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USING EXPLORATORY FACTOR ANALYSIS AND LATENT CLASS  
ANALYSIS**

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IDENTIFYING MCMI-IV PERSONALITY DISORDER SUBGROUPS USING  
EXPLORATORY FACTOR ANALYSIS AND LATENT CLASS ANALYSIS

A thesis submitted in partial fulfillment  
of the requirements for the degree of

MASTER OF ARTS

to the faculty of the

DEPARTMENT OF PSYCHOLOGY

of

ST. JOHN'S COLLEGE OF LIBERAL ARTS AND SCIENCES

at

ST. JOHN'S UNIVERSITY

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## **ABSTRACT**

### **IDENTIFYING MCMI-IV PERSONALITY DISORDER SUBGROUPS USING EXPLORATORY FACTOR ANALYSIS AND LATENT CLASS ANALYSIS**

Amanda Fisher

Patients diagnosed with personality disorders (PDs) have higher morbidity and mortality rates than those without PDs. The DSM-5 PD diagnoses and the cluster system lack a theoretical and empirical basis, which hinders the development of knowledge about PDs and interventions for PDs. This present study attempts to add to this literature by forming PD groups using a combination of exploratory factor analysis (EFA) and latent class analysis (LCA) based on PD scores from the Millon Clinical Multiaxial Inventory-IV (MCMI-IV), a method recommended by Gorman and Primavera (1983). Participants were 251 English speaking males and females ages 18 to 75 seeking outpatient psychotherapy at a private non-profit clinic. The EFA yielded a four-factor model of the MCMI-IV, and the factors can be described as Neuroticism, Antagonism, Extraversion vs. Introversion, and Compulsivity vs. Defiance factors. The results of the LCA suggest a five-class solution, with classes that can be labeled Neuroticism, Antagonism, Depression and Anxiety, No PD, and Extraversion classes, which were then compared on MCMI-IV personality, clinical, and Grossman Facet scales. Latent classes and factors were matched on some PD scales, but there were also some notable differences. Future research directions are discussed.

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## INTRODUCTION

### History of Personality Disorder Classification

Patients diagnosed with personality disorders (PDs) have higher morbidity and mortality rates than those without PDs (Gask, Evans, & Kessler, 2013; Tyrer, Reed, & Crawford, 2015). PDs are considered to be distinct from mental disorders because they are more persistent throughout adult life. Also, remission takes longer to occur, and recurrence of disturbance is more likely in comparison to other mental disorders. Individuals with PDs have increased comorbid mental health problems, and the presence of PDs significantly influences the course and treatment of comorbid psychiatric disorders, in that comorbid mental disorders are more difficult to treat and have worse treatment outcomes. Moreover, PDs are associated with high costs and services to society than patients without PDs (Tyrer et al., 2010).

Definitions of PDs vary depending on diagnostic systems and theoretical models (Gask, Evans, & Kessler, 2013). One view maintains that patients with PDs present with more interpersonal and social dysfunction than non-PD patients (Karukivi, Vahlberg, Horjamo, Nevalainen, & Korkeila, 2017). Namely, people with PDs have difficulties forming and maintaining satisfactory interpersonal relationships, leading to their own distress as well as distress for others around them (Tyrer, Reed, & Crawford, 2015). The DSM-5 is a widely used diagnostic system, and defines PD as “an enduring pattern of inner experience and behavior that deviates markedly from the expectations of the individual’s culture” manifested in two (or more) of the following areas: cognition, affectivity, interpersonal functioning, and impulse control (American Psychiatric Association, 2013).

One of the most controversial topics in psychopathology has been the classification of PDs (Tyrer, Reed, & Crawford, 2015; Crowhurst & Coles, 1989). Kurt Schneider, a German psychiatrist, was the first to formally classify PDs, which he labeled “psychopathic personalities” in 1923. He developed a prototypical model of PD diagnosis. Schneider’s diagnoses are theoretical standards against which patients can be evaluated. Dominant personality characteristics, or criteria, which clustered together constitute each prototype. The model is based on clinical observations as opposed to a theory or empirical research. Furthermore, the model assumes that PDs are homogeneous categories. Schneider’s classification system forms the foundation for all subsequent PD classification systems, from the International Classification of Diseases in 1948 to the DSM-5 in 2013, and although some of the names of PDs have changed, the PDs that Schneider defined have been largely unchanged (World Health Organization, 1992; American Psychiatric Association, 2013).

The DSM-5 classification system identifies ten discrete PDs, and these PD categories are further grouped into three clusters characterized by similar descriptive features (American Psychiatric Association, 2013; Sheets & Craighead, 2007). Cluster A is characterized by odd or eccentric features, cluster B is characterized by dramatic, emotional, or erratic features, and cluster C is characterized by anxious or fearful features.

Several problems with the DSM-5 PD diagnoses and cluster system have been identified (Widiger, 2007). One difficulty with the DSM-5 PD diagnoses is that, because normal personality is defined as dimensional, it appears inconsistent that PDs are characterized as categorical (Karukivi et al., 2017). Moreover, diagnostically

subthreshold personality difficulties have been found to be associated with psychiatric symptoms and low subjective well-being. The DSM-5 classification system infers that normal personality continua are distinguishable from abnormal personality types (Tyrer, Reed, & Crawford, 2015). Researchers are developing clearer, empirically derived conceptualizations of personality, notably the Five Factor Model (FFM) of personality, however defining the threshold at which the level of personality traits becomes disordered has been a challenging and complex undertaking, and no consensus has yet been reached (Widiger, 2007).

An additional complication with the idea that PDs form discreet categories is the high comorbidity rates between DSM-4 and DSM-5 PD diagnoses (Sheets & Craighead, 2007). This problem has also occurred over the years for the PD categories in the DSM-III and DSM-III-R systems. One study indicates that a cooccurrence rate of 60% for all PDs was found in a sample of psychiatric outpatients (Zimmerman, Rothschild, & Chelminski, 2005). Another study with a sample of Italian psychiatric inpatients found a co-occurrence rate greater than 50% (Fossati et al., 2000). Other studies have found similarly high PD comorbidity. High comorbidity rates could be due to shared diagnostic criteria that reflect surface features of PDs as opposed to etiology or important underlying factors. Comorbidity typically indicates the presence of two or more independent disorders. However, high comorbidity rates of DSM-5 PD diagnoses suggest that these disorders are not distinct and might reflect problems with the PD classification structure. As a result, the DSM-III, III-R, IV, and 5 diagnoses have been criticized for representing indistinct entities.

The DSM-5 PD cluster system assigns the discrete PD into a cluster system, which is the same as it has been for the DSM-III, DSM-III-R, and DSM-IV cluster systems. This taxonomy is not based on empirical evidence but was developed through committee consensus on common or shared clinical features of PDs (Sheets & Craighead, 2007). Because PDs are clustered by similar features, the current PD classification structure infers that disorders within classes are more similar than disorders across classes; however, research supports that there is high PD comorbidity both within and across PD clusters.

Because the DSM-5 cluster system was not empirically derived, some studies have aimed to empirically validate it. Sheets and Craighead (2007) reviewed investigations of the DSM-III, DSM-III-R, and DSM-IV PD cluster structure and found that reviewed studies generally failed to replicate the Axis-II cluster organization. Even though empirical support is lacking for the DSM Axis-II cluster system, it remains in the DSM-5 and is frequently used by clinicians and researchers because the comorbidity of individual PD categories makes classification difficult and partly because of the simplicity for researchers dealing with only three clusters rather than ten disorders as independent variables (Tyrer, Reed, & Crawford, 2015).

Gould (1987), the philosopher and historian of science, argued that taxonomy is crucial for any branch of science to progress. The continued use of an unsupported taxonomy hinders the development of knowledge in PDs. The DSM-5 diagnostic system's role in scientific research shapes our understanding of PDs and interventions. Researchers conduct analyses using the DSM-5 diagnoses and cluster membership as independent variables and report findings based on diagnoses and clusters. The DSM-5

PD diagnoses and the cluster system lack a theoretical and empirical basis, which signifies that PD diagnoses must be reorganized based on empirical evidence. The paper attempts to add to this literature by using latent class analysis of patients based on PD scores.

### **Dimensional Models of Normal Personality and PDs**

Given concerns about the limitations of a categorical classification of PDs, the field has been tilting towards a dimensional model of PD classification (Trull & Widiger, 2013). A dimensional model of PDs hypothesizes that diagnoses are distributed continuously as opposed to categorically. Of proposed dimensional models of PDs, the FFM of personality has received the most attention as an alternative method of conceptualizing and diagnosing PDs (Rottman, Kim, Ahn, & Sanislow, 2011). FFM defines personality as continuous traits grouped into five higher-order factors: extraversion (versus introversion), agreeableness (versus antagonism), conscientiousness, neuroticism, and openness to experience. Some have proposed that PDs can be understood as maladaptive or extreme variants of these FFM personality traits or facets. The most comprehensive instrument to assess the FFM is the NEO Personality Inventory-3 (NEO-PI-3; Costa & McCrae, 2010). This instrument has six facet scales for each of the broader five factors yielding 30 facet scales. The NEO-PI-3 measures each of the DSM-5 PDs and other traits of psychopathy outside of the scope of the DSM-5 (Trull & Widiger, 2013). There are impairments or maladaptive traits associated with each of the 60 poles of the 30 facets that can help determine the presence of a PD.

Widiger and Simonsen (2005) propose that maladaptive variants of the fifth domain, unconventionality or openness, refers to psychoticism and cognitive-perceptual

aberrations. The authors note that scales that assess this domain typically load onto other factors or load onto a very small independent factor that may not be worth identifying. Therefore, they suggest that this domain might not belong within a dimensional model of normal and abnormal personality functioning.

Each PD maps onto multiple domains of the FFM (Lynam, 2012). FFM is an empirically derived model of PDs that links normal and abnormal personality in a single unified structural framework. Several meta-analyses support that PDs can be conceptualized using FFM of normal personality (Markon, Krueger, & Watson, 2005; Saulsmon & Page, 2004; Trull & Widiger, 2013). O'Connor (2002) investigated factor structures of popular normal and abnormal personality inventories and FFM measures and indicated that the factor structures of popular personality inventories are well-captured by FFM. There is much research showing that PDs have distinct FFM profiles (Widiger, Gore, Crego, Rojas, & Oltmanns, 2017). Several studies have supported convergent and divergent relations between FFM measures and other measures of DSM-IV PDs (Lynam, Loehr, Miller, & Widiger, 2012).

One strength of the FFM is that the issue of comorbidity is irrelevant because personality is characterized as continuous and there are no categorical diagnoses (Rottman, Kim, Ahn, & Sanislow, 2011). Furthermore, the problem of arbitrary diagnostic thresholds of PDs is also irrelevant because the FFM does not implement cutoffs specifying the presence versus absence of a disorder. Additionally, FFM is biologically-based, universal, stable, and related to life outcomes. However, concerns have been raised about using FFM measures for assessment and diagnosis in clinical settings. FFM measures may be too ambiguous as a PD diagnostic tool. In one study by

Rottman and colleagues (2011), researchers found that clinical researchers who specialize in PDs had difficulty identifying the DSM diagnoses from FFM profiles. Therefore, the FFM of PDs might have low clinical utility. In another study with a national sample of psychiatrists and psychologists, FFM was rated as having little clinical utility in comparison to four other diagnostic tools, and only a minority of clinicians indicated that using the FFM provided an improvement to DSM-IV PD diagnoses (Spitzer, First, Shedler, Westen, & Skodol, 2008).

Some other notable issues with using FFM measures to identify individuals with PDs exists. Some studies of FFM for PDs use FFM measures developed for the general population, whereas others use newly developed FFM measures specifically designed to assess personality pathology/DSM-5 Section II PDs. It has been suggested that a personality measure developed in the general population to assess personality in this population (i.e., the NEO-PR-3) might be unsuitable for assessing personality pathology (Lynam, 2012). In response to this issue, measures of Five-Factor Model Personality Disorder have been developed to assess the DSM-5 Section II PDs; however, there are serious issues and limitations with such scales, including redundancy across subscales and concerns related to subscale discriminant validity (Bagby & Widiger, 2018). These psychometric issues are similar to problems with DSM-5 PD criteria, including symptom overlap between PDs and diagnostic co-occurrence.

This paper attempts to explore the latent cluster analysis of patients with personality disorders using the Millon Clinical Multiaxial Inventory fourth edition. Therefore, Millon's theory and the nature of this scale will be discussed.

## **Millon's Model**

Issues with FFM assessment of PDs indicate the importance of investigating clinically useful PD classification. Millon's evolutionary theory of personality and psychopathology represents an alternative theory of personality based on continuously distributed personality traits. Millon explored personality from the perspective of natural selection processes of Darwinian evolution and defined personality as an organism's distinctive style of adaptive functioning in relation to a range of environments (Choca & Grossman, 2015; Millon, 2011). His model is based on four basic accommodations that organisms use to adjust to their environment: existence, adaptation, replication, and abstraction. The theory posits that these objectives combine and interact to produce spectra of normal and abnormal personality. Existence refers to an individual's state of being versus nonbeing on a pleasure—pain continuum (Millon, Grossman, & Millon, 2015). Adaptation refers to homeostatic processes for survival over a lifetime and is expressed on an active-passive continuum. Replication refers to nurturance both inward and outward and is on a self-other continuum. Abstraction pertains to adaptive personality competencies related to anticipatory planning and reasoned decision-making. Millon has indicated that normal and abnormal personality traits lie on a continuum with no distinct cutoffs (Strack & Millon, 2007). Unlike the FFM, Millon's theory was developed to encompass both normal and abnormal personality. He posited that what distinguishes normal from abnormal is adaptive functioning. Namely, healthy, adaptive personalities exhibit an ability to adjust to circumstantial demands while maintaining boundaries reflective of the individual's usual functioning among these polarities. The Millon Clinical Multiaxial Inventory (MCMI-IV; Millon, Grossman, & Millon, 2015) is

the most recent iteration of this series of clinical tests to include the eight personality styles that can be found as normal, adaptive personality types or disorders, and three severe personalities (schizotypal, borderline, and paranoid PDs) that represent more advanced stages of personality pathology and do not have a normal counterpart. Individuals with severe personality patterns demonstrate marked deficits in social competence, frequent psychotic episodes, and vulnerability to everyday life stressors.

The MCMI-IV is a self-report instrument that operationalizes Millon's theory by assessing personality patterns and other major clinical syndromes (Millon, Grossman, & Millon, 2015; Strack & Millon, 2007). The MCMI-IV consists of 175 true-false questions, and 14 personality scales, 10 clinical syndrome scales, and 5 correction scales. The present study focuses on the personality scales. The personality scales operationalize personality patterns from Millon's evolutionary theory and cover each of the DSM-5 PD diagnoses as well as other personality patterns derived from Millon's theory. The MCMI was originally standardized on a psychiatric inpatient setting and an outpatient mental health setting (Johnson & Elbogen, 2013).

The birth of the MCMI began with Millon's book *Modern Psychopathology* (1969), which provided an organizational framework for conceptualizing personality prototypes and described personality on a continuum from functional to dysfunctional personality (Choca & Grossman, 2015). Millon became interested in developing assessments to measure his theoretical prototypes, so he developed the Millon Illinois Self-Report Inventory (MISRI) which contained 150 items to measure the proposed personality styles. The questionnaire was later expanded to include other major psychiatric disorders and validity scales and became the MCMI in 1977. The MCMI

included eight personality style scales, three severe personality pattern scales, nine clinical syndrome scales, and one validity scale. The MCMI was then revised to be more compatible with the DSM-III diagnoses, and some of the descriptions and names of the scales were changed. There was discussion about adding sadistic and masochistic PDs to the DSM-III, and Millon liked the concept, so he added these PDs to his a classification system and modified his theory to include a discordant element representing a reversal on the pleasure-pain continuum. The MCMI-II also included significant psychometric changes, including reducing item overlap between scales and assigning differential item weights. Furthermore, several test-taking aptitude measures labeled *modifier indices* were added to make base rate score adjustments. The MCMI-III was devised to reflect major changes in Millon's theory of personality, and also included the Depressive Personality Scale. The MCMI-IV introduced the turbulent personality pattern, a personality pattern characterized by high-spirited behavior, intrusiveness, and mercurial temperament, and more thoroughly represents the continuum of personality functioning in personality scales, so that personality scale scores more accurately depict personality adaptive capacity and dysfunction (Millon, Grossman, & Millon, 2015).

The MCMI-IV personality scale scores are continuous, but facilitate categorical diagnoses of mild, moderate, and severe using base rates from a population of psychiatric patients assessed using the DSM (Strack & Millon, 2007; Choca & Grossman, 2015; Millon, 2011). An important distinguishing feature of the MCMI-IV is that it converts raw scores to base rate scores (Millon, Grossman, & Millon, 2015). T scores are a commonly employed by other personality assessments (including The Minnesota Multiphasic Personality Inventory-2-RF [MMPI-2-RF]). However, Millon remained

concerned of several problems with using T scores as a metric for weighted scores. First, the normal distribution does not accurately represent the varying raw score distributions across MCMI-IV scales. Second, the arbitrary T score cutoff indicating clinical significance (2%) arbitrarily assumes the same prevalence rates across disorders, although prevalence rates vary. Base rate scores indicate a demarcation line according to the prevalence or base rate of any disorder. These categorical cutoffs reflect individual differences in the degree of functioning. Millon was not concerned about comorbidity because he viewed the nature of personality to involve a mixture of several different types, and thought that personality styles are complexly interrelated, as they involve shared underlying constructs.

Accurate classification of PDs is crucial for scientific research to reach an understanding of PDs that can lead to effective interventions. Some studies have explored PD clustering using earlier versions of the MCMI. Leaf, Ellis, Mass, DiGiuseppe, and Alington (1990) conducted an exploratory correlational study examining associations between MCMI PDs in 55 clients seeking outpatient psychotherapy at a private non-profit clinic in New York, NY. The authors found that participants with histrionic or narcissistic (and possibly those with antisocial, compulsive, and paranoid) PDs seemed to profit more from rational-emotive behavior therapy (REBT) than participants without those traits and were labeled the “healthy” PD group due to their associations with global self-upping. They found that participants with schizoid, avoidant, and schizotypal PDs demonstrated greater distress at baseline and profited less from REBT and labeled this group the “unhealthy” PD group due to global self-downing. In another study, Leaf, Ellis, DiGiuseppe, Mass, and Alington (1991) found that healthy PDs are associated with

hyperrationality, enhanced self-esteem, and relatively low distress, whereas unhealthy PDs are associated with irrationality, low self-esteem, and severe distress.

Several studies have examined the structure of the MCMI-III have been conducted. Dyce, O'Conner, Parkins, and Janzen (1997) were the first to investigate the correlational structure of the nonoverlapping PD scales from the MCMI-III using a principal components analysis with a varimax rotation. The authors examined the factor structure in a nonclinical sample of undergraduate students in the United States and compared the factor structure in the nonclinical sample to previously devised factor structures in clinical samples. The authors found that patterns of associations between scores on PD scales in clinical and nonclinical samples were similar, which suggests that PDs are problematic distortions of nonclinical personality traits. Moreover, the authors found that a four-factor solution best fits the data without the loss of excessive information. The four-factor solution did not support the DSM-IV clustering of PDs but does support the five-factor model of PDs. The first factor was labeled Neuroticism, and included Depressive, Dependent, Avoidant, Passive-Aggressive, Self-Defeating, and Borderline PDs. The second factor was labeled Low Agreeableness and included Antisocial, Sadistic, Narcissistic, and Paranoid PDs. The third factor was labeled Low Surgency-Extraversion and included Schizoid and Avoidant at one end and Histrionic at the other end. The fourth factor was labeled Conscientiousness and included Compulsive PD at one end and Antisocial PD on the other end. The authors note that their factor solutions do not represent Millon's theory, although factor analysis might not be an appropriate way to test such a complex theory.

Cueva, Garcia, Aluja, and Garcia (2008) explored the factor structure of the overlapping and nonoverlapping PD scales of the Spanish MCMI-III in a nonclinical sample of 674 subjects in Spain. The authors found that a four-factor solution best fit the data and provided adequate differentiation of the PDs, and that CFA models designed for overlapping scales did not fit well to the data. The authors posit that the factors revealed in the study align with FFM theory of PDs. Rossi, Elklit, and Simonsen (2010) next examined the factor structure of the MCMI-III in Danish and Belgian samples of 2,030 subjects and 1,210 subjects, respectively. The MCMI-III was translated into Danish and Dutch for each respective sample, and the authors demonstrated that the range of Chronbach alpha values of the translated MCMI-III scales were similar to those of the English MCMI-III scales. The authors applied confirmatory factor analysis on the basis of previously deduced factor structures and specified two- three- and four-factor models. They found that across both samples, the best fitting model was a four-factor model that is consistent with maladaptive variants of Five-Factor Model personality traits. The factors were labeled Factor 1: Emotional Regulation versus Emotional Stability, Factor 2: Antagonism versus Compliance, Factor 3: Extraversion versus Introversion, and Factor 4: Constraint versus Impulsivity. Factor 1 is a unipolar factor representing internalizing disorders and included Avoidant, Depressive, Dependent, Passive-Aggressive, Self-Defeating, Schizoid, and Borderline PDs. Factor 2 was a bipolar factor with Schizoid, Narcissistic, Antisocial, Sadistic, and Paranoid PDs at one end and modest loadings of Depressant and Dependent PDs at the other end. Factor 3 was a bipolar factor with Histrionic PD at one end and Schizoid and Avoidant PDs at the other end. Factor 4 was also a bipolar factor with compulsive PD at one end and borderline and antisocial PDs at

the other end. The authors note that empirical research supports a bipolar model of PDs that is more complex than the DSM model, but that a unipolar model may be more practical in clinical settings in order to avoid conceptual complexity. Furthermore, some PDs loaded onto multiple factors which corroborates past research suggesting that PD does not conform to a simple structure.

A literature search as of January 2020 did not reveal studies examining the factor structure of the MCMI-IV or studies investigating MCMI-II, MCMI-III, and MCMI-IV clusters. Choca and Grossman (2015) noted that, despite the success of the MCMI inventories, there has been a decline in research publications using this instrument. They attribute the decline to the increasing complexity of Millon's theory, as many psychologists and researchers prefer more parsimonious theories such as the FFM. They also indicate that Millon was critical of empirical findings that did not support his theory, although he may have benefited from reassessing or refining his theory in response to criticism.

The present study aimed to empirically identify PD clusters that could be useful in both clinical and research settings by exploring factors structures and latent classes of the MCMI-IV PD scores. We investigated if different cluster solutions were consistent with the model devised by Leaf and colleagues (1990), the DSM-5 model, or FFM of PDs. A cluster solution consistent with Leaf and colleagues' model would be comprised of three clusters: a "healthy" PDs cluster with participants with high histrionic and narcissistic (and possibly antisocial and turbulent) traits; an "unhealthy" PDs cluster with participants with high levels of schizoid, avoidant, and schizotypal (and possibly dependent and borderline) traits; and a no PD cluster with participants without MCMI-IV personality

scale elevations. A cluster solution consistent with the DSM-5 model would consist of four clusters: an “odd, eccentric” cluster (Cluster A) with participants with high levels of paranoid, schizoid, and schizotypal traits; a “dramatic, emotional, erratic” cluster (Cluster B) with participants with high levels of antisocial, borderline, histrionic, and narcissistic traits; a “anxious, fearful” cluster (Cluster C) with participants with high levels of avoidant, dependent, and obsessive-compulsive traits; and a no PD cluster with participants without MCMI-IV personality scale elevations. A cluster solution consistent with the FFM would include five factors: a “Neuroticism” cluster with participants with high levels of avoidant, melancholic, dependent, masochistic, schizotypal, borderline, and paranoid traits; an “Antagonism” cluster with participants with high levels of schizoid, narcissistic, antisocial, sadistic, schizotypal, and borderline traits; an “Extraversion” cluster with participants with high levels of histrionic and turbulent traits; a “Conscientiousness” cluster with participants high in the compulsive PD trait; and a no PD cluster with participants without MCMI-IV personality scale elevations. Given the robustness of the FFM model, we hypothesized that factors and clusters would align with maladaptive variants of FFM personality traits.

## METHOD

### Sample

Participants were 251 consecutive patients seeking outpatient psychotherapy at a private non-profit clinic in New York, NY. Participants were ages 18 to 75 and 46.6% of participants were female.

### Measures

A demographic form and the MCMI-IV were administered to all participants prior to the first outpatient psychotherapy appointment. Internal consistency estimates for MCMI-IV Personality Pattern scales and Clinical Syndrome scales mostly fall in the good range, while some estimates fall in the acceptable range (Millon, Grossman, & Millon, 2015). Internal consistency estimates for the Compulsive ( $\alpha=.67$ ) and Alcohol Use ( $\alpha=.65$ ) scales were the lowest and were the only estimates to fall in the questionable range. Test-retest reliability coefficients for MCMI-IV scales generally demonstrate good stability across scales, and all stability coefficients for Personality Pattern and Clinical Syndrome scales are in the .80s or higher. MCMI-IV scale intercorrelations and correlations between MCMI-IV scale scores and Brief Symptom Inventory (BSI) and Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF) scale scores generally provide support for high validity.

### Data analysis

The data analysis of this study aimed to form PD clusters using the MCMI-IV PD scores, as the DSM-5 clusters have not been empirically supported. We used a combination of exploratory factor analysis (EFA) and latent class analysis (LCA) to form PD groups, a method recommended by Gorman and Primavera (1983). Factor analysis

and cluster analysis are complementary techniques that both provide valuable information. The purpose of factor analysis is to provide coordinates or positions (i.e., factor loadings) of variables or subjects, but here for variables - in a multivariate space, and it assumes that latent variables are continuous (Magidson & Vermunt, 2004). Thus, factor analysis can serve to detect common, underlying dimensions on which participants can be located (Hudziak et al., 1998). EFA was used instead of principal components analysis because we aimed to identify latent variables as opposed to reducing the dimensionality of the data.

Cluster analysis aims to provide relatively homogeneous groupings of variables or subjects (here subjects) on the basis of one or more multivariate criteria (Gorman & Primavera, 1983). We used latent class analysis (LCA) as the clustering method in the present study. LCA is a method of classifying individuals from a larger group into latent classes, or smaller homogenous unobserved subgroups of participants, based on participants' observed response patterns (Hudziak et al., 1998). LCA hypothesizes that latent variables are categorical as opposed to continuous (Magidson & Vermunt, 2004). In LCA, each class shows a class-specific response profile. LCA estimates the number of participants per class and the probability that each participant falls within the class (Dantlgraber, Wetzel, Schützenberger, Stieger, & Reips, 2016). The conditional probabilities of meeting criteria for a PD are also specified and are independent for each class.

We used LCA was used in the present study to determine if PD categories matched PD continua from the factor analysis. In the method suggested by Gorman and Primavera (1983), when factors and clustering groups match on important variables, this

finding indicates the presence of simple structure in the data. Using this method, EFA can serve to detect common, underlying dimensions on which participants can be located, whereas LCA indicates participants' group membership to categories (Hudziak et al., 1998).

The MCMI-IV personality scales were subjected to EFA using the JASP software platform (Goss-Sampson, 2018; JASP, 2019) to determine the factor structure, and Parallel analysis and examination of a scree plot were used to determine the number of factors (Revelle, 2015). The LCA was conducted using statistical software Mplus 8<sup>th</sup> edition (Muthén & Muthén, 1998-2017). MCMI-IV personality scales were entered as categorical variables. The base rate cutoff of 75 was used to determine categories, because scores of 75–84 are taken to indicate the presence of clinically significant personality traits and scores of 85 or above suggest the persistence of these traits. It made more practical sense to categorize participants into clusters based on the presence of a clinically significant personality traits as opposed to a mean personality trait score. Several class solutions were evaluated based on sample size adjusted Bayesian Information Criterion (ABIC). For categorical LCA models, the ABIC has been shown to correctly identify the number of classes more consistently than other information criteria used to judge the appropriate number of latent classes (Nylund, Asparouhov, & Muthen, 2007).

## RESULTS

Prevalence of MCMI-IV PD diagnoses in the study sample is listed in Table 1 and MCMI-IV comorbidities are listed in Table 2. 43 participants (17.1%) in the sample were not diagnosed with a PD according to the MCMI-IV. The most common PD in the sample was melancholic PD ( $N=101$ , 40.2%), followed by avoidant PD ( $N = 89$ , 35.5%) and then dependent PD ( $N=78$ , 31.1%). Significantly more females in the sample were diagnosed with melancholic ( $F(1,249)=5.37$ ,  $p=.02$ ) and dependent PDs ( $F(1,249)=7.09$ ,  $p=.01$ ), and significantly more males were diagnosed with narcissistic PD ( $F(1,249)=6.70$ ,  $p=.01$ ).

Table 1

*Prevalence of MCMI-IV Personality Disorders in sample (N=251)*

MCMI-IV PD	<i>N</i> (%)
Schizoid	31 (12.4%)
Avoidant	89 (35.5%)
Melancholic	101 (40.2%)
Dependent	78 (31.1%)
Histrionic	44 (17.5%)
Turbulent	27 (10.8%)
Narcissistic	47 (18.7%)
Antisocial	36 (14.3%)
Sadistic	25 (10%)
Compulsive	19 (7.6%)
Negativistic	62 (24.7%)
Masochistic	46 (18.3%)
Schizotypal	19 (7.6%)
Borderline	56 (22.3%)
Paranoid	30 (12.0%)

Table 2

*MCMI-IV Personality Disorder Comorbidity Frequencies in Sample of N=251*

Number of MCMI-IV PDs	<i>N</i> (%)
0	43 (17.1%)
1	55 (21.9%)
2	40 (15.9%)

3	31 (12.4%)
4	27 (10.8%)
5	10 (4.0%)
6	14 (5.6%)
7	14 (5.6%)
8	11 (4.4%)
9	6 (2.4%)

### **Exploratory Factor Analysis**

An EFA using principal-axis factor extraction was conducted to determine the factor structure. Both parallel analysis and examination of a scree plot (Figure 1) indicated that a four-factor solution is most interpretable. A Promax oblique rotation was used to interpret the four factors because PD clusters are assumed to be correlated, and the factor correlation matrix revealed several correlation values greater than 0.32. Table 3 presents the factor loadings for each factor. Melancholic, borderline, masochistic, dependent, schizotypal, and avoidant PDs loaded onto Factor 1. Narcissistic, paranoid, sadistic, negativistic, schizoid, and antisocial PDs loaded onto Factor 2. Avoidant and schizoid PDs loaded onto Factor 3, and histrionic and turbulent PDs negatively loaded onto this factor. Antisocial PD loaded onto Factor 4 and compulsive PD negatively loaded onto this factor. JASP provides statistics often used in CFA that provide information on the goodness of fit of the model suggested by the EFA. The  $\chi^2=188.41$ ,  $df=51$ , the Root Mean Square Error of Approximation (RMSEA) = 0.11, 90% Confidence Interval (CI) for RMSEA=0.088-0.119, the Tucker Lewis Index (TLI)=0.90, which represents a barely acceptable fit. All scales in the analysis had primary factor loadings of above .4. Four personality scales, schizotypal, avoidant, negativistic, and antisocial PDs, are complex in that they had more than one factor loading greater than 0.30. These results suggest a four-cluster model for the LCA that would correspond to the EFA factors, and

descriptively each of the clusters correspond to a factor: Factor 1: Neuroticism, Factor 2: Antagonism, Factor 3: Extraversion vs. Introversion, and Factor 4: Compulsivity vs. Defiance. There would also be one additional cluster representing patients with no elevations on a PD subscale.

Figure 1

*Scree plot for Exploratory Factor Analysis of MCMI-IV Personality Disorders Scales.*

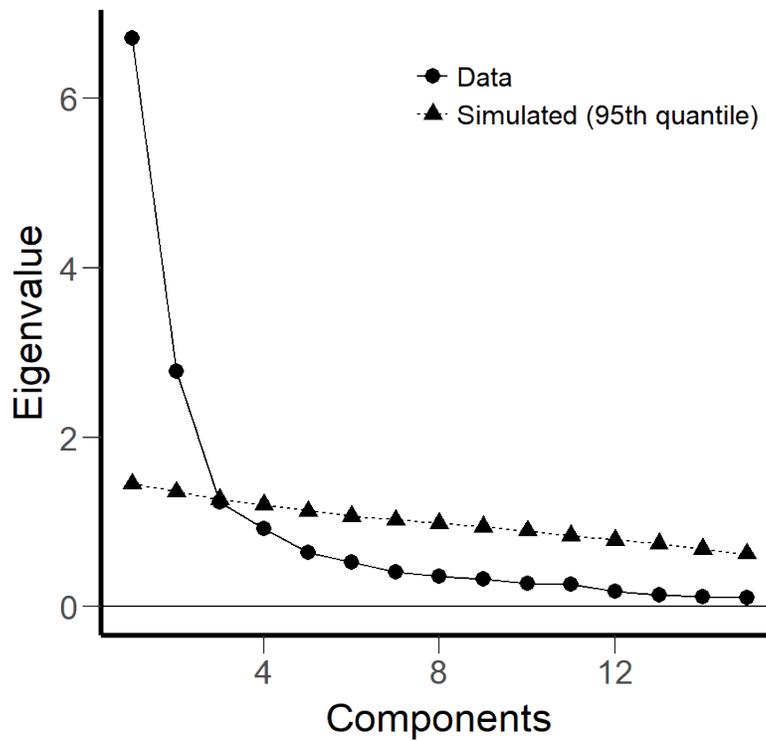


Table 3

*Pattern Matrix from the Promax Rotation for the Exploratory Factor Analysis of MCMI-IV Personality Disorders Scales.*

<b>Personality Disorder Scale</b>	<b>Factor 1: Neuroticism</b>	<b>Factor 2: Antagonism</b>	<b>Factor 3: Extraversion vs. Introversion</b>	<b>Factor 4: Compulsivity vs. Defiance</b>
<b>Melancholic</b>	<b>1.017</b>	-0.119	-0.056	0.024
<b>Borderline</b>	<b>0.926</b>	0.125	-0.135	0.000
<b>Masochistic</b>	<b>0.899</b>	-.007	0.005	0.100
<b>Dependent</b>	<b>0.641</b>	-0.024	0.029	-0.119
<b>Schizotypal</b>	<b>0.573</b>	<b>0.360</b>	-0.028	-0.011
<b>Avoidant</b>	<b>0.474</b>	0.120	<b>0.468</b>	0.007
<b>Narcissistic</b>	-0.139	<b>0.744</b>	-0.331	0.120
<b>Paranoid</b>	0.076	<b>0.725</b>	0.188	-0.140
<b>Sadistic</b>	0.110	<b>0.621</b>	-0.030	0.100
<b>Negativistic</b>	<b>0.424</b>	<b>0.590</b>	0.013	-0.132
<b>Histrionic</b>	0.206	-0.030	<b>-1.088</b>	0.003
<b>Turbulent</b>	-0.270	0.290	<b>-0.701</b>	-0.203
<b>Schizoid</b>	0.053	<b>0.433</b>	<b>0.517</b>	-0.036
<b>Compulsive</b>	-0.007	0.047	-0.138	<b>-0.753</b>
<b>Antisocial</b>	-0.068	<b>0.509</b>	-0.040	<b>0.578</b>

Note: Factor loadings above 0.35 are bolded and are considered loading on the factors.

### Latent Class Analysis

Five LCAs were conducted that specified either 2, 3, 4, 5, or 6 latent classes. The ABIC indicated improvement for the five-class solution (Table 4). A probability profile plot and plot of means of personality pattern scales for each of the five latent profiles are presented in Figure 2 and Figure 3, respectively. The six-class solution showed similarly good AIC but a worse ABIC value. Additionally, the five-class solution has a stronger grounding in FFM theory. Thus, we believe that the five-class solution best fits the data. There were 35 participants assigned to class 1 (13.6%), 27 participants assigned to class 2 (10.5%), 57 participants assigned to class 3 (22.2%), 94 participants assigned to class 4 (36.6%), and 39 participants assigned to class 5 (15.2%).

Table 4

*Latent Class Analyses model fit indices for 2, 3, 4, and 5 cluster models of the of MCMI-IV Personality Disorders Scales.*

<b><u>Solution</u></b>	<b>Chi Square</b>	<b>df</b>	<b>AIC</b>	<b>BIC</b>	<b>ABIC</b>	<b>p for LMR</b>
<b>1. Two-Class Solution</b>	2075.91	32713	3042.602	3151.891	3054.618	<.001
<b>2. Three-Class Solution</b>	2062.204	32703	2974.506	3140.202	2991.207	.3599
<b>3. Four-Class Solution</b>	1551.658	32689	2918.163	3140.267	2940.550	.0054
<b>4. Five-Class Solution</b>	1383.347	32673	2899.597	3178.108	2927.669	.0704
<b>5. Six-Class Solution</b>	1466.705	32661	2897.358	3232.276	2931.114	.4885

Note: *df* = degrees of freedom ; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; ABIC = Adjusted Bayesian Information Criterion ; LMR = Lo-Mendell-Rubin test

Figure 2

*Latent class analysis probability profile plot of the of MCMI-IV Personality Disorders Scales for the 5 Cluster Model.*

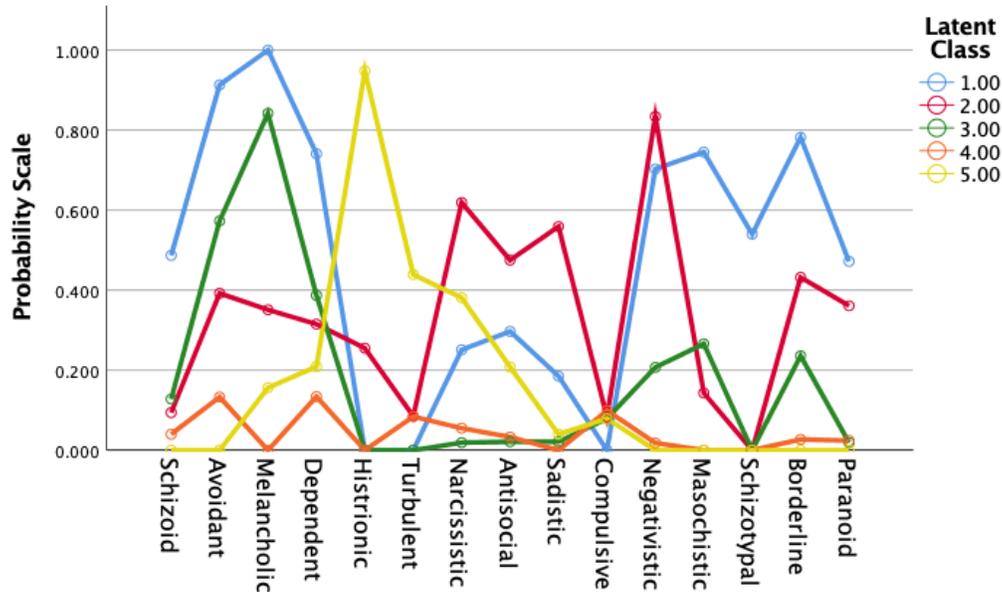
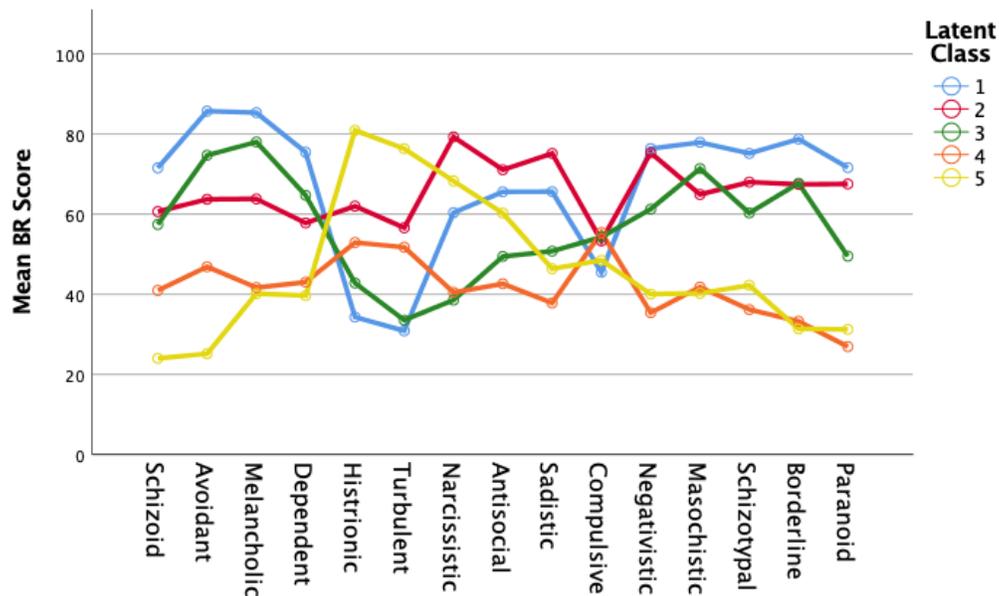


Figure 3

*Mean base rate scores of MCMI-IV personality scales by latent class for the Five-Cluster Model.*



Absolute model fit could not be evaluated for the five-class solution because there was a large discrepancy between Likelihood Ratio and Pearson chi-square values. This discrepancy indicates that one of these test statistics did not follow a theoretical chi-square distribution and that therefore the  $p$  values for these tests are not reliable. The entropy value for the five-class solution is 0.884, indicating good separation of latent classes. The class-specific endorsement probabilities for each symptom are graphically shown for the five-class solution in Figure 1. Descriptively, the clusters correspond to: Cluster 1: Neuroticism, Cluster 2: Antagonism, Cluster 3: Depression and Anxiety, Cluster 4: No PD, and Cluster 5: Extraversion.

## **Comparison of Classes**

Using the five-class solution, participants were assigned to the most likely latent class and were compared on the MCMI-IV personality scales, the clinical scales, and the Grossman Facet scales. We compared classes using one-way ANOVAs and post-hoc Tukey HSD tests. The results of these tests appear in Tables 5, 6, and 7. Differences between clusters across the MCMI-IV personality scales were all significant except for differences between clusters on the compulsive PD scale ( $p = .065$ ). Post-hoc Tukey HSD revealed no significant differences between clusters on the compulsive PD scale (Table 5). The differences between clusters across the MCMI-IV clinical scales and the Grossman Facet scales were all significant.

Table 5

*Differences in MCMI-IV Personality Scale Base Rate Scores Among the Five Latent Classes With 2, 243 Degrees of Freedom.*

	Neuroticism (Cluster 1) Mean (SD)	Antagonism (Cluster 2) Mean (SD)	Depression and Anxiety (Cluster 3) Mean (SD)	No PD (Cluster 4) Mean (SD)	Extraversion (Cluster 5) Mean (SD)	<i>F</i>
Schizoid	71.54 (12.33) <sup>a</sup>	60.64 (16.46) <sup>a,b</sup>	57.42 (19.62) <sup>b</sup>	40.97 (23.51)	24.00 (18.34)	34.13
Avoidant	85.71 (13.02)	63.72 (18.98) <sup>a</sup>	74.70 (8.86) <sup>a</sup>	46.86 (23.43)	25.16 (18.46)	70.26
Melancholic	85.34 (9.92) <sup>a</sup>	63.80 (21.91)	78.02 (4.52) <sup>a</sup>	41.68 (24.90) <sup>b</sup>	40.19 (26.18) <sup>b</sup>	53.49
Dependent	75.46 (15.10) <sup>a</sup>	57.80 (20.95) <sup>b</sup>	64.70 (19.78) <sup>a,b</sup>	43.03 (25.88) <sup>c</sup>	39.68 (27.78) <sup>c</sup>	19.52
Histrionic	34.31 (22.52) <sup>a</sup>	62.00 (17.95) <sup>b</sup>	42.82 (17.87) <sup>a</sup>	52.91 (16.81) <sup>b</sup>	80.92 (7.41)	41.85
Turbulent	30.89 (22.76) <sup>a</sup>	56.60 (19.80) <sup>b</sup>	33.56 (19.76) <sup>a</sup>	51.74 (20.53) <sup>b</sup>	76.32 (11.61)	35.85
Narcissistic	60.37 (22.24) <sup>a</sup>	79.28 (15.51) <sup>c</sup>	38.56 (26.38) <sup>b</sup>	40.48 (26.06) <sup>b</sup>	68.27 (17.21) <sup>a,c</sup>	23.93
Antisocial	65.57 (19.73) <sup>a</sup>	71.08 (18.35) <sup>a</sup>	49.44 (21.64) <sup>b,c</sup>	42.63 (25.95) <sup>b</sup>	60.24 (21.23) <sup>a,c</sup>	12.73
Sadistic	65.63 (15.28) <sup>a</sup>	75.16 (8.88) <sup>a</sup>	50.75 (23.32) <sup>b</sup>	37.84 (27.30) <sup>c</sup>	46.38 (26.87) <sup>b,c</sup>	17.38
Compulsive	45.49 (17.82) <sup>a</sup>	53.32 (18.90) <sup>a</sup>	54.28 (17.15) <sup>a</sup>	55.43 (19.35) <sup>a</sup>	48.49 (23.06) <sup>a</sup>	2.25
Negativistic	76.37 (7.64) <sup>a</sup>	75.32 (5.83) <sup>a</sup>	61.25 (15.98)	35.40 (24.17) <sup>b</sup>	40.05 (24.41) <sup>b</sup>	46.05
Masochistic	77.91 (6.10) <sup>a</sup>	64.92 (16.27) <sup>a</sup>	71.37 (5.27) <sup>a</sup>	41.81 (23.89) <sup>b</sup>	40.24 (25.02) <sup>b</sup>	43.26
Schizotypal	75.17 (8.12) <sup>a</sup>	68.00 (4.71) <sup>a,b</sup>	60.3 (13.99) <sup>b</sup>	36.19 (25.30) <sup>c</sup>	51.34 (24.80) <sup>c</sup>	35.47
Borderline	78.74 (6.08) <sup>a</sup>	67.44 (18.35) <sup>a</sup>	67.72 (9.59) <sup>a</sup>	33.27 (27.31) <sup>b</sup>	50.77 (28.70) <sup>b</sup>	51.56
Paranoid	71.60 (15.48) <sup>a</sup>	67.52 (13.99) <sup>a</sup>	49.51 (20.61)	26.94 (26.34) <sup>b</sup>	31.24 (29.77) <sup>b</sup>	34.44

Note: For each row, cell values that do not share subscripts are significantly different according to post hoc tests.

Table 6

*Means, (Standard Deviations), F tests, and Differences in MCMI-IV Clinical Scale BRs Among the Five Latent Classes with 4, 243 Degrees of Freedom.*

	Neuroticism (Cluster 1) Mean (SD)	Antagonism (Cluster 2) Mean (SD)	Depression and Anxiety (Cluster 3) Mean (SD)	No PD (Cluster 4) Mean (SD)	Extraversion (Cluster 5) Mean (SD)	F
Anxiety	85.34 (17.91) <sup>a</sup>	77.76 (22.03) <sup>a,b</sup>	73.02 (26.13) <sup>a,b</sup>	57.91 (32.97) <sup>c</sup>	62.03 (24.78) <sup>b,c</sup>	8.33
Somatoform	58.43 (26.02) <sup>a</sup>	43.84 (27.57) <sup>a,b</sup>	55.56 (25.53) <sup>a</sup>	38.48 (29.64) <sup>b</sup>	25.73 (27.04) <sup>b</sup>	9.85
Bipolar Spectrum	68.11 (18.35) <sup>a</sup>	73.24 (13.21) <sup>a</sup>	48.56 (23.50) <sup>b,c</sup>	39.29 (24.53) <sup>b</sup>	59.03 (23.53) <sup>a,c</sup>	18.81
Persistent Depression	85.63 (16.07) <sup>a</sup>	57.56 (26.43)	75.75 (12.59) <sup>a</sup>	40.46 (27.16) <sup>b</sup>	32.59 (24.18) <sup>b</sup>	46.98
Alcohol Dependence	71.83 (19.26) <sup>a</sup>	68.56 (17.92) <sup>a,b</sup>	51.05 (28.95) <sup>b</sup>	34.27 (35.68)	52.86 (31.86) <sup>a,b</sup>	13.37
Drug Dependence	65.20 (31.40) <sup>a</sup>	55.28 (33.59) <sup>a,b</sup>	44.42 (32.76) <sup>b</sup>	40.90 (30.96) <sup>b</sup>	55.49 (25.57) <sup>a,b</sup>	4.97
Posttraumatic Stress Disorder	70.69 (16.90) <sup>a</sup>	61.20 (23.16) <sup>a</sup>	58.75 (24.03) <sup>a</sup>	39.86 (27.55) <sup>b</sup>	51.01 (27.71) <sup>b</sup>	13.42
Schizophrenia Spectrum	70.31 (13.44) <sup>a</sup>	60.24 (11.99) <sup>a,b</sup>	54.91 (16.49) <sup>b</sup>	37.22 (23.78) <sup>c</sup>	38.51 (23.12) <sup>c</sup>	23.94
Major Depression	81.60 (17.08) <sup>a</sup>	55.88 (35.16) <sup>b,c</sup>	73.40 (23.52) <sup>a,b</sup>	41.87 (34.36) <sup>c</sup>	36.30 (32.90) <sup>c</sup>	20.28
Delusional Disorder	62.83 (21.40) <sup>a</sup>	56.00 (25.50) <sup>a,b</sup>	35.84 (30.86) <sup>c</sup>	26.87 (30.49) <sup>c</sup>	38.69 (31.53) <sup>b,c</sup>	12.34

Note: For each row, cell values that do not share subscripts are significantly different according to post hoc tests.

Table 7

Means, (Standard deviations), *F* tests, and Differences in the MCMI-IV Grossman Facet Scales Among the Five Latent Classes with 4, 243 Degrees of Freedom.

	Neuroticism (Cluster 1) Mean (SD)	Antagonism (Cluster 2) Mean (SD)	Depression and Anxiety (Cluster 3) Mean (SD)	No PD (Cluster 4) Mean (SD)	Extraversion (Cluster 5) Mean (SD)	<i>F</i>
Interpersonally Unengaged	73.09 (11.93) <sub>a</sub>	57.44 (23.27) <sub>a,b,c</sub>	57.46 (18.23) <sub>b</sub>	44.30 (26.97) <sub>c</sub>	24.43 (22.36)	25.10
Meager Content	76.57 (19.13) <sub>a</sub>	57.88 (20.38) <sub>b,c</sub>	68.07 (9.91) <sub>a,b</sub>	55.86 (16.62) <sub>c</sub>	20.00 (17.64)	66.67
Temperamentally Apathetic	75.83 (11.78) <sub>a</sub>	66.36 (13.75) <sub>a</sub>	66.14 (18.57) <sub>a</sub>	35.79 (28.45) <sub>b</sub>	36.59 (25.20) <sub>b</sub>	33.51
Interpersonally Aversive	74.63 (13.77) <sub>a</sub>	58.48 (26.51) <sub>b</sub>	69.23 (15.62) <sub>a,b</sub>	63.20 (17.85) <sub>b</sub>	20.97 (19.56)	52.64
Alienated Self-Image	82.26 (8.06) <sub>a</sub>	61.60 (23.45) <sub>b</sub>	76.09 (5.89) <sub>a</sub>	49.33 (25.20) <sub>b,c</sub>	39.73 (25.85) <sub>c</sub>	35.10
Vexatious Content	83.49 (8.05) <sub>a</sub>	68.96 (15.88) <sub>a,b</sub>	68.93 (13.07) <sub>b</sub>	36.20 (28.14) <sub>c</sub>	33.70 (28.27) <sub>c</sub>	47.30
Cognitively Fatalistic	88.29 (10.36) <sub>a</sub>	74.60 (16.13) <sub>a</sub>	79.82 (10.98) <sub>a</sub>	48.62 (25.49) <sub>b</sub>	54.59 (24.87) <sub>b</sub>	38.56
Worthless Self-Image	80.43 (15.98) <sub>a</sub>	62.32 (24.58) <sub>a</sub>	72.28 (12.35) <sub>a</sub>	34.56 (32.82) <sub>b</sub>	37.84 (31.85) <sub>b</sub>	32.52
Temperamentally Woeful	82.63 (12.12) <sub>a</sub>	57.80 (28.82) <sub>b</sub>	72.39 (17.50) <sub>a,b</sub>	38.11 (29.95) <sub>c</sub>	31.95 (31.25) <sub>c</sub>	34.02
Expressively Puerile	79.14 (9.96) <sub>a</sub>	63.80 (20.53) <sub>b</sub>	71.32 (9.98) <sub>a,b</sub>	44.15 (26.03) <sub>c</sub>	38.92 (23.25) <sub>c</sub>	34.44
Interpersonally Submissive	69.29 (19.52) <sub>a</sub>	57.40 (22.32) <sub>a,b</sub>	67.02 (15.72) <sub>a</sub>	43.78 (31.25) <sub>b,c</sub>	38.24 (34.30) <sub>c</sub>	13.07
Inept Self-Image	80.94 (8.91) <sub>a</sub>	63.00 (21.57) <sub>b,c</sub>	72.53 (7.30) <sub>a,b</sub>	52.90 (21.41) <sub>c</sub>	35.14 (26.89)	37.03
Expressively Dramatic	60.43 (26.50) <sub>a,b</sub>	79.00 (11.09) <sub>a</sub>	46.49 (31.20) <sub>b,c</sub>	44.57 (32.74) <sub>c</sub>	75.00 (7.73) <sub>a</sub>	14.78
Interpersonally Attention Seeking	34.63 (23.20)	58.24 (18.85) <sub>a</sub>	54.00 (17.13) <sub>a</sub>	60.56 (15.79) <sub>a</sub>	78.92 (5.42)	33.15
Temperamentally Fickle	31.54 (23.90) <sub>a</sub>	58.80 (18.85) <sub>b</sub>	31.09 (19.97) <sub>a</sub>	55.30 (21.43) <sub>b</sub>	73.49 (11.79)	35.47
Expressively Impetuous	29.29 (25.38) <sub>a</sub>	55.60 (26.90) <sub>b</sub>	31.58 (23.664) <sub>a</sub>	49.26 (27.44) <sub>b</sub>	76.89 (18.68)	23.76
Exalted Self-Image	28.29 (22.88) <sub>a</sub>	56.00 (21.02) <sub>b</sub>	37.98 (19.41) <sub>a</sub>	63.78 (12.50) <sub>b</sub>	72.97 (7.12)	55.44
Interpersonally Exploitive	60.63 (23.55) <sub>a</sub>	79.64 (12.34) <sub>b</sub>	43.25 (28.18) <sub>c</sub>	39.26 (28.90) <sub>c</sub>	68.43 (15.36) <sub>a,b</sub>	20.35
Cognitively Expansive	25.17 (21.91) <sub>a</sub>	55.68 (23.78) <sub>b</sub>	28.35 (18.63) <sub>a</sub>	50.72 (20.05) <sub>b</sub>	76.86 (14.90)	46.57
Admirable Self-Image	62.17 (27.56) <sub>a,b</sub>	66.80 (26.63) <sub>a</sub>	32.98 (32.93) <sub>c,d</sub>	24.70 (31.78) <sub>c</sub>	43.81 (33.28) <sub>b,d</sub>	15.42
Interpersonally Irresponsible		75.00 (20.36) <sub>a</sub>	50.70 (22.92) <sub>b</sub>	46.22 (24.28) <sub>b</sub>	67.97 (14.98) <sub>a</sub>	15.14

Autonomous Self-Image	63.86 (24.04) <sub>a</sub>	69.80 (14.75) <sub>a</sub>	48.07 (26.74) <sub>b</sub>	45.59 (22.93) <sub>b</sub>	54.46 (24.66) <sub>a,b</sub>	7.95
Acting-Out Dynamics	71.66 (8.52) <sub>a</sub>	60.84 (23.85) <sub>a,b</sub>	47.79 (29.13) <sub>b,c</sub>	29.77 (32.13) <sub>d</sub>	39.70 (31.71) <sub>c,d</sub>	16.86
Expressively Precipitate	65.46 (17.29) <sub>a</sub>	70.72 (10.33) <sub>a</sub>	40.60 (26.35) <sub>b</sub>	28.72 (26.98)	48.95 (24.67) <sub>b</sub>	24.72
Interpersonally Abrasive	67.77 (18.14) <sub>a</sub>	71.56 (4.67) <sub>a</sub>	61.12 (17.59) <sub>a,b</sub>	42.32 (30.75) <sub>c</sub>	47.11 (29.29) <sub>b,c</sub>	13.08
Eruptive Architecture	70.57 (10.92) <sub>a</sub>	77.64 (13.23) <sub>a</sub>	46.84 (31.34) <sub>b</sub>	31.53 (32.68) <sub>c</sub>	30.14 (33.51) <sub>b,c</sub>	22.43
Expressively Disciplined	38.57 (22.58) <sub>a</sub>	53.60 (19.66) <sub>b,c</sub>	46.40 (21.50) <sub>a,b</sub>	57.50 (19.15) <sub>c</sub>	62.97 (15.30) <sub>c</sub>	9.81
Cognitively Constrictive	74.97 (8.74) <sub>a</sub>	68.48 (10.51) <sub>a</sub>	65.58 (10.96) <sub>a</sub>	43.61 (21.20) <sub>b</sub>	40.08 (22.59) <sub>b</sub>	38.16
Reliable Self-Image	49.00 (21.01) <sub>a,b</sub>	43.52 (17.94) <sub>a</sub>	63.67 (14.12) <sub>c,d</sub>	65.46 (15.13) <sub>c</sub>	55.73 (19.51) <sub>b,d</sub>	13.27
Expressively Embittered	74.00 (15.89) <sub>a</sub>	70.44 (15.80) <sub>a</sub>	57.79 (24.42) <sub>a</sub>	34.80 (32.36) <sub>b</sub>	39.59 (33.47) <sub>b</sub>	19.56
Discontented Self-Image	79.94 (8.57) <sub>a</sub>	68.00 (13.14) <sub>a</sub>	70.72 (8.86) <sub>a</sub>	43.05 (24.50) <sub>b</sub>	39.32 (25.46) <sub>b</sub>	41.75
Temperamentally Irritable	74.46 (7.99) <sub>a</sub>	78.80 (7.57) <sub>a</sub>	61.86 (20.77) <sub>a</sub>	42.44 (32.55) <sub>b</sub>	44.97 (32.12) <sub>b</sub>	18.07
Undeserving Self-Image	76.57 (5.46) <sub>a</sub>	61.76 (17.47) <sub>b</sub>	69.18 (5.41) <sub>a,b</sub>	40.14 (26.45) <sub>c</sub>	47.32 (24.47) <sub>c</sub>	32.59
Inverted Architecture	80.74 (9.77) <sub>a</sub>	70.16 (15.90) <sub>a</sub>	69.65 (6.05) <sub>a</sub>	33.96 (28.49) <sub>b</sub>	34.27 (28.88) <sub>b</sub>	50.47
Temperamentally Dysphoric	75.97 (10.80) <sub>a</sub>	56.76 (19.57) <sub>b</sub>	73.79 (8.12) <sub>a</sub>	56.57 (18.95) <sub>b</sub>	36.89 (22.84)	35.96
Cognitively Circumstantial	71.66 (14.55) <sub>a</sub>	61.76 (16.82) <sub>a,b</sub>	55.81 (20.42) <sub>b</sub>	39.90 (27.66) <sub>c</sub>	49.86 (25.51) <sub>b,c</sub>	14.11
Estranged Self-Image	77.94 (12.37) <sub>a</sub>	63.96 (13.81) <sub>b</sub>	64.74 (12.10) <sub>a,b</sub>	40.49 (26.24)	27.32 (27.05)	40.00
Chaotic Content	71.86 (9.01) <sub>a</sub>	67.92 (6.06) <sub>a</sub>	42.16 (30.22) <sub>b</sub>	22.05 (30.24) <sub>c</sub>	28.38 (31.25) <sub>b,c</sub>	31.39
Uncertain Self-Image	76.43 (6.84) <sub>a</sub>	54.16 (30.64) <sub>b</sub>	67.77 (18.13) <sub>a,b</sub>	33.53 (31.09) <sub>c</sub>	33.22 (30.06) <sub>c</sub>	29.00
Split Architecture	78.31 (7.94) <sub>a</sub>	64.48 (16.34) <sub>a</sub>	68.42 (10.52) <sub>a</sub>	32.11 (28.84) <sub>b</sub>	38.68 (25.37) <sub>b</sub>	45.92
Temperamentally Labile	74.43 (8.67) <sub>a</sub>	75.36 (8.29) <sub>a</sub>	57.67 (22.91)	36.97 (29.96) <sub>b</sub>	33.51 (29.45) <sub>b</sub>	27.17
Expressively Defensive	72.49 (8.42) <sub>a</sub>	61.52 (19.09) <sub>a,b</sub>	47.84 (25.93) <sub>b</sub>	32.51 (28.34) <sub>c</sub>	25.78 (25.99) <sub>c</sub>	25.31
Cognitively Mistrustful	73.00 (15.63) <sub>a</sub>	70.80 (5.90) <sub>a</sub>	65.18 (13.33) <sub>a</sub>	33.24 (32.27) <sub>b</sub>	45.00 (30.07) <sub>b</sub>	28.24
Projection Dynamics	67.43 (25.99) <sub>a</sub>	62.92 (24.65) <sub>a,b</sub>	46.32 (30.80) <sub>b</sub>	23.24 (31.18) <sub>c</sub>	39.21 (34.47) <sub>c</sub>	20.91

Note: For each row, cell values that do not share subscripts are significantly different according to post hoc test

## DISCUSSION

In the present exploratory study, we sought to identify distinct groups of participants with similar PD profiles. Participants were clients in an outpatient psychotherapy clinic, and the MCMI-IV was used to assess personality pathology. We used a method recommended by Primavera and Gorman (1983) to form groups. Namely, an exploratory factor analysis and several alternative latent class solutions were devised. We evaluated if factors and clustering groups matched on important variables. The findings of the present study do not support the DSM-5 PD clusters. The EFA yielded a four-factor model of the MCMI-IV, and the factors can be described as Neuroticism, Antagonism, Extraversion vs. Introversion, and Compulsivity vs. Defiance factors. The results of the LCA suggest a five-class solution, with classes that can be labeled Neuroticism, Antagonism, Depression and Anxiety, No PD, and Extraversion classes.

The first latent class, the Neuroticism Class, was comprised of participants with a high likelihood of avoidant, melancholic, dependent, negativistic, masochistic, schizotypal, borderline, and/or paranoid PD diagnoses. Additionally, although there was not a high likelihood of participants with schizoid PD, there was a higher likelihood of participants with schizoid PD in comparison to other latent classes and the average schizoid PD base rate score was significantly higher in this class in comparison to average schizoid PD base rates scores of classes 3, 4, and 5. This class was characterized by the presence of anxiety, persistent depression, and major depressive disorders as classified by the average MCMI-IV clinical syndrome base rate scores.

The second latent class, the Antagonism Class, consisted of participants with a high likelihood of narcissistic, sadistic, and negativistic PDs. Although there was not a high

likelihood of participants with antisocial PD, there was a higher likelihood of participants with antisocial PD in comparison to other latent classes and the average antisocial PD base rate score was higher than those of other classes and significantly higher in this class in comparison to classes 3 and 5. This class was characterized by the presence of anxiety as classified by the average MCMI-IV clinical syndrome base rate scores.

The Anxiety and Depression Class was the third class and consisted of participants with a high likelihood of avoidant and melancholic PD diagnoses. This class was characterized by the presence of persistent depression disorder as classified by the average MCMI-IV clinical syndrome base rate scores.

The Extraversion Class was the fourth latent class and consisted of participants with a high likelihood of histrionic PD diagnoses. Although there was not a high likelihood of participants with turbulent PD, there was a higher likelihood of participants with turbulent PD in comparison to other latent classes and the average turbulent PD base rate score was significantly higher than those of classes 1, 3, and 5. The average turbulent PD base rate score for class 4 was similar to that of class 2. Latent class 5 was the No PD Class, which did not have clinically significant average base rate scores for MCMI-IV personality and clinical scales.

Latent classes and factors were matched on some PD scales, but there were also some notable differences. Factor 1 matched latent class 1 on melancholic, borderline, masochistic, dependent, schizotypal, and avoidant PDs. Factor 1 and latent class 1 were labeled the Neuroticism Factor and the Neuroticism Class, respectively. However, in the Neuroticism Class there was a high probability of participants with diagnoses of schizoid, negativistic, and paranoid PDs, although these PDs did not load onto the Neuroticism

factor. Factor 2 corresponded to latent class 2, and they were labeled the Antagonism Factor and the Antagonism Class, respectively. The Antagonism Factor and the Antagonism Class matched on narcissistic, sadistic, negativistic, and antisocial PDs. One discrepancy was that paranoid PD loaded onto the Antagonism Factor, but there was not a high probability that participants in the Antagonism Class have a diagnosis of paranoid PD. Factor 3 corresponded to latent class 5, and they were labeled the Introversion/Extraversion Factor and Class, respectively. The Introversion/Extraversion Factor and the Introversion/Extraversion Class matched on histrionic PD. Histrionic and turbulent PDs negatively loaded onto the Introversion/Extraversion Factor, and avoidant and schizoid PDs positively loaded onto the factor demonstrating an underlying dimension. Although the endorsement probability for turbulent PD was low for participants in the Introversion/Extraversion class, the endorsement probability was highest in this latent class in comparison to the four other latent classes. This finding might reflect a relatively small number of participants with Turbulent PD in the sample ( $N = 27$ ).

One latent class, the Anxiety and Depression Class, did not correspond to a factor. Endorsement probabilities were high for avoidant and melancholic PDs. There was also one additional latent class that was a no PD group. Additionally, there was one factor that did not correspond to a latent class. This factor was labeled the Compulsivity versus Defiance Factor. Compulsive PD negatively loaded onto this factor, and Antisocial PD positively loaded onto this factor.

A comparison of classes and the post-hoc analyses revealed important findings. Classes were significantly different across all MCMI-IV personality scales except for the

compulsive PD scale, for which there were no significant differences between classes. On all scales except for the Histrionic, Turbulent, Narcissistic, and Antisocial PD scales, there were no significant differences between the No PD cluster (Cluster 4) and Extraversion cluster (Cluster 5), and these two clusters had significantly lower average scores on these scales in comparison to the three other clusters (Table 5). These findings partially support Leaf and colleagues (1990) theory of healthy and unhealthy PDs, because they demonstrate that individuals with histrionic and turbulent PDs present in the Extraversion Class do not differ significantly from individuals without PDs on personality scales. However, other PDs that Leaf and Colleagues consider “healthy,” or experiencing little discomfort, including narcissistic PD, were not accounted for in the Extraversion Class and were found to have higher levels of distress according to personality scales in the present study.

Additionally, participants in the Extraversion Class were found to have higher scores on narcissistic and antisocial PD scales, and these participants’ scores on these scales were similar to those for participants in the Internalizing PD Class and Anxiety and Depression Class. Thus, the findings of the post-hoc analyses reveal specific clinical problems of participants in the Extraversion Class, although these problems might not be indicative of severe distress. Findings from the comparison of clusters on the MCMI-IV clinical scales and the post-hoc analyses also suggested that participants in the Extraversion Class are generally more similar to participants in the no PD group and also have significantly lower scores on somatoform, bipolar, persistent depression, posttraumatic stress disorder, schizophrenia spectrum, major depression, and delusional disorder scales. However, findings from these analyses also revealed significantly higher

scores on the bipolar spectrum, alcohol dependence, and drug dependence scales in comparison to participants in the no PD cluster. Findings from this analysis also suggest specific clinical problems of those in the Extraversion Class, even if these problems might not be associated with severe clinical distress. Furthermore, findings from the post-hoc analysis might support that participants in the Extraversion class have personality qualities that are considered positive and adaptive when moderately pronounced (Millon, Grossman, & Millon, 2015).

Findings from the current study have important implications for the classification of PDs and for future research. The findings of the EFA and some findings of LCA are congruent with current research and theory of the dimensional classifications of PDs and FFM personality traits. Results of the factor analysis aligned with FFM; however, the MCMI-IV may be a more clinically useful tool for diagnostic purposes and treatment planning in comparison to FFM measures. The results of the LCA indicate that there might be distinct PD profile categories. Factors and latent classes only matched on some variables, which indicates that there is a complex data structure that may not be revealed by EFA or LCA alone.

Future research should aim to investigate further and replicate the latent class structure found in the present study. PD classification using the MCMI-IV should be further examined by performing EFA and LCA in other samples. Future research should also devise latent classes using the MCMI-IV items because there is item overlap between personality pattern scales. As a next step, there should be further examination of the clinical and symptom profiles of PD subgroups found in the present study. Subgroups' responses to psychotherapy should also be examined and compared. Many

clinicians express pessimism and stigma about treating patients with PDs, however recent research suggests that such pessimism is not warranted. Comparing treatment response between PD subgroups would advance our specific understanding of treatment outcomes in PD patients.

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