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Personality Pathology, Health-related Stress, and General Functioning in Later Adulthood

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Personality Pathology, Health-related Stress, and General Functioning

in Later Adulthood

by Abigail Dart Powers

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ABSTRACT

Personality disorders (PDs) are associated with many negative health outcomes, including overutilization of health care resources, increased risk for chronic health problems, and poor adherence to medical recommendations. It is unclear, however, how significantly personality pathology affects an individual's daily health and functioning when health problems have already occurred. The purpose of this dissertation was to determine whether the presence of PD features moderate individual change over time in physical, emotional, and social functioning among individuals with significant health problems. The sample included 1,630 community-dwelling participants, ages 55-64. PD features were measured at baseline; health problems and all outcome variables were measured at baseline and four follow-up assessments. Multilevel modeling analyses were used to test the interactions between number of health problems, time, and personality disorder features in predicting physical, psychological, and social functioning. The results showed that PD features had a significant effect on functioning above and beyond the effects of health problems alone. Borderline, avoidant, and dependent PD features, in particular, showed significant main effects for all three functional outcome domains. Interaction effects with personality pathology were significant for medication use, medical resource utilization, and depressed mood. Individuals with borderline pathology showed significantly more medication use over the 2.5 years when health problems were not present. Individuals with avoidant features used more medical resources over time when health problems were present. Furthermore, individuals with antisocial or histrionic PD features and a higher number of health problems showed increased depressive mood scores over time.

CHAPTER 1: INTRODUCTION

There is growing evidence to support the assertion that personality plays an important role in general health (Kern & Friedman, 2008; Smith & Mackenzie, 2006). Personality disorders (PDs), in particular, are associated with a number of negative health outcomes, such as increased risk for chronic health problems and overutilization of healthcare services (Bender et al., 2001; Piertzak, Wagner, & Petry, 2007). It is unclear, however, how significantly personality pathology affects individuals' ability to cope with new health problems and the factors that may come from those new health problems, such as pain or role limitations.

As individuals age, physical health problems and illness emerge as common stressors. Gaining insight into how individuals experience physical illness or disability is important to our understanding of successful aging. Equally important is determining whether certain risk factors, like personality pathology, can be identified as indicators for maladjustment to major health stressors that are likely to occur.

PDs, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), reflect problematic patterns of perception and behavior that have a detrimental effect on individuals' functioning (APA, 2000). These patterns are thought to be inflexible and pervasive across many domains, including cognition, emotional responses, interpersonal functioning, and impulse control. The ten specific PDs are paranoid, schizoid, schizotypal, antisocial, borderline, histrionic, narcissistic, avoidant, dependent and obsessive-compulsive PD. Each PD has its own unique set of defining features and with that, its own unique set of problems. In the present paper, we will focus

on what functional problems may emerge from PD features in the face of health problems.

Personality Pathology and Physical Health Outcomes

Longitudinal research on PDs in adolescence (Cohen et al., 2005) and young adulthood (Skodol, Gunderson, et al., 2005; Zanarini et al., 2005) has demonstrated that personality pathology can lead to detrimental outcomes related to physical health, psychological well-being, and general functioning. PDs are associated with a number of detrimental physical health outcomes, including increased risk for chronic medical conditions (e.g., coronary heart disease) (Pietrzak et al., 2007) and increased likelihood of engaging in unhealthy behaviors (e.g., smoking) (Zanarini, Frankenburg, Hennen, Reich, & Silk, 2005). PDs also have been shown to have a negative prognostic impact on depression, another risk factor for problems with physical health (DiMatteo, Lepper, & Croghan, 2000; Skodol, Gunderson et al., 2005).

The Collaborative Longitudinal Personality Disorders Study (CLPS), a study of treatment-seeking individuals ages 18 to 45 (Skodol, Gunderson, et al., 2005), provides us with some clear evidence of how PDs impact individuals' health over time. Generally speaking, PDs are associated with increased utilization of medical resources (Bender et al., 2001). The investigators found that patients with borderline PD were significantly more likely to utilize all types of psychosocial treatments available and were found to use antianxiety, antidepression, and antipsychotic drugs at high rates. Obsessive compulsive PD was related to more individual psychotherapy and schizotypal PD to more use of psychiatric medication, when compared with patients with MDD alone. One limitation of the CLPS project is that only four PDs were selected for inclusion during this study (i.e.,

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schizotypal, borderline, avoidant, and obsessive-compulsive), making it difficult to draw conclusions about association across the full range of personality pathology with physical health problems.

Other studies have supported the specific health risk associated with borderline PD. A longitudinal study of borderline PD patients by Zanarini et al. (2005) confirmed the increased rates of medical use among individuals with borderline PD and also showed that unremitted borderline PD patients had more difficulty with chronic medical conditions. Even among borderline PD patients who are older (i.e., early to mid forties) and show fewer symptoms, the risk for overuse of medical services and worse functioning is still present (Blum et al., 2008). Furthermore, using data from the Wave 2 National Epidemiological Survey on Alcohol and Related Conditions (NESARC), El-Gabalawy et al. (2010) found that borderline PD was associated with a greater likelihood of having hypertension, hepatic disease, cardiovascular disease, gastrointestinal disease, arthritis, venereal disease or "any assessed medical condition," even when controlling for other psychopathology and sociodemographic variables relevant to physical health. Findings from a longitudinal study of adult inpatients with borderline PD (Frankenburg & Zanarini, 2006a) also showed that borderline PD is associated with obesity.

Despite growing evidence of health risks associated with personality pathology, the majority of research up to now has been done with clinical samples of younger adults (Oltmanns & Balsis, 2011). Two reports from the St. Louis Personality and Aging Network project (SPAN) provide preliminary evidence of the negative effects of personality pathology on health outcomes in a middle- to older-aged adult community sample. First, using cross-sectional data, Powers and Oltmanns (in press, A) examined

whether PD features were associated with subjective perception of health. Subjective perception of health is widely recognized in current research as an important indicator of future health outcomes, including mortality, health behaviors, and healthcare utilization (Fayers & Spranger, 2002). The results demonstrated that personality pathology explained a significant amount of variance in negative health perceptions independent of objective health indicators and general personality characteristics. Furthermore, Powers and Oltmanns (in press, B) found that PD features were predictive of worse physical functioning scores, greater healthcare utilization, and greater medication use at 6 month follow-up, even when baseline levels of functioning, the presence of illness, and depression were controlled. In both studies, borderline pathology was related to worse perceived health and functioning above and beyond other PD features. These preliminary studies demonstrate the relevance of personality pathology to many aspects of health in later adulthood, including both *subjective* feelings about health and *objective* aspects of health relevant to daily life, such as medication use, pain, and energy level.

The Importance of Personality Pathology in the Experience of Health Problems

Stressful life events often precipitate negative psychological outcomes, such as the onset of a major depressive episode (Monroe & Harkness, 2005; Wu & Andersen, 2010). The kinds of stressors that affect individuals change over the lifespan, with interpersonal stressors being more common in young adulthood and physical health problems more common in middle age and older adulthood (Jordanava et al., 2007). Personality pathology is associated with decreased psychosocial functioning following stressful experiences in younger people (Pagano et al., 2004), and it is possible that this may also translate into health-specific difficulties in later adulthood.

PDs influence the way that individuals perceive their health and physical functioning (Chen et al., 2009; Powers & Oltmanns, in press, A; Skodol, Grilo et al., 2005), which can in turn affect how an individual deals with the experience of health problems (Roberts, 2009). We know that variability in physical functioning and disability is affected by psychological factors (e.g., personality) (Turk & Okifuji, 2002). Furthermore, an individual's perception of a chronic physical illness (e.g., chronic pain) predicts functional outcomes, including adherence to medical treatment or time away from work following a surgery (Groarke et al., 2004; Petrie et al., 1996; Scharloo et al., 1998). The presence of multimorbidity must also be kept in mind because it can have a large effect on the experience of illness (Fortin et al., 2006). Dealing with the stress of one chronic physical condition may be very different than dealing with the stress of three conditions, and so the role of PD features in relation to health problems may change as illness load increases.

Social functioning also plays an important role in health maintenance and a strong social support network can help protect against the onset and progression of chronic conditions such as cardiovascular disease, cancer, and infectious disease (Cohen, 1988; Uchino, 2009). Family or friend support makes it easier for individuals to cope with daily stress and manage the course of chronic conditions. Interestingly, researchers suggest that *perceived* social support may be more important than actual received support in predicting health outcomes, and personality can affect those perceptions (Uchino, 2009). With this in mind, levels of social functioning or adjustment may be particularly important to consider in relation to personality pathology because one of the central characteristics of PDs is dysfunction in interpersonal relationships. The disorders that

cause individuals to avoid social contact, such as avoidant PD and schizoid PD, may be especially relevant to this aspect of health and functioning. Other PDs that are related to chaotic interpersonal relationships and tend to drive people away, such as borderline or narcissistic PD, may also be relevant here.

The Present Study and Specific Aims

As individuals age, the risk of developing a major medical condition increases, and the stress that accompanies major health problems can make it difficult to function and manage daily tasks. There is a great deal of variability in how individuals handle health problems, and personality pathology may play a key role in understanding these individual differences. Many of the studies reviewed here have emphasized the detrimental role of personality pathology in specific negative physical health outcomes, with borderline pathology emerging as particularly important. Despite extensive research into the influence of personality on mental and physical health outcomes (see Kern & Friedman, 2008; Lahey, 2009 for reviews), however, there is a scarcity of information on how pathological personality patterns affect the dynamic relationship between personality and general functioning when health problems arise. Furthermore, the inadequate research available on PDs in later adulthood makes it difficult to understand fully the role of personality pathology on health across the lifespan (Oltmanns & Balsis, 2011). Identifying the relationship between PD features and general functioning in the presence of major medical conditions (e.g., rheumatoid arthritis, heart disease) will broaden our understanding of how personality affects our health.

The present study assessed whether personality pathology impacted physical, psychological, and social functioning in the presence of physical health problems among

a community sample of middle- to older-aged adults. More specifically, patterns of change in physical functioning (i.e., healthcare and medication use, physical functioning, and perceived health), psychological functioning (i.e., depressed mood and emotional well-being), and social functioning (i.e., perceived relationship quality with family and friends) were examined in relation to the presence of major health problems over 2.5 years. Then, we tested whether the presence of PD features moderated those patterns of individual change. We predicted that increased numbers of symptoms of borderline PD would moderate the impact of health problems on medication use and healthcare utilization, as well as depressed mood and emotional well-being. Associations with the other nine DSM-IV PDs were also explored since less is known about the role of other PD symptoms in physical health outcomes and general functioning, especially in later adulthood.

CHAPTER 2: METHODS

Overview

The specific aims outlined above will be tested in the context of a larger longitudinal community-based study being conducted by Thomas F. Oltmanns, PhD: the St. Louis Personality and Aging Network (SPAN). Methods and measures relevant to the current analyses will be described here. Only the relevant methods used in the study will be discussed.

For the SPAN study, participants were recruited using listed phone numbers that were crossed with current census data in order to identify households with one member in the targeted age range. Households were asked to identify all eligible residents between the ages of 55 and 64, and the Kish method (Kish, 1949) was used to identify the target

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participant if more than one person was in that age range. Baseline assessment for participants in the SPAN study took approximately three hours and included a brief life narrative, a semi-structured diagnostic interview for personality disorders, and several self-report measures. After completing the baseline measures, participants were asked to complete a brief self-report assessment (30 minutes) once every 6 months. Participants received $60 compensation for the baseline assessment and $20 for each 6-month follow-up (FU) (Oltmanns & Gleason, 2011). Written and verbal informed consent was obtained from all participants prior to the baseline assessment.

Participants

By April, 2011, we obtained a representative sample (N=1630) of St. Louis residents, with ethnic diversity comparable to that of the greater St. Louis metropolitan area: 65.0% Caucasian, 32.4% African American, 1.1% Hispanic, 0.4% Biracial, 0.4% Middle Eastern, 0.3% Asian, and 0.4% other. The average age of participants was 59.5 (SD=2.7) and 55% were female. Most participants were married (48%), followed by divorced (29%), never married (14%), widowed (7%), and separated (2%). The participants varied in educational achievement with 32% having a high school education or less, 16% having education beyond high school, but not a bachelor degree, 26% having completed a bachelor degree, and 26% having a master degree or more. The median household income was $40,000-$60,000 and approximately 65% of participants were employed at the time of the baseline assessment.

On November 1, 2011, all data for FU1 - FU4 that had been collected was also obtained, resulting in the following sample sizes: For FU1, n=1442; for FU2, n=1317; for

FU3, n=989; for FU4, n=843[1]. These sample sizes reflect all participants who had

completed the demographics questionnaire and provided information on current health

status. Completed data for all measures were not obtained from all participants; therefore,

sample size varies depending on the dependent variables explored. Please see Table 1 for

a list of sample size by dependent variable for every follow-up[2].

Table 1

Sample sizes for each dependent variable

Dependent Variable:	**Baseline**	**FU1**	**FU2**	**FU3**	**FU4**
	N	N	N	N	N
Physical Functioning	1582	1402	1280	981	763
Health Perception	1583	1416	1304	984	765
Number of Medications	N/A	1396	1257	948	731
Medical Resource Utilization	N/A	1313	1207	913	738
Depression Score	1595	1384	1259	967	757
Emotional Well-being	1588	1423	1303	990	771
Social Adjustment	1344	1242	1120	849	678

Procedure

New health problems were identified in a number of ways. First, baseline levels

of health problems were determined by a structured interview (see the *baseline measures*

section below). Then, the presence of new health problems was assessed at all four

follow-up assessments, and a count of major physical illnesses or conditions was

determined at each follow-up. Through a self-report questionnaire, participants were

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[1] The SPAN study is ongoing, so these numbers do not represent attrition from the study, but instead show how many people had completed each FU at the time of this project. Current attrition rate for the overall SPAN study is 6%.

[2] See statistical plan for an explanation of why missing data is appropriate and manageable given the statistical analyses used in the present study.

asked to identify whether the onset of a new physical illness, disability, or surgical procedure occurred over the previous 6 months and to describe the condition. Inclusion criteria for the occurrence of health-related stressors were as follows: (1) for major health conditions (e.g., arthritis, diabetes), participants must also report at least one doctor visit or (2) for surgery or other medical emergencies (e.g., stroke, knee replacement surgery), participants must also report an outpatient procedure or overnight stay in the hospital. Health problems were also excluded if there were missing descriptions of the condition, if the description only identified a symptom without clearly identifying a physical condition (e.g., swelling in ankles), if the condition represented a psychological disorder (e.g., bipolar disorder) as opposed to a physical health problem, if a surgery was for cosmetic reasons (e.g., eye brow lift), if a routine testing or surgery was described (e.g., colonoscopy, mole removal), or if the condition reflected an acute infection (e.g., pneumonia, bladder infection)[3].

For all physical health conditions that met inclusion criteria, a trained research assistant was instructed to code each condition into one of the following categories[4]: heart disease, hypertension, high cholesterol, cancer, stroke, diabetes, rheumatic disease, chronic lung problem, gastrointestinal disorder, genitourinary problem, osteoporosis, chronic pain, brain tumor or aneurism, hernia, broken bone/torn muscle, thyroid problem, gastroesophageal reflux disease, eye problem, dental problem, ear problem, joint

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[3] See Appendix 1 for the percentages of physical conditions at each follow-up that were excluded from subsequent analyses.

[4] Questions concerning the nature of the health conditions described by participants were addressed using the resources of PubMed Health (http://www.ncbi.nlm.nih.gov/pubmedhealth/s/diseases_and_conditions/).

replacement, or other[5]. Table 2 provides the frequency of each condition at all four

follow-ups[6]. Appendix 1 lists all conditions included in each health condition category.

Table 2
Descriptive details of all new reported health problems

	FU1	FU2	FU3	FU4
	N (%)	N (%)	N (%)	N (%)
Number of Participants with New Health Problems	252 (17.5)	239 (18.1)	174 (17.6)	144 (17.1)
Type of Condition:				
Heart disease	11 (4.4)	18 (7.6)	15 (8.6)	8 (5.6)
Hypertension	6 (2.4)	8 (3.3)	6 (3.4)	2 (1.4)
High Cholesterol	5 (2.0)	5 (2.3)	5 (2.9)	2 (1.4)
Cancer	22 (8.5)	14 (5.8)	10 (5.7)	7 (4.9)
Stroke	2 (0.8)	3 (1.3)	3 (1.7)	4 (2.8)
Diabetes	12 (4.8)	12 (5.1)	11 (6.3)	8 (5.6)
Rheumatoid Disease	31 (12.3)	27 (11.4)	16 (9.2)	11 (7.6)
Chronic Lung Problem	7 (2.8)	3 (1.4)	4 (1.5)	3 (2.1)
Gastrointestinal Disorder	11 (4.4)	10 (4.2)	8 (4.6)	8 (5.6)
Genitourinary Problem	3 (1.2)	5 (2.1)	6 (3.4)	12 (8.3)
Osteoporosis	4 (1.5)	2 (1.0)	3 (1.7)	1 (0.7)
Chronic Pain	59 (23.4)	47 (19.7)	21 (12.1)	30 (20.8)
Brain Tumor/Aneurism	2 (0.7)	1 (0.5)	1 (0.6)	0 (0.0)
Hernia	9 (3.6)	10 (4.2)	7 (4.0)	7 (4.9)
Torn Muscle/Broken Bone	24 (9.5)	19 (8.0)	21 (12.1)	16 (11.1)
Thyroid Condition	4 (1.5)	6 (2.5)	0 (0.0)	1 (0.7)
Eye Problem	16 (7.5)	18 (7.6)	12 (6.9)	14 (9.7)
Dental Problem	4 (1.2)	3 (1.5)	0 (0.0)	1 (0.7)
Ear Problem	2 (0.5)	2 (0.9)	2 (1.1)	0 (0.0)
Gastroesophageal reflux disease	3 (1.2)	1 (0.4)	2 (1.1)	0 (0.0)
Joint Replacement	6 (2.3)	14 (5.8)	14 (8.0)	3 (2.0)
Other	9 (3.5)	8 (3.4)	7 (4.0)	4 (2.8)

Note: The percentages for the new health problem reflect percentages of the total sample size for each follow-up (FU1, n=1442; FU2, n=1317; FU3, n=989; FU4, n=843). All other percentages reflect percentages of all individuals with a new health problem.

Data obtained over the course of the first 2.5 years of the study (baseline

interview and four 6-month FU assessments) were used in subsequent analyses.

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[5] The *other* category included conditions that were extremely rare among participants and did not fit in one of the other categories described above (e.g., Parkinson's disease, traumatic brain injury).
[6] If the participant reported the onset of one or more conditions, the most debilitating was chosen. Coding did not affect subsequent analyses; they were used to provide descriptive data on the varied conditions that participants faced.

Measures

<u>Baseline Measures</u>

Structured Interview for DSM-IV Personality (SIDP-IV; Pfohl et al., 1997) is a semi-structured interview that elicits information from subjects about the presence or absence of all PD criteria in the DSM-IV. Questions are arranged by themes rather than by disorders (e.g., work style, interpersonal relationships), and each criterion is rated on a scale from 0 (*not present*) to 3 (*strongly present*). The SIDP-IV instructs individuals to focus on personality traits present in the past five years, thus providing an assessment of current personality. PD features (i.e., for paranoid, schizoid, schizotypal, antisocial, borderline, histrionic, narcissistic, avoidant, dependent, and obsessive-compulsive PDs) were calculated by adding ratings for the relevant criteria for each disorder and taking the average. See Table 3 for means and SDs.

From a clinical perspective, a PD is diagnosed if a certain number of criteria are given a minimum rating of 2 on the SIDP. Several participants met full diagnostic criteria for at least one specific PD (8.2%), and an additional 14 participants met criteria for PD not otherwise specified (PDNOS; 1.8%). However, many more participants met criteria for one or more symptoms but did not meet the threshold for a categorical diagnosis. It is important to keep in mind that the cut-off points used in DSM-IV-TR for current categorical diagnoses are arbitrary and many have shown that this is not the most useful way to understand personality pathology (Markon, Krueger, & Watson, 2005, Krueger et al., 2011). For example, recent evidence on the structure of borderline personality pathology suggests that a diagnostic threshold of 3 symptoms may be more useful

(Clifton & Pilkonis, 2007). As described above, we used scaled scores for all subsequent

analyses.

All interviews were video-recorded, and 145 interviews were randomly chosen to

be re-rated by independent judges. Reliability tests indicate adequate reliability at ICC =

0.67 for the overall scale (all PD's combined) with individual scales ranging from 0.53

for paranoid to 0.86 for avoidant; borderline had a reliability of 0.77. These numbers are

consistent with past research on the psychometric properties of the SIDP (Jane et al.,

2006; Pilkonis et al., 1995).

Table 3
Descriptive statistics for predictor variables

	Mean	SD	Min	Max
Paranoid	0.17	0.26	0.00	1.86
Schizotypal	0.08	0.15	0.00	2.00
Schizoid	0.14	0.25	0.00	2.14
Antisocial	0.05	0.16	0.00	2.14
Borderline	0.13	0.21	0.00	1.78
Histrionic	0.14	0.22	0.00	1.75
Narcissistic	0.18	0.28	0.00	2.33
Avoidant	0.16	0.34	0.00	2.86
Dependent	0.08	0.17	0.00	1.63
Obsessive Compulsive	0.37	0.34	0.00	2.00

Computerized screening version of the Diagnostic Interview Schedule (C-DIS;

Robins & Helzer, 1994). The DIS is an assessment developed for non-clinicians to collect

information that could be used to generate psychiatric diagnoses. The DIS has been

extensively pilot tested, and the validity and reliability of those data indicate good

agreement between diagnoses obtained by lay interviewers and clinicians. Health

problems were assessed using this measure. The health portion of the interview includes

participants' report of being under a doctor's care for the following long-lasting physical

illnesses: heart disease, cancer, stroke, arthritis, diabetes, hypertension, asthma, hepatitis,

tuberculosis, bleeding ulcer, and epilepsy. We calculated the number of chronic

conditions each participant had at the time of the baseline assessment, regardless of

original onset date (range $0 - 5$, mean $= 0.76$, SD $= 0.93$).

Outcome Measures (obtained at baseline and repeated every 6 months)

RAND Short Form 36 (SF-36) Health Status Inventory (HSI; Hays & Morales,

2001) is a self-report questionnaire that provides scores on 8 health constructs including:

physical functioning, role limitations due to physical/emotional problems, pain, health

perceptions, emotional well-being, social functioning, and energy. Extensive data are

available regarding the reliability and validity of these scales (Moorer et al., 2001). For

the present analyses, we used the *general health perceptions* (4 items), *emotional well-*

being (5 items), and *physical functioning composite* scores (10 items). All scores were

computed using the IRT weights determined by Hays and Morales (2001)[7]. Physical

functioning scores ranged from $209 - 564$; general health perception scores ranged from

$46 - 345$; emotional well-being scores ranged from $37 - 361$. Higher scores indicate

better functioning.

Social Adjustment Scale, Self Report (SAS-SR; Weissman & Bothwell, 1976) is a

48-item instrument that was used as the index of participants' social adjustment.

Compared with other interview-based scales, the SAS-SR is more sensitive to change in

the patient's clinical status and is considered a useful outcome measure in longitudinal

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[7] Full details on the syntax used to compute scores is available upon request.

studies. The SAS-SR has been tested in a wide range of populations including community samples (Weissman et al., 1978). For the present study, only the sections on family and friend support (17 items, scale 0-2) were used. Questions addressed regularity of social contact and size of social network, potential negative social behaviors (e.g., avoidance, excessive arguing), and satisfaction with available support. Scores were summed from these two categories to create an overall *social functioning scale.* The total score therefore can range from 0-34, with 34 representing better social functioning.

Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item self-report measure that has been widely used to measure the severity of depressive symptoms in clinical and non-clinical populations. Participants are asked to rate the severity of each symptom over the past two weeks, on a scale of 0-3. The total scale score therefore ranges from 0-63. Meta-analysis of the internal consistency yields an alpha coefficient 0.81 for use with non-psychiatric populations (Beck, Steer, & Carbin, 1988). In the present study, BDI total score was used as the measure of *depressed mood*.

Demographics Questionnaire. Our supplementary demographics questionnaire included questions related to daily health. Participants were asked to report how often in the past 6 months they had: visited a physician's office, gone to the emergency room, stayed overnight in the hospital, had an outpatient procedure, or visited a psychiatrist or psychologist (all on a scale of 0, 1-2, 3-5, or 6 or more times). These were summed to create an overall *medical resource utilization* score. Participants were also asked to indicate how many prescription medications they were taking, the dosage for each, what the medications were for, and duration of taking the medication. The total number of prescription medications was summed for an overall *medication use* score.

Table 4 includes the descriptive statistics for all seven outcome variables across all 5 time points.

Table 4

Descriptive statistics for dependent variables across all time points

Dependent Variables	Baseline		FU1		FU2		FU3		FU4	
	M	SD	M	SD	M	SD	M	SD	M	SD
Physical Functioning	477.36	94.01	475.82	94.32	476.99	92.83	476.10	92.82	482.77	88.17
Health Perceptions	246.98	66.97	248.73	65.99	248.74	65.66	249.81	65.86	252.52	64.66
Number of Medications	N/A	N/A	2.84	2.66	2.91	2.78	2.87	2.66	2.81	2.67
Medical Resource Utilization	N/A	N/A	1.64	1.49	1.64	1.42	1.63	1.43	1.69	1.41
Depression Score	5.24	6.06	5.21	6.42	5.35	6.74	5.38	6.97	4.65	5.95
Emotional Well-being	265.71	61.86	256.59	64.07	256.74	65.66	255.96	66.34	260.74	63.01
Social Adjustment	31.01	2.83	30.81	3.30	30.76	3.41	30.94	3.36	31.18	3.12

Physical functioning, range: 209-564; *health perceptions*, range: 46-345; *number of medications*, range: 0-10; *medical resource utilization*, range: 0-11; *depression score,* range: 0-63; *emotional well-being*, range: 37-361; *social adjustment,* range: 14-34.

Statistical Analyses

To assess the potential moderating effects of personality on functioning in the presence of physical health problems, two-level models were used. Models assessed within-person change in physical (i.e., physical functioning, medication use, medical resource utilization, and general health perception scores), psychological (i.e., depressed mood and emotional well-being scores), and social functioning (i.e., social adjustment score) over time and by number of illnesses (level 1), as well as assessed the main and moderating effects of personality (level 2). Most multilevel analyses were conducted in SPSS using MIXED and unstructured maximum-likelihood (ML) estimates. For medication use, we used GENERALIZED ESTIMATING EQUATIONS (GEE) models with a Poisson probability distribution. The Poisson distribution is recommended for use when the dependent variable is a count of a rare event; it is a probability distribution in that a one-unit increase in a predictor variable corresponds to the exponentiated value of that variable's regression coefficient and "is the predicted multiplicative effect of 1-unit of change" in the predictor variable (Coxe, West, & Aiken, 2009; p. 125).

Given the longitudinal nature of the data, we had to account for the dependency due to repeated measures. Multilevel modeling statistical techniques are best suited to examine both inter- and intra-individual change over time while accounting for this dependency (Raudenbush & Bryk, 2002). Moreover, multilevel models can handle missing data and permit time between observations to vary (Singer & Willett, 2003). While this study was designed to obtain follow-up data from participants every 6 months for two years following the baseline personality assessment, there was variability in how quickly participants actually completed follow-up assessments. Instead of setting

arbitrary dates for all participants, the *time* variable reflects the actual number of days past baseline that the follow-up assessment was completed by a participant[8], therefore providing a more accurate view of how time influences the outcome variables in question. Including time in the models also ensured that we could see relationships among our variables while holding time constant to avoid any potential confound effects.

Statistical models were constructed using the following model-building approach. First, to evaluate the amount of variation in the outcome variables at level 1, unconditional models were run to assess the time-varying effects of health problems (at baseline and each follow-up) on change in healthcare utilization, medication use, physical health composite score, general health perceptions, depressed mood, subjective well-being, and social functioning[9]. Separate one-level models were run to test for both the linear and quadratic effects of time. Separate two-level models were then run to assess the main effects of number of health problems, time, and each PD on the outcome variables. Next, separate two-level models were run to assess the interaction effects of number of health problems and time, each PD and time, and number of health problems and each PD on change in all outcome variables. Also, to determine if personality pathology moderated change in physical, psychological, and social functioning over 2.5 years, a three-way interaction between time, number of health problems, and each PD was included in these models. Finally, models were run with all PD features included in the models to determine the unique effects of each PD when accounting for the shared

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[8] FU1: mean=194 days (SD=26); FU2: mean=384 (SD=34); FU3: mean=572 days (SD=42); FU4: mean = 763 (SD=49).
[9] Onset of new health problems were also examined as level 2 variables; see the preliminary analyses section for more details.

variance among the PDs. Models depicted in the tables include those run with all PDs included.

The covariates included in all models were age, gender, race, and education, because of past evidence that these factors have independent associations with health outcomes (House, Kessler, & Herzog, 1990; Lahey, 2009). Due to small samples in several categories, race of participants was recoded into White/Caucasian and Black/African/Other for analyses and were then effect coded (-0.5 and 0.5, respectively, for ease of interpretation of coefficients). Gender was also effect coded. For education, participants were asked their highest education degree/certificate; the 9 categorical response options were then transformed to a continuous variable with a possible range of 6.5-20 years of education completed. Response options were as follows (years of education in parentheses): *Elementary or Junior High* (6.5); *GED* (12); *H.S. Diploma* (12); *Vocational Tech Degree* (14); *Associate Degree* (14); *R.N. Diploma* (15); *Bachelor Degree* (16); *Master Degree* (18); and *Doctorate: M.D., Ph.D., J.D., etc.* (20). Age and education were then centered for all analyses.

Throughout model fitting, all multilevel models were compared by deviance scores to assess goodness of fit. When chi-square tests showed that adding additional terms into the model did not significantly improve fit, the more parsimonious model was then used[10]. Covariance parameters were also examined with each new model and only models with significant variability at level 1 and level 2 remaining were fitted[11]. Once final models were established, non-significant interaction terms were removed from the final model (refer to Neslick et al., 2011 for an explanation of reason for this approach).

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[10] Information on all chi-square tests of fit is available upon request.
[11] The social support outcome variable showed limited variability and as a result, no interaction models were run.

Because of the skewed nature of many of our predictor and outcome variables, it was particularly important to evaluate model assumptions (see Raudenbush & Bryk, 2002; Singer & Willett, 2003). To make sure that the basic assumptions of the models were being met, the residuals of all final models were examined to check for error normality. The residuals were plotted against fitted values and all residuals of our final models approximated a normal distribution. As an additional check, we ran the MLM models using restricted maximum likelihood estimates (REML) because the variance components estimates are less biased. The standard error estimates were not significantly different from those using ML, again supporting that the assumptions of the mixed models were adequately met.

Preliminary analyses

Before running all models using a time-varying health status variable, we examined the relationships among our variables using dichotomous variables to represent the onset of new health problems at each follow-up. Specifically, onset of health problem was dummy coded into 7 separate dichotomous variables to account for the presence or absence of all possible onset patterns (i.e., onset at only 1 follow-up or new onset at multiple follow-ups)[12]. Those dummy codes were then included in all models with a separate control variable included for baseline number of illnesses. No significant relationships were found between specific onset times, personality pathology, and dependent variables in a consistent way. The models also became increasingly complicated with >20 interaction terms included in certain models (without accounting for models that would also include 10 PD variables), suggesting that looking separately at

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[12] Onset at FU1 only, n=134; onset at FU2 only, n=99; onset at FU3 only, n=71; onset at FU4 only, n=60; onset at 2 FUs, n=142; onset at 3 or 4 FUs, n=52.

the patterns of change related to these dummy coded variables was not useful in answering our research questions. The preliminary analyses did suggest, however, that having more events (>2) over the course of the follow-ups was significantly detrimental to all functional outcomes, with the exception of social adjustment and emotional well-being. This trend provided evidence that using a time-varying variable representing the number of illnesses for participants from baseline through all follow-ups would provide a clearer picture of how health problems impact functioning across a 2.5 year time span.

CHAPTER 3: RESULTS

Descriptive Information on Sample

While the average number of conditions remained relatively low among participants over the 2.5 years, some individuals experienced a large number of health stressors over the course of the study. The number of health problems participants came into the study with at baseline ranged from 0 to 5, with a mean = 0.76 and SD = 0.93. The number of new health problems reported at each follow-up were as follows: for FU1, the number of new health problems emerging in the 6-month time period ranged from $0 - 3$, with a mean = 0.20 and SD = (0.47); for FU2, range was $0 - 10$, with a mean = 0.23 and SD = $(0.60)^{13}$; for FU3, range was $0 - 3$, with a mean = 0.21 and SD = 0.50; for FU4, range was $0 - 3$, with a mean = 0.23 and SD = 0.53. As shown in Table 2, the types of medical problems that were experienced in FU1 – FU4 varied widely, with chronic pain conditions and rheumatic diseases consistently showing the highest rates across the follow-ups. Approximately 40% of all participants who faced a new medical condition also had surgery during that six month time period.

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[13] One participant reported 5 new illnesses, one reported 7 new illnesses, and one reported 10 new illnesses. Final models were run with the exclusion of these participants and results did not significant change, so they were included in all reported analyses.

Effects of PD Features and Illnesses on Physical Functioning

Parameter estimates of the associations between number of illnesses (across baseline and follow-ups), personality pathology, and physical functioning are shown in Table 5. On average (when all other predictors are at their mean value), borderline and antisocial PD features predicted lower levels of daily physical functioning (β = -15.72, $p<.001$; β = -9.91, $p<.05$, respectively); that is, independent of time, individuals who scored 1 standard deviation above the mean on borderline pathology reported lower physical functioning by the degree of 154.1 points, or 1.5 standard deviations below the mean in this sample (97.0 fewer points for antisocial PD, or 1 standard deviation below the mean). Alternatively, histrionic PD features predicted greater levels of daily physical functioning (β = 8.73, $p<.01$). A negative quadratic interaction between time and schizoid PD features was found (β = -0.51, $p<.05$). As shown in Figure 1, individuals with higher levels of schizoid features reported significantly lower levels of physical functioning over time compared to individuals with no schizoid features, independent of the number of illnesses and other personality pathology present. There was also a positive interaction between number of illnesses and time (β = 0.02, $p<.05$). Individuals with a high number of illnesses reported significantly lower levels of physical functioning compared with individuals without major illnesses. Interestingly, the level of physical functioning slowly decreased over time for individuals with no major illnesses, while reported physical functioning actually increased for individuals with higher levels of illness over the course of 2.5 years.

In terms of control variables, older age (β = -1.58, $p<.01$), female gender

(β = -16.28, $p<.001$), and African American or minority race (β = -30.06, $p<.001$) were predictive of worse reported physical functioning. Higher education level (β = 5.10, $p<.01$) was predictive of better reported physical functioning.

Table 5

Final models predicting physical functioning score by number of chronic illnesses (level 1), time (level 1), and personality pathology (level 2)

Baseline					FU4			
Predictor	*B*	*Stand. Error*	*t*		*Predictor*	*β*	*Stand. Error*	*t*
Intercept	508.17	4.77	151.30×		Intercept	507.46	4.77	106.37×
Age	-1.58	0.64	-2.47×		Age	-1.58	0.64	-2.47^
Gender	-16.28	3.65	-4.45×		Gender	-16.28	3.65	-4.34×
Race	-30.06	4.05	-7.40×		Race	-30.06	4.04	-7.40×
Education	5.10	0.54	9.46×		Education	5.10	0.54	9.71×
Illnesses	-27.30	1.54	-15.68×		Illnesses	-15.60	1.54	-10.15×
Baseline time			NS		FU4 time			NS
Baseline time^2			NS		FU4 time^2			NS
BPD	-15.72	3.20	-4.92×		BPD	-15.72	3.20	-4.92×
HPD	8.73	2.74	3.18×		HPD	8.73	2.74	3.18×
NPD			NS		NPD			NS
ASPD	-9.91	3.88	-2.55^		ASPD	-9.91	3.88	-2.55^
STPD			NS		STPD			NS
SZPD			NS		SZPD	-11.31	4.05	-2.70×
PPD			NS		PPD			NS
AVPD			NS		AVPD			NS
DPD			NS		DPD			NS
OCPD			NS		OCPD			NS
B-time*Illness	1.60	0.26	6.19×		FU4-time*Illness	1.60	0.26	6.19×
B-time^2*SZPD	-0.51	0.17	-3.02×		FU4-time^2*SZPD	-0.51	0.17	-3.02×

×$p<.01$; ^$p<.05$

Note: All significant PD effects were also tested in models without other PD variables and results remained significant.

Figure 1
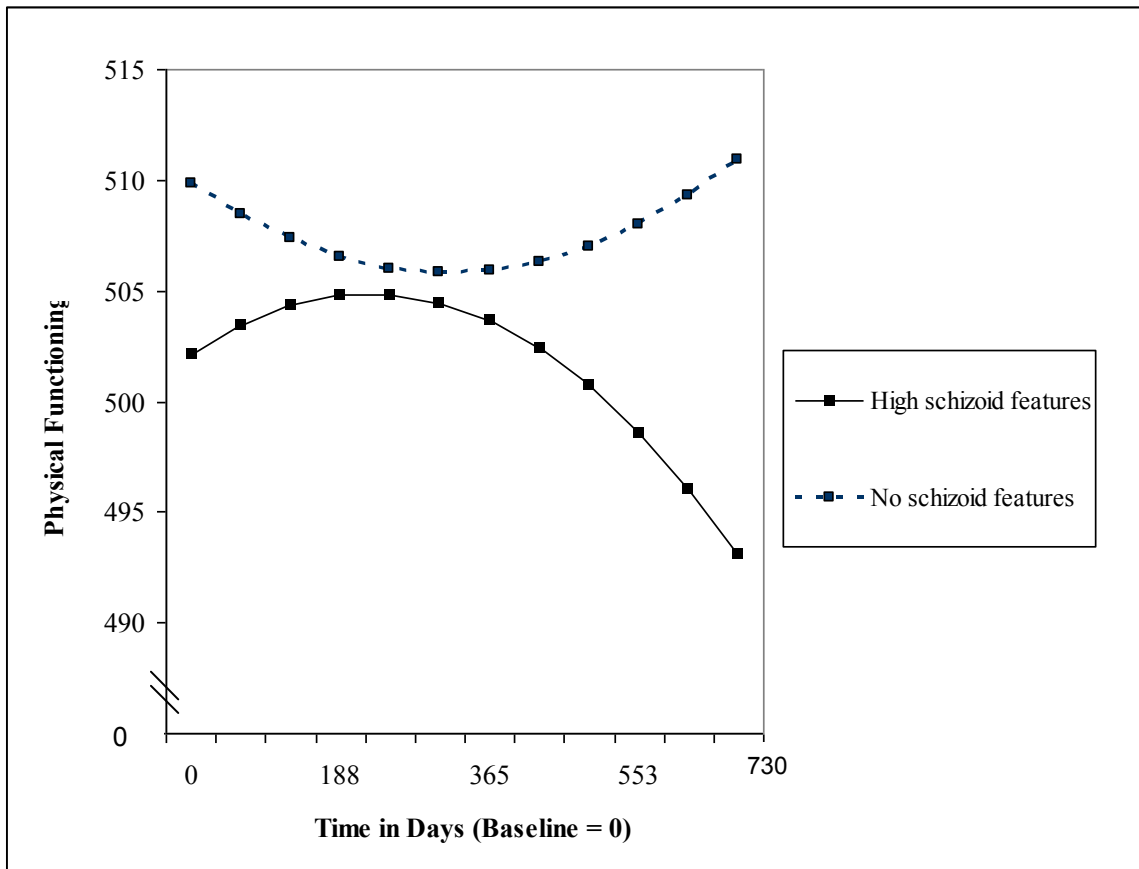
This figure shows the quadratic interaction between schizoid PD features and time predicting physical functioning score. "High levels" reflects 1 SD above the mean.

Effects of PD Features and Illnesses on Medication Use

There were also significant associations between number of illnesses, personality pathology, and medication use. Using a Poisson probability distribution, we found a significant 3-way positive quadratic interaction between number of illnesses, time, and borderline PD features. The predicted number of medication use when all variables are held constant at their mean was 1.01 (exp(0.01) = 1.01); see Table 6 for coefficients and Figure 2. Individuals with more illnesses were significantly more likely to report greater medication use regardless of whether borderline pathology was present; among individuals without any reported health problems, borderline features significantly predicted greater medication use, although the levels remained lower than for those with health problems.

There were also main effects with other PD features showing that the predicted number of medication use when all variables are held constant at their mean was 1.07 for narcissistic PD features (exp(0.07) = 1.07); in other words, individuals one standard deviation above the mean on narcissistic features reported using 1.07 more medications than those low on narcissistic features. Schizotypal PD features predicted less reported medication use (exp(-0.11) = 0.90); individuals one standard deviation above the mean on schizotypal features reported using 0.90 fewer medications than those low on schizotypal features.

In terms of control variables, male gender ($\beta = -0.11$, $p<.05$), Caucasian race ($\beta = -0.18$, $p<.001$), lower education level ($\beta = -0.03$, $p<.001$), and older age ($\beta = 0.03$, $p<.001$) were all predictive of higher medication use.

Table 6

Final GEE Poisson models predicting medication use by number of chronic illnesses (level 1), time (level 1), and personality pathology (level 2)

FU1					FU4			
Predictor	*β*	*Stand. Error*	X^2		*Predictor*	*β*	*Stand. Error*	X^2
Intercept	0.76	0.06	155.75ˣ		Intercept	0.71	0.12	36.69ˣ
Age	0.03	0.01	16.36ˣ		Age	0.03	0.01	16.36ˣ
Gender	-0.11	0.05	5.98^		Gender	-0.11	0.05	5.96^
Race	-0.18	0.05	13.24ˣ		Race	-0.18	0.05	13.24ˣ
Education	-0.03	0.01	17.47ˣ		Education	-0.03	0.01	17.47ˣ
Illnesses	0.30	0.03	152.09ˣ		Illnesses	0.20	0.03	60.32ˣ
FU1 time			NS		FU4 time			NS
FU1 time^2			NS		FU4 time^2			NS
BPD			NS		BPD			NS
HPD			NS		HPD			NS
NPD	0.07	0.03	6.91ˣ		NPD	0.07	0.03	6.91ˣ
ASPD			NS		ASPD			NS
STPD	-0.12	0.05	5.05^		STPD	-0.12	0.05	5.05^
SZPD			NS		SZPD			NS
PPD			NS		PPD			NS
AVPD			NS		AVPD			NS
DPD			NS		DPD			NS
OCPD			NS		OCPD			NS
FU1time^2*illness*BPD	0.01	0.01	4.09^		FU4time^2*illness*BPD	0.01	0.01	4.09^

ˣp<.01; ^p<.05

Note: All significant PD effects were also tested in models without other PD variables and results remained significant.

Figure 2
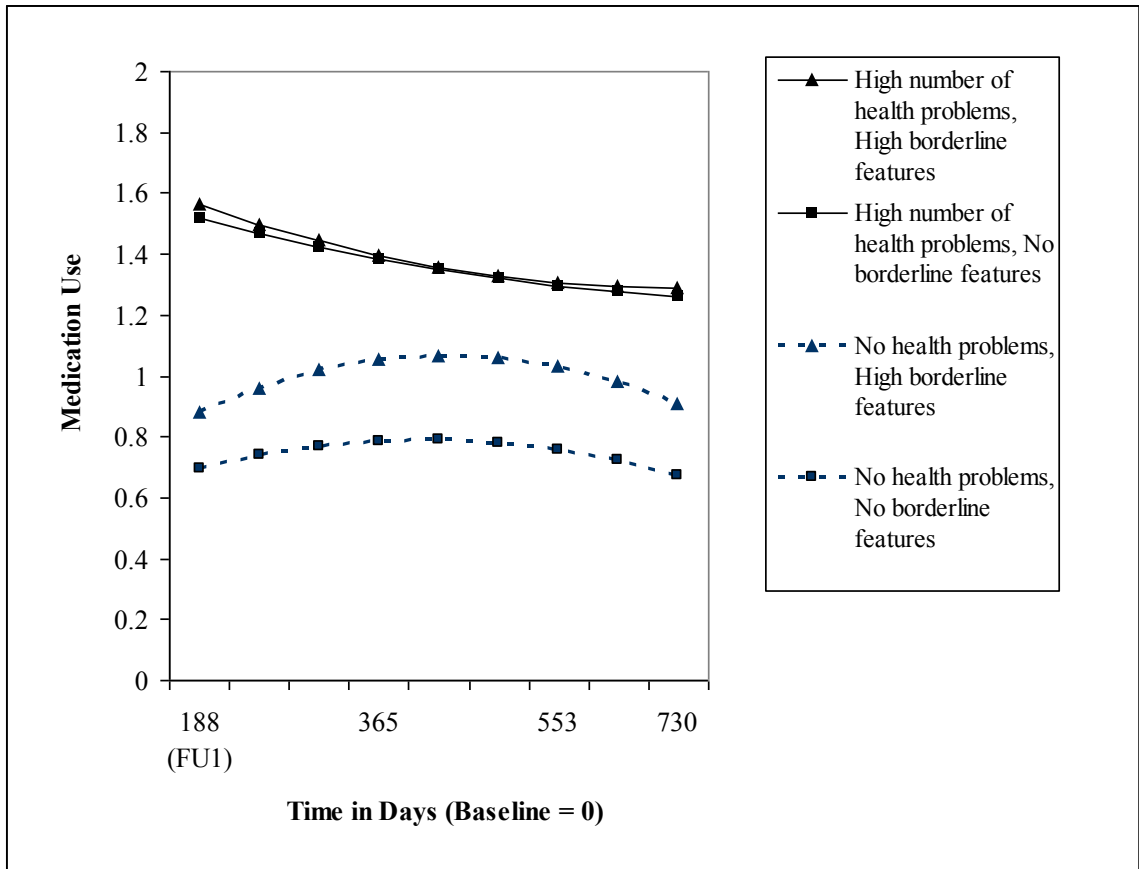
This figure shows the quadratic 3-way interaction between borderline PD features, number of illnesses, and time predicting medication use from FU1-FU4. "High levels" reflects 1 SD above the mean.

Effects of PD Features and Illnesses on Medical Resource Use

As shown in Table 7, significant associations between number of illnesses, personality pathology, and medical resource utilization showed different patterns than previous results. There was a significant 3-way negative quadratic interaction between number of illnesses, time, and avoidant PD features ($\beta = -0.01$, $p < .01$). Initially, individuals with more illnesses and high on avoidant PD features used significantly fewer medical resources than individuals with a high number of illnesses but no avoidant pathology. However, over time, individuals high on avoidant features and illnesses showed greater medical resource utilization than those with a high number of illnesses but no avoidant pathology (see Figure 3). We found significant 3-way positive quadratic interactions between number of illnesses, time, and dependent PD features ($\beta = 0.02$, $p < .01$), as well as obsessive-compulsive PD features ($\beta = 0.01$, $p < .01$). Individuals with more illnesses were significantly more likely to use medical resources; while that relationship was even greater among individuals high on dependent PD features at FU1, the levels of medical resource use became similar over time for all individuals with high levels of illnesses. Alternatively, as shown in Figure 4, among individuals with no major health problems, those high on dependent features actually showed less medical resource use over time compared with those without dependent pathology. The pattern for obsessive-compulsive PD was similar to that of dependent PD.

There were also main effects with other PD features showing that narcissistic and antisocial PD features predicted higher reported medical resource utilization ($\beta = 0.11$, $p < .01$ and $\beta = 0.17$, $p < .05$, respectively). More specifically, individuals who scored 1

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standard deviation above the mean on narcissistic and antisocial pathology reported 1.1 and 1.6 more medical resource use, respectively.

In terms of control variables, increasing age ($\beta = 0.02$, $p<.01$) and African American or other minority race ($\beta = 0.16$, $p<.001$) were predictive of greater use of medical resources.

Table 7

Final models predicting medical resource utilization by number of chronic illnesses (level 1), time (level 1), and personality pathology (level 2)

FU1					FU4			
Predictor	*β*	*Stand. Error*	*t*		*Predictor*	*β*	*Stand. Error*	*t*
Intercept	1.01	0.07	15.07×		Intercept	1.48	0.21	8.66×
Age	0.02	0.01	2.38^		Age	0.02	0.01	2.38^
Gender			NS		Gender			NS
Race	0.16	0.06	2.73×		Race	0.15	0.06	2.73×
Education			NS		Education			NS
Illnesses	0.72	0.06	13.31×		Illnesses	0.38	0.06	5.67×
FU1 time			NS		FU4 time	0.24	0.10	2.33^
FU1 time^2			NS		FU4 time^2			NS
BPD			NS		BPD			NS
HPD			NS		HPD			NS
NPD	0.11	0.03	3.32×		NPD	0.11	0.03	3.36×
ASPD	0.17	0.06	2.78×		ASPD	0.17	0.06	2.74×
STPD			NS		STPD			NS
SZPD			NS		SZPD			NS
PPD			NS		PPD			NS
AVPD			NS		AVPD			NS
DPD	-0.56	0.27	-2.11^		DPD	-0.69	0.27	-2.76^
OCPD			NS		OCPD			NS
FU1time^2*illness*AVPD	-0.01	0.003	-4.34×		FU4time^2*illness*AVPD	-0.01	0.003	-4.34×
FU1time^2*illness*DPD	0.02	0.007	2.67×		FU4time^2*illness*DPD	0.02	0.007	2.67×
FU1time^2*illness*OCPD	0.01	0.003	2.22^		FU4time^2*illness*OCPD	0.01	0.003	2.22^

×$p<.01$; ^$p<.05$

Note: All significant PD effects were also tested in models without other PD variables and results remained significant.

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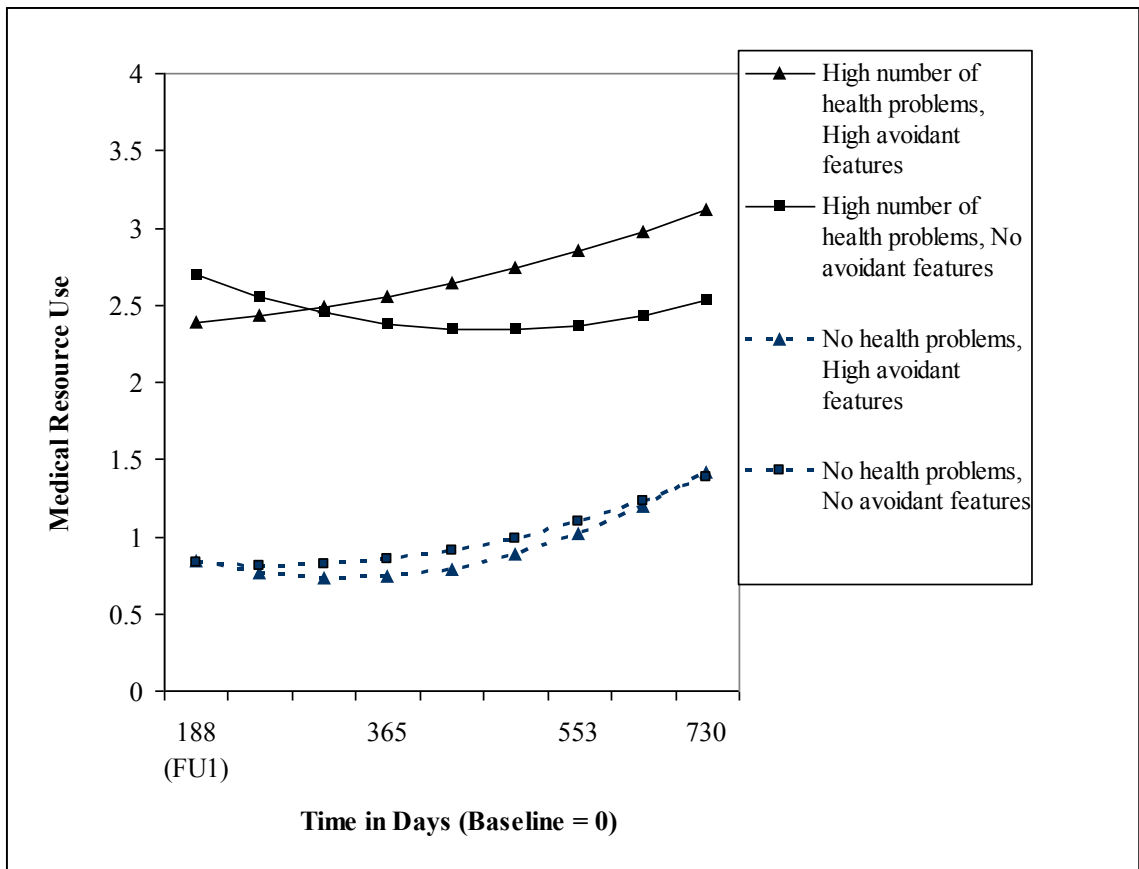
Figure 3

This figure shows the quadratic 3-way interaction between avoidant PD features, number of illnesses, and time predicting medical resource utilization from FU1 – FU4. "High levels" reflects 1 SD above the mean.

Figure 4
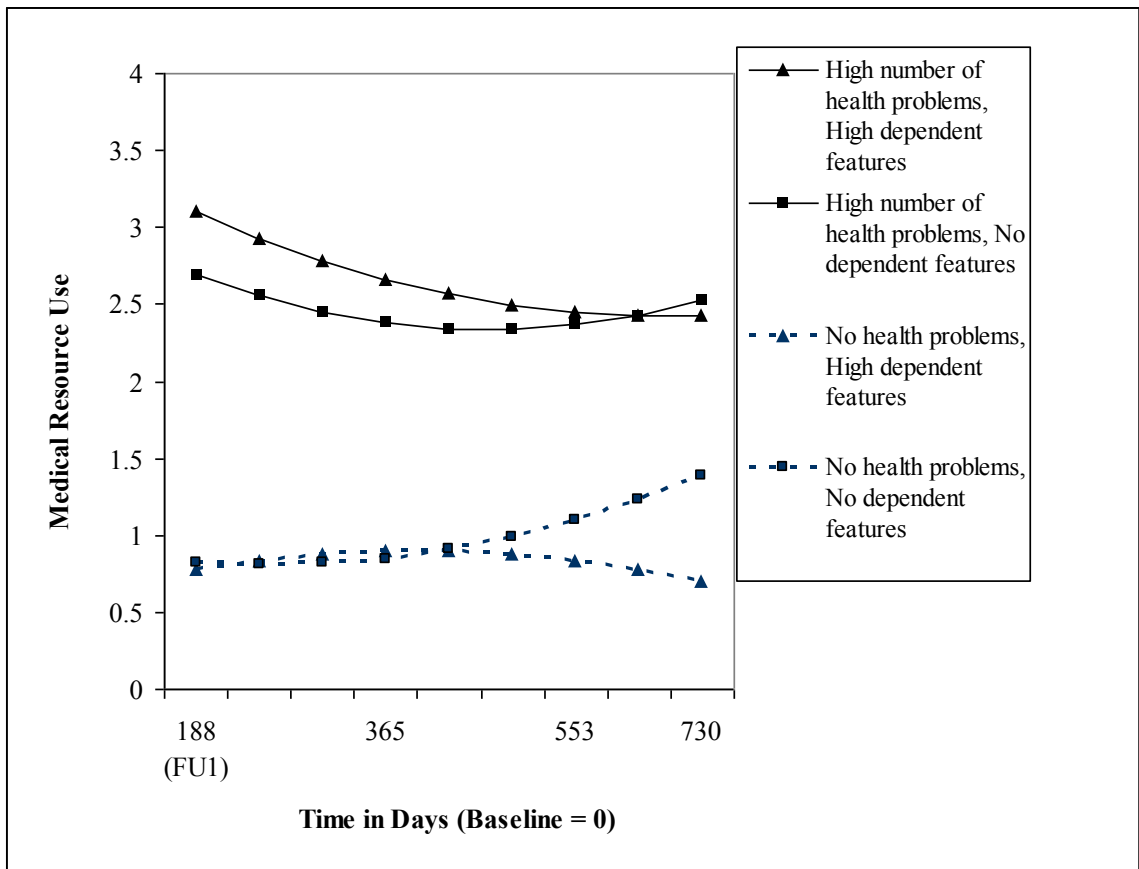
This figure shows the quadratic 3-way interaction between dependent PD features, number of illnesses, and time predicting medical resource utilization from FU1 – FU4. "High levels" reflects 1 SD above the mean.

Effects of PD Features and Illnesses on Health Perceptions

When examining the associations between number of illnesses, personality pathology, and general health perceptions, borderline PD features predicted worse perceptions of health (β = -17.54, $p<.001$) (see Table 8). Dependent PD features also predicted worse perceived health (β = -5.76, $p<.05$), while histrionic PD predicted better perceived health (β = 6.15, $p<.01$).

A negative quadratic interaction between number of illnesses and time was also found (β = -0.13, $p<.05$). This pattern was similar to the pattern found with physical functioning; that is, individuals with more health problems had significantly worse perceptions of health, but those perceptions actually improved over time despite increased numbers of health problems. Health perceptions for individuals without major health problems remained relatively stable over time.

In terms of control variables, Caucasian race (β = -18.91, $p<.001$) and greater education level (β = 2.03, $p<.01$) was predictive of better perceived health.

Table 8

Final models predicting general health perceptions score by number of chronic illnesses (level 1), time (level 1), and personality pathology (level 2)

| Baseline					FU4			
Predictor	*β*	*Stand. Error*	*t*		*Predictor*	*β*	*Stand. Error*	*t*
Intercept	269.91	3.43	108.06×		Intercept	269.41	3.43	78.65×
Age			NS		Age			NS
Gender			NS		Gender			NS
Race	-18.91	3.00	-6.30×		Race	-18.72	3.00	-6.30×
Education	2.03	0.41	5.07×		Education	2.03	0.41	5.07×
Illnesses	-18.22	1.25	-14.50×		Illnesses	-10.16	1.25	-8.58×
Baseline time			NS		FU4 time			NS
Baseline time^2			NS		FU4 time^2			NS
BPD	-17.54	2.37	-7.39×		BPD	-17.54	2.37	-7.39×
HPD	6.15	2.04	3.01×		HPD	6.15	2.04	3.01×
NPD			NS		NPD			NS
ASPD			NS		ASPD			NS
STPD			NS		STPD			NS
SZPD			NS		SZPD			NS
PPD			NS		PPD			NS
AVPD			NS		AVPD			NS
DPD	-5.76	2.72	-2.12^		DPD	-5.76	2.72	-2.12^
OCPD			NS		OCPD			NS
B-time^2*illness	-0.13	0.06	-2.05^		FU4-time^2*illness	-0.13	0.06	-2.05^

×$p<.01$; ^$p<.05$

Note: All significant PD effects were also tested in models without other PD variables and results remained significant.

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Effects of PD Features and Illnesses on Depression Score

As shown in Table 9, there were a number of significant associations between number of illnesses, personality pathology, and depression scores. There was a significant 3-way positive interaction between number of illnesses, time, and histrionic PD features ($\beta = 0.08$, $p<.01$). As Figure 5 demonstrates, individuals with more illnesses and high on histrionic features started out with significantly lower depressed mood scores at baseline; over time, those depression levels reached the same level as for individuals who had major health problems but no histrionic pathology. Among individuals who had no major health problems, individuals high on histrionic PD features actually reported fewer depressive symptoms when compared with those without any histrionic pathology. A similar 3-way interaction between number of illnesses, time, and antisocial PD features was found ($\beta = 0.07$, $p<.05$). Interestingly, the level of depressed mood for individuals with more health problems and high on antisocial PD features exceeded the level for those with major health problems but no antisocial pathology over time (see Figure 6). There was a significant 3-way negative interaction between number of illnesses, time, and schizoid PD features ($\beta = -0.06$, $p<.05$). In contrast to the findings with histrionic PD, individuals high on schizoid PD features reported more depressive symptoms than those without schizoid pathology, but among those with a high number of health problems, that difference eventually disappeared (see Figure 6).

There were also main effects with other PD features. Borderline features significantly predicted higher depression scores ($\beta = 3.34$, $p<.001$); in other words, individuals who scored 1 standard deviation above the mean on borderline pathology scored almost 33 points higher on the BDI than individuals with no borderline pathology.

Avoidant and dependent PD features also significantly predicted higher depression scores ($\beta = 0.71$, $p<.001$; and $\beta = 0.90$, $p<.001$, respectively), although these associations were smaller.

In terms of control variables, increasing age ($\beta = -0.12$, $p<.01$) and higher education level ($\beta = -0.18$, $p<.01$) were predictive of lower depressed mood scores, while African American or minority race ($\beta = 0.78$, $p<.01$) was predictive of higher depressed mood scores.

Table 9

Final models predicting depression score by number of chronic illnesses (level 1), time (level 1), and personality pathology (level 2)

	Baseline				*FU4*			
Predictor	*β*	*Stand. Error*	*t*		*Predictor*	*β*	*Stand. Error*	*t*
Intercept	2.79	0.25	11.16×		Intercept	2.46	0.25	6.09×
Age	-0.12	0.04	-2.73×		Age	-0.12	0.04	-2.73×
Gender			NS		Gender			NS
Race	0.78	0.27	2.88×		Race	0.78	0.27	2.88×
Education	-0.18	0.04	-5.03×		Education	-0.18	0.04	-5.03×
Illnesses	0.78	0.18	4.29×		Illnesses	0.56	0.18	3.03×
Baseline time			NS		FU4 time			NS
Baseline time^2			NS		FU4 time^2			NS
BPD	3.34	0.21	15.48×		BPD	3.34	0.21	15.87×
HPD			NS		HPD			NS
NPD			NS		NPD			NS
ASPD			NS		ASPD			NS
STPD			NS		STPD			NS
SZPD			NS		SZPD	0.80		3.02×
PPD			NS		PPD			NS
AVPD	0.71	0.12	5.80×		AVPD	0.71	0.12	5.80×
DPD	0.90	0.24	3.69×		DPD	0.90	0.24	3.69×
OCPD			NS		OCPD			NS
B-time*illness*HPD	0.08	0.03	2.75×		FU4-time*illness*HPD	0.08	0.03	2.75×
B-time*illness*ASPD	0.07	0.03	2.07^		FU4-time*illness*ASPD	0.07	0.03	2.07^
B-time*illness*SZPD	-0.06	0.02	-2.40^		FU4-time*illness*SZPD	-0.06	0.02	-2.41^

×p<.01; ^p<.05

      Note: All significant PD effects were also tested in models without other PD variables and results remained significant.

Figure 5
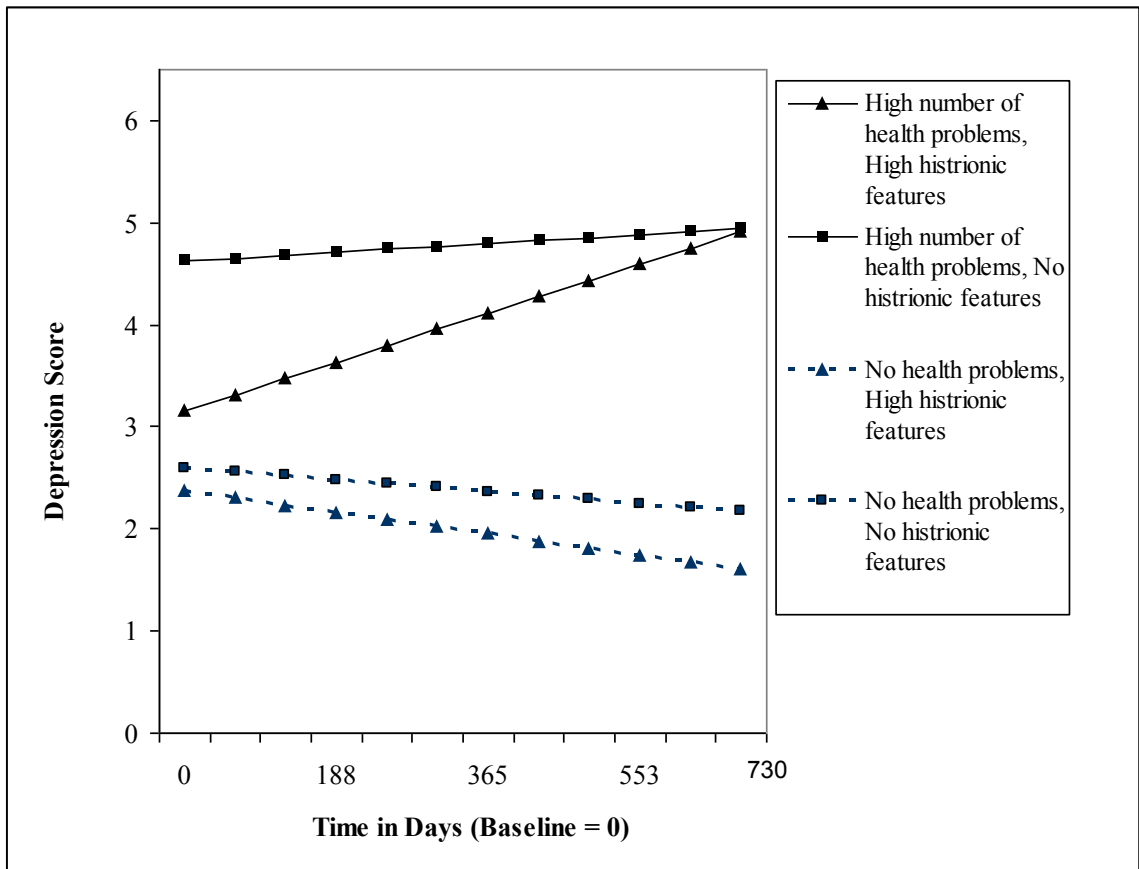
This figure shows the 3-way interaction between histrionic PD features, number of illnesses, and time predicting depressed mood score. "High levels" reflects 1 SD above the mean.

Figure 6
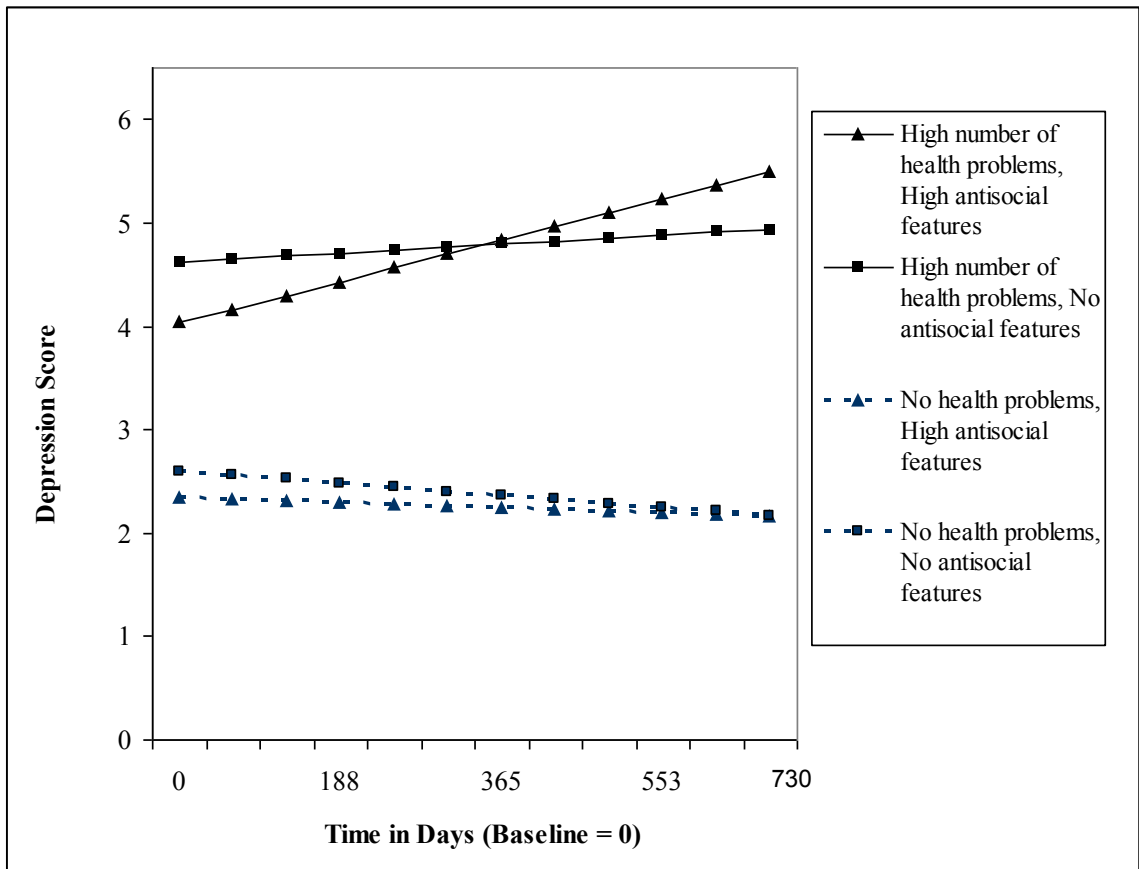
This figure shows the 3-way interaction between antisocial PD features, number of illnesses, and time predicting depressed mood score. "High levels" reflects 1 SD above the mean.

Figure 7
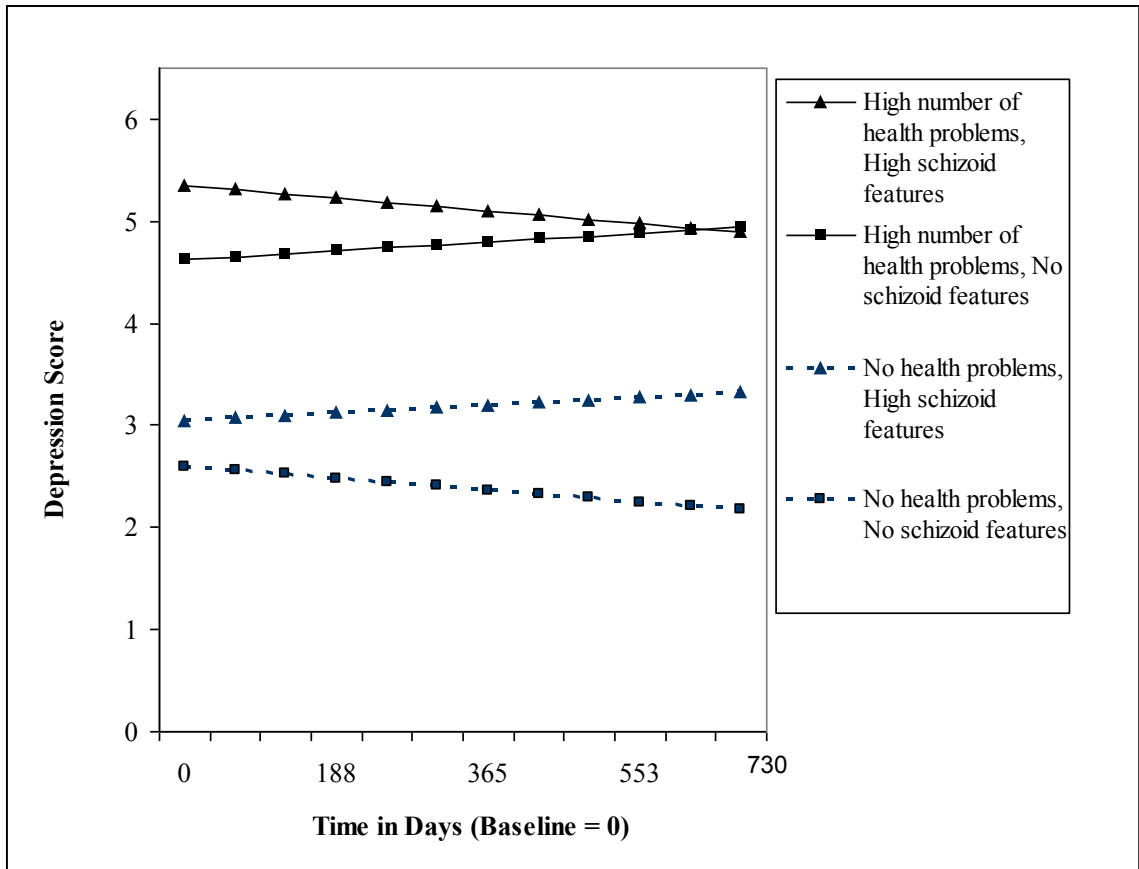
This figure shows the 3-way interaction between schizoid PD features, number of illnesses, and time predicting depressed mood score. "High levels" reflects 1 SD above the mean.

Effects of PD Features and Illnesses on Emotional Well-being

Main effect patterns of personality in predicting emotional well-being were similar to those found with depressed mood scores. Borderline, avoidant, and dependent PD features all significantly predicted lower reported emotional well-being (β = -32.37, p<.001; β = -7.68, p<.001; and β = -9.34, p<.001, respectively). Histrionic PD features were predictive of higher reported emotional well-being (β = 6.52, p<.01). There was also a significant main effect with number of illnesses, showing that the more illnesses individuals' experienced, the worse their reported emotional well-being (β = -4.44, p<.001). Additionally, a quadratic effect of time on emotional well-being was found (β = 0.57, p<.001). Age was the only significant control variable in relation to emotional well-being (β = 1.75, p<.001). Because no interactions were found with emotional well-being, the values are not included in a table.

Effects of PD Features and Illnesses on Social Adjustment Levels

There were also a number of significant PD main effects in relation to social adjustment levels. More specifically, we found that borderline, schizoid, avoidant, and dependent PD features all significantly predicted lower reported social functioning (β = -1.10, p<.001; β = -0.77, p<.001; β = -0.49, p<.001; and β = -0.29, p<.001, respectively). As might be expected, histrionic PD features were predictive of higher reported social functioning (β = 0.44, p<.01). Greater number of illnesses was also associated with lower reported social functioning (β = -0.12, p<.05). There was a quadratic main effect with time (β = 0.02, p<.01).

In terms of control variables, increasing age (β = 0.08, p<.01), female gender (β = 0.44, p<.01), and higher education level (β = 0.05, p<.01) were predictive of greater

reported social functioning, while African American or minority race ($\beta = -0.42$, $p<.01$) was predictive of lower reported social functioning. Because no interactions were found with social functioning, the values are not included in a table.

Table 10
Summary of findings

	Physical Functioning	**Medication Use**	**Medical Resource Utilization**	**Health Perceptions**	**Depressed Mood**	**Emotional Well-being**	**Social Adjustment**
Physical Illnesses	Lower	Higher	Higher	Lower	Higher	Lower	Lower
PD features:							
Borderline	Lower	Higher use among people w/out illnesses		Lower	Higher	Lower	Lower
Antisocial	Lower		Higher		Initially lower, but increased over time for people w/ illnesses		
Histrionic	Higher			Higher	Increased over time for people w/ illnesses; lower for people w/out illnesses	Higher	Higher
Schizoid	Lower over time				Higher for people w/out illnesses		Lower
Narcissistic		Higher	Higher				
Schizotypal		Lower					
Avoidant			Lower initially; higher over time for people w/ illnesses		Higher	Lower	Lower
Dependent			Higher initially; lower for people w/out illnesses	Lower	Higher	Lower	Lower
Obsessive-compulsive			Slightly higher initially for people w/ illnesses, but decreased w/ time				

Covariates:							
Age	Lower	Higher	Higher		Lower	Higher	Higher
Female Gender	Lower	Lower					Higher
Minority Race	Lower	Lower	Higher	Lower	Higher		Lower
Education	Higher	Lower		Higher	Lower		Higher

CHAPTER 4: DISCUSSION

This is the first longitudinal study to assess the relationship between personality pathology, physical health-related conditions, and functioning in later adulthood. Consistent with previous research on the detrimental effects of PDs (Bender et al., 2001; Pagano et al., 2004; Piertzak, Wagner, & Petry, 2007; Zanarini et al., 2005), we found that some types of personality pathology had a significant negative impact on physical, psychological, and social functioning over the 2.5 years examined. In particular, borderline, avoidant, and dependent PD features emerged as significant predictors of worse functioning across all three domains. Much of the research done with younger adults has focused on worse functioning among individuals with borderline PD (e.g., El-Gabalawy et al., 2010; Frankenburg & Zanarini, 2006a, 2006b). In our older adult sample, the results were similar. Above and beyond the effects of demographic variables and health status, borderline pathology predicted worse physical functioning, lower perceived health, increased depressive symptoms, lower reported emotional well-being, and lower social functioning. We did not find a significant association between borderline pathology and medical resource utilization when other PD features were included in the model. The patterns were similar in the psychological and social domains for avoidant and dependent PD features; individuals with higher levels of avoidant and dependent pathology showed an increased likelihood of depressive symptoms, lower reported emotional well-being, and lower social functioning.

What is it about borderline pathology that would cause worse functioning across these three domains in this older adult sample? Many of the problematic symptoms characteristic of borderline pathology have been shown to decrease over time; for

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example, self-injurious or impulsive behaviors are less likely to be present as individuals age (Blum et al., 2008). This is generally supported by the very low prevalence of borderline PD as a categorical disorder in our sample. Despite this, recent evidence on the stability (or instability) of borderline PD suggests that while many symptoms seem to remit over time, the long term negative consequences of the disorder are still very strong (Blum et al., 2008; Gunderson et al., 2011). The strong associations between borderline features and negative outcomes found in this study further demonstrate that functional problems do continue into older adulthood.

It is possible that by later adulthood, we see both the long-term consequences of past behavioral and affective patterns as well as the consequences of current negative patterns. For example, impulsivity may not directly cause as many problems at this developmental stage, but the repercussions of past health choices may continue to affect the individual. Additionally, poor social functioning (as a result of unstable interpersonal relationships and unhealthy behavioral patterns throughout life) may be particularly detrimental for health and functional outcomes in older adulthood because of the role social support plays in coping with stress and promoting well-being (Cohen, 1988; Uchino, 2009). Finally, affective instability, a feature that is often the most consistent over time and is suggested to underlie many of the other borderline symptoms, is associated with worse psychosocial functioning and may continue to play a strong role in older age (Tragesser, Solhan, Schwartz-Metter, & Trull, 2007; Zanarini, Frankenburg, Hennen, & Silk, 2003). Affective instability makes it difficult for individuals to manage their emotions, cope with negative feelings, and even self-soothe. These individuals, when faced with a negative event such as a health problem, may become overwhelmed

by strong negative emotions and without an adequate way to reduce the emotion may shut down or act out in ways that then further affect their ability to function.

The patterns of results for avoidant and dependent PD features may reflect the social impairment and low positive affect associated with these disorders. Avoidant PD is characterized by avoidance of intimate and interpersonal relationships because of fear of rejection and judgment, while dependent PD is characterized by overly needy behavior in relation to others and fears of being alone. Despite their differences, both disorders reflect a strong desire for relationships and an inability to foster such relationships adequately. Recent research into the effect of loneliness on older adults suggests the vital role that social interactions play in keeping us healthy and happy (Hawkley & Cacioppo, 2010). Furthermore, individuals with these personality pathologies are unlikely to have certain positive personality features (e.g., positive affect, optimism) that can benefit health outcomes, the ability to deal with stress, and increase social support (Cohen & Pressman, 2006). Since much of the research on PDs up to this point has been done with younger adults, it may be that risk associated with these PD features has been underestimated, and that such features emerge more as risk factors for negative health and functional outcomes among older adults.

Other PD features were related to the functional outcomes in our sample as well, although the findings varied, suggesting that PD features do in fact affect functioning in different ways. For example, antisocial PD features were predictive of worse reported physical functioning and more medical resource utilization, while narcissistic PD features were predictive of medication use and medical resource utilization. Schizoid PD features were related to worse physical functioning and worse social functioning. In contrast,

histrionic PD demonstrated a positive association with physical functioning and perceived health, as well as with greater social functioning scores, which might be expected considering the criteria for histrionic PD include items related to desire for social attention and exaggerated perception of relationship closeness. The association with schizoid PD features and lower social functioning also makes sense because of the social isolation characteristic of schizoid PD. Because these individuals typically do not desire interpersonal contact and relationships, we would expect them to report less social interaction on a regular basis. This may also carry over into physical functioning because there are fewer positive motivators to get out and engage in pleasurable activities; if someone is in pain and spends the majority of their time alone or working, it may be easier to focus on what they cannot do in relation to physical activities, as opposed to what they can do. Again, good social adjustment has been shown to be increasingly important in positive functioning and well-being as individuals' age (Hawkley & Cacioppo, 2010; Uchino, 2009). The positive association of histrionic PD features with physical functioning and perceived health is unexpected and more research should be done before any clear conclusions can be made.

Although the research on most PDs in relation to physical health is limited, there is already some evidence that antisocial PD is related to negative health outcomes, perhaps as a result of past impulsive acts or lifetime substance use (Frankenburg & Zanarini, 2006b). The link found in our sample between antisocial features, physical functioning, and medical resource utilization could also be reflective of the longer term effects of antisocial behavior, although the scope of this study does not allow for any clear determinations about risk pathways. The role of narcissistic features in physical

health and functioning is less clear. One possibility for understanding long-term health consequences of narcissistic PD may lie in recent research on narcissistic vulnerability (see Pincus & Lukowitsky, 2010 for a review of this concept) and the dysfunctional characteristics associated with it (i.e., poor self-image and self-criticism, affective instability, interpersonal problems, and suicidality). Although much more research needs to be done in this area, this "hidden" part of narcissistic PD includes features that are already linked to negative health consequences on their own, such as high negative affect and anger (Dembroski, & Costa, 1987; Lahey, 2009; Smith & MacKenzie, 2006).

Also in support of past research (Fortin et al., 2006), the number of health problems individuals experienced had a significant effect on the three areas of functioning over time. Increasing number of health problems was predictive of worse physical functioning, greater medication use, greater medical resource utilization, worse perceived health, increased number of depressive symptoms, lower emotional well-being, and worse social functioning. Interestingly, certain outcome variables, including physical functioning and perceived health scores, actually improved over time despite the continued stress of chronic illnesses (and added stress of new health problems). There are a number of reasons why this may have happened. One possibility is that, in general, individuals with health problems are able to adjust to the difficulties associated with their conditions over time. Because the pain or role limitations that may come with a chronic condition like arthritis do not go away, the individual is likely to adjust their life, and even their attitude toward the health problem, in a way that actually makes them feel more physically functional or healthier. Furthermore, in working with a medical doctor, the individual is likely to take medications or implement behavioral strategies that help

control symptoms over time and may make the individual feel better even if the condition is still present.

In examining the combined effects of health problems and personality pathology over time, we were also able to determine if personality pathology moderates those negative effects found with health-related stress on functional outcomes. Our results showed that certain pathological personality patterns did alter the effects of health problems on medication use, medical resource utilization, and depressed mood. In support of our hypothesis, we found that borderline pathology did have an effect on medication use in this sample. Although individuals with health problems and borderline pathology used a similar number of medications to those with health problems but no borderline pathology, individuals with borderline pathology and no health problems showed significantly greater medication use than those individuals without health problems or borderline pathology. The difference in medication use still remained relatively small, and so the implications of this finding may be limited. It is possible that the increased medication use is actually related to medication for psychological symptoms, as opposed to physical symptoms, and it would make sense that individuals with borderline pathology are more likely to be taking some kind of antidepressant or antianxiety medication. However, it is unclear why that difference would not also show up in the group with physical health problems. As we continue to follow these individuals into older adulthood, it may become easier to determine the nature of this relationship and how it should be understood in the context of health and general functioning.

The interaction effect between avoidant pathology and health problems in predicting medical resource utilization was quite different. Individuals with health

problems and higher levels of avoidant pathology reported fewer medical visits at baseline; however, over time, those individuals showed significantly greater medical resource utilization than individuals with health problems but no avoidant pathology. This suggests that while avoidant individuals may at first not seek out treatment even when sick, as the illness load increases, their behavior actually switches and they then overcompensate, going to the doctor more than individuals with health problems but no avoidant pathology. Alternatively, patterns with dependent and obsessive-compulsive PD features showed that initially individuals with health problems and high on dependent and obsessive-compulsive pathology used more medical resources than individuals with health problems but no pathology. Over time, those differences reduced and by follow-up 4, these individuals were reporting slightly less medical resource utilization than individuals with health problems and no pathology, although the levels remained higher than for those individuals without any health problems.

Our hypothesis that borderline pathology would moderate medical resource utilization was not supported. This was surprising given the previous evidence of over-utilization of medical resources among individuals with borderline pathology (e.g., Bender et al., 2001). It is possible that we did not find this effect because our range of borderline pathology is quite limited. It is also possible that, similar to what was found with many other outcomes measured in this study, borderline pathology has a negative effect on medical resource use whether or not health problems are present. When only borderline pathology was included in the model, it was predictive of greater medical resource utilization. However, once all PDs were entered in together, that relationship was no longer significant suggesting that there may be something more general across the

PD features that helps predict overutilization in our sample, rather than something unique to borderline features above and beyond what is shared among the PDs.

With depressed mood and emotional well-being, our hypotheses regarding borderline pathology were also not supported. Borderline pathology did not moderate the impact of health stressors on these outcomes. Instead, the negative impact of borderline pathology remained relatively stable over time; individuals with borderline features reported significantly higher depressed mood scores and lower emotional well-being scores, independent of the number of health problems experienced over the 2.5 years. Even though borderline pathology did not interact with health problems, we see the very serious effects of borderline features on mood and must keep that in mind because of how significantly depression can affect health and functioning as well.

Our results with depressed mood scores and other personality pathology still provide a very clear demonstration of how the combination of health stressors and personality pathology can interact to produce negative results. For individuals high on histrionic or antisocial pathology, a higher number of health problems was associated with significantly higher depressed mood scores over time, while depressed mood scores were either similar or even lower when health problems were not present. These interaction effects suggest that these individuals may have a much more difficult time coping with the stress of their health problems and are more likely to endorse depressive symptoms as a result. Interestingly, individuals with schizoid pathology reported more depressive symptoms than those without schizoid pathology; however, when individuals had a higher number of health problems, those differences in mood scores decreased over

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time and by 2.5 years, depressed mood was similar among those with or without schizoid pathology.

These varied findings support our need for continued research on the role of personality pathology in physical health and functioning. Clearly it is valuable to evaluate the whole spectrum of PD features. However, our measurement of health problems in the present study focused on a wide range of health problems and it is possible that by narrowing the scope to a single physical condition or more restricted group of conditions, more cohesive patterns would emerge. It makes sense that some health problems, such as chronic pain or diabetes, may be more likely to be influenced by PD features than other health problems, such as stroke. In the future, we hope to tease apart such relationships with the goal of finding specific risk factors that can then be targeted in medical settings.

We also found a number of important main effects with our demographic covariates across the three functional domains. As might be expected, older age was predictive of worse reported physical functioning, greater medication use, and greater medical resource utilization. Interestingly, older age was also predictive of higher reported emotional well-being, lower depressed mood scores, and greater reported social functioning, suggesting that although health and physical functioning may continue to decline as individuals' age, mood and well-being actually improves. Recent research has begun to focus on this emotional side of aging and provides one possible answer for why we find this result. Carstensen and colleagues (2005) have shown that a *positivity effect* occurs as individuals age; while younger adults tend to process negative material more readily, a shift occurs as individuals age and positive material is increasingly favored. *Socioemotional selectivity theory* posits that this shift in focus to positive emotional

stimuli is a result of the growing awareness by older adults that time is limited, and attention becomes directed to more emotionally meaningful aspects of life and thus promotes emotional well-being.

Our findings regarding education and race fit in the broader context of research on health disparities and socioecomonic status (Cutler & Lleres-Muney, 2010; Kendzor et al., 2009; Lodi-Smith et al., 2010; Mezuk et al., 2010). Higher education level was predictive of better reported physical functioning, lower medication use, lower depressed mood, and higher social functioning. African American or minority race was predictive of worse reported physical functioning, greater medical resource utilization, lower perceived health, higher depressed mood, and lower social functioning. There is extensive evidence to show that African Americans and other minorities experience profound health disparities (e.g., Mensah et al., 2005; Miller et al., 2004), so it is not surprising to see worse functioning in the physical health domain within our sample. However, the relations with higher depressed mood and lower social functioning is in contrast to previous findings showing that African American individuals tend to be more resilient to depression than Caucasians and also have greater community connections and social support (Keyes, 2009; Mezuk et al., 2010). BDI score certainly does not reflect a diagnosis of major depression, and that may be one reason for the disparity. More research is needed before a clear determination of these associations can be made.

This unique sample allows us to show that the detrimental impact of personality pathology continues across the lifespan. Although some PD features may decrease as individuals enter later adulthood, the negative effects of pathology even at low levels can still be seen from our results. The presence of borderline PD features was predictive of

worse functioning across all three outcome domains, regardless of health status. For other PD features, like antisocial or avoidant PD, negative effects on outcomes such as mood or medical resource utilization did not appear unless there were also significant health problems present. This suggests that as individuals enter a time of life when health problems are increasingly common, new difficulties with functioning may appear when individuals with personality pathology are faced with health-related stressors. Our research group is looking forward to continuing to research this and use additional follow-up data to determine how significant these effects really are on functioning and how long they persist (or possibly strengthen) over time.

Limitations

A number of limitations should be kept in mind when interpreting the results of these analyses. The first is the use of self-report to measure chronic physical health conditions across all 5 time points. The scope of the present study did not allow for thorough medical testing (e.g., the use of multidetector scanners to measure coronary artery calcification) or the cooperation of participants' medical doctors to provide corroboration. Although it would have been ideal to have had access to medical records to check participants' reports of physical illnesses, researchers have found little discrepancy between self-reports of physical illnesses and documented medical histories (Goodwin & Engstrom, 2002). Within the present study, we used the phrase "Have you ever been diagnosed by a doctor as having…" when asking about physical health problems in an effort to reduce participants' self-reported ailments and get them to think about whether they actually went to a doctor to receive treatment for a given condition. In addition, we created inclusion criteria for health problems reported at follow-ups to help

ensure the significance of the problems reported. These were not perfect measures of chronic physical health problems by any means, but the use of self-report allowed us to ask important questions about health within the larger SPAN project.

We also used self-report of medical resource utilization and medication use. While this is the standard method for measuring these variables, issues of reliability must be kept in mind (see Bhandari & Wagner, 2006 for more details regarding this issue). One of the factors that can greatly affect accuracy in reporting is the length of time individuals are asked to recall. We used a 6-month time frame for the present study and this shorter time frame likely helped with general accuracy, although that cannot be determined based on measurement methods. Additionally, for medication use, we asked participants to list out the names of medications they were taking and the reasons for use in an effort to reduce the likelihood that participants would simply estimate the number of drugs they were taking during the follow-ups.

Because we studied adults living in the community rather than focusing exclusively on clinical patients, our sample does not include a large number of individuals with extreme levels of personality pathology. However, roughly 10% of our sample met DSM-IV-TR criteria for at least one PD (using the SIDP), as expected based on previous epidemiological studies (9.1%) (Lenzenweger et al., 2007). Almost half of the people in our sample (>40%) have received some kind of mental health treatment, demonstrating that individuals with varying levels of psychopathology were represented in this data set (Lawton & Oltmanns, unpublished manuscript). Furthermore, we measured PDs on a continuous scale rather following the categorical approach to diagnosis included in DSM-IV-TR. Measuring PDs according to the presence of

symptoms allowed us to capture the full range of variability in personality pathology evident in this sample.

Finally, this research was conducted on a very specific group of individuals (adults aged 55-64), and the generalizability of these findings to other age groups should be considered carefully. The focus of this study, however, was on how PD symptoms relate to general functioning in the face of health-related stressors. The range of health status in our sample actually allowed for greater variability than would be found in younger participants. Older adults may represent a population in which the impact of personality pathology on physical health is stronger than might be found with younger participants, and therefore this may be an even more important population in which to study such associations.

Conclusions and Future Directions

The results of the present study further support the growing evidence that borderline pathology leads to worse physical, psychological, and social functioning, showing that even at subthreshold levels of pathology, individuals with borderline features show significantly worse outcomes into later adulthood. Other PD features should not be ignored, however. There is still a great deal to learn about how the risk associated with personality pathology may shift as individuals age. PD features do change as individuals age, and so we should expect the consequences of those features to change as well. Emerging evidence of the importance of social support and functioning in later adulthood (and in the face of health problems) means that the social and interpersonal dysfunction found in all the PDs may come to affect individuals in new ways. Furthermore, certain PD features may become more problematic in later adulthood

and so research should be done to identify what particular features drive these negative effects.

Since research on PDs in later adulthood is only in the beginning stages, there is so much more to understand. In addition to studying pathology across the lifespan, researchers should also commit to studying pathology in different kinds of settings. Much of the longitudinal research on PDs until now has been done on small clinical samples. While understanding the detrimental effects of severe psychopathology is important, it may be particularly beneficial to explore these effects in community samples when dealing with an older age range. This type of sample would allow for the variability in health problems and personality pathology that a medical doctor may see in a medical clinic, and thus allows us to see what kinds of negative outcomes to expect.

There is mounting evidence of the health burden and healthcare costs associated with personality pathology. Therefore, efforts to identify and treat PDs should be at the forefront of mental health research and treatment. As the healthcare field shifts to a focus on preventative medicine, early intervention and the treatment of psychopathology should be included in that plan. Personality pathology interferes with many aspects of health, from medical adherence to health-related behaviors to general functioning; but, evidence shows that when PDs are treated, there are significant reductions in healthcare utilization for up to three years following completion of treatment (Davies & Campling, 2003). It is impossible to consider mental and physical health separately, and as this study has shown, the presence of health problems can make functioning particularly difficult for individuals with personality pathology. Therefore, we must begin to think about ways to treat both together in an effort to promote better health and functioning for any age group.

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APPENDIX A

Conditions Included in Each Illness Category:
- Heart disease
    - Heart failure
    - Cardiac arrest
    - Artery blockage
    - Diastolic dysfunction
    - Bypass surgery
    - Aortic aneurism
    - Myocardial infarction
    - Mitral valve prolapse
    - Cardiac catherization
    - Re-entry tachycardia
    - Arterial fibrillation
    - Blood clots
- Cancer
    - Melanoma
    - Breast
    - Prostate
    - Colon
    - Cervical
    - Thyroid
    - Chronic myeloid leukemia
    - Endometrial adenocarcinoma
- Stroke
    - Transient Ischemic Attack
- Rheumatic Diseases
    - Rheumatoid mass
    - Arthritis Psoriatica
    - Lupus
    - Sjongren's syndrome
    - Scleroderma arthritis
- Diabetes
- Hypertension
- High Cholesterol
- Chronic lung problems
    - Chronic obstructive pulmonary disease
    - Asthma
    - Bronchitis
    - Emphysema
    - Pulmonary edema
- Gastrointestinal disorders (Digestive diseases)
    - Colitis
    - Small intestinal bacterial overgrowth
    - Post-cholecystectomy syndrome

- Gastro-esophigal reflex disease
- Diverticulitis
- Rectal malformation
- High liver enzymes
- Inflamed small intestine
- Barrett's esophagus
- Blocked colon
- Esophageal ulceration
- Rectal hernia
- Pharyngeal diverticulum
- Gastroparesis
- Liver disease
- Genitourinary problems
  - Kidney failure
  - Bladder stress
  - Kidney stones
  - Overactive bladder
  - Sacrospinous colopexy
  - Enterocele repair
  - Rectocele repair
  - Kidney disease
  - Incontinence
  - Anal fissure
  - Prolapsed uterus
  - Enlarged prostate
  - Prostate surgery
  - Hemmroids
  - Fibroids
- Osteoporosis
  - Bone deficiency
  - Osteopenia
  - Bone loss
- Chronic Pain
  - Knee pain
  - Foot pain
  - Ankle pain
  - Hip pain
  - Back pain
  - Carpal tunnel syndrome
  - Shoulder impingement syndrome
  - Degenerative lumbar disc disease
  - Foot neuroma
  - Injured fibular nerve
  - Frozen shoulder
  - Sacroiliac
  - Cervical myelopathy

- Trigeminal neuralgia
- Cervicalgia
- Spinal stenosis
- Lumbar spinal deterioration
- Scoliosis
- Degenerative joint disease
- Spurs on pelvis
- Cervical dystonia
- Brain tumor/aneurism
- Hernia
  - Spondylothesis
  - Non-union of cervical fusion
- Torn muscle/broken bone
  - Knee injury
  - Foot injury
  - ACL injury
  - Torn medial meniscus
  - Collapsed bone in foot
  - Broken back
  - Costochondritis
  - Broken rib
  - Torn cartilage
  - Broken sternum
- Thyroid
  - Hypothyroidism
  - Hyperthyroidism
- Eye problems
  - Glaucoma
  - Retinal vein occlusion
  - Bilateral iridectomy
  - Iritis
  - Detached retina
  - Anterior basement membrane corneal dystrophy
  - blepharoplasty
  - Botched eye surgery
- Dental problems
  - Root canal
- Ear problems
  - Hearing loss
  - Meniere's
- Gastroesophageal reflux disease
- Joint replacement
  - Knee replacement
  - Shoulder replacement
  - Toe replacement
- Other

- Sleep apnea
- Bed sore
- Parkinson's disease
- Tendonitis
- Hypercapnia
- Vocal cord polyps
- Traumatic brain injury
- Auto-immune condition
- Essential tremors in voice
- Loss of smell
- Hypokalemia
- Amputation
- Leg stents
- Chronic autoimmune urticaria
- Epilepsy

Conditions or symptoms not included:
- Infections
    - Appendicitis / Appendectomy
    - Cellulitis
    - Infection in left breast
    - Whooping cough
    - Pneumonia
    - Urinary tract infection
    - Influenza
    - Colon infection
    - Shingles (Herpes Zoster)
    - E.Coli
    - Bladder infection
    - Human Papiloma Virus (HPV)
    - Sinus infection
    - Ear infection
    - Salivary gland stone (sialolithiasis)
- Symptoms or surgeries not included
    - Cyst removed
    - Non-cancerous mole removed
    - Mass on hand
    - Swelling of left foot
    - Left shoulder sore
    - Ringing in ears
    - Atypical cells
    - Weakness in leg
    - Low vitamin D
    - Low testosterone
    - Swelling in ankles
    - Colonoscopy

- Biopsy
- Eyebrow lift

Descriptive details of reported health conditions not included in analyses:

	FU1	**FU2**	**FU3**	**FU4**
	N (%)	N (%)	N (%)	N (%)
Health Conditions Not Included	54 (3.7)	71 (5.4)	40 (4.0)	37 (4.4)
Reason:				
Did not meet inclusion criteria	20 (1.4)	22 (1.7)	10 (1.0)	5 (0.6)
Missing a description	14 (1.0)	17 (1.3)	11 (1.1)	15 (1.8)
Only described a symptom	2 (0.1)	10 (0.8)	3 (0.3)	5 (0.6)
Infection	11 (0.8)	12 (0.9)	6 (0.6)	8 (0.9)
Psychopathology	2 (0.1)	3 (0.2)	2 (0.2)	1 (0.1)
Cosmetic Surgery	1 (0.1)	1 (0.1)	3 (0.3)	1 (0.1)
Routine Testing/Surgery	4 (0.3)	6 (0.5)	5 (0.5)	2 (0.1)