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The Health Behavior Model of Personality in the Context of a Public Health Crisis

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Abstract

Objective: The US Centers for Disease Control and Prevention recommended behavioral measures to slow the spread of COVID-19, such as social distancing and wearing masks. Although many individuals comply with these recommendations, compliance has been far from universal. Identifying predictors of compliance is crucial for improving health behavior messaging and thereby reducing disease spread and fatalities.

Methods: We report preregistered analyses from a longitudinal study that investigated personality predictors of compliance with behavioral recommendations in diverse US adults across five waves from March to August 2020 (n = 596) and cross-sectionally in August 2020 (n = 405).

Results: Agreeableness—characterized by compassion—was the most consistent predictor of compliance, above and beyond other traits, and sociodemographic predictors (sample A, β = 0.25; sample B, β = 0.12). The effect of agreeableness was robust across two diverse samples and sensitivity analyses. In addition, openness, conscientiousness, and extraversion were also associated with greater compliance, but effects were less consistent across sensitivity analyses and were smaller in sample A.

Conclusions: Individuals who are less agreeable are at higher risk for noncompliance with behavioral mandates, suggesting that health messaging can be meaningfully improved with approaches that address these individuals in particular. These findings highlight the strong

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theoretical and practical utility of testing long-standing psychological theories during real-world crises.

Keywords

agreeableness; COVID-19; health behaviors; personality; public health

INTRODUCTION

Personality traits—characteristic patterns of thoughts, feelings, and behaviors—are powerful predictors of health behaviors (1,2). As such, a personality psychology perspective should be able to help us predict how people behave within large-scale, societal health crises. For example, behavioral measures to control the spread of infectious diseases like COVID-19 are critically important (3). Although many people comply with these guidelines, behavioral strategies only work when there is widespread adoption, yet there is often pervasive noncompliance (4). Identifying personality predictors of COVID-19 health behaviors will reveal who is most likely to ignore behavioral mandates, which can then be used to improve public health messaging to better reach these individuals and in turn increase compliance (5).

To inform the crucial time-sensitive question of what factors drive compliance with COVID-19 preventive health behaviors, we can leverage long-standing theories of personality. The health behavior model of personality is one of multiple models that aim to explain the relationship between personality traits on the one hand and physical health outcomes on the other hand (3). This model posits that particular personality dimensions, derived from the Big Five theory of personality (6), influence health behaviors (3,7), which in turn influence health outcomes. Although the majority of research on the health behavior model of personality has rarely considered acute infectious disease threats like COVID-19, the existing research and theory suggests that three traits may be particularly relevant: conscientiousness, agreeableness, and neuroticism. In particular, this work has found that conscientiousness—characterized by organization and responsibility—is generally the strongest predictor of health behaviors (3). This work has focused on individual health threats that hinge on *self-protecting* health behaviors (e.g., exercise habits to improve cardiovascular health). However, preventing the spread of the collective health threat of an infectious disease requires unique behaviors that are not only self-protecting but also *community protecting* (e.g., wearing a mask to protect others from infection). In this context, agreeableness—characterized by compassion and respect—may be particularly important: highly agreeable people's compassion for others may drive a desire to slow the disease's spread, and their tendency toward cooperation (8) may make them more likely to comply with behavioral recommendations. Finally, the vigilance required to reduce COVID-19 risk may also suggest that neuroticism—characterized by high levels of negative emotions such as worry—will predict greater compliance (9). This is consistent with the healthy neuroticism hypothesis, which suggests that neuroticism, especially in combination with conscientiousness, may lead to vigilance-based behaviors to avoid health threats (10,11).

The present study provides a test of whether personality predicts compliance with COVID-19 preventive behaviors recommended by the US Centers for Disease Control and Prevention (CDC) (12) during the first 5 months of the pandemic. Some prior research has begun to speak to this question using data from March and April (13-15). However, because *sustained* health behaviors have been needed, it is crucial to understand factors that drive *long-term* compliance. We addressed this critical question by assessing health behaviors each month in five waves of data collection between March and August 2020. This longitudinal approach provides a robust test of personality-behavior links across time as aspects of the situation change (e.g., as policies and social norms change). To examine the generalizability of associations across diverse individuals and to provide a test of conceptual replication, we conducted preregistered analyses in two online samples of US participants (sample A, $n = 596$; sample B, $n = 405$) that were diverse in terms of age, gender, racial and ethnic identity, and political affiliation.

Based on prior empirical and theoretical work, we preregistered the following predictions: higher agreeableness, conscientiousness, and neuroticism will predict greater engagement in COVID-19 preventive health behaviors, and the effect of neuroticism on health behaviors will be strongest at higher levels of conscientiousness. We did not make specific predictions for extraversion (characterized by assertiveness and sociability) or openness (characterized by intellect and creativity).

METHODS

All procedures were approved by the University of Toronto ethics board (protocol no. 33962). The preregistration, data, and statistical code are available at https://osf.io/ukvrh/.

Participants

US participants were recruited from Amazon's Mechanical Turk. Surveys with failed attention checks were excluded from analysis. Participants provided informed consent and were compensated approximately $9 per hour. Participants in sample A were specifically recruited to be relatively diverse with respect to racial and ethnic identity, and participants in sample B were specifically recruited to be relatively diverse with respect to political affiliation. The goal of this sampling strategy was to have large-enough subgroups of particular sociocultural variables so that we could feasibly examine these variables as moderators (which is not feasible in a purely representative design without much larger sample size). For example, the larger proportion of participants identifying as African or African American in sample A—an understudied population in psychology research (16)—allowed us to test whether the association between personality and health behaviors was comparable for individuals from these different sociocultural backgrounds. Sample A ($n = 596$; mean [SD] = 37 [11] years old) was 53% women, 34% European American/White/Caucasian, 30% African or African American, 22% East Asian or East Asian American, 50% Democrat, 16% Republican, and 33% Independent. Sample B ($n = 405$; mean [SD] = 44 [13] years old) was 51% women, 84% European American/White/Caucasian, 5% African or African American, 4% East Asian or East Asian American, 53% Republican, and 47% Democrat. Sample A ($n = 596$) provided 90% statistical power to detect a β of 0.13 or larger

at an α level of .05; sample B (n = 405) provided 90% statistical power to detect a β of 0.16 or larger at an α level of .05. Power analyses were conducted in R using the pwr package (17).

Measures

Personality—We assessed personality in March in sample A and in August in sample B using the extra-short form of the Big Five Inventory (BFI-2-XS) (6). The BFI-2-XS is a brief, 15-item measure that has been shown to efficiently and reliably assess the Big Five personality traits (6). In sample A, Cronbach α ranged from .60 to .76 across traits. In sample B, Cronbach α ranged from .61 to .77 across traits.

Health Behaviors—To assess health behaviors, participants rated how often they engaged in each of five CDC-recommended health behaviors (mask wearing, social distancing, self-isolation, sanitizing surfaces, and hand washing) "over the past four weeks" monthly from March to August in sample A and in August in sample B. Response options ranged from 0 (I did not do this) to 4 (I very often or always did this) for each health behavior. We computed a mean composite across the five health behaviors. In addition, results are reported separately for each health behavior in Table S1, Supplemental Digital Content (SDC; http://links.lww.com/PSYMED/A730).

Demographic Covariates—Participants reported their gender, age, racial and ethnic identity, and political affiliation at baseline. To assess racial and ethnic identity, participants responded to the question, "What ethnicity do you identify with most?" Response options were African or African American, East Asian or East Asian American, South Asian or South Asian American, European American/White/Caucasian, Middle Eastern American, Latino/Hispanic/Mexican American, and Native American. A limitation of this measurement approach is that the survey question only asked about ethnicity and not race; however, because the response options include both racial and ethnic identities, we refer to this construct as racial and ethnic identity throughout. We compared the three largest racial and ethnic groups (African or African American, East Asian or East Asian American, and European American/White/Caucasian) and recoded other racial and ethnic identities into a fourth other racial and ethnic identities group. To assess political affiliation, participants responded to the question "With which political party do you identify?" Responses options were as follows: Republican, Democrat, Independent, and Other. Independents and other political affiliation were combined for political affiliation analyses in sample A. Sample B included only Republicans and Democrats. See Table S2, SDC (http://links.lww.com/PSYMED/A730) for associations between sociodemographic covariates and health behaviors and Tables S3 to S7 (http://links.lww.com/PSYMED/A730) for associations between sociodemographic covariates and personality traits.

Analytic Approach

All analyses were conducted in R Version 3.6.1 using base R functions, the nlme package (18), and the lme4 package (19). In sample A, we used random-intercept multilevel models to predict health behaviors from March to August from personality traits. In sample B, we used linear regression to predict health behaviors in August from personality traits.

Age, education, gender, racial and ethnic identity, and political affiliation were included as covariates in primary analyses. To examine the robustness of results, we conducted three sets of preregistered sensitivity analyses: (1) simple associations without covariate adjustment, (2) unique associations controlling for other Big Five traits, and (3) associations with intended future health behaviors rather than past health behaviors.

We also conducted additional analyses that were not preregistered. First, we used a model comparison approach to test whether the effect of agreeableness was significantly larger than the effects of other traits in sample A and whether the effect of openness was significantly larger than the effects of the other traits in sample B. For example, to compare the effect size for agreeableness with the effect size for conscientiousness, we compared a model with both agreeableness and conscientiousness as predictors with the two effect sizes allowed to vary with a model with both agreeableness and conscientiousness as predictors with the two effect sizes constrained to be equal. Next, we investigated the consistency of personality-health behavior associations across time and sociodemographic groups. To examine consistency of associations across time, fixed and random effects of discrete time, and interactions between discrete time and personality were added to the multilevel models predicting health behaviors from personality and covariates in sample A. To examine consistency across sociodemographic groups, we modeled interactions between personality on the one hand and age, education, gender, racial and ethnic identity, and political affiliation on the other hand in both samples.

RESULTS

Descriptive statistics are displayed in Table 1.

Preregistered Analyses

Primary results are presented in Table 2. In both samples, agreeableness, conscientiousness, extraversion, and openness were positively associated with health behaviors. Neuroticism was not associated with health behaviors and did not interact with conscientiousness to predict health behaviors. In three sets of preregistered sensitivity analyses, agreeableness was the only consistent predictor across all analyses and in both samples (Table 3). Specifically, agreeableness was associated with greater compliance (1) with and without controlling for demographic covariates, (2) with and without controlling for the other Big Five traits, and (3) when assessing both past health behaviors and intended future health behaviors.

Exploratory Effect Size Comparison

In sample A, agreeableness was the strongest predictor of health behaviors. In the top quartile of agreeableness, 58% of participants engaged in health behaviors “often” or “very often or always” compared with only 36% of participants in the bottom quartile. In a model with both agreeableness and conscientiousness as predictors, allowing the effect sizes to vary significantly improved model fit ($\chi^2(1) = 5.94$, $p = .015$), indicating that the effect of agreeableness was significantly larger than the effect of conscientiousness. We repeated this process to compare agreeableness to each of the other Big Five traits, and results

indicated that the effect of agreeableness was significantly larger than the effects of the other traits (p values < .05). In sample B, the effects of agreeableness, conscientiousness, and extraversion did not significantly differ from one another (p values > .453) and the effects of agreeableness and openness did not significantly differ from one another (p = .207).

Additional Exploratory Analyses

When considering time, the main effect of time was positive (B = 0.14, p < .001), suggesting that compliance increased as the pandemic unfolded. The interaction between time and conscientiousness was also statistically significant (B = −0.02, p = .020), suggesting that the association between conscientiousness and health behaviors became weaker across time. All other interactions between time and personality were not statistically significant (p values > .143), suggesting that personality-behavior associations were largely consistent as the pandemic unfolded. When considering moderation by sociodemographic factors, there were no consistent moderation effects across samples. See SDC (http://links.lww.com/ PSYMED/A730) for discussion of the four interaction effects that were significant at α = .05. Given the large number of tests (50 moderation tests) and the lack of replication across samples, we caution readers to consider type I error rates when interpreting these interactions.

DISCUSSION

The present research bridges theory from personality and health psychology to test the generalizability of long-standing theory in the context of a real-world health crisis and, in turn, provide actionable information to an urgent public health crisis. We found that personality was a powerful predictor of compliance with CDC-recommended health behaviors aimed at slowing the spread of COVID-19. Consistent with the health behavior model of personality, these findings highlight the role of personality in predicting health behaviors (3,7). Most prior work on personality and health behaviors has focused on *self*-protecting behaviors that are largely self-directed (e.g., exercise) or doctor-mandated (e.g., medication adherence) (4). The present work is unique in that we examined behaviors that are both *self*- and *community*- protecting and that are mandated at the societal level. Even in this context, in which one might expect strong social mandates to overpower individual differences, personality remained a strong predictor of compliance. However, the relative predictive utility of Big Five traits compared with one another differed somewhat from prior research, underscoring the importance of incorporating both the person and the situation into the health behavior model of personality. Specifically, agreeableness, rather than conscientiousness, was the most consistent predictor of COVID-19 preventive health behaviors. Highly agreeable people's compassion for others may drive them to slow disease spread, and their tendency toward cooperation may make them more compliant with societal mandates.

Agreeableness may represent a highly scalable target for optimizing health behavior messaging in the context of a collective health threat like the COVID-19 pandemic. Health behavior messaging that focuses on appeals to agreeableness by emphasizing the community-protective benefits of slowing the spread of COVID-19 likely effectively reaches agreeable individuals and should be maintained. However, these appeals to agreeableness

may not be effective for less agreeable individuals who are most likely to ignore behavioral mandates. A twofold approach may be useful for addressing this problem. First, interventions to increase compassion in less agreeable individuals may improve the effectiveness of messaging (20). However, interventions that aim to change personality may not be effective or feasible on a large scale, suggesting that adapting health behavior messaging to better reach less agreeable individuals may be a more viable approach. Namely, adding additional messaging that does not rely as heavily on compassion—for example, messaging that focuses on self-protection (21)—may be effective for less agreeable individuals. Improving health behavior messaging to reach less agreeable individuals has the potential to improve compliance with health behaviors in the context of the COVID-19 pandemic and future collective health threats. These recommendations are based on prior theory and research regarding the promise of using personality to target and tailor health messaging, but it is important to note that present research did not directly test specific forms of messaging. Thus, further research is needed to test the effectiveness of this approach.

The following limitations should be considered when drawing conclusions from the current investigation and when generalizing to other contexts. First, we used two samples from Amazon's Mechanical Turk that were recruited to be diverse with respect to racial and ethnic identity (sample A) and political affiliation (sample B). Although this sampling approach allowed for time-sensitive data collection and large-enough group sizes to test for moderation by sociocultural factors, the present samples were not nationally representative and were limited to Mechanical Turk users who are representative of the general population for many but not all psychosocial characteristics (22). Second, although the demographic makeup of the two samples complemented one another and allowed for conceptual replication, sample B analyses were cross sectional and thus did not provide a direct replication.

Third, we used the extra-short form of the BFI-2. Although this is an efficient and reliable way to assess the Big Five personality traits, it does not allow for facet-level analyses. Fourth, because many of the health behaviors we assessed are private in nature, we relied on self-reports that may be subject to social desirability bias. Finally, the present research did not take into account shifting mandates across time (from March to August) and location (according to state and local guidelines). For example, many of the behaviors that we assessed were recommended by the CDC across the entire study period (e.g., hand washing and social distancing), but others were not added to official CDC guidance until later (e.g., mask wearing). However, all five health behaviors were widely discussed in the public domain throughout the study period and effects were largely consistent across time, suggesting that these shifting mandates likely did not have a large effect on personality-health behavior associations.

CONCLUSIONS

The present research highlights the importance of testing long-standing psychological theories using rigorous methods in the context of real-world crises. By doing so, we gain valuable insights that simultaneously improve theory and inform policy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Source of Funding and Conflicts of Interest:

This research was funded by a Social Sciences and Humanities Research Council Insight Grant awarded to Brett Ford, a University of Toronto COVID-19 Student Engagement Award awarded to Angela Smith, and a National Institute on Aging grant awarded to Daniel Mroczek (R01-AG018436). The authors declare no conflicts of interest.

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TABLE 1.

Descriptive Statistics of Key Study Variables

	Sample A		Sample B	
	M	**SD**	**M**	**SD**
Agreeableness	2.77	0.83	2.75	0.88
Openness	2.81	0.89	2.68	0.94
Conscientiousness	2.86	0.95	2.96	0.93
Extraversion	1.70	0.94	1.72	0.95
Neuroticism	1.63	1.08	1.43	1.11
Time 1 Health behaviors	2.64	0.77	—	—
Time 2 Health behaviors	3.08	0.84	—	—
Time 3 Health behaviors	3.12	0.80	—	—
Time 4 Health behaviors	3.07	0.82	—	—
Time 5 Health behaviors	3.15	0.80	2.95	0.83

All measures were assessed on a 0 to 4 scale.

M = mean; SD = standard deviation; — = not included in the present investigation.

TABLE 2.

Primary Analyses: Personality Predictors of COVID-19 Preventive Health Behaviors

Primary Analyses: Separate Models for Each Trait Adjusting for Demographic Characteristics							
Sample A (Longitudinal)	***B***	**95% CI**	***p***	**Sample B (Cross-Sectional)**	***B***	**95% CI**	***p***
Agreeableness	0.25	0.18 to 0.32	<.001	Agreeableness	0.12	0.03 to 0.22	.011
Openness	0.10	0.03 to 0.17	.005	Openness	0.16	0.06 to 0.25	.001
Conscientiousness	0.15	0.08 to 0.22	<.001	Conscientiousness	0.13	0.04 to 0.22	.007
Extraversion	0.14	0.07 to 0.21	<.001	Extraversion	0.11	0.02 to 0.21	.016
Neuroticism	−0.05	−0.12 to 0.02	.145	Neuroticism	−0.04	−0.13 to 0.06	.477
Neuroticism by conscientiousness	−0.02	−0.08 to 0.05	.616	Neuroticism by conscientiousness	0.00	−0.10 to 0.09	.931

Each row shows results from a separate model. Age, education, gender, racial and ethnic identity, and political affiliation were included as covariates.

CI = confidence interval.

TABLE 3.

Sensitivity Analyses: Predictors of COVID-19 Preventive Health Behaviors

A. Sensitivity Analysis 1: Simple Effects Without Covariate Adjustment							
Sample A (Longitudinal)	***B***	**95% CI**	***p***	**Sample B (Cross-Sectional)**	***B***	**95% CI**	***p***
Agreeableness	0.27	0.20 to 0.34	<.001	Agreeableness	0.14	0.04 to 0.23	.006
Openness	0.12	0.05 to 0.19	.001	Openness	0.22	0.12 to 0.31	<.001
Conscientiousness	0.16	0.09 to 0.22	<.001	Conscientiousness	0.07	−0.02 to 0.17	.141
Extraversion	0.14	0.07 to 0.21	<.001	Extraversion	0.10	−0.00 to 0.19	.055
Neuroticism	−0.05	−0.12 to 0.02	.172	Neuroticism	0.01	−0.08 to 0.11	.771
B. Sensitivity Analysis 2: Unique Effects Controlling for Other Big Five Traits							
Sample A (Longitudinal)	***B***	**95% CI**	***p***	**Sample B (Cross-Sectional)**	***B***	**95% CI**	***p***
Agreeableness	0.25	0.17 to 0.32	<.001	Agreeableness	0.10	0.00 to 0.20	.041
Openness	0.03	−0.04 to 0.10	.333	Openness	0.19	0.09 to 0.29	<.001
Conscientiousness	0.09	0.01 to 0.17	.027	Conscientiousness	0.07	−0.05 to 0.18	.251
Extraversion	0.11	0.04 to 0.18	.004	Extraversion	0.06	−0.05 to 0.16	.312
Neuroticism	0.11	0.03 to 0.19	.006	Neuroticism	0.12	0.00 to 0.23	.041
C. Sensitivity Analysis 3: Effects on Intended Future Behaviors							
Sample A (Longitudinal)	***B***	**95% CI**	***p***	**Sample B (Cross-Sectional)**	***B***	**95% CI**	***p***
Agreeableness	0.25	0.18 to 0.32	<.001	Agreeableness	0.12	0.02 to 0.22	.015
Openness	0.09	0.02 to 0.16	.009	Openness	0.14	0.05 to 0.24	.003
Conscientiousness	0.11	0.04 to 0.18	.002	Conscientiousness	0.12	0.02 to 0.21	.014
Extraversion	0.09	0.03 to 0.16	.007	Extraversion	0.12	0.02 to 0.21	.016
Neuroticism	−0.04	−0.12 to 0.03	.217	Neuroticism	−0.03	−0.13 to 0.07	.569

Each row in panels A and C show results from a separate model. Age, education, gender, racial and ethnic identity, and political affiliation were included as covariates in the models shown in panel C.

CI = confidence interval.