Regular Article

Psychotherapy and Psychosomatics

Psychother Psychosom 2003;72:10–15
DOI: 10.1159/000067184

Peptic Ulcer Disease and Neuroticism in the United States Adult Population

Renee D. Goodwin[a] Murray B. Stein[b]

[a]Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, N.Y., and
[b]Department of Psychiatry, University of California – San Diego, San Diego, Calif., USA

Key Words
Peptic ulcer disease · Ulcer · Neuroticism · Epidemiology · Personality

Abstract
Background: The goal of the current study was to determine the association between personality factors and peptic ulcer disease (PUD) among adults in the general population. ***Method:*** Data were drawn from the Midlife Development in the United States Survey (MIDUS), a representative household survey of the adult population (ages 25–74; n = 3,032) of the United States. Multiple logistic regression analyses were used to determine the association between the big five personality factors and PUD, adjusting for differences in sociodemographic characteristics, psychiatric and physical comorbidity. ***Results:*** Neuroticism was associated with significantly increased odds of PUD [OR = 1.5 (95% CI: 1.03, 2.4)], which persisted after controlling for differences in sociodemographic characteristics, cigarette smoking, perception of poor health, comorbid mental disorders and physical illnesses. This relationship was specific to neuroticism. ***Conclusions:*** These findings are consistent with and extend previous clinical and epidemiologic data by providing evidence of an independent association between neuroticism and PUD among adults in the general population. Future work investigating the relationship between neuroticism and the development of PUD in prospective data, including objective measures of physical and mental health status, may contribute to our understanding of this association.

Peptic ulcer disease (PUD) is a common, persistent, and impairing medical condition among adults in the community [1–3]. PUD is associated with increased use of health care services, increased risk of physical comorbidity, mental disorders and work loss [4, 5]. Despite increased availability of effective treatments for PUD and increased knowledge about its risk factors, the burden of disease associated with PUD continues to be high [6].

Over the past several years, research on the risk factors and the development of treatments for PUD has focused on immunologic/inflammatory pathways and genetic approaches [7]. Specifically, the identification of *Helicobacter pylori* as an infectious cause of PUD may have lessened interest in possible psychiatric factors [8]. There is strong clinical evidence of an association between *H. pylori* and PUD: *H. pylori* is present in a majority of patients with PUD, eradication of *H. pylori* results in resolution of the gastritis, and injection of *H. pylori* into animals causes gastric ruptures. Although a substantial percentage of

KARGER
Fax + 41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

0033–3190/03/0721–0010$19.50/0

Accessible online at:
www.karger.com/pps

Dr. Renee Goodwin
Department of Epidemiology, Columbia University
1051 Riverside Dr, Unit 43
New York, NY 10032 (USA)
Tel. +1 212 543 5688, Fax +1 212 305 9413, E-Mail rdg66@columbia.edu

PUD patients have *H. pylori,* only a small percentage of individuals with *H. pylori* develop ulceration [9]. Therefore unidentified host characteristics, including genetic influences [10], strain variability and other factors, must play a role in the pathogenesis of PUD [7].

Previous clinical research has suggested that personality dimensions may be strongly associated with PUD [11–13]. The nature of the relationship between personality factors and PUD, as well as possible interactions between personality and biological mechanism in PUD, have been under investigation for years. Specifically, previous data have shown that personality characteristics, including problems with dependence/independence and high levels of anxiety, are more common among patients with PUD compared with healthy controls [14]. Other clinical studies have compared personality traits among patients with various forms of ulcer and consistently found higher than expected levels of somatization and hysterical personality traits. In addition, gender differences have been documented among ulcer patients, including higher levels of emotional instability, tension and anxiety among females, and low enthusiasm and low self-control among male patients [15, 16].

Two main methodological constraints of previous studies, however, have limited our understanding of this relationship. First, previous studies have not investigated the specificity of the relationship between personality dimensions and PUD, controlling for mental and physical comorbidity. Therefore it is impossible to determine whether personality in general is associated with PUD, whether PUD is predicted by a specific personality characteristic, or whether the association is due to a comorbid mental disorder (e.g., major depression). Second, previous studies have not examined the nature of the relationship between PUD and personality dimensions in a representative community-based sample of individuals with and without PUD. In the absence of epidemiologic data, clinical findings cannot be generalized to the community, making it unclear whether they result from an exposure-disease relationship or from selection into treatment bias.

The objective of the current study is to determine the association between personality dimensions and PUD in the general adult population. First, this study will examine the relationships between the big five personality factors [17] and self-reported PUD among adults in the general population. Second, the study will determine the relationship between specific personality characteristics and odds of PUD. Third, the study will determine the population-based correlates of PUD, examining the relative importance of personality factors and psychopathology. Based on previous clinical and epidemiologic data, we hypothesized that neuroticism would be associated with increased likelihood of PUD.

Method

Sample

The Midlife Development in the United States Survey (MIDUS) is a nationally representative survey of 3,032 persons aged 25–74 years in the noninstitutionalized civilian population of the 48 coterminous United States of America [18]. The MIDUS was carried out by the John D. and Catherine T. MacArthur Foundation Network on Successful Midlife Development between January 1995 and January 1996. All respondents completed a 30-min telephone interview (70.0% response rate) and filled out two mailed questionnaires estimated to take a total of 90 min to complete (86.8% conditional response rate in the subsample of telephone respondents). The overall response rate was 60.8%. The data reported here were weighted to adjust for differential probabilities of selection and nonresponse. More details on the MIDUS design, field procedures, and sampling weights are available elsewhere [18, 19]. The subjects were grouped by marital status (married, never married, divorced, widowed) and educational attainment was dichotomized into those who had and had not completed high school.

Diagnostic Assessment

The MIDUS psychiatric diagnoses were based on the Composite International Diagnostic Interview Short Form scales, a series of diagnostic-specific scales that were developed from item level analyses of the Composite International Diagnostic Interview questions in the National Comorbidity Survey [20]. The Composite International Diagnostic Interview Short Form scales were designed to reproduce the full Composite International Diagnoses as exactly as possible, with only a small subset of the original questions. Composite International Diagnostic Interview Short Form diagnoses at 12 months included in the MIDUS were major depression, panic attacks, generalized anxiety disorder, and alcohol and drug abuse and dependence. Information on physical illness was obtained through self-report with the question, 'Have you experienced any of these health problems in the past 12 months?', with 'ulcer' included as one of the possible responses. Written informed consent was obtained from each participant after the survey had been fully explained.

Personality Factors

Assessment of personality traits in the Midlife Development Inventory Personality Scales (MIDI), based on the 'big five' factor model [17], was developed based on the results of a pilot study conducted in 1994 with a probability sample of 1,000 men and women, aged 30–70 (574 valid cases were usable for item analysis). Items with the highest item to total correlations and factor loadings were selected for MIDI [20–24]. Forward regressions were also run to determine the smallest number of items needed to account for over 90% of the total scale variance. Many of the negatively worded items (unemotional, unreliable, unsophisticated, unsympathetic, shy, unsociable) were dropped due to low variance. New items were added to increase reliabilities on some scales. Scales included agreeableness (helpful, warm, caring, softhearted, sympathetic) ($\alpha = 0.80$), 5-item

Table 1. Sociodemographic characteristics of adults with self-reported PUD (12-month) in the community

Characteristics	No ulcer n = 2,501	Ulcer n = 114	F value	d.f.	p value
Age, years	46.8 (13.1)	49.4 (13.0)	4.2	(1, 2613)	0.042
Gender, %					n.s.
Male	48.6	46.5			
Female	51.4	53.5			
Race, %					n.s.
Caucasian	86.2	85.0			
Minority racial status	13.8	15.0			
Marital status, %					n.s.
Married	64.4	60.2			
Separated/divorced/never married	35.6	39.8			
Education, %			8.0	(1, 2633)	0.005
Up to 11th grade	37.9	50.4			
HS Diploma+	62.1	49.6			

Figures in parentheses are standard deviations.

Table 2. Association between personality factors and self-reported PUD (12-month) using ANOVA

Personality factor	No ulcer n = 2,501	Ulcer n = 114	F value	d.f.	p value
Agreeableness	3.48 (0.48)	3.52 (0.6)			n.s.
Neuroticism	2.2 (0.66)	2.6 (0.7)	28.5	(1, 2605)	<0.0001
Openness to experience	3.0 (0.5)	2.96 (0.6)	2.8	(1, 2605)	0.095
Extraversion	3.2 (0.6)	3.2 (0.6)			n.s.
Conscientiousness	3.4 (0.5)	3.3 (0.6)	3.6	(1, 2605)	0.057

Figures in parentheses are standard deviations.

scale; openness to experience (creative, imaginative, intelligent, curious, sophisticated, adventurous) ($\alpha = 0.77$), 7-item scale; conscientiousness (organized, responsible, hardworking, (not) careless) ($\alpha = 0.57$), 4-item scale; extraversion (outgoing, friendly, lively, active, talkative) ($\alpha = 0.78$), 5-item scale; neuroticism (moody, worrying, nervous, (not) calm) ($\alpha = 0.74$) 4-item scale. Responses were on a likert-scale from 1–4, asking respondents to describe how much of the time the particular word described them. The scale ranged from 'all the time', 'most of the time' and 'sometimes' to 'a little'. For each trait, the score for each case was computed by finding the mean of the relevant personality items for cases that had valid values for at least half of the items for that trait. The alphas are based on the MIDUS national sample.

Analytic Strategy

First, differences in sociodemographic characteristics were compared between individuals with and without self-reported PUD using F-based tests for independence. Second, separate analyses of variance were used to determine the relationship between PUD and each of the big five personality factors. Adjusted odds ratios (ORs; with 95% CI) were then computed to describe the association between each personality factor and the risk of PUD, adjusting for differences in sociodemographic characteristics, daily cigarette smoking (lifetime), self-perception of poor health, and mental disorders. As personality factors were measured on a continuous 4-point scale, these associations reflect the degree of increased risk associated with every 1-point increase in score on each personality factor. Multiple logistic regression analyses were then used to calculate the ORs (with 95% CI) describing the correlates of PUD.

Results

Sociodemographic Characteristics Associated with PUD Among Adults in the Community

Self-reported PUD was prevalent in 3.8% of the population. Individuals with PUD were older and had less education compared with those without PUD (table 1). There were no significant differences in gender or race between individuals with and without PUD.

Table 3. Adjusted OR[1] between personality factors and risk of PUD: results of multivariate logistic regression analyses

Personality factor	No ulcer n = 2,501 OR	Ulcer n = 114 OR
Agreeableness	1.0	1.1 (0.7, 1.7)
Neuroticism	1.0	2.3 (1.7, 3.1)*
Openness to experience	1.0	0.8 (0.6, 1.2)
Extraversion	1.0	0.9 (0.6, 1.3)
Conscientiousness	1.0	0.7 (0.5, 1.02)

Figures in parentheses are 95% CI.
[1] Adjusted for age, gender, race, marital status, and education.
* $p < 0.05$.

Association between Personality Factors and PUD Among Adults in the Community

Individuals with PUD had significantly higher levels of neuroticism compared with those without PUD (table 2). Those without PUD had higher levels of openness to experience and conscientiousness, though these differences did not reach statistical significance. After adjusting for sociodemographic differences, neuroticism remained significantly associated with significantly increased odds of PUD (table 3).

Correlates of PUD Among Adults in the Community

Results of multivariate logistic regression analyses that included demographic characteristics, mental disorders and 15 common physical illnesses as potential indicators showed that neuroticism [OR = 1.5 (95% CI: 1.03, 2.4)] emerged as the only personality trait or mental disorder associated with significantly increased odds of PUD (table 4). As would be expected, recurring stomach problems [OR = 13.4 (95% CI: 7.8, 22.9)] were also associated with increased odds of PUD, as were migraine headaches [OR = 2.5 (95% CI: 1.4, 4.6)], which is consistent with previous findings [20] and which may point to nonsteroidal anti-inflammatory drug use as a possible pathway.

Table 4. Correlates of self-reported PUD (12-month) among adults in the community: results of multivariate logistic regression analysis simultaneously adjusting for all potential correlates

Correlates	OR
Gender	1.7 (0.4, 1.1)
Age	1.0 (0.98, 1.03)
Race	0.8 (0.4, 1.8)
Marital status	0.9 (0.5, 1.5)
Education	1.0 (0.5, 2.2)
Asthma/bronchitis	1.6 (0.9, 3.0)
Tuberculosis	22.4 (0.3, 179.6)
Other lung problems	1.3 (0.5, 3.6)
Bone or joint problems	1.5 (0.8, 2.7)
Sciatica	1.6 (0.9, 2.9)
Persistent skin problems	1.1 (0.6, 2.2)
Thyroid disease	1.9 (0.7, 5.4)
Hay fever	0.8 (0.4, 1.4)
Recurring stomach problems	12.9 (7.0, 23.6)*
Gall bladder disease	1.2 (0.4, 3.8)
AIDS	0.04 (0.002, 6.9)
Autoimmune disorder	0.7 (0.1, 6.0)
High blood pressure	1.3 (0.7, 2.4)
Migraine	2.0 (1.01, 4.1)*
Diabetes	1.2 (0.5, 2.9)
Neurological disorder	0.9 (0.2, 5.3)
Stroke	3.5 (0.7, 18.4)
Hernia	5.0 (2.1, 11.9)*
Major depression	0.9 (0.4, 1.9)
Panic attacks	0.3 (0.1, 1.9)
Generalized anxiety disorder	0.8 (0.2, 2.8)
Alcohol/substance use disorder	1.3 (0.4, 4.2)
Cigarette smoking (lifetime)	1.1 (0.6, 2.1)
Perception of poor health	1.2 (1.03, 1.4)*
Agreeableness	1.1 (0.5, 2.4)
Neuroticism	1.5 (1.03, 2.4)*
Openness to experience	0.9 (0.5, 1.6)
Extraversion	1.3 (0.7, 2.4)
Conscientiousness	1.1 (0.6, 2.1)

Figures in parentheses are 95% CI.
* $p < 0.05$.

Discussion

Consistent with our hypothesis, these data suggest an association between neuroticism and PUD among adults in the community, independent of the effects of comorbid mental and physical illnesses. Specifically, neuroticism is associated with increased likelihood of self-reported PUD. This association persists even after adjusting for self-perception of poor health and other confounding factors.

The mechanism of association between neuroticism and PUD remains unknown. It may be that neuroticism leads to the development of PUD. This hypothesis is consistent with the animal 'stress' model of gastrointestinal ulceration, using neuroticism as a marker for chronic stress [26, 28], and with results of previous research in

clinical samples [14–16]. It is also conceivable that having PUD leads to changes in personality and to the development of neuroticism. Most personality research would not be congruous with this contention, though there are data supporting this interpretation in one cohort study of ulcer patients [29]. It should also be noted that personality factors and mental disorders or psychiatric symptoms per se might not be distinct in all cases. For instance, nervousness and worrying may be reflective of both generalized anxiety disorder (GAD) and neuroticism, hence the lines between these constructs and between mental disorder and personality may be blurred or overlapping. Alternatively, it is possible that a third factor (either environmental or genetic) is associated with the co-occurrence of neuroticism and ulcer. It could be, for instance, that neuroticism increases risk of PUD by increasing health-related risk behaviors (e.g., alcohol use and cigarette smoking) that have been linked with neuroticism and with PUD in previous community-based studies [31–33]. The persistence of this association, even after adjusting for cigarette smoking, provides additional support that this association is genuine. Finally, it is conceivable that neuroticism is associated with an increased risk of *H. pylori* infection, though it is not clear what the mechanism for this association would be.

Limitations of this study should be considered when interpreting these results. First, data on ulcer and other medical conditions are based on self-report. These reports are retrospective and subject to recall bias. Second, mental disorder diagnoses were obtained with a structured lay-administered interview rather than through a clinician assessment. There is considerable evidence, however, of the validity and reliability of this instrument in the community [16]. Third, we have no data on nonpsychosocial risk factors for ulcer such as *H. pylori* or nonsteroidal anti-inflammatory drug use [34], which makes it impossible to assess confounding or to test mediation. Finally, it should also be noted that the ORs are modest in magnitude. Further replication of the findings is therefore indicated in order to verify this association.

The association between neuroticism and self-reported PUD, significant even in the absence of the Axis I mental disorders assessed in this study, may reflect its status as an indicator of long-term, stable-core psychopathology [32]. This interpretation is consistent with previous data suggesting that core psychopathological processes may be better reflected by specific patterns of comorbid Axis I disorders rather than specific DSM disorders [33]. It is also congruent with data from personality theorists who have documented complex associations between neuroticism and risk of physical illness, as well as disease-specific mortality among those with physical illness and high levels of neuroticism, which exist independently from Axis I disorders [15, 16]. Finally, these data complement our previous findings of a specific association between GAD and increased likelihood of PUD in another population-based sample [28]. Future studies that use prospective, longitudinal, epidemiologic data to determine the relationship between neuroticism and the likelihood of developing PUD, with data on objective measures of physical health, may improve our understanding of the complex relationship between personality factors and physical health.

Acknowledgment

The authors would like to thank Professor Robert Murison for helpful comments on a previous version of the manuscript.

References

1 Levenstein S: Peptic ulcer at the end of the 20th century: Biological and psychological risk factors. Can J Gastroenterol 1999;13:753–759.

2 Tennant C, Goulston K, Langeluddecke P: Psychological correlates of gastric and duodenal ulcer disease. Psychol Med 1986;16:365–371.

3 de Moraes JS: Peptic ulcer: Psychosomatic or infectious disease? Etiologic factors revisited ten years after the Campylobacter-helicobacter advent. Rev Soc Bras Med Trop 1995;28:1–5.

4 Lydiard RB, Greenwald S, Weissman MM, Johnson J, Drossman DA, Ballenger JC: Panic disorder and gastrointestinal symptoms: Findings from the ECA. Am J Psychiatry 1994;151:64–70.

5 Noyes R, Clancy J, Hoenk PR, Slymen DJ: Anxiety neurosis and physical illness. Compr Psychiatry 1978;19:407–413.

6 Sugiyama T, Nishikawa K, Komatsu Y, Ishizuka J, Mizushima T, Kumagai A, Kato M, Saito N, Takeda H, Asaka M, Freston JW: Attributable risk of *H. pylori* in peptic ulcer disease: Does declining prevalence of infection in general population explain increasing frequency of non-*H. pylori* ulcers? Dig Dis Sci 2001;46:307–310.

7 Goodman KJ, Cockburn M: The role of epidemiology in understanding the health effects of Helicobacter pylori. Epidemiology 2001;12:266–271.

8 Murison R, Overmier BJ: Comparison of different animal models of stress reveals a non-monotonic effect. Stress 1998;2:227–230.

9 Marshall BJ: *Helicobacter pylori* in peptic ulcer: Have Koch's postulates been fulfilled? Ann Med 1995:27:565.

10 Raiha I, Kemppainen H, Koskenvuo M, Sirander L: Lifestyle, stress, and genes in peptic ulcer disease: A nationwide twin cohort study. Arch Intern Med 1998;158:698–704.

11 Rotter JI: The genetics of gastritis and peptic ulcer. J Clin Gastroenterol 1981;3(suppl):35–43.

12 Levenstein S, Kaplan GA, Smith MW: Psychological predictors of peptic ulcer incidence in the Alameda County Study. J Clin Gastroenterol 1997;24:140–146.
13 Piper DW, Tennant C: Stress and personality in patients with chronic peptic ulcer. J Clin Gastroenterol 1993;16:211–214.
14 Magui G, DiMarco F, Aggio L, Borgherini G: Psychosomatic factors and peptic ulcer disease. Hepatogastroenterology 1986;33:131–137.
15 Jain AK, Gupta JP, Gupta S, Rao KP, Bahre PB: Neuroticism and stressful life events in patients with non-ulcer dyspepsia. J Assoc Physicians India 1995;43:90–91.
16 McIntosh JH, Nasiry RW, Frydman M, Waller SL, Piper DW: The personality pattern of patients with chronic peptic ulcer: A case control study. Scand J Gastroenterol 1983;18:945–950.
17 Costa PT Jr, McCrae RR: Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory. J Pers Soc Psychol 1988;54:853–863.
18 Kessler RC, DuPont RL, Berglund P, Wittchen HU: Impairment in pure and comorbid generalized anxiety disorder and major depression at 12 months in 2 national surveys. Am J Psychiatry 1999;156:1915–1923.
19 Wang PS, Berglund P, Kessler RC: Recent care of common mental disorders in the United States: Prevalence and conformance with evidence-based recommendations. J Gen Intern Med 2000;15:284–292.
20 Markush RE, Karp HR, Heyman A, O'Fallon WM: Epidemiologic study of migraine symptoms in young women. Neurology 1975;25:430–435.
21 Wittchen HU: Reliability and validity studies of the WHO Composite International Diagnostic Interview (CIDI): A critical review. J Psychiatr Res 1994;28:57–84.
22 Lachman ME, Weaver SL: The Midlife Development Inventory (MIDI) Personality Scales: Scale construction and scoring. Technical Report No. 1. Waltham, Brandeis University, 1997.
23 Bem SL: Bem Sex-Role Professional Inventory Manual. Palo Alto, Consulting Psychologists Press, 1981.
24 Trapnell PD, Wiggins JS: Extension of the Interpersonal Adjective Scales to include the Big Five dimensions of personality. J Pers Soc Psych 1990;59:781–790.
25 John OP: The 'Big Five' factor taxonomy: Dimensions of personality in the natural language and in questionnaires; in Pervin LA (ed): Handbook of Personality Theory and Research. New York, Guilford, 1990, pp 66–100.
26 Goldberg LR: The development of markers for the Big-Five factor structure. Psychol Assess 1992;4:26–42.
27 Weiner H: From simplicity to complexity (1950–1990). The case of peptic ulceration. 2. Animal studies. Psychosomatic Med 1991;53:491–516.
28 Jess P: Personality pattern in peptic ulcer disease: A cohort study. J Intern Med 1994;236:271–274.
29 Goodwin RD, Stein MB: Generalized anxiety disorder and peptic ulcer disease among adults in the United States. Psychosom Med, in press.
30 Yoshimura K: The psychological characteristics of tobacco dependence in a rural area of Japan. J Epidemiol 2000;10:271–279.
31 Loukas A, Krull JL, Chassin L, Carle AC: The relation of personality to alcohol abuse/dependence in a high-risk sample. J Pers 2000;68:1153–1175.
32 Levenstein S, Varvo V, Spinella S, Arca M: Life events, personality, and physical risk factors in recent-onset duodenal ulcer. J Clin Gastroenterol 1992;14:203–210.
33 Krueger RF: The structure of common mental disorders. Arch Gen Psychiatry 1999;56:921–929.
34 Lanas A: NSAID use and abuse in gastroenterology: Refractory peptic ulcers. Acta Gastroenterol Belg 1999;62:418–420.