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The Role of Conscientiousness in Health Behavior Adherence

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THE ROLE OF CONSCIENTIOUSNESS IN HEALTH BEHAVIOR ADHERENCE

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Abstract

Conscientiousness, a trait describing the degree to which an individual is industrious and responsible, relates to positive health behaviors (Kern & Friedman, 2008). We randomly assigned participants ($N = 138$) to one of five health interventions, each of which lasted four weeks. Prior to the intervention, participants completed measures of health and personality such as, conscientiousness, self-efficacy, and physical health. As a component of a larger study, individuals provided weekly, date-stamped photos of engagement in their assigned health behavior as a measure of objective adherence to the study. At the end of the four weeks, participants rated their perception of their own adherence to the study. Pearson's correlations were used to find the relationships between the health and personality variables and each measure of adherence. Measured objective adherence was found to be positively correlated with self-control, a facet of conscientiousness. Perceived adherence was positively correlated with facets of conscientiousness: responsibility and virtue, as well as being positively correlated with an independent measure of self-efficacy. These findings are meaningful when applied to health interventions as various facets of conscientiousness may predict who adheres to the treatment, and how individuals perceive their own adherence, ultimately informing the potential for more personalized treatments.

Keywords: conscientiousness, health, adherence, self-efficacy

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The Role of Conscientiousness in Health Behavior Adherence

Introduction

Even the best health care treatments, diets, and training programs fail when individuals do not follow through with the plan. What can be done to encourage adherence to health behaviors? How can health practitioners promote healthy behaviors among people with different personalities? Health behavior adherence is important to understand because it can lead to better health outcomes (Friedman, 2000). The present study begins to address the question of what personality and health factors relate to adherence to health interventions, and whether individuals' perceived adherence to a health behavior differs from their objectively measured adherence to a health behavior.

Researchers looking at implementing current health interventions have had difficulty with keeping people adherent to the desired health behaviors (Cameron & Best, 1987). In their review, the authors noted that participants who make goals, self-monitor their progress, and have high self-efficacy are more likely to have higher adherence rates to health intervention programs than participants who were low in self-efficacy, did not set goals, or self-monitor their progress (Cameron & Best, 1987). Goal direction and fulfillment as well as high self-monitoring are characteristics used in describing one of the Big Five personality traits, conscientiousness. If we delve deeper into the relationship between conscientiousness and health, Friedman's (2000) longitudinal study following participants from elementary school age to death, helps connect the relationship between health behavior adherence and conscientiousness. This research found that individuals who were higher in conscientiousness, ended up living longer and healthier lives than individuals low in conscientiousness. This finding is in part due to conscientious individuals being more likely to practice healthy life choices such as physical activity and

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healthy habits (Friedman, 2000). Stemming from these ideas, it can be hypothesized that individuals who are higher on conscientiousness will be more likely to have high adherence to a health intervention.

If researchers want to fully understand the relationship between health adherence and conscientiousness, a deeper approach should be taken. There are six facets that can be used to gain a better, holistic understanding of conscientiousness: responsibility, order, virtue, self-control, traditionalism, and industriousness (Roberts, Chernyshenko, Stark, & Goldberg, 2005). Each of these six facets expands further the complexity of conscientiousness. Virtue is described as adherence to moral and social standards of good behavior. Individuals who are high in virtue tend to behave in line with laws and rules. Responsibility or dutifulness, is how well an individual carries out plans and duties. Order refers to how well an individual is organized in their life, and how much they value organization. Self-control is how well an individual can control their behavior, and not act impulsively—thinking for the future rather than the now. Traditionalism describes the degree to which a person believes in strict social norms and holds high moral standards. Last, industriousness describes how hard-working a person is. Together these facets form conscientiousness. Though how these facets differentially relate to health and health behaviors has been studied (Hagger-Johnson & Whiteman, 2007), it is still unclear how each facet differentially relates to adherence to a new health intervention. The present study begins to shed light on these relationships.

Understanding conscientiousness and facets thereof in relation to health is only one component of the present study. We also seek to further understand the complexity of health behavior adherence. Adherence to health behaviors can be measured in two

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distinct ways: objectively and subjectively. Objective adherence is a quantitative measure of how well an individual follows through with the health behavior, while subjective (perceived) adherence is the individual's subjective perception of how well they adhered to the health behavior. In a study conducted looking at patient adherence to antipsychotic medication, researchers measured adherence using these two methods: subjective (self-report by participant) and objective measures (taking blood samples and electronic cap measurements). Scores on the subjective and objective measures were found to have no significant correlation to each other. The researchers concluded that subjective measures of adherence were not a reliable measure of medication adherence (Velligan et al, 2007). This current study will use as similar division of adherence by looking at participants' objective (behavioral) adherence and subjective (perceived) adherence.

As a part of a larger study on health intervention, the present study aims to look at the relationship between perceived (subjective) adherence and actual (objective) adherence, and how each relates to measures of conscientiousness and health.

Methods

Participants

The study had a total of 138 participants (95 female) from the University of California, Riverside. Participants were recruited using flyers, emails and through the University's Psychology Subject Pool. Participants were undergraduate and graduate students ranging in age from 17 to 31 ($M = 20.6$). The ethnicity breakdown was 13.8% White/Caucasian, 6.5% African American, 37.7% Hispanic, 31.2% Asian American, 1.4% Pacific Islander, and 9.4% who identified as other. For their participation individuals were entered into a drawing to win healthy prizes at the completion of the study, and were given the option to gain research credit through the Psychology Subject

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Pool. Because the study was a longitudinal study, 28 participants dropped out between pretest and posttest, leaving a total of 110 participants (79 female) who completed two time points.

Procedure

The study was longitudinal and took place over the course of 10 weeks. The participants came into the lab at the first time point to take the initial questionnaire which stood as a baseline for the participants' health behaviors. Participants were then randomly assigned to one of five health interventions: indoor plant growing, physical activity, social film club, communing with nature, and community gardening. The indoor plant group was given two pots in which they planted radish seeds and basil to take home and grow. The physical activity group was to do moderate intensity indoor physical activity each week. The participants in the social group, took part in a weekly social film club, where they would watch and discuss a film with a peer group. Communing with nature involved participants sitting alone in a natural setting. Lastly, the community garden group went to the University of California, Riverside community garden and helped with various gardening tasks. Each participant was instructed to engage in their health behavior for two hours a week for four weeks, and to send a date-stamped picture of themselves participating in their healthy activity each week. Halfway through the intervention the participants were emailed a questionnaire to complete (Time 2). After their intervention, the participants came into the lab and took another questionnaire, including their perceived adherence rating (Time 3, posttest). The fourth and final questionnaire was sent out three weeks after the completion of the intervention, to assess follow-up effects of the interventions (Time 4).

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For the purpose of the present study, adherence will be related to variables taken at Time 1 (pre-test) measures. As this study is a longitudinal study the number of participants at Time 1 ($N=138$) is greater than the number of participants at Time 3 ($N=110$), due to individuals dropping from the study. This means that fewer participants completed the perceived adherence scale ($N=110$) than were measured for objective adherence ($N=138$). As the present study was part of a larger health intervention study this paper will focus only on components of the larger study relevant to the study reported here.

Materials

Adherence was measured in two ways: objective and subjective (perceived). For the objective measure of adherence, participants sent in a weekly date-stamped photo of them completing the health intervention that they were assigned. Adherence was ranked on a 0 to 5 measure. A 0 indicated the participant dropped out of the study. A 1 was given if the participant completed a workshop that oriented them toward their health behavior. This workshop was required for continuation in the study. Participants received an additional point in their objective adherence score for every week they completed their assigned behavior and sent a date-stamped photo to the researcher (up to four). Subjective adherence was measured by participant self-evaluation at Time 3 (posttest). The participant rated how well they thought they adhered to the weekly health behavior on a scale of 0 to 100 (0=did not adhere at all and 100=adhered perfectly).

Personality was measured using the 44-item Big Five Inventory (BFI; John, Donahue, & Kentle, 1991). The facets of conscientiousness were derived from the 60-item Chernyshenko Conscientiousness Scale (Hill & Roberts, 2011): self-control,

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industry, traditionalism, order, responsibility and virtue. An additional self-control scale was used to measure participants' self-control (Tangney, Baumeister, & Boone, 2004). The 4-item Global Physical Health Scale, a subscale of the 10-item Global Health Short Form, was used to measure physical health (PROMIS; Hays, Bjorner, Revicki, Spritzer, & Cella, 2009). The 4-item Global Mental Health Scale, a subscale of the 10-item Global Health Short Form, as used to measure mental health (PROMIS; Hays, Bjorner, Revicki, Spritzer, & Cella, 2009). Self-efficacy was measured using a 10-item scale (NIH TB; Gershon et al., 2013). To measure stress, the 10-item Perceived Stress Scale was used (Cohen, Kamarck & Mermelstein, 1983). All measures were completed at Time 1, with the exception of perceived adherence, which was completed at Time 3.

Results

A Pearson's product-moment correlation was calculated for each health and personality variable with measured and perceived adherence (see Table 1). These correlations were then compared using Z-score comparisons (see Table 2). A statistically significant Z-score indicates that the correlation between measured (objective) adherence with a variable is significantly different from the correlation between perceived adherence and the same variable.

Adherence

Perceived and measured adherence were positively related, $r(108) = 0.475$, $p < .01$, accounting for 22.6% of the variance.

Big Five

No Big Five trait was found to have a correlation with perceived adherence, however conscientiousness was found to have a relationship with trending significance,

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$r(108) = 0.184, p = .055$. Each of the other personality traits did not have a significant relationship with perceived adherence: neuroticism, $r(108) = -.129, p = .178$, openness, $r(108) = -.020, p = .636$, agreeableness, $r(108) = .046, p = .636$, and extraversion, $r(108) = .022, p = .821$. Measured adherence was found to only have one significant relationship, with extraversion, $r(136) = -.221, p = .009$. No other personality trait was found to have a significant relationship with measured adherence: conscientiousness, $r(136) = .082, p = .34$, neuroticism, $r(136) = -.020, p = .817$, openness, $r(136) = -.024, p = .784$, and agreeableness, $r(136) = .023, p = .793$. The correlations of each personality trait and both measures of adherence were then compared for significance. Only the correlations between extraversion and measured and perceived adherence were found to be significantly different, $z = 2.481, p = .007$. There was no statistical difference between perceived and objective adherence in relation to conscientiousness $z = 1.042, p = .149$, neuroticism, $z = -1.105, p = .135$, openness, $z = .04, p = .484$, and agreeableness, $z = .232, p = .408$.

Facets of Conscientiousness

Responsibility and perceived adherence were found to have a significant correlation, $r(108) = 0.221, p = .020$. Objective adherence and responsibility did not have a significant correlation, $r(136) = .082, p = .342$. There was no statistical difference between perceived and objective adherence in relation to responsibility, although it was trending towards significance, $z = -1.427, p = .077$.

Traditionalism did not have a significant relationship with perceived adherence, $r(108) = .148, p = .123$. There was a positive correlation between traditionalism and measured adherence that was trending significance, $r(136) = .166, p = .051$. There was no

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statistical difference between perceived and objective adherence in relation to traditionalism, $z = -.185$, $p = .427$.

Industry had a positive correlation with perceived adherence that was trending significance, $r(108) = .165$, $p = .085$. Industry and measured adherence did not have a significant relationship, $r(136) = .036$, $p = .675$. The z-comparison showed a difference between perceived and measured adherence that was trending significance, $z = 1.313$, $p = .095$.

Order did not have a significant relationship with perceived adherence, $r(108) = .137$, $p = .153$. Order had a positive relationship with objective adherence trending towards significance, $r(136) = .147$, $p = .085$. There was no statistical difference between perceived and objective adherence in relation to order, $z = -0.102$, $p = .459$.

Virtue and objective adherence did not have a significant relationship $r(136) = .124$, $p = .149$. Virtue and perceived adherence did have a significant positive correlation, $r(108) = 0.214$, $p = .025$. There was no statistical difference between perceived and objective adherence in relation to the virtue facet of conscientiousness, $z = -0.926$, $p = .177$.

There was a no relationship between the self-control conscientiousness subscale and objective adherence, $r(136) = 0.124$, $p = .147$. Perceived adherence and the self-control facet of conscientiousness had no correlation, $r(108) = .124$, $p = .195$. There was no statistical difference between perceived and objective adherence in relation to the self-control facet of conscientiousness, $z = 0.769$, $p = .221$.

An additional measure of self-control was used in addition to the Chernyshenko subscale. This separate measure was found to have a significant relationship with

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objective adherence, $r(136) = .190, p = .026$, but had no relationship with perceived adherence, $r(108) = .115, p = .23$. There was no statistical difference between perceived and objective adherence in relation to the independent measure of self-control, $z = 0.779, p = 0.218$.

Health and Personality Measures

The self-report measure of self-efficacy was found to have a significant correlation with perceived adherence, $r(108) = 0.324, p = .015$. Measured adherence and self-efficacy did not have a significant relationship, $r(136) = -.051, p = .552$. There was a stronger correlation between perceived adherence and self-efficacy than between objective adherence and self-efficacy, $z = -2.892, p = .002$.

Stress and perceived adherence had a negative relationship, $r(108) = -0.221, p = .020$. Stress and measured adherence did not have a significant relationship, $r(136) = -.126, p = .14$. There was no statistical difference between perceived and objective adherence in relation to stress, $z = 0.979, p = .164$.

Mental health and physical health both had a significant relationship with perceived adherence, $r(108) = 0.19, p = .046$ and $r(108) = 0.258, p = .007$, respectively. Objective adherence had no significant correlation with mental health, $r(136) = .070, p = .416$, nor with physical health, $r(136) = .033, p = .701$. There was no statistical difference between perceived and objective adherence in relation to the mental health, $z = -1.226, p = .11$. There was a stronger correlation between perceived adherence and physical health than between objective adherence and physical health, $z = -2.313, p = .01$.

No significant correlations were found with gender and objective adherence, $r(136) = .066, p = .442$, or gender and perceived adherence, $r(108) = -.041, p = .674$.

There was no significant difference between objective and perceived adherence in regards to gender, $z = -1.081$, $p = .14$.

Discussion

In the present study, adherence—how well an individual continues and follows through with a treatment—was measured in two different ways: objectively through empirically collected data and subjectively through participant self-report. Over the course of the study, 28 individuals dropped out completely, leaving only 110 participants at Time 3 who filled out the perceived adherence measure. This may have left a slight skew in our data as it has been found that higher conscientious individuals have lower dropout rates (Nestler, Thielsch, Vasilev, & Back, 2015). This will be discussed in more detail later.

We expected to find a stronger relationship between the two measures of adherence; 22.6% of variation in measured (objective) adherence could be explained by perceived adherence and vice versa. That leaves a sizable percentage to be explained by other factors. This finding is in line with the findings of Velligan et. al (2007), stating that subjective and objective measures of adherence may not be strongly related. By looking at the different aspects of conscientiousness and other related measures of health, we can begin to explore the differences between the two measures of adherence.

Conscientiousness

Conscientiousness (from the BFI) was found to have a positive relationship with perceived adherence that was trending significant. Significant correlations were found for two out of the six facets (virtue and responsibility) with perceived adherence.

Measured adherence was found to have a small positive relationship with the independent

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self-control measure, and a trending positive relationship with the facets, traditionalism and order.

Self-control is the ability for an individual to weigh two opposing options—one that is better in the long-term and the other which is not as good for the long term, but is satisfying in the short term (Fishbach & Shah, 2006). While the self-control sub-scale on Chernyshenko's Conscientiousness Scale (Roberts, Chernyshenko, Stark, & Goldberg, 2005) was not significantly correlated to objective or perceived adherence, the independent scale measuring self-control had a significant positive relationship to objective adherence. By looking at the questions in each of these scales, a slight difference can be seen. The independent scale of self-control (Tangney, Baumeister, & Boone, 2004) focused more on right versus wrong and avoiding temptations, while the Chernyshenko sub-scale (Hill & Roberts, 2011) focused on impulsivity and avoiding making rash decisions. The difference in wording on these two scales may have led to the difference seen in the results, indicating the opportunity for more research into the field of self-control and adherence.

Perceived adherence was found to have a significant relationship with the facets: virtue and responsibility. These two factors combine to make up a higher-level facet of conscientiousness: integrity (Roberts, Chernyshenko, Stark, & Goldberg, 2005). Virtue and responsibility are similar in nature and each contribute to integrity in different ways. Virtue is the belief that following the rules are a good and important part of life. In the present study, individuals who were highly virtuous saw themselves as adhering well to the intervention. The belief that one adhered well to their assigned health intervention (perceived adherence), coincides well with the belief that one is rule following.

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Shifting to the second facet, responsibility, characterized by placing a high value on reliability, getting along well with others, and contributing to their community (Roberts, Chernyshenko, Stark, & Goldberg, 2005), was moderately correlated with perceived adherence. Fostering a better community and taking a direct role in making the community better is very important to people who are high on the facet of responsibility. Individuals high on responsibility perceived that they adhered well to the study, however their actual adherence was not significantly correlated, indicating that they believed they adhered better than they did.

The disconnect between action and perception may be because both the measure of responsibility, a facet of conscientiousness, and perceived adherence are based on self-report measures, while objective adherence is a behavioral measure. This fallacy is known as common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). If an individual perceives oneself as being responsible, then perceiving oneself as following through with a task makes sense. For example, in the questions regarding responsibility, the participant is asked to rate how well they stick with a task, and then later asked to rate how well they believed they adhered to a task. These two questions are, in practice, measuring the same construct. As the data showed, participants who rated themselves higher on responsibility rated themselves higher on perceived adherence. On the other end an individual's actions need to be measured as well, because there may be a disconnect in an individual's perception of themselves and the actions conducted by the same individual. Further research should use more measures of objective and subjective adherence, as well as objective and subjective measures of personality traits which could lead to a better understanding of this phenomena.

Extraversion

Extraversion (from the BFI) was found to have a moderate negative relationship with objective adherence. This relationship was found to be significantly greater than the relationship between extraversion and perceived adherence, meaning that overall individuals high on extraversion objectively adhered poorly to their health behavior, while their perception of their adherence to the health behavior was found to be not related to extraversion. Previous studies have looked at extraversion in its relation to health-relevant constructs. In a longitudinal study, high extraversion was found to be positively correlated to high subjective well-being (Friedman, Kern, & Reynolds, 2010). A study on exercise adherence and personality found that high-levels of extraversion was positively correlated to high, self-reported exercise adherence (Wheeler, Wagaman, & McCord, 2012). The results of the current study offer further understanding of extraversion and its relation to health. Extraversion has been shown to be positively correlated with health constructs such as well-being and exercise, however that does not mean that these individuals adhere well to health interventions. Individual's high in extraversion, may just be more likely to exercise overall, and because of their increased social circle they may believe themselves to have high well-being. Extraversion may be related to health-relevant constructs for reasons other than strict adherence to health interventions. Further studies should look deeper into the facets of extraversion and their relation to health and health behavior adherence.

Health Measures

Health measures and their relationship to both measures of adherence were analyzed to get an understanding of how self-reported health relates to how well an

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individual adheres to health behaviors. If a participant saw themselves as having high physical health at the beginning of the experiment, at the end of the experiment they were more likely to rate themselves high on adherence. When compared with their actual, measured adherence participants thought they adhered more than they objectively did, as shown through the z-comparison (see Table 2). High physical health ratings had no relationship as to whether an individual objectively adhered to the study. Mental health and perceived adherence were found to be negatively relate—high stress levels also related to a lower perception of adherence, showing that the more stress an individual has in their life, the less likely they are to think they adhered to health behaviors. A possible explanation for these findings is that more stressed individuals usually have many activities going on in their life leaving little room for the study, which then influences the participant to perceive that they are not adhering as well as they should. The sample we had consisted of college undergraduate and graduate students, and at Time 3, when perceived adherence was measured, finals for the quarter were three weeks away. Students who do not handle stress well or have overall higher amounts of stress could have minds preoccupied with other things, such as school, and in hindsight rated themselves as having adhered worse to the study.

Self-efficacy was found to be moderately correlated with perceived adherence. Individuals high in self-efficacy perceived themselves as adhering well to their assigned health intervention, while these individuals did not actually adhere better to their health intervention. Many studies have shown that high self-efficacy is related to high adherence, however most of these studies depend on subjective, self-report measures of adherence. One such study looked at self-efficacy and adherence to HIV treatment

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(Luszczynska, Sarkar, & Knoll, 2007). This study concluded that high self-efficacy led to a rise in adherence to HIV treatment for patients. The findings of this study show that an individual high in self-efficacy will report that they are adhering to their treatment or health behavior, even when they may not actually be adhering that well. The findings of the current study suggest that individuals who rate themselves high in self-efficacy, may just rate themselves higher on adherence because of the beliefs they hold about themselves. It may be dangerous to base conclusions of adherence to a study solely based on self-report measures of adherence, especially when the individual rates themselves high on self-efficacy.

Limitations

The current study design is only able to show correlational relationships between adherence and different facets of conscientiousness, as well as additional measures of health and personality. Because we are not able to experimentally manipulate adherence, or health and personality variables, we are unable to show a causal relationship in the present study. Additionally, the participants in this study were limited to young, college undergraduate and graduate students. Expanding beyond this group would allow for more generalizability beyond a University campus. The sample size of participants was relatively small for a study with many intervention groups, and a larger sample size may allow for stronger, more reliable results. Most of the measures compared with adherence in this study were subjective measures filled out by the participants, which may have skewed the results by self-reported measures having more correlations with perceived adherence. Another possibility is that the participants who dropped out of the study before Time 3—decreasing the sample size—caused an increase in the average

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conscientiousness scores and a decrease in the variation of the participants who rated themselves on subjective (perceived) adherence. The present study did not look at the differences. Conducting a study with behavioral measures of traits and a fully stable sample would give a more complete picture.

Conclusion and Future Studies

The study conducted aimed to look at the relationships between adherence to health behaviors and various personality and health measures. Perceived adherence was found to be positively correlated to facets of conscientiousness, responsibility and virtue, and physical health. It was found to be negatively correlated to mental health and stress. Objective adherence was found to be positively correlated to the independent measure of self-control, and negatively correlated with extraversion. Understanding what aspects of personality are positively correlated with health behavior adherence, can allow researchers and physicians to expand on the current adherence research; finding ways to incorporate interventions that appeal to these personality traits that correlate with high adherence, while simultaneously compensating for those personality traits that show low or negative relationships with adherence. It is also important to understand how perceived adherence and measured adherence differ across personality traits. Knowing the difference between what individual's report and what is being done regarding their health can help physicians take better care of patients. A larger study incorporating a larger and more diverse population could help future researchers more clearly understand how people adhere to treatments and interventions, and provide physicians with information to better understand how to help their patients adhere. By getting a clear picture of

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adherence to health behaviors researchers and practitioners will be able to help individuals live healthier and longer.

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Appendix

Table 1

Pearson's Product Moment Correlations for Objective and Perceived Adherence with Personality and other Health Measures

	Objective Adherence	Perceived Adherence
Conscientiousness	.082	.184 [†]
Traditionalism	.166 [†]	.148
Order	.147 [†]	.137
Virtue	.124	.214*
Responsibility	.082	.221*
Industry	.036	.165 [†]
Self-Control	.124	.124
Openness	-.024	-.020
Extraversion	-.221**	.022
Agreeableness	.023	.046
Neuroticism	-.020	-.129
Self-Control (independent scale)	.190*	.115
Self-Efficacy	-.051	.232*
Stress	-.126	-.221*
Mental Health	.070	.190*
Physical Health	.033	.258**
Gender	.066	-.041

Note: [†] $p < .10$, * $p < .05$, ** $p < .01$, $N = 138$ for Measured Adherence, $N = 110$ for Perceived Adherence

CONSCIENTIOUSNESS AND HEALTH BEHAVIOR ADHERENCE

Table 2

Z-Comparison Scores between Objective and Perceived Adherence and Health and Personality Variables

Health and Personality Variable	Z- Comparison Score
Openness	0.040
Extraversion	2.481**
Agreeableness	0.232
Neuroticism	-1.105
Conscientiousness	1.042
Traditionalism	-0.185
Self- Control	0.769
Order	-0.102
Virtue	-0.926
Responsibility	-1.427 [†]
Industry	1.313 [†]
Self-Control (independent scale)	0.779
Self-Efficacy	-2.892**
Stress	0.979
Mental Health	-1.226
Physical Health	-2.313**
Gender	1.08

Note: [†] $p < .10$, * $p < .05$, ** $p < .01$, $N = 110$. Positive Z-comparison scores indicate that the correlation with objective adherence is significantly higher than perceived adherence, and negative z- comparison scores indicate that the correlation with perceived adherence is significantly higher than objective adherence.