using these two clinical interviews, an experienced clinical psychologist with a PhD conducted the assessment in order to confirm (for BPD patients) or discard (for students) the BPD diagnosis criteria based on the SCID-II and DIB-R. Also, both ST-NSSI and BPD-NSSI participants fulfilled the DSM-5 diagnostic criteria for the DSM-5 (American Psychiatric Association, 2013) 'non-suicidal self-injury disorder' (Supplemental material). The present study is part of a larger study for which all participants received monetary compensation (€30-50). All procedures were approved by the corresponding Clinical Research Ethics Committee the study was conducted in accordance with the Declaration of Helsinki.

**College student sample (ST-NSSI group)**

This group included college students from Igualada (Barcelona) who studied engineering and social sciences and agreed to take part in the research voluntarily and anonymously. A total of 180 students completed an anonymous assessment including sociodemographic, self-report questionnaires, and a screening of NSSI in a mass session. Those who reported a history of NSSI behaviors were invited to participate in a second stage of the study, and if interested, they were asked to include their email address. Finally, 25 students with a positive NSSI screening (that is, 25 students reported a history of NSSI behaviors) qualified for the study and were included in the analysis. This group was not previously diagnosed with any pathology and did not meet criteria for any personality disorders, as determined by the Structured Clinical Interview (SCID II) (First et al., 1997).

Additionally, they were not receiving psychiatric/psychological treatment at the time of evaluation

**Group of patients (BPD-NSSI group)**

The BPD-NSSI group (N= 30) consisted of young patients with BPD and NSSI, who were recruited from the Mental Health Department of Igualada General Hospital. They were patients undergoing psychological treatment at the time of recruitment, and they agreed to participate in the study voluntarily. Diagnosis was based on the DSM-IV-TR and the Diagnostic Interview for Borderlines-Revised (DIB-R) (Barrachina et al., 2004). Exclusion criteria for this group included any presence of brain injury, psychotic, bipolar, current major depressive disorder, and drug abuse.

**Healthy control group (HC group)**

Healthy control participants (N= 31) with no history of NSSI were recruited via local advertisement using social media. Inclusion criteria for this group included: (i) no current psychiatric/psychological treatment, (ii) no current or past mental disorder, (iii) no present or past self-harm behaviors. To ensure that they met these inclusion criteria, healthy control participants completed a clinical interview in a single session with an expert clinician.

***Measures***

**Inventory of Statements About Self-Injury (ISAS)** (Klonsky & Glenn, 2009). This inventory consists of two sections. The first one assesses lifetime frequency of 12 NSSI behaviors (e.g., Cutting). Participants who endorsed one or more NSSI behaviors were then instructed to complete a second section of the inventory, which assesses 13 NSSI functions.

These functions are grouped into two separate factors that index interpersonal (e.g., interpersonal influence, self-care) and intrapersonal NSSI functions (e.g., affect-regulation, anti-suicide) (Klonsky & Glenn, 2009). We used the Spanish version of the ISAS which shows good internal reliability for both Interpersonal and Intrapersonal scales (α = 0.87 and α = 0.90, respectively) (Vega et al., 2017).

**The Borderline Personality Questionnaire (BPQ)** (Poreh et al., 2006). This is a self-report questionnaire that assesses BPD based on DSM-IV criteria. It consists of 80 statements, distributed over nine subscales: Impulsiveness, Affective Instability, Abandonment, Relationship, Self-Image, Suicide/Self-Mutilation, Emptiness, Intense Anger, and Quasi-Psychotic States. The Spanish version of the BPQ presents moderate to high internal reliability (Cronbach's $\alpha$ =.78 to .93) for all nine scales (Fonseca-Pedrero et al., 2011). BPQ is a good screening tool for the diagnosis of BPD in outpatient youth(Chanen et al., 2008). In this study, the total BPQ score was used as a measure of the severity of borderline personality symptoms. A higher total BPQ score indicated higher or more severe BPD symptoms.

**Depression Anxiety Stress Scales (DASS-21)** (Bados et al., 2005). The DASS-21 is a self-report instrument that assesses the intensity/frequency of 21 negative emotional symptoms during the previous week, distributed over three subscales: Depression, Anxiety, and Stress. The Spanish version presents moderate to good internal reliability (Cronbach's α = 0.84, 0.70 and 0.82) for each of the three scales, respectively (Bados et al., 2005).

**Brief Version of the Difficulties in Emotion Regulation Scale (DERS-18)** (Victor & Klonsky, 2016). DERS-18 is the abbreviated version of the Difficulties in Emotion

Regulation Scale (DERS) (Gratz & Roemer, 2004). The 18-item short-form maintains a similar structure to the 36-item DERS, with 6 subscales that assess emotion regulation difficulties: (i) lack of emotional awareness, (ii) lack of emotional clarity, (iii) nonacceptance of emotions, (iv) inability to engage in goal-directed behavior when feeling emotional, (v) engagement in impulsive behavior when feeling emotional, and (vi) inability to access emotion regulation strategies. The total DERS score presents a high internal reliability (Cronbach's $\alpha$ = .91) and the six scales present moderate to high internal reliability (Cronbach's $\alpha$ = .77 to .90) (Victor & Klonsky, 2016).

**Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency Impulsive Behavior Scale (UPPS-P)** (Verdejo-García et al., 2010). UPPS-P is a 59-item inventory that measures five distinct features of impulsive behavior. In the present study, we used only the negative urgency scales (see supplemental material for additional information). The urgency subscale consists of 12 items and it presents a good internal reliability (Cronbach's $\alpha$ = .87) in the Spanish version (Verdejo-García et al., 2010).

***Statistical analysis***

First, all continuous variables (ISAS, BPQ, DASS-21, DERS, UPPS-P-Negative Urgency) were assessed for normality and outliers. The scores for DASS-21 and DERS subscales were not normally distributed. NSSI-lifetime frequency and Intrapersonal functions of the ISAS were also non-normally distributed. Second, differences between groups for sociodemographic and self-report measures were evaluated; for categorical variables, Pearson´s Chi-square test ($\chi 2$) was used, whereas for continuous variables one-way ANOVA was used when the assumption of normality was met, and non-parametric

Kruskall-Wallis test was used when the assumption of normality was not met. In these analyses, self- report measures were included as within-subjects factors (BPQ, DERS, UPPS-P, DASS-21), and Group (BPD-NSSI, ST-NSSI, HC) as between-subjects factor. A post-hoc analysis was also performed using pairwise comparisons (Bonferroni correction) or Games-Howell tests, where applicable. Third, differences in NSSI-functions between BPD-NSSI and ST-NSSI groups were evaluated by using the Mann-Whitney and Wilcoxon non-parametric test. Finally, hierarchical multiple regression analyses were performed to evaluate whether measures of emotion dysregulation (DERS-subscales) and impulsivity (UPPS-P-Negative Urgency) were significant predictors of NSSI-functions and NSSI-lifetime frequency. Natural logarithm in NSSI-lifetime frequency and square-root transformations in the Interpersonal functions of ISAS and DERS subscales were used to achieve normal distribution. The descriptive analyses were performed with SPSS-21 and statistical tests were performed with RStudio Version 1.1.463.

### 4.3. Results

#### *Demographics and NSSI-characteristics*

Demographical information and NSSI characteristics are shown in Table 1 and psychometric properties of scales in Table S1. The three groups were matched by age ($\chi^2$ =2.83, *P* =.24) and sex ($\chi^2$ =.60, *P* =.74). The HC group had more years of formal education than the BPD-NSSI and ST-NSSI groups. Regarding NSSI-functions within self-harm groups, intrapersonal functions were significantly more prevalent than interpersonal functions both in BPD-NSSI (z = -4.45, *p* <.001) and ST-NSSI group (z = -4.37, *p* <.001). Between-group analysis can be found in Table S2. Notably, intrapersonal NSSI-functions

were significantly more prevalent in the BPD-NSSI group than in the ST-NSSI group and, specifically, anti-suicide NSSI-function was higher in the BPD-NSSI group. There were no significant differences in interpersonal NSSI-functions between groups.

**Table 1**. *Sociodemographic characteristics*

| | **BPD-NSSI** (N = 30) | **ST-NSSI** (N = 25) | **HC** (N =31) | **Analysis** $\chi^2$†/Z | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| **Age** (mean, SD) | 23.57 (4.5) | 20.92 (1.4) | 23.26 (4.2) | 2.83 | | .24 |
| **Sex** (female, %) | 90 % | 84 % | 83.9 % | | 0.60 | .74 |
| **Education years** (mean, SD) | 12.30 (1.5) | 12.80 (1.6) | 14.38 (2.9) | 6.85 | | < **.05** |
| **Employment** (Working, %) | 26.1 % | 40 % | 36.7 % | | 1.11 | .57 |
| **NSSI features** (mean, SD) | | | | | | |
| Age of onset NSSI (years) | 14.73 (4.7) | 13.22 (2.3) | - | -1.10 | | .27 |
| Frequency ( Lifetime) | 291.74 (356.7) | 194.48 (239.8) | - | -1.01 | | .31 |
| No. Method (range 1-12) | 6.08 (2.5) | 5.80 (2.5) | - | -.42 | | .66 |

*Note*. BPD-NSSI = Border Personality Disorder with Non-suicidal self-injury; ST-NSSI = Student with Non-suicidal self-injury; HC = healthy control group; Others = unemployment or sickness disability.
$\chi^2$† = Kruskall-Wallis test; Z = U Mann-Whitney test.

### *NSSI, emotion dysregulation, and clinical symptoms in 3 groups (hypothesis 1)*

Table 2 illustrates between-group differences in clinical measures. As shown, BPD patients with NSSI (BPD-NSSI group) and college students with NSSI (ST-NSSI group) scored higher than healthy controls on all scales, suggesting a higher clinical severity associated with the presence of NSSI. Additionally, the BPD-NSSI group scored higher than the ST-NSSI group in Negative Urgency (UPPS-P), symptoms of Depression (DASS-21), and inability to access emotion regulation Strategies (DERS). No differences (BPD-NSSI vs. ST-NSSI) were found in levels of emotion dysregulation (except on lack of emotion

regulation strategies), suggesting that the presence of NSSI is associated with poor emotion regulation. Importantly, BPQ discriminated between the three groups, and specifically, the ST-NSSI group differed significantly from the BPD-NSSI group in borderline pathology.

**Table 2.** *Multiple comparisons for the three groups in self-report measures*

| | **BPD-NSSI** (N = 30) | **ST-NSSI** (N = 25) | **HC** (N = 31) | **Analysis** | | |
|---|---|---|---|---|---|---|
| | Mean (SD) | Mean (SD) | Mean (SD) | *F* test/ $\chi^2$† | $\eta^2$ | Post-hoc |
| **BPQ** | | | | | | |
| BPD symptoms | 54.00 (10.7) | 39.52 (14.4) | 12.41 (8.3) | 107.67*** | .72 | **BPD > ST > HC** |
| **UPPS-P** | | | | | | |
| Negative Urgency | 37.17 (5.2) | 31.77 (6.1) | 24.16 (4.7) | 45.69*** | .53 | **BPD > ST > HC** |
| **DASS-21** | | | | | | |
| Depression | 14.32 (5.3) | 9.25 (5.8) | 1.52 (1.7) | 51.91*** | .59 | **BPD > ST > HC** |
| Anxiety | 10.96 (5.5) | 7.54 (5.0) | 1.39 (1.6) | 43.78*** | .48 | **BPD = ST > HC** |
| Stress | 14.04 (4.8) | 11.92 (5.5) | 3.39 (3.1) | 44.86*** | .53 | **BPD = ST > HC** |
| DASS total | 39.32 (14.3) | 28.71 (14.7) | 6.29 (5.9) | 50.66*** | .59 | **BPD > ST > HC** |
| **DERS-18** | | | | | | |
| Awareness | 9.37 (2.8) | 9.72 (2.4) | 6.13 (2.0) | 19.01*** | .34 | **BPD = ST > HC** |
| Clarity | 11.17 (2.9) | 11.16 (2.8) | 5.61 (2.4) | 42.28*** | .48 | **BPD = ST > HC** |
| Goals | 12.80 (2.6) | 11.36 (2.5) | 6.97 (2.3) | 42.67*** | .45 | **BPD = ST > HC** |
| Impulse | 7.16 (3.8) | 8.68 (3.5) | 4.00 (1.6) | 39.64*** | .42 | **BPD = ST > HC** |
| Nonacceptance | 10.10 (4.1) | 8.08 (4.0) | 4.61 (2.5) | 29.33*** | .32 | **BPD = ST > HC** |
| Strategies | 11.23 (2.9) | 8.52 (4.0) | 4.03 (2.2) | 45.48*** | .49 | **BPD > ST > HC** |
| DERS total | 63.83 (11.3) | 57.52 (11.6) | 31.35 (8.3) | 54.61*** | .62 | **BPD = ST > HC** |

*Note*. BPD-NSSI = Borderline Personality Disorder with Non-Suicidal Self-Injury; ST-NSSI = Student with Non-suicidal self-injury; HC = healthy control group; BPQ = Borderline Personality Questionnaire; UPPS = The Impulsivity Scale; DASS-21 = Depression, Anxiety and Stress Scale; DERS-18 = Difficulties in Emotion Regulation Scale.

* $p < .05$, ** $p < .01$, *** $p < .001$.

† = Kruskall-Wallis test.

***Emotion dysregulation, Negative Urgency and NSSI-functions (hypothesis 2)***

We assessed whether difficulties in emotion regulation are differentially associated with intrapersonal and interpersonal NSSI functions (Table 3). In these analyses, we controlled for Group (BPD-NSSI vs. ST-NSSI) to account for potential differences associated with the presence of a BPD diagnosis. In addition, since significant correlations were observed between predictors, we assessed multicollinearity by calculating the variance inflation factor (VIF). All VIF values were under 3, indicating that there were no multicollinearity problems (Hair, 2010).

First, we used NSSI-intrapersonal functions as the outcome variable. We entered Group and DERS-scales (Awareness, Clarity, Goals, Impulse, Nonacceptance, Strategies) as predictors. Results showed that only the lack of acceptance of one's emotions (i.e., Nonacceptance DERS-scale) significantly predicted NSSI-intrapersonal functions ($R^2$ =.47, $F(7,43) = 5.64$, $p$ <.001).

We repeated the previous analysis with NSSI-interpersonal functions as the outcome. When Group (BPD-NSSI vs. ST-NSSI) and DERS-scales were entered simultaneously as predictors, none of these variables significantly predicted NSSI-interpersonal functions. However, there was a moderate trend for clarity about the nature of one's emotions (i.e., Clarity DERS-scale) (Table 3).

We also evaluated whether Negative urgency, together with Group (BPD-NSSI vs. ST-NSSI), significantly predicted intrapersonal and interpersonal NSSI-functions. Surprisingly, negative urgency did not predict any NSSI-functions (all $p$ >.17).

All analyses were repeated using BPQ (i.e., severity of borderline symptoms) as an additional covariate, and results remained the same (supplementary material). Collectively, these results suggest that individuals with high negative urgency in the current sample are not more likely to incur to NSSI with an intrapersonal or an interpersonal motivation. However, results also suggest that out of all emotion regulation difficulties (DERS-scales), participants with specific difficulties in acceptance of emotions were more likely to engage in NSSI with an intrapersonal motivation, even after controlling for BPD severity.

**Table 3.** *Multiple linear regression analysis*

| | **ISAS Intrapersonal function** | | | | **ISAS Interpersonal function** | | | |
|---|---|---|---|---|---|---|---|---|
| | B | SE B | β | P-value | B | SE B | β | P-value |
| | BPD-NSSI and ST-NSSI groups (N = 51) | | | | | | | |
| **Model** | **(1)** | | | | **(2)** | | | |
| Group (BPD vs. ST) | .48 | .30 | 1.59 | .11 | -.07 | .12 | -0.61 | .53 |
| Awareness | .28 | .34 | .82 | .41 | -.09 | .14 | -.64 | .52 |
| Clarity | .08 | .36 | .23 | .81 | .30 | .15 | 1.98 | .05 |
| Goals | -.30 | .44 | -.67 | .50 | -.13 | .18 | -.71 | .48 |
| Impulse | .28 | .29 | .95 | .34 | .18 | .12 | 1.44 | .15 |
| Nonacceptance | .87 | .23 | 3.75 | **< .001** | .04 | .09 | .47 | .63 |
| Strategies | .41 | .33 | 1.24 | .22 | .14 | .14 | 1.00 | .31 |

*Note*. ISAS = Inventory of Statements about Self-Injury; BPQ = The Borderline Personality Questionnaire.

### *Frequency of NSSI: Emotion dysregulation and Negative urgency (hypothesis 3)*

According to hypothesis 3, we explored whether DERS-scales and Negative Urgency could potentially predict NSSI-lifetime frequency. In a first model, Group (BPD-NSSI vs. ST-NSSI) and DERS-scales were entered simultaneously as predictors, yet none of these

scales predicted NSSI-lifetime frequency (all $p$ >.13). Lastly, when negative urgency was included in a second model with Group as a control variable, it showed no predictive effect on NSSI-lifetime frequency (all $p$ <.62).

Additionally, we examined possible interactions between DERS-scales and Negative urgency. Results revealed a significant interaction between Strategies DERS-scale and Negative urgency in predicting NSSI-lifetime frequency (Strategies by Urgency =.32, $p$ < .05; $R^2$ =.20, $F(3,40) = 3.46$, $p$ <.05), even after controlling for BPQ ($R^2$ =.21, $F(4,39) = 2.71$, $p$ <.05). To decompose the interaction, we conducted simple slopes analysis to assess whether Strategies DERS-scale predicts NSSI-lifetime frequency for individuals with high and low Negative urgency (Preacher et al., 2006). We draw on previous studies to consider Negative Urgency as a moderator (Bresin et al., 2013). First, we mean-centered the two predictors of the interaction and then estimated individuals with high and low (±1 S.D) negative urgency. We found that DERS-strategies was significantly associated with NSSI-lifetime frequency (B =.24, $p$ <.05) in individuals with high negative urgency, but not in individuals with low negative urgency (B = -.04, $p$ =.58) (Figure 1).

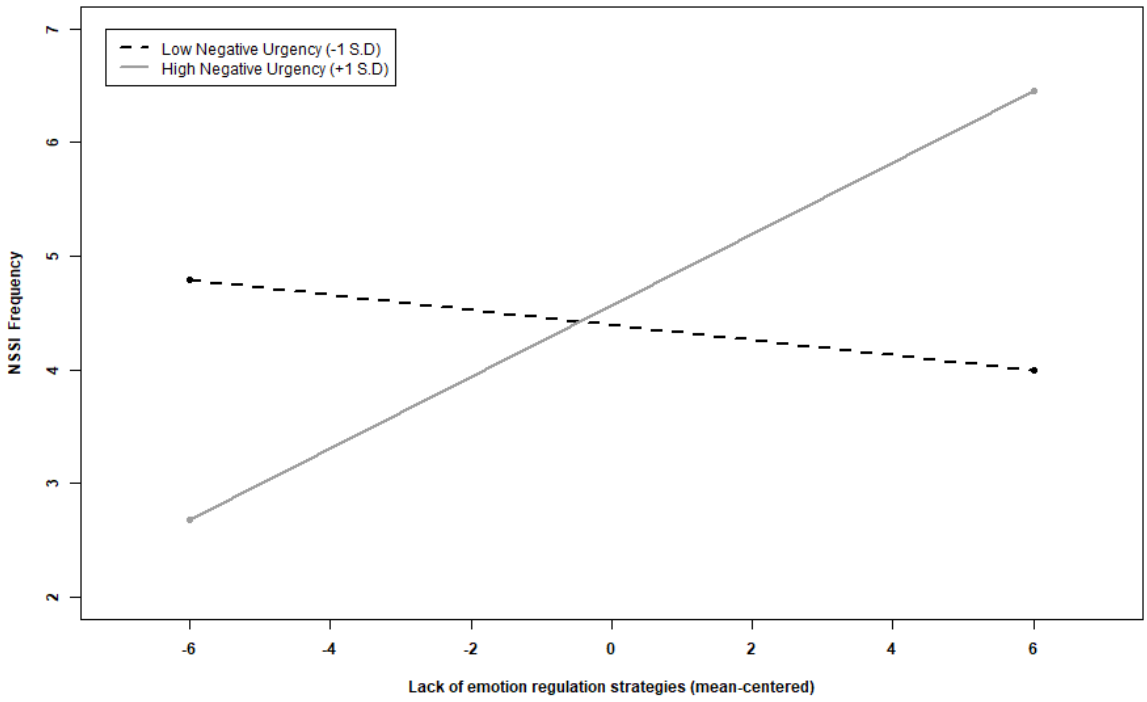



**Fig. 1**. Association between Lack of Emotion Regulation Strategies and NSSI-frequency moderated by Negative Urgency.

### 4.4. Discussion

Innovatively, the present study investigated whether specific dimensions of emotion dysregulation and negative urgency are differentially associated with NSSI functions and NSSI frequency. Innovatively, we recruited both a clinical and a subclinical group of young adults characterized by frequent NSSI engagement (and a group of healthy controls). Our findings indicate that a specific dimension of emotion dysregulation, namely nonacceptance of emotions, uniquely predicted intrapersonal motivations for engaging in NSSI, even after controlling for BPD symptom severity. Importantly, results also revealed an interaction

between lack of emotion regulation strategies and negative urgency in predicting NSSI-frequency.

While not previously documented, the unique association of nonacceptance of emotions (DERS-scale) with intrapersonal NSSI-functions may cohere with prior work in the field. For instance, a recent meta-analysis (Taylor et al., 2018) found that individuals most commonly engage in self-injury with an intrapersonal motivation (between 66 to 81%), most commonly to avoid or escape distressing emotions. A lack of acceptance of emotions implies rejecting states of distress by attempting to extinguish the emotion altogether or responding to the emotion with secondary negative emotions such as shame or guilt (Gratz & Roemer, 2004). Accordingly, non-acceptance of emotions could be perceived as an experiential avoidance strategy that may promote engaging in NSSI when individuals are faced with intense negative emotions (Chapman et al., 2006; Selby & Joiner, 2009). Indeed, previous studies have found that experiential avoidance and thought suppression strategies -constructs related to nonacceptance of emotions (Gratz & Roemer, 2004)- have been associated with an increased risk of NSSI (Chapman et al., 2005, 2006). Importantly, nonacceptance of emotions has also been associated with an increased risk of maintenance of NSSI. Compared to college students who stopped engaging in self-injury one year ago, students who continued engaging in NSSI behaviors showed significantly less acceptance of emotional responses, regardless of gender (Anderson & Crowther, 2012). Interestingly, efforts to suppress or avoid a negative emotion may have a counter-effect, increasing rather than decreasing psychological distress (Kashdan et al., 2006). Therefore, recurrent use of these strategies in the presence of high-intensity emotions may serve as a stepping-stone towards other maladaptive strategies, such as NSSI, when emotional avoidance alone is no longer effective.

Consistent with our hypothesis, we did not find a significant association between any emotion dysregulation dimensions and interpersonal NSSI-functions. As reported in previous literature, interpersonal motivations for NSSI are less common (Taylor et al., 2018), especially among individuals with high levels of emotion dysregulation (Vega et al., 2017), as is the case in the current sample. Interpersonal NSSI functions such as communicating distress or seeking support (Taylor et al., 2018) reflect deficits in interpersonal emotion regulation skills that are not necessarily captured by the DERS scale. Only lack of emotional clarity DERS-scale approached a significant association with interpersonal NSSI-functions. This trend may reflect deficits in identification and communication of emotions (Gratz & Roemer, 2004; Gross, 2015), which may stem from invalidating environments and dysfunctional parenting that detriment the emotion regulation capacity (Crowell et al., 2009; Linehan, 1993). Indeed, a recent study found that an invalidating environment characterized by childhood maltreatment was specifically related to deficits in emotional clarity, which were in turn associated with increased probability of NSSI in young adults (Guérin-Marion et al., 2020). These deficits, added to a context of interpersonal conflicts (Adrian et al., 2011), may motivate engagement in NSSI. However, these relationships should be explored in larger samples.

Additionally, we found that the association between lack of emotion regulation strategies (DERS-dimension) and NSSI-frequency was moderated by negative urgency. Specifically, among individuals who reported a lack of emotion regulation strategies, only those with higher negative urgency, that is, a proclivity to act rashly when experiencing intense negative emotions, were likely to engage in more frequent NSSI. These findings are consistent with meta-analyses that identify limited access to emotion regulation strategies

and negative urgency as the most robust predictors of NSSI (Sheppes et al., 2015; You et al., 2016) and with biosocial models that characterize NSSI by emotion dysregulation and impulsivity (Kashdan et al., 2006; Lieb et al., 2004). Effectively, the observed interaction highlights negative urgency as a critical risk factor for NSSI and corroborates prior research reporting that negative affect, specifically daily sadness, only predicted NSSI engagement in college students with high negative urgency but not with low urgency (Peckham et al., 2020).

Notably, while negative urgency predicted NSSI-frequency (in interaction with lack of emotion regulation strategies), it did not predict motivations for self-harm. This null finding is not surprising, given that negative urgency interferes with NSSI only after NSSI urges surpass a temporal or intensity threshold. As recently study demonstrated, negative urgency in NSSI is not associated with deficits in restraining an emotionally impulsive act before it is initiated, but it is rather associated with deficits in terminating an ongoing negative emotional response after it is initiated (Allen & Hooley, 2019). Such findings suggest that negative urgency may not be involved in the motivations for engaging in NSSI, but it may be involved in readily transforming the NSSI urge into an NSSI act.

Additionally, when comparing the NSSI groups with healthy controls, individuals with NSSI scored higher on all clinical measures. As predicted, the BPD-NSSI group presented higher severity (e.g., psychopathology) than the student group, which is also reflected in the higher prevalence of intrapersonal NSSI-functions. Importantly, both the BPD-NSSI and ST-NSSI groups showed similar levels of emotion dysregulation and did not differ in age onset, frequency, and number of methods used in NSSI. Complementarily, both BPD and student groups engaged in NSSI with intrapersonal functions more frequently than with interpersonal functions, which reflects that the main motivation for NSSI in both groups

was to regulate an internal state of emotional distress. These findings are consistent with a study reporting that intrapersonal NSSI-functions are associated with affective dysregulation in college students (Vega et al., 2017). Given the growing prevalence of NSSI among young adults in community populations (Muehlenkamp et al., 2012; Swannell et al., 2014), exploring the characteristics of NSSI in subclinical samples may be particularly pertinent. Findings indicate that the phenotypic characteristics of NSSI may not differ for clinical and subclinical groups with frequent NSSI.

Our results suggest that specific dimensions of emotion dysregulation may provide unique information about different NSSI features**.** Precisely, nonacceptance of emotions may predict the motivation for engaging in NSSI (i.e., NSSI used as an experiential avoidance strategy), while lack of emotion regulation strategies (in the presence of negative urgency) may predict increased frequency and maintenance of NSSI. Addressing these emotion regulation deficits in therapy could have a direct impact on NSSI. Interestingly, Dialectical Behavioral Therapy (DBT), specifically DBT skills training (Linehan, 1993; 2014), has been shown to effectively reduce NSSI acts (Linehan et al., 2015) by improving acceptance skills (Krantz et al., 2018). Therefore, therapeutic interventions which target emotion acceptance and emotion regulation (e.g., DBT) may be a necessary goal for patients with NSSI. Correspondingly, by learning acceptance and mindfulness skills, patients can learn to tolerate disruptive emotions that can trigger urgency of NSSI, and by learning emotion regulation skills they can learn to identify and describe emotions that precede the NSSI act and obtain greater cognitive and behavioral control (Linehan et al., 2014).

Despite promising findings, this study has some important limitations that need to be addressed to inform cautious interpretation of the data. Firstly, the low sample size may have

led to less robust estimates as well as some null findings, therefore the results presented should be confirmed by future research with larger sample sizes. Secondly, the BPD-NSSI and ST-NSSI groups demonstrated considerable homogeneity in emotion dysregulation, which may have attenuated associations and reduced power to detect subtle differences. Also, our data is based on self-reports, therefore, information about retrospective NSSI may be under or overestimated (or may entail memory biases). In addition, the clinical measures only assessed the past few weeks, while NSSI-frequency was measured over a longer timeframe; therefore, comparison of these measures could be biased. Ecological momentary assessment may offer a better alternative to capture clinical information related to NSSI acts in real time. Lastly, we used a cross-sectional design, whereas longitudinal studies could be more informative of the NSSI trajectory.

### *Conclusion*

Results reveal facets of emotion dysregulation that are uniquely associated with the functions and frequency of NSSI and they highlight the need for emotion regulation skills and distress tolerance (to prevent negative urgency) as a common treatment target in psychotherapy. While preliminary, our findings are expected to have clinical implications and may serve as a guide for more proactive interventions, especially in subclinical groups of people with NSSI.

# 5. Identifying High-Risk Subgroups of College Students with Non-Suicidal Self-Injury: A Latent Profile Analysis and Two-Years Follow-up Study

## 5.1. Introduction

Non-suicidal self-injury (NSSI) is a serious public health concern. NSSI refers to the deliberate, self-inflicted destruction of body tissue without suicidal intent and for purposes not socially sanctioned, and includes behaviors such as cutting or burning oneself (Nock, 2010). NSSI tends to first emerge during early adolescence (Plener et al., 2015) or early adulthood (Gandhi et al., 2018) and is prevalent among adolescents (17.2%) and young adults (13.4%) in the community (Swannell et al., 2014). Previous studies have shown that young adults with NSSI has remarkable increased risk of future suicide attempts and poor mental health, suggesting that this behavior may serve as an early indicator of psychological vulnerability (Ghinea et al., 2020; Nakar et al., 2016). However, there is still limited research on the existence of possible higher-risk profiles. This study addresses this research gap using a person-centered approach (i.e., Latent Profile Analysis), with the aim of identifying latent subgroups that are differentially related to later psychological issues.

Prior cross-sectional studies have shown that individuals engaging in NSSI exhibited elevated levels of emotion dysregulation and a diminished perception of social support (Mendez et al., 2022; Muehlenkamp et al., 2013). Briefly, perceived social support alludes to the perception that one would be loved, valued, and supported in times of need by their social network (Barrera, 1986). Congruently, NSSI is associated with impaired psychological and social functioning both in the short and long-term (Skegg, 2005). Remarkably, despite limited in number, longitudinal studies indicate that this impairment could be sustained over time, irrespective of whether NSSI persists (Daukantaitė et al., 2021; Wångby-Lundh et al.,

2023). This relationship is stronger between NSSI and later development of borderline personality disorder (BPD; Stead et al., 2019).

Given that NSSI is a heterogeneous phenomenon, several previous studies have examined how individuals who engage in NSSI are grouped together according to a particular set of symptoms, behaviors, or traits. This relatively novel approach is substantially different from the usual methodologies that compare a group of individuals with NSSI versus a healthy control group. In this regard, the existence of different subgroups of individuals engaging in NSSI has been confirmed in two seminal works with young adults (Klonsky & Olino, 2008; Whitlock et al., 2008). For instance, one of these studies identified four subgroups that differed on NSSI features. When compared to measures of depression, anxiety, BPD, and suicidality, the subgroup with the highest risk of psychopathology (i.e., the highest scores on these clinical measures) was the group with higher number of episodes, functions, and methods of NSSI (Klonsky & Olino, 2008).

Subsequently, only a few studies have replicated and extended these earlier findings, identifying subgroups of individuals that differ not only on NSSI characteristics but also on emotion dysregulation. For example, a previous study found four subgroups in which emotion dysregulation and number of NSSI methods appeared to describe a continuum of risk in a sample of undergraduate students (Peterson et al., 2019). Here, the subgroup exhibiting high emotional difficulties along with elevated frequency of severe NSSI had a more severe risk (i.e., higher rates of suicide attempt, disordered eating, and impulsivity) than the other three subgroups. Similarly, a recent study identified three different profiles of undergraduate students with NSSI, where the subgroup exhibiting emotion regulation difficulties was the one that presented psychopathological symptoms (i.e., risky drinking,

symptoms of BPD, eating disorders, depression, anxiety and stress) (Christoforou et al., 2021). On the other hand, previous studies have also shown that interpersonal difficulties can constitute a variable that helps establish more homogeneous groups. For instance, among different profiles, the subgroup with higher emotion regulation difficulties reported parent–child relational problems (Guérin-Marion et al., 2021) and, in another similar study, the subgroup characterized by frequent and multiple methods of NSSI reported problematic parental relationships and poor quality of friendships (Hamza & Willoughby, 2013). Lastly, it is worth noting that all this previous research conclude that less severe profiles were associated with a lower frequency of NSSI, lower difficulties in emotion regulation and fewer problems in the parental relationship.

Together, these previous findings provide support for the different vulnerability profiles that may co-exist within populations of students with a history of NSSI. NSSI features as well as emotion dysregulation can be variables that identify different levels of psychopathological risk and social difficulties. However, this field of study is at an early stage and all these studies are cross-sectional. The few longitudinal studies with latent profiles of young people with NSSI have focused on identifying latent trajectories of NSSI over time (Barrocas et al., 2015; Tilton-Weaver et al., 2023). However, a previous study longitudinally analyzed the psychopathological status of different subgroups of late adolescents practicing NSSI (Burke et al., 2018). In this study, it was identified that the subgroup with greater affective dysregulation showed more depressive symptoms and worse well-being, as well as higher risk of engaging in NSSI, at 1-year follow-up. These results suggest that the identification of subgroups of young people engaging in NSSI could have value not only at baseline, but also in detecting future mental health problems.

### *Current Study*

While the association between NSSI and an elevated risk of future psychological problems is acknowledged, the specific characteristics of individuals at greater risk for such outcomes remain unknown. The present longitudinal study aimed to bridge this research gap, specifically examining the interaction between NSSI features, emotion dysregulation, and perceived social support in the formation of latent groups. Based on previous research, there is hypothesized to find different subgroups (Hypothesis 1), among which the group exhibiting the most psychopathological symptoms is expected to be characterized by the most severe NSSI, heightened emotion dysregulation, and low perceived social support (Hypothesis 2). Moreover, it is anticipated that this high-risk subgroup at baseline (Time 1) will exhibit a sustained elevated level of psychopathology at the two-year follow-up (Time 2) compared to the other subgroups, irrespective of the continued presence of NSSI (Hypothesis 3).

## 5.2. Methods

### *Participants*

A total of 854 college students (Mage = 20.50, SD = 2.01; 79.4% females) took part in the study. Participants were recruited from two Universities in Catalonia (Autonomous University of Barcelona and University of Vic- Central University of Catalonia). Participants who reported having engaged in NSSI five or more times in the last year formed the final sample of study. This sample consisted of 259 participants (30% of the original sample; Mage = 20.39, SD = 1.90; 89% females). The average age of onset of NSSI was 14.57 years old

(SD = 2.68), and participants reported using an average of 4.46 different NSSI-methods (SD = 2.24, range 1-11).

After two years (i.e., follow-up), a total of 113 participants completed the survey again (44% of the final sample; Mage = 21.48, SD = 2.01; 81% females).

***Procedure***

First, across-sectional data collected by an online survey was analyzed. Prospective participants were invited to participate by e-mail between January and February 2020 (Time 1), where they were informed that participation was voluntary and were given information regarding the purpose of the study. Furthermore, they were informed of the possibility to receive a monetary compensation (30 euros) as an acknowledgement of their time, effort, and contribution. After reading the instructions, participants interested in participating provided informed consent electronically. Then, they were redirected to the online survey which consisted of three different sections (see below): (i) sociodemographic information; (ii) perceived social support; (iii) emotion dysregulation; (iv) clinical information; and (v) NSSI features. The last section about NSSI features was only completed if participants reported having engaged in NSSI (i.e., frequency, methods, age of onset and functions). Time to complete the survey ranged between 30 and 40 minutes approximately.

Second, the same methodology in a follow-up evaluation two years later was used (i.e., between January and February 2022; Time 2), which allowed us to collect longitudinal data. At Time 2, the criterion for being included in the NSSI group was ≥ 1 episodes in the last year. All procedures were approved by the Clinical Research Ethics Committee of Bellvitge University Hospital (protocol number: PR330/17).

***Measures***

**Self-reported measures for the latent profile analysis**

**NSSI characteristics.** NSSI frequency, methods and age of onset were assessed by means of the Section I of the Inventory of Statements about Self-Injury (ISAS; Klonsky & Glenn, 2009; Vega et al., 2017). This section assesses the frequency of 12 NSSI behaviors: hitting self, biting, burning, carving, cutting, wound picking, needle-sticking, pinching, hair pulling, rubbing skin against rough surfaces, severe scratching, and swallowing chemicals. For the current study the cumulative frequency of moderate/severe and minor methods of NSSI was computed by summing the frequency of occurrence of each NSSI method (ranging from 0 to 4: 0= null; 1= 1-4 times; 2= 5-10 times; 3= 11-15 times; 4= more than 15 times) in accordance with Lloyd-richardson et al (2007) (see Table S1 in the Supporting information). The NSSI behaviors of the original ISAS show good internal reliability ($\alpha$ = .84) and in the present study showed an acceptable internal reliability at Time 1 ($\alpha$ = .72) and Time 2 ($\alpha$ = .72).

**NSSI functions.** The motivations (or functions) of NSSI were assessed by means of the Spanish translation of the Non-Suicidal Self-Injury Disorder Scale (NSSIDS; Victor et al., 2017). NSSIDS is a self-report measure designed to assess proposed criteria for Non-Suicidal Self-Injury Disorder (DSM-5: American Psychiatric Association, 2013). In this scale, the items 3 ("to obtain relief from negative feelings or thoughts") and 4 ("to cope with problems with other people") were used to assess intrapersonal and interpersonal motivations, respectively. The Spanish version of the NSSIDS shows good internal reliability

(α = .88) (Victor et al., 2017). In the present study, the internal reliability was acceptable at Time 1 (α = .79) and Time 2 (α = .78).

**Perceived social support.** Perceived social support was assessed by using the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1990). The Spanish version of the MSPSS was used (www.heardalliance.org), which is one of the most broadly used scales to rate perceptions of social support. It consists of a 12-item scale, which assesses three sources of perceived social support: (i) family, (ii) friends, and (iii) significant others. The Spanish version of the MSPSS shows good internal reliability (α = .88) (Calderón et al., 2021). In the present study, the internal reliability was good at Time 1 (α = .90) and Time 2 (α = .89).

**Emotion dysregulation.** Emotion dysregulation was assessed by means of the Brief Version of the Difficulties in Emotion Regulation Scale (DERS-18; Victor & Klonsky, 2016). The Spanish translation of this scale was used. This is an 18-item self-report measure that assesses 6 subscales: (i) lack of emotional awareness, (ii) lack of emotional clarity, (iii) inability to engage in goal-directed behavior when feeling emotional, (iv) engagement in impulsive behavior when feeling emotional, (v) nonacceptance of emotions, and (iv) inability to access emotion regulation strategies. This scale presents high internal reliability (Cronbach's α = .91) (Victor & Klonsky, 2016). In the present study, results show good internal reliability at Time 1 (α = .85) and Time 2 (α = .85).

**Clinical and sociodemographic self-reported measures**

**Borderline symptoms**. The Borderline Personality Questionnaire (BPQ; Fonseca-Pedrero et al., 2011). It assesses BPD traits or symptoms. It consists of 80 statements that

assess nine subscales based on the DSM-IV criteria: Impulsiveness, Affective Instability, Abandonment, Relationship, Self-Image, Suicide/Self-Mutilation, Emptiness, Intense Anger, and Quasi-Psychotic States. The total BPQ-score was used as a measure of general BPD traits. The Spanish version of the BPQ presents moderate to high internal reliability (Cronbach's α = .78 to .93) through the nine scales (Fonseca-Pedrero et al., 2011). Interestingly, the total score of this questionnaire has been used as a screening instrument for Borderline Personality Disorder (cut-off score >56) (Chanen et al., 2008). In the current study, the BPQ total score showed good internal reliability at Time 1 (α = .84) and Time 2 (α = .86).

**Psychological distress.** Depression Anxiety Stress Scales (DASS-21; Bados et al., 2005). It assesses psychological distress through the frequency of 21 negative emotional symptoms during the week prior to the evaluation. DASS-21 consists of 3 subscales: Depression, Anxiety, and Stress. The Spanish version presents moderate to good internal reliability (Cronbach's α = 0.84, 0.70 and 0.82) for each of the subscales, respectively (Bados et al., 2005). In the present study, the depression subscale showed an excellent internal reliability at Time 1 (α = .92) and Time 2 (α = .92). On the other hand, anxiety and stress subscales showed good internal reliability at Time 1 (α = .86 and α = .81) and Time 2 (α = .80 and α = .82), respectively.

**Suicidal tendencies.** Suicidal tendencies. One item of dichotomous response (true or false) was used from the Suicide/Self-Mutilation BPQ-subscale (BPQ; Fonseca-Pedrero et al., 2011) to assess potential suicidal tendencies in the sample of study ('I have made a suicide attempt in the past').

***Statistical analyses***

The statistical analysis comprised three steps. Firstly, a latent profile analysis was conducted to identify subgroups of college students engaging in NSSI. This type of analysis allows to explore latent heterogeneity within a group of individuals with a common observable characteristic (i.e., NSSI). In other words, latent profile analysis allows to establish a classification of individuals based on unobserved (i.e., latent) characteristics within an observed data rather than the typical classification based on a diagnostic cutoff (e.g., clinical group vs. control group) (Oberski, 2016).

Secondly, the subgroups were compared on clinical and sociodemographic measures to identify those with higher risk for psychopathology. The presence of two or more subgroups that exhibit significant differences in the clinical and sociodemographic measures would support the hypothesis of the study.

Finally, a follow-up assessment was conducted two years later to identify any potential changes in the psychopathological status of the subgroups over time and explore whether they continued to engage in NSSI.

**Step 1. Latent profile analysis**

Three different types of information were included in the latent profile analysis. First, information about NSSI features: (i) functions of NSSI (intrapersonal and interpersonal), (ii) severity of methods used for engaging in NSSI (number of moderate/severe versus minor methods), (iii) age of onset of NSSI, (iv) total number of different methods used to engage in NSSI. Second, information relating to emotion dysregulation (i.e., the total score of the

DERS-18 scale) and perceived social support was included (i.e., the total score of the MPSS) (see Figure 1). The total scores rather than the subscales of the DERS-18 and MSPSS was included to obtain a more parsimonious model.

The "mclust" package (Scrucca et al., 2016) was used to estimate the latent profile analysis models with 1–9 profiles and with four different model configurations (Wardenaar, 2021). Model configuration refers to whether the variances and covariances of the variables included in the latent profile analysis are fixed, constrained and/or freely estimated between profiles. In the first model, the variances of the variables are allowed to vary within profiles but are constrained to be equal between (EEI model; equal volume, equal shape [and undefined orientation]). In the second model, like EEI model, the complete (co)variance matrix is estimated and constrained to be equal across profiles (EEE; equal volume, equal shape, and equal orientation). In the third model, the covariance of the variables within- and between profiles is set to zero, but variances are now allowed to vary within and between profiles (VVI; varying volume, varying shape [and undefined orientation]). The fourth model allows the most variation in (co)variances across profiles; both the variances and covariances are allowed to vary within and between profiles (VVV; varying volume, varying shape, varying orientation) (see Wardenaar, 2021). Finally, the models were fitted using expectation maximization (EM) clustering. The best fitting model was selected based on the Bayesian Information Criterion (BIC) and classification accuracy. Lower BIC values indicate better model fit and a classification accuracy value greater than .90 was considered adequate (Muthén & Muthén, 2000). Once the optimal number of profiles was obtained, each participant was allocated to a profile based on their highest-profile probability.

**Step 2. Comparison of subgroups on clinical and sociodemographic measures**

A subgroup comparison analysis was conducted using RStudio (R Core Team, 2017) and IBM SPSS Statistics (Version 27). For continuous variables, a one-way ANOVA was performed with the Clinical and Sociodemographic measures as within-subject factors and Profile (1, 2, 3) as between-subject factor. In the presence of violations of normality and homogeneity of variance, a non-parametric Kruskall-Wallis test was performed. For multiple comparisons, the Bonferroni post-hoc test was utilized. For unequal variances, the Games-Howell test was used. Lastly, when the subgroups were compared on categorical variables, Pearson´s Chi-square test ($\chi 2$) was used. The post-hoc test was calculated using the corrected standardized residuals. This method indicates which cells of the contingency table contribute significantly to the overall chi-square statistic (see Beasley & Schumacher, 1995).

**Step 3. Comparison of subgroups in the follow-up**

Linear mixed models (LMM) were performed (Pinheiro & Bates, 2000) with a restricted maximum likelihood (REML) estimation method to evaluate whether the three subgroups (i.e., Profiles) obtained in the latent profile analysis showed changes in clinical measures and NSSI behavior at two-years follow-up (Time 2). For these analyses, Subgroups (i.e., Profile 1 vs Profile 2 vs Profile 3), Time of clinical measures (i.e., Time 1 vs Time 2), and their interaction (i.e., Profiles x Time), were modeled as fixed effects. The participants' intercept was modeled as a random effect. LMM allows modeling both variation in clinical measures from Time 1 to Time 2 (i.e., within-person effects) and the effect of Subgroups (i.e., between-person effects) on these clinical measures. LMM is advantageous because it allows modeling observations, that are assumed to be correlated with each other, by including

fixed and random effects simultaneously in the same model and fitting subjects as a random term (West et al., 2014). These analyses were performed with the lme4 package (Bates et al., 2015) in Rstudio (R Core Team, 2017).

## 5.3. Results

### *Latent Profile Analysis*

The best fitting model was a three-profile solution with an EEE configuration (equal volume, equal shape, and equal orientation), based on the BIC values (see Table S2). In this EEE configuration model, mean scores varied across latent profiles, but the covariance matrix of the variables was equal across profiles (Wardenaar, 2021). The mean profiles probabilities (i.e., participants' probability of belonging to each profile) were .97, .95, and .94, for profile 1, 2, and 3, respectively, while the mean classification uncertainty (i.e., uncertainty of assigning participants to the correct profile) was .04, indicating high certainty that participants were assigned to the correct profile (see Table S3). Figure 1 shows the standardized means of the resulting three-profile solution (i.e., subgroups).

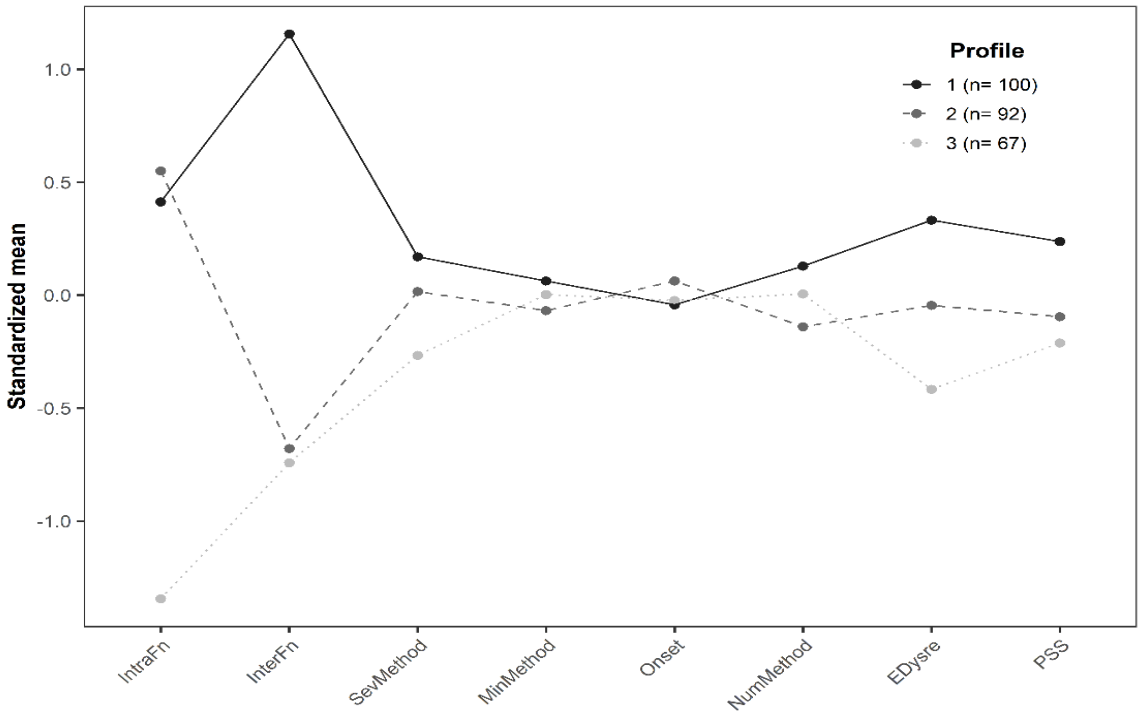



**Figure 1.** Three-profile solution. IntraFn = Intrapersonal NSSI-function; InterFn = Interpersonal NSSI-function; SevMethod = cumulative frequency of moderate/severe NSSI-methods; MinMethod = cumulative frequency of minor NSSI-methods; Onset = age of NSSI onset; NumMethod = number of NSSI-methods (range 1-11); EDysre = Emotion Dysregulation; PSS = Perceived Social Support.
* PSS scores were inverted to facilitate interpretation, therefore, a higher score indicates less perceived social support.

Scores of NSSI features, emotion dysregulation and perceived social support included in the latent profile analysis are depicted in Table 1 for each profile. The majority of participants were grouped in Profile 1 (n = 100; 38.5%), followed by Profile 2 (n= 92; 35.5%) and Profile 3 (n= 76; 25.8%). Regarding NSSI features, participants in Profiles 1 and 2 (vs Profile 3) showed more severe methods and reported more intrapersonal NSSI functions. In contrast to Profiles 2 and 3, participants in Profile 1 showed higher scores in interpersonal NSSI functions. All profiles were different in emotion dysregulation and perceived social support, with Profile 1 participants showing the higher (i.e., more severe) scores (i.e., 1>2>3).

**Table 1.** *Comparison of the three Profiles on NSSI-Features, Emotion Dysregulation and Social Support*

| | **Profile 1** (N= 100) | **Profile 2** (N= 92) | **Profile 3** (N= 67) | *F* test/ H test | post-hoc comparison |
|---|---|---|---|---|---|
| **Variables included in LPA** | | | | | |
| NSSI-Function | | | | | |
| Intrapersonal | 5.76 (1.51) | 6.05 (1.02) | 2.00 (1.14) | 140.49*** | 1, 2 > 3 |
| Interpersonal | 5.64 (1.04) | 1.61 (.73) | 1.55 (1.87) | 192.43*** | 1 > 2, 3 |
| NSSI-Methods | | | | | |
| Moderate/severe | 3.20 (2.77) | 2.69 (2.71) | 2.11 (2.81) | 9.57** | 1 > 3, 1 = 2 |
| Minor | 4.47 (3.73) | 3.93 (4.04) | 4.32 (4.24) | 1.94 | 1 = 2 = 3 |
| Total | 4.85 (2.06) | 4.25 (2.13) | 4.70 (2.19) | 5.17 | 1 = 2 = 3 |
| NSSI-Age of onset | 14.49 (2.80) | 14.75 (2.87) | 14.49 (2.88) | .71 | 1 = 2 = 3 |
| Emotion Dysregulation | 58.41 (14.19) | 52.85 (13.39) | 47.22 (14.28) | 22.78*** | 1 > 2 > 3 |
| Perceived Social Support | 40.98 (15.07) | 35.69 (16.13) | 33.92 (13.62) | 9.32** | 1 > 2, 3 |

Note. H = Kruskal-Wallis test; LPA = Latent Profile Analysis; Intrapersonal = to obtain relief from negative feelings or thoughts; Interpersonal = to cope with problems with other people; Moderate/severe = cumulative frequency of moderate/severe NSSI-methods; Minor = cumulative frequency of minor NSSI-methods; Total number = number of NSSI-methods (1-11).
**p < .01, ***p < .001

### *Comparison of the three subgroups on sociodemographic and clinical variables*

Table 2 shows the between-groups comparison of clinical and sociodemographic variables. Profile 1 (high risk group) showed the highest scores on all psychopathological variables. Profile 3 (low risk group) showed the lowest scores across all psychopathological measures. Finally, participants in Profile 2 (medium risk group) did not differ from participants in Profile 3 on any psychopathological measures, but they did score higher on emotion dysregulation and intrapersonal functions of NSSI (i.e., affect regulation function), suggesting that profile 2 is mainly characterized by emotion regulation difficulties without psychopathological comorbidity.

Moreover, an additional analysis including the subscales of the DERS-18 and the MSPSS was conducted (see Table S4). This sub-analysis revealed that Profile 1 and Profile

2 were similar in the 'non-acceptance of emotions' DERS-18 subscale. Moreover, Profile 1 exhibited lower perceived social support from friends (versus family or other significant members), compared to the other profiles.

Finally, each Profile has been labeled according to this 'continuum of risk' (Profile 1>2>3). Thus, the Profile 1 was named the 'emotional dysregulation without social support' subgroup, the Profile 2 was named the 'emotional dysregulation with social support' subgroup, and lastly, the Profile 3 was named the 'emotional stability and social support' subgroup.

**Table 2.** *Comparison of the three Profiles on Demographic information and Clinical Measures*

| | **Profile 1** (N= 100) | **Profile 2** (N= 92) | **Profile 3** (N= 67) | $\chi^2$ / *F* test/ H test | post-hoc comparison |
|---|---|---|---|---|---|
| Age M (SD) | 20.15 (1.80) | 20.30 (1.67) | 20.88 (2.24) | 4.91 | 1 = 2 = 3 |
| Sex (female) N (%) | 91 (91%) | 82 (89.13%) | 58 (86.57%) | .81 | 1 = 2 = 3 |
| **Clinical Variables** | | | | | |
| BPQ Total M (SD) | 43.92 (12.63) | 34.19 (10.47) | 33.02 (14.81) | 20.52*** | 1 > 2, 3 |
| BPD screening positive N (%) | 18 (18%) | 2 (2.17%) | 3 (4.48%) | 16.99*** | 1 > 2, 3 |
| DASS-21 M (SD) | | | | | |
| Depression | 13.56 (6.06) | 9.96 (6.14) | 8.32 (5.66) | 30.69*** | 1 > 2, 3 |
| Anxiety | 11.69 (5.95) | 7.95 (5.71) | 8.44 (5.33) | 20.39*** | 1 > 2, 3 |
| Stress | 13.30 (4.51) | 10.34 (4.74) | 9.61 (4.64) | 28.64*** | 1 > 2, 3 |
| Suicidal tendencies N (%) | 42 (42%) | 20 (21.74%) | 19 (28.36%) | 9.50** | 1 > 2, 3 |

Note. $\chi^2$ = Chi-square test; H = Kruskal-Wallis test; Attended Psy/Psych = ever attended a psychologist or psychiatrist; BPQ Total = Borderline Personality Questionnaire; BPD screening positive = Diagnosis for Borderline Personality Disorders based on cut-off < 56 (Chanen et al., 2008); DASS-21 = Depression, Anxiety and Stress Scales; Suicidal tendencies = past suicide attempts.
**p < .01, ***p < .001

***Comparison of the three subgroups at follow-up***

A total of 113 students (44% of the original sample) completed the follow-up assessment and were included in the longitudinal analysis (retention rates: Profile 1, 42%; Profile 2, 45%; Profile 3, 45%). These participants were similar than the rest of the sample (non-responders at T2, n = 146) on clinical measures scores (all *p-values* > .05), NSSI characteristics (all *p-values* > .24), gender ($p$ = .75), and age ($p$ = .45).

A significant reduction in NSSI frequency from Time 1 to Time 2 was found in all three subgroups. Specifically, only 16 of participants in Profile 1 (38.1%; $\chi^2 = 37.65$, $p < .001$), 19 of participants in Profile 2 (46.3%; $\chi^2 = 30.06$, $p < .001$) and 8 participants in Profile 3 (26.7%; $\chi^2 = 34.73$, $p < .001$) reported engaging in NSSI at Time 2. No significant differences were found between subgroups in the frequency of NSSI at Time 2 ($\chi^2 = 2.84$, $p = .24$).

Most importantly, the mixed model analysis revealed differences in the psychopathological status of the subgroups in a similar way that was found at baseline (i.e., a significant effect of subgroup). The participants in Profile 1 maintain, after two years, higher scores in the measures of psychopathology than the other two profiles (even though many of them have stopped engaging in NSSI), suggesting that the variables that define Profile 1 could be used to identify individuals at higher risk (see Table 3 and Table 4).

**Table 3.** *Multilevel analyses of clinical measures and Profiles at Two-year follow-up*

| Multilevel Models | B | SE | *p*-value |
|---|---|---|---|
| **BPQ Total** | | | |
| Borderline Traits change | | | |
| BPQ (Time 1 – Time 2) | -1.57 | 2.38 | .51 |
| Profile (1, 2, 3) | -6.44 | 1.56 | < .001 |
| BPQ x Profile | .46 | 1.15 | .69 |
| **DASS-21** | | | |
| Depression change | | | |
| Depression (Time 1 – Time 2) | -2.56 | 1.41 | .07 |
| Profile (1, 2, 3) | -2.84 | .71 | < .001 |
| Depression x Profile | .94 | .69 | .17 |
| Anxiety change | | | |
| Anxiety (Time 1 – Time 2) | -3.12 | 1.34 | < .05 |
| Profile (1, 2, 3) | -1.69 | .65 | < .05 |
| Anxiety x Profile | 1.11 | .65 | .09 |
| Stress change | | | |
| Stress (Time 1 – Time 2) | -.61 | 1.17 | .60 |
| Profile (1, 2, 3) | -1.52 | .56 | < .01 |
| Stress x Profile | .36 | .57 | .52 |

Note. BPQ Total = Borderline Personality Questionnaire; DASS-21 = Depression, Anxiety and Stress Scales.

**Table 4.** *Descriptive statistics of the Multilevel Analyses*

| | **Profile 1** (N= 42) | **Profile 2** (N= 41) | **Profile 3** (N= 30) |
|---|---|---|---|
| | M (SD) | M (SD) | M (SD) |
| **BPQ Total** | | | |
| Time 1 | 42.60 (13.00) | 31.63 (11.53) | 30.31 (12.60) |
| Time 2 | 40.49 (13.78) | 32.37 (13.50) | 29.04 (14.04) |
| **DASS-21** | | | |
| Depression | | | |
| Time 1 | 13.17 (5.86) | 9.51 (6.52) | 7.77 (5.94) |
| Time 2 | 11.34 (5.80) | 9.17 (5.91) | 7.80 (6.24) |
| Anxiety | | | |
| Time 1 | 11.20 (5.82) | 7.51 (6.32) | 8.13 (5.16) |
| Time 2 | 8.83 (5.51) | 7.24 (4.54) | 7.93 (5.39) |
| Stress | | | |
| Time 1 | 12.78 (4.86) | 10.20 (4.78) | 9.93 (4.66) |
| Time 2 | 12.44 (4.65) | 10.49 (4.22) | 10.30 (5.20) |

Note. BPQ Total = Borderline Personality Questionnaire; DASS-21 = Depression, Anxiety and Stress Scales.

## 5.4. Discussion

Previous research has demonstrated that young adults who engage in NSSI exhibit a heightened risk of future suicide attempts and poor mental health. Nevertheless, there is still a lack of studies exploring latent subgroups that may exhibit different associations with subsequent psychopathological risk. The current longitudinal study intricately explores the interaction between NSSI features, emotion dysregulation, and perceived social support to uncover latent subgroups within individuals engaged in NSSI, identifying those at an increased risk for future psychopathological problems. Importantly, three profiles were observed, each maintaining a consistent level of psychopathology both at baseline and follow-up. Current results extend previous findings that support the utility of identifying subgroups of young people engaging in NSSI, and provide new insights into its prospective value in the early identification of individuals at risk of developing mental health problems.

The latent profile analysis revealed three profiles among young people engaging in NSSI (see Figure 1). Two of these profiles appear to represent the upper and lower end of a continuum (i.e., Profiles 1 and 3, respectively). Specifically, Profile 1 (compared to Profile 3) exhibited high endorsement of severe NSSI-methods (e.g., self-cutting), high difficulties in emotion regulation, and low perceived social support. Further, Profile 2 (the 'middle' profile) showed high endorsement of severe NSSI-methods (similar to Profile 1), high levels of perceived social support (similar to Profile 3), and medium levels of difficulties in emotion regulation. Importantly, Profile 1 exhibited the highest scores across all clinical measures of psychopathology (e.g., DASS-21) both at baseline and follow-up, emerging as the 'high risk' profile.

The current finding of (three) different profiles of risk in young people engaging in NSSI is consistent with previous studies (e.g., Christoforou et al. 2021), and supports the hypothesis that NSSI in non-clinical settings is a heterogeneous phenomenon. The existence of two profiles (1 and 2) composed of students with emotion regulation difficulties (high and medium, respectively) is congruent with prior theoretical and empirical work that emphasizes the crucial role of emotion dysregulation in the engagement of NSSI (e.g., Tuna & Bozo, 2014; Wolff et al., 2019). Indeed, these two profiles represented a significant part of the sample (74 % of participants) and, in line with their emotion regulation difficulties, both groups reported frequently using NSSI for self-regulation motives (i.e., intrapersonal NSSI-functions). On the other hand, Profile 3 (26% of participants) showed the least difficulties in emotion regulation. In this regard, individuals in this profile may have different strategies to cope with difficult emotions and, therefore, NSSI may represent an isolated and less severe coping behavior, as has been previously proposed in prior research (Peterson et al., 2019; Whitlock et al., 2008).

Participants across profiles also differed in their perceived social support. In contrast with Profiles 2 and 3, participants in Profile 1 reported less social support. This finding is consistent with previous cross-sectional and longitudinal research indicating that perceived social support is inversely associated with risk of NSSI (Hankin & Abela, 2011; Wolff et al., 2014). For instance, it has been observed that high social support decreases the odds of engaging in NSSI in adolescents from both nonclinical (Wan et al., 2019) and clinical samples (Baiden et al., 2017). In this regard, previous studies have demonstrated the prominent role of social factors in NSSI (Cipriano et al., 2017; Taylor et al., 2018). For example, interpersonal conflicts or feelings of rejection by peers are frequent triggers for

NSSI (Briones-Buixassa et al., 2021; Brunstein Klomek et al., 2016). At the same time, young people who engage in NSSI often report feelings of loneliness, poorer relationships with parents, and invalidating life environments, which are constructs closely related to perceived social support (Musser et al., 2018; Wang et al., 2020).

Interestingly, social support is theorized to indirectly protect against NSSI behaviors by improving emotion regulation (Rissanen et al., 2021). Indeed, recent studies have showed that the social context may impact emotion regulation (Marroquín & Nolen-hoeksema, 2015). Thus, people who report higher levels of perceived social support are able to more positively and more effectively regulate their emotions (Lakey, 2010). For instance, in a sample of college students, the habitual use of cognitive reappraisal is associated with fewer future experiences of depression and anxiety, primarily through higher perceived social support (d'Arbeloff et al., 2018). This finding suggests that social support may help improve emotion regulation and may help cope more effectively with interpersonal (among others) stressors (see also: Sachs-Ericsson et al., 2021). Current results are congruent with these previous findings. On the one hand, it is plausible that among students in Profile 2 (compared to Profile 1), high social support mitigated or buffered the effects of poor emotion regulation, reducing clinical symptoms and risk for psychopathology. On the other hand, among students in Profile 1, low perceived social support could be exacerbating emotion regulation difficulties, thus increasing psychological suffering.

In addition, participants in Profile 1 reported feeling less supported, especially by friends (see Table S4). They also highly endorsed interpersonal motives for engaging in self-injury. It is important to note that college represents a critical developmental period, due to the transition from adolescence to young adulthood. Therefore, the findings may suggest that

the college environment may make social support from friends particularly important for the mental health of young people and, especially for those students with emotion regulation difficulties. Consistently, previous studies found that negative peer relationships may increase the occurrence of NSSI behavior in young people (Heath et al., 2009; Peng et al., 2019). From a longitudinal point of view, these findings are consistent with a recent longitudinal study with a 5-year follow-up that found that high perceived social support from friends may be particularly critical in preventing the onset of self-cutting in adolescents (Rissanen et al., 2021).

Prior research proposes that NSSI can be an early behavioral marker of psychopathological vulnerability (e.g., Ghinea et al., 2019). The present study goes one step further to better understand this important relationship, suggesting that this vulnerability is not implicit to the NSSI, but rather a combination of emotion regulation difficulties with low perceived social support. This result is supported by the high scores on all measures of psychopathology (including suicidal tendencies) among students in Profile 1, both at baseline and at follow-up. Additionally, Profiles 1 and 2 are very similar except for social variables, which may suggest that social support plays a critical role in the relationship between NSSI, psychopathology, and suicide. In this respect, the results are consistent with previous findings showing that perceived social support is associated with fewer depressive and anxiety symptoms, and fewer suicide-related outcomes at 1-year follow-up (Scardera et al., 2020). Interestingly, at follow-up, the scores in psychopathological measures were maintained similar to the baseline, although most participants stopped engaging in NSSI (i.e., Profile 1 showed an enhanced psychopathological risk compared to the other two profiles). This finding is partially consistent with previous longitudinal studies showing a greater risk of

developing later psychopathology in young people engaging in NSSI, regardless of whether NSSI is maintained over time (e.g., Daukantaitė et al., 2021).

The results of this study may have some clinical implications. On the one hand, the findings could help optimize preventive interventions, paying special attention to those young people with NSSI who also have high emotional regulation problems and a low perceived social support. On the other hand, current findings support evidence-based interventions for addressing NSSI such as dialectical behavioral therapy (DBT; Linehan, 2015). Interestingly, this type of psychological intervention addresses both interpersonal and emotion regulation skills. Currently, DBT has already been adapted for college settings to improve emotion regulation and social adjustment (Chugani, 2017), and its implementation so far has shown feasibility and acceptability (Uliaszek et al., 2016). For example, DBT interventions have been shown to decrease NSSI events and improve emotion regulation capacity, social adjustments and functioning (Pistorello et al., 2012; Rizvi et al., 2014) through decreasing dysfunctional coping skills (e.g., avoiding people) in college students (Uliaszek et al., 2018). However, further research is needed to determine its efficacy.

The present study has several limitations. First, only self-report measures were used, so a recall bias could influence the information reported by the participants, especially when asked about NSSI events in the last 12 months. Second, in the latent profile analysis model two functions commonly reported by young people was included (Taylor et al., 2018). However, other types of functions that are less common were not included (i.e., self-punishment function: Klonsky, 2007), but also characterize severe profiles in college students (Christoforou et al., 2021). Third, an overall measure of emotion dysregulation was included in the latent profile analysis (DERS: Gratz & Roemer, 2004). However, other

measures of emotion dysregulation were not considered, such as rumination, which also characterizes severe NSSI profiles in college students (Guérin-Marion et al., 2021). Fourth, the sample was largely skewed toward females. However, this gender difference has been consistently found in previous studies, suggesting that females were significantly more likely to report a history of NSSI than males (see: Bresin & Schoenleber, 2015). Finally, a low retention rate was obtained in the follow-up that can yield biased estimates of participant characteristics under study (i.e., Type II error) and, therefore, may limit the conclusions from the longitudinal results.

### *Conclusion*

Despite acknowledging the link between NSSI and an elevated risk of psychopathology, unraveling the specific profiles at increased risk for future psychological issues remains an ongoing scientific challenge. This study explored the presence of latent subgroups in a sample of young adults engaged in NSSI using a longitudinal approach, as well as the distinct association of each of these groups with psychopathological risk over both the short term (baseline) and long term (follow-up). The findings revealed a high-risk profile characterized by a heightened endorsement of severe NSSI methods (e.g., self-cutting), elevated emotion dysregulation, and low perceived social support. These results contribute to highlight the role of perceived social support in the complex relationship between NSSI and the risk of psychopathology in young adults with NSSI. Moreover, these findings unveil promising avenues for prevention and treatment strategies in the management of NSSI. In this regard, fostering social support may be fundamental among youth engaging in NSSI.

# Chapter IV

## Mechanisms of Change and Emotion Dysregulation

### Study 3. Mediating processes in Mindfulness Skills Training

Schmidt, C., Soler, J., Carmona I Farrés, C., Elices, M., Domínguez-Clavé, E., Vega, D., & Pascual, J. C. (2021). Mindfulness in Borderline Personality Disorder: Decentering Mediates the Effectiveness. *Psicothema*, *33*(3), 407–414. https://doi.org/10.7334/psicothema2020.437

### Study 4. Mindfulness Practice and Emotion Dysregulation

Schmidt, C., Soler, J., Vega, D., & Pascual, J. C. (2024). Practice matters: The role of mindfulness skills in emotion dysregulation in borderline personality disorder. *Journal of Contextual Behavioral Science*, 32, 100756. https://doi.org/10.1016/j.jcbs.2024.100756

### Study 5. Mechanisms of Change in Mindfulness Skills Training

Schmidt, C., Soler, J., Vega, D., Nicolaou, S., Arias, L., & Pascual, J. C. (2024). How does mindfulness skills training work to improve emotion dysregulation in borderline personality disorder?. *Borderline personality disorder and emotion dysregulation*, *11*(1), 22. https://doi.org/10.1186/s40479-024-00265-0

# 6. Mindfulness in Borderline Personality Disorder: Decentering Mediates the Effectiveness.

## 6.1. Introduction

Borderline personality disorder (BPD) is a severe, complex mental illness characterized by a pervasive pattern of emotion dysregulation, impulsivity, interpersonal relationships disturbances, and identity dysfunction (American Psychiatric Association, 2013). It is also associated with intensive use of mental health resources, chronicity, and severe psychosocial deterioration (Álvarez-Tomás et al., 2017). Consequently, there is a clear need for effective, empirically-based psychotherapies designed to address the full complexity of this disorder.

Meta-analyses have shown that dialectical behavior therapy (DBT) is an effective psychotherapeutic treatment for BPD (Stoffers-Winterling et al., 2012; Storebø et al., 2020). Standard DBT is a multifaceted therapeutic intervention involving four primary modes of treatment delivery: individual therapy, group skills training, consultation teams for therapists, and telephone coaching (Linehan, 1993; 2014). The group skills component is often used as a stand-alone treatment which has proven to be an effective, non-comprehensive treatment by itself (Linehan et al., 2015; Soler et al., 2009). DBT skills training has been shown to be effective in decreasing anxiety, depression, in reducing suicide attempts, nonsuicidal self-injury, and in improving anger control (Linehan et al., 2015; Neacsiu et al., 2010; Soler et al., 2009).

DBT skills training comprises four different modules: mindfulness, distress tolerance, interpersonal effectiveness, and emotion regulation (Linehan, 1993; 2014). The specific efficacy of each module alone, and the mechanism of action through which these modules

achieve benefits, are still unknown, nor is it clear whether DBT can still be effective when certain skills (or modules) are absent (Valentine et al., 2015). Therefore, dismantling designs for the study of DBT skills are necessary to evaluate the active components of each module and to understand the specific mechanism of action that contribute to symptomatic improvement in patients with BPD. Linehan (2014) postulated that mindfulness training is the core component of these four modules. Studies have shown that the mindfulness module alone can effectively reduce BPD symptoms (Elices et al., 2016) and impulsivity (Carmona i Farrés et al., 2019; Soler et al., 2016). Given the effectiveness of this module and the relevance of mindfulness in DBT, understanding the active component of this module is relevant to clinical practice.

The concept of mindfulness is derived from the Buddhist tradition and it is generally defined as present-centred awareness with an attitude of acceptance and openness as opposed to a tendency to judge experience (Kabat-Zinn, 1990; Linehan, 2014). Linehan (1993) developed a treatment strategy that integrates the principles of Zen Buddhism and acceptance-related mindfulness practice, which includes specific techniques on how to achieve acceptance. Deficits in mindfulness skills have been linked to certain key characteristics of BPD such as impulsivity and emotion dysregulation (Fossati et al., 2012). Moreover, patients with BPD score significantly lower on measures of dispositional mindfulness (Soler et al., 2014) and show greater deficits in DBT skills (Neacsiu & Tkachuck, 2016) compared to patients with other psychiatric disorders.

Metacognitive awareness has been described as a primary cognitive mechanism within mindfulness meditation that is associated with an individual's decentering ability (Dahl et al., 2015). Decentering is defined as the capacity to observe one's thoughts and feelings in a

non-attached manner (Fresco et al., 2007). Decentering allows people to shift their perspective and to disidentify themselves from the contents of their experience (thoughts and emotions), while perceiving these experiences as transitory mental events, instead of identifying with them or believing that they are reflection of a static self or reality (Safran & Segal 1990; Shapiro et al., 2006). These metacognitive processes (meta-awareness and disidentification from experiential content) also help to reduce reactivity from thought (Bernstein et al., 2015). Decentering has been proposed as a mediating mechanism in several disorders, including generalized anxiety (Hoge et al., 2015), social anxiety (Hayes-Skelton & Graham, 2013), and depression (Gelcht et al., 2014). In patients with BPD, the decentering capacity is diminished (Soler et al., 2014). Mindfulness-based DBT skills training could help to compensate for those deficits since mindfulness interventions have been shown to improve decentering capacity in BPD. This studies have shown that this capacity is a predictor of reduced symptom severity, although its mediating effect on DBT skills training has not yet been tested (Elices et al., 2016; Soler et al., 2014).

Furthermore, emotion dysregulation is a central feature of BPD, characterized by greater reactivity and intensity of negative affect (Linehan, 1993; Selby et al., 2009). Individuals with BPD show significant deficits in emotion regulation (Glenn & Klonsky, 2009) and DBT skills training is effective at reducing difficulties in this area (Carmona i Farrés et al., 2019). To our knowledge, the relationship between decentering and emotion dysregulation has not been explored in DBT skills training, although both capacities are likely mechanisms of change underlying the reduction in overall symptoms in patients with BPD who undergo this treatment. Similarly, it is not known whether changes in decentering precede changes in emotion dysregulation or the inverse, although some studies in patients

with anxiety disorders have found that decentering improve emotion regulation (Hayes-Skelton et al., 2015; O'Toole et al., 2019).

In this context, we hypothesized that decentering is a primary mechanism of action -driven by mindfulness skills- in the treatment of BPD, which improves emotion dysregulation and BPD symptoms. The objective of the present study was to compare the DBT mindfulness module (acceptance skills) with the interpersonal effectiveness module (change skills) and to assess the mediating role of decentering and emotion dysregulation in reducing BPD symptoms. We chose interpersonal effectiveness as an active control group because is the module that differs the most from mindfulness skill. Comparing an acceptance-oriented module to a change-oriented module ensures that there is no overlap between the contents of each training.

## 6.2. Methods

### *Participants*

This study forms part of a wider project that includes several trials to evaluate the effectiveness of DBT skills training. The present study was based on data from BPD outpatient facility of the Hospital de la Santa Creu i Sant Pau (Barcelona, Spain) who participated in two previous psychotherapeutic clinical trials (Carmona i Farrés et al., 2019; Elices et al., 2016). In addition, new participants were recruited to complement the previous data in order to obtain a larger sample. The same procedure was performed as in the previous trials. All participants were interviewed by a psychiatrist and a psychologist, with experience in BPD research and treatment, who performed the diagnostic interviews and conducted the clinical assessments. A total sample of 149 patients was obtained, whose 47 were excluded

due to the absence of key clinical data (i.e., without post-assessment scales completed). Therefore, 102 participants were included in the present study.

Inclusion criteria were as follows: 1) clinical diagnosis of BPD based on two semi-structured interviews (Structured Clinical Interview for DSM IV axis II Disorders (SCID II: First et al., 1997) and the Revised Diagnostic Interview for Borderlines (DIB-R: Barrachina et al., 2004); 2) age 18-50 years (inclusive); 3) absence of any of the following comorbid conditions: schizophrenia, drug-induced psychosis, organic brain syndrome, substance dependence, bipolar disorder, intellectual disability, or major depressive episode in course; 4) not receiving any other type of psychotherapy at the time of study enrolment. Patients were allowed to continue taking any medications prescribed prior to study inclusion but they were not allowed to modify the type or dose of these drugs during the intervention period. The participants had no previous experience in mindfulness meditation and had not participated in a DBT skills training.

***Procedure***

A single-center randomized controlled trial design was used, with pre- and post-treatment measures. Participants were randomized and assigned to one of two treatment conditions: DBT-mindfulness skill training (DBT-M) or DBT-interpersonal effectiveness skill training (DBT-IE). The research unit coordinator was responsible for the randomization process.

The sessions were led by DBT-trained therapists (two in each group) and organised according to usual DBT procedures. All therapists were psychologists with a PhD degree and personal experience in mindfulness meditation. Both interventions followed the same

structure and were delivered in group format (9-12 participants/group). Each treatment session was 2.5 hours in duration and held weekly over a 10-week period (10 sessions). At the start of each session, the assigned home-based tasks were reviewed and then each participant commented on their experience with the practice (including any difficulties). Next, the therapists reinforced the participants' progress and suggested specific changes related to DBT skills. Subsequently, a new skill was introduced and practiced through the use of role plays and discussion. At the end of the session, new tasks were assigned for home-based practice during the week. Written informed consent was obtained prior to inclusion in the study. The study was approved by the Clinical Research Ethics Committee at the Hospital de la Santa Creu i Sant Pau and carried out in accordance with the Declaration of Helsinki.

**DBT-MFN training.** Mindfulness training consisted in teaching mindfulness skills based on the DBT skill training protocol (Linehan, 1993; 2014). The skills taught were: (i) Wise mind skill; (ii) What skills (i.e., observe, describe, participate); (iii) How skills (i.e., taking a non-judgmental stance, focusing on one thing in the moment, and being effective). Both formal and informal meditations were taught. Participants received a CD with all formal meditations and were instructed to practice at home. As our objective was to evaluate all the skills related to mindfulness of DBT skill training protocol, we also included acceptance skills taken from the Distress tolerance module to reinforce the attitudinal component of mindfulness practice (6-weeks mindfulness skills plus 3-weeks acceptance skills). Similarly, a 10-session mindfulness skill program is also proposed by Linehan as an alternative to the standard DBT skill (Linehan, 2014, p. 120) that include mindfulness and acceptance skills.

**DBT-IE training.** Interpersonal effectiveness training was also based on the DBT skill training protocol (Linehan, 1993; 2014). The overall aim was to increase the patient's

repertoire of effective social behavior. Three types of effectiveness skills were taught: (i) Learn to act effectively in maintaining your rights and goals in a particular situation; (ii) Learn to act effectively in relationships, including skills for keeping and improving relations and validation skills; (iii) Learn to defend their self-respect. Because the interpersonal effectiveness module consists of 6 sessions in the original protocol, two consecutive sessions were dedicated to each of the three effectiveness skills to equal the number of DBT-MFN sessions.

***Instruments***

**The Borderline Symptom List -23** (BSL-23: Bohus et al., 2009). A self-report instrument that assesses global BPD severity. The BSL-23 has an unifactorial solution, with higher scores indicating more severe BPD. The Spanish validation study showed high internal reliability (Cronbach's $\alpha = 0.94$) and good test-retest results ($r = 0.73$; $p < 0.01$) (Soler et al., 2013).

**Experiences Questionnaire** (EQ: Fresco et al., 2007). This is a 20-item self-report scale to assess decentering and rumination. In the present study, we used the EQ-Decentering scale, which assesses an individual's ability to observe thoughts and feelings in a detached manner (Fresco et al., 2007). The EQ has a proven sensitivity to detect changes after mindfulness-based interventions (Soler et al., 2014). The Spanish version has good internal reliability (Cronbach's $\alpha = .89$) (Soler et al., 2014).

**Difficulties in Emotion Regulation Scale** (DERS: Gratz & Roemer, 2004). This is a self-report questionnaire to assess difficulties in emotion regulation and consist of five factors: Awareness, Clarity, Non-acceptance, Goals, and Impulse-Strategies. The Spanish

validation showed high internal reliability (Cronbach's α = .93) with moderate to high internal reliability on the five scales (Cronbach's α = .73 to .91) (Hervás & Jodár, 2008). In this study, the total DERS score was used as an overall measure of emotion dysregulation.

***Data analysis***

First, multiple chi-square and independent t-tests were performed at baseline to assess for possible demographic and clinical differences between groups (DBT-M vs. DBT-IE). Second, to evaluate the impact of both treatments on the primary outcome (BSL-23), a repeated measure ANOVA were conducted. Self-reported BPD symptoms scores were entered as the dependent variable; time (pre- and post-treatment) was entered as the within-subjects factor, and group condition (DBT-M vs. DBT-IE) was entered as the between-subjects factor. Two repeated-measures ANOVAs were conducted for secondary variables (EQ and DERS); time (pre- and post-treatment) was included as the within-subjects factor and group condition (DBT-M vs. DBT-IE) was entered as the between-subjects factor. Post hoc analyses were conducted when significant interactions were found.

Finally, we conducted mediation analyses to evaluate the possible mediating role of secondary outcomes (i.e., EQ and DERS) in the post-treatment decrease in BSL-23 scores. We used the PROCESS macro in SPSS 24.0 and bootstrapping confidence intervals with 10,000 resamples to obtain estimates of indirect effects (Hayes, 2013; Hayes & Preacher, 2014). The proposed model included the intervention (DBT-M vs. DBT-IE) as independent variable and borderline symptoms (BSL-23) as the outcome. Two possible mediators were included in a serial multiple mediation model: decentering (EQ) and emotion dysregulation (DERS).

## 6.3. Results

### *Baseline demographic and clinical characteristics*

The demographic and clinical variables are shown in Table 1. There were no significant differences between the groups in demographic variables (age, sex, education, employment, marital status) or clinical characteristics (DIB-R and pharmacological treatment). Likewise, there were no between-group differences in self-report measures at baseline: BSL-23 ($t$ = -.17, $df$ = 100, $p$ = .86), EQ ($t$ = -.50, $df$ = 100, $p$ = .61), and DERS ($t$ = -.43, $df$ = 92, $p$ = .66).

**Table 1**. *Baseline Demographics and Clinical Characteristics*

| | DBT-M | | DBT-IE | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | $n$ = 50 | | $n$ = 52 | | $t$ | $\chi^2$ | $p$ |
| Age (mean, SD) | 32.06 | 8.0 | 32.56 | 8.0 | -.31 | | .75 |
| Female (n, %) | 47 | 92.2 | 48 | 92.3 | | .00 | .97 |
| Education (n, %) | | | | | | .89 | .64 |
| Primary | 13 | 25.5 | 14 | 26.9 | | | |
| Secondary | 20 | 39.2 | 24 | 46.2 | | | |
| University | 18 | 35.3 | 14 | 26.9 | | | |
| Employment status (n, %) | | | | | | 5.04 | .08 |
| Student | 1 | 2.0 | 5 | 9.6 | | | |
| Employed | 20 | 39.2 | 12 | 23.1 | | | |
| Unemployed/sick leave | 30 | 58.8 | 35 | 67.3 | | | |
| Marital Status (n, %) | | | | | | 2.97 | .22 |
| Single | 34 | 66.7 | 26 | 50.0 | | | |
| Married/couple | 9 | 17.6 | 13 | 25.0 | | | |
| Divorced/separated | 8 | 15.7 | 13 | 25.0 | | | |
| DIB-R (mean, SD) | 7.35 | 1.25 | 7.75 | 1.59 | -1.30 | | .19 |
| Pharmacological treatment (n, %) | | | | | | | |
| Antidepressants | 38 | 80.9 | 40 | 83.3 | | .10 | .75 |
| Benzodiazepines | 28 | 59.6 | 26 | 54.2 | | .28 | .59 |
| Mood stabilizers | 10 | 21.7 | 10 | 20.8 | | .01 | .91 |
| Antipsychotics | 15 | 32.6 | 20 | 41.7 | | .82 | .36 |

*Note.* DBT-M = Dialectical Behavior Therapy-Mindfulness group; DBT-IE = Dialectical Behavior Therapy-Interpersonal Effectiveness group; DIB-R = Revised Diagnostic Interview for Borderlines.

***Differences between groups in efficacy***

We first evaluated the effects of the two interventions on the primary outcome (Table 2). BSL-23 scores showed a main effect of time ($F$ (1,100) = 7.27, $p$ = .008, $\eta^2$ = .07) and a significant group × time interaction ($F$ (1,100) = 7.38, $p$ = .008, $\eta^2$ = .07), without a group main effect ($F$ (1,100) = 2.48, $p$ = .11, $\eta^2$ = .02). Post hoc analyses showed that, after treatment, BSL-23 scores decreased only in the DBT-M group while remaining unchanged in the DBT-IE group (post-treatment score of DBT-M vs. DBT-IE: $t$ = -2.52, $df$ = 100, $p$ = .01). For secondary outcomes, EQ showed a main effect of time ($F$ (1,100) = 29.02, $p$ < .00, $\eta^2$ = .22) and a significant group × time interaction ($F$ (1,100) = 12.27, $p$ = .001, $\eta^2$ = .11), without a group main effect ($F$ (1,100) = 1.31, $p$ = .25, $\eta^2$ = .01). Post hoc analyses showed that EQ scores increased significantly after treatment only in the DBT-M group (post-treatment score of DBT-M vs. DBT-IE: $t$ = 2.85, $df$ = 100, $p$ = .005). For DERS scores, we found only a main effect of time ($F$ (1,90) = 16.73, $p$ < .000, $\eta^2$ = .16), without group × time interaction ($F$ (1,90) = 2.97, $p$ = .08, $\eta^2$ = .03) and without a group main effect ($F$ (1,90) = 1.51, $p$ = .22, $\eta^2$ = .02). Post hoc analysis showed a tendency for further improvement in DBT-M (post-treatment score of DBT-M vs. DBT-IE: $t$ = -1.82, $df$ = 92, $p$ = .07).

**Table 2.** *Scores pre- and post-treatment between Groups in Self-report Measures*

| | DBT-M | | | | DBT-IE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | PRE | | POST | | PRE | | POST | | Group x Time Interaction | | |
| | M | SD | M | SD | M | SD | M | SD | *F* | *p* | $\eta^2$ |
| BSL-23 | 48.04 | 20.26 | 37.38 | 24.91 | 48.75 | 21.73 | 48.90 | 20.75 | 7.38* | **.000** | .07 |
| EQ | 25.20 | 7.38 | 31.28 | 6.58 | 26.19 | 7.44 | 27.48 | 6.78 | 12.27* | **.001** | .09 |
| DERS | 97.97 | 22.06 | 86.32 | 24.79 | 100.00 | 23.04 | 95.26 | 22.70 | 2.97* | .08 | .03 |

*Note*. DBT-M = Dialectical Behavior Therapy-Mindfulness group; DBT-IE = Dialectical Behavior Therapy-Interpersonal Effectiveness group; BSL-23 = Borderline Symptom List-23; EQ = Experiences Questionnaire-Decentering Scale; DERS = Difficulties in Emotion Regulation Scale.
* = Time Main Effect.

### *Mediation analysis*

We evaluated whether the decrease in BPD symptoms (BSL-23) observed in the DBT-M group versus the DBT-IE group was influenced by changes in decentering (EQ) and emotion dysregulation (DERS) scores. We performed a mediation analysis that simultaneously included these measures, first EQ and then DERS, in a serial mediator model (Model 6: Hayes, 2013). In this analysis, we followed the recommendations of Hayes & Rockwood (2017) in order to obtain more precise estimates, therefore, we specified baseline scores of BSL-23, EQ and DERS as covariates. That is, we used the post-treatment scores while controlling by earlier measures of those variables (pre-treatment) rather than using difference score as a measure of change (i.e., post-treatment minus pre-treatment). We obtained a model with three possible mediation paths (Figure 1). The first mediation analysis showed that DBT-M treatment versus DBT-IE was significantly associated with decentering (path $a_1$: B = 3.30, SE = 1.20, $p$ = .007), while decentering was significantly associated with

borderline symptoms (path $b_1$: B = -.66, SE = .30, $p$ = .03). The DBT-M treatment condition was not significantly associated with borderline symptoms after controlling for the mediators (path c´: B = -.86, SE = 3.16, $p$ = .78). In these analyses, bias-corrected bootstrapping showed that the confidence interval did not include zero, indicating that the indirect effect was significant (path $a_1b_1$: B = -2.18, Boot SE = 1.35, 95% CI [-5.33, -0.12]), and demonstrating that the reduction of BSL-23 scores in the DBT-M group was mediated by decentering.

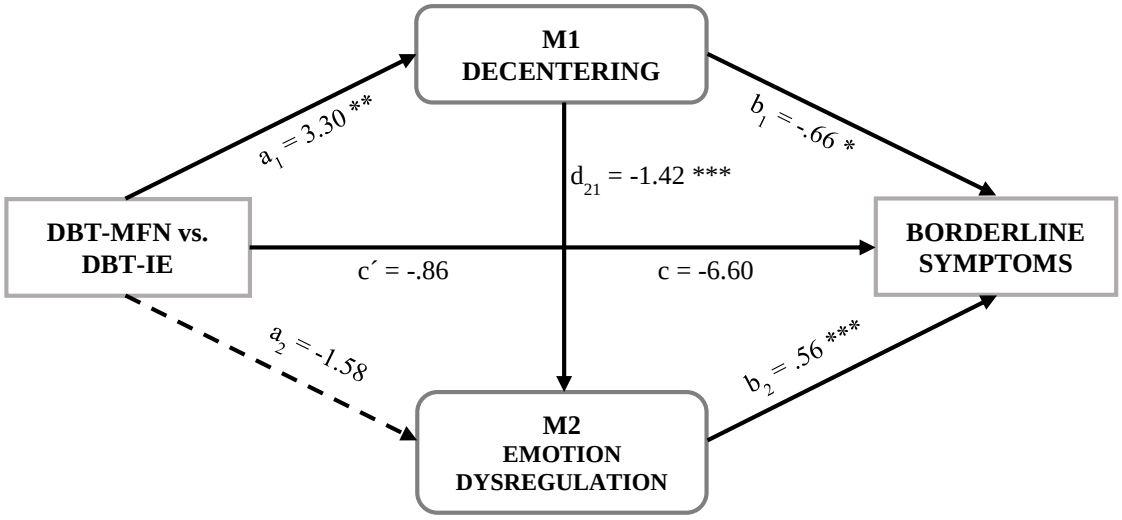
In the second mediation path, the DBT-M treatment condition, compared to DBT-IE, was not significantly associated with emotion dysregulation (path $a_2$: B = -1.58, SE =3.57, $p$ = .65); however, emotion dysregulation was significantly associated with borderline symptoms (path $b_2$: B = .56, SE = .09, $p < .001$). Moreover, the bias-corrected bootstrapping showed that the indirect effect was not significant (path $a_2b_2$: B = -.89, Boot SE = 2.09, 95% CI [-5.58, 2.76]). In this case, emotion dysregulation does not mediate between DBT-M and a reduction in borderline symptoms.

In the third mediation path, which includes the two serial mediators, the DBT-M treatment condition -in contrast to DBT-IE- was significantly associated with decentering (path $a_1$: B = 3.30, SE = 1.20, $p$ = .007) and decentering (M1) was significantly associated with emotion dysregulation (path $d_{21}$; B = -1.42, SE = .30, p < .001). Consecutively, emotion dysregulation (M2) was significantly associated with borderline symptoms (path $b_2$: B = .56, SE = .09, $p < .001$). The bias-corrected bootstrapping showed that the indirect effect was significant (path $a_1d_{21}b_2$: B = -2.66, Boot SE = 1.20, 95% CI [-5.33, -0.60]). This mediation means that DBT-M reduces borderline symptoms by increasing decentering ability, which in turn decreases emotion dysregulation. In order to test this serial relationship between the mediators, we contrasted this indirect effect by reversing the order of the mediators; that is,

we placed emotion dysregulation first followed by decentering in a new mediation model. In this case, the indirect effect with two mediators was not significant (path $a_1d_{21}b_2$: B = -.59, Boot SE = .44, 95% CI [-1.57, 0.10]). The above finding indicate the unidirectional relationship of the mediators in the proposed model.

***Contrast of indirect effects***

In the model we obtained two significant indirect effects (path a1b1: decentering [M1] and path a1d21b2: decentering and emotion dysregulation [M1→M2]. For this reason, we tested whether these effects differed in terms of the estimate size. We used a pairwise contrast of the indirect effect using bias-corrected bootstrapping to assess whether one indirect effect was significantly superior to the other (Hayes & Rockwood, 2017), a procedure that is available in the PROCESS macro (Hayes, 2013). We found that the indirect effect via decentering (EQ) was not significantly different from the indirect effect via decentering and emotion dysregulation (EQ→DERS) (path a1b1 minus path a1d21b2: B = .48, Boot SE = 1.60, 95% CI [-2.90, 3.60]). This result indicates that when we added DERS to the mediation model, the indirect estimation effect did not differ significantly.




| | Total Effect (95% CI) | Direct Effect (95% CI) | Indirect Effect (95% CI) |
|---|---|---|---|
| DBT-M vs. DBT-IE | -6.60 (-14.50, 1.29) | -.86 (-7.15, 5.43) | -5.74 (-11.71, -0.77) |
| Path EQ | | | -2.18 (-5.33, -0.12) |
| Path DERS | | | -.89 (-5.58, 2.76) |
| Path EQ→DERS | | | -2.66 (-5.33, -0.60) |

**Figure 1.** Analysis with multiple mediators. Dotted line means that path was not significant. c´ = Direct Effect; c = Total Effect.
* P < .05, ** P < .01, *** P < .001.

## 4. Discussion

This study was carried out to compare the mindfulness-based DBT skills training with the interpersonal effectiveness-based DBT skills training and investigate the mediational role of decentering and emotion dysregulation -as possible mechanisms of action- in improvement BPD symptoms. Our findings showed that DBT-M (but not DBT-IE) reduced BPD symptomatology, and this improvement was mainly mediated by decentering. We also identified a multiple mediation model in which DBT-M was associated with a decrease in BPD symptoms through the two proposed mediators (decentering and emotion dysregulation). Interestingly, this path resulted in a serial mediation; that is, decentering led to a decrease in emotion dysregulation (but not the inverse). These findings indicate that the

decrease in emotion dysregulation and BPD symptoms both depend on improvements in decentering ability.

Only a few studies have evaluated the effectiveness of the DBT skills modules separately. However, two studies found that DBT-M was more effective than DBT-IE in reducing impulsivity (Carmona i Farrés et al., 2019; Soler et al., 2016), although both interventions were equally effective in decreasing BPD symptoms and certain aspects of emotion dysregulation (Carmona i Farrés et al., 2019; Elices et al., 2016). Our results -based on a larger dataset (sample size)- expands the findings of those previous studies, demonstrating that DBT-M is more effective than DBT-IE in increasing decentering ability and reducing BPD symptoms.

A core component in mindfulness-based interventions that foster decentering is through a state of meta-awareness (Lutz et al., 2015). Meta-awareness -awareness of subjective experience- is the process that leads to disidentification of disruptive thought patterns by generating non-reactive attention to the contents of the experience (Bersntein et al., 2015; Bernstein et al., 2019). Although decentering skill can be explicitly trained through different therapeutic interventions (e.g., emotion regulation therapy: Mennin & Fresco, 2014) or through similar strategies (e. g., perspective broadening: Travers-Hill et al., 2017), is the mindfulness meditation what promotes the ability to monitor our experience from a decentered perspective. This process is well explained in the mindfulness mechanism denominated “reperceiving”, a decentering-related construct, described by Shapiro and colleagues (Shapiro et al., 2006). Those authors suggested that, by developing the capacity to stand back and witness thoughts and emotional states (i.e., disidentification), habitual reactive patterns are interrupted and thus the individual becomes less controlled by emotions

and thoughts. In turn, development of this capacity should decrease impulsivity and mood-dependent behaviours, consistent with previous studies that used DBT-M to decrease impulsivity in BPD (Carmona et al., 2019; Soler et al., 2016).

In our study, mindfulness training consisted of 10 sessions of DBT-M based on skills from the mindfulness module and acceptance skills from the distress tolerance module. Therefore, the core of this training was to teach mindfulness and acceptance skills. Mindfulness practice in DBT-M is the intentional process of observing, describing, and participating nonjudgmentally in reality, in the moment, and with effectiveness (i.e., by using skilful means). The combination of attention and acceptance training is likely to cultivate a "decentering" perspective in patients, since all three constructs are intercorrelated (Feliu-Soler et al., 2016, Fresco et al., 2007). Indeed, the mindfulness-based DBT skills are the first taught to the patients (e.g., observe and describe nonjudgmentally), since comprise primary skills to later be able to develop any other set of skills (i.e., emotion regulation or distress tolerance). In particular, the observing without judgment exercises in DBT promote the ability to attend to events, which requires a corresponding ability to step back from the event and to be alert and awake, like a sentry guarding a gate. This process eventually reduces reactivity to the content of the experience (Berstein et al., 2015) and can help to change maladaptive strategies such as experiential avoidance or thought suppression (Hayes-skelton et al., 2015). This likely explains why decentering leads to a decrease in emotion dysregulation.

Interventions focused on improving decentering ability appear to be crucial to obtaining therapeutic achievements in disorders characterized by high emotion dysregulation (Neacsiu et al., 2014; Neacsiu & Trachuck, 2016). From a transdiagnostic perspective, some

researchers suggest an endophenotype common in emotion dysregulation disorders, as in BPD, consisting of a negative self-referential processing characterized by higher worry, rumination, and self-criticism (Mennin & Fresco, 2013). Interestingly, several studies have found that DBT skills training adapted to this type of patient significantly reduces emotion dysregulation (Kells et al., 2020; Neacsiu et al., 2014), while decentering ability predicted changes in clinical outcomes in interventions aimed at treating anxiety and depression disorders (Mennin et al., 2018). These results show the importance of metacognitive skills as a self-regulatory mechanism of the emotion reactivity. Future studies should continue to study the potential of decentering as a cognitive mechanism that capable of generating emotional well-being in patients with high emotion dysregulation.

This study has several important limitations. First, all of the patients continued pharmacological therapy during the study. This means that the changes observed could be, at least partially, attributable to the effect of these medications. Nonetheless, it is important to emphasise that there were no differences between groups in terms of the medications used. Second, another limitation was not including intention-to-treat analysis. We only analysed data from individuals completing the interventions and this left out people that dropped out. This information could be useful to assess the level of efficacy according to the level of adherence. Thirth, we did not use an appropriate time sequence between the proposed mediators and the outcome variable, since we only assess pre and post-treatment.

However, the theory has proposed decentering as a robust mediator in other therapies and some studies have occupied a time sequence similar (e.g., Hoge et al., 2014). Finally, the instrument used to assess BPD symptoms, the BSL-23, may not have been the optimal choice. Although the BSL-23 is a specific tool for BPD with a global single score, other multifaceted

scales could potentially have provided more specific information related to the dimensions of borderline pathology.

The findings of this study underscore the crucial role of decentering as a primary mechanism of action to reduce BPD symptoms and improve emotion regulation in patients who receive mindfulness-based DBT skills training. These novel results advance our understanding of DBT skill modules, revealing the specific mechanism by which the individually contribute to therapeutic change. These findings indicate that decentering plays a key role in BPD treatment, which suggests that future interventions should focus on decentering as a primary component of BPD treatment.

# 7. Practice matters: The role of mindfulness skills in emotion dysregulation in borderline personality disorder

## 7.1. Introduction

Borderline personality disorder (BPD) is a highly complex, severe mental illness characterized by shifting intense emotions, unstable identity, and disturbed interpersonal relationships (American Psychiatric Association, 2013; Bohus et al., 2021). Individuals with BPD commonly experience intense and overwhelming emotions, which leads them to use maladaptive strategies such as self-injury to obtain immediate relief from those emotions (Linehan, 1993; Santangelo et al., 2017). Given the connection between overwhelming emotions and dysfunctional behavior, one of the key targets of psychological treatment for BPD is emotion dysregulation (ED).

Dialectical behavior therapy (DBT) has emerged as an empirically-based treatment for BPD (for a meta-analysis see: Storebø et al., 2020). DBT is a multifaceted therapeutic intervention consisting of individual therapy sessions and group skills training (Linehan, 1993, 2014). Skills training, which teaches participants how to regulate emotions, is considered a key component of DBT (Chapman, 2019). Therefore, research has focused on exploring the processes by which DBT leads to improved emotion regulation in BPD (Gratz et al., 2016). In this regard, greater acquisition and use of DBT behavioral skills (e.g., assessed by weekly skills tasks) has consistently been found to contribute for clinical outcomes in BPD (Barnicot et al., 2016; Edwards et al., 2021; Rudge et al., 2020) and specifically for improvements in ED (Neacsiu et al., 2014; Southward et al., 2023). Interestingly, within DBT skills, mindfulness skills are the most used by participants (Lindenboim et al., 2007; Stepp et al., 2008) and the specific use of mindfulness skills appears

to be one of the main components at the basis of ED improvements in BPD (Mehlum, 2021; Wyatt et al., 2023).

Mindfulness skills are considered a core component of DBT for the treatment of BPD, and mindfulness training is actively used to improve emotion regulation (Linehan, 2014). Several studies have evaluated the effectiveness of mindfulness skills training compared to other DBT modules (e.g., interpersonal effectiveness) in improving BPD symptoms (Carmona i Farrés et al., 2019; Elices et al., 2016; Soler et al., 2016). Interestingly, mindfulness skills alone mediate the impact of DBT skills training on psychiatric symptoms and associated risk behaviors (Krantz et al., 2018; Zeifman et al., 2019). Specifically, Schmidt et al (2021) found that DBT mindfulness skills increase emotion regulation capacity, which in turn reduces BPD symptoms. However, it remains to be clarified how the link between the mindfulness practice and improvements in ED occurs.

As noted, while mindfulness training can be effective in DBT, the time spent practicing these skills at home is likely to impact treatment outcomes. Nevertheless, to our knowledge, only one study has evaluated the association between the amount of home practice of mindfulness skills and clinical outcomes in patients with BPD (Soler et al., 2012). In that study, daily practice correlated with improvement in general psychiatric symptoms and depression, but not with behavioral measures of inattention and impulsivity. In short, due to the lack of data, the extent to which mindfulness practice is an active component and serves as a specific process to improve ED remains unclear. In this regard, it is important to better understand the impact of practice time in order to potentiate the effectiveness of interventions designed to improve ED.

Spiritual traditions such as Buddhism emphasize the importance of regular meditation practice to alleviate suffering. In secular meditation, mindfulness practice has been described as being analogous to weight training, except that mindfulness targets the mind whereas weight training is aimed at building muscle (Kabat-Zinn, 1990). Based on the available data, this analogy seems to be accurate. Several studies have shown that the number of years of mindfulness practice, minutes per session, and days per week are all significantly associated with higher mindfulness scores (Davis & Hayes, 2011; Soler et al., 2014). However, few studies have measured and quantified the amount of mindfulness practice (i.e., practice time) needed to alleviate mental health problems (Creswell, 2017) and the results are mixed. For example, one study compared mindfulness-based cognitive therapy (MBCT) with and without meditation practice, finding no significant differences between the two conditions in preventing relapse in patients with depression (Williams et al., 2014). A meta-analysis (Vettese et al., 2009) performed to determine whether engagement in mindfulness practice was associated with clinical outcomes found a clinical benefit from mindfulness practice in only half of the 24 studies. Subsequently, Parsons et al. (2017) conducted a systematic review and meta-analysis of 47 studies that reported home practice time, finding that only 28 of those studies detected a significant (albeit small) association between the amount of home practice and treatment outcomes. Given these data, the extent to which the practice of mindfulness improves positive mental health outcomes remains unclear, particularly as a process of emotion regulation in clinical populations with high levels of ED, such as BPD. Nonetheless, it is important to note that the lack—or only small—significant association between practice and positive outcomes could be at least partially due to deficiencies in the methods used to date to track and assess home practice (Visted et al., 2015). In this regard, it is important to accurately quantify the time spent on home mindfulness practice in order to

determine the true impact on emotion regulation, which would provide clinicians with valuable data about how much home practice is really needed. Similarly, quantifying the minimum effective dose would also benefit patients, who would then understand the amount of practice actually needed to improve their ED. In turn, this would adjust treatment expectations and increase motivation to regularly practice mindfulness.

According to the theoretical framework of DBT, core behavioral problems in BPD such as self-injury occur in response to a dysregulated emotional state (Linehan, 1993). Research findings support the importance of skills training to regulate emotions as a potential mechanism of change in DBT (Chapman, 2019), with mindfulness skills occupying a central role in treatment (Linehan, 2014). However, studies carried out to explore the relationship between the amount of mindfulness practice and ED as an outcome variable are scarce. In fact, to our knowledge, no studies have been performed to examine this relationship using DBT mindfulness skills training in patients with BPD. Similarly, mindfulness practice may be mood-dependent, although research in this area is scant (see Elices et al., 2019), and thus the individual's degree of dysregulation could affect engagement in practice, which in turn would influence the extent of improvement in ED.

In this context, the aim of the present study was to determine whether mindfulness practice improves emotion regulation in BPD outpatients undergoing DBT mindfulness skills training. Specifically, we sought to determine whether the amount of mindfulness skill practice (days and minutes per week) plays a relevant role in improving emotion regulation. We also aimed to determine the minimum dose of mindfulness practice needed. This study was conducted under the following hypotheses: 1) participation in DBT-Mindfulness (DBT-MFN) training would decrease ED; 2) the temporal dynamics between weekly practice and

ED would be bidirectional (i.e., ED would improve in those individuals who practiced mindfulness skills, and in turn, greater ED would affect commitment to practice); 3) participants who sustained their weekly practice of mindfulness skills would improve ED compared to participants who practice less, while controlling for the previous week's ED. We made no assumptions about the minimum dose needed because we have no prior history on the amount of practice relevant in DBT-MFN to obtain the expected results.

## 7.2. Methods

### *Participants*

Participants were recruited from the Department of Psychiatry Unit of a General Hospital. This outpatient program provides specialized care to individuals with BPD as a part of Public National Mental Health Service of Spain. A total of 95 outpatients with BPD were enrolled in a standard DBT skills training program. For the purposes of the study, the intervention consisted of a 10-week DBT mindfulness skill training program.

All participants were evaluated by a psychiatrist and a clinical psychologist from the psychiatry unit, both with extensive experience in the treatment of BPD. The clinical diagnosis was based on two semi-structured interviews, the Structured Clinical Interview for DSM IV axis II Disorders (SCID II: First et al., 1997) and the Revised Diagnostic Interview for Borderlines (DIB-R: Barrachina et al., 2004).

The inclusion criteria were: 1) diagnostic confirmation of BPD; 2) age between 18-55 years; 3) absence of any of the following comorbid conditions: schizophrenia, drug-induced psychosis, organic brain syndrome, substance dependence, bipolar disorder, intellectual disability; 4) not receiving any other type of psychotherapy at the time of study

enrollment. Patients were allowed to continue taking their usual medications prior to study enrollment. However, they were not allowed to change the type or dose of drugs during the 10-week study period. None of the participants had previously participated in group DBT skills training.

### *Procedure*

Participants were enrolled in 10-week mindfulness-based DBT skills training program. Each session was 2.5 hours. A total of seven groups (12-15 participants/group) participated in this program between February 2020 and October 2022. All groups were led by the same team (two clinical psychologists with training and experience in DBT and mindfulness meditation). Written informed consent was obtained from all participants prior to study inclusion. The study was approved by the Clinical Research Ethics Committee of the Hospital de la Santa Creu i Sant Pau and was conducted in accordance with the criteria of the Declaration of Helsinki.

**DBT-MFN training.** The intervention was based on the DBT skills training protocol (Linehan, 1993, 2014). The 10-week program consisted of one week of orientation and goal setting, followed by six weeks of mindfulness skills training, and finally three weeks of acceptance skills (from the distress tolerance module). This type of mindfulness training for BPD was proposed by Linehan as an alternative to standard DBT skills training (Linehan, 2014, p. 120) and its efficacy has been demonstrated in several clinical trials (Carmona i Farrés et al., 2019; Elices et al., 2016). The following mindfulness and acceptance skills were taught: 1) Wise Mind; 2) "What" Skills (i.e., observing, describing, participating); 3) "How" Skills (i.e., non-judgment, single-mindedness, and being effective); 4) Radical Acceptance;

5) Mind Turning and Willingness; 6) Half-smile and willing hands; and 7) Mindfulness of current thoughts (for details, see Supplementary material, Table S1).

The mindfulness skills taught during the sessions included both formal (i.e., meditation) and informal (i.e., being mindful of any thoughts or feelings, noticing not to be judging) mindfulness practices. In each session, a new skill was introduced and practiced through role-playing and discussion. At the conclusion of each session, participants were then provided with meditation audios (approximately 10 minutes in duration) and accompanying worksheets to practice the skills learned at home. The meditation audios were recorded by the lead therapist. Mindfulness practice at home included both formal (i.e., "stone flake in the lake" meditation for wise mind skill) and informal (i.e., completing a worksheet on the activities they did with wise mind during the week) exercises. At the next session, the homework was reviewed and each participant commented on his/her experience with the practice, including any difficulties. The therapist then reinforced the participants' progress and suggested effective ways to improve their practice.

***Measures***

Several repeated measures were performed weekly during the 10-week program. Only the first session (introduction/orientation) was not assessed, as it did not include mindfulness practice tasks. Prior to each new session, participants completed the short version of the Difficulties in Emotion Regulation Scale (DERS-18) and recorded the time spent practicing the assigned tasks (days and minutes per week), relative to the past week.

**Emotion Dysregulation.** The DERS-18 (Victor & Klonsky, 2016) was used to assess how participants managed difficult emotional experiences each week. We used the 18-item

Spanish-language version of this self-report scale. The total score was used as an overall measure of emotion dysregulation. Items on this scale are rated from 1 (almost never) to 5 (almost always). The scale has high internal reliability (Cronbach's α = .91; Victor & Klonsky, 2016). In the current study, the scale was assessed during the first session, showing good internal reliability (Cronbach's α = .87).

**Weekly Tasks.** At the start of each session participants were asked to indicate the time spent each week practicing the mindfulness skills exercises (formal and informal). They also indicated how much time it took them to complete the worksheets. We assessed two time-related continuous variables: 1) number of days practiced per week (range, 0-7) and 2) total weekly practice time in minutes. Then, the first variable, "practice days", was categorized into four levels, as follows: 0 = did not practice; 1 = 1-2 days of practice; 2 = 3-4 days of practice; 3 = 5-7 days of practice. The second variable, "practice time", was categorized into six levels, as follow: 0 = did not practice; 1 = 1-10 minutes; 2 = 11-20 minutes; 3 = 21-30 minutes; 4 = 31-50 minutes; 5 = more than 50 minutes.

***Data analysis***

Descriptive analyses of the participants' sociodemographic and clinical characteristics were performed. Then, we assessed continuous variables for normality and outliers. Most of the variables showed a normal distribution. The practice time variable had a non-normal distribution and was square root transformed to achieve normality. Next, we determined whether any of the sociodemographic and clinical variables was associated with weekly mindfulness practice engagement (i.e., practice days and/or time). For these analyses, we performed a one-way ANOVA for continuous variables and the Bonferroni post hoc test for multiple comparisons. Pearson's Chi-square test ($\chi^2$) was used to compare categorical

variables. The post-hoc test was calculated using corrected standardized residuals. This method indicates which cells in the contingency table contribute significantly to the overall chi-square statistic (see Beasley & Schumacher, 1995). A paired simple t-test was calculated to assess pre-post treatment change in ED, based on DERS-18 scores. Cohen's d effect size was calculated by dividing the mean difference between pre- and post-training by the averaged standard deviation (Cumming, 2014).

We then conducted multilevel modeling (MLM) analyses with a restricted maximum likelihood (REML) estimation method and time-lagged approach to examine the relationship over time between the frequency of weekly mindfulness practice and ED. Continuous variables used in these analyzes (i.e., practice days, practice time, and DERS-18) were mean centered. First, we assessed the temporal dynamics between mindfulness practice and ED. In these analyses, mindfulness practice at session x (i.e., practice days and practice time per week, separately) predicted the level of ED at session x+1, ensuring there was no overlap between measures. We then explored the reverse temporal dynamics by assessing whether the level of ED (DERS-18 score) in session x predicted the level of engagement with mindfulness practice in session x+1. Second, we assessed whether different frequencies of mindfulness practice were associated with an improvement in ED, controlling for the ED level from the previous time segment (i.e., previous week). For these analyses, the variables practice days and practice time were categorized in order to identify the specific dose of practice related to improvements in ED (i.e., DERS-18). In these analyses, weekly practice was used to predict ED at session x, controlled for ED at session x-1. As such, there was no temporal overlap in segments assessed for ED. The weekly practice level (practice days and practice time) was considered as a fixed effect and the participants as random effects (random

participants' intercept). MLM is recommended for the analysis of repeated measures data because this method is more robust than other methods in cases with missing data (e.g., participants who did not attend all sessions). On the MLM, regression coefficients were transformed into an effect size (r), which were classified as follows: small (0.1 – 0.3), medium (0.3 – 0.5), and large (> 0.5) (Cohen, 1988). All models were tested with the lme4 package (Bates et al., 2015) using RStudio (CoreTeam, 2017). The IBM-SPSS statistical software program (v. 24) was used to perform the descriptive analyses.

### 7.3. Results

#### *Sociodemographic and clinical characteristics of the sample*

A total of 95 patients were enrolled in the 10-week DBT-MFN training program. Of these, 13 discontinued treatment before the first session (i.e., only attended the introduction/orientation session) and 7 completed < 3 weekly assessments (i.e., only attended one or two mindfulness skills sessions and/or did not complete the weekly assessment). Participants with at least 3 weekly assessments were considered as criteria to run multilevel analyses with repeated measures over time (Santangelo et al., 2014) and model the within-person changes in ED over the course of DBT-MFN training. As a result, a total of 75 outpatients with a diagnosis of BPD were included in the analyses, resulting in a total of 499 observations (M = 4.95, SD = 2.60) across the nine sessions (note that the 1$^{st}$ session—orientation and goal setting—was not included in the multilevel analyses because mindfulness skills were not practiced in that session). We found no differences between participants who dropped out (or completed < 3 assessments) and the rest of the study participants in clinical and sociodemographic variables (all p-values < .11). The sociodemographic characteristics of the sample are shown in Table 1.

There was no association between sociodemographic variables (age, sex, educational level, or employment status) and weekly practice of mindfulness skills (practice days and time in minutes) (all *p*-values > .09). Similarly, we found no association between weekly practice and baseline DIB-R scores, prior suicide attempts, or history of non-suicide self-injury (*p*-value > .10). The type of pharmacological treatment had no effect on the level of weekly practice (all *p*-values > .16).

Overall, the participants practiced mindfulness skills for a median of 3 days (M = 2.80, SD = 1.97, range= 0-7) and a mean of 27.90 minutes per week (SD = 27.81, range= 0 - 180). The total frequency of practice in DBT-MFN was also assessed. 16.2% of the time participants did not engage in practice at home during mindfulness training. In relation to practice days, in most cases (63.2%), the participants practiced mindfulness, 1-2 days or 3-4 days per week. Less commonly (20%), they practiced 5-7 days. In relation to practice time, slightly more than half (51.5%) of participants practiced < 30 minutes/week, while 15.6% practiced between 31-50 minutes, and 16.8% practiced > 50 minutes per week. Interestingly, the mean time spent practicing mindfulness skills increased over the course of training, both in days (b = .16, SE = .02, $p < .001$) and minutes (b = 1.27, SE = .38, $p < .01$). Only one participant did not practice mindfulness during the training period. All other participants practiced mindfulness at some point during the training period.

**Table 1.** *Sociodemographic Characteristics of total sample*

| | **Total simple** (n= 75) |
|---|---|
| **Age,** mean (SD) | 27.55 (9.09) [range 18-53] |
| **Sex,** female, n (%) | 70 (93.3) |
| **Educational level,** n (%) | |
| Secondary school | 33 (44) |
| Any post-secondary school | 23 (30.7) |
| College degree | 16 (21.3) |
| Master degree | 3 (4) |
| **Employment Status,** n (%) | |
| Unemployed | 17 (22.7) |
| Employed | 25 (33.3) |
| Student | 24 (32) |
| Sick leave | 4 (5.3) |
| Disability pension | 5 (6.7) |
| **Experience in meditation practice,** n (%) | 13 (17.3) |
| **Clinical characteristics,** mean **(**SD) | |
| DIB-R total score | 7 (1.05) |
| **Previous self-injury behavior,** n (%) | |
| Past suicide acts | 32 (42.6) |
| Past non-suicide self-injury | 53 (70.6) |
| **Pharmacological treatment,** n (%) | |
| Antidepressant | 56 (74.6) |
| Benzodiazepines | 27 (36) |
| Antipsychotics | 17 (22.6) |
| Mood stabilizers | 15 (20) |

*Notes*. SD, standard deviation. DIB-R = Revised Diagnostic Interview for Borderlines.

***DBT-MFN training decreases the level of ED over time***

Significant decreases in ED were observed from the pre- to post-training assessment, with a medium effect size (t = 18.06, $p < .001$, $d = .79$; $M_{pre} = 63.59$ (9.66), $M_{post} = 54.59$ (12.98)).

In terms of session-by-session changes in ED over the 10-week course, we observed an improvement in ED levels over time (b= -.78, SE= .14, $p < .001$) (see Figure 1). Specifically, mean levels of ED did not decrease significantly from sessions 2 to 4 versus baseline score (all p-values > .09). However, from session 5 onward, the level of ED decreased significantly (session 5: b = -3.35, $p < .05$; session 6: b = -5.01, $p < .01$; session 7: b = -5.98, $p < .001$; session 8: b = -5.06, $p < .01$; session 9: b = -6.42, $p < .001$).

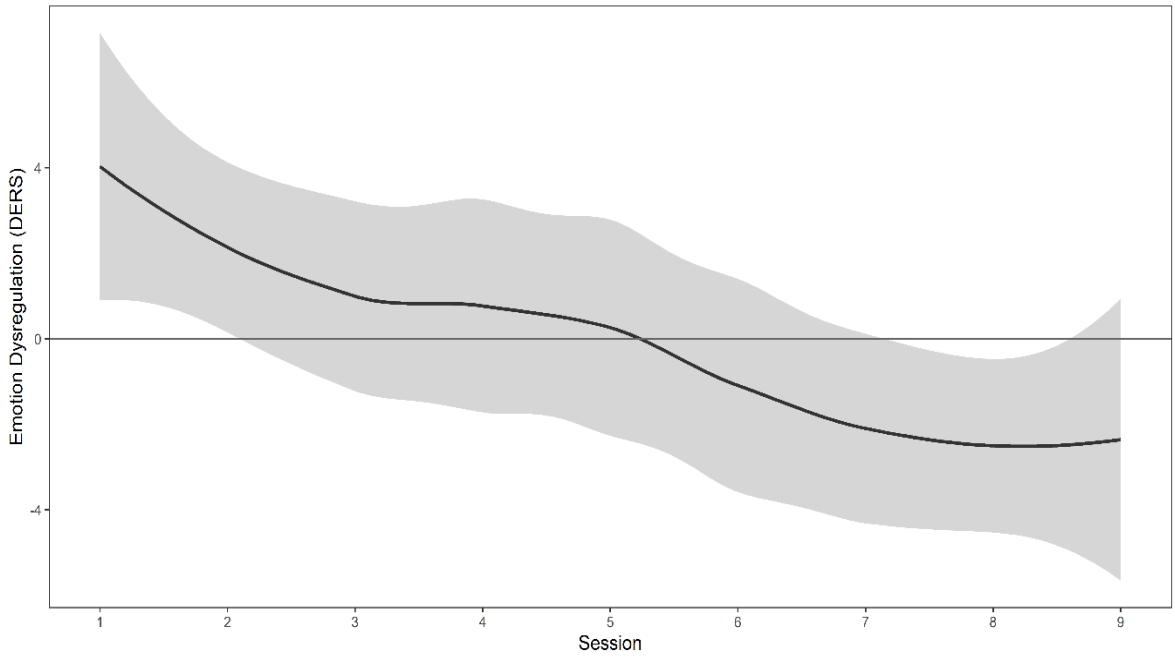



**Figure 1.** Improvement in emotion dysregulation through mindfulness-based DBT skills training sessions (DBT-MFN). The horizontal line represents the mean of the emotion dysregulation measures (mean-centered) during DBT-MFN training.

***Temporal dynamics between mindfulness practice and ED***

The temporal dynamics between mindfulness practice and ED were assessed using time lagged measures. Engagement with practice days at session x temporally predicted improvements in ED at session x+1 (b = -.86, $p < .001$, $r = .17$). Next, we tested the inverse relationship. The temporal association between ED level at session x and practice days at session x+1 was not statistically significant, although a trend towards significance was observed (b = -.01, $p = .07$, $r = .09$).

We found a bidirectional relationship between practice time and ED levels. Minutes of practice at session x predicted improvements in ED at session x+1 (b = -.51, p < .01, r = .14). Conversely, the ED level at session x predicted lower practice engagement in terms of minutes at session x+1 (b = -.02, p < .05, r =.12), indicating a bidirectional association between mindfulness practice and ED.

***Association between weekly practice and ED, controlled by the previous week's ED level***

We assessed whether the amount of weekly practice (days and time) was associated with ED, controlling for the ED level measured the previous week. This assessment was performed using time-lagged analysis (i.e., whether weekly practice predicted improvements in ED at session x, controlled by ED at session x-1). Practice frequencies of 3-4 days and 5-7 days per week were both associated with a significant reduction in ED compared to no practice (see Table 2 and Figure 2). There was no significant difference between a practice frequency of 1-2 days versus no practice.

**Table 2.** *Time-lagged analysis of weekly practice of mindfulness skills and emotion dysregulation over time*

| Weekly practice | B | SE | p-value | Effect size (r) |
|---|---|---|---|---|
| **Model 1** | | | | |
| DERS (Intercept) | 2.21 | 1.50 | .14 | |
| **Practice days** (ref: no practice) | | | | |
| 1-2 days | -1.39 | 1.47 | .34 | .05 |
| 3-4 days | -3.03 | 1.53 | **<.05** | **.10** |
| 5-7 days | -7.20 | 1.70 | **<.001** | **.20** |
| $DERS_{(x-1)}$ | .47 | .04 | **<.001** | **.58** |
| **Model 2** | | | | |
| DERS (Intercept) | 2.23 | 1.47 | .13 | |
| **Practice time** (ref: no practice) | | | | |
| 1-10 minutes | -0.44 | 1.65 | .78 | .02 |
| 11-20 minutes | -2.47 | 1.60 | .12 | .08 |
| 21-30 minutes | -2.44 | 1.68 | .14 | .07 |
| 31-50 minutes | -5.64 | 1.73 | **< .01** | **.16** |
| + 50 minutes | -6.77 | 1.76 | **< .001** | **.19** |
| $DERS_{(x-1)}$ | .49 | .04 | **< .001** | **.63** |

*Notes*. DERS = Difficulties in Emotion Regulation Scale; $DERS_{(x-1)}$ = Difficulties in Emotion Regulation in the previous week

In terms of practice time (in minutes), 31-50 minutes and > 50 minutes per week were both associated with a significant reduction in ED compared to no practice when controlling for the ED level assessed the previous week (Table 2 and Figure 3). There were no differences between a practice frequency of < 30 minutes per week versus no practice.

Finally, we explored session by session whether the frequency of mindfulness practice depended on participants' level of ED that week. We found that at the beginning of

the training, those who reported no practice had a higher level of ED compared to those participants who practiced 5-7 days ($F(3, 70) = 2.76$, $p = .05$; $M_{\text{no practice}} = 63.86$ vs. $M_{\text{5-7 days}} = 47.40$) and > 30 minutes per week ($F(5, 60) = 3.21$, $p < .05$; $M_{\text{no practice}} = 69.20$ vs. $M_{\text{31-50 min}} = 51.50$). These differences can be visualized in Figure 2 and 3. However, no significant differences were found from the third session onwards (all p-values > .10).

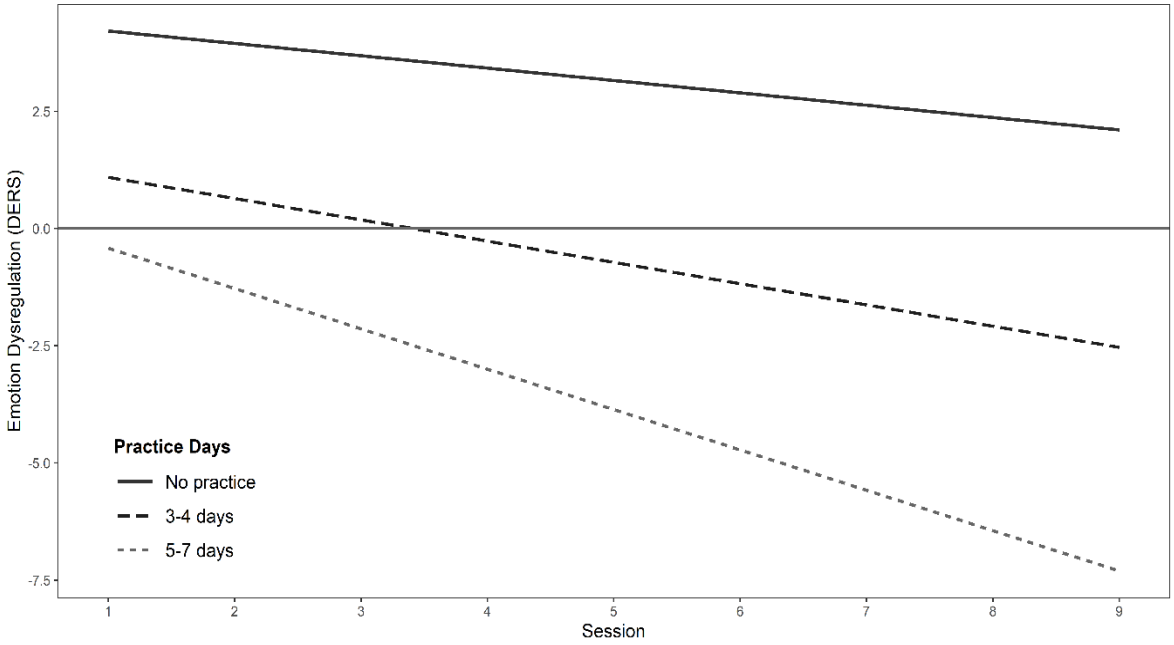



**Figure 2**. Effect of mindfulness practice in days per week on emotion dysregulation. The horizontal line represents the mean of the emotion dysregulation measures (mean-centered) during mindfulness-based DBT skills training.

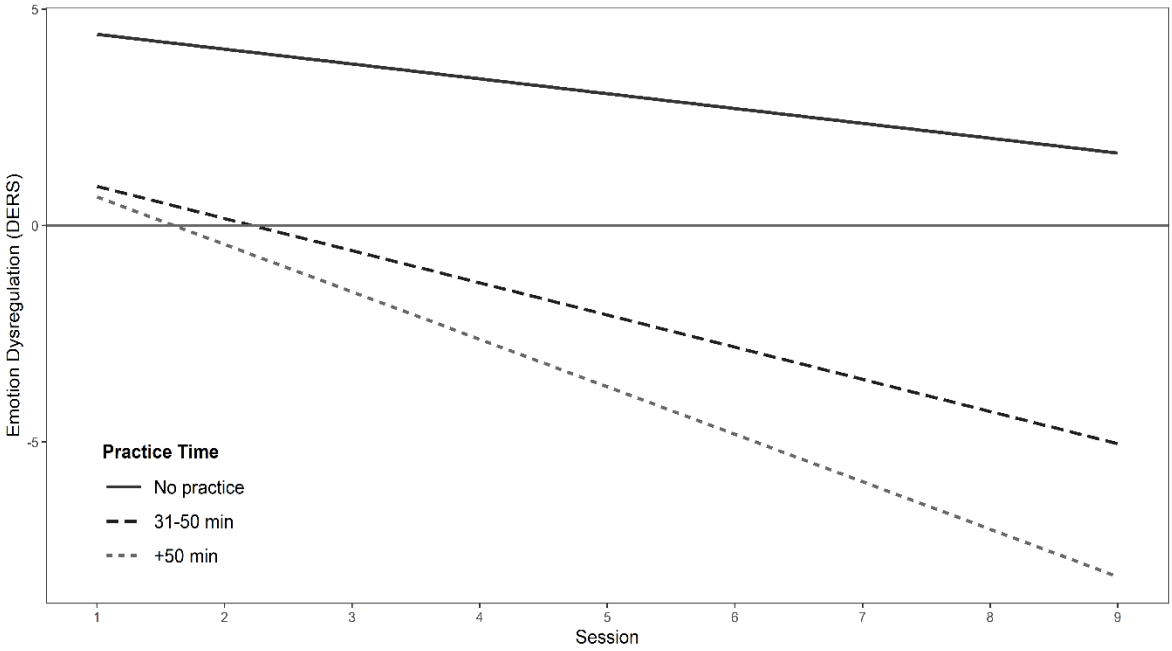



**Figure 3.** Effect of mindfulness practice in time (i.e., minutes) per week on emotion dysregulation The horizontal line represents the mean of the emotion dysregulation measures (mean-centered) during mindfulness-based DBT skills training.

## 6.4. Discussion

Mindfulness is a central component of DBT skills training for BPD. Mindfulness practice has often been assumed to be the active component responsible for the positive mental health changes observed in mindfulness interventions (Carmody & Baer, 2009; Creswell, 2017). However, empirical evidence for this effect is mixed, with most studies showing that the effects of mindfulness on expected outcomes are either small or have no effect (Parsons et al., 2017; Vettese et al., 2009; Williams et al., 2014). In this context, we sought to determine whether the practice of DBT mindfulness skills is associated with improvements in ED, a core element of BPD. Our results show that DBT-MFN training led

to an overall reduction in ED and this improvement became statistically significant from the fifth session onward. We also observed a bidirectional temporal relationship between mindfulness practice and ED; individuals who engaged in more frequent mindfulness practice experienced an improvement in ED in the subsequent week. However, higher ED levels were predictive of a lower commitment to practice during the following week. When we explored the effects of different levels of practice, we found that practicing mindfulness at least three days and > 30 minutes per week was associated with improved emotion regulation, even after controlling for the ED level of the previous week.

These results show that mindfulness practice is an active component of DBT-MFN training to improve ED. Mindfulness practice in DBT is defined as the repeated effort to consciously focus attention on the present moment without a judgmental attitude, with the goal of decreasing emotional reactivity to mental events (Linehan, 1993). In addition, the practice of acceptance skills was also part of the mindfulness training in the present study. Acceptance skills are inherent to mindfulness practice in DBT and involve recognizing and accepting reality without judgment (Robins, 2002). Although we did not assess the constructs of mindfulness and acceptance (only practice), both components are taught during training and practice of these skills appear relevant to ameliorating emotional regulation difficulties in BPD. For example, nonjudgmental acceptance is a relevant mediator of changes in clinical outcomes following DBT skills training (Krantz et al., 2018; Zeifman et al., 2019). Furthermore, it is important to note that significant benefits (in terms of reduced ED) occur from the 5th session onwards. Therefore, patients should be informed that the therapeutic benefits will only become apparent about halfway through the 10-week program, in part because the first few sessions involve learning new skills and consolidating practice.

Some studies have shown that some people find that practicing mindfulness generates unpleasant experiences such as anxiety or boredom, at least initially (Cebolla et al., 2017). These sensations may be similar to those experienced by people who start to play a new sport or musical instrument. Consequently, mindfulness instructors should be aware of this in order to better manage the expectations of novice practitioners, and to inform them of the potential challenges, including the fact that the benefits of practice will likely take time to become apparent (Baer et al., 2021). In order to avoid premature dropouts from such training programs, therapists need to be prepared to employ mechanisms such as therapeutic alliance and validation (Mehlum, 2021). For example, it can be important for therapists to validate the difficulties faced by people who start practicing mindfulness, even as they must also emphasize that these challenges are a necessary part of the process of improving emotion regulation in the medium term. In this regard, it is not surprising to note that most dropouts occur close to the initiation of mindfulness training and that the dropout rate for the mindfulness module of DBT is even higher than that of other modules (e.g., Elices et al., 2016). Notwithstanding these challenges, it is important to note that participants who successfully complete the entire mindfulness module achieve significantly greater clinical benefits than those obtained with the interpersonal effectiveness DBT module (Carmona i Farrés et al., 2019; Schmidt et al., 2021). Importantly, our data suggest that the benefits of mindfulness become apparent from the $5^{th}$ session, and that these benefits seem to progressively increase over time until the final session. In this regard, since the program only lasted 10 weeks, we do not know if this trend would continue beyond the last session or if a ceiling effect would occur at some point. Nonetheless, one study found that several mindfulness skills continue to increase over time in non-clinical controls, mainly in those who sustain their practice over time (Soler et al., 2014).

As expected, we found a bidirectional association between mindfulness practice and ED. Those who practiced more (in days and minutes) showed greater improvement in ED levels the next week. By contrast, the presence of a high level of ED in the previous week negatively affected practice engagement in the following week, mainly in terms of reduced practice time (i.e., minutes). This bidirectional relationship shows that both practice and mindfulness appear to be mood-dependent, a finding that is consistent with the study by Elices et al. (2019), who found that the attention and acceptance components of mindfulness were differently affected by mood. Nevertheless, our findings indicate that nearly all participants (with only one exception) practiced mindfulness skills at some point and that the time spent practicing mindfulness increased throughout the training. This suggest that teaching and practicing skills in a group setting seems to be an effective strategy that motivates participants, even when experiencing high ED, to cope with difficult experiences and regulate emotions in daily life rather than avoid or suppress them (Linehan, 2014).

Interestingly, we found that the previous week's ED level had a greater influence on the total number of minutes spent on practice than on the number of days. This finding suggests that therapist should tell patients to focus on ensuring that they practice as many days as possible, even if the duration is only short (e.g., at least one daily, 10-minute meditation). This reciprocal relationship among skill use, ED levels, and clinical outcomes has been observed in other studies that have evaluated the change processes involved in DBT skills training (Barnicot et al., 2016; Southward et al., 2022; Wilks et al., 2016). Therefore, it is important for researchers and clinicians to be aware of these bidirectional relationships when assessing and/or performing an intervention in individuals diagnosed with BPD. In addition, future studies should control for these variables (i.e., the extent to which practice

depends on the participant's level of ED and its influence on clinical outcomes). Similarly, in therapeutic interventions, therapists should emphasize the need for patients to practice these skills wisely (Linehan's "wise mind skill"): "if I feel more emotionally dysregulated on a given day, I could practice less" (Linehan, 2014).

In the course on any mindfulness intervention, it is clear that the therapist will ask the patients to practice. However, it would be useful to better understand, in a more tangible way, the degree to which the required practice leads to the desired improvement. In the case of rule-governed behaviors, nonspecific demands that lead to nonspecific rewards cause low motivation (Martin & Pear, 2019). In the context of our study, we found that the minimum dose needed to obtain significant improvements in ED is 3-4 days per week and more than 30 minutes. That said, practicing 5-7 days per week was even more beneficial. It is important that patients be made aware of these findings, which may help motivate them to strive to reach the minimum dose. While this amount of mindfulness practice is much lower than the levels observed in mindfulness-based interventions designed to treat other disorders such anxiety or depression ( i.e., an average of 30 minutes per day, 6 days per week: Parsons et al., 2017), in a clinical population with high emotion dysregulation such as BPD, it may be more important to get patients to commit to daily (or close to daily) practice (i.e., 5-7 days per week) rather than focusing on the duration of the practice sessions.

The importance of mindfulness skills use as a behavioral component in DBT to improve ED is supported by data from several studies (Mehlum, 2021; Wyatt et al., 2023). However, some mechanisms of change common to DBT not assessed in the present study may also improve ED. Mindfulness is not the only approach to effecting changes in emotion regulation, as evidenced by the fact that some people who did not practice at all or only very

little also showed improvement in ED at completion of this program. Common factors such as expectations about the intervention or the therapeutic alliance may have influenced the expected outcomes (Wampold, 2016). It also seems probable that the group effect played a role in effecting improvement in these patients. In DBT skills training—as Chapman et al. (2019) pointed out—patients with BPD often face overwhelming emotions upon joining a skills training group, and they must also face the potentially challenging group dynamics. Therefore, an important part of the therapist's role is to advise patients on how best to avoid dropping out, to avoid harmful behaviors, stay focused, and contribute to group discussions, despite their emotionality. These experiences provide patients with lessons in self-regulation within a structured environment, which in turn may help them to develop capabilities that will be useful in other, less structured environments, including everyday life.

This study presents several limitations. First, it was a nonrandomized single-arm trial, and the absence of an active control group raises uncertainty about whether the observed improvements in ED in BPD are exclusively attributed to mindfulness practice. For example, other DBT modules have also been shown to independently yield improvements in ED (Heath et al., 2021), although probably by different pathways. It would be interesting to assess how time spent practicing other DBT skills (e.g., distress tolerance or interpersonal effectiveness) contributes to emotion regulation in BPD. Therefore, future studies could incorporate an active control group (e.g., another DBT module). This approach would enable the comparison of different components, shedding light on their potential contributions. This would provide insight into the specificities of each DBT module in ameliorating emotion regulation difficulties in individuals with BPD. Second, the relatively short evaluation period, performed once per week for 10 weeks, may be insufficient, as a longer, more intensive

intervention may be needed for mindfulness to exert a more robust effect on ED. A third limitation is related to the use of the DERS-18 to assess different maladaptive regulation processes (Victor & Klonsky, 2016) and measure the participants' level of ED . Given the characteristics of BPD patients, the DERS-18 may have captured ED as a trait rather than a temporal capacity to regulate emotions at a given moment in time. Fourth. while we did asses the quantity of mindfulness practice, we did not assess the quality of that practice, nor the effectiveness of skills use. This may be relevant given that quality and efficacy of skill use have been shown to influence outcomes in mindfulness and DBT interventions (Goldberg et al., 2020; Southward et al., 2022). A final limitation is that we did not assess the level of ED in the first session (introduction/orientation). Therefore, we could not assess whether participants improved their level of ED until the first week of training, even though they had not yet started mindfulness practices. For example, common therapy factors (e.g., motivation) could have also driven ED changes.

In conclusion, these results show that mindfulness practice can improve emotion regulation in BPD outpatients, provided that patients practice these skills with a certain frequency. In this regard, therapists should inform patients about the minimum dose of practice needed in order to adjust their expectations and increase motivation for practice. These findings may be useful for DBT therapists, both to help motivate patients and to help decide how much practice time they should ask of their patients. A strong commitment to practice appears to be one of the main behavioral component at the core of mindfulness training, and a certain level of commitment is necessary to improve ED. In short, the amount of practice is crucial and therapists should keep this in mind when performing interventions focused on improving emotional regulation.

# 8. How does mindfulness skills training work to improve emotion dysregulation in borderline personality disorder?

## 8.1. Introduction

Borderline personality disorder (BPD) is a severe mental illness with an estimated community prevalence of 2.7%. It is characterized by affective dysregulation, unstable identity and interpersonal relationships, and serious behaviors such as non-suicidal self-injury (American Psychiatric Association, 2022; Trull et al., 2010). The complexity and severity of BPD is characterized by high comorbidity with other psychiatric disorders, drug and/or alcohol abuse, and a high risk of suicide (McGlashan et al., 2000), which lead to an extensive use of healthcare resources, high costs of treatment, polymedication, as well as impaired psychosocial and occupational functioning (Alvarez-Tomás et al., 2017; Leichsenring et al., 2024; Pascual et al., 2021).

One of the main features underlying cognitive, affective, and behavioral instability in BPD is a pervasive pattern of emotion dysregulation (ED) (Carpenter & Trull, 2013; Glenn & Klonsky, 2009). ED involves the inability to regulate or change an emotional response or expression in a desired manner and involves a lack of (or maladaptive use of) emotion regulation strategies (Neacsiu et al., 2014), which in turn facilitates the emergence of impulsive and risky behaviors (e.g., self-harm, substance use). These risk behaviors can be understood as a consequence of emotion regulation difficulties or as a strategy to regulate a distressing emotional state (Bohus et al., 2021). Therefore, prevention and treatment efforts are focused on addressing ED as a means of reducing distress, suffering, psychosocial impairment, and potentially life-threatening risk behaviors in individuals with a diagnosis of BPD (Chapman 2019).

Psychotherapy is the main recommended treatment for BPD (Bohus et al., 2021; NICE, 2018). One of the empirically based therapies for the treatment of BPD is dialectical behavior therapy (DBT) (Storebø et al., 2020). DBT is a multifaceted intervention involving individual and group therapy. The group therapy addresses the skills training and comprises four different modules: mindfulness, emotion regulation, distress tolerance, and interpersonal effectiveness. Mindfulness is one of the main components of DBT, and usually mindfulness skills serve as a foundational basis for all other DBT skills (Linehan, 1993; 2014). Interestingly, mindfulness skills training as a stand-alone intervention improves ED in BPD (Carmona i Farrés et al., 2019; Schmidt et al., 2021), but the underlying mechanisms of change are not yet fully understood.

An understanding of the mechanisms (i.e., mediators) through which psychological interventions produce changes in desired outcomes (understanding how and why it works) is essential to optimize treatments (Kazdin, 2007). In addition, identifying moderators (i.e., the effects on direction or magnitude of the relation between the intervention and outcome) may guide therapeutic strategies that effectively impact the mechanisms or processes of an intervention in order to obtain therapeutic improvements (Kazdin, 2014). Thus, clinical research based on mechanisms of change (and moderators) may inform which processes (e.g., cognitive, behavioral) of an intervention contribute to the expected outcomes and in what ways. One way to study the mechanisms is to demonstrate that changes in the putative mechanism are related to changes in the expected outcome through a temporal precedence with repeated session-by-session measures (Holmes, 2018; Kazdin, 2007) and also disaggregating within- and between-person effects of the mechanisms (Wang & Maxwell,

2015). This method allows for a more precise examination of the process of change within an individual.

Research has focused on uncovering the mechanisms of change by which DBT skills training improves ED in BPD (Chapman & Owens, 2020). Studies suggest that a greater use of behavioral skills (learned during DBT skills training) mediates changes in emotion dysregulation (Asarnow et al., 2021; Neacsiu et al., 2014). More specifically, studies exploring the within-person effects found that greater skills use predicted improvements in ED (Southward et al., 2023; Wyatt et al., 2025) and fewer risk behaviors associated with high ED (Barnicot et al., 2016) after undergoing DBT skills training. However, there is a scarcity of studies focused on studying the mechanisms of change of mindfulness skills training as a stand-alone intervention. For example, a recent study reported that the amount of mindfulness practice at a given week (a required dose of at least 3 days and 30 minutes per week) predicted improvements in ED at the following week in BPD outpatients (Schmidt et al., 2024). Importantly, previous studies have proposed four mechanisms by which mindfulness practice may work (Hölzel et al., 2011; Tang et al., 2015), which are reviewed below.

Decentering consists of adopting a change in perspective of one's own experience through the disidentification of the mental contents that are usually experienced as defining the self (Carmody et al., 2009; Fresco et al., 2007). This metacognitive capacity involves a process of meta-awareness by observing thoughts and emotions in a non-attached manner, which results in a reduced reactivity to thought content (Bernstein et al., 2015). Interestingly, decentering has been proposed as a mediating mechanism in both DBT mindfulness skills training to decrease borderline symptoms (Schmidt et al., 2021) and emotion regulation therapy to decrease anxious-depressive symptoms (O'Toole et al., 2019). Furthermore,

decentering has also been postulated as a moderator that attenuates the association between other mechanisms (e.g., rumination) and psychopathology (Wu et al., 2022). Given the metacognitive quality of decentering (Bernstein et al., 2015), this capacity seems useful as a therapeutic strategy to decrease fusion with negative contents of the self.

The emotion regulation process related to a nonjudgmental stance towards internal experience (i.e., when individuals stop criticizing themselves) is associated with a lower level of psychopathology (Carpenter et al., 2019). However, individuals with BPD are characterized by a high tendency to judge their internal experience (Linehan, 1993; Wupperman et al., 2009). Therefore, strategies that help increase the capacity for nonjudgment are particularly relevant to foster emotional acceptance in BPD (Linehan, 2014). Interestingly, this capacity (i.e., nonjudgment) is an active component of mindfulness DBT skills training. Furthermore, nonjudgmental ability has been shown to act as a mediating mechanism between DBT skills training and clinical outcomes in BPD (Krantz et al., 2018; Zeifman et al., 2020). For instance, increased levels of nonjudgment over time predict fewer borderline symptoms in women with BPD features (Eisenlohr-Moul et al., 2016).

Body awareness involves paying attention to body information by identifying internal body sensations (e.g., tension) and the associated emotional state (feeling relaxed or stressed) as opposed to avoiding the bodily experience (Price & Thompson, 2007). Bodily sensations are a common object of attention during mindfulness meditations (Carmody & Baer, 2008) and would be cultivated through the ability to observe the inner experience (Baer et al., 2006). Body awareness levels are significantly decreased in individuals with BPD compared to healthy controls, and this deficit is associated with ED (Schmitz et al., 2021). Therefore,

increasing body awareness is a relevant aspect in the treatment of psychological disorders, including BPD (Hölzel et al., 2011; Linehan, 2014).

Attention awareness is another putative mechanism underlying mindfulness practice and involves cultivating a present-moment awareness. For instance, mindfulness meditation involves focusing attention on an object (e.g., breathing), noticing distraction, and returning to the object of attention (Lutz et al., 2008). Promoting attention regulation in individuals with BPD is relevant to ameliorate ED and impulse control by teaching participants to observe what they are experiencing in the present moment, without attachment or avoidance of the content of the experience (Linehan, 2014). To our knowledge, no study has evaluated these proposed mechanisms at the same time in a mindfulness training for individuals with BPD.

Understanding how these mechanisms work can be useful for clinicians. This knowledge may provide guidance on how to teach the skills more effectively, focus on the mechanisms with the greatest impact on ED, and target precise and direct strategies on the therapeutic needs of individuals. In summary, the main question guiding this study is how participants with BPD improve their level of ED through a mindfulness skills training. Therefore, this study explored the potential mechanisms of change within mindfulness training, focusing on decentering, nonjudgment, body awareness and attention awareness. Firstly, we evaluated whether these mechanisms and ED showed improvement over the course of mindfulness skills training. Secondly, we explored the temporal dynamics between mechanisms and ED throughout mindfulness skills training. Thirdly, based on previous findings (Wu et al., 2021), we explored decentering as a metacognitive ability that could moderate (i.e., increase the strength) the relationship between the other proposed mechanisms

and ED. In summary, our hypotheses were: (1) Decentering, nonjudgment, body awareness and attention awareness would increase and ED would decrease during mindfulness skills training; (2) greater within- and between-person effects of mechanisms would predict improvements in ED in the following week; and this relationship would be bidirectional; and (3) the association between nonjudgment, body awareness, and attention awareness with ED would be greater among participants with higher decentering capacity.

## 8.2. Methods

### *Participants*

Participants were recruited from the Department of Psychiatry Unit of the Hospital de la Santa Creu i Sant Pau (Barcelona, Spain). This outpatient program is part of the Public National Mental Health Service of Spain and provides specialized care for people with BPD diagnosis. A total of 95 BPD outpatients were enrolled in a DBT skill training. Of these, 75 participants were included in the present study (13 discontinued the treatment before starting the first session; 7 had very low attendance and completed less than 3 weekly assessments). All participants were evaluated by a psychiatrist and a clinical psychologist from the psychiatry unit, both with a doctoral degree and experience in the treatment of people with BPD. The clinical diagnosis was based on two semi-structured interviews: Structured Clinical Interview for DSM IV axis II Disorders (SCID II) (First et al., 2007) and the Revised Diagnostic Interview for Borderlines (DIB-R) (Barrachina et al., 2004). In addition, the baseline severity of borderline symptoms was assessed (Borderline Symptom List: BSL-23) (Soler et al., 2016). The inclusion criteria were: (i) diagnostic confirmation of BPD; and (ii) age between 18-55 years. The exclusion criteria were: (i) presence of any of the following comorbid conditions: schizophrenia, drug-induced psychosis, organic brain syndrome,

substance dependence, bipolar disorder, intellectual disability; and (ii) be receiving another type of psychotherapy at the time of study enrollment. Patients were allowed to continue with the drug regimen followed prior to study enrollment. However, they were not allowed to change the type or dose of drugs during the study period. Participants had not previously participated in DBT skills training.

***Procedure***

Participants were enrolled in a 10-week DBT mindfulness skills training. In total, 7 groups were conducted between February 2020 and October 2023 (12-15 participants/group). Each intervention group followed the same structure and weekly sessions were 2.5 hours in length. All groups were led by the same team (2 clinical psychologists with training and experience in DBT, and expertise in mindfulness meditation). For each participant, written informed consent was obtained prior to inclusion in the study. The study was approved by the Clinical Research Ethics Committee of the Hospital de la Santa Creu i Sant Pau and was conducted in accordance with the criteria of the Declaration of Helsinki.

The intervention was based on the DBT skills training protocol (Linehan, 2014). The 10-week mindfulness training program consisted of 1 week of orientation and goals, 6 weeks of mindfulness skills, and 3 weeks of acceptance skills (taken from the distress tolerance module). This mindfulness training for BPD is proposed by Linehan as an alternative to standard DBT skills training (Linehan, 2014) and its efficacy has been shown in previous clinical trials (Carmona i Farrés et al., 2019; Elices et al., 2016). The mindfulness and acceptance skills taught were (i) Wise Mind; (ii) "What" Skills (i.e., observing, describing, participating); (iii) "How" Skills (i.e., nonjudgmentally, one-mindfully, and effectively); (iv) Radical Acceptance; (v) Mind Turning and Willingness; (vi) Half-smile and willing hands;

and (vii) Mindfulness of current thoughts. Formal and informal mindfulness practice were taught during the sessions. In each session, a new skill was introduced and practiced through role-playing and discussion. Participants were then given meditation audios and worksheets related to the skills and instructed to practice at home. In the next session, the homework was reviewed and each participant commented on his or her experience with the practice, as well as any difficulties encountered. The therapist then reinforced the participants' progress and suggested effective ways to improve skill practice. The meditation audios were recorded by the lead therapist and lasted 10 minutes.

***Measures***

Several repeat measures were collected on a weekly basis during the mindfulness training. Only the first introduction/orientation session was not assessed because it did not include mindfulness skills practice. In order to assess the participants' level of ED and specific mechanism of change, they were asked to complete the following scales before starting a new session (i.e., session 2 onwards).

**Emotion Dysregulation**. The Brief Version of the Difficulties in Emotion Regulation Scale was used to capture how participants managed their weekly difficult emotional experiences (DERS-18) (Victor & Klonsky, 2016). The 18-items Spanish translation of this self-report scale was administered and the total score was used in the analyses as an overall measure of emotion dysregulation. Items were rated on a scale from 1 (almost never) to 5 (almost always). This scale has high internal reliability (Cronbach's $\alpha = .91$). In the current study, this scale obtained a good internal reliability at session 1 (Cronbach's $\alpha = .87$).

For each mechanism of change proposed, the three most representative items from each original scale were used based on their highest factor loadings within the respective general construct. This approach aimed to simplify the weekly assessment process for participants and minimize the time required to complete the scales. The same Likert scale was used for all items, from 1 (almost never) to 5 (almost always).

**Decentering**. It was assessed with the Experiencing Questionnaire (EQ) (Fresco et al., 2007). The EQ is a 20-item self-report scale that assesses decentering and rumination. Decentering is the ability to observe thoughts and feelings in a detached manner (Fresco et al., 2007). In the present study, items from the Spanish validation EQ-Decentering was used (Soler et al 2014). These items were: (i) "*I can separate myself from my thoughts and feelings*" (factor loading: .74); (ii) "*I can observe unpleasant feelings without being drawn into them*" (factor loading: .72); (iii) "*I view things from a wider perspective*" (factor loading: .77). The Spanish EQ version has good internal reliability (Cronbach's $\alpha = .89$) [50] and in the present study the 3-items scale had an acceptable internal reliability at session 1 (Cronbach's $\alpha = .73$).

**Nonjudgment**. It was assessed with the Nonjudging of Inner Experience sub-scale of Five Facets Mindfulness Questionnaire (NJ-FFMQ) (Carmody & Baer, 2008). NJ-FFMQ refers to taking a non-evaluative stance toward thoughts and feelings and is closely associated with acceptance, a central component of mindfulness (Baer et al., 2006; Cebolla et al., 2012). In the present study, items of the Spanish validation of NJ-FFMQ subscale was used (Cebolla et al., 2012). These items were: (i) "*I make judgments about whether my thoughts are good or bad*" (factor loading: .69); (ii) "*I tell myself I shouldn't be thinking the way I'm thinking*" (factor loading: .67); (iii) "*I think some of my emotions are bad or inappropriate and I*

*shouldn't feel them*" (factor loading: .73). The Spanish NJ-FFMQ version has an excellent internal reliability (Cronbach's α = .91) [51] and the internal reliability of the 3-items in the current study at session 1 was good (Cronbach's α = .81).

**Body awareness**. It was assessed with the Body Awareness of Scale Body Connection (BA-SBC), which measures the conscious attention to sensory signals of the state of the body, such as the sensation of tension or relaxation (Price & Thompson, 2007). Items of the Spanish BA-SBC version was used in the current study (Quezada-Berumen et al., 2014). These items were: (i) "*I take my body's signals to understand how I feel*" (factor loading: .83); (ii) "*I listen to my body's information about my emotional state*" (factor loading: .85); (iii) "*When I am tense, I pay attention to where the tension is concentrated in my body*" (factor loading: .72). The Spanish BA-SBS has a good internal reliability (Cronbach's α = .86) (Quezada-Berumen et al., 2014). The 3-items scale used in the current study also showed good internal reliability at session 1 (Cronbach's α = .84).

**Attention awareness**. It was assessed with the Mindfulness Attention Awareness Scale (MAAS) (Brown & Ryan, 2003). It is a 15-item self-reported questionnaire, which measures an individual's awareness of their experience in the present moment, in contrast to having automated behaviors. Items of the Spanish MAAS version were used in the current study (Soler et al., 2012). These items were: (i) "*I drive places on 'automatic pilot' and then wonder why I went there*" (factor loading: .77); (ii) "*I find myself doing things without paying attention*" (factor loading: .71); (iii) "*I snack without being aware that I'm eating*" (factor loading: .69). Both the original version [(Brown & Ryan, 2003) and the Spanish version (Soler et al., 2012) present high internal reliability (Cronbach's α=0.82 and 0.89,

respectively). In the present study, the 3-items scale showed an acceptable internal reliability at session 1 (Cronbach's $\alpha = .71$).

***Data analysis***

First, descriptive analyses of the participants were conducted. Second, pre- and post-intervention correlations were calculated to determine baseline and post-treatment relationships between mechanism of change and ED. Third, multilevel modeling (MLM) analyses with a restricted maximum likelihood (REML) estimation method and with a time-lagged approach were conducted to examine the temporal dynamics over time between the proposed mechanism of change (i.e., mediators) and ED. MLM allows modeling changes in the measures of interest over time and time-lagged predictions allows exploring the association of a previous time point measure (i.e., time x) with a later time point measure (i.e., time x+1). For these analyses, the between- and within-person variability was disaggregated, that is recommended for multilevel models with repeated measures data (Wang & Maxwell, 2015). To calculate the within-person effects (i.e., level 1), the person-mean-centered was calculated by subtracting the participant-level mean of all time points (i.e., each participant's mean from session 1 to 9) from each participant's score at each time point. Thus, scores at each time point become a deviation score, representing the person's deviation from her own average at that time point. To obtain the between-person effects (i.e., level 2), the grand-mean-centered was calculated by subtracting the sample average of all participant means from the participant-level mean. Thus, the participant-level mean represents the person's deviation from the total sample average (Wilks et al., 2016). This approach is recommended to interpret the parameters in MLM (Enders & Tofighi, 2007). Then, it was estimated whether the within- and between-person effects of mechanisms (i.e.,

decentering, nonjudgment, body awareness and attention awareness) at session x predicted changes in ED at session x+1, over mindfulness skills training. The reverse direction was also explored to assess the bidirectional relationship. That is, whether within- and between-person effects of ED level at session x predicted changes in the proposed mechanisms of change at session x+1.

Fourth, cross-level interactions were conducted to assess the moderating role of decentering between the association of the other mechanisms and ED. A cross-level interaction occurs when a level 2 variable (i.e., between-person) moderates the magnitude of a level 1 association (i.e., within-person) (Enders & Tofighi, 2007). Separate MLM analyses were performed to explore whether the between-person effect of decentering (level 2) moderates the within-person effects of nonjudgment, body awareness and attention awareness (level 1) on the prediction of ED. Significant interactions were probed by testing the simple slopes of each mechanism (e.g., nonjudgment) on ED at high and low levels of decentering capacity (i.e., ±1 SD) (Aiken & West, 1991).

In all MLM analyses the participants' intercept was defined as random effects. The part$R^2$ package was used (Stoffel et al., 2017) to estimate the marginal and conditional $R^2$ (Nakagawa & Schielzeth, 2013). The coefficient of determination $R^2$ was used to interpret the effect size of the models, which were classified as weak (.02-.13), medium (.13-.26) and large (> .26) (Cohen, 1988). All models were tested with the lme4 package (Bates et al., 2015) in RStudio and IBM SPSS statistics (version 24) was used for descriptive analyses.

## 8.3. Results

### *Characteristics of the sample*

A total of 75 outpatients with a diagnosis of BPD attended a mindfulness skills training ($M_{age}$ = 27.15 [range 18-53], 93.3% female). A total of 499 observations were obtained (Mean= 4.95, SD = 2.60). Most participants were working (33%) or studying (32%) at the time of the evaluation (see Table 1). Regarding the weekly practice of the tasks assigned during training, the participants practiced mindfulness skills for a median of 3 days (M = 2.80, SD = 1.97, range = 0-7) and a mean of 27.90 minutes per week (SD = 27.81, range = 0-180). In addition, practice time increased over the course of the training, both in days (b = .16, SE = .02, $p < .001$) and minutes (b = 1.27, SE = .38, $p < .01$).

Table 2 shows the correlations between ED (DERS-18) and the mechanisms of change proposed in sessions 1 and 9 of the mindfulness training. Correlations were significant both at baseline (*r* range from -.306 to -.487) and at the end of the training (*r* range from -.573 to -.642). However, more robust correlations were observed in session 9 (moderate to high).

**Table 1.** *Sociodemographic characteristics of total sample*

| | Total sample (N = 75) |
|---|---|
| **Age,** mean (SD) | 27.15 (8.62) |
| **Sex,** female, n (%) | 70 (93.3) |
| **Educational level,** n (%) | |
| Middle school | 33 (44) |
| High school | 23 (30.7) |
| University degree | 19 (25.3) |
| **Employment Status,** n (%) | |
| Unemployed | 17 (22.7) |
| Employed | 25 (33.3) |
| Student | 24 (32) |
| Sick leave | 4 (5.3) |
| Disability pension | 5 (6.7) |
| **Clinical characteristics,** mean **(**SD) | |
| DIB-R total score | 7 (1.05) |
| **Previous self-injury behavior,** n (%) | |
| Past suicide acts | 32 (42.6) |
| Past non-suicide self-injury | 53 (70.6) |
| **Pharmacological treatment,** n (%) | |
| Antidepressant | 56 (74.6) |
| Benzodiazepines | 27 (36) |
| Antipsychotics | 17 (22.6) |
| Mood stabilizers | 15 (20) |

Notes. SD = standard deviation. DIB-R = Revised Diagnostic Interview for Borderlines; BSL-23 = Borderline Symptom List.

**Table 2.** *Correlations between Skills and Emotion Dysregulation*

| | DERS | Decentering | Nonjudgment | Body awareness | Attention awareness |
|---|---|---|---|---|---|
| DERS | - | -.558** | -.642** | -.593** | -.573** |
| Decentering | -.487*** | - | .290* | .569** | .439** |
| Nonjudgment | -.416** | .369** | - | .434** | .235 |
| Body awareness | -.480** | .533** | .241 | - | .443** |
| Attention awareness | -.306* | -.089 | .240 | .101 | - |

Notes. Correlations below the diagonal correspond to session 1 scores. Correlations above the diagonal correspond to session 9 scores. DERS = Difficulties in Emotion Regulation Scale; Decentering = Experience Questionnaire - Decentering items [EQ]; Nonjudgment = Five facet Mindfulness Questionnaire – Nonjudge sub-scale items [FFMQ-NJ]; Body Awareness = Scale Body Connection – Body-Awareness sub-scale items [SBC-BA]; Attention Awareness = Mindful Attention Awareness Scale items [MAAS]. *p < .05, **p < .01, ***p < .001

***Changes in emotion dysregulation and mechanisms of change during mindfulness training***

The effects of mindfulness training on ED levels and mechanisms of change were assessed. The mindfulness training (sessions from 1 to 9) prompted improvements in participants' ED over time (b = -.82, $p < .001$) as well as an increase in each of the mechanisms assessed (decentering: b = .13, $p < .001$; nonjudgment: b = .20, $p < .001$; body awareness: b = .12, $p < .01$; attention awareness: b = .14, $p < .01$). See Figure 1 to visualize the trajectory of the mechanisms of change session by session. Also, Table S1 (in additional file 1) presents the mean and standard deviation of all outcomes (i.e., mechanisms and ED) at each time point.

Subsequently, it was explored whether improvements in ED and gains in mechanisms of change over mindfulness training were moderated by sociodemographic variables (e.g., age, sex) or baseline clinical variables (i.e., score in diagnostic interview for borderlines [DIB-R], borderline symptoms [BSL-23]; past suicide acts, past non-suicidal self-injury). Improvements in ED and gains in mechanisms were not moderated by sociodemographic variables (all p-values > .11) or by baseline clinical measures (all p-values > .18). Only a trend moderating effect of baseline borderline symptoms (i.e., BSL-23) on the session-by-session trajectory of ED was found (b = -.01, SE = 0.009, $p = 0.053$).

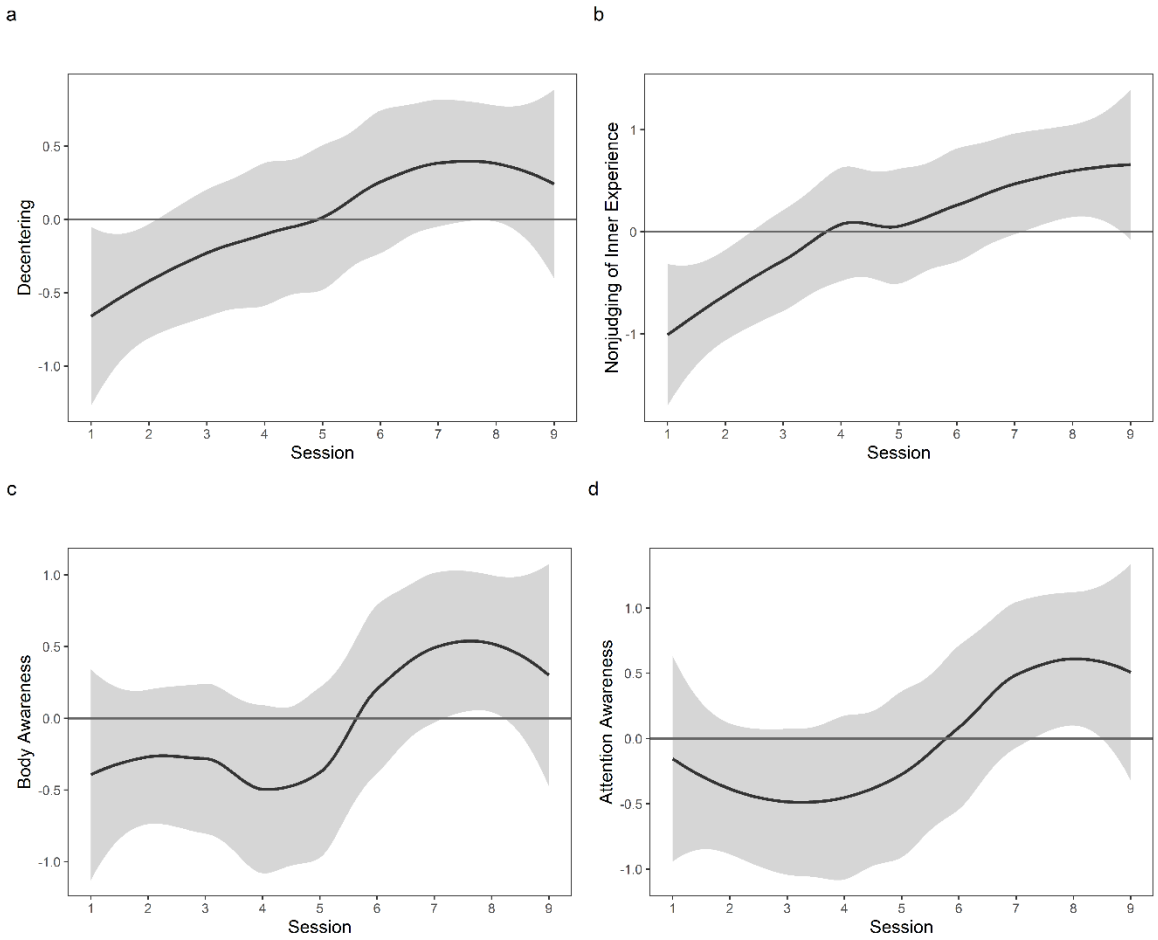



**Figure 1** Session-by-session trajectory of mechanisms of change through mindfulness skills training. The gray area represents the confidence intervals (standard error). The horizontal line represents the mean of the measures of all time points (mean-centered).

## Effects of mechanisms of change on emotion dysregulation over time

The time-lagged effects of decentering, nonjudgment, body awareness and attention awareness on ED was explored. In these analyses, the effect of both between and within person mechanisms on ED was tested (see Table 3). Consistent with our hypothesis, greater both within- and between-person effect of nonjudgment and body awareness at session x predicted improvements in ED at session x+1. This means that when participants reported

higher capacity of nonjudgment and body awareness than their personal average (i.e., higher-than-usual), and more than the total sample average, they also showed an improvement/reduction in their ED level at the following week. Similarly, greater between-person (but not within-person) effects of decentering and attention awareness at session x also predicted improvements in ED at session x+1. Therefore, when participants reported higher capacity of decentering and attention awareness than the total sample average, they showed improvements in their ED in the following week (see also Table 3). Medium-to-large effects size were obtained in all models ($R^2$: .20-.31).

Subsequently, both the between- and within-person effect was assessed of all mechanisms on ED in the same model (see Table 4). Greater between-person effects of decentering, nonjudgment, and attention awareness, as well as greater within-person effects of body awareness in session x predicted improvements in ED at the following week (i.e., session x+1). The variance of the time lagged fixed effects (i.e., the four mechanisms at session x) explained 52% of the total variance of DERS in the following week, yielding a large effect size.

In addition, since significant correlations were observed among the predictors, multicollinearity was assessed in all models by calculating the variance inflation factor (VIF). All VIF values were < 2, indicating that there were no multicollinearity problems (Hair et al., 2010).

**Table 3**

*Time-lagged analysis of changes in mechanisms and improvement in emotion dysregulation*

| | DERS Predicted by time-lagged Decentering | | | | | Decentering Predicted by time-lagged DERS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Predictor (session x-1) | B | SE | *t* | p-value | 95% CI | B | SE | *t* | p-value | 95% CI |
| Intercept | 2.73 | 1.42 | 1.92 | .05 | [-.04, 5.52] | -.29 | .29 | -1.01 | .31 | [-.87, .27] |
| Time (sessions) | -.58 | .17 | -3.36 | < **.001** | [-.91, -.24] | .08 | .03 | 2.13 | < **.05** | [.006, .16] |
| Between-person | -3.71 | .52 | -7.02 | < **.001** | [-4.74, -2.67] | -.12 | .01 | -7.09 | < **.001** | [-.15, -.08 ] |
| Within-person | -.23 | .23 | -.98 | .32 | [-.69, .22] | -.02 | .01 | -2.17 | < **.05** | [-.04, -.002] |
| | $R^2_{marginal}$ = .31 [95% CI: .19-.41]; $R^2_{conditional}$ = .69 [95% CI: .66-.74] | | | | | $R^2_{marginal}$ = .27 [95% CI: .20-.33]; $R^2_{conditional}$ = .56 [95% CI: .46-.64] | | | | |
| | DERS Predicted by time-lagged Nonjudgment | | | | | Nonjudgment Predicted by time-lagged DERS | | | | |
| Predictor (session x-1) | B | SE | *t* | p-value | 95% CI | B | SE | *t* | p-value | 95% CI |
| Intercept | 1.78 | 1.44 | 1.22 | .22 | [-1.04, 4.60] | -.88 | .32 | -2.71 | < **.01** | [-1.51, -.24] |
| Time (sessions) | -.51 | .17 | -2.95 | < **.01** | [-.85, -.17] | .17 | .03 | 4.42 | < **.001** | [.09, .25] |
| Between-person | -3.05 | .45 | -6.74 | < **.001** | [-3.94, -2.16] | -.14 | .02 | -6.76 | < **.001** | [-.18, -.10] |
| Within-person | -.43 | .20 | -2.10 | <**. 05** | [-.84, -.03] | -.02 | .01 | -2.24 | < **.05** | [-.05, -.003] |
| | $R^2_{marginal}$ = .29 [95% CI: .21-.45]; $R^2_{conditional}$ = .68 [95% CI: .63-.75] | | | | | $R^2_{marginal}$ = .30 [95% CI: .23-.39]; $R^2_{conditional}$ = .67 [95% CI: .57-.76] | | | | |
| | DERS Predicted by time-lagged Body Awareness | | | | | Body Awareness Predicted by time-lagged DERS | | | | |
| Predictor (session x-1) | B | SE | *t* | p-value | 95% CI | B | SE | *t* | p-value | 95% CI |
| Intercept | 2.35 | 1.51 | 1.55 | .12 | [-.59, 5.31] | -.52 | .35 | -1.46 | .14 | [-1.21, .17] |
| Time (sessions) | -.54 | .17 | -3.19 | < **.01** | [-.87, -.21] | .11 | .04 | 2.75 | < **.01** | [.03, .20] |
| Between-person | -2.29 | .47 | -4.89 | < **.001** | [-3.22, -1.37] | -.12 | .02 | -5.13 | < **.001** | [-.16, -.07] |
| Within-person | -.59 | .20 | -2.83 | < **.01** | [-1.00, -.18] | -.01 | .01 | -1.00 | .31 | [-.03, .01] |
| | $R^2_{marginal}$ = .20 [95% CI: .15-.33]; $R^2_{conditional}$ = .69 [95% CI: .57-.74] | | | | | $R^2_{marginal}$ = .19 [95% CI: .07-.25]; $R^2_{conditional}$ = .63 [95% CI: .56-.73] | | | | |
| | DERS Predicted by time-lagged Attention Awareness | | | | | Attention Awareness Predicted by time-lagged DERS | | | | |
| Predictor (session x-1) | B | SE | *t* | p-value | 95% CI | B | SE | *t* | p-value | 95% CI |
| Intercept | 2.24 | 1.48 | 1.50 | .13 | [-.65, 5.14] | -.86 | .35 | -2.43 | < **.05** | [-1.56, -.17] |
| Time (sessions) | -.57 | .17 | -3.36 | < **.001** | [-.91, -.24] | .16 | .03 | 4.15 | < **.001** | [.08, .24] |
| Between-person | -2.28 | .40 | -5.59 | < **.001** | [-3.07, -1.48] | -.14 | .02 | -5.80 | < **.001** | [-.19, -.09] |
| Within-person | -.35 | .22 | -1.58 | .11 | [-.78, .08] | -.03 | .01 | -2.69 | < **.01** | [-.05, -.008] |
| | $R^2_{marginal}$ = .24 [95% CI: .21-.36]; $R^2_{conditional}$ = .69 [95% CI: .66-.77] | | | | | $R^2_{marginal}$ = .26 [95% CI: .14-.33]; $R^2_{conditional}$ = .73 [95% CI: .69-.77] | | | | |

Notes. DERS = Difficulties in Emotion Regulation Scale; Decentering = Experience Questionnaire - Decentering items [EQ]; Nonjudgment = Five facet Mindfulness Questionnaire – Nonjudge sub-scale items [FFMQ-NJ]; Body Awareness = Scale Body Connection – Body-Awareness sub-scale items [SBC-BA]; Attention-Awareness = Mindful Attention Awareness Scale items [MAAS]; $R^2_{marginal}$ = the variance explained by fixed effect predictors relative to the total variance in the response; $R^2_{conditional}$ = the variance explained by fixed effects plus random effects relative to the total variance in the response.

**Table 4**

*Full model time-lagged analysis of mechanisms and improvement in emotion dysregulation*

| | DERS Predicted by time-lagged Skills | | | | |
|---|---|---|---|---|---|
| Predictor (session x-1) | B | SE | *t* | p-value | 95% CI |
| Intercept | 1.62 | 1.25 | 1.30 | .19 | [-.79, 4.04] |
| Time (sessions) | -.44 | .17 | -2.51 | < **.05** | [-.78, -.09] |
| Decentering $_{\text{Between-person}}$ | -1.73 | .52 | -3.29 | < **.01** | [-2.74, -.72] |
| Decentering $_{\text{Within-person}}$ | -.006 | .24 | -.02 | .97 | [-.48, .47] |
| Nonjudgment $_{\text{Between-person}}$ | -2.00 | .36 | -5.52 | < **.001** | [-2.69, -1.30] |
| Nonjudgment $_{\text{Within-person}}$ | -.31 | .21 | -1.50 | .13 | [-.72, .09] |
| Body Awareness $_{\text{Between-person}}$ | -.58 | .39 | -1.47 | .14 | [-1.34, .17] |
| Body Awareness $_{\text{Within-person}}$ | -.52 | .22 | -2.34 | < **.05** | [-.96, -.09] |
| Attention-Awareness $_{\text{Between-person}}$ | -1.42 | .29 | -4.86 | < **.001** | [-1.98, -.86] |
| Attention-Awareness $_{\text{Within-person}}$ | -.19 | .22 | -.86 | .38 | [-.63, .24] |
| | $R^2_{marginal}$ = .52 [95% CI: .44-.60]; $R^2_{conditional}$ = .69 [95% CI: .65-.74] | | | | |

Notes. DERS = Difficulties in Emotion Regulation Scale; Decentering = Experience Questionnaire - Decentering items [EQ]; Nonjudgment = Five facet Mindfulness Questionnaire – Nonjudge sub-scale items [FFMQ-NJ]; Body Awareness = Scale Body Connection – Body-Awareness sub-scale items [SBC-BA]; Attention Awareness = Mindful Attention Awareness Scale items [MAAS]; $R^2_{marginal}$ = the variance explained by fixed effect predictors relative to the total variance in the response; $R^2_{conditional}$ = the variance explained by fixed effects plus random effects relative to the total variance in the response.

### *Effects of emotion dysregulation on mechanism of change over time*

We then explored the lagged effects of ED on each mechanism of change to determine the possibility of bidirectionality (see Table 3). Higher within- and between-person level of ED at session x predicted decreased capacity of decentering, nonjudgment and attention awareness at session x+1. However, only higher between-person level of ED at session x predicted decreased body awareness at session x+1. This means that when participants had a week with more emotion regulation difficulties than their personal average, they were less able to increase decentering, nonjudgment and attention awareness at the following week. In

addition, when participants had more ED than the total sample average, they were also less able to increase body awareness in the following week. In all models, medium-to-large effects size were obtained ($R^2$: .19-.30). Thus, a bidirectional temporal dynamic between the proposed mechanisms and ED was found. Again, no multicollinearity problems were found (all VIF < 2).

***Decentering moderates the association of body awareness, attention awareness, and nonjudgment with emotion dysregulation***

Subsequently, the moderating role of decentering as a metacognitive process on the association between nonjudgment, body awareness, attention awareness, and ED was assessed. In these analyses, the between-person effects of decentering as moderator, the within-person effects of nonjudgment, body awareness and attention awareness as predictors, and ED as outcome were used (Enders & Tofighi, 2007). First, an interaction effect was found between nonjudgment x decentering in predicting ED (b= -.41, SE = .09, $p < .001$). Simple slope analysis showed that within-person increase in nonjudgment predicted improvements in ED more strongly among participants with high decentering (b = -2.37, SE = .31, $p < .001$) than among participants with low decentering (B = -.71, SE = .22, $p < .01$; see Figure 2).

Second, an interaction effect was also found between body awareness x decentering in predicting ED (b= -.25, SE = .08, $p < .01$). Simple slope analysis showed that a within-person increase in body awareness predicted improvements in ED more strongly among participants with high decentering (B = -1.88, SE = .30, $p < .001$) than among participants with low decentering (B = -.84, SE = .21, $p < .001$; see Figure 3).

There was no significant moderating effect of decentering on the association between attention awareness and ED (b= -.09, SE = .09, $p$ = .31). In addition, there was no evidence that a within-person effect of decentering was moderated by the between-person effects of nonjudgment, body awareness or attention awareness (all p-value > .69).

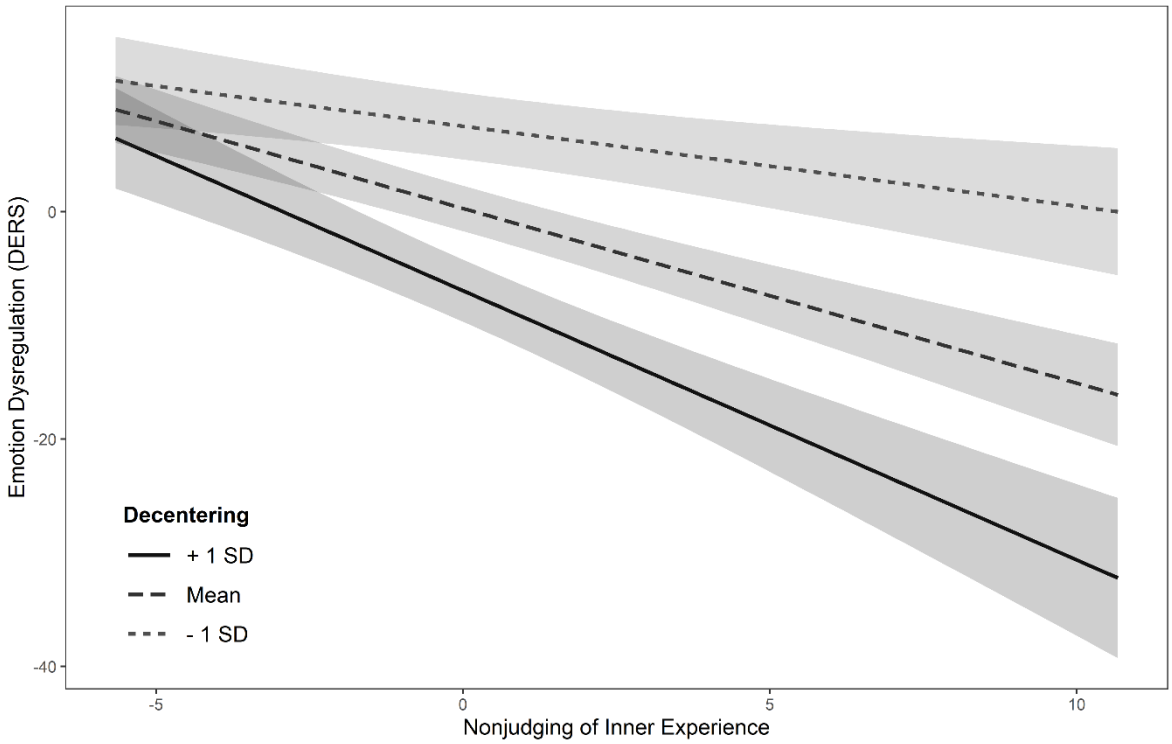



**Figure 2.** Decentering moderating the association between Nonjudging of Inner Experience and Emotion Dysregulation.

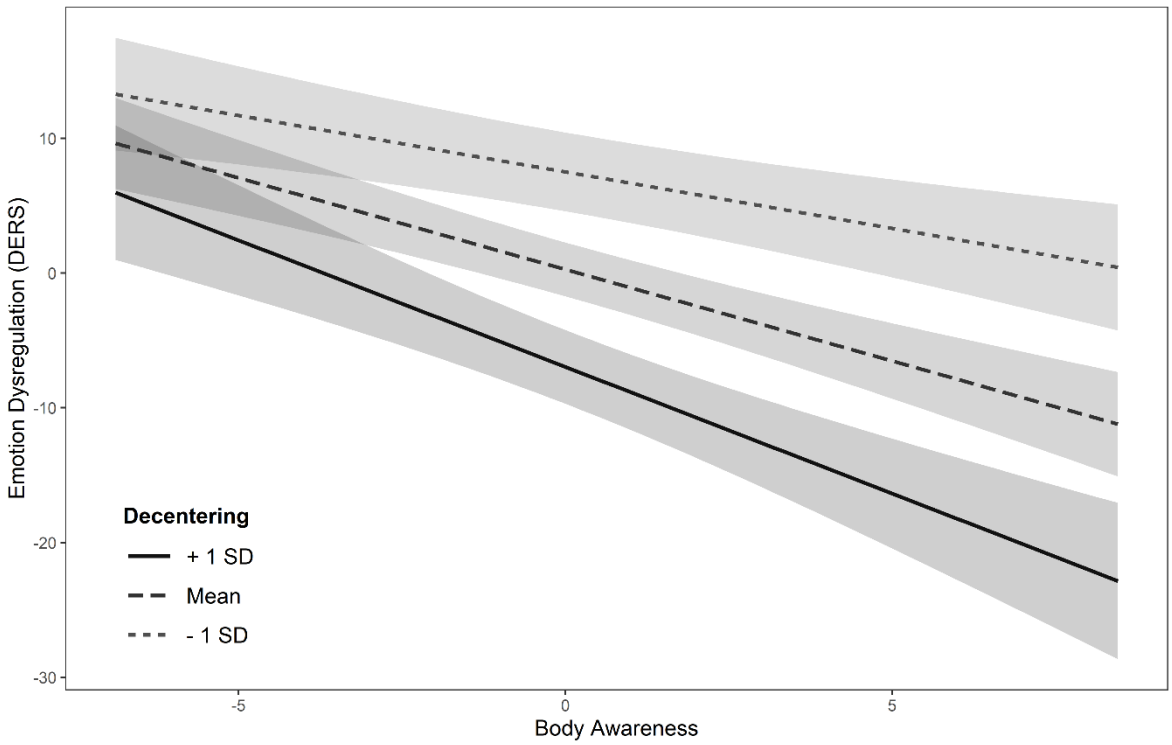



**Figure 3.** Decentering moderating the association between Body Awareness and Emotion Dysregulation.

## 8.4. Discussion

This study aimed to explore how mindfulness DBT skills training improves emotion regulation in people with BPD. A main finding was that participants who at a given week increased their capacity for nonjudgment of inner experience and body awareness more than their own personal average (i.e., within-person effects), and those who increased their capacity for decentering and attention awareness more than the total sample average (i.e., between-person effects), showed improvements in ED at the following week. Moreover, as expected, a bidirectional relationship was found. That is, when participants were more emotionally dysregulated than their own usual state, they showed less gains in decentering,

nonjudgment and attention awareness at the following week. Lastly, decentering moderated the relationship between nonjudgment and body awareness with ED, such that increased nonjudgment and body awareness predicted improvements in ED more strongly in those participants with high decentering capacity compared with those participants with low decentering. Therefore, the hypotheses of the present study were mostly confirmed, mainly in the effect of each of the proposed mechanisms on ED (hypothesis 1), specifically a within-person effects for nonjudgment of inner experience and body awareness on ED (hypothesis 2) and evidence for the moderating role of decentering (hypothesis 3).

The present study is an advance in identifying the possible mechanisms of change involved in a mindfulness DBT skills training as a stand-alone intervention to improve ED in BPD outpatients, using ad hoc methodology (Holmes et al., 2018). Previous studies reporting the mechanisms of change involved in a DBT skills training agree that greater use of behavioral skills mediates changes in ED (Neacsiu et al., 2014). Specifically, when participants use more DBT skills than their own personal average, their emotion regulation capacity improves (Southward et al., 2023; Wyatt et al., 2023). A recent study explored this question only in a DBT mindfulness skills training and also found that greater use of behavioral skills (i.e., mindfulness practice) predicted improvements in ED (Schmidt et al., 2024). Current results extend previous findings and provide further evidence to report specifically what are the mechanisms of change involved in a mindfulness skill training.

Specifically, the within-person effects of nonjudgment and body awareness predicted subsequent improvements in ED. Previous empirical studies support these findings, showing that acceptance without judgment mediated changes in psychiatric symptoms and frequency of nonsuicidal self-injury –ED related outcomes– following DBT skills training (Krantz et

al., 2018; Zeifman et al., 2020). Similarly, Eisenlohr-Moul et al. (2016) found that fluctuations in nonjudgment of internal experience over time (i.e., at within-person level) predicted lower borderline symptoms in women with BPD features. The tendency to judge internal experience is characteristic in individuals with BPD and contributes to emotional regulation problems (Elices et al., 2018; Wupperman et al., 2009) Therefore, strategies focused on improving this ability are key in the treatment of BPD (Linehan, 1993). The role of body awareness as a mechanism of change has been less studied in DBT interventions and the evidence obtained from other mindfulness-based interventions shows significant but small effects (Treves et al., 2019). However, our results support the role of body awareness as a relevant mechanism to foster emotion regulation in BPD. For example, some of the items used to assess body awareness ("*I take my body's signals to understand how I feel*") highlight the importance of the body (e.g., attending to bodily sensations) to facilitate awareness of one's emotions and feelings, which is a pre-condition for regulating them (Hölzel et al., 2011).

An additional finding in the current study was that decentering ability modulated the strength of the association between nonjudgment, body awareness, and ED, such that high decentering capacity reinforced the effect of these mechanisms on reducing ED. This result is consistent with previous studies (Wu et al., 2022) and highlights the role of decentering as a metacognitive capacity that promotes emotion regulation (O'Toole et al., 2019). Decentering is described as a metacognitive awareness that helps us disidentify from the contents of our experience so that instead of fusing with them (e.g., "*I am not lovable*"), we can perceive them as transient mental events (e.g., "*I am having a thought of not being lovable*") (Bernstein et al., 2015). Given that decentering is diminished in individuals with

BPD (Soler et al., 2014), a goal of mindfulness skills in DBT is to increase meta-awareness of mental contents by enhancing the ability to detach from thoughts and sensations, and decreasing reactivity to mental events (Linehan, 2014). Furthermore, the findings support that decentering not only allows for greater meta-awareness of mental contents but also of bodily sensations, but not inversely (i.e., moderating role), suggesting that observing judgmental thought patterns and intense bodily sensations (e.g., associated with distress) from a decentered perspective may help reduce emotional reactivity (Carpenter et al., 2019).

As noted, a bidirectional temporal dynamic between the proposed mechanisms and ED was found. Interestingly, previous studies also found a bidirectional relationship between poorer psychosocial functioning and ED (Wilks et al., 2016), and between mindfulness practice skills and ED (Schmidt et al., 2024) in people with BPD who attended DBT skill training. These antecedents suggest that when participants with BPD had a previous high level of ED, they tended to practice less and, therefore, improved less in the proposed mechanisms. One explanation for this effect is that mindfulness practice is mood-dependent (Elices et al., 2019) and therefore practicing skills is more difficult when one is emotionally dysregulated. This leads to a challenge for clinicians when intervening with individuals diagnosed with BPD who usually have pervasive patterns of ED. However, part of the effectiveness of DBT skill training is that participants are taught to express and manage difficult emotional states within a structured group setting in which the therapist models skills and provides positive feedback and reinforcement (Chapman & Owens (2020). This encourages exposure to difficult experiences rather than avoidance or fusion with them (Wu et al., 2022). In this way, patients undergoing DBT skills training may feel more capable to apply their newly learned skills to the real-world. In addition, the DBT skill set also includes

distress tolerance skills when elevated emotional dysregulation hinders access to mindfulness skills (Linehan, 2014).

The results of this study may have some clinical implications and allow for possible causal interpretations of the mechanisms that favor improvements in ED after mindfulness skill training. Nonjudgment and body awareness increases were related to within-person effects, whereas increases in decentering and attention awareness were only related to between-person effects. These differences suggest that certain facets of mindfulness are more attitudinal and may be more sensitive to within-person variability (i.e., capacity for nonjudging) while other aspects are more stable and may be related to between-person individual differences (e.g., capacity for paying attention or perspective taking) (Zeifman et al., 2020). In light of the results, we hypothesize that mindfulness training in DBT is promoting both levels. However, changes at within-person level, such as learning to observe one's own experience without judgment, appear to be relevant psychological processes for fostering greater emotion regulation. Therefore, clinicians can optimize their interventions by emphasizing these processes of change in clients who exhibit high levels of self-judgment or self-criticism, as is often observed in individuals with BPD.

Importantly, when all four proposed mechanisms of change were included in the same model, they explained 52% of the variance of changes in ED in the following week. Thus, these mechanisms appear to complement each other and therapists could consider this information to improve the efficacy of BPD-oriented treatments. In addition, decentering capacity acted as a metacognitive process that enhances the effect of the other mechanisms on ED. This also suggests that therapists may use strategies that increase the decentering ability in BPD treatments.

The present study has some limitations that should be considered when interpreting the results. First, a single-arm non-randomized trial was implemented, that limits the generalizability of our conclusions. Second, to facilitate the weekly evaluation of the participants, the 3 most representative items of each measure (i.e., mechanisms of change) was used. However, these items may not be fully representative of the overall construct and may therefore increase risk of false negatives (i.e., type II error). Third, a measure of ED was used as the outcome. However, ED can also be considered as a process that contributes to the development or maintenance of psychopathology (Aldao et al., 2010). Therefore, a repeated measure of borderline symptoms would have enriched the results by exploring how mechanisms and ED session-by-session predict the trajectory of borderline symptoms after mindfulness skills training. Fourth, only the moderating role of decentering was tested and whether decentering was not moderated by the other mechanisms. However, we did not explore the possible moderating role of the other mechanisms among themselves and future studies could explore this issue. Fifth, the MLM analyses used did not account for autoregressive effects (e.g., whether the change in ED at a specific time point could be influenced by an earlier time point of the same measure), potentially introducing bias into the findings (Falkenström et al., 2022). Future studies should address the autoregressive effect when analyzing repeated measures data. Lastly, the sample was mostly composed of women. It is desirable that future studies consider more representative samples of men with BPD.

***Conclusions***

Knowing how a psychological intervention works (i.e., the mechanisms) is key to understanding the processes involved in therapeutic change. A recommended methodology for exploring this issue in a framework of multilevel modeling with repeated measures is to disaggregate the total effect of predictors into the between- and within-person effects (Wang & Maxwell, 2015). This approach not only allows to obtain information about the between-person differences (e.g., those who frequently practice nonjudgment of their internal experience improve in ED compared to those who practice less) but also provides information into within-person processes (e.g., individuals who practice nonjudgment of their experience beyond their habitual tendency, demonstrate improvements in ED). The present study provides preliminary evidence of the mechanisms of change underlying mindfulness skills training. When treating emotional dysregulation in BPD patients, therapists could benefit from this information by promoting within-person processes such as nonjudgment and body awareness, as well as decentering strategies that strengthen the effects of these mechanisms. Finally, understanding how mindfulness DBT skills training works can help optimize treatment for BPD.

# Chapter V

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## General Discussion and Conclusions

# 9. General Discussion

Existing research underscores the robust association between emotion dysregulation, NSSI, and BPD, highlighting the therapeutic significance of addressing emotion regulation skills in individuals who engage in self-harm and exhibit borderline features. Notably, previous studies have demonstrated the efficacy of DBT in mitigating core BPD symptoms and reducing NSSI behaviors. However, there is a need for further research to clarify (i) the role of emotion dysregulation in identifying high-risk subgroups for NSSI, and (ii) the mechanisms of change by which mindfulness-based DBT skills training reduces emotion dysregulation in individuals with BPD. This dissertation addresses these gaps through five studies, utilizing ad-hoc methodologies and encompassing both clinical and non-clinical samples.

## 9.1. Emotion dysregulation and Non-Suicidal Self-injury

Specific dimensions of emotional dysregulation were identified that are relevant to understanding and treating NSSI. Specifically, non-acceptance of emotions (i.e., not accepting unwanted emotional responses) emerged as a unique predictor of intrapersonal NSSI functions (i.e., affect regulation), even when accounting for BPD severity. This finding supports the conceptualization of NSSI as a maladaptive emotion regulation strategy closely related to experiential avoidance (Chapman et al., 2006), highlighting the importance of targeting emotional acceptance in interventions. While no specific emotion regulation dimension significantly predicted interpersonal NSSI functions, potentially due to their common lower prevalence (Taylor et al., 2018; Vega et al., 2017), a trend for lack of emotional clarity (DERS subscale) emerged. This trend suggests a possible link between

deficits in emotional awareness and communication, potentially stemming from early invalidating environments (Guérin-Marion et al., 2021), leading to the use of NSSI for interpersonal purposes.

Furthermore, the interaction between lack of emotion regulation strategies and negative urgency (a measure of impulsivity) in predicting NSSI frequency underscores the importance of considering both emotion regulation and impulsivity in understanding the maintenance of NSSI over time (Sheppes et al., 2015). In other words, individuals who experience emotion regulation difficulties, particularly those with comorbid impulsive traits, are more susceptible to engaging in maladaptive behaviors when faced with heightened emotional distress. While negative urgency did not predict NSSI functions, likely reflecting its role in the impulsive act rather than the initial motivation (Allen & Hooley, 2019), it emphasizes the need to address urges to self-injure in times of emotional distress, particularly among those with a high tendency to act rashly when experiencing negative affect. To minimize this tendency, teaching distress tolerance skills in people prone to self-injury could be useful (Linehan et al., 2015).

Another relevant finding was to find comparable levels of emotional dysregulation in both NSSI groups assessed in study 1 (i.e., BPD with NSSI and Non-Clinical group with NSSI). The above reinforces the role of emotional dysregulation in heterogeneous populations with NSSI, despite the absence of a mental disorder. Furthermore, the predominant use of NSSI for intrapersonal functions in these both groups is consistent with previous research in college samples, indicating a common motivation for NSSI to regulate states of internal distress (Vega et al., 2017). These results highlight the importance of identifying groups of young people who commonly engage in self-injury and who do not

meet criteria for a diagnostic criterion (i.e., subclinical population) but still exhibit high levels of psychological distress and interpersonal difficulties (e.g., Vega et al., 2018).

Subsequently, study 2 used Latent Profile Analysis and longitudinal design to explore the presence of latent subgroups within a sample of college students involved in NSSI and their prospective association with psychopathology. Three latent subgroups were found with differential characteristics in NSSI, emotion dysregulation levels and perceived social support. Notably, two profiles (representing 74% of the sample) exhibited elevated emotion regulation difficulties, consistent with prior research emphasizing the role of emotion dysregulation in NSSI (Wolff et al., 2019). Furthermore, these profiles differed significantly in their levels of perceived social support, highlighting the potential moderating role of social support in the relationship between NSSI and psychopathology (Rissanen et al., 2018). These findings reinforce the notion that NSSI among young adults is a heterogeneous phenomenon (Christoforou et al., 2021).

Specifically, it was found that the high-risk profile (Profile 1), characterized by severe NSSI features, high emotion dysregulation, and low perceived social support, demonstrated the highest scores across psychopathology measures at both baseline and follow-up (borderline features, psychological distress and suicidal tendencies), even though many participants in this group had ceased engaging in NSSI by the two-year assessment. In contrast, participants in Profile 3 (low-risk group) showed the lowest levels of psychopathology, and participants in Profile 2 (medium-risk group) did not differ significantly from those in Profile 3 on measures of psychopathology. However, Profile 2 participants reported higher levels of emotion dysregulation and endorsed intrapersonal

functions of NSSI (i.e., affect regulation). This suggests that Profile 2 may be characterized by difficulties in emotion regulation without psychopathological comorbidity.

These findings highlight the protective effect that social support can have in mitigating the risk of self-injury (Hankin & Abela, 2011; Wolff et al., 2014). Specifically, high levels of perceived social support, particularly from friends, may buffer against the negative consequences of emotion dysregulation on self-harm, potentially by promoting adaptive coping strategies and reducing reliance on maladaptive behaviors (d'Arbeloff et al., 2018; Sachs -Ericsson et al., 2021). This is particularly relevant during the transition from adolescence to young adulthood when peer relationships often take on greater significance (Rissanen et al., 2021). Furthermore, these results highlight the importance of considering the association of psychopathological (e.g., borderline features) and interpersonal (e.g., social support) factors involved in NSSI behavior, mainly in clinical populations (see appendix, study 1: Mendez et al., 2022).

Therefore, researchers should consider interpersonal factors, in addition to emotion dysregulation, when identifying high-risk subgroups among youth with a history of self-harm. From an intervention perspective, this implies not only fostering adaptive emotion regulation strategies but also promoting social support as a potential protective factor against self-injurious behaviors.

### 9.2. Mechanisms of Change and Emotion Dysregulation

The following studies in this dissertation focused on exploring the potential mechanisms underlying the effectiveness of mindfulness-based DBT skills training in reducing overall BPD symptoms and emotion dysregulation. Study 3 compared the

mindfulness skills training with interpersonal effectiveness skills training, two modules which are part of the DBT. Utilizing a larger sample size, mindfulness skills training was found to be more effective in reducing borderline symptoms and enhancing decentering ability. Specifically, mindfulness skills training led to increases in decentering, which, in turn, reduced emotion dysregulation, ultimately resulting in a reduction in BPD symptoms. Interestingly, when exploring a serial relationship with emotion dysregulation driving changes in decentering, this association was not significant.

This serial mediation effect highlights the decentering capacity as a key metacognitive mechanism underpinning the effectiveness of mindfulness-based interventions (Maloney et al., 2024). Specifically, the findings suggest that decentering may be a central process through which these interventions operate, directly influencing therapeutic outcomes. Specifically, in a mindfulness skill training participants are encouraged to observe their experiences from a decenter perspective, fostering an attitude of acceptance rather than judgment (Linehan et al., 2014). This capacity requires stepping back from one's emotional experience and observing the content of that experience from a more objective and detached stance. This decentering process is likely to reduces reactivity to the content of experience (Bernstein et al., 2015), cultivating a more adaptive way of relating to one's experiences, as opposed to maladaptive strategies like experiential avoidance or suppression (Hayes-Skelton et al., 2013).

The following two studies in this dissertation further explored the mechanisms of change in mindfulness skill training by incorporating repeated measures and statistical approaches focused on uncovering individual processes of change. For instance, study 4 explored the temporal dynamics between weekly mindfulness practice and emotion

dysregulation. While the literature suggests that mindfulness meditation practice is a key mechanism for cultivating emotion regulation (Tang et al., 2015) and is an active component of mindfulness-based DBT skills training (Linehan, 2014), previous findings regarding the impact of mindfulness practice on mental health outcomes in the broader mindfulness literature remain mixed (Creswell, 2017; Parsons et al., 2017; Williams et al., 2014). Relevantly, it was found in study 4 that a greater commitment with mindfulness practice (measured in days and minutes per week) at a given week predicted significant reductions in emotion dysregulation in the subsequent week during a mindfulness skill training. This finding highlights the importance of actively encouraging and supporting mindfulness practice among individuals with BPD, reinforcing its potential as a mechanism for enhancing emotion regulation.

Another key finding was the identification of a minimum effective dose of mindfulness practice to improve emotion dysregulation; an average of ≥ 3 days and a total of 30 minutes per week. Although this amount of practice is less than doses typically recommended for other mindfulness-based interventions (e.g., Parsons et al., 2017), this finding suggests that a more modest amount of practice may be more beneficial for individuals with BPD, while pushing for more extensive practice could be counterproductive. Furthermore, significant reductions in emotion dysregulation were observed from the fifth session onward in the 10-week mindfulness skill training. This suggests that while participants may initially experience a lack of progress or even adverse effects that could lead to premature dropout (Cebolla et al., 2017), maintaining commitment throughout the training program is crucial to achieving remarkable results. These finding may be useful to increase motivation and adjust participants' expectations by explicitly informing them about the

minimum dose of mindfulness practice needed to obtain significant benefits, as well as the importance of maintaining adherence to treatment.

Building on previous findings, study 5 explored the mechanisms through which mindfulness skill training improves emotional dysregulation in individuals with BPD. Four potential mechanisms—decentering, non-judging of inner experience, body awareness, and attention awareness—were examined. Relevantly, more robust methods were used to explore the temporal dynamics between each putative mechanism and emotional dysregulation by using a time-lagged approach and disaggregating between- and within-person effects (Holmes et al., 2018; Wang & Maxwell, 2015)

It was found that both nonjudgment of internal experience and body awareness demonstrated significant within-person effects on emotion dysregulation, suggesting that fluctuations in these capacities (i.e., individual changes) contribute to ameliorating emotional regulation difficulties. These findings align with previous research emphasizing the role of nonjudgment in reducing BPD and NSSI symptoms (Eisenlohr-Moul et al., 2016) and support the notion that attending to bodily sensations can enhance emotional awareness and regulation (Price & Thompson, 2007).

Interestingly, in study 5 it was also found that decentering capacity moderated the relationship between non-judging of inner experience, body awareness and emotion dysregulation. Decentering is a metacognitive capacity that allows one to take a perspective on one's own experience (Fresco et al., 2007). Therefore, individuals with higher levels of decentering experience more pronounced reductions in emotion dysregulation when they also increased their nonjudgment of inner experience and body awareness. This suggests that

decentering may facilitate a more effective utilization of these skills, highlighting its potential as a key therapeutic target for enhancing emotion regulation in BPD.

Another interesting finding revealed in these studies was a crucial bidirectional relationship between mindfulness practice, proposed mechanisms of change (e.g., decentering), and emotion dysregulation. Greater engagement in mindfulness practice and strengthening of these mechanisms predicted subsequent improvements in emotion regulation. However, heightened emotion dysregulation negatively impacted both subsequent engagement in mindfulness practice and gains in these mechanisms. This finding underscores the mood-dependent nature of mindfulness (Elices et al., 2019; Wilks et al., 2016) and highlights a critical dynamic for therapists to consider when working with individuals with BPD. Recognizing that engagement in mindfulness practice and the cultivation of these mechanisms can fluctuate based on emotional state, particularly during periods of heightened dysregulation, has significant implications for treatment. Therapists can foster greater engagement and maximize therapeutic benefits by validating patients' struggles with practice, normalizing fluctuations in motivation, and encouraging a flexible and compassionate approach, especially when emotions are intense (Mehlum, 2021).

### 9.3. Strengths and Limitations

These findings provide valuable insight into the specific dimensions of emotion dysregulation that are differentially associated with NSSI functions and frequency. Furthermore, these studies highlight the importance of a person-centered approach to understanding and addressing NSSI, recognizing that individual risk profiles can inform tailored intervention strategies. Specifically, these studies also highlight the significance of

emotion dysregulation and low social support as dimensions that characterize more severe NSSI profiles and also increase the risk of developing psychopathology over time.

Of particular interest, the studies focused on mechanisms suggest potential avenues through which mindfulness skills training may improve emotion regulation. Specifically, these studies highlight the crucial role of decentering, nonjudgment of inner experience and body awareness in improving emotion regulation and reducing BPD symptoms, and also demonstrates the importance of commitment to mindfulness practice, particularly in establishing the minimum effective dose required to achieve significant change in emotion dysregulation. Collectively, these studies also underscore the dynamic, bidirectional relationship between mindfulness practice and emotion regulation.

Despite the significance of these findings, several limitations warrant consideration when interpreting the results. study 1 employed a small sample size, relied on self-report measures, and used a cross-sectional design. However, study 2 addressed these limitations by utilizing a larger, more representative sample of individuals who engage in NSSI and by implementing a longitudinal design. Nonetheless, the relatively low retention rate during follow-up in Study 2 partially limits the interpretation of the findings. In addition, the cross-sectional design of study 3 limits conclusions about the temporal order of effects. While studies 4 and 5 addressed this limitation by employing repeated measures designs, the inclusion of single-arm designs without active control groups limits the generalizability of the findings. Additionally, the predominantly female sample across all studies limits the generalizability of the findings. Finally, the multilevel analyses in studies 4 and 5 did not account for potential autoregressive effects of the emotion dysregulation measure, potentially introducing bias into the findings.

# 10. General Conclusions

***Studies 1 & 2***

i. Both the BPD with NSSI group and the non-clinical with NSSI group exhibited greater clinical severity and emotion dysregulation compared to the healthy control group. While the BPD and Non-clinical with NSSI groups did not differ in emotion dysregulation, the BPD with NSSI group reported significantly higher levels of depressive symptoms and impulsivity.

ii. Non-acceptance of emotions uniquely predicted the use of intrapersonal NSSI functions, but not for interpersonal functions. A lack of emotion regulation strategies predicted NSSI frequency only among individuals with high negative urgency, but not among those with low negative urgency.

iii. Three latent subgroups were found with different characteristics in NSSI, emotional dysregulation and perceived social support.

iv. The subgroup (Profile 1) characterized by severe NSSI features, higher emotion dysregulation, and low perceived social support, demonstrated the highest risk for psychopathology both at baseline and two-year follow-up.

***Studies 3, 4 & 5***

i. The effects of mindfulness-based DBT skills training on borderline symptoms were mediated by a unidirectional pathway; increased decentering led to decreased emotion dysregulation.

ii. Increased engagement in mindfulness skills practice predicted significant improvements in emotion regulation. A minimum dose of 3 days and in total more than 30 minutes per week was required to observe these effects.

iii. A bidirectional temporal relationship was found between weekly mindfulness practice and emotion dysregulation.

iv. Greater within-person effects on nonjudging the inner experience and body awareness within a given week predicted subsequent improvements in emotion regulation at the following week.

v. A bidirectional temporal relationship was also found between the proposed mechanisms and emotion dysregulation.

vi. Decentering moderated the relationship between nonjudging the inner experience, body awareness, and emotion dysregulation. Notably, these associations were stronger among participants with higher levels of decentering.

## 11. Clinical Implications and Directions for Future Research

This dissertation offers significant contributions to the understanding of the complex interplay between emotion dysregulation, NSSI, and BPD, carrying important implications for both research and clinical practice. Specifically, this research advances our understanding of NSSI by identifying distinct risk profiles, highlighting the interplay of NSSI characteristics, emotion dysregulation, and social support. The identification of a high-risk profile characterized by elevated emotion dysregulation and low social support provides a clear direction for prevention and intervention—teaching emotion regulation skills and bolstering social support are likely to be crucial, particularly for young people engaging in NSSI.

Furthermore, this body of work sheds light on the specific mechanisms by which mindfulness-based DBT skills training influences emotion regulation in BPD. By emphasizing decentering, nonjudgment of inner experience, and body awareness as key mechanisms of change, this research offers clinicians valuable guidance for optimizing treatment protocols. Moreover, the identification of a minimum effective dose of mindfulness practice, considered within the context of the dynamic, bidirectional relationship between mindfulness and emotion regulation, highlights the need for tailored and flexible approaches. Ultimately, this dissertation emphasizes the importance of validating patients' struggles with practice and promoting flexibility during periods of heightened emotional distress to maximize the benefits of mindfulness-based interventions for individuals with BPD.

Future research should continue to identify the clinical characteristics of high-risk NSSI profiles in youth, particularly within under-identified subclinical populations, to inform targeted interventions aimed at reducing self-injury behaviors and the risk of developing psychopathology. Additionally, future investigations should expand beyond mindfulness-based DBT skills training to explore the mechanisms of change associated with other DBT modules. It is plausible that each DBT module contributes to improved emotion regulation through distinct pathways. Understanding these specific mechanisms could optimize treatment for individuals with BPD by promoting different emotion regulation skills tailored to each person's unique needs at any given time.

Finally, it is crucial for future mechanism-focused research to incorporate rigorous methodologies, such as those employed in the present study, to advance our understanding of these complex processes. Additionally, expanding assessment beyond self-report measures to more comprehensively capture key dimensions of BPD, including chronic feelings of emptiness, and incorporating ecological momentary assessment methodologies would be critical for obtaining a more contextualized understanding of emotion dysregulation and its treatment in BPD. This dissertation provides a foundation for such future investigations, ultimately contributing to more effective and personalized interventions for individuals with BPD.

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## 13. Annex | Table 1

**Table 1**. Summary of the skills training curriculum for both interventions.

| SESSION | Mindfulness Skill Training | Interpersonal Effectiveness Skill Training |
|---|---|---|
| 1 | The objective of DBT skill training, group norms and the biosocial theory for BPD was explained. | The objective of DBT skill training, group norms and the biosocial theory for BPD was explained. |
| 2 | States of the mind: emotion mind, reasonable mind and wise mind. The participants were instructed to distinguish between the three mental states and to promote the wise mind. | Clarifying goals of Interpersonal effectiveness (IE). Factors reducing IE. Deciding the importance of the three effectiveness types: objectives effectiveness, relationship effectiveness, and/or self-respect effectiveness. |
| 3 | What and How skills: Observe. Noting and attending to the ongoing experience both internal (e.g., bodily sensations) and external (e.g., a food while eating). | Objective effectiveness: Describe, Express, Assert, Reinforce, Stay Mindful, Appear confident, Negotiate (DEAR MAN). Role playing of DEAR: Describe, Express, Assert and Reiforce. |
| 4 | What and How skills: Observe/One-Mindfully. Attention control. Pay attention focusing on one thing at a time. Let go of distractions and return to what is being done again and again. | Role playing of MAN: Mindful, appear confident and Negotiate. |
| 5 | What and How skills: Describe/non-judge. Label the observed experience in words (e.g., describing thoughts, emotions, physical sensations). Practicing describing events with non-judgmental. Observe and recognize the judgments themselves. | Relationship effectiveness: be Gentle, act Interested, Validate, Easy manner (GIVE) |
| 6 | What and How skills: Participating/being effective. Participating in the experience of the present moment without separating from the events that are occurring. Staying tuned on goals and do what it takes to achieve them. | Role playing of GIVE: Gentle, act Interested, Validate, Easy manner. |
| 7 | Radical Acceptance. Choosing to accept. Turning the mind. Accept what is not possible to change at this time. | Self-respect effectiveness: be Fair, no Apologies, Stick to values, be Truthful (FAST). |
| 8 | Learning to respond wisely and effectively to events: Practice open and flexible willingness to difficult events over willfulness. | Role playing of FAST: be Fair, no Apologies, stick to values and be Truthful. |
| 9 | Accepting with the body: Half-smile and Willing hands skills. Mindfulness of current thoughts that prevent acceptance. | Evaluating options: how intensely to ask or say “no” in interpersonal relationships. |
| 10 | Summary of the training: motivate participants to continue practicing mindfulness and acceptance skills in daily life. | Summary of the training: motivate participants to continue practicing interpersonal effectiveness skills in daily life. |

# **Annex** | **Publication 1** †

† Mendez, I., Sintes, A., Pascual, J. C., Puntí, J., Lara, A., Briones-Buixassa, L., Nicolaou, S., Schmidt, C., Romero, S., Fernández, M., Carmona I Farrés, C., Soler, J., Santamarina-Perez, P., & Vega, D. (2022). Borderline personality traits mediate the relationship between low perceived social support and non-suicidal self-injury in a clinical sample of adolescents. *Journal of affective disorders*, *302*, 204–213. https://doi.org/10.1016/j.jad.2022.01.065

# Borderline personality traits mediate the relationship between low perceived social support and non-suicidal self-injury in a clinical sample of adolescents


## Abstract

**Background:** Non-suicidal self-injury (NSSI) is a serious public health concern among adolescents, especially in clinical settings. Social support plays a critical role in the onset and maintenance of NSSI in adolescence. NSSI is closely associated with borderline personality disorder (BPD), yet no previous work has analyzed the mediating role of borderline traits in the relationship between perceived social support (PSS) and NSSI. This study aimed to address this gap.

**Methods:** Participants were 228 adolescent patients (12 to 18 years old), who completed a clinical interview and self-report measures of BPD-traits, current psychological distress, emotion dysregulation and PSS. They were grouped based on the presence (vs. absence) of NSSI. Univariate and multivariate logistic regression analyses were used to identify risk factors of NSSI, and a mediation analysis was conducted to examine the intermediary role of borderline traits in the relationship between PSS and NSSI.

**Results:** NSSI was highly prevalent in our sample (58%) and was associated with higher clinical severity. Low PSS predicted NSSI in univariate, but not multivariate regression. Mediation analyses showed that borderline traits fully accounted for the relationship between low PSS and NSSI, even when controlling for current psychological distress and gender.

**Limitations:** Cross-sectional design through self-report assessment. Conclusions: Findings suggest that adolescents with low PSS are especially vulnerable for developing NSSI due to elevated BPD traits. In clinical settings, interventions aimed to reduce borderline symptoms may be a promising treatment option for adolescents with NSSI and low PSS.

## Introduction

Non-suicidal self-injury (NSSI) refers to the deliberate destruction of one's own body tissue in the absence of conscious suicidal intent (Nock, 2010; Plener et al., 2015; Vega et al., 2018). NSSI is associated with potentially detrimental consequences, ranging from low interpersonal, academic, and daily functioning to high risk of suicide (Claes et al. 2003; Daukantait˙ e et al. 2020). Adolescence constitutes a critical and vulner able phase for developing NSSI, as indicated by higher prevalence rates in both community (17–38%; Brunner et al., 2014) and clinical samples (50–60 %; Kaess et al., 2013). Recent research suggests a crucial role of social factors in the onset and maintenance of NSSI during this important developmental period (Brown and Witt, 2019). Therefore, it is not surprising that in the context of the social distancing measures imposed during the COVID-19 pandemic, NSSI rates have increased even more, especially in those adolescents suffering from mental disorders (Plener, 2021; Wester et al. 2018). In this regard, a deeper understanding of how social factors contribute to the prevalence and severity of NSSI in adolescent psychiatric samples, as well as how they interplay with other risk factors, is necessary to maximize prevention and treatment programs.

In adolescents, NSSI is present in broader internalizing and externalizing problems (Meszaros et al., 2017; Zetterqvist, 2015), and is highly associated with borderline personality disorder (BPD) (Nock et al., 2006; Sadeh et al., 2014). Around 61% of adolescents with BPD pathology have engaged in NSSI at least once, making the criterion "recurrent NSSI and suicidal behavior" the most frequently met in adolescents with BPD (Chanen et al., 2008; Kaess et al., 2014). The occurrence of NSSI often precedes a BPD diagnosis and is therefore considered to be a precursor for BPD (Ghinea et al., 2019;

Groschwitz et al., 2015; Homan et al., 2017). On the other hand, the presence of BPD symptoms (such as emotion dysregulation or identity disturbances) increases the risk of engaging in some form of NSSI in adolescents (Stead et al., 2019), and the presence of a BPD diagnosis involves greater severity of NSSI (Jacobson et al., 2008; Stead et al., 2019). Therefore, it has been suggested that BPD features precede and interact with NSSI (Reichl and Kaess, 2021). Notwithstanding the above, additional research is needed to clarify this relationship, as approximately 50% of adolescents with NSSI do not meet diagnostic criteria for BPD (Ayodeji et al., 2015).

Prior research indicates that emotion dysregulation, a core feature of BPD, is a specific risk factor for NSSI (Wolff et al., 2019). For example, emotion regulation difficulties detect the presence of NSSI in psychiatric inpatients, regardless of sex and psychopathology (Perez et al., 2012). In addition, adolescents commonly report engaging in self-harm as a strategy to cope with emotional pain (Laye-Gindhu and Schoner t-Reichl, 2005). In this regard, NSSI could be considered as a maladap tive response to strong negative affect because of poor emotion regulation skills (Chapman et al., 2006).

In addition to individual risk factors (e.g., emotion dysregulation), social factors also play a prominent role in NSSI engagement (Cipriano et al., 2017; Taylor et al., 2018). Most people engaging in NSSI usually endorse social motives (e.g., to cope with social conflicts) (Hankin and Abela, 2011; Klonsky, 2007). For instance, interpersonal conflicts or feelings of rejection by peers are frequent triggers for NSSI (Brio nes-Buixassa et al., 2021; Klomek et al., 2016). Importantly, adolescents who engage in NSSI often report feelings of loneliness, low social competence, poorer relationships with parents, and invalidating life environments (Musser et al., 2018; Wang et al. 2020).

Social interactions and social support are vital for healthy person ality development in young people (Blakemore and Mills, 2014; Orben et al., 2020). Perceived social support (PSS) refers to an individual's perceptions of the general availability and quality of the social support available to them (Haber et al., 2007). Adolescents with high PSS exhibit better mental health and less high-risk behaviors (Lai and Ma, 2016; Reininger et al., 2012). Previous evidence suggests that high PSS is a protective factor for suicide and self-harm (Kleiman and Liu 2013; Muehlenkamp et al., 2013; Nemati et al., 2020; Tham et al., 2020). More specifically, different previous studies show that high PSS decreases the odds of engaging in NSSI in adolescents from nonclinical (Wan et al., 2018) and clinical samples (Baiden et al., 2017; Miller et al., 2015). A recent longitudinal study with a 5-year follow-up also suggests that high PSS from friends may be particularly critical in preventing the onset of self-cutting in adolescents (Rissanen et al., 2021).

It should also be noted that young people with low PSS are prone to use the social media as an alternative source to feel connected with others (Zhang et al., 2018). However, the reality is that overuse of the internet and the social media has been associated with psychological distress in adolescents (Marino et al., 2018). More specifically, internet addiction might be a risk factor for engaging in NSSI in the presence of a comorbid psychiatric disorder (Karaer and Akdemir, 2019; Mészáros et al., 2020), suggesting that virtual interaction does not improve perceptions of social support in these adolescents.

It is worth noting that PSS may interact with other risk factors to augment or reduce the odds of engaging in NSSI in adolescents. For example, a large-scale study involving ten European countries showed that adolescents with parental and peer support were at significantly lower risk of engaging in direct self-injurious behaviors after being victimized

by bullying, compared to students without social support (Klomek et al., 2016). Similarly, high parental support appears as a protective factor against NSSI in adolescents who are bullied (Claes et al., 2015). Lastly, Crowell et al. (2009) also suggested that the association between NSSI and emotion dysregulation becomes stronger in non-supportive social contexts, further emphasizing the protective role of social support.

While a significant body of research has demonstrated the protective effects of social support on NSSI in adolescents, only a few studies have explored the mediating mechanisms that may underlie this association in adolescents. Rissanen et al. (2021) reported that depression symp toms mediated the effect of subjective loneliness on the initiation of self-cutting in a non-clinical sample of adolescents. Similarly, Madjar et al. (2021) found that depression symptoms fully mediated the association between perceptions of school-related social support (e.g., from teachers and peers) and NSSI in a non-clinical adolescent sample. Lastly, a different study in young adults revealed that deficits in emotion regulation mediated the relationship between feelings of alienation in parent and peer relationships (i.e., low PSS) and NSSI (Yurkowski et al., 2015).

These studies only focused on the mediating role of emotion dysre gulation and depressive symptoms in the relationship between PSS and NSSI. However, despite a strong association between NSSI and BPD (e.g., Stead et al., 2019), no previous study has analyzed the potential mediating role of borderline features. In this regard, it is important to note that unsupportive and invalidating environments during infancy and childhood (e.g., disturbed relationships, bullying) have been suggested as a prominent risk factor for the development of BPD (Crowell et al., 2009; Fruzzetti et al., 2005). However, longitudinal studies do not provide consistent evidence to support this causal relationship. For instance, while a study of

Wolke et al. (2012) suggests that victimization by peers in childhood increases the risk of developing BPD symptoms in early adolescence, another study indicates reciprocal associations between invalidating parenting behaviors (e.g., low caregiver warmth) and BPD symptoms in adolescence (Stepp et al., 2014). Importantly, these studies assessed constructs (e.g., low caregiver warmth) related to social support, but they have not directly assessed PSS. Taken together, prior evidence does not allow us to establish temporal precedence in the relationship between PSS and borderline features in adolescence.

To address these gaps, the current study aimed to examine whether low PSS predicts NSSI in a Spanish clinical sample of adolescents. For the first time to our knowledge, we also explored whether borderline personality traits mediate this relationship in such a clinical sample. Based on previous research, we hypothesized that adolescents who engage in NSSI would report lower PSS than adolescents without NSSI. Addition ally, we hypothesized that psychological distress (i.e., depression and anxiety) and emotion dysregulation would mediate the association between PSS and NSSI. Lastly, given the well-established relationship between BPD and NSSI, as well as the negative bias in the processing of social information previously found in BPD patients (Kleindienst et al., 2019; Reichenberg et al., 2017), we also hypothesized that borderline personality traits would appear as an important mediator in the association between PSS and NSSI. However, given that the present study is cross-sectional and there is no prior evidence that firmly supports the specific ordering of the variables in this mediation model, we also explored a competing hypothesis (i.e., a plausible alternative model where PSS mediates the association between BPD features and NSSI).

## Methods

### *Participants*

The present study was conducted between April 2019 and February 2020 in partial and complete hospitalization programs from six hospitals in the county of Barcelona (Spain): Consorci Sanitari de l'Anoia, Hospital Clínic de Barcelona, Hospital de la Santa Creu i Sant Pau, Hospital Sant Joan de Déu de Barcelona, Althaia Manresa, and Consorci Corporació Sanitária Parc Taulí. By means of a recruiting sampling method, 382 consecutive patients were invited to participate. Inclusion criteria comprised ages between 12 and 18 years old, and a written informed consent form signed by both patients and their parents or legally authorized representatives. Exclusion criteria included clinically significant behavior problems that impede the assessment, failure to complete all phases of the evaluation, and IQ below 70. For the NSSI group, participants reporting NSSI on less than five days in the past year were also excluded from the study. Finally, 83 participants (or parents) rejected to participate, and 71 participants were excluded (74.65% were incomplete assessments). The final sample of study comprised 228 adolescents. Participants were divided in two groups as a function of a history of NSSI (N=132: NSSI group; N=96: Non-NSSI group). Demographic characteristics are provided in Table 1. Ethics approval was issued by the Bellvitge's Hospital Ethics Committee (PR330/17).

***Procedure***

First, a trained senior member of the study staff gathered clinical information (see Table 1). All participants were assessed with the Spanish version of the Mini International Neuropsychiatric Interview Kid (M.I.N.I. Kid) (Colón-Soto et al., 2005) (see Table S1). After that, participants answered both demographic questions and self-reported questionnaires through an online platform under the supervision of a researcher. This platform also included

questions about: (i) healthy habits, (ii) usage of internet and social media, and (iii) lifetime NSSI (yes or not).

***Measures***

**Multidimensional Scale of Perceived Social Support (MSPSS)** (Zimet et al., 1990) We used the Spanish version of the MSPSS (www.heardalliance.org), which is one of the most broadly used scales to rate social support. It consists of 12 items, which assess three sources of personal support: (i) family (e.g., "my family really tries to help me"), friends ("my friends really try to help me"), and significant others (e.g., "there is a special person who is around when I am in need"). A higher score in this scale indicates higher PSS. Both scores from the original and Spanish version of the MSPSS show good internal reliability (α =.88 and α =.90 respectively) (Calderón et al., 2021; Zimet et al., 1990). Suitable psychometric properties have been shown in different populations, including adolescents (Canty-Mitchell and Zimet, 2000).

**The borderline personality questionnaire (BPQ)** (Fonseca-Pedrero et al., 2011) This questionnaire assesses BPD traits or symptoms, based on the DSM-IV criteria. It consists of nine subscales: Impulsiveness, Affective Instability, Abandonment, Relationship, Self-Image, Suicide/Self-Mutilation, Emptiness, Intense Anger, and Quasi-Psychotic States. BPQ is a good screening tool to detect BPD in outpatient youth (Chanen et al., 2008). In the current study, we used the total BPD-score as a measure of general BPD features, but we excluded the Suicide/Self-Mutilation subscale to avoid a potential confounding effect in the analysis.

**Brief Version of the Difficulties in Emotion Regulation Scale (DERS- 18**) (Victor and Klonsky, 2016) We used the Spanish translation of this scale (Briones-Buixassa et al., 2021). This 18-item self-report measure assesses 6 subscales of emotion regulation difficulties: (i) lack of emotional awareness, (ii) lack of emotional clarity, (iii) nonacceptance of emotions, (iv) inability to engage in goal-directed behavior when feeling emotional, (v) engagement in impulsive behavior when feeling emotional, and (vi) inability to access emotion regulation strategies. The total DERS-score presents a high internal reliability, and the six scales show moderate to high internal reliability (Victor and Klonsky, 2016).

**Depression anxiety stress scales (DASS-21) (Arturo et al., 2005)** The DASS-21 is a self-report instrument that assesses current psychological distress. It measures the frequency of 21 negative emotional symptoms related to Depression, Anxiety, and Stress during the previous week. The Spanish version presents moderate to good internal reliability for each of the three subscales, respectively (Arturo et al., 2005). Ad hoc questionnaire assessing internet addiction and mobile (Beranuy et al., 2009). Participants were asked to indicate their Internet and mobile usage. They responded to the following 5 items by choosing one of four answers: (‘almost never’, ‘sometimes’, ‘most times’, ‘almost always’): (1) ‘do you prefer to connect with people over the Internet than in person?’, (2) ‘has your academic performance been adversely affected by social network usage?’, (3) ‘do you suffer from sleep disorders due to aspects related to mobile phones?’, (4) ‘do you feel restless when you don’t receive messages or calls?’, (5) ‘how often do you say things on your cell phone that you wouldn’t say in person?’. These questions were obtained from two previous questionnaires in the Spanish language (Beranuy et al., 2009).

Only participants with NSSI (NSSI group) completed the following scales:

**Non-suicidal self-injury disorder scale (NSSIDS)** (Victor et al., 2017) The NSSIDS is a self-report measure that assesses whether participants meet criteria for the DSM-5 NSSI disorder. We used a Spanish translation to test whether the 'criterion A' was met (i.e., five or more days in the past year in which participants engaged in NSSI).

**Inventory of statements about self-injury (ISAS)** (Klonsky and Glenn, 2009) This inventory assesses lifetime frequency of 12 NSSI behaviors (e.g., cutting) and 13 NSSI functions. These functions are grouped into two separate factors that index interpersonal (e.g., interpersonal influence) and intrapersonal NSSI functions (e.g., affect-regulation). We administered the Spanish version of the ISAS (Vega et al., 2017).

***Statistical analyses***

All analyses were conducted in RStudio (R Core Team, 2021). To investigate between-group differences (NSSI vs. Non-NSSI), we con ducted Pearson's chi-squared tests for categorical variables, independent-samples t-tests for dimensional variables that met the assumption of normality, and Mann-Whitney U tests for dimensional variables that violated the assumption of normality.

***Logistic regression analysis***

The outcome was a dichotomized variable indicating the presence (≥ 5 days) or absence of NSSI in the past year, and the explanatory variables were age, gender, perceived social support (MSPSS-Family, MSPSS- Friends, MSPSS-Significant Others, MSPSS-Total), borderline traits (BPQ), current psychological distress (DASS-21), and difficulties in emotion regulation (DERS-subscales). We first ran univariate logistic regression on all predictors, producing odds ratios (OR) presented with 95 % confidence intervals. Predictors

that showed a statistically significant effect in the univariate analyses were entered in a multivariate logistic regression analysis, using a backward stepwise selection to obtain the final model. Before running the multiple regression analysis, we checked for multicollinearity by calculating the variation inflation factor (VIF) for all predictors entered in the model. All VIF values were below 3, indicating that there are no multicollinearity problems (Hair et al., 2010). Receiver operating characteristic (ROC) curve analysis was also conducted to determine the capacity of the final model to discriminate between patients with and without a history of NSSI.

***Mediation analysis***

We finally conducted a mediation analysis to assess whether borderline traits (BPQ) account for the relationship between perceived social support and NSSI and, alternatively, whether perceived social support may account for the relationship between borderline traits and NSSI. The "Mediation" package in R (Tingley et al., 2014) was used to test the theorized mediation relationship with 10000 bootstrapped samples. Unstandardized indirect effects were computed for each of 10000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. Unstandardized indirect effects were computed using the difference between coefficients approach (c – c´), that is, the difference between the total and direct effect. To ensure that the indirect effects estimated with this approach are not affected by a change of scale in the logistic regression models (i.e., our mediation is based on logistic regression), we repeated all mediation analyses by standardizing the coefficients before estimating the indirect effect (Rijnhart et al., 2019).

## Results

### *Sample characteristics*

Participants were between 12 and 18 years old at the time of consent (Mage =15.34, SD= 1.45), and were mostly females (67.1%) (Table 1). As shown in Table 1, the presence (vs. absence) of NSSI was associated with a worse academic performance, less hours of sleep, more alcohol abuse, lower food intake, and more problematic use of the internet and the social media. Specifically, participants in the NSSI group showed a significantly stronger preference to connect with others via the internet and online social networks rather than in person, and they recognized sleep disturbances due to social media use more frequently (Table 1). In addition, only 62.1% (n=82) of participants in the NSSI group met the full criteria for the NSSI disorder (based on the NSSIDS). This result is similar to previous findings in clinical samples of adolescents (e.g., Washburn et al., 2015).

Compared to participants without NSSI, those engaging in NSSI exhibited more depressive and anxiety disorders, and higher suicide risk according to the MINI-KID classification. Moreover, although most participants in the non-NSSI group had 1 or 2 diagnoses, most participants in the NSSI group exhibited three or more clinical diagnoses (Table S1). Importantly, the average number of lifetime suicide attempts was higher in the NSSI group than in the non-NSSI group. Specifically, there were significantly more patients reporting one or more suicide attempts in the NSSI group vs the non-NSSI group (see Table 1). Collectively, these results indicate that the presence of NSSI entails greater clinical severity and higher suicide risk. Adolescents who engage in NSSI reported that the mean age of onset was 12.76 years (SD = 2.11). The most frequent types of NSSI were self- cutting (79.4%), hitting (74.8%), and scratching (71%) oneself. Results from the ISAS revealed that

adolescents from the NSSI group incurred in NSSI mainly with an intrapersonal motivation (intrapersonal vs. inter personal NSSI-function; $M_{intrapersonal}$ =3.41, SD =1.43; $M_{interpersonal}$ = .88, SD =.85; Z =-8.30, P < .001).

Table 2 depicts between-group differences (NSSI vs. Non-NSSI) in the self-report measures. Participants with NSSI showed lower scores in perceived social support and higher scores in borderline traits, emotion dysregulation, and psychological distress, which further suggests higher clinical severity in the presence of NSSI.

**Table 1.** *Sociodemographic Characteristics of the sample*

| | **NSSI** (N = 132) | | **Non-NSSI** (N = 96) | | **Analysis** | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Z | *P-value* |
| **Age** | 15.46 | 1.30 | 15.17 | 1.62 | -1.10 | .27 |
| **Lifetime Suicide Attempts** | .73 | 1.76 | .20 (.72) | | -4.40 | **<.001** |
| | n | % | n | % | $\chi^2$ | *P-value* |
| **Sex** (female) | 104 | 68 | 49 | 32 | 19.32 | **<.001** |
| **Academic Performance** | | | | | | |
| Bad | 48 | 36.36 | 18 | 18.75 | 9.97 | **<.01** |
| Regular | 36 | 27.27 | 26 | 27.08 | | |
| Good | 48 | 36.36 | 52 | 54.17 | | |
| **Study Time** | | | | | | |
| <10% of time per week | 57 | 43.51 | 27 | 29.03 | 10.02 | **<.05** |
| 50-75% of time per week | 12 | 9.16 | 18 | 19.35 | | |
| **Internet Time** | | | | | | |
| > 20 hours per week | 47 | 35.61 | 25 | 26.04 | 8.13 | .09 |
| **Mobile abuse** (almost always) | | | | | | |
| Item 1 | 60 | 45.47 | 19 | 18.78 | 17.43 | **<.001** |
| Item 2 | 30 | 22.70 | 15 | 15.60 | 2.64 | .26 |
| Item 3 | 32 | 24.18 | 14 | 14.62 | 4.28 | .11 |
| Item 4 | 20 | 15.20 | 9 | 9.37 | 1.85 | .39 |
| Item 5 | 42 | 31.78 | 22 | 22.87 | 2.31 | .31 |
| **Hours of Sleep** | | | | | | |
| < 6 hours per night | 38 | 28.79 | 8 | 8.33 | 15.11 | **<.05** |
| **Lifetime Suicide Attempts** (categorical) | | | | | | |
| 0 attempts | 80 | 60.50 | 85 | 88.50 | 21.69 | **<.001** |
| ≥ 1 attempts | 52 | 39.50 | 11 | 11.50 | | |

*Note*. Item 1 = ‘do you prefer to connect with people over the Internet than in person?’; Item 2 = ‘has your academic performance been adversely affected by social network usage?’; Item 3 = ‘do you suffer from sleep disorders due to aspects related to mobile phones?’; Item 4 = ‘do you feel restless when you don't receive messages or calls?’; Item 5 = ‘how often do you say things on your cell phone that you wouldn’t say in person?’.

**Table 2.** *Differences between Groups in Borderline Symptomatology, Perceived Social Support, Current Psychological Distress, and Emotion Dysregulation*

| | **NSSI** (N = 132) | | **Non-NSSI** (N = 96) | | **Analysis** | **Effect Size** |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mann-Whitney / Student´s *t*-test | Wilcoxon *r*/ Cohen´s *d* |
| **BPQ** | | | | | | |
| Suicide | 4.74 | 1.29 | 1.19 | 1.62 | -11.40*** | .78 |
| Impulsivity | 3.15 | 1.60 | 2.12 | 1.44 | -5.00*** | .33 |
| Self-Image | 5.80 | 2.49 | 3.22 | 2.75 | -6.59*** | .44 |
| Emptiness | 7.31 | 2.51 | 4.16 | 2.75 | -7.80*** | .52 |
| Affective Instability | 7.54 | 2.04 | 5.62 | 2.58 | -5.64*** | .37 |
| Intense Anger | 5.72 | 2.80 | 4.31 | 2.60 | -3.75*** | .25 |
| Quasi-Psychotic States | 2.49 | 1.88 | 1.05 | 1.22 | -6.03*** | .40 |
| Abandonment | 4.96 | 2.68 | 2.59 | 2.04 | -6.52*** | .43 |
| Relationships | 4.33 | 2.42 | 2.74 | 2.03 | -4.86*** | .32 |
| BPQ Total | 41.31 | 11.81 | 25.80 | 11.69 | -9.83*** | 1.32 |
| **MSPSS** | | | | | | |
| Family | 18.64 | 6.85 | 22.47 | 6.30 | -4.56*** | .30 |
| Friends | 18.92 | 7.47 | 21.30 | 6.68 | -2.58** | .17 |
| Significant Other | 21.22 | 7.08 | 21.80 | 7.46 | .89 | |
| MSPSS Total | 58.79 | 17.47 | 65.57 | 16.26 | -3.08** | .20 |
| **DASS-21** | | | | | | |
| Depression | 15.31 | 4.98 | 8.38 | 5.70 | -8.10*** | .54 |
| Anxiety | 13.29 | 5.64 | 7.24 | 5.18 | -7.22*** | .48 |
| Stress | 13.57 | 4.60 | 9.31 | 5.14 | -5.98*** | .40 |
| DASS total | 42.17 | 13.13 | 24.94 | 14.42 | -7.84*** | .52 |
| **DERS-18** | | | | | | |
| Awareness | 9.73 | 2.86 | 8.57 | 3.22 | -2.71** | .18 |
| Clarity | 10.14 | 3.26 | 7.76 | 3.59 | -4.90*** | .33 |
| Goals | 12.07 | 3.02 | 9.77 | 3.66 | -4.74*** | .32 |
| Impulse | 9.95 | 3.98 | 7.04 | 3.56 | -5.29*** | .35 |
| Nonacceptance | 9.40 | 4.00 | 6.29 | 3.34 | -5.66*** | .38 |
| Strategies | 10.17 | 3.54 | 6.71 | 3.35 | -6.68*** | .44 |
| DERS total | 61.45 | 12.80 | 46.15 | 13.94 | -8.59*** | 1.15 |

*Note*. BPQ = Borderline Personality Questionnaire; MSPSS = Multidimensional Scale of Perceived Social Support; DASS-21 = Depression, Anxiety and Stress Scale; DERS-18 = Difficulties in Emotion Regulation Scale. W = Mann-Whitney test; Wilcoxon r = effect size measure for the Mann-Whitney test.
* p < .05, **p < .01, ***p < .001.

***Logistic regression analysis***

Univariate logistic regression analyses showed that participant´s gender, perceived social support (except the "significant other" MSPSS subscale), borderline traits (BPQ), current psychological distress (DASS- 21), and difficulties in emotion regulation (all DERS-subscales) significantly predicted the odds of engaging in NSSI (Table 3). However, when all predictors were tested simultaneously in a multivariate regression, the final model obtained via backward stepwise selection showed that only borderline traits and current psychological distress significantly predicted NSSI, while gender was maintained in the model with a marginal significance (see Table 3). Receiver operating characteristic (ROC) analysis showed that the Area Under the Curve (AUC) of the final multivariate model was .84 (95% CI: .79-.89; Sensitivity =.92; Specificity =.62) and the OR was 20.33 (95% CI: 9.45-43.73, $p < .001$), indicating a high capacity to discriminate between patients with and without NSSI (see Fig. 1).

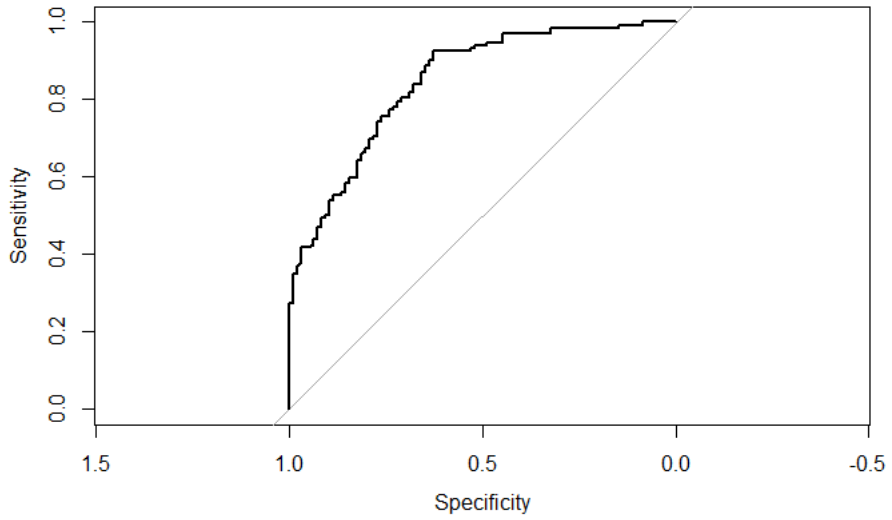



**Figure 1**. ROC curve final logistic regression model, AUC.

**Table 3.** *Uni- and Multivariate Logistic Regression Analyses Examining Predictors of NSSI*

| | **Univariate Analyses** | | **Multivariate Analyses** | |
|---|---|---|---|---|
| | OR (95% CI) | *P-value* | OR (95% CI) | *P-value* |
| Age | 1.15 (.96-1.38) | .12 | | |
| Sex | 3.56 (2.00-6.35) | **< .001** | 1.96 (.97-3.93) | .05 |
| **MSPSS** | | | | |
| Family | .91 (.87-.95) | **< .001** | | |
| Friends | .95 (.92-.99) | **< .05** | | |
| Significant others | .99 (.95-1.03) | .54 | | |
| MSPSS Total | .98 (.96-.99) | **< .01** | | |
| **BPQ** | 1.11 (1.08-1.15) | **< .001** | 1.07 (1.03-1.11) | **< .001** |
| **DASS-21** | 1.09 (1.06-1.11) | **< .001** | 1.05 (1.02-1.08) | **< .01** |
| **DERS-18** | | | | |
| Awareness | 1.14 (1.04-1.24) | **< .01** | | |
| Clarity | 1.22 (1.12-1.32) | **< .001** | | |
| Goals | 1.22 (1.12-1.33) | **< .001** | | |
| Impulse | 1.21 (1.13-1.31) | **< .001** | | |
| Nonacceptance | 1.24 (1.15-1.34) | **< .001** | | |
| Strategies | 1.31 (1.20-1.43) | **< .001** | | |
| DERS total | 1.08 (1.06-1.11) | **< .001** | | |
| | | | AIC = 226.08 | |

Note. OR = Odds Ratio; MSPSS = Multidimensional Scale of Perceived Social Support; BPQ = Borderline Personality Questionnaire; DASS-21 = Depression Anxiety and Stress Scales; DERS = Difficulties in Emotion Regulation Scale.

### *Mediation analysis*

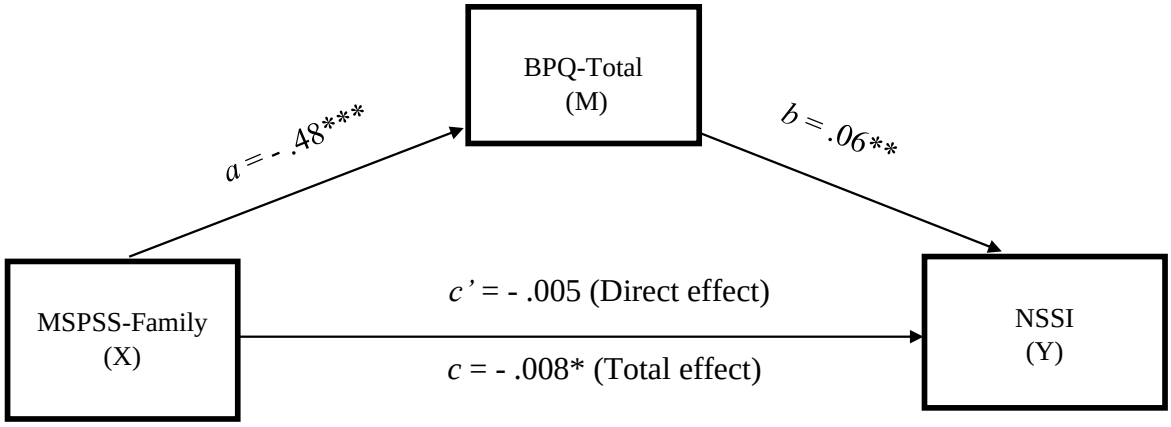
Given that the effect of PSS on NSSI disappeared when borderline traits was included in the regression, we conducted two mediation analyses to examine whether this variable could account for the relationship between: (i) MSPSS-Family and NSSI, and (ii) MSPSS-Friends and NSSI. That is, whether the relationship between low perceived social support

and NSSI could be explained by a negative association of PSS with borderline traits. Given that gender and current psychological distress (DASS-Total) significantly (or marginally) predicted NSSI in the final multivariate model, they were included in the analysis as covariates.

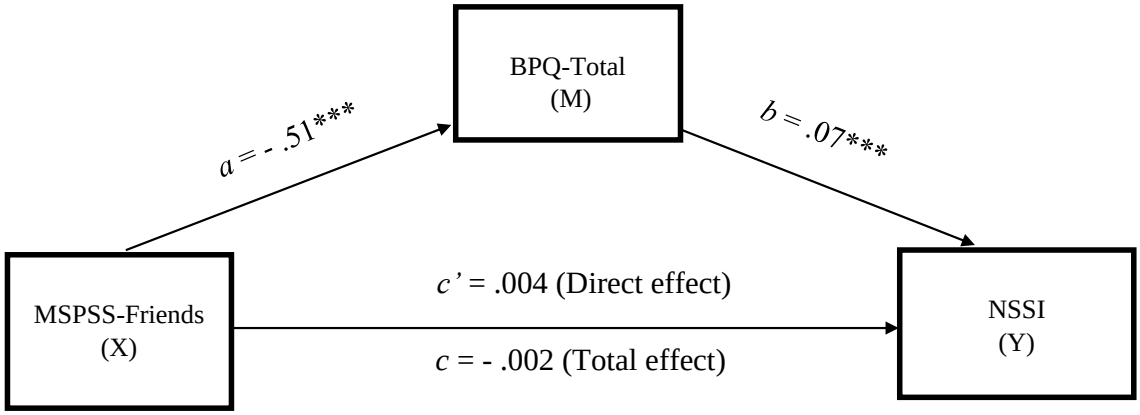
The effect of perceived social support from family (MSPSS-Family) on NSSI was fully mediated via borderline traits (BPQ). The boot strapped estimate for the average causal mediation effect (ACME) was -.004 (95% CI: -.006 to -.001). Thus, the indirect effect of MSPSS-Family on NSSI via BPQ was statistically significant, even when controlling for current psychological distress (DASS-21) and gender. The total effect, that is, the effect of MSPSS-Family on NSSI without controlling for the effect of the mediator, was estimated to be -.008 (95% CI: -.011 to -.001) and was also statistically significant. However, the average direct effect (ADE), that is, the effect of MSPSS-Family on NSSI after controlling for the effect of the mediator, was -.005 (95% CI: -.008 to 0.00) and did not remain significant, indicating a full mediation (Fig. 2A).

Similarly, the effect of perceived social support from friends (MSPSS- Friends) on NSSI was fully mediated via borderline traits (BPQ). The bootstrapped estimate for the average causal mediation effect (ACME) was -.006 (95% CI: -.000 to -.001), indicating that the indirect effect was significant, even when controlling for current psychological distress (DASS-21) and gender. The total effect was not statistically significant, -.002 (95% CI: -.008 to .01), and neither was the average direct effect (ADE), 004 (95% CI: -.003 to 0.01), indicating a full mediation (see Fig. 2B).

**A)**




**B)**




*p* < .001***, *p* < .05**, *p* < .01 *

**Figure 2.** Mediation models for NSSI (controlling for gender and current psychological distress; DASS-21). (**A)** Borderline traits (BPQ) fully mediate the relationship between perceived social support from family (MSPSS-Family) and probability of engaging in NSSI. (**B)** Borderline traits (BPQ) fully mediate the relationship between perceived social support from friends (MSPSS-Friends) and probability of engaging in NSSI.

To evaluate the specificity of borderline traits as a mediator in the relationship between perceived social support and NSSI, we conducted two additional mediation analyses exploring current psychological distress (DASS-21) as a mediator (controlling for borderline traits and gender). The bootstrapped estimate for the average causal mediation effect was not significant either for the mediation analysis with MSPSS- Family as the independent variable (ACME =-.0005 [95% CI: -.001 to .00]) or for the mediation analysis with MSPSS-Friends as the independent variable (ACME = .001 [95% CI: -.0001 to .00]). Therefore, perceived social support from family and friends only exerts an indirect effect on NSSI through borderline traits, but not through current psychological distress. Since none of the emotion dysregulation dimensions remained significant in the multivariate model, they were not further explored as potential mediators.

Finally, as depicted in Figure S1, the mediation results we obtained using the standardized regression coefficients are consistent with the results we obtained using the unstandardized coefficients. In addition, given the cross-sectional design of our data, we analyzed alternative models with BPD-traits as the predictor and PSS as the mediator, but the indirect effect was not statistically significant (see the Supplementary Material).

**Discussion**

In the current study, we evaluated the association between perceived social support (PSS) and NSSI in a psychiatric sample of adolescents, and we also explored potential mediators of this relationship. Specifically, and in a novel way, we analyzed the mediating role of borderline personality traits. The most relevant results of this study suggest that low PSS from family and peers was indirectly related to NSSI through borderline personality traits, even when controlling for gender and current psychological distress. This finding

suggests that adolescents with low PSS may be especially vulnerable for developing NSSI due to elevated BPD traits.

The prevalence of NSSI in our sample (58%) was similar to previous studies with clinical samples (Kaess et al., 2013). Importantly, our findings suggest that the presence of NSSI is associated with high clinical severity and suicide risk, as well as with low interpersonal, academic, and daily functioning, regardless of the diagnosis. This finding is in line with previous research suggesting that NSSI may be an unspecific pre cursor of psychopathology and suicide (Groschwitz et al., 2015; Meszaros et al., 2017). Furthermore, adolescents engaging in NSSI reported lower PSS from family and friends and exhibited a stronger preference to interact virtually (e.g., connect with peers over the internet that in person), compared to adolescents without NSSI. These results are congruent with recent work indicating a relationship between PSS and risk of engaging in NSSI in clinical samples (Baiden et al., 2017; Miller et al., 2015). Moreover, consistent with our findings, previous studies have suggested that individuals with low PSS tend to use online social networks to compensate for the lack of social support experienced in the 'real world' (Tang et al., 2021).

Previous research shows that lower social support from family and peers plays a crucial role in the onset and maintenance of NSSI (Brown and Witt, 2019; Rissanen et al., 2021; Victor et al., 2019). The present study extends this evidence, providing data in a well-characterized clinical sample of adolescents. Specifically, in our sample, adolescents with NSSI perceived less support from family and friends than their counterparts without NSSI did, suggesting that PSS from very close relationships (i.e., family and friends but not from significant others) is a factor involved in NSSI. On the one hand, this finding may suggest an important role of interpersonal stress in triggering NSSI. In the context of low PSS, there

may be a higher frequency of interpersonal stressors, which may enhance negative affect and promote NSSI as an emotion regulation strategy (Nock, 2010). On the other hand, the relationship between low PSS and NSSI may also indicate that adolescents who engage in NSSI may feel rejected or stigmatized by family and friends due to their self-harm behavior (Piccirillo et al., 2020), and may therefore feel less supported by their central social network.

We conducted a multivariate analysis to better understand the relationship between PSS and NSSI, which revealed that borderline traits and psychological distress significantly predicted NSSI, while PSS did not. This finding suggests that when tested simultaneously, clinical status is a better predictor of NSSI than PSS. Importantly, the NSSI predictor with the highest odds ratio in the multivariate model was borderline traits. This is consistent with a longitudinal study reporting that BPD features (along with NSSI severity) was the best predictor of continued engagement in NSSI one year later (Glenn and Klonsky, 2011), as well as with prior research showing that BPD-symptoms are associated with an increased risk of engaging in NSSI (Reichl and Kaess, 2021; Stead et al., 2019). In addition to borderline traits, current psychological distress also appeared as a significant predictor of NSSI in our sample. Given that this predictor includes symptoms of anxiety and depression in the last two weeks, our results are consistent with prior findings in both adolescents (Giletta et al., 2012) and young adults (Kiekens et al., 2020) suggesting that higher levels of depressive symptoms in the past weeks predict NSSI (Fox et al., 2015). In contrast with our hypothesis, emotion dysregulation did not remain as a significant predictor of NSSI in the multivariate model.

Finally, we conducted a mediation analysis to explore if clinical status (i.e., BPD traits and current psychological distress) intermediates between PSS and the odds of

engaging in NSSI. This analysis revealed that borderline traits fully explained the relationship between PSS (from family and friends) and NSSI, even when controlling for current psychological distress (i.e., symptoms of depression, anxiety, and stress). This would mean that, low PSS is associated with NSSI through higher levels of BPD traits. This finding is consistent with a recent study suggesting that high-perceived support from parents predicted fewer BPD symptoms in a psychiatric sample of adolescents, while invalidating behaviors from parents were associated with greater BPD symptoms in daily life (Vanwoerden et al., 2021). Congruently, recent research shows that adolescents with BPD perceive their caregivers to be less supportive and more invalidating than did controls without BPD, suggesting that their perceptions of caregiving behaviors are vital in the context of enduring borderline psychopathology (Bennett et al., 2019). Research in non-clinical adult samples also indicates that BPD features are associated with fewer supportive relationships and less satisfaction with social support (Beeney et al., 2018; Lazarus et al., 2016; Zielinski and Veilleux, 2014). Importantly, while BPD features are associated with low PSS, they are also closely associated with NSSI. For example, the number of BPD criteria met significantly predicted repeated (vs. single) NSSI history in an outpatient clinical sample of adolescents (Muehlenkamp et al., 2011).

While borderline traits mediated the relationship between PSS and NSSI when controlling for current psychological distress (e.g., depressive symptoms), current psychological distress did not significantly mediate this relationship when controlling for borderline traits. This result shows the relevance of long-lasting traits versus state symptoms in the relationship between PSS and NSSI. This finding may be inconsistent with prior studies in non-clinical samples that highlight the mediating role of depressive symptoms (Madjar et

al., 2021; Rissanen et al., 2021). However, those studies did not control for borderline symptomatology, possibly because the latter tends to be more common in clinical rather than non-clinical adolescent samples (Hutsebaut and Aleva, 2021; Reichl and Kaess, 2021).

The current study highlights the role of interpersonal factors in adolescent NSSI, adding to existing research in clinical samples that has thus far focused on comorbid psychopathology, stressful life events and neglected social factors (Greenfield et al., 2015; Skabeikyte and Bar kauskiene, 2021; Strandholm et al., 2017). Despite promising findings, the present study is not without limitations. First, due to our cross-sectional design, we cannot establish temporal precedence in the relationships proposed in the mediation analyses (e.g., whether PSS predicts BPD traits or vice versa). Even though we tested a plausible, alternative model with BPD traits as the predictor and PSS as the mediator and found that the hypothesized indirect effect there did not materialize, our cross-sectional design does not allow us to discard this alternative model, and the matter will ultimately have to be investigated in longitudinal studies. Second, our data were collected through self-report questionnaires, which may entail retrospective memory biases. Third, our measure of PSS is quite general and fails to capture whether low PSS refers to childhood adversity or a difficult childhood temperament. Fourth, although participants were thoroughly assessed, no specific interview was used to diagnose BPD. Finally, although it was not the aim of the present study, future research needs to address potential differences between patients with NSSI who meet the full criteria for NSSI disorder and patients with NSSI who do not meet the full criteria Findings from these studies may help determine the clinical utility of NSSI as an independent diagnostic category (Hooley et al., 2020).

Current findings highlight the mediating role of borderline traits in the relationship between PSS and NSSI. Results suggest that adolescents with NSSI constitute a more severe clinical group due to more pronounced BPD-traits and less PSS. Importantly, current results are consistent with previous evidence suggesting a role of perceived invalidation in borderline pathology (Zanarini et al., 1997). Findings could have several implications for prevention and treatment of NSSI in adolescents. On the one hand, our results emphasize the importance of evaluating BPD-traits in clinical settings, especially in those adolescents reporting low PSS. On the other hand, findings support the use of specific interventions aimed at improving BPD symptoms and social support in adolescent patients with NSSI and their caregivers (e.g., the Dialectical Behavioral Therapy; Boritz et al., 2021; McCauley et al., 2018). Indirectly, our findings could also be useful in the context of the current pandemic, where compliance with social distancing measures may lead to lower PSS and increased risk of NSSI, especially among adolescents with elevated BPD traits. Future research should also consider replicating our findings in non-clinical samples of adolescents with sub-clinical BPD.

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UNIVERSITAT DE BARCELONA

# The role of Emotion Dysregulation in Non-Suicidal Self-injury and Borderline Personality Disorder: Predictors and Mechanism-Based Treatment Approach

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