Personality Correlates of Risky Health Outcomes: Findings from a Large Internet Study

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Abstract

Numerous studies have documented the effects of personality on health outcomes. However, which traits are most relevant to health, and the precise magnitude of their effects, is inconsistent across studies. The present study used a large sample (N=460,172) to replicate and extend the relations between the Big Five and three health-related outcomes: self-reported health, body mass index, and substance use. Low Conscientiousness predicted all outcomes, indicating that individuals who are less responsible and less self-controlled tend to report poorer health, be more overweight, and engage in more substance use. In addition, individuals who were more emotionally unstable (high Neuroticism) reported poorer health, and individuals prone to seek out social experiences and rewards (high Extraversion) engaged in more frequent substance use.

1. Introduction

Over the past few decades, a growing body of research has established a link between personality traits and health-related mechanisms, behaviors, and outcomes. Numerous models have been proposed to explain how personality can affect health through processes such as physiological responses, preventative and risky health behaviors, coping mechanisms, and shared genetic risk and resilience factors (Smith, 2006). However, despite widespread agreement that personality plays a critical role in promoting and maintaining health, the field lacks consensus about which particular traits are most strongly linked to health outcomes (Friedman & Kern, 2014). The aim of the present study was to replicate and extend the literature by examining the relation between the Big Five traits and three important health outcomes: (1) general self-reported health, (2) body mass index, and (3) substance use.

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Self-reported health is a widely used indicator of current health status and an important predictor of many health outcomes (Idler & Benyamini, 1997). Although the findings vary across studies, all of the Big Five personality traits have been linked to self-reported health, with Conscientiousness generally showing the strongest and most consistent effects (Hampson, Goldberg, Vogt, & Dubanoski, 2006; Takahashi, Edmonds, Jackson, & Roberts, 2013). Recent longitudinal research has demonstrated that increases in Conscientiousness, Openness, Extraversion, and Agreeableness are associated with improvements in self-reported health over time, whereas increases in Neuroticism are associated with poorer self-reported health over time (Letzring, Edmonds, & Hampson, 2014; Magee, Heaven, & Miller, 2013).

Body mass index (BMI) is a health marker known to be a causal predictor for many obesity-related disease outcomes (National Institutes of Health, 1998). Individuals who are more neurotic and extraverted, and less conscientious, tend to have higher BMI scores, based on both cross-sectional and longitudinal research (Sutin, Ferrucci, Zonderman, & Terracciano, 2011). However, Brummett et al. (2006) found gender differences in these effects; Neuroticism was related to BMI only in females whereas Extraversion was related to BMI only in males.

Substance use is a risky health behavior that has deleterious consequences for health later in life. Individuals who are more neurotic, extraverted, and open, and less conscientious and agreeable, tend to engage in more substance use, based on both cross-sectional and longitudinal research (Turiano, Whiteman, Hampson, Roberts, & Mroczek, 2012). Moreover, substance use and personality trait change are reciprocally related over time (Littlefield, Sher, & Wood, 2009).

The present research used data from a large Internet-based study to address several questions about personality and health: (1) Are there gender, ethnic, and age differences in self-reported health, BMI, and substance use? (2) Which of the Big Five personality domains are most strongly related to self-reported health, BMI, and substance use? (3) What are the independent and interactive effects of personality on self-reported health, BMI, and substance use? and (4) Does gender, ethnicity, or age moderate any of the personality effects? The extremely large sample size (nearly half a million participants) provided sufficient power to detect very small effects and examine differences in effect sizes across Big Five domains and demographic subgroups.

2. Method

2.1. Participants and procedure

The sample consists of 460,172 adults (63% women) who ranged in age from 18 to 90 years (M=34.5 years, SD=13.53). 86.7% reported being White, 6% Asian, 1.5% Black or African, 4.4% multiracial/other, and 1.4% "rather not say".

The data were collected between 2009 and 2012 as part of a large internet-based study of personality sponsored by the British Broadcasting Corporation (BBC). To complete the survey, respondents clicked a link on the BBC's Lab UK website, which was widely

advertised through the BBC webpages and television and radio channels. The survey included questions about demographics, education/work, relationships, personality, health, and childhood experiences. For the present study, we focused on the personality and health measures.

2.2. Measures

2.2.1. Personality

The 44-item Big Five Inventory (BFI) is a well-validated measure of the five basic domains of personality (John, Naumann, & Soto, 2008). The items were rated on a 5-point likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). In the present sample, the alpha reliabilities were .86 for Extraversion (M=3.24, SD=.82), .76 for Agreeableness (M=3.73, SD=.62), .83 for Conscientiousness (M=3.62, SD=.70), .83 for Neuroticism (M=2.97, SD=.81), and .79 for Openness to Experience (M=3.70, SD=.64); these reliabilities are comparable to those obtained when the BFI is administered in person.

2.2.2. General health

We used 11 items from the RAND 36-Item Health Survey, which was adapted from the SF-36 Health Survey (Ware, 2004). Participants reported on their physical and emotional health (e.g., "During the past 4 weeks, have you accomplished less with your work or other daily activities than you would like as a result of your physical health?"), exercise and sleeping habits (e.g., "During the last 30 days, how often did you have trouble sleeping?"), and stress in their daily lives (e.g., "In general, how stressful do you find your daily life?"). The items were standardized because of their varying response formats and averaged to create a measure of General Health (alpha=.82; M=.00, SD=.59).

2.2.3. Body mass index

Body mass index (BMI) was calculated from each participant's self-reported height (M=5′ 6″, SD=.32 feet) and weight (M=160.4 pounds, SD=40.0 pounds). These questions were described as "optional" in the survey, so BMI scores (M=24.9, SD=5.7) are only available for a subset of participants (N=225,217).[1]

2.2.4. Substance use

We used 5 items from the Youth Risk Behavior Survey (Center for Disease Control and Prevention, 2013). These items ask about cigarette, alcohol, and recreational drug use (e.g., "During the past 30 days, on average how many cigarettes did you smoke per day?"). Items were standardized and averaged to create an overall Substance Use scale (alpha=.71; M=.01, SD=.71). One of the five items ("During your life, have you ever used 'recreational' drugs?") was described as "optional", so it is only available for a subset of participants (N=220,117).[2]

3. Results

Because of the large sample size, we focus on the magnitude rather than the statistical significance of the effects. The three health outcomes were weakly inter-correlated: BMI

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[1] Participants who responded to the questions about their height and weight did not differ substantially on any of the key study variables from those who did not respond; the standardized difference (Cohen's *d*) between respondents and non-respondents was .03 for health, .10 for substance use, and from .01 to .08 for the Big Five dimensions.
[2] Participants who responded to the recreational drug use question did not differ substantially on any of the key study variables from those who did not respond; the standardized difference (Cohen's *d*) between respondents and non-respondents was .02 for BMI, .03 for health, .11 for substance use, and from .02 to .07 for the Big Five dimensions.

was correlated −.15 with General Health and .03 with Substance Use; General Health and Substance Use were correlated −.04.

3.1. Demographic effects

On average, men (M=.07, SD=.57) reported better health than women (M=−.04, SD=.60). However, men (M=.16, SD=.75) reported higher levels of substance use than women (M=−. 07, SD=.67). Men (M=25.1, SD=4.9) and women (M=24.8, SD=6.0) did not differ on BMI. With regard to ethnicity, White individuals reported slightly better health (M=.01, SD=.59), than Black (M=−.02, SD=.59), Asian (M=−.07, SD=.58), and multiracial (M=−.07, SD=.60) individuals. However, White individuals reported more substance use (M=.05, SD=.70), compared to Black (M=−.29, SD=.66), Asian (M=−.43, SD=.60), and multiracial individuals (M=−.03, SD=.72). Black individuals reported higher BMI (M=26.1, SD=7.2) than White (M=25.0, SD=5.6), multiracial (M=24.5, SD=6.1), and Asian (M=23.5, SD=5.3) individuals. Age was associated with higher BMI scores (r=.25) and greater substance use (r=.09), but was not related to self-reported health (r=−.01).

3.2. Personality correlates of general health

Table 1 shows zero-order correlations between the Big Five personality traits and General Health. Healthy individuals tended to be low in Neuroticism (r=−.48), and high in Extraversion (r=.23), Conscientiousness (r=.21), and Agreeableness (r=.16). The relation between Openness and health was near zero (r=−.03).

To examine the independent effects of the Big Five, we conducted multiple regression analyses with all five traits entered simultaneously, along with gender, age, and ethnicity as control variables (see Table 1).[3] Neuroticism and Conscientiousness were the most powerful predictors of health, with smaller effects for Extraversion and Openness. The effect of Agreeableness decreased to zero.

To test for moderator effects, we performed a series of multiple regression analyses in which we predicted health from the demographic variables (i.e., age, gender, ethnicity), the Big Five dimensions, and the interaction between each of the demographic variables (age, gender, and dummy codes for ethnicity) and the Big Five. None of the interaction effects accounted for more than a trivial portion of the variance (all $R^2 < 1\%$). Similarly, when we tested for interactions among the Big Five traits (e.g., Conscientiousness x Neuroticism), none of the interaction effects explained more than 1% of the variance.[4]

The General Health scale includes items related to both physical and emotional health. To better understand the link between personality and *physical* health, we removed the 4 items that refer to stress or emotional problems and re-ran the analyses reported in Table 1 using this abbreviated scale (alpha=.76). The Big Five effects for Extraversion (B=.07, r=.19),

[3]We also examined the effects of social class, assessed by a standardized composite of occupational status (ranging from "professional" to "farm worker"), education level, and income (alpha=.60). Adding social class as a control variable (along with age, gender, and ethnicity) did not change any of the personality effects reported in Table 1 by more than +/− .01, for any of the three health outcomes. In addition, social class did not moderate any of the personality effects (all $R^2 < 1\%$).
[4]We also tested for all possible three-way interactions among the Big Five dimensions, and between the Big Five dimensions and each of the demographic variables. We did not find any non-trivial effects for any of the three health outcomes (all $R^2 < 1\%$).

Agreeableness (B=.01, r=.12), Conscientiousness (B=.13, r=.17), and Openness (B=−.04, r= −.00) were similar in magnitude to those obtained with the broader General Health scale. Not surprisingly, the Neuroticism effect showed the most substantial change, declining to B= −.22 (r=−.34).[5]

3.3. Personality correlates of BMI

Table 1 shows zero-order correlations between the Big Five domains and BMI, as well as unstandardized beta coefficients from a multiple regression analysis predicting BMI from the Big Five domains and the control variables. All of the zero-order correlations were close to zero. Similarly, none of the beta weights except for Conscientiousness (B=−.12) exceeded .04. There were no interactions between the demographic variables and the Big Five, or among the Big Five, that accounted for more than 1% of the variance.

3.4. Personality correlates of substance use

Table 1 shows zero-order correlations between the Big Five personality traits and substance use, as well as unstandardized beta coefficients from a multiple regression analysis predicting substance use from the Big Five domains and the control variables.

Extraversion and Conscientiousness were the most robust predictors of substance use, with weaker effects found for Agreeableness, Neuroticism, and Openness. The results were similar when we examined each individual substance use item; specifically, Extraversion and Neuroticism had positive beta weights, and Conscientiousness and Agreeableness had negative beta weights, regardless of whether the outcome was cigarette, alcohol, or recreational drug use (controlling for the other Big Five dimensions, age, gender, and ethnicity). The one exception is that Openness was positively associated with cigarette and recreational drug use, but the effects were mixed for alcohol use.

Consistent with the findings for health and BMI, we did not find any non-trivial interactions between the demographic variables and the Big Five, or among the Big Five, when predicting substance use (all $R^2 < 1\%$).

4. Discussion

The present study used a sample of nearly a half million participants to replicate and extend previous research examining the link between the Big Five personality domains and self-reported health, BMI, and substance use. Consistent with previous findings, Conscientiousness was associated with all three health outcomes; that is, individuals who were less responsible and less able to control their impulses tended to report poorer general health, be more overweight, and engage in more substance use. Moreover, the prophylactic effects of Conscientiousness were robust, and did not vary as a function of age, gender, or ethnicity. Aside from poor self-control (low Conscientiousness), individuals who were emotionally unstable and highly reactive to stress (high Neuroticism) were more likely to

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[5]It is also worth noting that all 11 of the General Health items were positively correlated with Extraversion, Agreeableness, and Conscientiousness and negatively correlated with Neuroticism (the item-level correlates of Openness were distributed around zero). This suggests that any sampling of items – regardless of whether it includes primarily physical or primarily emotional health items – will lead to similar conclusions about the personality correlates of health and produce a similar pattern of findings.

report poor health. These effects partially replicated the findings of Magee et al. (2013), who found that increases in Conscientiousness and Extraversion, and decreases in Neuroticism were the strongest longitudinal predictors of self-reported health.

Conscientiousness emerged as the strongest predictor of BMI, an important risk factor for obesity. This partially replicated Sutin et al. (2011), who found the strongest cross-sectional and longitudinal effects for Extraversion, Neuroticism, and Conscientiousness, followed by Agreeableness and Openness in relation to objective measures of BMI. In contrast to Brummett et al. (2006), we did not find gender differences in the relation between the Big Five and BMI.

The most robust predictors of substance use were Conscientiousness and Extraversion, which suggests that individuals who have difficulty controlling their impulses (low Conscientiousness) and are more likely to seek social attention and other rewarding experiences (high Extraversion) report engaging in more frequent substance use. Overall, the direction of the Big Five effects were consistent with prior research (Turiano et al., 2012), but weaker in magnitude.

In contrast to previous research, we did not find any non-trivial interactions among the Big Five personality traits when predicting self-reported health, BMI, or substance use. Some studies have shown that the combination of high Neuroticism and high Conscientiousness, a pattern referred to as "healthy Neuroticism," has health benefits, including improved immune functioning (Turiano, Mroczek, Moynihan, & Chapman, 2012). Although we did not replicate this effect, "healthy Neuroticism" may be beneficial for health outcomes that we did not assess, or for particular subpopulations of individuals.

The present findings highlight the importance of considering personality tendencies in clinical health settings (Bogg & Roberts, 2013). Specifically, the findings suggest that personality-informed interventions aimed at improving health should target the behavioral and cognitive manifestations of the traits most associated with that specific health outcome. For Conscientiousness in particular, promoting better health is often manifested through healthy behaviors such as physical activity and dieting (Roberts, Walton, & Bogg, 2005), which, in turn, reduce the amount of body fat accumulated. However, these associations require further replication in large-scale longitudinal studies before being applied in clinical contexts, which leads us to several limitations that should be considered when interpreting the findings.

First, the present findings are based on cross-sectional data, which do not allow for strong conclusions regarding the causal influence of personality on health. Because a lifespan approach for investigating the relations between personality and health is crucial for understanding the causal directionality of effects linking personality and health (Friedman & Kern, 2014), future research should examine these pathways longitudinally. Although the present study does not support causal inferences, the findings do provide a foundation for future research by demonstrating the robustness and relative size of the Big Five effects on three important health outcomes.

Second, although Internet-based data collection can provide substantial statistical power, the sample of participants may be biased toward those individuals who have access to and regularly use the Internet. However, studies have shown that Internet samples are generally quite diverse (Fraley, 2007), and the large sample size allowed us to confirm that the results did not vary by gender, age, or ethnicity.

Third, the present research was based exclusively on self-report measures. In future research, it would be useful to include informant-based measures of personality and objective measures of health, such as BMI computed from measured height and weight, to control for possible self-report biases (e.g., an unwillingness to acknowledge health problems, or neurotic complains about non-existent health problems) and to account for the effects of shared method variance on the personality-health correlations. However, research has shown that self-report measures of health are strongly correlated with many objective measures. For example, although self-reports of height and weight may seem particularly susceptible to response biases (because people are motivated to appear taller and thinner than they are), people's reports of their height and weight typically correlate in the .80s and .90s with ruler and scale measurements of their height and weight (Roth et al., 2013).

Lastly, because the healthcare system in the United Kingdom (UK) allows all permanent residents free healthcare at the point of need, the ability to prevent and treat health-related diseases and outcomes is more readily and widely available than in other countries. This does not mean that all UK residents take advantage of these resources when health problems arise, but caution should be taken when generalizing our findings to countries with different healthcare systems.

Despite these limitations, our extremely large sample size allowed us to detect and precisely estimate even very small effects, and examine the robustness of these effects across demographic subgroups. Our results indicated that, although Conscientiousness clearly emerged as the single most important trait for these three health outcomes, the other Big Five traits also play a role in health outcomes, even after controlling for shared variance among the Big Five and demographic factors such as age, gender, and ethnicity. Thus, the present findings add to the growing awareness that different personality traits are related to different aspects of health. Rather than focusing exclusively on Conscientiousness, it would be beneficial in future research to examine how personality traits are related to different health processes (e.g., physiological mechanisms, health behaviors, coping) that contribute to different disease outcomes and longevity. Although age, gender, and ethnicity are stable factors that contribute to better or worse health outcomes, we found that the effects of personality on health are largely independent of these demographic variables. Targeting specific traits for different health outcomes will allow for a more cohesive approach to designing future interventions to improve the health of individuals.

Acknowledgments

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Highlights

- Conscientious individuals tend to be healthier and less overweight

- Conscientious individuals are less likely to use drugs

- Neurotic individuals tend to be less healthy

- Extraverts are more likely to use drugs

Table 1

Demographic and Personality Associations with General Health, Body Mass Index, and Substance Use

Predictors	General Health (N=460,172)		Body Mass Index (N=225,217)		Substance Use (N=460,172)	
	r	*B* (SE)	*r*	*B* (SE)	*r*	*B* (SE)
Step 1: Demographics						
Age	−.01	−.01 (.00)	**.25**	.02 (.00)	.09	.01 (.00)
Gender	.09	.06 (.00)	.00	.00 (.01)	**.16**	**.22** (.00)
Black vs. White	−.01	−.09 (.01)	.03	**.28** (.02)	−.05	**−.32** (.01)
Asian vs. White	−.03	**−.10** (.00)	−.07	**−.16** (.01)	**−.15**	**−.48** (.00)
Multiracial vs. White	−.02	−.07 (.01)	−.01	.02 (.01)	−.01	−.08 (.01)
R²		.01		.07		.06
Step 2: Personality						
Extraversion	**.23**	.06 (.00)	.01	.04 (.00)	**.13**	**.14** (.00)
Agreeableness	**.16**	.00 (.00)	.01	.00 (.00)	−.07	−.05 (.00)
Conscientiousness	**.21**	**.11** (.00)	−.01	**−.12** (.00)	**−.12**	**−.14** (.00)
Neuroticism	**−.48**	**−.31** (.00)	−.00	.02 (.00)	−.01	.04 (.00)
Openness	−.03	−.07 (.00)	−.02	−.04 (.00)	.08	.04 (.00)
Multiple R		.51		.27		.32
R²		.25		.01		.05

Note. For gender, females are the reference group. All of the dependent variables (general health, BMI, substance use) were standardized. *B* values are unstandardized beta coefficients. Effects +/− .01 are significant at the *p* < .01 level. Values +/− .10 are highlighted in bold.