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Publication Date

2017-10-01

DOI

10.1016/j.paid.2017.05.039

Peer reviewed



Published in final edited form as:

Pers Individ Dif. 2017 October 15; 117: 130–138. doi:10.1016/j.paid.2017.05.039.

Association of Personality Profiles with Depressive, Anxiety, and Cancer-related Symptoms in Patients Undergoing Chemotherapy

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Abstract

Background—This study identified latent classes of cancer patients based on Big Five personality dimensions and evaluated for differences in demographic and clinical characteristics, depression, anxiety, and cancer-related symptoms.

Methods—Patients (n=1248) with breast, gastrointestinal, gynecological, or lung cancer completed the Center for Epidemiological Studies-Depression scale, Spielberger State-Trait Anxiety Inventories, NEO-Five Factor Inventory (NEO-FFI), and Memorial Symptom Assessment Scale (MSAS). Latent class profile analysis of NEO-FFI scores was used to identify patient subgroups.

Results—Three latent classes were identified. The “Distressed” class (14.3%) scored highest on neuroticism and lowest on extraversion, agreeableness, and conscientiousness. The “Resilient” class (31.9%) scored lowest on neuroticism and highest on extraversion, agreeableness, and conscientiousness. The “Normative” class (53.8%) was intermediate on all dimensions except openness. Compared to the Resilient class, patients in the Distressed class were younger, less educated, more likely to care for another adult, had more comorbidities, and exercised less. The three classes differed by performance status, marital and employment status, and income, but not

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Conflict of interest disclosures: The authors have no conflicts of interest to disclose.

by gender, time since diagnosis, or type of prior cancer treatment. The classes differed (Distressed > Normative > Resilient) in depression, anxiety, and cancer symptoms.

Conclusions—Personality is associated with psychological and physical symptoms in cancer patients.

Keywords

cancer; oncology; chemotherapy; personality; depression; anxiety; latent profile analysis; physical symptoms

INTRODUCTION

The Five Factor model of personality structure is strongly established.¹ The Big Five personality dimensions or traits (i.e., neuroticism, extraversion, openness to experience, agreeableness, conscientiousness)² describe enduring, cross-culturally validated, individual traits that are known to influence numerous important health outcomes, including disease burden,³ self-rated health,^{4, 5} impact of illness events,⁶ and mortality.^{7–10} In addition, personality traits, particularly high neuroticism and low conscientiousness, are associated with greater risk of depression and anxiety symptoms and syndromes.^{11–16} Personality is associated with physical symptoms in both clinical and non-clinical populations.¹⁷

An extensive literature has documented the risk for depressive and anxiety symptoms in oncology patients undergoing treatment,^{18–20} as well as in cancer survivors.^{20–23} These symptoms exert deleterious effects not only on quality of life, but also on many important outcomes, including adherence, physical symptoms, functioning, and possibly mortality.^{20, 24, 25} Substantial efforts have been made to understand risk factors for depression and anxiety in patients with cancer, in order to identify higher risk patients, provide treatment for those with elevated symptom levels, and elucidate mechanisms of action for interventions.

Despite the well-established relationship between personality traits and depression and anxiety, relatively few studies were identified that examined this relationship in oncology patients.^{26–32} These studies suggest that higher levels of neuroticism increase the risk for depression and anxiety in patients with various cancer types. For example, among women with breast cancer who underwent surgical treatment (n=210), neuroticism increased the risk for depression.²⁸ Similarly, among patients with lung cancer (n=1334), higher neuroticism, coping characterized by helplessness/hopelessness, and female gender were associated with higher levels of anxiety.²⁷ A limited number of studies, with inconsistent findings, have examined the relationship between personality and physical symptoms (e.g., pain, fatigue) in cancer patients.^{33–36}

No studies were found that utilized combinations of traits, rather than single personality traits (e.g., neuroticism), to identify profiles of personality dimensions that may increase risk for depressive, anxiety, and physical symptoms among patients undergoing cancer treatment. Person-centered approaches to examining data³⁷ enable the identification of latent classes (subgroups) of individuals with distinct profiles of personality dimensions. Such approaches, which include cluster analysis, latent profile analysis (LPA), and latent class analysis,

complement variable-centered approaches by conceptualizing personality as “an interrelated system of several traits.” Subgroups or latent classes can then be evaluated for differences on a wide range of characteristics.

Such person-centered methods can be viewed as complementary approaches to trait-based, variable-centered approaches to examining personality.^{37–40} Examination of multivariate distributions of patterns in personality traits can help identify previously unobserved patterns of personality and compare these patterns or types across samples and studies.³⁸ As noted by Specht, “The aim of the typological approach is to identify a preferably parsimonious number of personality types that allow for broad categorizations of individuals.”³⁹

Numerous typological studies of personality have been conducted in non-medically ill populations (reviewed in Specht³⁹). Caspi posited, based on a number of studies, that there are three major personality types (labeled generally as “resilients,” “overcontrollers,” and “undercontrollers”),⁴¹ and Asendorpf and colleagues confirmed this hypothesis in four studies of children and (primarily young) adults.³⁸ Their broadly categorized prototypes differed somewhat depending on the specific sample and method of personality assessment, but the overall generalizability of the three major types was confirmed. Thus, to date, a substantial body of literature exists, primarily in non-medically ill populations (i.e., general population samples, college students, adolescents), that has identified three broad classes of personality based on distributions of patterns of dimensional traits.³⁹

In addition, several studies have utilized latent class methods to examine associations between membership in personality profile classes and psychological measures and outcomes. For example, Merz and Roesch utilized LPA to examine personality profiles in a sample of university students (n=371), using the International Personality Item Pool,⁴² a measure based on the Five Factor Model.⁴³ A three-class solution provided the best fit to the data. Based on the mean levels of each of the five personality dimensions, the classes were characterized as: “well-adjusted,” “reserved,” and “excitable.” Relationships among the classes and measures of affect, self-esteem, depression, anxiety, and coping efficacy were examined. Compared to both the reserved and excitable classes, the well-adjusted class (i.e., low on neuroticism, high on extraversion, agreeableness, and openness) reported better psychological functioning in terms of positive affect, negative affect, depression, anxiety, self-esteem, and coping. The reserved and excitable groups differed on anxiety, with the excitable group (i.e., high neuroticism, high extraversion) reporting generally higher anxiety than the reserved group (i.e., moderate neuroticism, low extraversion, agreeableness and openness).

Hori and colleagues utilized LPA among outpatients with major depression to identify personality profiles using a different personality measure (the Temperament and Character Inventory⁴⁴), with the goal of better characterizing the heterogeneity of symptoms in major depressive disorder.⁴⁵ They identified three latent profiles that they termed “neurotic,” “adaptive,” and “socially detached.” The three profiles differed on a number of characteristics salient to diagnosis, treatment, and outcomes of major depression (e.g., depressive symptomatology, anxiety symptom, psychotropic medication use, and social

functioning),⁴⁵ suggesting the utility of latent class methods for uncovering important contributors to heterogeneity among clinically-characterized populations.

To our knowledge, no prior studies have utilized latent class methods to examine the relationship between personality profiles and psychological or cancer-related symptoms in patients with cancer. Therefore, the purposes of this study were to: 1) identify, using LPA, latent classes of cancer patients with distinct personality profiles based on the Five Factor Model,⁴⁶ and evaluate for differences among the latent classes in demographic and clinical characteristics; and 2) examine differences among the latent classes in trait and state anxiety, depressive symptoms, and cancer-related symptoms. Based on prior work demonstrating associations between personality and depression, anxiety, and cancer-related symptoms, 11–16, 27, 28, 33, 34 we hypothesized that classes with personality profiles higher on neuroticism and lower on conscientiousness would exhibit higher levels of anxiety, depression, and cancer-related symptoms and symptom-related distress.

METHODS

Patients, settings, and procedures

This analysis utilizes data from a descriptive, longitudinal study that evaluated the symptom experience of oncology outpatients receiving chemotherapy (CTX).^{47–50} Eligible patients were 18 years of age; had a diagnosis of breast, gastrointestinal, gynecological, or lung cancer; had received CTX within the preceding four weeks; were scheduled to receive at least two additional cycles of CTX; were able to read, write, and understand English; and gave written informed consent. Patients were recruited from two Comprehensive Cancer Centers, one Veteran's Affairs hospital, and four community-based oncology programs. Eligible patients were approached by a research staff member in the infusion unit to discuss study participation. Written informed consent was obtained from all patients. Depending on the length of their CTX cycle, patients completed questionnaires in their homes, a total of six times over two cycles of CTX. Medical records were reviewed for disease and treatment information.

The cross-sectional analysis presented here is based on data collected at the enrollment assessment that asked patients to report on their symptom experience for the week prior to the administration of the next cycle of CTX (i.e., recovery from previous CTX cycle).

A total of 2234 patients were approached and 1343 consented to participate (60.1% response rate). The present analysis is based only on those patients who completed the NEO-FFI (n=1248), which was added to the study measures shortly after study initiation. The major reason for refusal was being overwhelmed with their cancer treatment.

The study was approved by the Committee on Human Research at the [blinded] and by the Institutional Review Board at each of the study sites.

Instruments

A demographic questionnaire obtained information on age, gender, ethnicity, marital status, living arrangements, education, employment status, and income.

The Karnofsky Performance Status (KPS) scale is widely used to evaluate functional status in patients with cancer and has well established validity and reliability.⁵¹ Patients rated their functional status using the KPS scale that ranged from 30 (I feel severely disabled and need to be hospitalized) to 100 (I feel normal; I have no complaints or symptoms).^{51, 52}

The Self-Administered Comorbidity Questionnaire (SCQ) consists of 13 common medical conditions simplified into language that can be understood without prior medical knowledge.⁵³ Patients indicated if they had the condition, if they received treatment for it (proxy for disease severity), and if it limited their activities (indication of functional limitations). For each condition, the patient can receive a maximum of 3 points. The total SCQ score ranges from 0 to 39. The SCQ has well established validity and reliability.^{54, 55}

The Alcohol Use Disorders Identification Test (AUDIT) is a 10-item questionnaire that assesses alcohol consumption, alcohol dependence, and the consequences of alcohol abuse in the last 12 months. The AUDIT gives a total score that ranges between 0 and 40. Scores of 8 are defined as hazardous use and scores of 16 are defined as use of alcohol that is likely to be harmful to health.^{56, 57} The AUDIT has well established validity and reliability.^{58–60} In this study, its Cronbach's alpha was 0.63.

The NEO-Five Factor Inventory (NEO-FFI) is a 60-item instrument that was used to assess personality.⁶¹ Factor analytic studies found that the NEO-FFI measures the "Big Five" domains of personality^{62, 63} (i.e., neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness). Each of the five domains is evaluated using 12 self-rated items utilizing a 5-point Likert scale (i.e., 0 = strong disagreement, 1 = disagreement, 2 = neutral, 3 = agreement, 4 = strong agreement). Higher scores indicate higher levels of each domain. The validity and reliability of the NEO-FFI were demonstrated in studies of personality in middle and older adulthood.^{64, 65} In this study, the Cronbach's alphas for the NEO-FFI were as follows: 0.87 for neuroticism, 0.80 for extraversion, 0.77 for openness to experience, 0.76 for agreeableness, and 0.84 for conscientiousness.

The Spielberger State-Trait Anxiety Inventories (STAI-T and STAI-S) each have 20 items that are rated from 1 to 4. The summed scores for each scale can range from 20 to 80. The STAI-T measures a person's predisposition to anxiety as part of one's personality. The STAI-S measures a person's temporary anxiety response to a specific situation or how anxious or tense a person is "right now" in a specific situation. Cutoff scores of 31.8 and 32.2 indicate high levels of trait and state anxiety, respectively. The STAI-T and STAI-S inventories have well established validity and reliability.^{66–68} In the current study, the Cronbach's alphas for the STAI-T and STAI-S were 0.92 and 0.96, respectively.

The Center for Epidemiological Studies-Depression scale (CES-D) consists of 20 items selected to represent the major symptoms in the clinical syndrome of depression. Total scores can range from 0 to 60, with scores of 16 indicating the need for individuals to seek clinical evaluation for major depression. The CES-D has four subscale scores (i.e., somatic, depressed affect, positive affect, interpersonal problems). The CES-D has well established validity and reliability.^{69–71} In the current study, the Cronbach's alpha for the CES-D total score was 0.89.

A modified version of the Memorial Symptom Assessment Scale (MSAS), a self-report questionnaire designed to measure the multidimensional experience of symptoms,⁷² was used to evaluate the occurrence, severity, frequency, and distress of 38 symptoms commonly associated with cancer and its treatment. In addition to the original 32 MSAS symptoms, the following six symptoms were assessed: hot flashes, chest tightness, difficulty breathing, abdominal cramps, increased appetite, weight gain. Using the MSAS, patients were asked to indicate whether or not they had experienced each symptom in the past week (i.e., symptom occurrence). If they had experienced the symptom, they were asked to rate its frequency of occurrence, severity, and distress. Symptom frequency was evaluated using a 4-point Likert scale (i.e., 1 = rarely, 2 = occasionally, 3 = frequently, 4 = almost constantly). Symptom severity was measured using a 4-point Likert scale (i.e., 1 = slight, 2 = moderate, 3 = severe, 4 = very severe). Symptom distress was measured using a 5-point Likert scale (i.e., 0 = not at all, 1 = a little bit, 2 = somewhat, 3 = quite a bit, 4 = very much). Three subscale scores (i.e., physical, psychological, global distress index) and a total MSAS score were calculated. The reliability and validity of the MSAS is well established in studies of oncology inpatients and outpatients.⁷²

Data analysis

Data were analyzed using SPSS version 22 (IBM, Armonk, NY) and Mplus version 7.31.⁷³ Descriptive statistics and frequency distributions were calculated for demographic and clinical characteristics. Analyses of variance, Kruskal-Wallis, and Chi-square analyses evaluated for differences in demographic, clinical, and symptom characteristics among the latent classes. A p-value of <.05 was considered statistically significant. Post hoc contrasts were done using the Bonferroni procedure.

Unconditional LPA was employed to identify the profiles of mean scores on the NEO-FFI dimensions that characterized unobserved subgroups (latent classes) of patients. Estimation was carried out with full information maximum likelihood (FIML) with standard errors and a Chi-square test that are robust to non-normality and non-independence of observations. Model fit was evaluated to identify the solution that characterized the observed latent class structure with the Bayesian Information Criterion (BIC), the Vuong-Lo-Mendell-Rubin likelihood ratio test, entropy, and latent class percentages that were large enough to be reliable (likely to replicate in new samples; 15% or about 85 patients).^{73, 74} Missing data were accommodated with the use of the Expectation-Maximization (EM) algorithm.⁷⁵ This method provides unbiased estimates as long as the missing data are ignorable (i.e., missing at random, missing completely at random, or covariate-dependent missingness).⁷⁶ Mixture models such as LPA are known to produce solutions at local maxima. Therefore, our models were fit with from 1,000 to 4,000 random starts. This approach ensured that the estimated model was replicated many times and not due to a local maximum. Estimation was conducted with Mplus Version 7.31.⁷³

RESULTS

Latent profile analysis

Using LPA, three distinct classes of patients were identified based on their scores on the five major dimensions of the NEO-FFI. Fit indices for the candidate models are shown in Table 1. The three-class solution was selected because the BIC for that solution was lower than the BIC for both the 2- and 4-class solutions.⁷⁷ In addition, the Vuong-Lo-Mendell-Rubin likelihood ratio test for the K vs. K-1 model (VLMR) was significant for the 3-class solution, indicating that three classes fit the data better than two classes, and the VLMR was not significant for the 4-class solution, indicating that too many classes had been extracted.⁷⁸ Further, entropy was acceptable for the 3-class solution (.70⁷⁹), and the profiles of NEO-FFI means for the three-class solution made conceptual sense.^{73, 74, 80} Labels for each of the three classes were chosen by the authors based on examination of the pattern of scores on the personality dimensions, and prior literature using latent class methods to identify classes of personality profiles using either the NEO-FFI or other validated personality measures.^{43, 81, 82}

As summarized in Table 2 and depicted in Figure 1, the largest proportion of patients (53.8%; n=671) was classified in the “Normative” class. This class had intermediate scores (i.e., between the other two classes) on four of the five personality dimensions (i.e., except openness to experience). Compared to the Resilient class, the Normative class had lower scores on openness to experience.

A second group, that comprised 31.9% of the sample (n=399), was classified in the “Resilient” class. Compared to the other two classes, this group of patients scored lowest on neuroticism and highest on extraversion, agreeableness, and conscientiousness. The third class, that comprised 14.3% of patients (n=178), was classified in the “Distressed” class. This group scored highest on neuroticism and lowest on extraversion, agreeableness, and conscientiousness compared to the other two classes.

Differences in patient characteristics among the latent classes

Table 3 summarizes the differences in demographic and clinical characteristics among the latent classes. Compared to the Resilient class, patients in the Normative and Distressed classes were younger, had lower educational levels, and were more likely to provide care for another adult. Compared to the Resilient class, patients in the Distressed class had a higher number of comorbidities and were less likely to exercise regularly. The three classes differed from one another in functional status (i.e., KPS score), comorbidity (i.e., SCQ score), the proportion who were married or partnered, employment status, and income level. The three classes did not differ in terms of cancer diagnoses, number of metastatic sites, number of prior treatments, types of prior treatments, time since diagnosis, or types of metastatic sites.

Differences in depressive and anxiety symptoms among the latent classes

The classes differed from one another on CES-D total scores, on each of the four CES-D subscale scores, and on both trait and state anxiety scores (Table 4). The Distressed class had

higher levels of depression and anxiety compared to the Normative class, who in turn had higher levels of depression and anxiety compared to the Resilient class.

Differences in cancer-related symptoms among the latent classes

The classes differed from one another on MSAS total scores, number of symptoms, psychiatric and physical subscales, and global symptom-related distress (Table 5). The Distressed class had higher levels of symptoms and symptom-related distress on the MSAS compared to the Normative, who in turn had higher levels of symptoms and symptom-related distress than the Resilient class.

DISCUSSION

This study is the first to use LPA to identify latent classes of cancer patients based on the Big Five personality dimensions, complementing prior studies that used trait-based approaches to examine personality in relation to cancer patients' symptoms.^{26–32} As hypothesized, we found that personality profiles characterized by higher levels of neuroticism and lower levels of conscientiousness endorsed higher levels of anxiety, depression, cancer-related symptoms and symptom-related distress. Although we did not explicitly predict a dose-dependent pattern in these associations, we found that the Distressed class had higher symptom levels than the Normative class, who in turn had had higher symptom levels than the Resilient class. The consistency of this pattern suggests that these findings are robust.

Our findings are partially consistent with an LPA analysis conducted by Specht et al., who identified three latent classes of personality profiles in a German sample (n=14,718), and four latent classes in their Australian sample (n=8,315).³⁹ The authors emphasized the similarity of the three types identified in the German sample to a substantial prior literature—i.e., the “resilient” class (56% of the sample) had low neuroticism and high extraversion, openness, agreeableness and conscientiousness; “undercontrollers” (22%) had relatively lower levels of agreeableness and conscientiousness; and “overcontrollers” (23%) had low levels of extraversion and openness and slightly higher neuroticism. The Australian sample resulted in a four-class solution—i.e., “average” (41% of the sample); “resilients” (36%; low neuroticism; high extraversion, agreeableness, and conscientiousness; average openness); “undercontrollers” (13%; high neuroticism, lower agreeableness and conscientiousness); and “overcontrollers” (high neuroticism, high openness). Our Resilient class resembles the “resilients” in both samples and our Distressed class resembles the “undercontrollers” in both samples.

Our findings validate and extend the work of Merz and Roesch,⁴³ who identified three latent classes based on Big Five personality profiles in 371 university students. They characterized these three classes as “well-adjusted” (49.3% of the sample; relatively low neuroticism, and relatively high on the other four factors), “reserved” (moderate neuroticism and conscientiousness, lowest extraversion, and relatively low agreeableness and openness) (28.3%) and “excitable” (22.4%; highest neuroticism and extraversion, and relatively high openness). Their latent classes shared some similarities with our findings in terms of the combinations of traits. For example, our “Resilient” class resembles their “well-adjusted”

class (i.e., these classes demonstrated low levels of neuroticism and relatively high levels of other personality dimensions). In addition, the classes that scored highest on neuroticism were the smallest classes (i.e., their “Excitable” group, 22.4%; our “Distressed” group, 14.3%). Their “Excitable” group was characterized by higher levels of anxiety, higher emotional instability, higher negative affect, and lower coping self-efficacy compared to their “Well-adjusted” group. Similarly, our “Distressed” group had the highest levels of state and trait anxiety as well as the highest levels of each domain of depressive symptoms. The possible mediating role of coping self-efficacy in the relationship between personality profiles and anxiety, as well as other symptoms commonly reported by cancer patients, should be investigated.

However, the personality profiles identified in each study do not completely map onto one another. For example, whereas our “Distressed” class scored highest on neuroticism and lowest on extraversion, agreeableness, and conscientiousness, their “Excitable” class scored highest on neuroticism but also highest on extraversion.⁴³ These differences may be explained by differences in the sample size and composition, and the use of different measures to assess personality dimensions. Moreover, whereas we found statistically significant differences among the three classes on all five dimensions (essentially a validity check for separation of the identified classes), Merz and Roesch described the classes in terms of relative levels of each personality dimension, but did not report statistical significance for differences in personality dimensions.⁴³

In terms of demographic characteristics, patients who were younger, had lower education, were not married or partnered, provided care for another adult, did not exercise regularly, or smoked were more likely to be in the Distressed class. In terms of age, our findings, while cross-sectional, are consistent with longitudinal studies that used variable-centered or person-centered approaches. For instance, hierarchical linear modeling analyses of age trends in personality among participants in the Baltimore Longitudinal Study of Aging found that neuroticism, extraversion, and openness tended to decline over time, while agreeableness and conscientiousness tended to increase over time.⁸³ The longitudinal study by Specht et al. (described above) that used LPA to examine personality profiles found that older adults were more likely to have a “resilient” personality profile.³⁹ The psycho-oncology literature has consistently shown that younger patients are more likely to be distressed (higher levels of depression and anxiety). Could this reflect, in part, underlying age differences in personality profiles? Other authors have argued that age-related differences in distress may be explained by social, occupational, and relational pressures and expectations.⁸⁴

Additionally, compared to White patients, Non-white patients were more likely to be classified in the Distressed versus the Resilient class. In addition, compared to Non-Hispanic patients, Hispanic patients were more likely to be classified in the Distressed versus the Resilient or Normative classes. Prior literature utilizing LPA to identify latent personality classes did not describe findings related to ethnicity, so comparisons cannot be made.^{39, 43} However, other studies by our group found higher levels of distress (i.e., depressive and anxiety symptoms) in Non-white oncology patients. However, these studies did not specifically examine personality.^{85, 86}

While it is plausible that some differences among the personality profile classes may reflect differences in disease or treatment-related characteristics, we did not find significant differences in terms of cancer diagnoses, number of metastatic sites, number of prior treatments, types of prior treatments, time since diagnosis, or types of metastatic sites, arguing against the idea that disease or treatment-related characteristics were responsible for differences in personality profiles. However, the number and impact of comorbidities did differ across the groups. A number of plausible explanations exist for these differences. For example, patients with higher levels of neuroticism and lower levels of conscientiousness were more likely to have more comorbidities, as well as more likely to have functional impairments. This hypothesis is supported by our finding that patients in the Distressed class exercised less and were more likely to smoke. The findings related to differences in smoking and exercise, as well as functional status, are consistent with literature on personality and health behaviors and outcomes.^{87–89} However, caution is warranted when inferring causality from this cross-sectional analysis, as it is plausible that patients with lower functional status or more comorbidities were more likely to endorse specific patterns on the personality assessment that would place them in the more “Distressed” class. Thus, further work is needed to examine the possible influence of personality profiles, as well as of individual traits and facets, on functioning and comorbidity in cancer patients, and to identify possible mechanisms that explain the observed associations.

As predicted, patients in the class that scored highest on neuroticism reported the highest levels of anxiety and depressive symptoms. These findings are consistent with prior studies in both cancer and non-cancer populations that demonstrated positive relationships between trait neuroticism and these symptoms.^{11, 12, 27, 30, 90–92} Notably, the Distressed class had a mean CES-D score (24.1) that was above the accepted cutoff for clinically meaningful depression,⁹³ while the Normative class had a mean level of depressive symptoms that might be considered subsyndromal.⁹⁴ Our results for STAI-T and STAI-S are similar.⁸⁶

Additionally, as hypothesized, the classes with lower levels of conscientiousness (i.e., the Normative and Distressed classes) reported higher levels of depressive and anxiety symptoms, in a dose-dependent manner. These findings are consistent with a substantial literature documenting the association between lower levels of conscientiousness and worse mental health outcomes and quality of life.^{87, 95–97} Evidence suggests that conscientiousness exerts its effects on health outcomes (including physical health outcomes) through its effects on health behaviors.⁸⁹

Personality profiles were also associated with different levels of physical symptoms and symptom-related distress, as measured by the MSAS. Although no prior studies were found that examined MSAS scores in relation to Big Five personality profiles, these findings are consistent with several studies that found associations between specific traits and symptoms (e.g., higher neuroticism and fatigue^{33, 34}). However, findings regarding the relationship between other traits (extraversion, openness, conscientiousness) and self-reported pain and fatigue are inconsistent.^{35, 36} Such inconsistent findings may be explained in part by different sample characteristics and measures. However, it is possible that the integrated LPA approach used in the present study helps clarify the trait-based approaches used in prior studies.

Several study limitations should be noted. First, the sample may not accurately represent the distribution of personality traits among patients undergoing CTX, as the most common reason for declining participation was feeling overwhelmed. Also, because personality was assessed during (but not before) CTX, it is possible that trait levels may have been affected by this experience. Literature on personality provides evidence that personality is stable over time⁹⁸ and is a predictor rather than an outcome of how patients cope with stressful life events.¹⁷ Nevertheless, future research using prospective designs is needed to delineate further the relationship between personality traits and profiles and psychological and physical symptoms in patients with cancer and other illnesses.

Despite these limitations, the present findings suggest that personality traits are important to consider when evaluating the symptom experience of cancer patients. The personality profile in the Distressed class may represent a combination of traits that, in this particular context (undergoing CTX), predisposes to higher levels of depressive and anxiety symptoms. In contrast, the Resilient class showed a predisposition to lower psychological symptom levels, and the Normative class was intermediate in terms of psychological symptoms. These findings should not be construed to suggest that some traits or combinations of traits are inherently better, more advantageous, or more desirable. Rather, the extensive literature on personality traits and psychological functioning suggests that certain traits, combinations of traits, and facets (sub-domains of traits), *in different contexts, situations, and life circumstances*, may predispose to different thoughts, behaviors, and actions, as well as different psychological experiences and outcomes.¹⁷

Future research should examine the influence of personality profiles on other symptoms commonly experienced by cancer patients (e.g., sleep disturbance, fatigue, pain). Approaches such as LPA may be useful to researchers examining the relationship of personality to symptoms, illness responses, coping, and quality of life in patients with medical illnesses. Moreover, investigation of the mechanisms by which personality profiles may influence psychological and physical symptoms should be investigated, as a deeper understanding of these mechanisms would help investigators and clinicians develop and test screening and intervention strategies that target specific strengths and vulnerabilities that may influence important health-related outcomes.

Acknowledgments

Funded by a grant from the National Cancer Institute (NCI CA134900) and by a grant from the National Institute of Mental Health (NIMH R25MH060482). Dr. Miaskowski is funded by grants from the NCI (CA168960) and the American Cancer Society.

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Highlights

- We identified three groups of cancer patients based on personality profiles.
- We named them “Normative” (54%), “Resilient” (32%), and “Distressed” (14%).
- The groups differed in levels of depressive and anxiety symptoms.
- The groups also differed in levels of cancer-related symptoms.
- Personality may affect psychological and physical symptoms during chemotherapy.

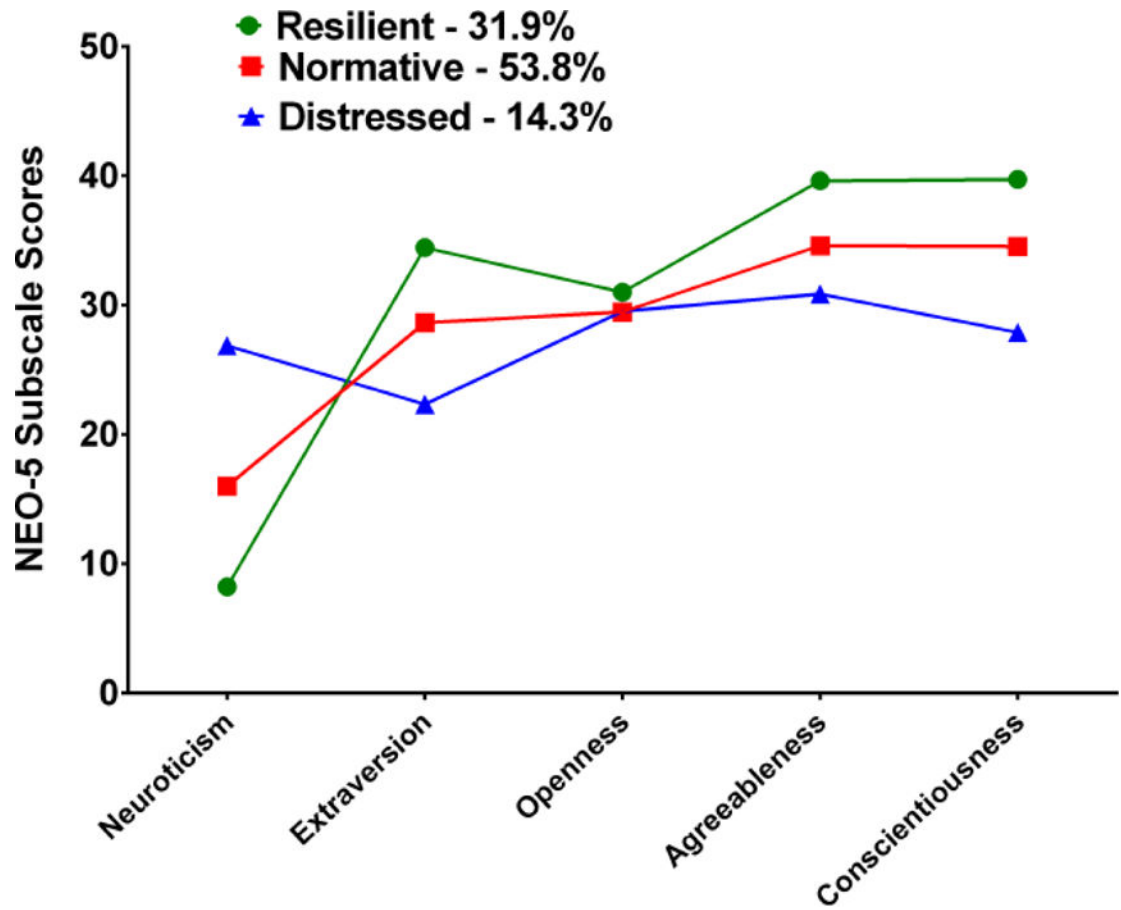


Figure 1.
Mean Scores on the Five Personality Dimensions of the Three Latent Classes

Table 1

Latent Profile Solutions and Fit Indices for Two- Through Four-Class Solutions

Model	LL	AIC	BIC	Entropy	VLMR
2 Class	-20169.94	40371.89	40453.96	.68	814.29 ^{*****}
3 Class ^a	-20050.32	40144.65	40257.49	.70	239.24 ^{*****}
4 Class	-20029.14	40114.29	40257.91	.73	42.36 ⁺

⁺ Not significant;^{*****}
p < .0001^a The three class solution was selected because the BIC for that solution was lower than the BIC for both the 2- and 4-class solutions. In addition, the VLMR was significant for the 3-class solution, indicating that three classes fit the data better than two classes, and the VLMR was not significant for the 4-class solution, indicating that too many classes had been extracted.

Note: AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; LL = log-likelihood; VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test for the K vs. K-1 model.

Table 2

Differences in five NEO-FFI personality dimensions among the personality latent classes (n = 1248)

NEO-FFI Dimension	Resilient (1) n = 399 31.9% Mean (SD)	Normative (2) n = 671 53.8% Mean (SD)	Distressed (3) n = 178 14.3% Mean (SD)	Test statistic and post hoc contrasts
Neuroticism	7.7 (4.4)	16.2 (5.1)	27.6 (5.1)	F = 1051.2; p < 0.001 1 < 2 < 3
Extraversion	34.8 (5.0)	28.5 (5.1)	22.0 (5.2)	F = 422.9; p < 0.001 1 > 2 > 3
Openness to Experience	31.1 (6.7)	29.4 (6.3)	29.7 (6.9)	F = 8.24; p < 0.001 1 > 2
Agreeableness	40.0 (4.2)	34.4 (4.5)	30.7 (5.4)	F = 305.1; p < 0.001 1 > 2 > 3
Conscientiousness	40.2 (4.5)	34.4 (4.5)	27.3 (5.5)	F = 494.4; p < 0.001 1 > 2 > 3

Abbreviations: NEO-FFI = NEO Five Factor Inventory; SD = standard deviation

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Table 3

Differences in demographic characteristics among the personality latent classes (n = 1248)

Characteristic	Resilient (1) n = 399 31.9% Mean (SD)	Normative (2) n = 671 53.8% Mean (SD)	Distressed (3) n = 178 14.3% Mean (SD)	Test statistic and post hoc contrasts
Age (years)	58.6 (11.6)	56.5 (12.4)	54.6 (13.0)	F = 7.2; p = .001 1 > 2 and 3
Education (years)	16.7 (3.1)	16.1 (2.9)	15.6 (3.0)	F = 10.4; p < .001 1 > 2 and 3
	% (N)	% (N)	% (N)	
Gender				
Female	77.9 (311)	76.6 (514)	83.1 (148)	$\chi^2 = 3.5$; p = .173
Male	22.1 (88)	23.4 (157)	16.9 (30)	
Ethnicity				
White	72.2 (283)	69.9 (458)	63.0 (109)	$\chi^2 = 14.2$; p = .027*
Black	6.1 (24)	7.5 (49)	7.5 (13)	
Asian or Pacific Islander	12.0 (47)	13.3 (87)	11.0 (19)	
Hispanic, Mixed or Other	9.7 (38)	9.3 (61)	18.5 (32)	
Married or partnered (% yes)	71.5 (279)	63.5 (420)	52.9 (92)	$\chi^2 = 19.0$; p < .001 1 > 2 > 3
Lives alone (% yes)	18.4 (72)	21.3 (141)	27.4% (48)	$\chi^2 = 5.9$; p = .051
Child care responsibilities (% yes)	21.9 (86)	22.2 (145)	25.6 (45)	$\chi^2 = 1.1$; p = .591
Care of adult responsibilities (% yes)	4.6 (17)	9.2 (56)	10.7 (17)	$\chi^2 = 8.7$; p = .013 1 < 2 and 3
Currently employed (% yes)	43.7 (171)	33.8 (225)	23.6 (42)	$\chi^2 = 23.4$; p < .001 1 > 2 > 3
Income ⁺⁺				
< \$30,000	11.1 (39)	16.4 (100)	38.2 (60)	KW; p < .001 1 < 2 < 3
\$30,000 to < \$70,000	15.7 (55)	24.2 (147)	21.7 (34)	
\$70,000 to < \$100,000	19.4 (68)	16.3 (99)	12.7 (20)	
\$100,000	53.8 (189)	43.1 (262)	27.4 (43)	
Exercise regularly (%yes)	76.5 (300)	70.4 (464)	61.8 (105)	$\chi^2 = 13.0$; p = .001 1 > 3
Smoker (current or past, % yes)	30.6 (121)	36.7 (241)	40.9 (72)	$\chi^2 = 6.74$; p = .034 No significant pairwise contrasts

Abbreviations: KW = Kruskal-Wallis Test; SD = standard deviation

* Post hoc comparisons for ethnicity:

- Compared to White patients, Non-white patients more likely to be classified in Distressed vs. Resilient group
- Compared to Non-Hispanic patients, Hispanic patients more likely to be classified in Distress vs. Resilient or Normative groups.

⁺⁺ For purposes of post hoc comparisons, Income < \$30,000 was the reference group

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Table 4

Differences in clinical characteristics among the personality latent classes (n = 1248)

Characteristic	Resilient (1) n = 399 31.9%	Normative (2) n = 671 53.8%	Distressed (3) n = 178 14.3%	Test statistic and post hoc contrasts
	Mean (SD)	Mean (SD)	Mean (SD)	
Body Mass Index (kg/m ²)	25.9 (5.3)	26.0 (5.5)	27.1 (7.0)	F = 2.7; p = .070
Karnofsky Performance Status score	83.0 (12.2)	80.2 (12.2)	73.4 (12.1)	F = 35.2; p < .001 1 > 2 > 3
Number of comorbidities	2.2 (1.4)	2.4 (1.4)	3.1 (1.6)	F = 28.3; p < .001 1 and 2 < 3
Self-administered Comorbidity Questionnaire score	4.8 (2.8)	5.4 (3.1)	7.2 (3.9)	F = 38.4; p < .001 1 < 2 < 3
AUDIT total score	2.8 (2.2)	3.0 (2.4)	2.9 (3.3)	F = 0.61; p = .546
Time since cancer diagnosis (years)	1.9 (3.5)	2.0 (3.7)	2.0 (4.7)	KW; p = 0.235
Median time since cancer diagnosis (years)	0.39	0.44	0.45	
Number of prior cancer treatments	1.5 (1.4)	1.6 (1.5)	1.7 (1.6)	F = 0.90 p = .407
Number of metastatic sites including lymph node involvement	1.2 (1.2)	1.3 (1.2)	1.3 (1.4)	F = 0.86 p = .424
	% (N)	% (N)	% (N)	
Cancer diagnosis	39.8 (159)	39.8 (267)	44.4 (79)	
Breast	32.6 (130)	30.6 (205)	25.8 (46)	$\chi^2 = 3.6$ p = .725
Gastrointestinal	17.3 (69)	17.6 (118)	19.1 (34)	
Gynecological	10.3 (41)	12.1 (81)	10.7 (19)	
Lung				
Type of prior cancer treatment				
No prior treatment	25.4 (99)	24.4 (160)	26.0 (45)	$\chi^2 = 6.3$; p = .393
Only surgery, CTX, or RT	43.7 (170)	42.2 (277)	38.7 (67)	
Surgery & CTX, or Surgery & RT, or CTX & RT	19.0 (74)	21.3 (140)	17.3 (30)	
Surgery & CTX & RT	11.8 (46)	12.2 (80)	17.9 (31)	
Metastatic sites in combination				
No metastasis	34.3 (135)	30.6 (204)	35.6 (62)	$\chi^2 = 4.3$; p = .634
Only LN metastasis	22.6 (89)	23.1 (154)	18.4 (32)	
Only metastatic disease in other sites	19.0 (75)	21.8 (145)	19.5 (34)	
Metastatic disease in LNs and other sites	24.1 (95)	24.5 (163)	26.4 (46)	

Abbreviations: AUDIT = Alcohol Use Disorders Identification Test; CTX = chemotherapy; kg = kilograms; KW = Kruskal-Wallis Test; LN = lymph node; m² = meter squared; RT = radiation therapy; SCQ = Self-Administered Comorbidity Questionnaire; SD = standard deviation

Table 5

Differences in depression and anxiety among personality latent classes (n = 1248)

Measure	Resilient (1) n = 399 31.9% Mean (SD)	Normative (2) n = 671 53.8% Mean (SD)	Distressed (3) n = 178 14.3% Mean (SD)	Test statistic and post hoc contrasts
CES-D Total	7.6 (6.2)	12.9 (8.3)	24.1 (11.0)	F = 247.6; p < 0.001 1 < 2 < 3
CES-D Somatic Subscale	4.2 (3.6)	5.9 (3.8)	9.1 (4.4)	F = 102.8; p < 0.001 1 < 2 < 3
CES-D Depressed Affect Subscale	1.6 (2.4)	3.5 (3.8)	8.3 (5.3)	F = 200.8; p < 0.001 1 < 2 < 3
CES-D Positive Affect Subscale	10.3 (2.2)	8.7 (2.8)	6.2 (2.8)	F = 149.0; p < 0.001 1 > 2 > 3
CES-D Interpersonal Problems Subscale	0.08 (0.47)	0.19 (0.63)	0.83 (1.21)	F = 75.1; p < 0.001 1 < 2 < 3
STAI-Trait Anxiety	27.8 (5.9)	35.7 (8.6)	49.8 (8.8)	F = 470.3; p < 0.001 1 < 2 < 3
STAI-State Anxiety	26.5 (7.9)	34.3 (10.8)	48.0 (12.5)	F = 270.4; p < 0.001 1 < 2 < 3

Abbreviations: CES-D = Center for Epidemiological Studies – Depression scale; SD = standard deviation; STAI = Spielberger State-Trait Anxiety Inventory

Table 6

Differences in cancer-related symptoms among personality latent classes (n = 1248)

Measure	Resilient (1)	Normative (2)	Distressed (3)	Test statistic and post hoc contrasts
	n = 399 31.9% Mean (SD)	n = 671 53.8% Mean (SD)	n = 178 14.3% Mean (SD)	
MSAS Total	.560 (.42)	.735 (.46)	1.04 (.48)	F = 68.44; p < 0.001 1 < 2 < 3
MSAS Number of Symptoms Out of 38	11.5 (6.5)	14.3 (6.9)	18.1 (7.2)	F = 58.89; p < 0.001 1 < 2 < 3
MSAS Number of Symptoms Out of 32	10.4 (5.9)	12.9 (6.1)	16.1 (6.0)	F = 57.43; p < 0.001 1 < 2 < 3
MSAS Psychiatric Subscale	0.613 (.59)	.904 (.68)	1.45 (.77)	F = 96.3; p < 0.001 1 < 2 < 3
MSAS Physical Subscale	0.642 (0.49)	0.81 (0.55)	1.08 (.57)	F = 41.1; p < 0.001 1 < 2 < 3
MSAS Global Distress Index Scale	0.728 (5.7)	1.03 (.66)	1.55 (.69)	F = 100.1; p < 0.001 1 < 2 < 3

Abbreviations: MSAS = Memorial Symptom Assessment Scale; SD = standard deviation

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