

The Role of Personality in Predicting Repeat Participation in Periodic Health Screening

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Abstract

Objective: Drawing on the Five-Factor Model of personality, the aim of the present study was to find out which personality traits predict health maintenance behaviors, reflected in routine participation in health screenings, over and above objective and subjective health status.

Method: Participants were 2,803 employed individuals (61% men), free of background diseases, who underwent a routine health examination and were subsequently notified whether they were healthy or at risk. These participants were invited to repeat the examination within the next few years, as is medically recommended.

Results: Logistic and negative binomial regressions were used to predict participants' odds of returning for a second examination, within the next 7 years, as well as the number of consecutive visits, while controlling for sociodemographic factors, objective and subjective health, and length of follow-up. We found that both endpoints were positively predicted by Conscientiousness and negatively predicted by Extraversion and Openness. The association between Neuroticism and these endpoints followed a bell-shaped curve (i.e., individuals high or low in Neuroticism were less likely to return).

Conclusions: The present findings suggest that personality traits should be taken into consideration in the planning and implementation of health-promoting interventions.

Keywords: Health screening, health behaviors, personality, five factor model, big five

Increasing evidence shows that personality differences are related to various health outcomes such as cardiovascular diseases, diabetes, and gastroenterological complaints (for reviews, see Chapman, Roberts, & Duberstein, 2011; Hampson & Friedman, 2008). Personality traits have also been associated with the likelihood of adopting behaviors aimed at reducing the risk of developing disease in the future (for reviews, see Bogg & Roberts, 2004; Hampson, Goldberg, Vogt, & Dubanoski, 2007). Such health-promoting behaviors include physical exercise, smoking cessation, sunscreen use, moderate alcohol consumption, and dietary improvements (Chapman et al., 2011).

Nevertheless, personality traits are not yet incorporated as a vital component of health promotion interventions. To date, studies have explored the incorporation of biomedical and demographic characteristics such as age, inflammation biomarkers, disease manifestations and genes into disease prevention and treatment guidelines (Hamburg & Collins, 2010). We suggest that referring to individual personality traits when planning, implementing and assessing health promotion interventions, or when offering health promotion services such as routine health screening, may improve the utilization and out-

comes of these efforts above and beyond the data contained in an individual's demographic or biomedical profile.

A few studies have assessed the role of personality in utilization of health services (e.g., Chapman, Fiscella, Kawachi, & Duberstein, 2009; Goodwin, Hoven, Lyons, & Stein, 2002; Iwasa et al., 2009) and in associated psychological processes that focus on health-related cognition and behavior, such as health decision making and health risk perception (e.g., Flynn & Smith, 2007). Notably, most of these studies were conducted among populations at risk (e.g., individuals with impaired mental or physical health, the elderly). In contrast, the role of

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personality in utilization of preventive health services, among healthy individuals, is yet to be revealed. Knowledge on whether and how personality traits influence healthy individuals to utilize health promotion services such as routine health screening may enable policy makers and health practitioners to alter their interventions or their methods of marketing and implementing these interventions (e.g., intense follow-up for individuals bearing specific traits). Therefore, the inclusion of both groups (i.e., healthy and at risk) may further our understanding of the role that personality plays in health related decision making.

In addition, most previous research on the linkage between personality and preventive health behaviors has measured these behaviors on the basis of observer reports or self-reports (e.g., Chapman et al., 2009; Goodwin et al., 2002), whereas studies using objective measures of health-related behaviors are rare. Literature on the accuracy of such self-reports suggests that preventive health behaviors may tend to be over-reported (Durnate & Ainsworth, 1996).

In an attempt to fill the gaps in the literature, the present study focuses on a sample of employed individuals, free of background medical illness who underwent a routine health examination and were subsequently reported that they were either currently healthy or at a pre-clinical stage (i.e., being at risk for the development of chronic diseases such as cardiovascular disease, diabetes). Among these two groups (i.e., healthy or at risk), we seek to reveal, for the first time, which personality traits better predict the ongoing maintenance of one's health, reflected in routine, medically recommended visits at a center for health screening (Harris et al., 2001). Specifically, we explored whether personality is associated with routine visits over and above the objective and subjective health status of the individual (i.e., is the person healthy or at risk for the development of diseases?). In what follows we first discuss the concept of health screening and then introduce the five dimensions of personality. Next, we develop hypotheses linking these personality dimensions to participation in health screening.

Health Screening: Definition and Study Findings

Health screening (also referred to as “risk assessment” or “risk factor testing”) refers to routine medical tests or examinations done in order to detect early signs of various diseases. Screening has been a significant part of health care—specifically, preventive medicine—for more than five decades (Holland & Stewart, 2005), serving as a means of both primary prevention (i.e., reassuring the person that he or she is free of disease) and secondary prevention (i.e., diagnosing and treating diseases in their early stages before they cause significant morbidity). Health screenings differ from traditional medicine in that their target population is apparently-healthy individuals. According to the American Heart Association guidelines, the recom-

mended frequency of health screenings for healthy, risk-free individuals is once every 5 years, and for individuals at risk for cardiovascular or metabolic diseases more frequent visits are recommended, ranging from 1 year to every 3 years (Harris et al., 2001).

Participation in health screenings can be seen, from a psychological perspective, as a tendency to maximize benefits and minimize losses (e.g., Ajzen, 1991), regardless of whether one's motivation is health promotion or disease prevention. Nevertheless, the utilization of medical checkups and tests by apparently-healthy individuals varies considerably (Marteau, 1993). According to a 1999 national survey, 24% of the workplaces in the United States offered health screenings as a subsidized fringe benefit (Linnan et al., 2007). Reviews report that among workplaces that offer health promotion programs, a substantial proportion of employees (50%–75%) choose not to participate (Linnan, Sorensen, Colditz, Klar, & Emmons, 2001; Robroek, van Lenthe, van Empelen, & Burdorf, 2009). As significant efforts are invested in planning, subsidizing, and marketing these health screenings, finding out what leads employees to engage in and maintain this health-promoting behavior may prove beneficial.

One approach to finding the barriers to participation in health screenings focuses on the possible consequences of participation. Individuals who are identified during such examinations as being at risk for the development of disease are labeled as “bearing risk” and as a result may experience social and psychological harm (Stewart-Brown & Farmer, 1997). In their review of 54 studies, Shaw, Abrams, and Marteau (1999) suggest that discovery of a risk factor to one's health (e.g., high cholesterol or blood glucose) may cause short-term distress (e.g., depression, anxiety, poorer perceptions of health, and psychological distress) and avoidance of future screening, thus suggesting that individuals at risk will refrain from future check-ups (Kash, Holland, Halper, & Miller, 1992). In the context of the present study, being at risk further limits the likelihood that participants will engage in routine health screenings; in Israel, the country where this study took place, routine extensive health screenings are conducted in private health screening facilities, whereas specific examinations and treatments (if a medical condition is discovered) are supplied by public health providers, under public medical insurance. Once a clinical condition is revealed, the patient's attention is likely to shift from general health screening to treatment and monitoring of the progression of the specific condition. As health screening facilities are intended for screening only, the patient is less likely to visit them once a targeted health intervention has begun. It is therefore reasonable to assume that among individuals at risk for morbidity, the results of these health screenings pose a potential barrier to additional routine screenings.

A question still remains as to what prevents individuals who are informed of “negative” screening results (i.e., the absence of risk factors) from routinely continuing to undergo these tests. According to Shaw and colleagues (1999), this popula-

tion has not gained much attention. The studies that do relate to these healthy individuals compare them to individuals diagnosed with risk factors, and report that those free of risk factors do not develop short-term or long-term affective distress following their health screening results.

Although it may be difficult to identify the specific reasons why individuals repeat or do not repeat health screening examinations, finding out which personality traits are associated with such avoidance behaviors over and above the medical results of their former visit may enhance our understanding of individual differences in health screening utilization. Personality traits represent tendencies to manifest particular patterns of cognitions, emotions, motivations and behaviors (John, Robins, & Pervin, 2008). The likelihood of routinely undergoing health screenings is, in part, a behavioral tendency, and hence a potential manifestation of personality traits. To the best of our knowledge, no study to date has examined the influence of personality traits on the frequency and tendency to return to health screenings. In the present study we examine a large sample of employees to identify which personality traits are associated with adherence to routine health screening sponsored by employers (measured according to their odds of return and the number of visits within a given time of follow up). This would enable practitioners to personalize the ways in which these health screenings are initiated, implemented and marketed.

The Five-Factor Model: Personality Traits and Their Effect on Individuals' Health

We conceptualize personality traits according to the Five-Factor Model (FFM), a widely used framework for studying the associations between personality and health (Chapman et al., 2011). The FFM subsumes most personality traits under five dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (Costa & McCrae, 1992). These factors have been linked in numerous studies with physical health, health behaviors, and longevity (for a review, see Chapman et al., 2011). We will now review each of the five factors and formulate specific hypotheses regarding their association with the likelihood of return to health screenings during the recommended time lag (Harris et al., 2001). Since the role of personality in the utilization of health services among population free of health risk has not been tested yet (Chapman et al., 2009; Goodwin et al., 2002), and the mechanisms underlying differences between population with and without risk in these relationships are not yet sufficiently understood, we formulated our hypotheses in a general manner, while conducting an exploratory test of the moderating effect of employees' objective risk status (i.e., healthy or at risk). For cross-validation, we use two different criteria to measure health screening utilization: (a) the odds of return (yes/no); and (b) the number of return visits within a given time period.

Neuroticism

Being neurotic predisposes individuals to experience negative emotions, to view the world pessimistically, and to interpret various stimuli as threatening (Costa & McCrae, 1992). With regard to health, studies have consistently shown that neuroticism leads to poor health habits and is associated with negative illness beliefs and prognoses (for a review, see Lahey, 2009). Research suggests that neuroticism can influence individuals' health-related behavior in two ways, both associated with attempts to minimize unpleasant emotions. On the one hand, highly neurotic individuals are more likely to use certain avoidance, withdrawal, and flight behaviors (Connor-Smith & Flachsbart, 2007). In the context of the present study, neurotic individuals who are informed of a desired health status (i.e., the absence of risk factors) may be motivated to preserve this status and therefore refrain from reassessing their health status. That is, by refraining from future examinations, neurotic individuals lower the chance that new risk factors will be diagnosed. On the other hand, there is a specific type of neurotic individual—the “health nut” or “worried well” individual—who is hypervigilant about germs and getting medical attention for symptoms (Friedman, 2000). These individuals may engage frequently in preventive health behavior to allay their concerns about acquiring chronic health problems and making sure that no medical impairments have been “missed.” In light of these opposite behaviors, we explore the association between neuroticism and the odds and the frequency of return to health screenings but offer no a priori hypotheses regarding our expected observations.

Extraversion

Extraversion is referred to as an appetitive positive affect system devoted to foraging and reward seeking (Carver & White, 1994) and therefore seek to implement health behaviors that are associated with positive rewards such as physical activity and increased fruit intake (e.g., De Bruijn, Kremers, Van Mechelen, & Brug, 2005). However, as periodic health screenings might be associated with negative rewards that trigger negative affect, we expect those scoring highly on extraversion to be less likely to return. Additionally, individuals with high positive mood states such as extraverts are more likely to be reckless, to perceive themselves as less vulnerable to undesirable health conditions, and to adopt maladaptive health behaviors such as avoidance of participation in health screening (for reviews, see Gruber, Mauss, & Tamir, 2011). Accordingly, we hypothesize the following:

***Hypothesis 1.** Extraversion will be a negative predictor of the odds of return to health screening and the frequency of visits.*

Conscientiousness

Individuals who are conscientious tend to be dutiful, plan-oriented, orderly, and goal-oriented in the implementation of

their plans (Costa & McCrae, 1992). These qualities could prevent stressful situations from escalating and could also enhance coping. Conscientiousness is positively associated with longevity, with more moderate deterioration of chronic illness (Chapman et al., 2011), with preventive health behaviors and fewer risky health behaviors (Bogg & Roberts, 2004), and with lower overall medical burden (Chapman, Lyness, & Duberstein, 2007). These findings suggest that conscientious individuals may reflect upon the future consequences of health choices and tend to take a more active role in trying to improve their health. We propose that conscientious individuals are aware that the likelihood of being diagnosed with new disease risk factors escalates as time passes, and therefore are more likely to routinely attend health screening examinations as recommended (Harris et al., 2001). Accordingly, we hypothesize the following:

Hypothesis 2. *Conscientiousness will be a positive predictor of the odds of return to health screening and the frequency of visits.*

Openness to Experience

Openness to Experience refers to the extent to which an individual is intelligent and curious and has a proclivity for various new experiences (Costa & McCrae, 1992). People high in Openness are interested in seeking new thoughts and new ideas and expanding their base of knowledge (Costa & McCrae, 1992). These “experience seekers” might be more proactive in seeking out information that might afford them some advantage in managing their health (e.g., Iwasa et al., 2009). In the context of the present study, people high in Openness may view participation in health screenings as a fruitful experience (e.g., because they gain exposure to new health-related scientific developments) and be motivated to repeat it. Accordingly, we hypothesize the following:

Hypothesis 3. *Openness will be a positive predictor of the odds of return to health screening and the frequency of visits.*

Agreeableness

Agreeableness is a composite of several lower-order traits related to maintaining interpersonal harmony: trust, honesty, compliance, interpersonal deference, and altruism, with a preference for cooperation (Costa & McCrae, 1992). People on the low end of this dimension may be egocentric, competitive, and skeptical about other people’s intentions (Costa & McCrae, 1992). Thus, those scoring high on agreeableness are likely to have a trusting and compliant nature, which may be associated with lower skepticism with regard to health screening, as well as with a predisposition to comply with recommendations to return for additional screening examinations. Indeed, there is evidence showing that trusting of others is an important factor in health care utilization (Ciechanowski, Walker, Katon, & Russo, 2002). Accordingly, we hypothesize the following:

Hypothesis 4. *Agreeableness will be a positive predictor of the odds of return to health screening and the frequency of visits.*

Method

Design

The design of the present study was prospective and included a baseline measurement and follow-up for 7 years (in case some participants decided to return after more than five years). Study participants ($N = 4,725$) were employees who came to the Center for Periodic Health Examinations at the Tel Aviv Souraski Medical Center, Israel, between 2003 and 2004 for a routine medical examination (referred to here as T1). The examination was sponsored or subsidized by participants’ employers as a fringe benefit, and each employee, independent of health status, was eligible to attend screenings every 12–36 months until retirement. The examination included blood sampling (after an overnight fast), anthropometric measurements, physical examination, urinalysis, and electrocardiogram. All participants were approached while awaiting their turn for the medical examination and were invited to participate in a study of risk factors for chronic diseases. In return, participants were eligible for an extended battery of blood tests that included two more inflammation biomarkers (C-reactive protein and fibrinogen) free of charge. In addition, participants were told that they would be able to complete the paper-and-pencil survey in about 20 minutes, while awaiting their turn for the medical examinations. Ninety-one percent agreed ($n = 4,302$) and completed a detailed paper-and-pencil survey that included psychosocial, occupational, and health-related measures as well as the personality inventory. The study protocol was approved by the ethics committees of the medical center, and all participants signed a written informed consent form. To reduce potential social desirability bias, confidentiality was assured, and neither the medical staff nor the employer saw the questionnaires at any time. Following the examination, each participant was mailed a personalized written feedback report. The feedback, written by a physician, included the detailed results of the medical examination, the level of risk for developing chronic diseases, specific recommendations for lifestyle behaviors such as smoking cessation, and referrals for further examinations (if needed). During the following 36 months, the medical center’s staff contacted all participants via postal mail or phone calls (two attempts were made)—regardless of medical examination results—and invited them to repeat the examination. Participants’ visits to the medical center were recorded until 2011, and were available to the research staff.

Sample

As discussed above, the present study focused on a sample of 4,302 employed individuals, who underwent a routine health examination and were subsequently notified of the results of

these health screenings. Each employee received a letter detailing the results of each test (e.g., blood tests results) and recommendation for treatment and healthy lifestyle behaviors. Since the purpose of routine health screenings is to diagnose or identify risk for current diseases, we excluded 1,148 participants who had background chronic diseases, including cardiovascular diseases, cancer, diabetes, and hypertension. We focused on cardiovascular preconditions as well as on cancer, as these are routinely screened in these health examinations, and practitioners place particular emphasis on early detection and treatment of these conditions. An additional 351 participants aged 59 or older were excluded, as these participants were close to retirement age and were therefore not eligible any more for this fringe benefit within the follow-up period. Thus the final sample included 2,803 apparently healthy employees. Among these, 1,093 (39%) were women, and the mean age of all participants was 43 ($SD = 9.62$); 2,242 (80%) were married or lived with a partner, and the mean number of children per participant was 2.23 ($SD = 1.34$). On average, each participant had completed 15.6 years of education ($SD = 2.89$). Participants were employed by more than 150 different employers from the public sector (60% of employers) and the private sector (40% of employers). Participants were employed in a variety of occupations (21% high and low technology, 26% teaching or academia, 11% administration, 8% sales and services, 3.5% blue collar, 4% health care, and 15% security). In terms of organizational level, an average of 33% of the respondents were rank-and-file employees, not in charge of other employees, 12% were first-level supervisors or foremen, 27.4% were middle managers, and 27% were managers in charge of other managers.

Measures

Health Behavior Criteria. Return for a second visit was coded as 1 (= return) and 0 (= non-return). Frequency of return to health screenings was measured according to the number of visits ranging from 0 (for those who did not return) to three follow-up visits (continuous measure).

The Five-Factor Model (FFM). We assessed personality dimensions using the Big Five Mini-Marker scale (Saucier, 1994), which consists of 40 adjectives measuring 5 personality factors (8 for each factor): Extraversion (e.g., talkative and extraverted), Agreeableness (e.g., cooperative and kind), Conscientiousness (e.g., organized and practical), Neuroticism (e.g., moody and touchy), and Openness to Experience (e.g., creative and intellectual). Respondents indicated how accurately or inaccurately each adjective described them on a 9-point Likert scale ranging from 1 (*extremely inaccurate*) to 9 (*extremely accurate*). We chose this version to maintain the interest of participants and to minimize respondent refusal. We translated the scale into Hebrew, and three independent judges assessed the adequacy of the translation in a back-translation procedure, yielding an inter-rater reliability score of .83. Con-

firmatory factor analysis confirmed the expected five-factor structure (see Armon, Shirom, & Melamed, 2011). The scores and the Cronbach internal consistency reliabilities of the FFM (α range = .70–.80) were largely on par with those reported in the original version (Saucier, 1994), with those reported in a meta-analysis (Viswesvaran & Ones, 2000), and with other studies using multinational samples (Thompson, 2008), including studies in Israel that used the Hebrew version of the Mini-Marker scale (e.g., Ein-Gar, Goldenberg, & Sagiv, 2008).

Health Risk Status. Health risk status was coded based on the medical center's detailed results of the health screening examination. Participants were coded as at risk (health risk status = 1) if they had one or more of the following diagnoses: dysfunctional electrocardiogram screening, fasting glucose >126 mg/dl, systolic blood pressure >140, diastolic blood pressure >90, or triglycerides >180 mg/dl. Participants free of these risk factors were coded as healthy (health risk status = 0).

Control Variables. We controlled for years of education (at T1), based on substantial evidence linking education level (as a proxy of socioeconomic status) with preventive health-related behaviors (for reviews, see Hanson & Chen, 2007; Jagger et al., 2008). In addition, we controlled for age, gender (women = 1, men = 0), and marital status (married or living with a partner = 1, others = 0) as these variables differed between the participants who returned and those who did not return for a second visit. We also calculated the length of follow-up (in years) between participants' first visit and the end of the follow-up period (June 2011), as a shorter follow-up period may account for participants' non-return. Finally, we controlled for participants' self-rated health. Self-rated health has been found to predict health service utilization, above and beyond objective health measures such as physician ratings (e.g., DeSalvo, Fan, McDonell, & Fihn, 2005). We included a standard measure of self-rated health to help exclude the possibility that individual differences in initial levels of subjective health perceptions (as measured at T1 or following the first examination's results as measured in T2) moderate the effect of personality on likelihood or frequency of return to health screening. A single survey item measured respondents' self-ratings of their general health, on a 5-point scale ranging from 5 (*excellent*) to 1 (*poor*). The predictive validity and reliability of this measure were reported by DeSalvo et al. (2005).

Statistical Analyses

We used a logistic regression (SPSS Version 19.0) to examine the associations between personality traits and odds of return to health screening. In the first step we entered the control variables of age, gender, marital status, education, self-rated health at T1, length of follow-up in years, and health risk status. In the second step we entered the FFM traits. Odds ratios (OR) and 95% confidence interval (95% CI) were calculated.

Next, we analyzed the frequency of return to health screenings. The distribution of return to health screenings was skewed due to the large proportion of participants who did not return for a second visit (39%) versus those who returned for a second, third or fourth visit (24.5%, 17.1% and 19.4% respectively). Therefore, using Mplus 6.0 (Muthén & Muthén, 2007), we carried out a negative binomial regression (Coxe, West, & Aiken, 2009).

On an exploratory basis we further tested, in a third step, using a stepwise method, the possibility that the FFM traits interacted with health risk status, self rated health, age, gender, and education, in the prediction of health maintenance via health screenings, or that the relationship between the FFM traits and these endpoints is not linear. We therefore included the interactive terms of health risk status, self-rated health, age, gender, and education with each of the FFM traits, as well as the quadratic terms of the T1 FFM predictors, as nonlinear associations may masquerade as interactive terms, as suggested by Cortina (1993). To reduce the possibility of multicollinearity among the interaction and quadratic terms and their component predictors, all predictors were centered prior to the regression runs (Aiken & West, 1992). We used a stepwise method in which the final output includes the significant interactive and quadratic terms only (Cortina, 1993). In the present analysis the squared term of Neuroticism was the only significant predictor.

recurrent visit, 479 employees (28%) had two recurrent visits, and 544 employees (31.9%) had three recurrent visits. Among this sample, 25% of the participants returned for a second visit within 1–3.6 years, 25% returned within 3.7–4.9 years, 25% returned within 5–5.7 years and the remaining 25% returned within 5.8–7 years.

A comparison of the baseline characteristics of employees who chose to return versus those who did not (using independent *t*-tests and χ^2 tests; see Table 1) suggests that the former group had lower levels of extraversion than did the latter. In addition, consistent with previous reports (Fine, Philogene, Gramling, Coups, & Sinha, 2004), those who did not return were younger, were less likely to be married, and had fewer years of education on average. However, in contrast to a previous report (Bertakis, Azari, Helms, Callahan, & Robbins, 2000), women were less likely to return as compared to men. These possible confounders were controlled for in the analysis. The intercorrelations between all study variables are presented in Table 2. Neuroticism was positively associated with the frequency of visits ($p < .05$). Extraversion was negatively correlated with odds of return to health screening and with the frequency of visits ($p < .05$). Additionally, both dependent variables were associated with age, gender, marital status and education. These confounders were controlled for in the statistical analysis.

Results

Descriptive Data

Tables 1 and 2 show the means and standard deviations of the study variables and the correlations between them. Within 7 years, 1,707 employees (60.9%) returned for a second health screening. Among these, 685 employees (40.1%) had one

Testing the Study Hypotheses

The results of the logistic and linear regression analyses are reported in Table 3. As will be elaborated herewith, baseline levels of each of the following personality factors: Neuroticism (linear and nonlinear effect), Extraversion, Conscientiousness, and Openness were significantly associated with the likelihood to return or refrain from returning to a health screening during

Table 1 Frequencies, Means and Standard Deviations, of the Study Variables

	Whole sample (<i>n</i> = 2,803)	No return (<i>n</i> = 1,096)	Return (<i>n</i> = 1,707)	<i>p</i>
1. Neuroticism, Mean (<i>s.d.</i>)	3.62 (1.35)	3.62 (1.32)	3.62 (1.24)	
2. Extraversion, Mean (<i>s.d.</i>)	5.54 (.97)	5.61 (1.35)	5.49 (1.35)	*
3. Conscientiousness, Mean (<i>s.d.</i>)	7.60 (1.21)	7.57 (1.04)	7.62 (.96)	
4. Openness, Mean (<i>s.d.</i>)	6.21 (1.00)	6.24 (1.19)	6.18 (1.21)	
5. Agreeableness, Mean (<i>s.d.</i>)	7.57 (1.01)	7.60 (1.02)	7.55 (1.01)	
6. Age (years), Mean (<i>s.d.</i>)	43.00 (9.62)	41.59 (10.13)	43.90 (9.40)	*
7. Gender (1 = women), <i>N</i> (%)	1,093 (39%)	537 (49%)	631 (37%)	*
8. Marital status (1 = married), <i>N</i> (%)	2,242 (80%)	856 (78%)	1400 (82%)	*
9. Education (years), Mean (<i>s.d.</i>)	15.60 (2.89)	15.15 (2.87)	15.64 (2.90)	*
10. Self-rated health, T1, Mean (<i>s.d.</i>)	4.21 (.60)	4.18 (.66)	4.22 (.59)	
11. Health risk status (1 = at risk), <i>N</i> (%)	897 (32%)	362 (33%)	546 (32%)	
12. Time lag (years), Mean (<i>s.d.</i>)	7.07 (.47)	7.00 (.55)	7.12 (.59)	*

Note. The significance of the difference between the mean scores of the study variables is based on independent sample *t*-tests for each variable, except for gender, which is based on χ^2 .

* $p < .05$.

Table 2 Intercorrelations Between the Study Variables (*n* = 2,803)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Returning to screening (1 = yes)	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Number of visits	.73*	—	—	—	—	—	—	—	—	—	—	—	—
3. Neuroticism	.04	.05*	—	—	—	—	—	—	—	—	—	—	—
4. Extraversion	-.05*	-.05*	.01	—	—	—	—	—	—	—	—	—	—
5. Conscientiousness	.01	.02	-.21*	.22*	—	—	—	—	—	—	—	—	—
6. Openness	-.02	-.03	.09*	.14*	.12*	—	—	—	—	—	—	—	—
7. Agreeableness	-.01	-.01	-.20*	.23*	.25*	.10*	—	—	—	—	—	—	—
8. Age (years)	.05*	.13*	-.01	-.01	-.02	-.03	.03	—	—	—	—	—	—
9. Gender (1 = women)	-.07*	-.12*	-.01	.08*	.04	-.08*	.14*	.11*	—	—	—	—	—
10. Marital status (1 = married)	.04	.08*	-.02	-.01	.02	-.07*	-.02	.29*	-.10*	—	—	—	—
11. Education (years)	.02	.08*	-.01	-.01	-.04*	.23*	-.13*	.11*	-.11*	—	—	—	—
12. Self-rated health, TI	.02	.03	-.13*	.09*	.22*	.02	.13*	-.17*	-.10*	-.07*	.02	—	—
13. Health risk status (1 = at risk)	.01	.01	-.01	-.01	-.02	-.02	-.01	.27*	-.10*	.01	.02	-.18*	—
14. Time lag (years)	.16*	.25*	.01	-.05*	.01	-.06*	-.01	.09*	.16*	.25*	.02	-.04	.08*
Cronbach's alpha	—	—	.74	.80	.72	.70	—	—	—	—	—	—	—

**p* < .05

Table 3 Logistic and Negative Binomial Regression Analysis Predicting the Likelihood to Return to Health Screening and the Number of Visits (*n* = 2,803)

Measure	Logistic Regression Analysis: Return to Health Screening		Negative Binomial Regression Analysis: Number of Visits		
	Odds Ratio	95% Confidence Interval	Estimate	SE	Standardized
Education (years)	1.06	.82–1.23	.03	.01	.25
Self-rated health, TI	1.12	.98–1.28	.08*	.03	.16
Time lag (years)	1.41*	1.23–1.62	.27*	.03	.55
Agreeableness	.99	.91–1.08	.02	.02	.04
	Nagelkerke <i>R</i> ² = .06		<i>R</i> ² = .10*		

Note. SE stands for the standard error of the regression coefficient; ²quadratic term.

**p* < .05.

a follow-up period of 7 years as well as with the number of visits during this time.

As presented in Table 3, Neuroticism was associated with the odds of return for a second visit (nonlinear effect, OR = .96, 95%CI = .92–.98, *p* < .05), and with the number of visits (linear and nonlinear effects, B(SE) = -.04(.02), B(SE) = -.02 (.01), respectively, *p* < .05).

A plot of these curvilinear relationships revealed that at low to moderate levels of neuroticism, the relationship between Neuroticism and the log odds of return to health screening and frequency of health screening was positive, whereas at moderate to high levels of Neuroticism, this relationship was negative (Figure 1).

Supporting Hypothesis 1, an increase of 1 point in extraversion was associated with a 7% decrease in the log-odds of return to health screening (OR = .93; 95% CI = .87–.98) and with lower frequency of visits (B(SE) = -.03(.02), *p* < .05). Hypothesis 2 was supported as well, as an increase of 1 point in Conscientiousness was associated with a 10% increase in the log-odds of return to health screening (OR = 1.10, 95% CI = 1.01–1.20) and with more visits (B(SE) = .02(.00), *p* < .05).

Contrary to our prediction (Hypothesis 3), an increase of 1 point in openness was associated with a 6% decrease rather than with an increase in the log-odds of return to health screening (OR = .94; 95% CI = .87–.98) and with a decrease in frequency of visits (B(SE) = -.04(.02), *p* < .05). Agreeableness was not significantly associated with either criterion; thus, Hypothesis 4 was not supported.

The quadratic terms of the FFM (excluding neuroticism) and the interactive terms of the FFM with perceived health, health risk status, age, gender, and education were nonsignificant.

Discussion

There is growing evidence that some personality traits are associated with behaviors that protect, maintain or improve one's health, while other personality traits are associated with behaviors that risk one's health. Nevertheless, personality traits have not yet been incorporated into health promotion interventions, which may limit the effects of such tailored interventions, as well as patients' compliance. Additionally, most studies on the relationships between personality and

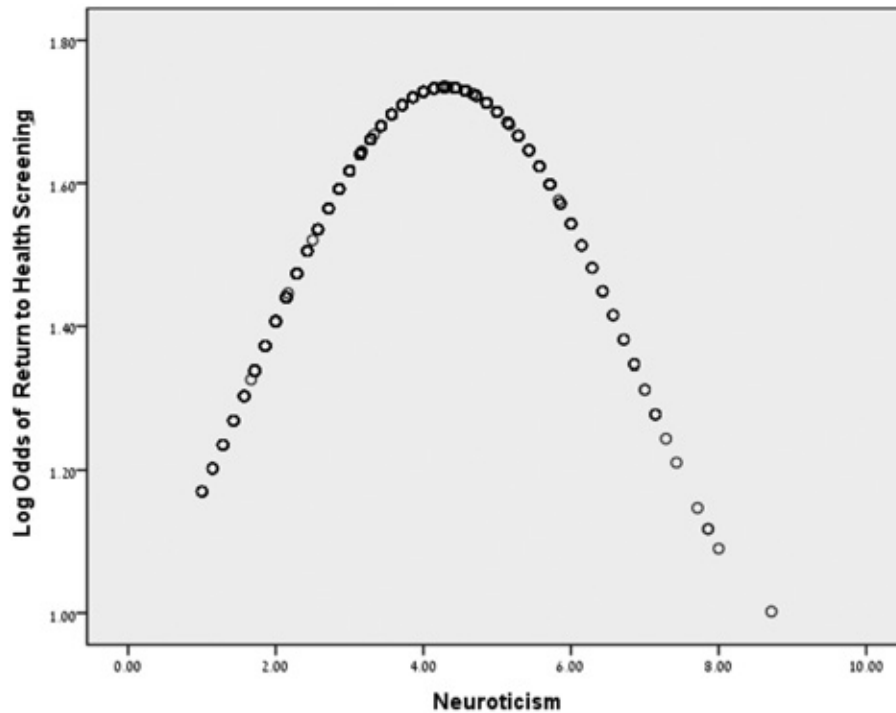


Figure 1 The curvilinear relationship between neuroticism and the log odds of return to health screening.

health-promoting behaviors have focused on populations at risk (i.e., having a medical condition, or practicing unhealthy behaviors) and failed to include healthy individuals in their sample. To the best of our knowledge, this study is the first to investigate the role of personality traits in maintaining one's health—reflected in repeat participation in routine health screenings—among both healthy and at-risk individuals.

Using a prospective design, and following a large heterogeneous cohort of employees with no background disease who were informed by the medical staff of their health status (having or not having risk factors for development of disease), this study partially uncovered the contradictory influence of Neuroticism on one's health behaviors, and fully supported the positive influences of Conscientiousness on healthy lifestyle, as documented in past studies. This study also suggests that two apparently favorable personality traits (namely, Extraversion and Openness) are negatively associated with health maintenance, as reflected in the present study in lower participation levels in follow-up health screenings. Moreover, the results of this study show that personality is directly associated with the likelihood to maintain one's health and that this association is not dependent on individuals' subjective (perceived) and objective health risk status. We obtained these results after controlling for age, gender, marital status, education, self-rated health, health risk status and time lag, while including in the analysis both linear and non-linear associations. We cross-validated our results using two different measures: odds of return for a health screening, and number of visits.

We found that the association of Neuroticism with the odds of returning to health screening as well as with the number of visits is nonlinear in nature, forming an inverted-U curve. Specifically, we found that participants whose neuroticism levels were at either the low or high extreme were less likely to return for an examination, but as Neuroticism levels approached the mean, the odds of returning and the number of visits gradually increased.

What could account for the tendency to avoid further screenings among participants who scored low or high on Neuroticism? First, as mentioned in the introduction, persons scoring high on Neuroticism have poorer coping skills and exhibit less adaptive behavior in threatening situations and therefore tend to adopt avoidance as a coping mechanism (Connor-Smith & Flachsbart, 2007). As the possibility of obtaining negative information about one's health status can be considered an anticipatory threat, it is likely that people scoring high in neuroticism avoid actions that are expected to broaden their knowledge about their health. This avoidance coping behavior would lead to decreased utilization of health screening.

Furthermore, an inverted-U relationship is known to be associated with the Yerkes–Dodson law (Yerkes & Dodson, 1908), which has been observed in research examining the effects of emotionality, anxiety, and tension, and recently also Neuroticism on performance (see Le et al., 2011). The lowest and highest scores in Neuroticism may thus indicate suboptimal levels of concern about one's health, whereas moderate

scores may represent optimal levels of concern and, accordingly, may be associated with increased odds of health screening utilization. This is in line with the general claim of the vitamin model (Warr, 1994), which suggests that the effects of psychological features on mental health are analogous to the nonlinear effects that vitamins are supposed to have on individuals' physical health. Following this line of reasoning we could refer to Neuroticism as representing a specific affective vitamin that, beyond a certain level, may have a detrimental effect on health screening utilization. In this case, the moderate levels of Neuroticism would correspond to what Friedman (2000) termed *healthy neuroticism*. Healthy Neuroticism encompasses "worried well" tendencies that may facilitate engagement in preventive health behaviors aimed at allaying concern about acquiring chronic health problems. Clearly, our findings regarding the curvilinear associations between personality characteristics and health screening utilization should be replicated in future studies in order to lend further empirical support to our propositions.

In congruence with our expectation, Extraversion was positively associated with decreased odds of return for future health screenings and with fewer visits during the recommended period. Apparently, attending a periodic health screening is not perceived as a rewarding health behavior, and therefore extraverts are less likely to practice this behavior. These findings support previous studies showing individuals in positive mood states to be more worryless and reckless, to perceive themselves as less vulnerable to undesirable health conditions, and to adopt inappropriate coping strategies or maladaptive behaviors (for reviews, see Gruber, Mauss, & Tamir, 2011). In the case of health promotion behaviors, this might include a failure to routinely follow up on one's health status.

Conscientiousness was associated with increased odds of return to the health center, and with more frequent visits during the recommended period, thus supporting previous findings regarding the linkages between conscientiousness and a variety of health behaviors such as physical activity (Bogg & Roberts, 2004). The positive association may be attributed to the self-discipline facet of conscientiousness, namely, the ability to both begin a task (i.e., attend the center for the first time) and carry it through over the long run (Costa & McCrae, 1992).

Whereas we expected individuals who scored high on Openness to engage in health-promoting behavior via repeated participation in health screenings, results pointed to a negative association. These results were somewhat surprising; a recent study (Iwasa et al., 2009) found a positive association between Openness and participation in mass health checkups among Japanese elderly living in community housing. One possible explanation for the negative association found in the present study could be that individuals with high levels of trait Openness might be more proactive in seeking alternative means of maintaining their health once an initial screening has been conducted. As these individuals tend to seek new experiences

and are considered to be intelligent and curious (Costa & McCrae, 1992), they may perceive repeat participation in the same type of health screening as redundant. Individuals high in Openness may therefore turn to self-examinations, transfer to new screening facilities, or seek out novel screening methods that are not offered by the present facility.

A second possible explanation is that individuals high in trait Openness trust their own ability to make judgments about their health conditions and needs, and therefore prefer to adjust their own health-promoting behaviors instead of returning to health screenings. A third possible explanation is that people high in Openness often exhibit many nonconformist behaviors (Woods & Hampson, 2010), such as rejecting authority and social norms, and therefore avoid routine utilization of health screenings that are sponsored by their employers. A different explanation may stem from the characterization of individuals high in trait Openness as sensation seekers who tend to adopt unhealthy behaviors such as substance abuse (Roberti, 2004). As these people age, their likelihood of developing chronic diseases increases, and, as discussed in the introduction, in our specific setting a greater tendency to develop health problems may be reflected in a lower likelihood of attending routine health examinations, as medical focus shifts from screening to treating the disease. Future studies may focus on how individuals with high levels of Openness interpret personal positive and negative medical results, and how these interpretations influence their decision making.

Our interpretations of the negative association between Openness and routine participation in health screenings are, of course, speculative and should take into consideration the fact that, in contrast to the other FFM traits, Openness has begun to receive research attention only recently (e.g., Woods & Hampson, 2010). In addition, numerous authors have pointed to the complicated definition and inconsistent effects of this trait (e.g., Barrick & Mount, 1991), thus calling for an in-depth examination of this trait and its effects.

Finally, we did not find significant associations between Agreeableness and the odds of return to health screening or the number of visits. As noted in the introduction, it is possible that the trusting and compliant nature of those who scored high on Agreeableness is associated with a predisposition to follow suggested guidelines with respect to health screening visits. However, the tendency of high agreeable people to pay more attention to the social context and match their behavior correspondingly (Suls, Martin, & David, 1998; Tobin, Graziano, Vanman, & Tassinary, 2000) might further have differential effects on utilization of health screenings, depending on others' attitudes and preferences (e.g., Peterson, Morey, & Higgins, 2005). Thus, we speculate that Agreeableness may have led to a variety of responses among the sample subjects.

Limitations of This Study

The present study is, of course, not free of limitations. First, our sample is composed of individuals who have already

attended a medical examination at T1. These participants may be representative of healthy individuals who already engage in preventive health screening. This seems to limit the utility of the findings, because the results may not be applicable to a broad population who fails to utilize health examinations in the first place. However, as noted in the Method section, the scores of the FFM were largely on par with those reported in other multinational studies, including in Israel, suggesting that results can be generalized to the broader population. In addition, the focus of the present study is on healthy individuals and their decision to maintain their health status by means of periodic screening. These healthy individuals represent a large population of employees who participate in health screenings sponsored by employers worldwide (in the United States 22%–30% of employers offer screening services to their employees; e.g., Linnan et al., (2007)). As routine follow-up is key to the success of these programs (Goetzel & Ozminkowski, 2008), it is important to identify the characteristics of those apparently healthy employees who fail to participate in follow-up examinations.

Second, it is possible that individuals who returned for a second visit had a less favorable health status during follow-up compared with those who did not return and thus had an “objective” reason to undergo an examination. As the objective medical records of the individuals who decided not to return were not available to us, this possibility is difficult to confirm or reject. We controlled for this possibility, albeit imperfectly, by adding a covariate of self-rated health at T1. Surprisingly, we found no association between perceived health at baseline and the likelihood to return to health screening, which suggests that personality factors predict the likelihood to return, over and above subjective perceptions of one’s health. Additionally, other objective changes such as change of address or may partially confound the findings of the present study.

Furthermore, in the current study we used the Mini-Marker scale, which provides only a total score for each of the broad domains of the FFM. We chose this brief scale to maintain the interest of participants and to minimize respondent refusal. However, detailed facet-level analyses would provide a circumscribed and deeper understanding of the relation between personality traits and various outcomes, including health promotion behaviors (e.g., Chapman et al., 2011). We recommend that future studies consider using personality scales, e.g., the NEO-PI-R (Costa & McCrae, 1992), that allow an assessment not only of each broad FFM trait but also of each trait’s specific facets.

Implications and Future Study Directions

Our findings point to possible expansions and refinements of the conceptual frameworks guiding health promotion behavior research, as well as personality research.

For a long time, researchers have implicitly assumed that the relationships between personality traits and health outcomes or behaviors are linear. The current study contributes to

the personality literature by providing evidence for a curvilinear relationship between Neuroticism and routine participation in periodic health screening. Specifically, we show that there is an optimal midrange level (threshold) of Neuroticism that is associated with a maximum likelihood of participation. We suggest that the focus on linear relationships between personality traits and various outcomes may have produced an incomplete picture of these relationships; therefore, the curvilinear relationship found in the present study may have important theoretical and practical implications. We believe that curvilinear relationships deserve more attention in personality psychology, a notion supported by the evolution of personality theory, which suggests that extremely high or low levels of personality traits are not likely to be globally adaptive (Nettle, 2006). First, researchers are encouraged to search for optimal levels of strengths and virtues. In line with the Yerkes–Dodson law (Yerkes & Dodson, 1908) or with the vitamin model (Warr, 1994), each trait may have a different optimal “dosage” when it comes to specific personal or social outcomes. In one study, for instance, Agreeableness, which is considered to be a trait that is more “feminine” in nature, was found to be associated with low income among men, whereas the association was far less pronounced among women (Judge, Livingston, & Hurst, 2012). Although Judge and colleagues assumed a linear relationship between Agreeableness and income, a nonlinear relationship among women may have been an interesting possibility to consider (e.g., extremely agreeable or nonagreeable women may be least advantaged). Our current endeavor may thus offer a more balanced perspective on the boundaries of the impact of personality traits on various outcomes.

Another theoretical contribution of the present study relates to the field of positive psychology. Positive affective traits, such as Extraversion, are generally considered to have desirable outcomes. Research has highlighted the ways in which positive affective traits increase the pursuit of important goals, contribute to vital social bonds, broaden people’s scope of attention, and increase well-being as well as physical and psychological health (see Pressman and Cohen, 2005 for a review). However, in congruence with recent evidence (see Gruber et al., 2011 for a review), our findings suggest that a simple “positive is good” perspective limits our understanding of the full range of outcomes that accompany positive affective traits. We hope that our findings will spur further research and ultimately a deeper understanding of when and how Extraversion is functional and when it is not.

Convincing patients to adopt health-protecting behaviors poses a challenge to practitioners worldwide. Difficulties may result, in part, from the stability of specific personality traits and from the limitations of our knowledge regarding the determinants of change in personality traits in adulthood (e.g., Roberts, Walton, & Viechtbauer, 2006). Targeted interventions based on personality traits might thus overcome the barriers to adoption as part of primary prevention (Kaplan, 2000). A large body of literature suggests that prevention programs that are tailored to their target audiences are more effective and cost-

effective compared with nontailored programs (for a review, see Noar, Benac, & Harris, 2007), and that personality may be a key consideration in such tailoring (e.g., Dutta-Bergman, 2003). Assessment of a patient's personality traits during a health screening visit may help the physician to better understand the patient's health cognitions and behaviors and can further guide intervention choices. For instance, given that Extraversion is referred to as an appetitive-positive affect system devoted to foraging and reward seeking (Carver & White, 1994), tailored medical feedback detailing the absence or existence of risk factors may include emphasis on the advantages and rewards of returning to health screening in subsequent years. For individuals with high Openness, the medical feedback might include a detailed stimulating scientific description of the potential health risks of not returning for health screening in subsequent years. As the results of the present study indicate that personality traits are associated with a 6% to 10% increase / decrease in routine participation in health screenings, even targeted interventions that yield modest results (e.g., affecting only 50% of these employees) may have a noticeable impact.

Information on personality traits can be used not only in tailoring prevention and intervention programs but also in identifying specific target audiences who can benefit from health promotion efforts (Kaplan, 2000). For instance, according to the results of the present study, individuals who scored low on Conscientiousness, high on Extraversion and Openness and high or low on Neuroticism were less likely to maintain their health by means of routinely screening their health status. This suggests that those individuals in particular can represent a "target population" much like other at-risk demographic groups that are sometimes targeted (e.g., based on gender or age).

A final consideration in targeting and tailoring behavioral intervention based on personality traits relates to the assessment of personality. Clearly, in order to tailor behavioral interventions to a patient's personality traits, it is necessary to evaluate these traits. Although extensive assessments may be difficult to incorporate into standard health screenings at medical centers, the use of very brief personality assessments, such as the Ten-Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003), may provide sufficient information to derive guidelines for communicating medical information to specific patients. Patients at medical centers can easily complete such short personality inventories while awaiting their turn for a medical examination. It is less feasible, however, to evaluate large segments of the population with the purpose of tailoring health interventions or promotion efforts. Internet-based interventions can overcome such challenges; e.g., patients who visit a website might be asked to fill out a short personality inventory and then be presented with tailored messages. A similar approach is used in health promotion interventions that take into account a person's level of readiness for change (e.g., Yap, Davis, Gates, Hemmings, & Pan, 2009).

An alternative strategy is to develop an intervention that will target at-risk subgroups (i.e., high on Openness and Extraversion, low on Conscientiousness and low or high on Neuroticism) and at the same time be applicable to the general population. Such an intervention might present patients with the advantages and rewards of returning to health screening in subsequent years as well as the potential health risks of not returning for health screening in subsequent years as suggested above.

While these points are speculative at present, they illustrate how consideration of personality factors might lead to more effective, efficient health behavior modification interventions. Our study suggests that personality traits affect health-promoting behaviors over and above the effects of subjective perceived health and objective health risk status, and other socio-demographic and familial factors, and therefore may be integrated into health promotion interventions. Further research will explore how medical practitioners can evaluate these traits, and the extent to which specific traits should be taken into consideration when planning, implementing and evaluating health-related interventions.

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