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MALADAPTIVE PERSONALITY TRAITS AND ACUTE PSYCHOLOGICAL DISTRESS IN INDIVIDUALS
WITH HEAD AND NECK CANCER

By

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A dissertation submitted in partial fulfillment of the requirements
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Major Professor: Jeffrey Bedwell

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ABSTRACT

Personality disorders (PD) and related traits are associated with and predictive of medical outcomes. One mechanism whereby this may occur is through the interaction of PD traits and distress during treatment of chronic illness, especially in cancer. The majority of head and neck cancers (HNC) are caused by alcohol and tobacco, the disordered use of which is prevalent in those with PDs. This study examined how PD traits relate to distress for individuals during and after treatment of HNC (32.8% in active treatment). A sample of 137 individuals (70.8% male; median age 66) with a diagnosis of HNC from a large southeastern cancer center completed measures of personality and psychological distress. Results of Bayesian structural equation modeling indicated that higher levels of trait negative affectivity related to greater psychological distress. Contrary to our hypotheses, Bayesian one-sample tests indicated that those with HNC may be much lower, rather than higher, in PD traits compared to a census-weighted normative community sample. Years since diagnosis (Median: 2.38 years) and treatment status were unrelated to PD trait scores, suggesting that recency of a diagnosis and active treatment may not explain the PD trait findings. Overall, PD trait scores may be lower in HNC samples and some of these traits may be predictive of distress during and after HNC treatment. Future research should use prospective longitudinal designs and examine how PD traits measured before a cancer diagnosis can affect the course of distress during and after HNC treatment. Using PD trait measures to identify those who are at greater risk of distress may allow clinics to allocate clinical resources to those individuals to address their distress and health behaviors.

Keywords: PID-5; personality disorders; personality traits; medical illness; Bayesian analysis; structural equation modeling; psychological distress; negative affectivity, general personality dysfunction; cancer; head and neck cancer; alternative DSM-5 model for personality disorders

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INTRODUCTION

Personality disorders are conditions characterized by a temporally stable and situationally pervasive pattern of dysfunction in cognitive, affective, interpersonal, and/or impulse control domains (American Psychiatric Association, 2013). Population prevalence studies spanning seven countries estimate the point prevalence of having at least one personality disorder (PD) to range between 4 to 21% (Quirk et al., 2016). These disorders are associated with a variety of negative outcomes and comorbid conditions. For example, estimates of comorbidity between PDs and other non-PD psychiatric diagnoses range from 41-84.5% (Lenzenweger et al., 2007). Further, based on an epidemiological study, if an individual has one PD, the odds ratio of having a second can be quite high. For example, the odds ratio of having both obsessive-compulsive and antisocial PDs is 4.9, whereas the odds ratio of having avoidant and dependent PDs is 118.6 (Grant, Stinson, Dawson, Chou, & Ruan, 2005). However, while there is some clinical utility in the 10 categorical PD diagnoses currently described in the Diagnostic and Statistical Manual for Mental Disorders-5th edition (DSM-5; American Psychiatric Association, 2013), meta-analysis indicates that a catch-all "Not Otherwise Specified PD" is commonly diagnosed (this was renamed to "unspecified personality disorder" in DSM-5; American Psychiatric Association, 2013; Verheul & Widiger, 2004) and that a dimensional model

captures variance of the PD categories and provides incremental utility (Bender et al., 2011; Miller et al., 2018; Morey et al., 2012).¹

Recent research on the structure of PDs indicates that transdiagnostic general personality dysfunction that is expressed through one's unique constellation of personality traits may be a useful way of describing these disorders (Bender et al., 2011). In the DSM-5 Alternative Model for Personality Disorders, general personality dysfunction (GPD) is parsed into dysfunction in self (GPD-S) and interpersonal (GPD-I) domains. Self-pathology (GPD-S) refers to aspects of identity or the coherence, stability, and conceptualization of who one is, and self-direction or the motivation and ability to set goals and inhibit impulses to realize one's goals (Morey et al., 2011). Interpersonal pathology (i.e., GPD-I) is defined as a lack of desire for or inability to establish stable and meaningful interpersonal relationships and the inability to empathize (Morey et al., 2011). Within this model, the second component of a PD is trait specific features, in which individualistic features of one's personality are measured by use of a pathological personality trait model. The current trait model for the alternative section of the DSM-5 (American Psychiatric Association, 2013) includes factors of negative affectivity, antagonism, disinhibition, psychoticism, and detachment (Krueger et al., 2012). Genetic and psychometric evidence suggests that, by-and-large, this pathological model resembles maladaptive variants of the Five-Factor Model (FFM) of Personality (Kendler et al., 2016;

¹ This idea has been discussed for almost three decades (Widiger, 1993) and surveys of PD experts indicate this type of model is strongly preferred over a categorical approach (Morey & Hopwood, 2019).

McCrae & Costa, 2013; Suzuki, Samuel, Pahlen, & Krueger, 2015). Negative affectivity maps onto high FFM Neuroticism, antagonism onto low FFM Agreeableness, disinhibition onto low FFM Conscientiousness, detachment onto low Extraversion, and psychoticism is more equivocal but relates to pathological high openness to experience (Chmielewski et al., 2014)².

On average, individuals with one or more PDs have an 18 year lower life expectancy than those without a PD (Fok et al., 2012). There is a large body of research that indicates adverse outcomes for those with PDs including violence (35%), self-harm (51%), suicidality (26%), and disorders related to substance use (22.6%), anxiety (52.4%), mood (24.1%), and impulse control (23.2%; Harford et al., 2018; Lenzenweger et al., 2007; Newhill et al., 2009; Østergaard et al., 2017). While there is less research, the effect that PDs and personality traits have on medical illness may help to explain the lower life expectancy of those with PDs.

Researchers have proposed at least two broad interacting mechanisms by which personality may affect or have a causal role in medical illness (Roberts et al., 2007). First, personality traits may be a direct causal risk or protective factor as they may relate to individual differences in reactions to environmental stressors through physiological processes (Smith & Spiro, 2002). For example, in laboratory tests, a higher level of neuroticism related to greater

² Hereafter personality disorders (PD), personality traits, and PD traits are all discussed interchangeably because the same underlying universal traits underlie these constructs. This is due to the current organization of the literatures where clinical psychology studies tend to examine categorical PDs, with more recent movement toward PD traits, whereas medical and general personality literature often defines personality in the context of the five-factor model. Our use of PD, personality, PD traits is dependent on how the study defined personality.

cortisol response to a naloxone test, suggesting differences in hypothalamic-pituitary-adrenal axis functioning (Mangold & Wand, 2006). Similarly, after a social stress task, people with Borderline Personality Disorder are shown to have greater increases in diastolic blood pressure, a possible mechanism for increased rates of cardiovascular disease in this group (Grove et al., 2017). Further, higher conscientiousness meta-analytically predicts lower levels of inflammatory hormones—even when health behaviors (e.g., smoking) and medical illnesses are controlled for, which authors suggest may be due to a healthier dispositional response to stress in more conscientious individuals (Chapman et al., 2011; Elliot et al., 2017; Luchetti et al., 2014). There is even some evidence that even at 6 and 17 months old, temperament (an early antecedent to personality) relates to immune and neuroendocrine markers, suggesting these relationships may precede lifestyle or health behaviors (O'Connor et al., 2017).

A second broad mechanism is that personality may relate to specific diseases or outcomes through health damaging or promoting behaviors. For example, personality is predictive of midlife allostatic load, which is considered to be indicative of the cumulative effect of stress on the body across the lifespan (Christensen et al., 2019). Additive effects of health behaviors across the lifespan may also predispose individuals with specific traits to have medical illnesses associated with those risk factors—a sort of probabilistic funneling effect (Smith & Spiro, 2002).³ For example, low agreeableness is meta-analytically related to greater

³ This association would be probabilistic and would relate to the strength of association between the health behavior and the medical outcome.

use of alcohol (Malouff et al., 2007; Munafò et al., 2007) and research suggests that those with alcoholic liver disease are lower in agreeableness than those with liver diseases not caused by alcohol use (e.g., familial amyloid polyneuropathy; Telles-Correia et al., 2008). This funneling effect of personality may also be relevant to one's response to the medical treatment. For example, abstinence from alcohol becomes an important predictor of mortality after a diagnosis of alcoholic liver disease (Bruha et al., 2012) and relapse to alcohol after substance use treatment is meta-analytically related to less cooperativeness (a trait subsumed under agreeableness; Foulds, Newton-Howes, Guy, Boden, & Mulder, 2017). The role of personality in adherence to medical regimens appears to be important for other chronic medical illnesses as well (e.g., Axelsson et al., 2011).

Through these two mechanisms, personality traits may increase risk of specific medical illnesses and may play a moderating role in the treatment of those illnesses. One such medical illness that both personality mechanisms may be important to understand and has had relatively little research to date is cancer. In cancer treatment, psychological distress is so prevalent that it is considered to be a vital sign (American College of Surgeons, 2016).

Examining the relationship of personality disorder traits in cancer may be particularly important because distress intolerance is central to some PDs (Cavicchioli et al., 2015). In this study, we examine how PD traits may relate to distress during treatment of serious medical illness and that those with PDs may be overrepresented in certain medical clinics. To do this, we focus on head and neck cancer (HNC) which is associated with high levels of psychological distress (51%; Buchmann, Conlee, Hunt, Agarwal, & White, 2013) and the cause of which is often associated

with long-term health damaging behaviors (e.g., tobacco and alcohol use; Blot et al., 1988; Rodriguez et al., 2004). Furthermore, research on cancer and PDs is understudied (especially HNC compared to other cancers, such as breast), despite cancer being one of the leading causes of death worldwide (Quirk et al., 2016).

Psychosocial and health correlates of psychosocial distress in cancer treatment

Cancer is an umbrella term referring to class of diseases involving aberrant cell growth. These abnormal cells have the potential to spread past the original diseased site and invade healthy organs and cells, a process referred to as metastasizing (National Cancer Institute, 2015b). Cancer progression is rated by a staging system, the most popular of which is the Tumor, Node, Metastasis (TNM) staging system. The TNM staging system includes information about the size and invasiveness of the original tumor (T), lymph node (N) involvement, and if it has metastasized (M; National Cancer Institute, 2015). Head and neck cancers refer to cancer in areas within the oral cavity, pharynx (nasopharynx, oropharynx, hypopharynx), the larynx, visceral tissue (e.g., thyroid), paranasal sinuses/naval cavity, and salivary glands (HNC excludes brain cancers; U.S. Department of Health and Human Services, 2017). Compared to individuals with other types of cancer, treatment for HNC can be more disfiguring, impairing, and more visible because of the location of the cancers.

Psychological distress is variably defined, but generally refers to a negative emotional experience often comprised of anxiety and negative mood changes that range from normal stress-related response, to an adjustment or an internalizing disorder (Haman, 2008). Distress is

relevant across chronic health conditions and is especially important in cancer care as 33-45% of patients experience clinically significant distress, at any given time during cancer treatment (Bultz & Carlson, 2006; Clark et al., 2011). Individuals with HNCs show even higher levels of distress, as research indicates that 35-60% of patients experience distress above established clinical cutoffs (based on optimal cut points established with cancer and community samples; Batterham et al., 2018; Buchmann et al., 2013; Williams, 2017). With regards to internalizing disorders, one study found that the 63-67% of HNC patients with subthreshold depression before starting radiation therapy converted to severe depression by the end of treatment (as rated by BDI-II; Chen et al., 2009). This finding is particularly concerning, as depression is shown meta-analytically to confer a 39% greater mortality risk in cancer patients (Satin et al., 2009).

Possible contributing factors to HNC distress include physical surgical changes, emotional reactions to the diagnosis and prognosis (e.g., anxiety, depression), physical pain, reduced social support, as well as other practical, physical, and family concerns (Buchmann et al., 2013). While research suggests that the ability to cope with health and surgical complications may increase over time, psychosocial problems such as anger, anxiety, interpersonal relations, and general life satisfaction appear to worsen from short (0.5-1.5 years), to medium (1.5-5 years), and long-term (5-21 years) time periods after successful cancer treatment (Rapoport et al., 1993). A likely mechanism in this psychosocial trajectory is that, in some cancer centers, up to 82% of distressed patients with HNC receive no psychological or psychiatric care (Krebber, Jansen, Cuijpers, Leemans, & Verdonck-de Leeuw, 2016). Of those who receive treatment, there is no clear evidence regarding whether antidepressants perform

better than placebo for cancer patients (Ostuzzi et al., 2018) and research suggests that recent adaptations of evidence-based treatments such as Cognitive-Behavioral Therapy (CBT) may not meaningfully improve quality of life in the HNC population (Calver et al., 2018; Richardson et al., 2019)⁴. In order to successfully adapt current evidence-based treatments, a better understanding of pre-cancer attributes, especially personality pathology, may be important.

Personality pathology as a risk factor for psychological distress in cancer treatment

Research across various chronic health conditions suggests that pre-illness attributes such as neuroticism can predict one's distress trajectory (Debnar et al., 2020). Across cancer literatures, psychosocial factors are predictive of psychological outcome after treatment. For example, research in a breast cancer sample suggests that a history of a premorbid PD may be prevalent (33%⁵; $N = 141$) and predict a negative post-treatment psychiatric outcome and lower quality of life—independent of cancer severity and treatment type (Brunault et al., 2016; Champagne et al., 2016).

With regards to personality traits and across multiple types of cancer, higher trait neuroticism—a strong predictor of depression generally—consistently relates to increased distress during cancer treatment, although a limitation of most of this research is that traits are

⁴ However, these treatments were varied in the goals, definition of CBT, and level of therapist training; and many had methodological problems (e.g., no power analysis).

⁵ This estimate may be inflated by the self-report measure used and the relatively small sample size.

measured post-diagnosis (Den Oudsten et al., 2009; Goldstein & Klein, 2014; Hinnen et al., 2008; Morgan et al., 2017; Perry et al., 2020; Ranchor et al., 2002; Shimizu et al., 2015; Van Der Steeg et al., 2010). However, one prospective study measured neuroticism and distress before and after a diagnosis of cancer and found that pre-diagnosis neuroticism predicted distress across all three time points in the study (pre-diagnosis, two months, and one year post-diagnosis; Ranchor et al., 2002). Another notable study examined personality in a chemotherapy center which included breast, gastrointestinal, gynecological, and lung cancers (Morgan et al., 2017). They used latent class analysis and derived three classes—resilient, normative, and distressed. The distressed class was characterized by greater neuroticism and lower extraversion, agreeableness, and conscientiousness, whereas the resilient class was comparatively low in neuroticism and high in extraversion, agreeableness, and conscientiousness (Morgan et al., 2017). Being in the distressed class predicted greater severity of state anxiety, trait anxiety, and depression, independent of type of cancer, type or combination of treatments, and cancer stage (including if the cancer was metastatic; Morgan et al., 2017). Being in the resilient class was indicative of having the lowest and subthreshold levels of anxiety and depression. This article suggests promise in examining personality as a contributor to distress, but the authors used normal range personality measures and did not include HNCs in the sample. Further, while normal range personality measures index mostly the same general constructs, they measure the constructs at nonpathological ranges on the latent dimensions and therefore may fail to adequately sample maladaptive high or low levels of these trait dimensions (for an item response theory study examining this phenomenon see: Suzuki et al., 2015).

In the HNC literature, personality studies use traits that are narrowly defined and, generally, are not explicitly related to any well-established personality model such as the FFM. For example, one study found that in the HNC population, higher general dispositional optimism was associated with lower mortality risk (Allison et al., 2003), which appears to be mostly a combination of low neuroticism and high extraversion (Sharpe et al., 2011). Other studies use various personality models and some traits that appear to relate to neuroticism also relate to a more “depressed coping” style, which they described as “social withdrawal, self-pity and a generally depressive way of coping with their disease” (Rana, Gellrich, Czens, Kanatas, & Rana, p. 2984, 2014). Most studies use the Eysenck-Personality Inventory (EPI; Parish, Eysenck, & Eysenck, 1965) which includes three factors—Neuroticism, Extraversion, and Eysenck’s Psychoticism⁶—and, while neuroticism consistently positively relates to distress (Aarstad et al., 2002; Beisland et al., 2013), it is unclear to what degree this measure assesses the extreme ends of the personality pathology continua. To the authors’ knowledge, only one published study has examined all five personality factors in a HNC sample (but used a normal range scale) and found that increased openness to experience related to greater general quality of life (QoL), but distress was not examined (Kohda et al., 2005)⁷. Most of these studies assess personality post-diagnosis, which is a limitation because an individuals’ self-report of

⁶ From the FFM perspective, psychoticism in Eysenck’s model is a combination of low agreeableness and low conscientiousness, and is *not* the same construct measured in the PID-5 (Costa & McCrae, 1992).

⁷ Other research examining QoL uses measures such as the EPI and show neuroticism to relate to worse outcomes (for a review see Dunne et al., 2017)

personality traits may be colored by their state distress. For example, a sample item measuring neuroticism asks participants to rate how well descriptions such as “[I] fear for the worst” describe themselves (for the measure from which this item is taken see Maples et al., 2014). In the context of a recent diagnosis, this item may be understood in an entirely different way (although some authors argue the report is still a valid representation of current functioning; e.g., Costa, Bagby, Herbst, & McCrae, 2005). Even if distress distorts one’s personality trait scores, it appears that those with HNC may actually have higher levels of neuroticism prior to diagnosis. One study compared neuroticism from a sample of HNC patients to a comparison group of hospitalized patients. The comparison patients were scheduled for surgery the next day to treat a “benign” condition or to evaluate for the presence of HNC (Aarstad et al., p. 893, 2002). The authors found those with confirmed HNC were significantly higher in neuroticism than the comparison group who is also likely to be experiencing distress (Aarstad et al., 2002).

While there is little research in this area, certain factors in the HNC population suggest some overlap between PD traits and HNC. For example, epidemiological research suggests that 75% of HNC is caused by alcohol and tobacco use (Blot et al., 1988), and 32.1% percent of individuals with a PD have a comorbid alcohol use disorder (Lenzenweger et al., 2007). Moreover, a meta-analysis found that certain personality traits (e.g., low agreeableness) predict increased likelihood of using alcohol or tobacco, regardless if the use meets diagnostic criteria as a disorder (Malouff, Thorsteinsson, Rooke, & Schutte, 2007). There is also evidence that substance use is a prevalent challenge in this population as 33 - 50% of those with HNC

continue to use tobacco and/or alcohol after diagnosis and treatment, and one-fourth of the individuals who quit relapse within 12 months (Howren et al., 2013).

In addition to substance use, other associated psychological sequelae of PDs are evident in the HNC population. For example, suicide rates in those with HNC are three times that of the general population (Kam et al., 2015) and are the third highest across cancer categories (Zaorsky et al., 2019)⁸. Increased suicide risk is also found in individuals with alcohol use problems (OR: 12.18), a personality disorder (OR: 16.52), and both (OR: 45.40; Doyle et al., 2016). Although far from conclusive, these associated risk factors and outcomes suggest that the HNC population may be elevated in certain pathological personality traits prior to diagnosis, and that in a subset of these individuals, the cancer may result from common health damaging behaviors engaged in by those with PDs. There is also evidence that continued engagement in negative health behaviors following HNC diagnosis (e.g., Howren et al., 2013) can result in poorer response to cancer treatment and increased rate of recurrence. If this is the case, care for those with HNCs may be improved by screening for personality pathology and related negative health behaviors, so that empirically supported treatments that are tailored to address these comorbid features when present can be used (e.g., Dialectical Behavior Therapy skills training; Linehan et al., 2006).

⁸ The authors indicate that the rates of suicide in HNC are decreasing, which may be due to the success of HNC treatments for those with HPV-positive cancers.

Even if there is not a higher rate of personality pathology in this population, effectively treating distress is important because research shows those who are depressed have increased risk of mortality (Satin et al., 2009) and the course of distress occurs relatively independent of the severity of one's cancer or type of treatment (Morgan et al., 2017). Understanding which pre-diagnosis factors relate to distress and poorer psychiatric outcome can help improve treatment of distress for those with HNC. The purpose of this study is to examine the personality trait make-up of an HNC sample, as compared to normative data, and how potential personality pathology may relate to severity of acute psychological distress during the treatment phase for these individuals.

H1: We expect that the personality traits of negative affectivity, psychoticism, GPD-I, and GPD-S will be positively related to acute psychological distress during treatment for HNC. We hypothesize these relationships because GPD-S and neuroticism are positively related (Widiger et al., 2019) and neuroticism relates to greater distress with other cancer and non-cancer samples (e.g., Few et al., 2013). While there is no research examining psychoticism and distress in cancer treatment, a higher level of psychoticism relates to greater distress in community samples (Few et al., 2013), so we expected this to also be the case in this study. Finally, we expected interpersonal dysfunction to relate to greater distress because of previous reports suggesting that greater perceived social support may relate to less depression (Howren et al., 2013).

H2: We expect that this sample will have higher scale score means for antagonism, disinhibition, and negative affectivity, when compared published normative means from a

community sample calibrated to be representative of the US population (sample 3 from Krueger et al., 2012). We expect this to be the case because the relation of alcohol and tobacco use to HNC and the meta-analytic relationship between alcohol/tobacco use and the three corresponding normal range FFM personality traits (Malouff et al., 2007).

H3: We believe that the subset of participants who are categorically above calibrated clinical cutoffs (i.e., ≥ 2 for any of the pathological personality factor scores; Samuel et al., 2013) will also be higher in GPD-I, GPD-S, substance use, latent distress, and score lower on a measure of quality of life, when compared to the rest of the sample.

METHODS

Participants

Participants were recruited from a clinic waiting room of a large specialized cancer center. The initial recruitment included patients with HNC, lung cancer, new patients being evaluated for cancer, individuals who were being followed after cancer treatment (days to years out), and a smaller proportion of individuals who were in the clinic for noncancerous tumors or other head and neck surgeries. Undergraduate and graduate research assistants (RAs) approached patients in the waiting room to ask if they wanted to participate. Due to the possibility of a HIPAA breach by asking only those with HNC, the RA was instructed to ask each established patient as they check in to the front desk. During consent, the RA indicated that the study was intended for individuals with HNC, and did not include any compensation for participation (allowing for people to self-select, without discussing health information in the waiting room). To be included in the study, an individual needed to report a cancer of the larynx, oral cavity, oropharynx, nasal cavity, nasopharynx, paranasal sinuses, visceral tissue (e.g., thyroid, salivary glands), skin of the head, or cutaneous areas. A total of 734 individuals were approached and 544 (74%) did not participate. The full initial sample of data included 190 participants, 53 of whom were non-HNC patients and were excluded. This resulted in a final sample of 137 individuals who met criteria for the study.

In the final HNC sample ($N = 137$), the minority (34.9%) were undergoing active cancer treatment, defined as: surgery only (10.8%), multiple treatments (5.69%), follow-up (6.27%),

chemotherapy only (4.09%), other (4.09%), radiation (2.04%), immunotherapy (1.02%), pre-treatment (0.87%). The majority of patients reported they were currently cancer free (64.1%). The remaining participants reported that their cancer stage was unchanged since diagnosis (23.07%) or had increased (11.11%), while others reported not knowing their status or just that it “has improved” (1.70%). The most common stage at diagnosis was reported to be stage four (42%), followed by stage 1 (23.9%), stage 2 (18.25%), stage 3 (8.6%), limited stage (5.84%), and extensive stage (0.87%). The most common cancer location in the study was nasal cavity (21.2%), followed by oral cavity (17.5%), visceral (14.6%), oropharynx (13.1%), other (12.4%), multiple types of HNC (8.85%), skin/cutaneous (7.3%), nasopharynx (3.6%), paranasal sinuses (0.73%), and larynx (0.73%). Patients reported the median time since most recent cancer diagnosis to be 2.47 years (skew: 2.56; kurtosis: 8.82; for additional statistics see Table 1). The randomized measure conditions were approximately evenly split (condition A: 26.5%; B: 13.28%; C: 20.73%; D: 19.70%; E: 19.7%).

Most participants identified as male (70.8% male; 26.3% female; 2.9% not reported). The majority indicated that they were Caucasian (84.3%), followed by Black or African American (7.08%). The remaining participants reported Native American/Alaska Native (1.44%), South Asian (<1%), and individuals who wrote “Hispanic” in an “other” category (4.72%). Assessed separately from race, the majority identified their ethnicity as non-Hispanic/LatinX (87.5%). The majority of the sample consisted of older adults (median age = 66; SD = 12.05; range = 26 to 85.2) and 66.9% of participants indicated that their household annual income was between \$15,000 and \$74,000 (for comparison, census data indicate that the median household income

in the area is \$49,000; *U.S. Census Bureau QuickFacts: Orlando city, Florida, 2019*). The second largest household income division was < \$15,000+ (23.2%) suggesting that a sizeable portion of patients had substantially lower household income than the median household in the area. The final sample size of 137 used in the analyses exceeds the sample size of 130 indicated by an *a priori* power analysis (see Statistical Methods section below for details).

Measures

Personality Inventory for DSM-5—100 item version (PID-5-100)

The 100-item Personality Inventory for DSM-5 is a shortened version of the full version of the PID-5, derived from item response theory analysis (PID-5; Maples et al., 2015). The PID-5-100 incorporates five broad factors, as well as lower order facets that load onto each factor, as follows - negative affectivity: anxiousness, emotional lability, hostility, perseveration, lack of restricted affectivity, separation insecurity, and submissiveness; detachment: anhedonia, depressivity, intimacy avoidance, suspiciousness, and withdrawal; psychoticism: eccentricity, perceptual dysregulation, and unusual beliefs/experiences; antagonism: attention seeking, callousness, deceitfulness, grandiosity, and manipulativeness; and disinhibition: distractibility, impulsivity, responsibility, lack of rigid perfectionism, and risk-taking. The PID-5-100 demonstrates Cronbach's alphas ranging from .87 to .91 for the broad factors and .72 to .95 for the facets, across samples (Maples et al., 2015). When comparing the PID-5-100 to the full-length PID-5, the association with other relevant constructs in its nomological network appears to be largely identical ($r_{ICC} = .995$; Maples et al., 2015). The PID-5 presents questions by asking

the participant to answer the measure based on how they would describe themselves, without an indication of what time period.

Severity Indices of Personality Problems-Short Form (SIPP-SF)

The SIPP-SF is a 60-item short version of the 118 item SIPP, both of which index aspects of general personality dysfunction including Self-Control ($\alpha = .88$), Social Concordance ($\alpha = .81$), Identity Integration ($\alpha = .87$), Relational Functioning ($\alpha = .81$), and Responsibility ($\alpha = .83$; Rossi, Debast, & van Alphen, 2017). The SIPP-SF asks the participant to describe how they have been over the past three months.

Level of Personality Functioning Scale-BF 2.0 (LPFS-BF)

The LPFS-BF is a 12-item scale that measures the broad aspects of general personality dysfunction including interpersonal and self-dysfunction. The LPFS-BF shows satisfactory predictive validity, construct validity, and reliability (i.e., $\alpha_{\text{interpersonal}} = 0.80$, $\alpha_{\text{self}} = 0.86$; Bach & Hutsebaut, 2018). For the LPFS-BF, the participants were asked to describe how they have been over the past three months. For the latent variable model, two LPFS-self item parcels were created using a random number generator to assign half of the items to each parcel.

Distress thermometer (DT)

The distress thermometer is a single-item scale for which a patient rates their level of distress from 0 to 10 (Zwahlen et al., 2008) . Despite the brevity of the scale, studies using item response theory show established cutoffs of 5 or greater provides a good balance of sensitivity (.75) and specificity (.70; Batterham, Sunderland, Slade, Calear, & Carragher, 2018). This

measure is included in the study because of its efficiency, and its ubiquity in cancer research (Riba et al., 2019). The DT presents a thermometer with 0 to 10 on it and asks the participant to “please circle the number (0–10) that best describes how much distress you have been experiencing in the past week including today.”

Distress questionnaire-5 (DQ5)

The DQ5 is a five-item measure of distress created as a screener to identify individuals who are greater risk for common forms of psychopathology including major depressive disorder, generalized anxiety disorder, social anxiety disorder, panic disorder, adult attention deficit hyperactivity disorder, PTSD, and OCD (Batterham et al., 2016). A recent population-based IRT analysis suggested that the DQ-5 performed well as a screener for distress compared to other measures of distress (sensitivity: .83, specificity: .80; Batterham et al., 2018). The DQ5 asks participants “In the last 30 days...” to rate five statements about distress on a 5-point Likert scale.

Patient Health Questionnaire-4 (PHQ-4)

The PHQ-4 is a four-item screening measure of anxiety and depression. Two of the items on the PHQ-4 measure depression and two items measure anxiety. The overall scale shows satisfactory internal consistency ($\alpha = 0.80$; Löwe et al., 2010). The depression items have satisfactory sensitivity (.83) and specificity (.90) in detecting major depressive disorder, and the anxiety questions have moderate to good sensitivities for generalized anxiety disorder (88%), panic disorder (76%), social anxiety disorder (70%), and posttraumatic stress disorder (59%).

The specificities for the anxiety questions are also satisfactory (.81 -. 83; Kroenke, Spitzer, Williams, & Lowe, 2009). The PHQ-4 asks “in the last 2 weeks, how often have you been bothered by the following problems?” Likert scores range from 0 to 3, with zero indicating “Not at all.”

Kessler-10 (K10)

The K-10 is a 10-item screening measure of general psychiatric distress, which shows good psychometric properties ($\alpha = .92$) and was designed using item response theory to adequately measure scores that reach more severe end of the latent distress dimension (i.e., 90-99th percentile). Sensitivity and specificity metrics are different depending on the population to which one is administering the K-10; however, area under the Receiver Operating Characteristic curve is approximately 0.88 (Kessler et al., 2002, 2003). The K10 asks about distress in the past thirty days. Likert scores range from 1-5, with 1 being “none of the time.”

Substance Use Brief Screen (SUBS)

The SUBS is a 3-item screening scale for substance use disorders that includes screening questions for tobacco, alcohol, illicit drug, and prescription drug misuse (Mcneely et al., 2016). Across substances, it has a sensitivity of .82-1.0 and a specificity .65-.82 (Mcneely et al., 2016). The SUBS measure asks about substance use in the last 12 months and defines a “drink” and “recreational” use of drugs for participants. Response options are dichotomized with the “never” response being negative and “one or two days” or “three or more days” indicating a positive score.

Head and Neck Cancer Inventory (HNCI)

The HNCI is a 30-item measure of Health-Related Quality of Life (HRQOL) designed specifically for the challenges experienced by the H&NC population. It assesses functional ability and attitude towards impairment in areas of speech, eating, aesthetics, and social disruption (Funk et al., 2003). The HNCI asks about symptoms in the past four weeks and has a Likert scale from “not at all” to “extremely.”

Demographics and medical variables

Patients were asked basic demographic questions including age, sex, race, and whether they are Hispanic/LatinX. Participants reported time since most recent diagnosis, the location(s) of their cancer, the staging, and type of cancer treatment (surgery, chemotherapy, radiotherapy, other, or some combination of treatments). Patients gave consent to access their medical record to export their medication list. Medications were classified by converting them to their Anatomical Therapeutic Class (ATC) codes, these codes were scraped from Wikipedia (example web page: https://en.wikipedia.org/wiki/ATC_code_N06). All patient medications were coded in this way⁹; however, only specific psychoactive drugs expected to affect distress were included in the analysis. Patients were also asked about engagement in other types of treatments (e.g., physical therapy, chiropractic, massage therapy). This question included

⁹ For example, the ATC code N06AB indicates selective serotonin reuptake inhibitors, so sertraline and fluoxetine would be counted under N06AB, although they are identified as N06AB06 and N06AB03, respectively.

whether they were seeing a mental health professional (internal or external to clinic) or using other integrative medicine services at the hospital. In the control analyses, psychoactive drug classes that were included as separate variables were antipsychotics (N05A), antidepressants (N06A), psychostimulants (N06B), and opioids (N02A). There were too few individuals on anxiolytics (N05B) for them to be included as a control variable.

Procedures

The study was approved by the Institutional Review Boards of both the University of Central Florida and Orlando Regional Medical Center. Participants completed an informed consent procedure followed by paper versions of all self-report measures. After completion, a research assistant scored the DQ5 and if the individual was above the threshold ($DQ5 \geq 11$; Batterham et al., 2016), they were referred to a clinical social worker or another member of the behavioral health staff at the same hospital. The amount of time for completion of the packet was anticipated to be approximately 30 minutes, which was also the average wait time for patients. We anticipated possibly high levels of missing data due to the inability to provide financial compensation for the study, the possibility of survey fatigue, and/or being finished with their appointment before completing the packet. In an attempt to reduce the effect of missing data, two approaches were used: 1) different conditions which included pre-randomized ordering of questionnaire presentation in the packet (a planned missing data design method; Graham, Taylor, Olchowski, & Cumsille, 2006) and 2) multiple imputation by chained equations at the item level (as recommended by Eekhout et al., 2014).

Statistical methods

A priori latent variable and power analyses

First, we exported data from the correlation matrices of already published studies to decide which variables to include in the distress and the GPD latent traits. This was not done for the PID-5 traits because they have a well-established latent structure (Al-Dajani et al., 2016). Correlation matrices were converted to covariance matrices using the Lavaan package in R (version 0.6-5) and the “Cor2Cov” function (Rosseel, 2012). Only one study was missing published descriptive statistics needed to create the covariance matrix, so a request to the study authors was made who then provided the needed information (Bach & Hutsebaut, 2018).

For the following measures, the same process was used to decide on the number and adequacy of the latent variables. To ensure that two latent variables were needed for adequate fit, a principal components analysis was run in Rcmdr (2.6-1; Fox, 2016) with the covariance matrix (Component 1 variance: 5.89, component 2 variance: 0.96). Statisticians suggest that a variance of 1 or greater is a good metric for indicating the number of components to retain (i.e., the Kaiser criterion; Westland, 2015). Although the variance of 0.96 in component 2 is below this cutoff, we included it because it is very close to 1 and there is a theoretical reason to maintain this factor (Bender et al., 2011). This model was subjected to SEM (using Lavaan “sem” function) to evaluate the assumption that two latent variables were defensible, and results indicated that the two-factor model of GPD-I and GPD-S fit significantly better than the one-factor model ($\Delta\text{AIC}: 56.2; \Delta\chi^2 [DF_{\text{diff}} = 1, N = 187] = 58.18, p < .001$). Variables selected for the GPD-I latent model included the LPFS Interpersonal, SIPP Relationship Capacity, SIPP

Responsibility (which includes items related to trustworthiness and following of societal rules), SIPP Self Control (this was included on GPD-I, based on model modification indices), and SIPP Social Concordance scales. Scales selected for the GPD-S included the LPFS Self and SIPP Identity Integration. The scales selected for each latent variable were based on theory and tested by the adequacy of fit to the model. The final latent variable model, using the previously defined latent variables, indicated fit that was fair and better than the alternatives (χ^2 [12, $N = 187$] = 72.27, $p < .001$; Standardized Root Mean Square Residual [SRMR] = .083; Root Mean Square Error of Approximation [RMSEA] = .16; 90% CI [.13, .20]).

Variables selected for the latent distress model included total scores for the K10, DT, PHQ-4, and DQ-5. We used the correlation matrix from a previous crosswalk study using the general population ($N = 3620$) to establish the validity of a single latent distress variable (Batterham et al., 2018). Using the Kaiser criterion, one component was selected for this model (i.e., component 1 variance = 3.29; component 2 = .05). This model was subjected to SEM to evaluate the hypothesis that the four measures load onto one latent trait and the results indicated adequate fit (χ^2 [2, $N = 3620$] = 64.66, $p < .001$; SRMR = .01; RMSEA = .09; 90% CI [.07, .11]). The RMSEA CI suggests a well-fitting model as the majority of the CI is below the often-used cutoff score (i.e., $< .10$; Tabachnick & Fidell, 2012).

We conducted a power analysis using two methods and compared the results. The second method is more commonly used and indicated a larger N was required, so we relied upon this method to determine sample size. The second method was a simulation study using the simsem package in R (Jorgensen et al., 2018; L. K. Muthén & Muthén, 2002). Standardized

parameter estimates for factor loadings were taken from the aforementioned latent variable development process. The unknown parameters in the model were the distress to GPD-I, GPD-S, Negative Affectivity, and Psychoticism relationships (see Figure 1 for a depiction of the latent variable model). For these parameters, standardized parameters were used from a previous study examining general distress and personality pathology in a noncancer population (Few et al., 2013).

Next, three power simulations were completed. The first simulation examined the sample size needed to have power = .80 and tested sample sizes from 50 to 150. Using this method, 130 participants (rounded up from 127) provided a power of .80 for the parameters of interest. This sample size also provided satisfactory relative parameter estimate bias ($.10 >$ for all parameters), relative standard error bias ($.10 >$ for all parameters; $.05 >$ for parameters of interest), and coverage (between .91 and .98; Beaujean, 2014; Muthén & Muthén, 2009). Next, as recommended, two separate simulations were conducted with 10,000 replications and different random seeds. Both of these simulations indicated that 130 participants provided power greater than .80 and met the other additional criteria discussed above.

Bayesian structural equation modeling (BSEM via Blavaan in *R*; Merkle & Rosseel, 2015) and Bayesian one group metric analysis (i.e., Bayesian analog to the frequentist one sample *t*-test; Kruschke, 2014) were used for the main analyses of the study. We chose to use BSEM because we anticipated that the PD-trait variables would be positively skewed and this would cause non-normal residuals in the SEM; however, in Bayesian SEM, the residual variances are

given a noninformative Wishart prior distribution which is more flexible than the assumption of normality in frequentist analysis. Additionally, BSEM is not based on large sample theory like frequentist SEM (i.e., maximum likelihood) and can be more appropriate for smaller samples (although this is debated, we expect this to be a nonissue here as the study is adequately powered; Smid, Mcneish, Miočević, & Van De Schoot, 2019). Bayesian one group metric analysis was also used for consistency in methods across the study (i.e., "BESTmcmc" function via the BEST package in R; Kruschke, 2013, 2014).

In addition to the practical estimation-based advantages, Bayesian analysis has a number of interpretational advantages as compared to frequentist analyses. Bayesian analysis avoids null hypothesis significance testing (NHST) analysis shortcomings, including alpha inflation, the inability to interpret a null finding, and the dearth of information provided by frequentist p-values, parameters, and confidence intervals. In Bayesian analysis, one is able to conclude a degree of probability indicating that a result is zero (compared to the conclusion from failing to reject a null hypothesis). One interprets the highest density interval (HDI) as an indication of probability that a parameter is between the two end points (confidence intervals do not provide this information and are misused when interpreted in this way)¹⁰. Additionally,

¹⁰ Neyman strongly argued against this interpretation of confidence intervals in his original paper outlining them (see Neyman, 1937).

parameters in Bayesian analysis are considered to be random variables and this allows the distribution of parameters (i.e., posterior distribution) to be interpreted.

In contrast to testing a null hypothesis, two methods are used in combination to evaluate parameters. First, the 95% HDI is calculated which contains 95% of the most probable/credible parameter values (similar to how confidence intervals are commonly interpreted; Kruschke & Liddell, 2018). Second, a region of practical equivalence (ROPE) is used (Kruschke & Liddell, 2018), which is similar to equivalence testing in the frequentist framework. For the ROPE, one establishes an area of parameter space, that is considered null or not practically meaningful. Here we use a standardized parameter between $-.10$ and $.10$ (inclusive of all parameters between, including zero) as considered to be equivalent to a null and is used as the ROPE (Kruschke, 2014). The ROPE is flexible enough that it could contain any range of parameters, this range was chosen because it contains a null value (i.e., zero), a standardized parameter of $< |.10|$ is likely practically inconsequential, and, additionally, is less than half the size of a small effect size for a standardized regression parameter (Kruschke, 2018). Two decision rules are used in this study, which are taken from Kruschke and Liddell (p. 185, 2018).

1. “When the 95 % HDI [entirely] falls *outside* the ROPE, it literally means that the 95% most credible values of the parameter are all *not* practically equivalent to the null value.”
2. “When the 95 % HDI [entirely] falls *inside* the ROPE, it literally means that all the 95% most credible values of the parameter *are* practically equivalent to the null value.”

Rule one is not rejecting a null hypothesis, but the motivation behind this is similar. Rule two is not accepting the null hypothesis, though one could think of this as an analog. When a portion of the HDI overlaps with the ROPE, we will report the probability that parameter estimates are practically equivalent to the null value (i.e., the percentage of the HDI that is within the ROPE). In this case, however, the decision is undecided because some values are equivalent to the null and some are not (Kruschke, 2018). Both unstandardized and standardized parameter values will be reported.

Bayesian path and SEM model fit is evaluated using the positive predictive p -value (PPP), which is a statistic based on the chi-square (Muthén & Asparouhov, 2012). The PPP reflects the “proportion of times that the observed data are more probable than the generated data” in the calculation of the model (Zyphur & Oswald, p. 402, 2015). Using this metric, poor fit is indicated by extreme values (i.e., good fit indicated by $.05 < \text{PPP} < .95$) and a PPP of .50 indicates that the model and data were equally likely (Asparouhov & Muthén, 2010). A PPP of less than .05 or greater than .95 are used as the cutoffs in the following analyses to indicate poor fit.

The ROPE is also used for the one-sample test that examines the hypothesis that this sample will be higher in negative affectivity, antagonism, and disinhibition compared to a normative sample. To compare means, Cohen’s d is used as an effect size metric, so the same logic for the ROPE is used for this analysis as for the BSEM analysis. The ROPE included all values between $-.2$ and $.2$ which is a positive or negative small effect size (Cohen’s d) and is inclusive of zero.

Two methods were used to address missing data. The first method included creation of five measure conditions, which included the exact same questions; however, the measures were presented in randomized order. The exceptions to this were that consent, demographic, and the DQ5 were always first. The rationale for this was that if the average participant stopped 2/3 of the way through the measures, the last 1/3 of missing measures would differ across participants. Second, multiple imputation (MI) at the item level was used for missing data to avoid biasing results and reducing power by using listwise or pairwise deletion (Buuren & Groothuis-Oudshoorn, 2011). We chose to use MI because it produces less biased estimates than listwise deletion in cases with data that are missing completely at random (MCAR), missing at random (MAR), and not missing at random (NMAR; for rebuttals to popular MI misconceptions see van Ginkel, Linting, Rippe, & van der Voort, 2019). Further, the use of MI at the item level retains participant information and is shown to perform better than mean replacement at the sample or participant level and better than complete item analysis¹¹ (Eekhout et al., 2014). The items that were used for main analyses for the study, including relevant control and demographic variables, were included in the model. Due to the high number of items and to have as much power as possible for the imputation model, the full collected sample of data ($N = 190$) was used for the process of imputation and were

¹¹ Complete item analysis refers here to including only participant scale scores that has no missing items. Another alternative option is to count the scale score as missing if X out of total items are missing. This practice would require an arbitrary cutoff and would still result in a loss of information.

subsequently removed after the imputations were created. The Multiple Imputation by Chained Equations (MICE) package in R was used to create imputations (Buuren & Groothuis-Oudshoorn, 2011). As recommended, convergence plots and histograms were examined to check the appropriateness and validity of the imputations and these indicated that the imputation model fit the data well. Five imputed datasets were created using the Midas Touch method of imputation for Likert items and analyses were pooled at the end (van Buuren, 2018). Descriptive statistics of study relevant variables are presented in Table 1.

RESULTS

First, the control variable analysis was conducted that included variables that may affect distress (see Table 1 for descriptive statistics not already described in Participants section). Variables included their age, sex, location of cancer, cancer stage at diagnosis, whether they are in active cancer treatment, the years since most their recent diagnosis, current prescription of particular classes of psychoactive medications (i.e., separate dichotomized values for antidepressants, antipsychotics, psychostimulants, and opioids), the measure order condition (see Methods section), self-reported lifetime history of at least one mental health diagnosis (dichotomized), their household income (categorized as “less than \$15,000” and including four \$15,000 increments up to \$74,999 with the final anchor “\$75,000 or more”), and if they are receiving other current mental health treatment (self-reported and dichotomized). To avoid issues of multicollinearity within the control variable analysis, preliminary regressions followed by tetrachoric correlations for the dichotomous variables were conducted. The multicollinearity analysis indicated that the tolerance statistics were all satisfactory (i.e., > 0.2 ; Field, Miles, & Field, 2012) and across imputations, the highest tetrachoric correlation was .72 which authors suggest is a nonproblematic level of shared variance, especially considering the tolerance statistics (Field et al., 2012).

Next, the control variable analysis was conducted across the five imputations using path modeling in Blavaan (i.e., "bsem" function; Merkle & Rosseel, 2015). The distress measures were combined to make a principal component for use in the regression (using “princomp” in the stats package; R Core Team, 2018). Results of the control variable analysis indicated that all

of the models had good fit (Positive Predictive P-Value Median [PPPs] = .50, 95% HDI = .493, .503). The models with 3 chains each were run for a sample of 12,000 after a burn-in period of 50,000 (totaling 11 hours of computation time). The default priors from Blavaan were used and convergence was reached (i.e., Geweke diagnostic $< |2.575|$ ¹², trace plots, autocorrelation plots, effective sample size (ESS) $> 10,000$, and PSRFs were all satisfactory). Examination of the posterior parameter estimates indicated that none of the HDIs of the variables excluded the ROPE (all were greater than 5% in the ROPE; see Figure 3 for standardized posterior distributions). The self-reported use of other mental health treatment approached a “significant” ROPE; however, the percentage in the ROPE was 5.33% and did not reach the $<5\%$ criterion so it was not included in subsequent analyses. These results indicate that there was insufficient evidence that a null value could be ruled out, so none of the control variables were included in the main Bayesian SEM (see Table 2 for unstandardized and standardized parameters and ROPE percentages).

Next, the main Bayesian SEM model was calculated. This model included latent variables for GPD-I, GPD-S, Negative Affectivity, Psychoticism, and Distress with paths between the latent personality variables to the Distress latent variable (see Figure 1). This model was unable to converge and satisfy the convergence diagnostics. The burn-in and sample sizes were increased

¹² One parameter across all five imputation models had a Geweke that was significant. It met convergence criteria for all other metrics, so this was interpreted as a false positive due to many Geweke comparisons (this is a frequentist-based test).

in an attempt to achieve convergence. Increasing the burn-in (from the 1,000 default to 200,000) and sample (from 500 to 10,000) failed to reach convergence (even after 55+ hours of computation time). The Markov chain Monte Carlo (MCMC) estimator used in Blavaan (i.e., “Stan”) also indicated errors in the calculations of posterior estimates (i.e., 120 divergent transitions indicating issues with Hamiltonian Monte Carlo simulations). The recommendation to ameliorate this error is to increase adapt delta to a higher value or reparametrize the model, as a poorly specified model may be the cause of the issue (Stan Development Team, 2019). Changing adapt delta to the highest possible value (i.e., .999, as is recommended) failed to avoid this error. The results of Bayesian analysis are unreliable and should not be trusted without clear evidence of convergence of the model, so the next step taken was to examine the model for poor path specification¹³.

To investigate the appropriateness of the hypothesized structural part of the model, a procedure recommended by Westland (2015) was used. In this procedure, one submits all of the measured variables to a principal component analysis (PCA) to examine the degree to which the latent variable part of the model fits the data (Westland, 2015). For this analysis, all of the measures that comprise latent variables were submitted to the PCA, using the correlation matrix pooled across all imputations. Parallel analysis (psych R package with “fa.parallel”

¹³ The same model with the data were submitted to frequentist SEM using robust maximum likelihood estimation (MLR) and the results indicated that the specified model fit poorly (all χ^2 were significant across imputations at $p < .0001$, suggesting this is not simply an issue with Bayesian model convergence).

function; Revelle, 2015; Horn, 1965) was used to determine the number of principal components present in the data. Results indicated two principal components were warranted and the PCA loadings failed to clearly represent the theoretically defined latent variables. Because of this, the latent variables for the personality traits—negative affectivity, psychoticism, GPD-I, and GPS-S—were excluded in the final model and just the scale scores from those measures were used. The same method was applied to the distress variables and results indicated that one principal component fit the data well, so this latent variable was retained.

To resolve this issue, the PID-5 and GPD latent variables were removed from the model. The reasons for removal were: (1) due to poor fit to the data; (2) because there is literature suggesting factor issues with the GPD traits generally (i.e., that GPD factors may be just a bloated factor and that they overlap with the traits to a large degree; Oltmanns & Widiger, 2016, 2018); (3) and the ability to test the main hypotheses without these variables. The latent distress variable was the only latent variable that was retained and the PID-5¹⁴, LPFS, and SIPP scale scores were used as observed variables. The final BSEM model included the DQ5, K10, and PHQ4 loading onto a latent distress variable with negative affectivity, psychoticism, the SIPP,

¹⁴ Negative affectivity and psychoticism were calculated using the PID-5 measure scoring instructions (i.e., average the facets for the factor scores).

and LPFS-BF scale scores variables as predictors (see Figure 2 for the final latent variable model).

The models converged after a burn in of 100,000-150,000 and a sample of 20,000 using the aforementioned convergence diagnostics¹⁵. The PPP for these models indicated an adequate fit (Median PPP: .23; 95% HDI: .20-.42). Next, parameter estimates for the regression parameters were examined. The only variable that had less than 5% of the HDI within the ROPE was Negative affectivity (see Figure 4 and Table 3 for posterior information), which was positively related to latent distress (Standardized parameter mean: 0.43; HDI: 0.27-0.60; ROPE = < .0001), indicating that more negative affect is related to greater distress. The remaining regression parameters—LPFS interpersonal, LPFS self, psychoticism, SIPP relational capacity, responsibility, identity integration, self-control, and social concordance—had distributions that failed to exclude the ROPE, indicating no evidence of “significance” (for standardized posterior distributions see Figure 4).

Next, the second hypothesis was examined using one-sample Bayesian tests (the Bayesian equivalent to a one-sample t-test) and the means were interpreted on the Likert scale. The BEST package in R was used for all one-sample tests (Kruschke, 2013). The trace plots, scale reduction factors (R-hat in this case), and effective sample size indicated convergence for all

¹⁵ Five parameters had a significant Geweke (i.e., $Z \geq 2.575$); however, the remainder of the convergence diagnostics indicated that these parameters converged. These are likely false positives, as the Geweke test is frequentist-based and there are 369 parameters to evaluate total.

models. The comparison means that were used for the negative affectivity, disinhibition, and antagonism variables were taken from a study ($N = 264$) of community adults (Krueger et al., 2012). This comparison sample was collected by a global consumer research company (i.e., *IPSOS*, 2020) who administered the PID-5 online to community individuals using a sampling strategy calibrated to ensure representativeness of the US population (Krueger et al., 2012). The collected sample contained 49.1% men and 50.1% women, who were approximately evenly split among four age groups (i.e., 22.1% = 18-39 years, 26.4% = 30-44, 27% = 45-59, 24.5% = 60+ years old), and split among education levels (e.g., 31.8% high school education; 27.9% bachelor's degree or higher). The majority of the sample identified as white and non-Hispanic (70.6%) followed by black and non-Hispanic (11.6%). Approximately 13% of individuals identified as Hispanic.

The ROPE criterion for the one-sample tests was similar to that of the BSEM analysis (i.e., -0.20 to 0.20 inclusive of a small effect size). The ROPEs indicated that a null value could be rejected for all three personality variables, as the ROPEs contained < 5% of the posterior distribution (see Figure 5). The mean for this sample was smaller with a large effect size compared to the community sample for negative affectivity (Median of mean: 0.42, $SD = .43$, HDI of Cohen's d : -2.34, -0.88), disinhibition (Median of mean: 0.28, $SD = .27$, HDI of Cohen's d : -3.82, -1.96), and antagonism (Median of mean: 0.15, $SD = .17$, HDI of Cohen's d : -3.55, -1.89). See Table 4 for results of the Bayesian one-sample tests.

A sensitivity analysis was also conducted to examine if self-selection into the study could have affected the results of hypothesis two. For this analysis, the full collected sample (190)

was used which allowed the number of people who declined to participate (544) to be defined. For each trait—negative affectivity, disinhibition, and antagonism—an additional 544 responses were added to the data. These additional responses were randomly sampled from the comparison distributions using the “rnorm” function in R (i.e., published negative affectivity mean = 1.07; SD = 0.44; Krueger et al., 2012). Each analysis was conducted 10,000 times and analyses were pooled across imputations for frequentist t-tests. This analysis allows one to test how the results may change, if the other 544 participants who participated were actually at normal levels of the PD traits (based on the comparison distribution).

Results of the sensitivity analysis indicated that the results were robust for negative affectivity (t -value 95% HDI = -7.22, -4.23; Cohen’s d HDI = -2.69, -.52; p -value HDI = < .0000001, .001; ROPE for percentage of p -values > .05 = < .0001) and disinhibition (t -value 95% HDI = -10.9, -7.32; Cohen’s d HDI = -5.57, -.73; p -value HDI = < .0000001, < .0000001; ROPE for percentage of p -values > .05 = .04). Less than 5% of the distribution of p -values for negative affectivity and disinhibition was greater than .05, indicating that the interpretation of the results is unchanged under the sensitivity analysis assumptions. However, for antagonism, the results suggested that, if the participants who declined to participate were from the comparison distribution and actually participated, the effect we found for antagonism would no longer be present (t -value 95% HDI = -.61, .66; Cohen’s d HDI = -.28, .37; p -value HDI = .53, .99; ROPE for percentage of p -values > .05 = 1). In other words, for antagonism, 100% of the HDI of the p -values were greater than .05.

Supplemental analyses indicated there was no evidence that time since most recent diagnosis correlated with any of three PID-5 factors (all correlation HDIs overlapped the $-.1$ to $.1$ ROPE: $.27-.78$), which suggests that recency of a diagnosis and associated distress may not have affected personality trait reports. The difference between personality trait levels in the active treatment group vs post-treatment group also showed no evidence of an effect of active treatment on PID-5 factor scores (ROPEs: $.12-.88$).

The third hypotheses depended on the assumption that there would be a subsample of individuals who scored above the recommended cutoffs for the PID-5 measure (i.e., a score of 2); however, there were no individuals who scored above the cutoff for antagonism or disinhibition. There were three individuals who scored above the cutoff for negative affectivity which is too small to be adequately powered, so the final hypothesis could not be tested.

In a final supplementary analysis, we examined the level of psychological distress in this sample and the comparison score used was taken from a large online sample of community adults ($N = 3,577$; Batterham et al., 2018). The Kessler-10 (K10) distress scale was used for this analysis because an IRT analysis suggests that it covers a substantial portion of a latent distress domain (compared with other distress measures; Batterham et al., 2018). Norms for the K10 indicate that a score of 7 approximates a T-score of 50, so this was used as a comparison score

(Batterham et al., 2018)¹⁶. Results of a Bayesian one-sample test indicated that the level of distress in the sample from the present study was considerably lower than the average score from this community sample with a large effect size (Median of mean: 3.51, $SD = 2.99$, HDI of Cohen's d : -1.13, -.52; ROPE < .0001). Examination of the effect of active treatment on K10 scores provided no evidence of a difference in distress between those who were in active cancer treatment vs post-treatment phases (Post-treatment median of the mean: 3.11; Active treatment median of the mean: 4.14; Median of Cohen's d : -0.61; 95% HDI = -1.51, 0.27; ROPE = .15). Bivariate correlations between the K10 and time since diagnosis in years suggested there is no evidence of a correlation between the two variables (Posterior median of the correlation: .0005; 95% HDI = -0.19, 0.19; ROPE = .72).

¹⁶ The k10 was re-scored by summing the items for this analysis, so that the scale would match that of the study.

DISCUSSION

Research suggests that personality traits may predict important medical outcomes (e.g., Chapman et al., 2013). This study sought to examine how PD-traits (negative affectivity, psychoticism, self- and interpersonal-dysfunction) may relate to distress during head and neck cancer (HNC) treatment. The second aim was to examine the average level of negative affectivity, psychoticism, and disinhibition in an HNC sample. Finally, we were interested in examining if those participants above PD-trait cutoffs have a greater prevalence of factors associated with worsened course (e.g., alcohol use).

First, we examined if control variables (e.g., cancer stage, time since most recent diagnosis, etc.) affected psychological distress. Results indicated there was insufficient evidence that any of these variables contributed to distress. The “in other mental health treatment” variable approached the criterion of < 5% of the highest density interval (HDI) being in the region of practical equivalence (ROPE); however, 5.3% of the HDI was in the ROPE which precluded it from being in the full SEM model. The 5% decision rule is arbitrary, but it was established a priori and has precedence in the literature (i.e., Kruschke, 2018), so we did not include the variable in the main model. For the control variable model, it was especially surprising is that time since most recent diagnosis was not a predictor of distress. This finding may be due to the fact that patients self-reported their diagnostic date or that people returning to the HNC clinic continue to be distressed as a result of returning to the clinic at which they received cancer treatment, even if they are weeks to years out of treatment. Another possibility is that there is range restriction in distress scores and that less distressed individuals

volunteered to participate. This idea may be supported by the fact that the average K10 distress rating was much lower than the general population. Future research could provide monetary compensation for participation, which may help with sampling issues.

With regards to the main model examining the relationship between negative affectivity, psychoticism, self- and interpersonal-dysfunction latent variables and a latent distress variable, we found poor fit to the structural component of the model. This was likely due to the overlap between the personality variables (Widiger et al., 2019). A growing body of literature suggests that this issue is not unique to this study, as there is some evidence that the personality disorder traits and general personality dysfunction overlap to a substantial degree (Few et al., 2013). Because our question was one of relationship between traits and distress, and less about verifying the latent structure of these constructs, we used the measured variables instead. In doing so, we only found that higher scores on negative affectivity related to greater psychological distress at the time of the assessment. This finding was expected and is consistent with previous research on distress in non-cancer and cancer samples (Aarstad et al., 2002; Beisland et al., 2013). The unique contribution of this finding indicates that this short personality trait measure may be useful in identifying individuals shortly after diagnosis who are more susceptible to developing distress during treatment. This possible applied implication is supported by the finding from a supplementary analysis, that there was no evidence that time since most recent diagnosis was related to the PID-5 factors (all Bayesian ROPEs > .05). Further, there was no evidence that those actively engaged in treatment compared to those post-treatment had elevated personality traits, suggesting the validity of the personality trait

scores in this context. Personality measures generally (Marek et al., 2020), and these measures specifically, may have utility in identifying individuals to whom a clinic could allocate resources by increased contact and distress assessment. However, this study is limited because it is cross-sectional and predictive validity can only be speculated about at this time. An ideal study design would include prospective longitudinal methods (similar to Ranchor et al., 2002), in which community individuals at risk of HNC are assessed in primary care before diagnosis and are followed through cancer treatment to see how personality relates to or predicts the course of distress.

The latent variable model also suggested that there was insufficient evidence to conclude that psychoticism, self, and interpersonal dysfunction measures were meaningfully related to distress (overlap of the ROPEs indicate 9.3-77.3% probability that they are not meaningfully different from the null value). This is unexpected and may suggest that treatments tailored to those with HNC may benefit more from addressing aspects of negative affectivity, compared to psychoticism-, self-, or interpersonally-focused treatments. We also expected that psychoticism would predict distress; however, we also found no evidence this was the case. The study may have been underpowered to detect an effect of psychoticism on distress as research suggests this relationship is less than half as large as negative affectivity (i.e., .58 vs .24; Few et al., 2013). It may also be the case that there is a null relationship; however, more research is needed with larger samples to increase precision of the results and allow for a more definitive conclusion about the ROPE.

The second hypothesis tested whether individuals with HNC had higher levels of PD traits on average. We found that individuals in this sample were much lower (with a large effect size) on all PD traits examined (i.e., negative affectivity, disinhibition, and antagonism), when compared to a published sample of community adults who were sampled to be representative of the US population (Krueger et al., 2012). There are a few possibilities for the finding that individuals in the current study were much lower than the comparison sample. The PID-5 is a face valid instrument and is shown to be susceptible to underreporting (Dhillon et al., 2017), so individuals may have presented themselves in a highly desirable way, although we are unaware of a secondary motivation to underreport. While possible, this seems an unlikely cause for these results because in other studies, when participants are given explicit instructions to underreport on the PID-5, their scores drop by approximately one standard deviation (Dhillon et al., 2017). Such a drop in scores would still equate to a medium and large effect size difference for negative affectivity and antagonism (disinhibition would have a near small effect size) between this sample and the comparison sample. This would also require the assumption that social desirability would have as strong of an effect as explicit instructions to underreport, which seems unlikely and could be tested empirically. To rule this issue out, future research could include social desirability measures (e.g., Reynolds, 1982) to account for this possible effect. Other options could include normal and pathological range measures of personality and/or include an informant report of personality.

A second possibility is that those who are much lower on these traits volunteered their time to participate because they are lower on these traits. There is research suggesting

that personality traits affect who volunteers for research studies (with a small to medium effect size for decreased neuroticism and increased conscientiousness predicting volunteering; Lönqvist et al., 2007). While this is a possible explanation for the findings, the small to medium effect size would still not negate the findings of the average trait being much lower. Moreover, results of the sensitivity analysis—which assumed that the 544 participants who did not participate were from the comparison distribution—found that the results were still unchanged for negative affectivity and disinhibition, although the antagonism result was no longer present. This finding increases the confidence in the former traits and suggests the results from the latter is less robust. It seems plausible that antagonism (i.e., low agreeableness) would be a trait that affects one’s willingness to volunteer for a study with no monetary compensation. This further supports the importance of providing monetary compensation for participation in future studies to help incentivize participants who are less likely to volunteer their time.

It may also be that the comparison sample was inadequate in some way. While there is evidence that the traits measured by the PID-5 are generally age-neutral (Van Den Broeck et al., 2013), some traits are not, so an age-matched sample may be better suited to compare to this group, as 72% of individuals in our sample were 60 or older, whereas the comparison sample had 24.5% individuals 60 or older (Krueger et al., 2012). There is evidence of measurement invariance across sexes for the PID-5 measure (Suzuki et al., 2019); however, we had a much higher percentage of men in our study compared to the comparison sample, which may have affected the results (i.e., 49.1% male vs 70.8% in this study). To the authors’ knowledge, no

such high-quality sample using the PID-5 is available. A future study could collect samples across cancer types to examine the stability of these results.

These findings may also be a result of censored data (of which range restriction is a type). For example, it could be that those with maladaptive personality traits were not well represented in the clinic because of a worsened course of illness and unsuccessful treatment due to other factors (e.g., missed appointments). This may also explain why the average person in the clinic rated themselves as less distressed than even community adults (i.e., Batterham et al., 2018), those who are more distressed or higher in PD traits were less likely volunteer. Again, some form of financial compensation may help reduce this possible effect.

Finally, the lower levels of personality traits may be due to psychological change processes occurring as a result of treatment, such as posttraumatic growth (PTG) and/or increases in self-compassion. Individuals may have had a positive change in personality traits as a result of a cancer diagnosis (the trauma) and successful treatment. As currently defined, those with HNC show lower scores on PTG, compared to those with other cancers (Sharp et al., 2018); however, personality trait change is rarely an outcome in PTG research (Jayawickreme & Blackie, 2014). Although, there is evidence that personality traits change after a chronic illness diagnosis, this is often in the less adaptive direction (e.g., lower extraversion, greater neuroticism; Jokela, Hakulinen, Singh-Manoux, & Kivimäki, 2014), so more research is needed to understand this process. One mechanism by which this change may occur is through an increase self-compassion after cancer diagnosis and treatment. There is some literature suggesting that a mindfulness and self-compassion intervention can reduce the severity of

Borderline Personality Disorder symptoms (Feliu-Soler et al., 2017) and, in this case, the increase may be occurring as a function of treatment. However, more research is needed to examine if self-compassion changes as a result of treatment and if it affects personality trait change. Further, self-selection effects and censored data will be important methodological concerns to address in future studies.

The third hypothesis proposed that those elevated in pathological traits would show a worsened course by use of more recreational substances, lower quality of life, and more general personality dysfunction. This third hypothesis was dependent on the premise of the second hypothesis—namely, that there would be individuals elevated in those traits in this sample. We suspect this is partially due to the low base-rates of pathological trait elevations in this relatively small sample. Future research could either use a larger sample to increase the n of low base rate trait elevations or this question could be better answered by a longitudinal approach. A future study could measure pathological traits at the beginning of cancer treatment and examine how they affect the course of distress during and after treatment. Future research should also investigate the effect of personality traits on health damaging behaviors that may increase the risk of recurrence of cancer (e.g., smoking and drinking; Howren et al., 2013).

Conclusion

Collectively, we found that individuals in an HNC cancer sample were shown to have substantially lower pathological PD traits compared to a relatively small but census-weighted

normative sample. Our findings also suggest that elevated severity of negative affectivity may be useful as a predictor of increased psychological distress during HNC treatment and subsequent follow-up visits.

APPENDIX A: FIGURES AND TABLES

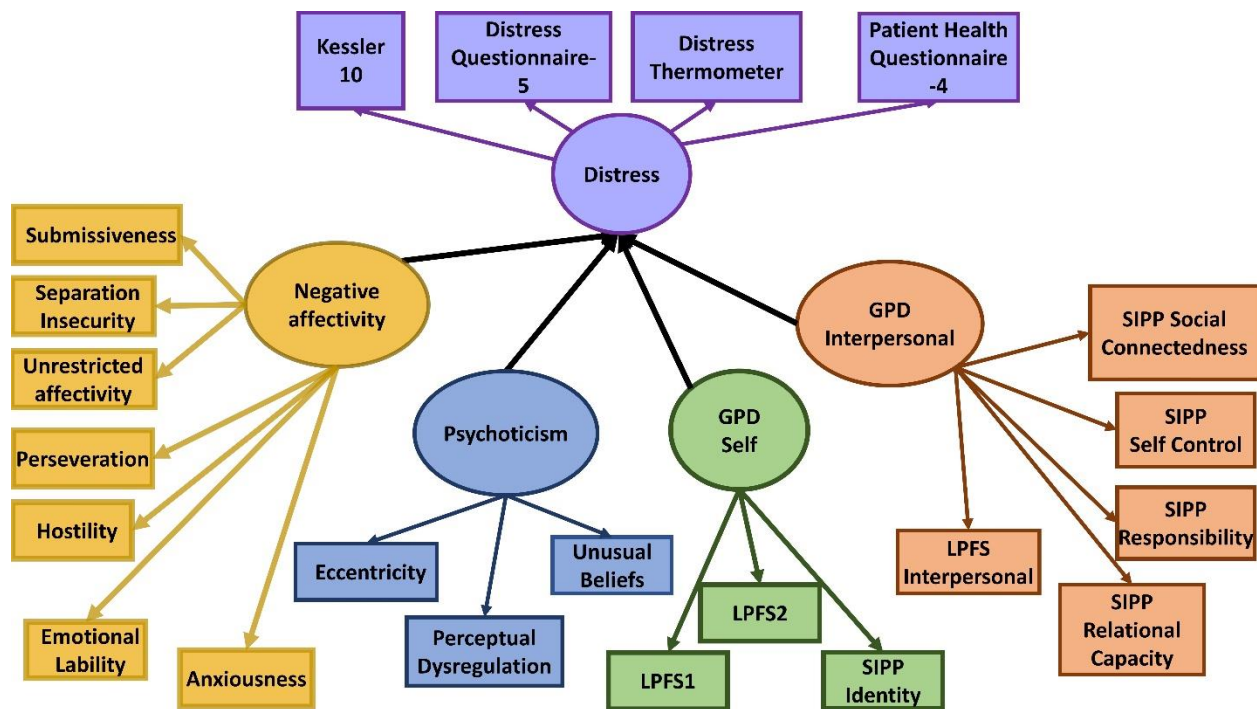


Figure 1. Original latent variable model.

Note: Squares indicate measured variables and ovals indicate latent variables. Arrows indicate direction of relationship. SIPP indicates the Severity Indices of Personality Pathology measure. LPFS refers to the level of personality functioning scale. LPFS1 and LPFS2 refer to the two LPFS-self item parcels. GPD refers to general personality dysfunction. Unrestricted affectivity is reverse scored restricted affectivity (as is indicated by the measure; Maples et al., 2015).

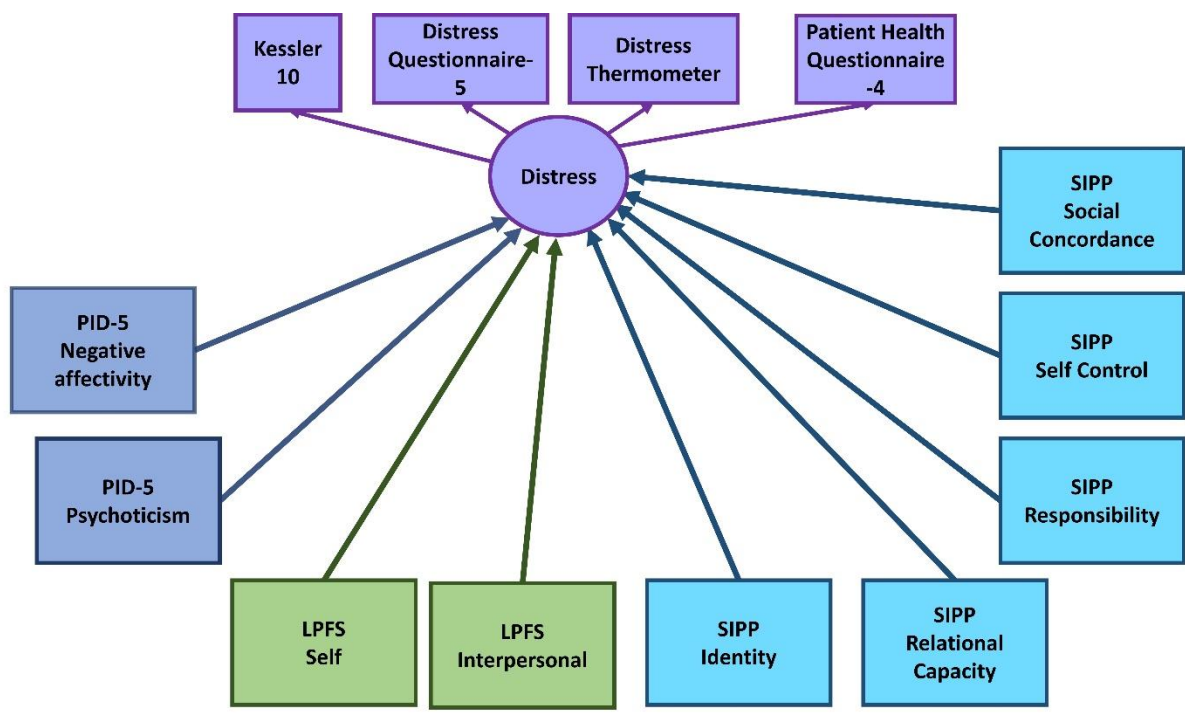


Figure 2. Final latent variable model.

Note: Squares indicate measured variables and ovals indicate latent variables. Arrows indicate direction of relationship. SIPP indicates the Severity Indices of Personality Pathology measure. LPFS refers to the level of personality functioning scale. PID-5 refers to the personality inventory for DSM-5.

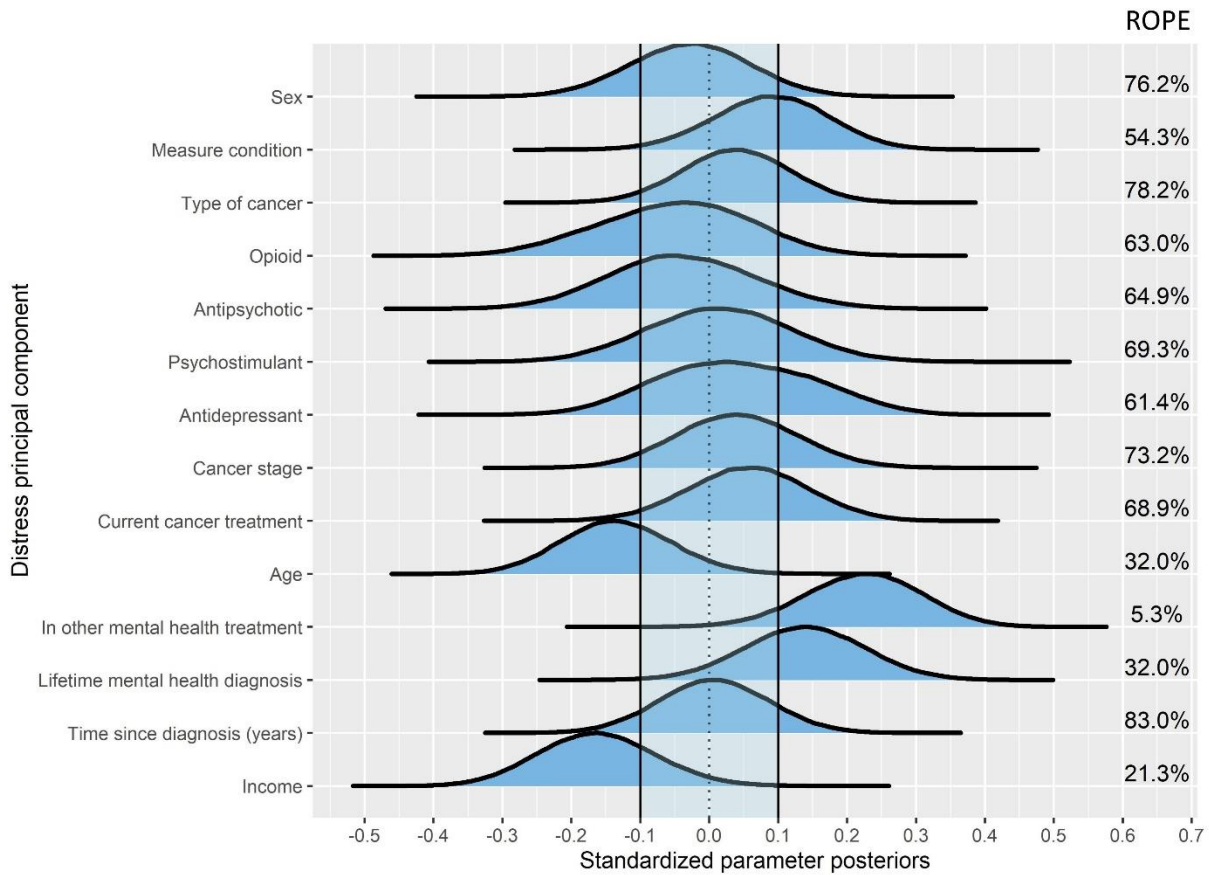


Figure 3. Standardized posterior estimates of the control variable model.

Note: Posterior estimates are of the standardized regression parameters predicting the latent distress principal component. The Region of Practical Equivalence (ROPE) that ranges from – 0.1 to 0.1 is plotted at the center of the plot and ROPE percentages are presented in the plot on the far right.

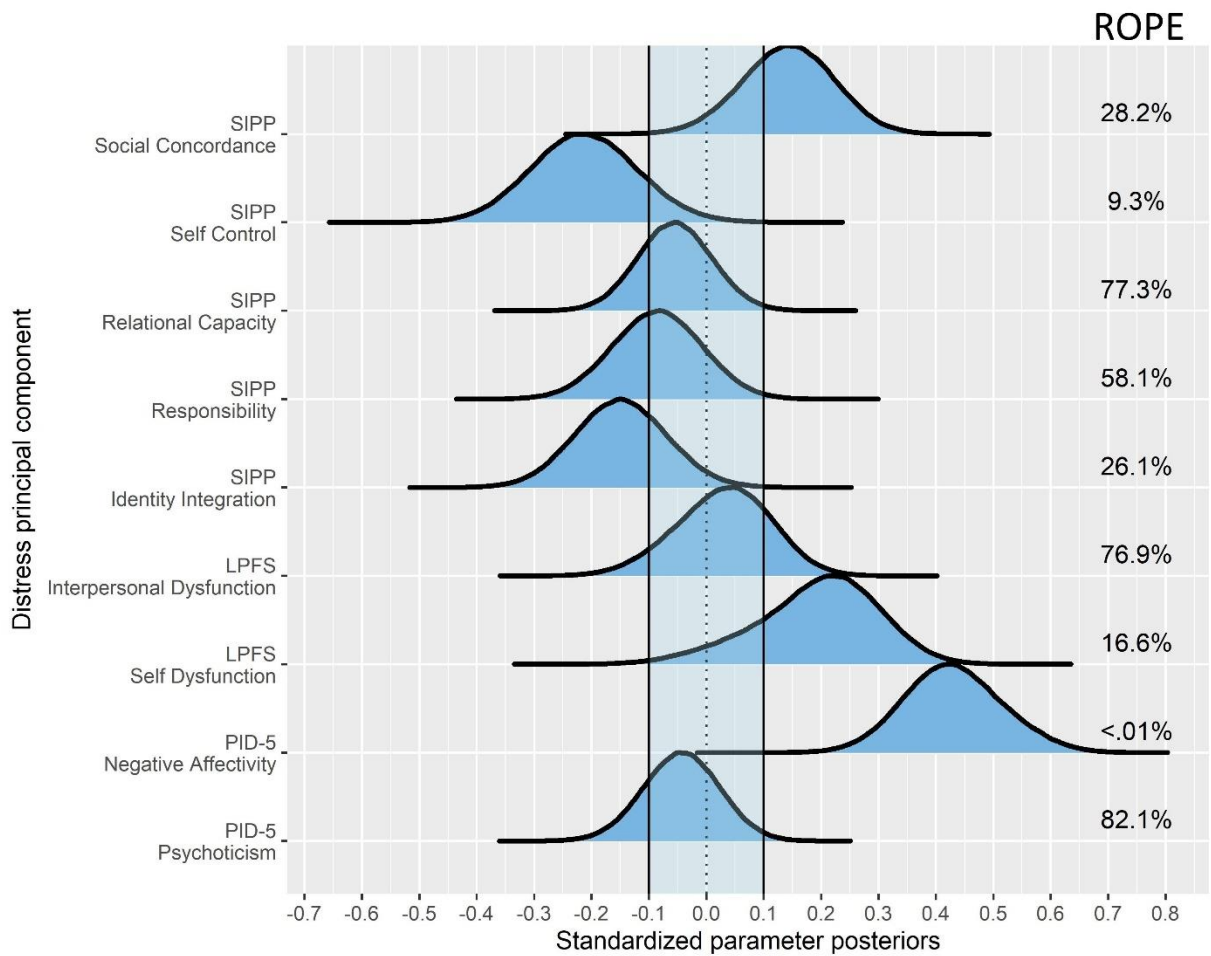


Figure 4. Standardized posterior estimates for the final latent variable model.

Note: Posterior estimates are of the regression parameters predicting latent distress. SIPP indicates the Severity Indices of Personality Pathology measure. LPFS refers to the level of personality functioning scale. PID-5 refers to the Personality Inventory for DSM-5. The Region of Practical Equivalence (ROPE) that ranges from -0.1 to 0.1 is plotted at the center of the plot and ROPE percentages are presented in the plot on the far right.

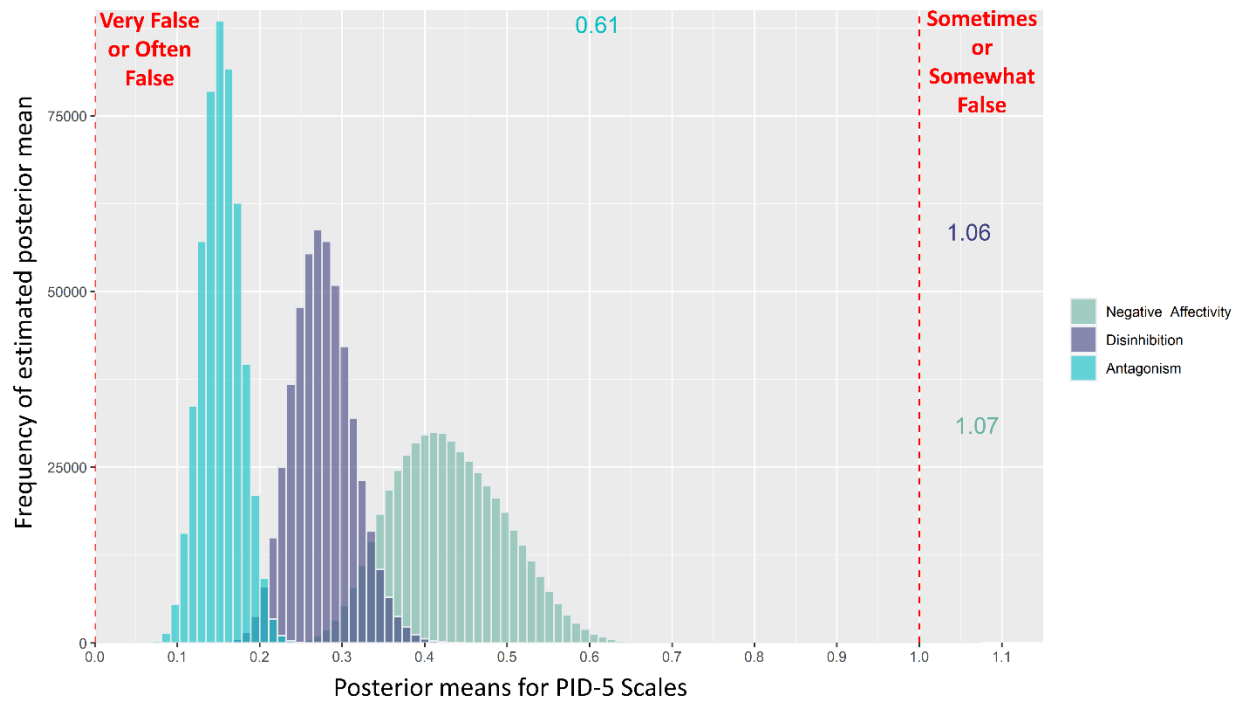


Figure 5. Unstandardized posterior estimates of Bayesian one-sample tests.

Note: Posterior estimates are of the posterior means of each of the Personality Inventory for DSM-5 variables. The data are plotted on the Likert scale of the PID-5 measure. The Likert responses are presented at the top of the plot in red and the Likert anchors are demarcated with a vertical dashed red line. The colored numbers on the right side of the plot correspond to the comparison value from the normative sample (Krueger, 2012).

Table 1. Descriptive statistics of study variables.

	Mean/ <i>N</i>	SD/%	Min	Max
Time since diagnosis (in years)	4.35	5.24	0	33
Age	60.25	12.05	26	85.2
SIPP Self Control	3.60	0.44	1.5	4.0
SIPP Identity Integration	3.55	0.44	1.92	4.0
SIPP Responsibility	3.55	0.44	2.0	4.0
SIPP Relational Capacity	3.31	0.45	1.75	4.0
SIPP Social Concordance	3.54	0.42	1.83	4.0
PID-5 Negative affectivity	0.52	0.53	0	2.33
PID-5 Antagonism	0.27	0.33	0	1.5
PID-5 Disinhibition	0.36	0.39	0	1.67
PID-5 Psychoticism	0.23	0.32	0	1.5
Distress Thermometer	2.88	2.81	0	10
Distress Questionnaire-5	1.90	0.89	1.0	4.8
Kessler 10	1.49	0.51	1.0	3.5
LPFS Interpersonal	1.30	0.41	1.0	2.83
LPFS Self parcel 1	1.37	0.58	1.0	4.0
LPFS Self parcel 2	1.27	0.48	1.0	3.67
PHQ-4	0.60	0.76	0	3.0
Sex (Male)	97	70.8%	0	1
Current cancer treatment	45	33%	0	1
Opioid R (ATC N02A)	48.4	35%	0	1
Antipsychotic R (N05A)	35.0	26%	0	1
Psychostimulant R (N05B)	38.4	28%	0	1
Antidepressant R (N06A)	46.6	34%	0	1
In other mental health treatment‡	9.0	7%	0	1
Self reported lifetime mental health diagnosis	18.6	14%	0	1

Note: SIPP indicates Severity Indices of Personality Pathology; PID-5 indicates Personality Inventory for DSM-5; LPFS refers to the Level of Personality Functioning Scale; and PHQ-4 refers to the Patient Health Questionnaire. For dichotomous variables, the percentage indicates percentage of scores in the yes (i.e., coded 1) direction. Descriptive statistics are averaged across the 5 imputations.

Table 2. Control variable analysis of predictors of Distress Principal Component

	Posterior of parameter estimates					ROPE
	Standardized Median	Unstandardized Median	SD	HDI Low	HDI High	
Age	-0.14	-0.02	0.01	-0.29	0.02	0.32
Cancer Stage	0.04	0.05	0.11	-0.13	0.21	0.73
Measure condition	0.09	0.11	0.10	-0.07	0.25	0.54
Active cancer treatment	0.06	0.21	0.32	-0.11	0.23	0.69
Sex	-0.03	-0.11	0.35	-0.20	0.14	0.76
Income	-0.16	-0.15	0.08	-0.33	0.00	0.21
Reported lifetime mental health diagnosis	0.14	0.75	0.48	-0.03	0.31	0.32
In other mental health treatment	0.22	1.66	0.65	0.05	0.39	0.053
Opioid R (ATC N02A)	-0.05	-0.17	0.40	-0.26	0.16	0.63
Antipsychotic R (N05A)	-0.04	-0.16	0.41	-0.24	0.17	0.65
Psychostimulant R (N05B)	0.01	0.06	0.41	-0.19	0.21	0.69
Antidepressant R (N06A)	0.04	0.14	0.42	-0.17	0.26	0.61
Time since recent diagnosis	0.01	0.00	0.03	-0.15	0.16	0.83
Type of HNC	0.04	0.02	0.04	-0.11	0.19	0.78

Note: HDI indicates the highest density interval and is set at 95%. Variables with an * are considered significant (i.e., the distribution is excluded by the Region of Practical Equivalence [ROPE]). The ROPE was set as a standardized parameter from -.10 to .10. HNC refers to head and neck cancer. Codes in parentheses beside medication classes are the anatomic therapeutic codes (ATC).

Table 3. Main Bayesian SEM parameter estimates predicting distress.

	Median	Standardized Median	HDI Low	HDI High	ROPE
<i>Distress</i>					
LPFS Interpersonal	0.06	0.03	-0.14	0.19	.77
LPFS Self dysfunction	0.29	0.20	-0.04	0.38	.17
Negative Affectivity	0.56	0.43	0.27	0.60	< .00001
Psychoticism	-0.09	-0.04	-0.17	0.09	.82
SIPP Relational Capacity	-0.09	-0.05	-0.18	0.07	.77
SIPP Responsibility	-0.14	-0.08	-0.24	0.07	.58
SIPP Self Control	-0.34	-0.21	-0.39	-0.03	.09
SIPP Social Concordance	0.25	0.14	-0.01	0.30	.28
SIPP Identity Integration	-0.24	-0.15	-0.3	0.01	.26

Note: HDI indicates the highest density interval and is set at 95%. Variables with an * are considered “significant” (i.e., the distribution is excluded by the Region of Practical Equivalence [ROPE]). SIPP indicates Severity Indices of Personality Pathology and LPFS refers to the Level of Personality Functioning Scale.

Table 4. One sample tests comparing the three PID-5 factor means.

	Median	HDI Low	HDI High	<i>Comparison Value</i>	ROPE
Negative Affectivity					
Distribution mean	0.42	0.31	0.56	1.07	
Distribution SD	0.43	0.30	0.56		
Distribution Cohen's D	-1.51	-2.34	-0.88		< .00001*
Antagonism					
Distribution mean	0.15	0.11	0.20	0.61	
Distribution SD	0.17	0.13	0.22		
Distribution Cohen's D	-2.64	-3.55	-1.89		< .00001*
Disinhibition					
Distribution mean	0.28	0.21	0.35	1.06	
Distribution SD	0.27	0.21	0.36		
Distribution Cohen's D	-2.86	-3.82	-1.96		< .00001*

Note: HDI indicates the highest density interval and is set at 95%. Variables are considered “significant” (indicated by *) if < .05 of the distribution is excluded by the Region of Practical Equivalence (ROPE). Comparison values refer to the mean of the comparison scores from the original derivation sample that was census-matched (Krueger, et al., 2012).

Table 5. Correlations among Bayesian structural equation modeling variables.

	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Distress Thermometer	-.31*	-.32*	-.37*	-.26*	-.26*	.39*	.22*	.44*	.47*	.30*	.40*	.49*
2. SIPP Self Control		.65*	.65*	.51*	.66*	-.59*	-.45*	-.51*	-.60*	-.50*	-.57*	-.52*
3. SIPP Identity Integration			.53*	.57*	.57*	-.57*	-.39*	-.48*	-.60*	-.46*	-.61*	-.44*
4. SIPP Responsibility				.46*	.61*	-.44*	-.48*	-.39*	-.47*	-.45*	-.45*	-.43*
5. SIPP Relational Capacity					.46*	-.43*	-.29*	-.37*	-.43*	-.42*	-.44*	-.36*
6. SIPP Social Concordance						-.40*	-.45*	-.35*	-.40*	-.44*	-.43*	-.37*
7. PID-5 Negative Affectivity							.53*	.57*	.69*	.45*	.65*	.59*
8. PID-5 Psychoticism								.30*	.40*	.47*	.41*	.31*
9. Distress Questionnaire-5									.65*	.35*	.51*	.65*
10. Kessler-10										.51*	.72*	.75*
11. LPFS Interpersonal Dysfunction											.58*	.35*
12. LPFS Self Dysfunction												.58*
13. PHQ-4												

Note: SIPP indicates Severity Indices of Personality Pathology and LPFS refers to the Level of Personality Functioning Scale. All correlations are pooled across imputations using Rubin's rules. * indicates $p < .005$.

APPENDIX B: IRB APPROVAL LETTERS



UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board
FWA00000351
IRB00001138
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

ACKNOWLEDGEMENT OF RELIANCE ON AN EXTERNAL IRB

March 4, 2019

Dear Christopher Spencer:

On 3/4/2019, the UCF IRB reviewed your request for external IRB review for the following study:

Type of Review:	IRB Site, Category
Title:	Site for PERSONALITY TRAITS AND DISTRESS IN HEAD AND NECK CANCER PATIENTS
Investigator:	Christopher Spencer
Local IRB ID:	SITE00000018
External ID:	1397913-1
Funding:	None
Grant ID:	None

This notification serves to acknowledge your request to rely on Orlando Health as the IRB of record for the above listed study and does not constitute an approval to conduct the research. Orlando Health review and approval of the study is required prior to study initiation.

Promptly notify the UCF IRB Office upon:

1. Notification that Orlando Health has renewed its approval at continuing review
2. Closure of the study

Sincerely,

Designated Reviewer



1414 Kuhl Ave.
Orlando, FL 32806
321.843.7000
orlandohealth.com

FWA # 0000384

DATE: February 18, 2019

TO: Diane Robinson, PhD
FROM: Orlando Regional Medical Center (ORMC) IRB

PROJECT TITLE: [1397913-1] PERSONALITY TRAITS AND DISTRESS IN HEAD AND NECK
CANCER PATIENTS

REFERENCE #: 18.149.11
SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: February 18, 2019

REVIEW CATEGORY: Exemption category # 2ii

Thank you for your submission of New Project materials for this project. The Orlando Regional Medical Center (ORMC) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at (321) 841-5895. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Orlando Regional Medical Center (ORMC) IRB's records.

Orlando Health Facilities:

- ARNOLD PALMER HOSPITAL FOR CHILDREN
- SOUTH SEMINOLE HOSPITAL
- UF HEALTH CENTER AT ORLANDO HEALTH
- WINNIE PALMER HOSPITAL FOR WOMEN & BABIES
- SOUTH LAKE HOSPITAL
- DR. P. PHILLIPS HOSPITAL
- ORLANDO REGIONAL MEDICAL CENTER
- HEALTH CENTRAL HOSPITAL

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