2022

LATENT CLASSES OF SYMPTOM TRAJECTORY IN A BRIEF TREATMENT FOR BORDERLINE PERSONALITY DISORDER

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Digital Object Identifier: https://doi.org/10.13023/etd.2022.452

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LATENT CLASSES OF SYMPTOM TRAJECTORY IN A BRIEF TREATMENT FOR BORDERLINE PERSONALITY DISORDER

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Arts and Sciences
at the University of Kentucky

By

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2022

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ABSTRACT OF THESIS

LATENT CLASSES OF SYMPTOM TRAJECTORY IN A BRIEF TREATMENT FOR BORDERLINE PERSONALITY DISORDER

It is likely that patients with BPD progress through treatment in different ways. Characterizing symptom trajectories during treatment can facilitate the identification of distinct treatment responses, which may be shared by subgroups of patients. Researchers have consistently identified multiple distinct symptom trajectories among individuals with common psychopathological conditions, but no research to date has attempted to do so among patients with BPD. This study used latent growth mixture modeling to identify and characterize distinct classes of symptom trajectories among patients receiving an 18-week cognitive-behavioral treatment for BPD. Two distinct BPD symptom trajectories were identified in this sample, which were primarily separated by symptom severity throughout treatment. Patients with BPD symptoms severity above a certain threshold at baseline therefore may not be suitable candidates for brief treatment. In addition, non-responders reported significantly higher severity in concurrent mood disorder symptoms, greater functional impairment, lower conscientiousness, and higher neuroticism. At outcome, non-responders had significantly lower agreeableness. Identifying symptom trajectories in this population may be useful in detecting patient deviation from anticipated progress, and personalizing treatment plans. In addition, determining baseline factors associated with certain trajectories may improve clinicians' ability to assign patients to optimal treatment protocols.

KEYWORDS: Trajectory, Symptom Change, Outcome, Borderline Personality Disorder, Baseline Predictors

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CHAPTER 1. INTRODUCTION

1.1 Background

Borderline personality disorder (BPD) is a severe and heterogeneous condition characterized by a pervasive pattern of instability in interpersonal relationships, self-image, emotion, and impulsive behavioral responses (American Psychiatric Association [APA], 2013). BPD is the most commonly diagnosed personality disorder across treatment settings, occurring in 10-20% of people receiving outpatient treatment, and up to 40% of people receiving inpatient treatment, and has a prevalence of 1.6% to 5.9% in the general population (APA, 2013; Grant et al., 2008; Zimmerman et al., 2008). BPD is also highly comorbid with other forms of psychopathology, especially depressive, anxiety, and substance use disorders (Carpenter et al., 2015; Grant et al., 2008).

A diagnosis of BPD requires the endorsement of five out of nine symptoms according to the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5), resulting in 256 different symptom combinations (APA, 2013). Based on this definition, two people could receive a diagnosis of BPD and share only one symptom in common. This variability in symptom presentation may indicate variability in how people with BPD respond to treatment (Cardona et al., 2021). For example, a person who primarily endorses BPD symptoms of emotional instability (e.g., affective liability, inappropriate or intense anger, feelings of emptiness) may respond to and progress through treatment differently than a person who primarily endorses symptoms of relationship difficulties (e.g., unstable and chaotic relationships, fear of abandonment, paranoid ideation).

Despite this variability in symptom combinations, instability across domains is considered a core feature of BPD, as people with BPD experience frequent fluctuations in mood, self-image, and relationship functioning. A multitude of studies using ambulatory assessment methodology have demonstrated that people with BPD show heightened affective instability in daily life compared to people without the condition (Kockler et al., 2022). For example, Tolpin et al., (2004) used daily process design to demonstrate that individuals who have higher BPD features experience greater instability in mood and self-esteem on a daily basis. Existing treatments for BPD are not specifically designed to reduce symptom fluctuation but instead focus on reducing the severity of patients' negative affectivity, or teaching adaptive coping skills to increase emotion regulation (e.g., dialectical behavior therapy [DBT]; Linehan, 1993) or attachment insecurity (e.g., mentalization-based treatment [MBT]; Bateman and Fonagy, 2008). However, several evidence-based treatments have demonstrated efficacy in reducing the symptoms of instability that characterize this condition (Cristea et al., 2017), highlighting that instability is an important aspect of the presentation and treatment of BPD.

Given the heterogeneity and instability that characterize BPD, it is likely that patients with this disorder progress through treatment in different ways. Characterizing patients' treatment trajectories at the individual or subgroup level can facilitate the identification of unique treatment responses, deviation from anticipated progress, and personalized treatment plans that make treatment more efficient for a given individual. By characterizing patients' trajectories of symptom change in treatment, it may further be possible to empirically link specific trajectories to better outcomes and predict these trajectories from baseline characteristics. For example, if a patient is following a

trajectory associated with ultimate nonresponse, clinicians may use this information to examine the therapeutic alliance, consider patient motivation for change, or otherwise modify their treatment plan. Similarly, if a patient is following a trajectory associated with positive response, clinicians can be confident that the current treatment plan is facilitating the desired change. Researchers have yet to examine specific symptom trajectories among patients receiving treatment for BPD, though numerous researchers have identified common symptom trajectories among patients with psychiatric conditions that are frequently comorbid with BPD, such as post-traumatic stress disorder (PTSD), major depressive disorder (MDD), and a variety of anxiety disorders (Currier et al., 2014; Hartmann et al., 2018; Murphy & Smith, 2018; Owen et al., 2015; Palmer et al., 2021).

1.2 Characterizing Symptom Change in Treatment

The majority of researchers examining symptom change during treatment have used single model curves to determine whether treatment leads to symptom change at the group level (i.e., on average). For instance, DBT has been shown to lead to decreases in symptoms, suicidal thoughts and behaviors, and hospitalizations on average across several samples of patients with BPD (Cristea et al., 2017). Recently, researchers have begun to model multiple treatment trajectories simultaneously, rather than relying on single model curves. Modeling multiple trajectories allows for the identification of subgroups of patients that progress through treatment on distinct paths. For example, Owen et al. (2015) studied changes in broad psychological symptoms among nearly 11,000 patients receiving short-term treatment in 47 treatment centers in the United States. They identified three distinct treatment trajectories: rapid change (early or late in treatment), deterioration followed by improvement, and slow but steady improvement.

Two of these trajectories (i.e., rapid early change and slow and steady improvement) were replicated in an independent sample of 2,500 patients receiving short-term treatment at a university counseling center (Palmer et al., 2021). These results provide large-scale evidence of distinct and replicable symptom trajectories, though both studies were conducted in naturalistic settings in which specific diagnoses were not collected.

Among patients receiving treatment for specific disorders, researchers have consistently identified at least two classes of symptom trajectories: (1) non-responders, who either do not meaningfully improve or initially improve before reaching a plateau and (2) responders, who demonstrate either rapid, early improvement or steady and consistent improvement throughout treatment (Allan et al., 2016; Behrendt-Moller et al., 2019; Hartmann et al., 2018; Held et al., 2021; Lin & Farber, 2021; Ulvenes et al., 2021). Beyond these two classes, findings are largely inconsistent regarding the numbers of distinct symptom trajectories patients follow, with researchers identifying three to seven classes, depending on the disorder and treatment setting (Currier et al., 2014; Hartmann et al., 2018; Held et al., 2021; Murphy & Smith, 2018). Despite inconsistencies in the specific number of symptom trajectories, these findings demonstrate that patients with a variety of mood, anxiety, and related disorders exhibit patterns of trajectories of symptom change, although these distinct trajectories have yet to be examined in treatments for BPD.

1.3 Predicting Trajectories from Baseline Factors

Researchers who have identified distinct and replicable symptom trajectories in certain disorders have explored factors that predict these trajectories at the start of treatment. The most well-replicated predictor of symptom trajectories to date is baseline

symptom severity. Patients with more severe symptoms of anxiety, PTSD, and depression at the start of treatment are more likely to follow nonresponse trajectories than patients with milder baseline symptoms (Allan et al., 2016; Elliott et al., 2005; Lin & Farber, 2021). By contrast, several researchers have examined whether demographic characteristics are related to distinct symptom trajectories, but thus far, no consistent demographic predictors have emerged (Chu et al., 2013; Currier et al., 2014; Heckman et al., 2017).

In the context of specific treatment protocols, additional baseline factors have shown promise in predicting symptom trajectories. For example, negative cognitions, negative mood, and greater hyperarousal distinguished the "minimal response" trajectory from other trajectories among veterans with PTSD receiving brief cognitive processing therapy (Held et al., 2021). Among inpatients with MDD, those with greater concurrent PTSD symptom severity, higher emotional distress, and greater fears of compassion were more likely to follow the "deterioration before improvement" trajectory (Ulvenes et al., 2022). Taken together, these results suggest that psychological, rather than demographic, characteristics at baseline may be particularly useful in distinguishing unique symptom trajectories.

As unique symptom trajectories among patients with BPD have yet to be identified, it is unclear if any common or treatment-specific baseline factors would predict them in this population. However, the previous research on other mental health conditions described above point to candidate factors. For instance, baseline BPD severity may predict membership in particular response classes, similar to studies of depression, anxiety, and PTSD (Allan et al., 2016; Elliott et al., 2005; Lin & Farber,

2021). People with differing levels of BPD symptom severity show differential responses to skill use during treatment (Seow et al., 2020), and greater clinical severity has been associated with better or poorer outcomes, depending on the treatment protocol provided (Bateman & Fonagy, 2013; Kvarstein et al., 2019). In addition, particular BPD symptoms (e.g., interpersonal difficulties, endorsement of suicidal behaviors) may predict treatment trajectories, akin to hypervigilance emerging a predictor of response in PTSD samples (Held et al., 2021). Moreover, the presence of comorbid conditions, particularly PTSD (Ulvenes et al., 2022), may affect treatment response for patients with BPD. Finally, researchers have suggested that treatment-specific mechanisms (e.g., negative cognitions in cognitive processing therapy; CPT; Resick et al., 2016) can also predict patients' symptom trajectories in treatment (Held et al., 2021). Different treatments for BPD also specify putative mechanisms of action (e.g., emotion intolerance in DBT, mentalizing in MBT) that could be used to potentially predict symptom trajectories.

1.4 Predicting Outcomes from Symptom Trajectories

Implicit in the definitions of symptom trajectories is that different trajectories are associated with different treatment outcomes. Trajectories characterized by early and rapid symptom reduction have been shown to predict positive immediate treatment outcomes in both symptoms and global functioning regardless of the treatment provided (Lewis et al., 2012; Lutz et al., 2009). Similarly, the occurrence of rapid symptom decreases, referred to as sudden gains, at any point in treatment consistently predicts positive ultimate symptom change for a variety of psychiatric conditions (Shalom & Aderka, 2020).

However, the majority of researchers who have examined the association between symptom trajectories and outcomes use the same construct (e.g., total symptom severity) to define both trajectory and outcome (Lutz et al., 2009; Schumm et al., 2013; Zeeck et al., 2020). Using the same construct to define both trajectories and outcomes to distinguish between responders and non-responders may lead to redundant conclusions: patients who follow a trajectory involving a decrease in symptoms are more likely to have lower symptom severity at the end of treatment. To avoid this redundancy, it may be more appropriate to use separate constructs to define patients' trajectories and outcomes. Depending on the context and problem area, a wide range of variables can represent valued outcomes (e.g., symptom severity, quality of life, frequency of a behavior, relationship satisfaction, functioning; Boswell, 2020). For instance, researchers examining treatments for BPD have defined outcomes using symptoms (e.g., impulsivity, affective liability, self-image, self-harm), emotion regulation, global functioning, and interpersonal functioning (Cheavens et al., 2022; Finch et al., 2019; Guimond et al, 2021; Laporte et al., 2018). Researchers have demonstrated that BPD can be conceptualized by high neuroticism, low agreeableness, and low conscientiousness (Saulsman & Page, 2004; Samuel and Widiger, 2008). Therefore, scores on these dimensions may serve as potential treatment outcomes. In addition, people with BPD often have high levels of mood disorder symptoms (Dell'Osso et al., 2019). Thus, severity of concurrent mood disorder symptoms may also be an indicator of treatment outcome among people with BPD.

1.5 Limitations of Treatment Research on BPD

Despite the possibility of multiple unique symptom trajectories in treatments for BPD, no researchers to our knowledge have identified them. Several study design characteristics may have contributed to this lack of research. First, BPD treatment studies may be underpowered to identify distinct trajectories (Weller et al., 2020). Evidence-based treatments for BPD are delivered for up to a year (Clarkin et al., 2001; Young et al., 2003; Linehan, 1993) which limits both the number of participants who can be enrolled and makes more intensive assessments less feasible. For instance, many BPD treatment studies include relatively small sample sizes (i.e., *ns*: 50-100), with assessments spaced 3-4 months apart (Linehan et al., 2015; Rizvi et al., 2017; Yin et al., 2021). By contrast, distinct symptom trajectories have been identified in treatment studies of MDD in larger samples (i.e., *n*s: 50-500) with either weekly or monthly assessments (Lin & Farber, 2021; Hartmann et al., 2018). A limited number of timepoints may reduce researchers' ability to identify meaningful latent classes without the use of larger sample sizes (Weller et al., 2020). A relatively brief treatment for BPD is well-suited to both recruit a larger sample and include more frequent assessments, which would provide greater power to identify distinct symptom trajectories. Together, this information can inform clinicians about whether a patient is following a symptom trajectory that is likely to result in a poor response, thus allowing clinicians to modify treatment accordingly.

1.6 Current Study

The current study was a secondary analysis of data collected among patients receiving an 18-session cognitive-behavioral treatment for BPD (BPD Compass; Sauer-Zavala et al., 2022). Specifically, we used latent growth mixture modeling to explore

potential classes of BPD symptom trajectories. We evaluated trajectories based on empirical change during treatment (i.e., symptom severity during and at the end of treatment) without imposing a priori specifications on the number or shape of trajectories. Thus, we did not have hypotheses related to number and shape of trajectories, nor for the number of participants exhibiting each pattern.

The second goal of the current study was to test whether membership in distinct trajectory classes can be predicted by demographic factors, BPD symptom severity, presence of comorbid conditions, and clinical characteristics (including mood symptoms, functioning, and quality of life). Researchers have consistently found that BPD is associated with a high prevalence of childhood trauma (Golier et al., 2003) and that there is a high comorbidity between BPD and PTSD (Zanarini et al., 2011). People with comorbid BPD and PTSD have poorer functioning compared to either diagnosis alone (Pagura et al., 2010), and demonstrate less favorable response to treatment (Barnicot & Priebe, 2013; Vignarajah & Links, 2009). Therefore, in addition to the presence of a diagnosis of PTSD, we explored whether baseline PTSD symptom severity as a predictor of BPD symptom trajectories. Additionally, BPD Compass is designed to target three personality-based mechanisms that are implicated in the development and maintenance of BPD: negative affectivity, antagonism, and disinhibition. Thus, we also examined whether putative mechanisms relevant to the treatment (i.e., negative affectivity, agreeableness, conscientiousness) predict trajectories. Finally, based on prior findings that higher baseline symptom severity was associated with non-responder trajectories (Allan et al., 2016; Elliott et al., 2005; Lin & Farber, 2021), we hypothesized that patients

with elevated baseline symptoms will be more likely to demonstrate a symptom trajectory resulting in nonresponse.

The third goal of the present study was to explore whether membership in a given trajectory class predicts functioning/outcomes at the final treatment session. To overcome the limitations of previous studies that have used the same measure to determine class and outcomes, we examined whether certain trajectories (determined using BPD symptom severity) predict mood disorder symptoms and the personality dimensions relevant to BPD at each patient's last session of treatment.

CHAPTER 2. METHOD AND MATERIALS

2.1 Participants

A sample of adult participants were recruited for this study via online advertisements and from a general pool of people seeking treatment at a local graduate student training clinic. People were eligible for the study if they met DSM-5 (APA, 2013) criteria for BPD; were willing to maintain a stable dosage of psychotropic medications; and were willing to refrain from additional non-study psychological treatment for the duration of the study period. People were excluded if they endorsed symptoms that would be better addressed by alternative treatments (e.g., psychotic disorders, mania within the past year, substance use disorders necessitating a higher level of care, or acute suicide risk). After exclusion criteria, a final sample of 40 people were included in this study. The study was approved by the local university Institutional Review Board, and participants provided informed consent prior to engaging in any research activities.

2.2 Study Treatment

The current study was a secondary data analysis of a randomized waitlist control trial designed to evaluate BPD Compass, a novel, personality-based, 18-session treatment for BPD (Sauer-Zavala et al, 2022). BPD Compass, which loosely stands for Cognitive-behavioral Modules for Personality Symptoms, was designed to engage the putative mechanisms associated with the three personality dimensions most characteristic of BPD: negative affectivity, antagonism, and disinhibition. The components of BPD Compass were drawn from or inspired by existing treatments targeting emotion dysregulation and impulsivity (e.g., DBT) and attachment insecurity (e.g., MBT, Schema-Focused Therapy, [SFT]: Young et al., 2003), with added content focused on values identification.

Specific treatment components of BPD Compass were administered in modules of 3-6 weekly, individual, 50-60 minute sessions. The first module involves three sessions: psychoeducation, values identification, and self-monitoring of emotional experiences and their short- and long-term consequences. The second module involves four sessions focused on cognitive interventions (e.g., cognitive restructuring, core belief identification). The third module involves six sessions focused on behavior change (e.g., opposite action to emotion driven urges, assertiveness training, emotional exposures). The last module involves four sessions focused on mindfulness skills (e.g., nonjudgmental emotion awareness, compassion training, urge surfing), with a final session dedicated to preventing relapse. Sessions within the second, third, and fourth module were focused on targets related to negative affectivity, antagonism, or disinhibition. For instance, each session of the cognitive restructuring module was applied to automatic thoughts related to strong negative emotions (negative affectivity),

relationships (antagonism), or impulsive urges (disinhibition), with a final wrap-up/troubleshooting session.

2.3 Study Design

Upon referral or self-referral to the study, participants completed a brief phone screen to determine potential eligibility. Likely eligible participants then underwent a structured diagnostic assessment, which consisted of informed consent procedures and an interview-based diagnostic assessment to confirm study eligibility and assess baseline clinical severity. Assessments were conducted by advanced graduate students masked to study condition. Participants completed a battery of baseline self-report questionnaires, including BPD symptoms, demographic factors, BPD-relevant constructs, and treatment-relevant constructs. Following the baseline assessment, participants were randomized to either an immediate treatment condition or an 18-week delayed treatment condition. All study procedures (i.e., phone screens, assessments, therapy sessions) were conducted via telehealth due to the COVID-19 pandemic.

Those in the immediate treatment condition began receiving treatment after the baseline assessment. Participants completed weekly self-report measures of BPD symptoms, anxiety, and depression no more than 24 hours before each session. Following session 18, participants repeated the diagnostic assessment and self-report measures administered at baseline. Those assigned to the delayed treatment condition began treatment 18 weeks after their initial phone screen and diagnostic assessment. After this waitlist period, participants completed the same diagnostic assessment and baseline self-report battery prior to beginning treatment. Participants then began treatment, following

the same procedures and assessment schedule as those in the immediate treatment condition.

2.4 Measures

Treatment Trajectories

BPD Symptoms. The self-report version of the Zanarini Rating Scale for Borderline Personality Disorder (ZAN-BPD; Zanarini et al., 2015) is a 9-item measure of BPD symptoms over the past week. Ratings of each item range from 0 (*no symptoms*) to 4 (*severe symptoms*) and are summed to create a total score ranging from 0 to 36. Participants completed the ZAN-BPD at baseline and before each weekly session. The self-report ZAN-BPD was used to define BPD symptom trajectories. In the current sample, ZAN-BPD items demonstrated good internal consistency at baseline (α = .87).

Baseline Predictors of Treatment Trajectories

Demographic Characteristics. Demographic characteristics were collected at baseline, and include age, gender, racial background, income, education level, martial status, and sexual orientation.

BPD Symptom Severity. Given that the self-report version of the ZAN-BPD was used to define trajectory classes, to avoid criterion contamination, we used the summed clinician-rated version of the ZAN-BPD as a predictor of trajectories. In the current sample, assessors demonstrated excellent reliability on ZAN-BPD severity ratings (Krippendorff's a = .99, 95% CI [.97, 1.00])

Personality at Pre-Treatment. The Big Five Inventory-2 subscale (BFI-2; Soto & John, 2017) is a 60-item measure designed to assess the Big Five personality dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism.

Ratings on each item range from 1 (*disagree strongly*) and 5 (*agree strongly*) and each subscale is averaged to create a mean score ranging from 1 to 5. Scores on personality dimensions consistently associated with BPD (neuroticism, agreeableness, and conscientiousness) were included as predictors of treatment trajectories. Participants completed the BFI-2 at baseline. In the current sample, the BFI-2 items in each subscale demonstrated good internal consistence at baseline (Neuroticism α = .86, Agreeableness α = .85, Conscientiousness α = .87).

PTSD Symptoms. Comorbid diagnoses were assessed using the Diagnostic Interview for Anxiety, Mood, and OCD and Related Neuropsychiatric Disorders (DIAMOND; Tolin et al., 2018), a semi-structured clinician-rated interview. You can pull the psychometrics and reliability from the main outcomes paper. The DIAMOND was used to assess the *presence* (or absence) or PTSD. Additionally, the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013) is a 20-item measures designed to assess the *severity* of PTSD symptoms corresponding to the DSM-5 (APA, 2013). Ratings on each item range from 0 (*not at all)* to 4 (*extremely)* and are summed to create a total score of 0-18, with a clinical cutoff score of 31-33. Participants who endorsed a past traumatic event completed the PCL-5 at baseline. In the current sample, the PCL-5 items demonstrated excellent internal consistency at baseline (α = .95).

Functioning. The Work and Social Adjustment Scale (WSAS; Mundt et al., 2002) is a 5-item self-report measure of functional impairment experienced over the past week. Ratings of each item range from 0 (*not at all*) to 8 (*severe interference*) and are summed to create a total score ranging from 0 to 40. Participants completed the WSAS at

baseline and post-treatment. In the current sample, the WSAS items demonstrated good internal consistency at baseline (α = .85).

Quality of Life. The Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q; Endicott et al., 1993) is a 14-item self-report measure of overall satisfaction in a variety of domains (e.g., work, mood, household activities) over the past week. Ratings of each item range from 1 (*very poor*) to 5 (*very good*) and are summed to create a total score ranging from 14 to 70. Participants completed the Q-LES-Q at baseline and post-treatment. In the current sample, the WSAS items demonstrated excellent internal consistency at baseline (α = .90).

Treatment Outcomes

Anxiety and Depression at Post-Treatment. The Overall Anxiety Severity and Impairment Scale (OASIS; Norman et al., 2006) is a 5-item self-report measure of anxiety symptoms over the past week. Ratings of each item range from 0 (*none*) to 4 (*extreme*) and are summed to create a total score ranging from 0 to 20, with a clinical cutoff score of 8. Participants completed the OASIS at baseline and before to each weekly session. The Overall Depression Severity and Impairment Scale (ODSIS; Bentley et al., 2014) is a 5-item self-report measure of depressive symptoms over the past week. Ratings of each item range from 0 (*none*) to 4 (*extreme/constant*) and are summed to create a total score ranging from 0 to 20, with a clinical cutoff score of 8. Participants completed the ODSIS at baseline and before each weekly session. In the current sample, the OASIS and ODSIS items demonstrated excellent internal consistency at baseline (OASIS α = .92; ODSIS α = .93).

Personality at Post-Treatment. The Big Five Inventory-2 Extra-Short Form (BFI-2-XS) is a 15-item measure designed to briefly assess the Big Five personality dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Ratings on each item range from 1 (*disagree strongly*) and 5 (*agree strongly*) in each subscale are averaged to create a mean score ranging from 1 to 5. Scores on personality dimensions consistently associated with BPD (neuroticism, agreeableness, and conscientiousness) were included as measures of treatment outcome at patient's final session. Patients completed the BFI-2-XS before each session. In the current sample, the BFI-2-XS items in each subscale demonstrated poor-to-questionable internal consistency at patient's final session (Neuroticism α = .62, Agreeableness α = .61, Conscientiousness α = .55).

2.5 Data Analytic Plan

To identify patients' trajectories of BPD symptoms, a latent growth mixture model (LGMM) was conducted on patients' total BPD symptom scores at 18 time points throughout the course of treatment, using *lcmm* package (Proust-Lima et al., 2017) in R (Version 1.4; R Core Team, 2020). LGMM was chosen over other methods (i.e., cluster analysis, group-based trajectory modeling) because LGMM can identify unique subgroups that share a similar trajectory across a series of longitudinal scores (Nylund et al., 2007), and has been used to identify and characterize trajectories of change in patients receiving psychotherapy (Laurenceau et al., 2007; Lin & Farber, 2021). In addition, LGMM allows for greater variability in trajectories within identified classes when compared to other methods (i.e., latent class analysis). Due to the variability and symptom fluctuation common in BPD (Cardona et al., 2021), allowing this variability

within classes may better capture symptom trajectories within this population. The inclusion of random effects in LGMM allows for examination of within-class variability in addition to between-class variability, increasing the nuance of predictor effects (Frankfort et al., 2016). The LGMM models were estimated using robust maximum likelihood method with 100 initial stage random starts to determine if the best log-likelihood is reached, and therefore that models are not only representative of a local maximum solution (Frankfurt et al., 2016).

To determine the number of classes of BPD symptom trajectories, we started with a one-class model and then added one additional class in subsequent models until the addition of more classes did not improve the model's ability to explain changes in BPD symptoms during treatment. Information criteria that reward parsimony (fewer parameters) was compared for each model to determine the model fit, including Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Consistent AIC (CAIC), and Sample Size Adjusted BIC (ssBIC). AIC and BIC are the most commonly used of these criteria (Nylund et al., 2007), therefore the most weight was given to these values, with lower values indicating better fit. In addition, several information criteria that factor optimal entropy were examined for each model, including Classification Likelihood Criterion (CLC) and Normalized Entropy Criterion (NEC), with lower values indicating better fit. Finally, model entropy was examined, which is a measure of the likelihood of being able to differentiate individuals in their respective latent classes. Model entropy ranges from 0 to 1, with higher scores indicating better ability to differentiate between classes. These quantitative metrics were synthesized with theoretical considerations to determine the most appropriate model.

Baseline Predictors of Trajectory Class Membership

Next, demographic and clinical characteristics were examined as potential predictors of class membership. To identify predictor variables, χ^2 tests of association and independent samples *t*-tests were conducted to examine significant differences in predictor variables between classes (Heckman et al., 2017; Murphy & Smith, 2018; Hirai et al., 2015).

Trajectory Class Membership Predicting Outcome

To determine whether class membership is associated with specific outcomes, a one-way analysis of variance (ANOVA) was conducted examining differences between classes in mood disorder symptoms and personality dimensions at each participant's final attended session of treatment. Measures from the final session of treatment that each participant attended were chosen to capture information from participants who dropped out early or otherwise did not complete post-treatment questionnaires. In addition, a one-way analysis of covariance (ANCOVA) was conducted, using first-session scores of mood disorder symptoms and personality dimensions as a covariate, to test for significant differences between classes in the amount of change in these outcomes during treatment.

Finally, a sensitivity analysis was conducting using G*Power version 3.1.9.6 (Faul et al., 2007), to determine the effect size that I would be able to detect given the parameters of this study. With an alpha level of .05, results indicated that I would be able to detect an effect size of $d = 1.37$.

CHAPTER 3. RESULTS

3.1 Number and Shape of Trajectory Classes

The number of distinct BPD symptom trajectories was determined by examining information criteria fit statistics for latent growth mixture models with one through five classes. Values of all fit statistics for each number of classes can be found in Table 1. Nearly all fit statistics indicated a two-class model was the best fit to the data, with the exception of ssBIC, which indicated a three-class model solution. Visually, the addition of a third class of BPD symptom trajectory did not result in clinically meaningful information. Therefore, based on the majority of fit statistics and theoretical considerations a two-class model was determined to be the best fit to capture BPD symptom trajectories in this sample.

Figure 1 depicts the mean BPD symptom scores across treatment for each of the two classes. People in Class 1 (high symptom starters; n = 5, 12.5%) began treatment with significantly higher self-reported BPD symptoms (M = 24.00, SD = 4.06) than those in Class 2 (low symptom starters; n = 35, 87.5%; M = 12.80, SD = 6.76), $t(38) = 3.59$, $p < .01$, 95% CI [4.87, 17.52], d = 1.72. In the high symptom starter class, the highest baseline BPD symptom severity score was 26 and the lowest was 22. In the low symptom starter class, the highest baseline BPD symptom severity score was 21 and the lowest was 4.

In addition, high symptom starters self-reported significantly higher BPD symptoms in their final treatment session (M = 18.60, SD = 4.72) compared to low symptom starters (M = 7.11 SD = 4.59), $t(38) = 5.21$, $p < .01$, 95% CI [7.02, 15.95], d = 2.49. Figure 2 depicts the individual trajectory of each participant in each class, providing further detail regarding the participant trajectories that comprise each class.

3.2 Predictors of Trajectory Class Membership

Several demographic, clinical, and personality measures were significantly correlated (Table 2). The strongest numerical associations were between the clinician-rated ZAN-BPD and the self-reported ZAN-BPD, $r = .71$, $p < .01$, as well as the clinician-rated ZAN-BPD and the Q-LES-Q, $r = .71$, $p < .01$.

No demographic characteristic were significantly associated with class membership, *p*s > .07 (Table 3). Participants in the high symptom starter class were significantly more likely to have a comorbid diagnosis of generalized anxiety disorder than those in the low symptom starter class, $\chi^2(1) = 7.73$, $p < .01$ (Table 4). No other comorbid diagnoses were significantly associated with membership in either class, *p*s > .10.

At baseline, class membership demonstrated significant medium-to-large effects on the majority of clinical, personality, and functional measures (Table 5). Specifically, those in the high symptom starter class had significantly higher self-reported depression ($t(37) = 1.73$, $p = .04$, $d = .83$), anxiety ($t(37) = 2.08$, $p = .02$, $d = .99$), and PTSD ($t(37) = 1.75$, $p = .04$, $d = .84$) symptoms, as well as significantly higher clinician-rated BPD symptoms ($t(37) = 1.96$, $p = .03$, $d = .94$). In addition, those in the high symptom starter class reported significantly lower conscientiousness ($t(37) = -1.82$, $p = .04$, $d = -.87$) and higher neuroticism ($t(37) = 2.39$, $p = .01$, $d = 1.15$). Finally, those in the high symptom starter class also reported significantly greater functional impairment ($t(37) = 2.74$, $p < .01$, $d = 1.31$) and lower quality of life ($t(37) = -1.85$, $p = .04$, $d = -.89$). Agreeableness did not significantly differ between classes at baseline ($t(37) = -1.65$, $p = .06$, $d = -.79$).

3.3 Trajectory Class Membership Predicting Outcome

At the final treatment session, class membership demonstrated significant, large effects on BPD symptom severity. Specifically, high symptom starters reported higher BPD symptoms in their final treatment session (M = 18.60, SD = 4.72) compared to responders (M = 7.11 SD = 4.59), $t(38) = 5.21$, $p < .01$, 95% CI [7.02, 15.95], d = 2.49.

Class membership demonstrated nonsignificant small-to-medium effects on the majority of clinical and personality measures at the final treatment session (Table 6). Specifically, those in the high symptom starter class reported significantly lower agreeableness at the final treatment session ($t(38) = -1.72$, $p = .04$, $d = -.83$). There were no significant mean differences between any other measure at the final attended session, $ps > .06$.

When controlling for baseline scores on these measures as covariates, ANCOVA results showed no mean differences between classes in mood disorder symptom or personality dimensions at participant's final attended session, $ps > .08$ (Table 7).

Table 1: Information Criteria Fit Statistics for One through Five Latent Classes

	Parsimony Criteria				Clustering Criteria		
Classes	AIC	BIC	CAIC	ssBIC	CLC	NEC	E
1	2863.76	2868.83	2871.83	2859.44	2857.76	1.00	-
2	2853.30*	2863.43*	2869.43*	2844.66	2842.77*	0.09*	0.97*
3	2853.62	2868.82	2877.82	2840.66*	2860.88	1.14	0.71
4	2858.54	2878.81	2890.81	2841.26	2872.60	1.64	0.66
5	2862.00	2887.34	2902.34	2840.40	2872.68	1.58	0.68

*Best fit value for each information criteria.

Table 2: Correlations Among Pre-Treatment Measures of Interest

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender															
2. Education Level	-.07														
3. Marital Status	.09	-.05													
4. Age	-.12	.59**	-.48**												
5. Trajectory Class	.02	.27	-.21	.24											
6. ZAN-BPD-SR	-.14	-.26	.08	-.20	-.45**										
7. ZAN-BPD-CR	-.22	-.30	-.13	.04	-.31	.71**									
8. ODSIS	-.17	-.20	-.27	.08	-.27	.48**	.49**								
9. OASIS	-.13	-.23	-.32*	.15	-.32*	.55**	.61**	.61**							
10. PCL-5-SF	-.11	-.31	-.12	-.11	-.29	.54**	.61**	.44**	.58**						
11. BFI-A	-.12	.10	< -.01	-.04	.27	-.24	-.42**	-.25	-.26	-.28					
12. BFI-C	-.18	.21	.35*	-.25	.29	-.11	-.38	-.28	-.36*	-.03	.32*				
13. BFI-N	< .01	.18	-.18	.31	-.37	.30	.51**	.28	.44**	.35*	-.29	-.23			
14. WSAS	-.03	-.28	-.12	-.01	-.42**	.39*	.54**	.57**	.61**	.35*	-.37*	-.34*	.51**		
15. Q-LES-Q	.08	.17	.27	-.14	.30	-.50**	-.71**	-.70**	-.71**	-.42**	.41**	.49**	-.44**	-.70**	

Note. ZAN-BPD-SR = Zanarini Rating Scale for Borderline Personality Disorder, Self-Reported. ZAN-BPD-CR = Zanarini Rating Scale for Borderline Personality Disorder, Clinician-Rated. ODSIS = Overall Depression Severity and Impairment Scale. OASIS = Overall Anxiety Severity and Impairment Scale. PCL-5-SF = PTSD Checklist for DSM-5, Short Form. BFI-A = Big Five Inventory Agreeableness Subscale. BFI-C = Big Five Inventory Conscientiousness Subscale. BFI-N = Big Five Inventory Neuroticism Subscale. WSAS = Work and Social Adjustment Scale. Q-LES-Q = Quality of Life Enjoyment and Satisfaction Questionnaire. Gender: 0 = female, 1 = male. Trajectory Class: 1 = Non-Responders, 2 = Responders.
* $p < .05$, ** $p < .01$.

Table 3: Demographic Characteristics in Symptom Trajectory Classes

Characteristic	Full Sample (n = 40)		High Symptom Starters (n = 5)		Low Symptom Starters (n = 35)			
	n/M	*%/SD*	*n/M*	*%/SD*	*n/M*	*%/SD*	χ^2/t	*p*
Gender							1.29	.86
Male	3	7.5	0	0	3	8.6	.46	.50
Female	34	85.0	4	80.0	30	85.7	.11	.74
Non-binary	5	12.5	1	20.1	4	11.4	.29	.59
Transgender	1	2.5	0	0	1	2.9	.15	.70
Education Level							4.50	.34
High School/GED	2	5.0	1	20.0	1	2.9	2.71	.10
Some College	20	50.0	3	60.0	17	48.6	.23	.63
Technical or Associates Degree	6	15.0	1	20.0	5	14.3	.11	.74
4-year College	9	22.5	0	0	9	25.7	1.66	.20
Master's Degree	3	7.5	0	0	3	8.6	.46	.50
Marital Status							2.76	.60
Married	2	5.0	0	0	2	5.7	.30	.58
Living with Partner	5	12.5	0	0	5	14.3	.82	.37
Relationship	5	12.5	1	20.0	4	11.4	.29	.59
Divorced	6	15.0	0	0	6	17.1	1.01	.32
Never married	22	55.0	4	80.0	18	51.4	1.44	.23
Race							3.29	.35
White	38	95.0	5	100	33	94.3	.30	.58
Black	4	10.0	0	0	4	11.4	.64	.43
Latinx	3	7.5	0	0	3	8.6	.46	.50
Native American	2	5.0	1	20.0	1	2.9	2.71	.10
Age	28.0	9.8	22.0	4.06	28.90	10.10	-1.49	.07

Note. Gender and racial categories were not mutually exclusive.
*$p < .05$.

Table 4: Comorbid Diagnoses in Symptom Trajectory Classes

	Full Sample (n = 40)		High Symptom Starters (n = 5)		Low Symptom Starters (n = 35)			
DSM-5 Disorder	*n*	%	*n*	%	*n*	%	χ^2	*p*
Mood Disorders								
Major Depressive Disorder	11	27.5	1	20.0	10	28.6	.16	.69
Persistent Depressive Disorder	10	25.0	1	20.0	9	25.7	.08	.78
Bipolar II Disorder	7	17.5	1	20.0	6	17.1	.25	.87
Any Mood Disorder	14	35.0	3	60.0	23	65.7	.06	.80
Anxiety Disorders								
Generalized Anxiety Disorder	17	42.5	5	100.0	12	34.3	7.73	.01
Panic Disorder	8	20.0	2	40.0	6	17.1	1.43	.23
Posttraumatic Stress Disorder	10	25.0	2	40.0	8	22.9	.69	.41
Obsessive Compulsive Disorder	6	15.0	0	0	6	100.0	1.01	.32
Social Anxiety Disorder	15	37.5	3	60.0	12	34.3	1.23	.27
Any Anxiety Disorder	9	.23	0	0	26	74.3	1.66	.20
Premenstrual Dysphoric Disorder	6	15.0	1	20.0	5	14.3	.11	.74
Substance Use Disorder	9	22.5	2	40.0	7	20.0	1.00	.32
Bulimia	2	5.0	1	20.0	1	2.9	2.71	.10
Binge Eating Disorder	5	12.5	1	20.0	4	11.4	.29	.59

Table 5: Pre-Treatment Clinical and Personality Characteristics in Symptom Trajectory Classes

	High Symptom Starters (n = 5)		Low Symptom Starters (n = 33)				
Pre-Treatment Measure	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
ZAN-BPD-CR	20.20	4.32	13.47	7.44	1.96*	.03	.94
ODSIS	13.80	1.64	9.74	5.16	1.73*	.04	.83
OASIS	14.00	1.41	9.43	4.83	2.08*	.02	.99
PCL-5-SF	50.80	26.54	31.17	22.79	1.75*	.04	.84
BFI-A	3.03	.50	3.53	.63	-1.65	.06	-.79
BFI-C	2.07	.32	2.70	.77	-1.82*	.04	-.87
BFI-N	4.77	.39	4.17	.54	2.39*	.01	1.15
WSAS	30.80	3.11	18.82	9.61	2.74*	<.01	1.31
Q-LES-Q	32.20	4.49	39.94	9.11	-1.85*	.04	-.89

Note. ZAN-BPD = Zanarini Rating Scale for Borderline Personality Disorder. ODSIS = Overall Depression Severity and Impairment Scale. OASIS = Overall Anxiety Severity and Impairment Scale. PCL-5-SF = PTSD Checklist for DSM-5, Short Form. BFI-A = Big Five Inventory Agreeableness Subscale. BFI-C = Big Five Inventory Conscientiousness Subscale. BFI-N = Big Five Inventory Neuroticism Subscale. WSAS = Work and Social Adjustment Scale. Q-LES-Q = Quality of Life Enjoyment and Satisfaction Questionnaire.
*$p < .05$.

Table 6: Final Session Clinical and Personality Characteristics in Symptom Trajectory Classes

	High Symptom Starters (n = 5)		Low Symptom Starters (n = 34)				
Final Session Measure	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
ZAN-BPD-CR	18.60	4.72	7.11	4.59	5.21	<.01	2.49
ODSIS	10.80	2.68	7.00	5.15	1.60	.06	.77
OASIS	9.80	2.59	7.48	5.05	1.46	.16	.48
BFI-2-XS-A	2.93	.28	3.54	.77	-1.72*	.04	-.83
BFI-2-XS-C	2.54	.50	2.58	.80	-.12	.45	-.06
BFI-2-XS-N	4.34	.75	4.01	.70	.97	.17	.46

Note. ODSIS = Overall Depression Severity and Impairment Scale. OASIS = Overall Anxiety Severity and Impairment Scale. BFI-2-XS-A = Big Five Inventory-2 Extra-Short Form Agreeableness Subscale. BFI-2-XS-C = Big Five Inventory-2 Extra-Short Form Conscientiousness Subscale. BFI-2-XS-N = Big Five Inventory-2 Extra-Short Form Neuroticism Subscale.
* $p < .05$.

Table 7: ANCOVA Descriptive Statistics and Results for Post-Test by Class and Pre-Test

		Final Session Score					
Measure	Group	*n*	Observed Mean	Adjusted Mean	*SD*	*F*	η^2
ODSIS	Low Symptom Starters	35	7.00	7.16	2.68	26.37	.30
	High Symptom Starters	5	10.80	9.71	5.16		
OASIS	Low Symptom Starters	35	7.80	7.57	4.34	.10	.003
	High Symptom Starters	5	9.80	8.12	2.59		
BFI-2-XS-A	Low Symptom Starters	34	3.54	3.49	.77	.26	.03
	High Symptom Starters	5	2.93	3.24	.28		
BFI-2-XS-C	Low Symptom Starters	34	2.58	2.53	.80	1.96	.05
	High Symptom Starters	5	2.54	2.87	.50		
BFI-2-XS-N	Low Symptom Starters	34	4.01	4.05	.70	0	0
	High Symptom Starters	5	4.33	4.05	.75		

Note. ODSIS = Overall Depression Severity and Impairment Scale. OASIS = Overall Anxiety Severity and Impairment Scale. BFI-2-XS-A = Big Five Inventory-2 Extra-Short Form Agreeableness Subscale. BFI-2-XS-C = Big Five Inventory-2 Extra-Short Form Conscientiousness Subscale. BFI-2-XS-N = Big Five Inventory-2 Extra-Short Form Neuroticism Subscale.

ODSIS: R^2 = .15, Adj. R^2 = .11, adjustments based on ODSIS pre-test mean = 10.25. Homogeneity of variances tested and not significant: F = 3.08, p > .05. OASIS: R^2 = .39, Adj. R^2 = .36, adjustments based on OASIS pre-test mean = 10.00. Homogeneity of variances tested and not significant: F = 1.18, p > .05. Agreeableness: R^2 = .62, Adj. R^2 = .60, adjustments based on BFI-2-XS pre-test mean = 3.42. Homogeneity of variances tested and not significant: F = 1.28, p > .05. Conscientiousness: R^2 = .60, Adj. R^2 = .58, adjustments based on BFI-2-XS pre-test mean = 2.51. Homogeneity of variances tested and not significant: F = .04, p > .05. Neuroticism: R^2 = .23, Adj. R^2 = .19, adjustments based on Functioning pre-test mean = 4.59. Homogeneity of variances tested and not significant: F = .05, p > .05.

*p < .05

Figure 1: Mean trajectories of participants' BPD symptom severity during 18 sessions of BPD Compass treatment.

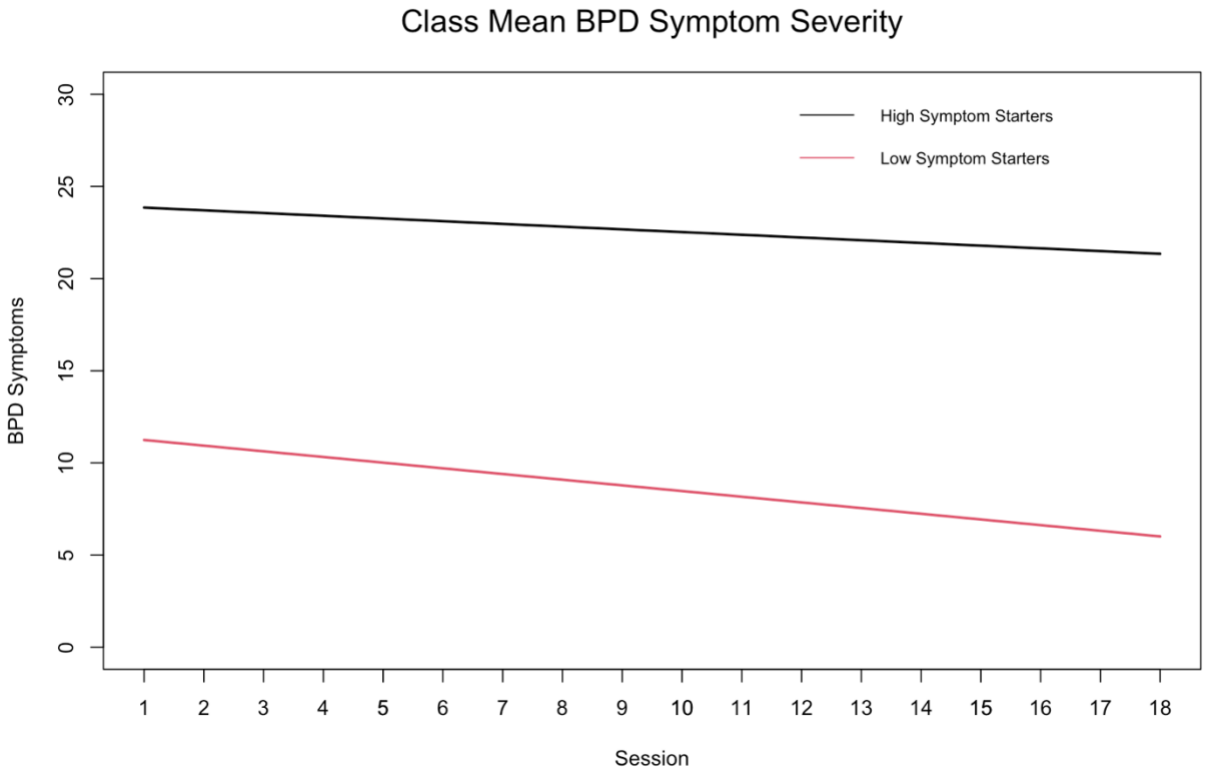
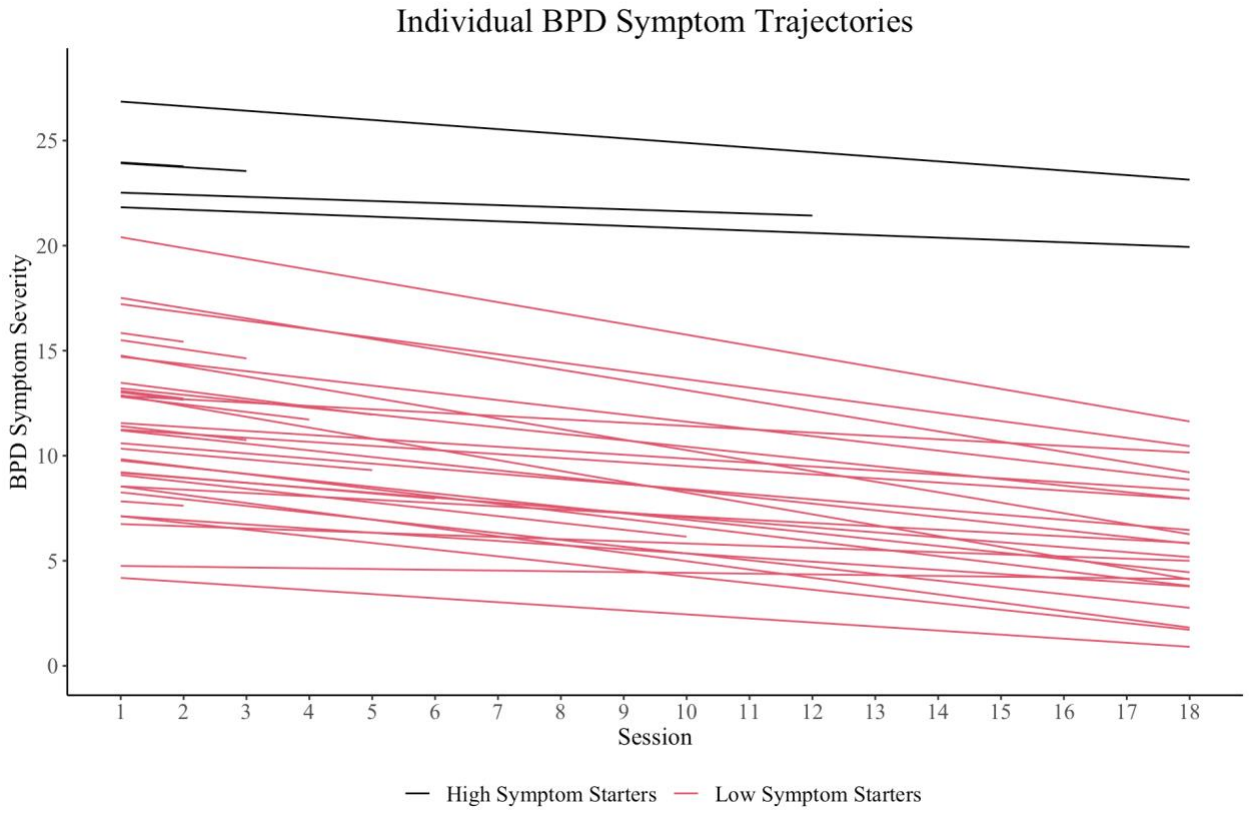


Figure 2: Individual mean trajectories of participants' BPD symptom severity *during 18 sessions of BPD Compass treatment.*



CHAPTER 4. DISCUSSION

The goal of the present study was to explore potential BPD symptom trajectory classes among people receiving an 18-session cognitive-behavioral treatment for BPD. In addition, I also sought to examine baseline predictors of membership in symptom trajectory classes, as well as the effects of class membership on mood disorder symptoms and personality outcomes. As the vast majority of researchers examining treatment trajectories have done so in samples of people receiving treatment for mood disorders (Lin & Farber, 2021; Ulvenes et al., 2021), I aimed to expand this research by exploring symptom trajectories in a sample of people with BPD. In this sample, I identified two distinct BPD symptom trajectories during treatment: a low symptom starter class and a high symptom starter class. At baseline, participants in the high symptom starter class reported greater severity across multiple clinical measures including BPD symptoms, were more likely to be diagnosed with comorbid generalized anxiety disorder, and reported lower conscientiousness, higher neuroticism, and marginally lower agreeableness. At post-treatment, high symptom starters only demonstrated significantly greater BPD symptoms and lower agreeableness, but demonstrated medium-to-large differences in anxiety, depression, conscientiousness, and neuroticism in the expected directions.

The identification of two trajectories in this sample is consistent with prior research identifying classes during treatment for mood disorders, in which two diverging symptom trajectories have consistently been reported (Hartmann et al., 2018; Held et al., 2021; Lin & Farber, 2021; Ulvenes et al., 2021). In the current sample of people receiving treatment for BPD, participants with higher baseline BPD severity were more likely to follow a higher symptom trajectory and maintain relatively higher BPD symptom severity throughout treatment compared to those in the low symptom starter class. At baseline, all participants in the low symptom starter

class scored 21 or lower on the ZAN-BPD, whereas all participants in the high symptom starter class scored 22 or higher, suggesting that a score of 22 may serve as a useful threshold for predicting response to BPD Compass. Practically, patients who score below this threshold may be good candidates for BPD Compass, whereas those scoring above this threshold may require more time in treatment to decrease symptoms, and instead may benefit from a more specialized or intensive treatment for BPD (e.g., DBT, MBT, Transference-Focused Therapy (TFT; Kernberg, 1985), Schema Therapy (ST; Young et al., 2003), as has been previously noted (Bateman and Fonagy, 2013).

4.1 Predictors of Trajectory Class Membership

To optimize and personalize treatment, it is important to identify variables that predict membership in symptom trajectory classes. In a meta-analysis of outcomes in BPD treatment, higher baseline BPD, depression, and general psychiatric symptom severity were associated with greater overall symptom change during treatment (Barnicot et al., 2012). This result may be an example of regression to the mean, a statistical mechanism in which individuals who score further away from the group baseline average show greater treatment effects (Bland & Altman, 1994; Herzog et al., 2020). However, in the current study, the high symptom starter class reported greater baseline severity across all clinical measures, though demonstrated less ultimate improvement than the low symptom starter class, which is contrary to the phenomenon of regression to the mean. It is possible that higher baseline BPD symptom severity separates high symptom starters from the low symptom starters specifically in BPD Compass treatment, and regression to the mean may not occur in this treatment modality. People with a greater BPD symptom severity may also have more concurrent internalizing disorder symptoms (van Dyjke et al., 2012; Vignarajah and Links, 2009) and a greater overall level of functional impairment

(Conklin et al., 2006; Skodol et al., 2005), which may necessitate more intensive treatment than a brief, weekly skill-based treatment such as BPD Compass can provide. Indeed, BPD Compass was developed as a short-term alternative to more intensive treatment; thus, it is useful to know how to triage patients based on their presenting severity.

Beyond symptom severity, those in the high symptom starter class also reported higher neuroticism and lower conscientiousness at baseline than those in the low symptom starter class. Researchers have suggested that higher levels of neuroticism may worsen treatment outcomes for a variety of emotional disorders (Bock et al., 2010; Thibodeau et al., 2015), and that neuroticism should be targeted specifically in individuals in treatment for emotional disorders (Barlow et al., 2014). In addition, there is evidence that lower conscientiousness may also be associated with poorer treatment outcome among patients with emotional disorders (Bucher et al., 2019; Quilty et al., 2008). As higher neuroticism and lower conscientiousness are characteristic of BPD (Saulsman & Page, 2004; Samuel and Widiger, 2008), maladaptive levels of these personality dimensions at baseline may indicate a patient is more likely to follow a symptom trajectory that does not end in ultimate response during brief treatment. However, I was underpowered to detect these baseline differences, and thus these results may have limited utility.

4.2 Trajectory Class Membership Predicting Outcome

In addition to ending treatment with significantly greater BPD symptom severity, participants in the high symptom starter symptom trajectory class reported significantly lower agreeableness at the final treatment session. Lower agreeableness can result in a poorer therapeutic alliance, resulting in less symptom improvement in treatments for BPD (Hirsh et al., 2012; Zufferey et al., 2019). Though therapeutic alliance was not examined in the current study, it is possible that high sympom starters' lack of improvement in agreeableness contributed to

their minimal BPD symptom change by negatively affecting the alliance with their therapists. We encourage future researchers to test this mechanistic model with more frequent measurements of agreeableness, the alliance, and BPD symptoms.

When controlling for baseline scores, symptom trajectory classes did not significantly differ in anxiety, depression, neuroticism, or conscientiousness at the final treatment session. This lack of significant differences across mood disorder symptoms at the final session was surprising, given the large effect of trajectory class membership on BPD symptoms at this timepoint. One possible explanation is that changes in personality disorder symptoms are relatively distinct from changes in mood and anxiety symptoms, since mood and anxiety symptoms may be more variable and responsive to environmental stressors than BPD symptoms. Given that BPD Compass specifically aims to teach patients skills to address maladaptive variants of neuroticism and conscientiousness (Sauer-Zavala et al., 2020), the lack of significant differences between low and high symptom starter classes in these personality dimensions was also surprising. Some researchers have found that personality dimensions remain relatively stable over the course of acute psychotherapy (De Fruyt et al., 2006; Ferguson, 2010), which may explain why these personality dimensions did not differ in responders and non-responders at the final treatment session. Conversely, recent research has demonstrated that some personality dimensions do appear more likely to change during psychotherapy, including neuroticism (Hengartner et al., 2020; Roberts et al., 2017; Sauer-Zavala et al., 2021). While these results suggest that personality dimensions may change in the short-term, it is possible that the 18-week duration of BPD Compass is not sufficient for such changes to be detected. Rather, it may be that whereas symptoms can change significantly during treatment, personality dimensions change at a slower rate. In addition, it is possible that measurement issues contributed to this result.

Specifically, it may be that whereas the ZAN-BPD is sensitive to change in the pathological range, the BFI-2-XS is more sensitive to change in the normative range. Therefore, it is possible that personality changes during treatment were not detected by the BFI-2-XS among this population. Finally, I was underpowered in this study to detect effect sizes smaller than $d = 1.37$, which may also explain the lack of significant differences in neuroticism and conscientiousness between low and high symptom starter classes at the final treatment session.

4.3 Utilizing Symptom Trajectories in Clinical Practice

Characterizing patients' symptom trajectories during treatment can facilitate the identification of subgroups of treatment responses in a given population. In clinical practice, this information can then be used to identify patient deviation from anticipated progress, and therefore give clinicians an opportunity to personalize treatment. For example, if a patient is identified as following a symptom trajectory likely to end in ultimate nonresponse, the clinician has an opportunity to attempt to prevent this outcome by examining the therapeutic alliance, revisiting the patients' motivation for change, considering an alternative treatment modality, or otherwise modifying their treatment plan. Similarly, if a patient is identified as following a symptom trajectory likely to end in a positive response, the clinician can be confident that the current method of treatment is facilitating the desired change. In addition, having the information to predict the symptom trajectory that a given individual is likely to follow may also benefit clinicians, as it may help them develop or adjust treatment plans.

Beyond monitoring patient progress during treatment, identifying classes of symptom trajectories may also improve clinician's ability to assign patients to an optimal treatment protocol. Researchers have developed models using baseline patient characteristics to determine the optimal treatment for individual patients, such the Personalized Advantage Index (PAI;

DeRubeis et al., 2014), which uses baseline information to predict symptom severity at post-treatment. Similarly, as certain baseline patient characteristics may predict which symptom trajectory a patient is likely to follow, these characteristics may be used to assign patients to the appropriate level of care prior to treatment initiation. For example, the current study suggests that a brief, CBT-based intervention for BPD may not be sufficient for patients who are above a certain level of baseline symptom severity. With this information, clinicians can assign patients who are above this level of severity to a higher level of care, thus providing a more beneficial treatment to these patients and protecting space for patients who would benefit from brief treatment.

4.4 Limitations

The results of this study should be considered in the context of certain limitations. First, this study was conducted with participants receiving treatment in a single location who were mostly white, female, and held at least a high school diploma. Replication of this study among participants with a wider range demographic characteristics is warranted to improve generalizability. Previous researchers have identified symptom trajectories using similar sample sizes to that of the current study (Abbott et al. 2019, Eisenlohr-Moul et al., 2020; Lin & Farber, 2021); however, our sample size may be insufficient to accurately capture the number and shape of possible BPD symptom trajectories. Future researchers should build on our results by examining symptom trajectories in a larger sample to validate the number of classes identified here. In addition, with the exception of the clinician-rated ZAN-BPD, all measures included in analysis were self-reported, which may have introduced bias in participant responses due to cognitive processes or social desirability (Bauhoff, 2014). Finally, the use of latent growth mixture models results in certain inherent limitations. All group-based trajectory modeling

generally involves some degree of uncertainty regarding the number and shape of trajectories due to the lack of agreed-upon metrics for class enumeration. Consequently, studies often differ in findings due to different analytical approaches (Franklin et al., 2016). In addition, researchers have shown that when using growth mixture models, multiple trajectories can appear to be the optimal fit even when only one group truly exists in the population (Bauer & Curran, 2003).

4.5 Conclusion

In this study examining BPD symptom trajectories in a sample of individuals receiving a novel 18-week cognitive behavioral treatment for BPD, two distinct classes of symptom trajectories were identified; low symptom starters and high symptom starters. These two classes were primarily separated by BPD symptom severity, with the high symptom starter class reporting significantly higher symptom severity at baseline, throughout treatment, and at outcome. In addition, high symptom starters reported significantly higher severity in concurrent mood disorder symptoms, greater functional impairment, lower conscientiousness, and higher neuroticism. At outcome, high symptom starters had significantly lower agreeableness than responders. These results demonstrate that distinct symptom trajectories can be identified in patients receiving treatment for BPD, and a number of characteristics can predict which trajectory an individual is more likely to follow. In addition, these results lend support for future investigations into symptom trajectories in this population. If replicated, clinicians may use this information to identify likely symptom trajectories prior to treatment, as well as identify when a patient is following a trajectory likely to end in nonresponse, and therefore modify treatment accordingly.

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PUBLICATIONS

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