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Clinical Psychology

Dyadic Associations Between Conscientiousness Facets, Health, and Health Behavior Over Time

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Previous studies show consistent associations between conscientiousness and health outcomes. However, less is known about how various facets of conscientiousness, of both individuals and their partners, are associated with changes in health in older adults over time. Applying the actor–partner interdependence model, we examined dyadic associations of broader conscientiousness and its six facets and changes in health, health behavior, and well-being in middle-aged and older couples. With a sample of 3,271 couples (N=6,542) from the Health and Retirement Study, we found that actor conscientiousness, orderliness, and industriousness were most reliably associated with better health outcomes over time. Partner orderliness was associated with better health and more positive health behavior. The remaining associations were near-zero in their effect sizes. Many of these associations persisted over the 10-year period of the study, and there was little evidence for gender differences or multiplicative interactions.

The personality of one's romantic partner is associated with an individual's intra- and interpersonal functioning. In one of the first studies examining the spousal effects of personality on physical health, Roberts, Smith, Jackson, & Edmonds (2009) found that having a spouse high in conscientiousness (e.g., being goal-directed, organized, able to control their impulses) was associated with better health over and above an individual's own level of conscientiousness (subsequently replicated in Nickel et al., 2017). Although this research was an important first step in examining associations between spousal personality and health, it is still unclear which *particular* aspects of conscientiousness are most reliably associated with better health within couples. Only examining overall conscientiousness might obscure more descriptive findings found by looking at particular features of conscientiousness. For example, does this association exist because conscientious partners are more responsible or orderly? Having responsible and orderly partners might be more likely to encourage their partners to exercise regularly, remind them to take their medication, or help them keep their scheduled doctor's appointments. Or does this association exist because conscientious partners are more traditional and may help individuals avoid risky situations?

Unfortunately, these aspects of conscientiousness, or *facets*, and their associations with health have not been examined within couples very much. Most research on individual and partner personality traits to health and well-being has focused on broader, super-ordinate traits rather than their subordinate facets (John et al., 2008; Orth, 2013). Nevertheless, recent efforts aimed at delineating facet-level information from personality traits have been fruitful—lower-order personality facets are associated with distinct outcomes over-and-above the contribution of the super-ordinate trait (Chopik, 2016; J. J. Jackson et al., 2009; Soto et al., 2011). Is this also true in the context of spouses' personalities conferring health benefits? The current study builds on the research by examining the dyadic associations of conscientiousness and its facets on changes in health and health behavior over time.

Conscientiousness and individual health

The Big Five personality traits are extraversion, neuroticism, conscientiousness, agreeableness, and openness to experience. Of all the Big Five traits, conscientiousness has been most consistently associated with better health and health behavior (Roberts, Walton, et al., 2005; Roberts & Bogg, 2004). Conscientiousness is a personality trait that describes individuals who are goal-directed, organized, able to control their impulses, and follow socially accepted norms and values (John & Srivastava, 1999). Much of the research on conscientiousness details its purported benefits with respect to physical health, occupational success, and marital stability across the lifespan (Bogg & Roberts, 2004; Hogan & Holland, 2003; Roberts, Walton, et al., 2005; Roberts & Bogg, 2004; Shanahan et al., 2014). Not sur-

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prisingly, conscientious individuals engage in many healthy behaviors (Bogg & Roberts, 2004; Friedman et al., 1993). Further, a meta-analysis demonstrated a negative association between conscientiousness and risky health behaviors, like excessive drinking, tobacco/drug use, unhealthy eating, risky driving, risky sex, suicide, and violence (Bogg & Roberts, 2004). The protective health behaviors of conscientious individuals may also explain the trait's relationship with longevity (Graham et al., 2017; Hampson et al., 2013). Based on a seven-decade longitudinal study of gifted children, childhood conscientiousness was significantly related to higher survival in middle to old age (Friedman et al., 1993). The magnitude of this effect (a relative hazard ratio of 1.20) is comparable to other risk factors (e.g., higher levels of systolic blood pressure and cholesterol) for all-cause mortality (Bogg & Roberts, 2004).

Recent efforts at identifying and measuring *facets* of conscientiousness have provided additional insight into how conscientiousness is associated with health. The facets of conscientiousness most often studied are impulse/self-control (cautious v. careless), orderliness (organized v. sloppy), industriousness (tenacious v. lazy), conventionality/traditionalism (traditional v. nonconforming), reliability/responsibility (dependable v. unreliable), and virtue (honesty v. dishonesty) (Chopik, 2016; Roberts, Chernyshenko, et al., 2005; Schwaba et al., 2020; Stephan et al., 2019; Sutin et al., 2018). For example, broader conscientiousness, orderliness, industriousness, and responsibility are most consistently associated with better health and fewer chronic illnesses (Chopik, 2016; Roberts, Chernyshenko, et al., 2005), a reduced risk of developing dementia (Sutin et al., 2018), and lower likelihood of mortality among older individuals (Stephan et al., 2019).

Other facets of conscientiousness may be less commonly associated with health and well-being. For example, Roberts and colleagues (2005) tested the validity of six facets of conscientiousness and correlated them with self-reported measures of health behavior. Among six facets, only responsibility and orderliness were associated with preventive health behaviors (e.g., exercise, regular doctor visits). Similarly, Chopik (2016) examined longitudinal associations between conscientiousness facets and physical health among older adults, finding that responsibility and orderliness were associated with better global health (i.e., a global evaluation of one's health) and fewer chronic illnesses, and industriousness and self-control were associated with fewer chronic illnesses. The persistence in adhering to healthy behaviors (i.e., diet and exercise, a sign of industriousness) and avoidance of unhealthy habits (i.e., drug use, a sign of self-control) may be particularly valuable in preventing the development of chronic illnesses in older adulthood.

Partner conscientiousness and health

Extant work on conscientiousness facets has focused exclusively on individual-level health outcomes. Indeed, there are no existing studies examining the dyadic associations of conscientiousness facets on health outcomes over time. Although our current study is not well equipped to isolate the exact causal effect of conscientiousness on health, it seems reasonable, at least on the surface, that conscientiousness facets in one person would be associated with better health in their romantic partner. Perhaps the most convincing evidence comes from demonstrations of how couple members' health and health behavior are coordinated with each other over time. Couples tend to change in similar ways with respect to their social activities, physical limitations, cognition, health, and happiness (Hoppmann et al., 2008; Hoppmann, Gerstorf, & Hibbert, 2011; Hoppmann, Gerstorf, Willis, et al., 2011; Hoppmann & Gerstorf, 2009). Further, when one person initiates a positive health change, their partner is quick to follow, whether it be quitting smoking, drinking less, exercising more, going for a cholesterol screening, getting a flu shot, or losing weight (Falba & Sindelar, 2007; S. E. Jackson et al., 2015).

As a result, it is likely that one person's personality can be associated with his/her partner's health, considering the associations of conscientiousness at the individual level and the degree of coordination between romantic partners. There is preliminary evidence that having a conscientious partner is associated with better global health and fewer functional limitations (Nickel et al., 2017; Roberts et al., 2009). Unfortunately, the two previous studies examining the dyadic effects of conscientiousness on health were cross-sectional, only examined broader conscientiousness, and did not examine health behavior. Thus, no study has examined the associations between partner conscientiousness (facets) and health and health behavior over time.

Approaching the question of whether actor and partner conscientiousness facets are associated with health and health behavior over time necessarily involves making some assumptions about the causal role of these variables on health more generally. Although many previous studies have not carefully laid out the causal linkages between conscientiousness and health, we feel that it is reasonable to assume that higher levels of conscientiousness have at least some causal effects on health (e.g., conscientiousness is an individual difference factor that motivates healthy behavior, and this might explain conscientious people are healthier). Making an assumption like that was a necessary motivator for the analyses below. However, knowing the exact extent to which it is conscientiousness per se and not an additional variable that shares some overlapping variance with conscientiousness can be challenging. This is especially the case given that conscientiousness is often examined in cross-sectional studies and in isolation of other characteristics (which might be considered parcels of conscientiousness, antecedents of conscientiousness, or even mechanisms along the chain linking conscientiousness to health).

The current study makes some of those same assumptions—it assumes that conscientiousness facets—of both people—might have some association with health. We provided some reasons why we think an association might exist, and we think conscientiousness is probably unique in the way that it affects health because there is not as much evidence for other characteristics doing so. Nevertheless, our study design is such that it cannot incontrovertibly prove a causal association between these variables. Necessary elements would include a strong consideration of covariates, time-ordered processes, related constructs, ran-

dom assignment, and better measurement. In the remainder of the paper, we try to be careful with how we portray and discuss the findings. Specifically, we provide a descriptive account of the associations between conscientiousness and health across partners and promise nothing more. We return to the difficulty in establishing causal inferences in individual difference characteristics on health in the Discussion.

The Current Study

In the current study, we examined the dyadic associations of conscientiousness facets on changes in health and health behavior over time. A large sample of middle-aged and older couples completed a facet-level measure of conscientiousness and measures of health and health behavior five or six times over a 10-year period. Because previous research has previously established an association between spousal (broader) conscientiousness and health (Roberts et al., 2009), we controlled for a broader measure of conscientiousness in our analyses. We employed the actor-partner interdependence model to examine the associations of individual and spousal conscientiousness on health and health behavior over time.

We also ran three additional analyses. First, we examined if any actor or partner associations of conscientiousness on health were moderated by time. These analyses test if the associations of conscientiousness persist, decline in magnitude, or increase in magnitude over time. Second, we examined whether the associations of conscientiousness facets and the outcomes were stronger for men or women. These analyses were conducted because some research suggests that women's behavior might have a stronger influence on their male partners' health decisions and outcomes (Thomeer et al., 2013; Williams & Umberson, 2004). Third, we examined whether a "compensatory" association of conscientiousness facets existed for couples. A compensatory association would suggest that having a partner *higher* in a conscientiousness facet shows a larger association with health (i.e., compensates) for an individual having *lower* standing on that facet (Roberts et al., 2009).

Differences from prior work

In the interest of full disclosure, we are using data (from the Health and Retirement Study) that have been previously used in and overlaps with other reports examining associations between conscientiousness and health-related outcomes (Chopik, 2016; Roberts et al., 2009; Stephan et al., 2019; Sutin et al., 2018). The most relevant papers have looked at either conscientiousness facets at the individual level (and their associations with health and health behavior; Chopik, 2016) and dyadic effects of broader conscientiousness on health (Roberts et al., 2009). Our work is unique from the Chopik (2016) report by examining data from both romantic partners, additional outcomes (depression and health behavior in addition to global health and chronic illnesses), and additional waves (10 years of data instead of 4). Our work is also unique from Roberts et al. (2009) report by examining longitudinal data over 10 years (instead of cross-sectionally), investigating facets (in addition to broader conscientiousness), and examining additional outcomes (chronic illness, depression, and health behavior in addition to global health).

Method

Participants were 3,271 middle-aged and older opposite-sex couples (6,542 individuals; M_{age} = 67.34, *SD* = 8.59) from the Health and Retirement Study (HRS). Participants averaged 13.01 (*SD* = 2.93) years of education. The racial/ethnic breakdown of the sample was: 83.2% White/Caucasian, 7.4% Black/African American, 7.3% Hispanic, and 2.1% other. HRS is a nationally representative and prospective panel study that has surveyed more than 22,000 Americans aged 50+ every two years (Sonnega et al., 2014). Data have been collected since 1992. The current study reports on psychological and health data collected in 2008, 2010, 2012, 2014, 2016, and 2018. The University of Michigan is responsible for the study and provides extensive documentation about the protocol, instrumentation, sampling strategy, and statistical weighting procedures. The data use agreement of HRS does not allow for the public sharing of data. However, we have uploaded our syntax and output files at https://osf.io/q6fvh/. Full details on the methodology and previously published papers using the data can be found on the HRS website (https://hrs.isr.umich.edu/).

In 2006, a random 50% of HRS respondents were selected for an enhanced face-to-face interview. In 2008, the remaining 50% of HRS respondents were visited for an enhanced face-to-face interview. Respondents received a self-report psychosocial questionnaire every other wave (every four years) that they completed and mailed to the University of Michigan. Facet-level information for conscientiousness is available for 2008 and 2010 only. Thus, two distinct cohorts were formed that had psychosocial assessments and health information (i.e., Cohort 1: Assessed in 2008, 2010, 2012, 2014, 2016, and 2018; Cohort 2: Assessed in 2010, 2012, 2014, 2016, and 2018). Thus, half the sample had six waves of data on the outcomes, and the other half of the sample had five waves of data on the outcomes.

The cohorts were combined into one sample for the present analyses to increase statistical power and precision; cohort source did not moderate any of the effects reported below. Facet-level information on the other Big Five personality traits was not collected. Inclusion of the other four personality traits (i.e., neuroticism, extraversion, agreeableness, openness) did not substantively change the results reported below, so they were not considered further. We gained access to data from opposite-sex couples in which both husbands and wives privately completed all target measures. Using Ackerman and Kenny (2016)'s APIM-Power program, we ran a sensitivity analysis to examine the smallest possible effect size we could detect at 80% power (at α = .05) with 3,271 couples. Results from this analysis suggested that we could reliably detect effects as small as *r* = .034.

Measures

Conscientiousness. Global conscientiousness was measured with an adjective-based measure developed for studying midlife development (Lachman & Weaver, 1997). Partic-

ipants rated the extent to which five adjectives (organized, responsible, hardworking, careless, thorough) described them on a four-point scale ranging from 1(*not at all*) to 4(*a lot*). Ratings were averaged to yield a composite of conscientiousness (α_{2008}=.66; α_{2010}=.68). This broader, adjective-based measure was included in addition to the facet measure (below).

We elected to include this additional measure of conscientiousness (instead of a composite of the facet-level information) because of its inclusion in past dyadic research on this topic in this sample (Roberts et al., 2009) and its inclusion in other, related panel studies (e.g., MIDUS; Hill et al., 2012) to allow for more direct comparisons to the effects found in the current study.

Facets of conscientiousness. An inventory that tapped into six facets of conscientiousness was used (Roberts, Chernyshenko, et al., 2005). The six facets available in the current study were self-control, orderliness, industriousness, traditionalism, virtue, and responsibility. Each facet was assessed with four items to which participants agreed or disagreed using a six-point scale ranging from 1(*strongly disagree*) to 6(*strongly agree*).

The self-control facet assesses the degree to which people can inhibit actions, feelings, and emotions (e.g., "I often rush into action without thinking about potential consequences"; α_{2008}=.52; α_{2010}=.52). The orderliness facet assesses the degree to which people are organized versus messy/disorganized (e.g., "I hardly ever lose or misplace things"; α_{2008}=.48; α_{2010}=.45). The industriousness facet assesses the degree to which people work hard and complete tasks (e.g., "I make every effort to do more than what is expected of me"; α_{2008}=.63; α_{2010}=.63). The traditionalism facet assesses the degree to which people follow social norms and traditions (e.g., "I support long-established rules and traditions"; α_{2008}=.44; α_{2010}=.44). The virtue facet assesses the degree to which people try to be honest and tell the truth (e.g., "If the cashier forgot to charge me for an item, I would tell him/her"; α_{2008}=.49; α_{2010}=.51). The responsibility facet assesses the degree to which people are reliable and responsible in their actions (e.g., "I carry out my obligations to the best of my ability"; α_{2008}=.53; α_{2010}=.54). The virtue facet is one originally proposed by Roberts et al. (2005) but was not examined in Jackson et al. (2009)'s study of age differences.

The low reliabilities of the facet scales result primarily from the short length of the questionnaire. Low reliabilities are common in short personality scales (Donnellan et al., 2006; Gosling et al., 2003). The aforementioned validation study ensured that these facets were reliably distinct from one another and showed strong consistency when the full version is used (Roberts, Chernyshenko, et al., 2005). Further, one previous study using this short measure demonstrated that it can reliably capture variation across development and is associated with distinct health outcomes, replicating research that uses the longer scale (Chopik, 2016; J. J. Jackson et al., 2009). Nevertheless, we acknowledge this as a limitation of the current study.

Health Measurements. Health was assessed at each wave using two different measurements. First, global health was assessed with a single item, "Would you say your health is excellent, very good, good, fair, or poor?" Participants rated their health on a scale ranging from 1(*poor*) to 5(*excellent*).

Second, an index of eight major chronic illnesses was computed for each participant at each wave. Participants were asked to report if he or she was diagnosed by a physician with any of the following: (1) high blood pressure, (2) diabetes, (3) cancer or a malignant tumor of any kind, (4) lung disease, (5) coronary heart disease including heart attacks, angina, and congestive heart failure, (6) emotional, nervous, or psychiatric problems, (7) arthritis or rheumatism, and (8) stroke. The number of major health problems was summed so that higher values reflect more health problems.

Depression. Depression was assessed using a modified eight-item version of the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). Participants indicated whether or not they experienced any of these symptoms in the past week: feeling depressed, felt everything they did was an effort, restless sleep, happiness, lonely, enjoyed life, sad, felt unmotivated. The number of depressive symptoms was summed, with higher levels indicating higher levels of depression. Internal consistency for the CES-D was high (α = .82)(Ayotte et al., 2010).

Physical activity. Physical activity was assessed with three questions asking about different levels of activity. Participants were asked to answer with how often they engaged in forms of light (e.g., vacuuming, laundry), moderate (e.g., gardening, walking at a moderate pace), and vigorous (e.g., running/jogging, working out at the gym) forms of physical activity on a scale from 1(*hardly ever or never*) to 5(*every day*).

Statistical Analyses

To account for the interdependence of individuals within dyads, we used multi-level modeling (MLM) procedures recommended for dyadic data analysis (Kenny et al., 2006). In MLM, the actor-partner interdependence model estimates both *actor effects* (associations between a person's conscientiousness and his/her own health and physical activity) and *partner effects* (associations between a person's conscientiousness and his/her partner's health and physical activity) while accounting for the statistical non-independence of members in a couple. Both actor and partner effects of conscientiousness (facets) were tested as moderators of changes in health, depression, and physical activity within couples over time.

Conscientiousness (facets) at the first assessment wave were treated as time-invariant and used as predictors of changes in health, depression, and physical activity. Health, depression, and physical activity were time-varying variables, and the linear effect of time was modeled in each analysis.

Following recommended procedures, gender was contrast-coded (-1 = men, 1 = women) and predictor variables (partner/actor global conscientiousness, conscientiousness facets) were grand-mean centered (Kenny et al., 2006). Global health, chronic illness, depression, and physical activity served as the dependent measures. Separate multilevel models were conducted predicting each of the six outcomes from actor conscientiousness (facets) and partner

conscientiousness (facets). We also included covariates (age, gender, and education) and the linear effect of time in each model.

We also ran three additional analyses. First, we examined whether actor/partner conscientiousness (global and facet) moderated changes in health and health behavior over time. To test this, we included the interactions between actor/partner conscientiousness (facets) and the linear effect of time. A non-significant moderation of an effect by time suggests that an association endures over time (neither increasing nor decreasing in strength over the study window). Significant moderation suggests that the strength of a conscientiousness-health association changes in strength over time. We decomposed these significant interactions as they emerged. Second, an important consideration in research modeling dyadic outcomes involves testing whether actor and partner effects are "distinguishable" (i.e., moderated) by gender, such that the relationships observed may be stronger among husbands or wives (Kenny et al., 2006). To test for this distinguishability, the moderating role of actor gender for all possible interactions was included in a second follow-up analysis. Finally, previous research has tested multiplicative effects of actor and partner conscientiousness on health (Roberts et al., 2009). We extend these tests to conscientiousness facets as well by testing a selection of actor-partner cross interactions (e.g., actor orderliness × partner orderliness) for each outcome. Significant interactions would indicate that there might be unique combinations of actor and partner conscientiousness facets that are associated with better or worse health. For example, it could be the case that having a partner high in orderliness is more strongly associated with health among individuals low in orderliness themselves. We tested these possibilities in our additional analysis, after our primary analysis.

Inference Criteria

Due to both the large sample and the number of tests, the current study raises several issues that come along with relying on Null Hypothesis Significance Testing. In other words, solely relying on whether an effect is significant or not is challenging in this context. With the number of tests and exploratory nature of the study, it is possible that false positives (and negatives) could emerge, such that we interpret too many associations that might not be reliable or, similarly important, miss associations that are reliable in other contexts. With the large sample, many associations might be significantly different from zero but may be so small that they are practically zero. Ideally, a study should be pre-registered by setting out the minimum effect size of interest, so that we could be more deliberate in highlighting which results we consider to be the most reliable according to a predetermined criterion. Although we did not pre-register the study and are not sure which effect size would be most meaningful to readers, we were cognizant of these challenges when reporting the results below. In the sections below, we chose to discuss the largest associations from each model and note when confidence intervals are particularly wide or close to zero (see Table 3) to help guide our discussion. Oftentimes, the smallest effects that are statistically significant are also those with p-values closest to $p = .05$, but plenty of small effects are significant at a much lower p-value. We present p-values in the interest of disclosure and completeness but will primarily frame our results in terms of effect sizes and confidence intervals.

Finally, it is worth reminding readers that this study was not pre-registered. Because of this oversight, and the fact that we were at least somewhat familiar with the data set already, all of the tests and results below should be considered exploratory. We were not in a position to make decisions or discuss the results (or even set up the questions) in a completely data-independent way. Thus, we tried to be careful in how we discussed and interpreted the results below and encourage future investigations to pre-register their hypotheses, analytic plans, and inference criteria.

Results

Preliminary Analyses

Means, standard deviations, and zero-order correlations are presented for men (in the lower diagonal) and women (in the upper diagonal) in Table S1.

Conscientiousness and its facets were positively intercorrelated ($.21 \leqslant r \leqslant .49$). For both men and women, conscientiousness and its facets were generally related to better global health, fewer chronic illnesses, less depression, and more light, moderate, and vigorous physical activity both cross-sectionally (within a wave) and longitudinally (across waves). The exceptions were that actor/partner traditionalism and virtue were most often unrelated to health and well-being. Indices of global health, chronic illness, depression, and physical activity were correlated in expected directions and moderately stable over time. The outcomes were not so highly correlated with each other to suggest redundancy.

Do actor and partner conscientiousness facets predict health and health behavior?

The results from the multi-level analyses are presented in Tables 1 (for global health, chronic illnesses, and depression) and 2 (for light exercise, moderate exercise, and vigorous exercise); see summary in Table 3.

Global Health. For global health, actor conscientiousness, actor industriousness, actor orderliness, and actor responsibility had the largest associations (though still small), such that higher levels of each were associated with better health. Partner conscientiousness, partner orderliness, and partner responsibility had confidence intervals that did not include zero but were relatively small in magnitude and their intervals were close to zero. The other conscientiousness facets (for both actors and partners) were near-zero and had confidence intervals that included zero. Global health declined over time on average.

Chronic Illness. For chronic illness, higher levels of actor orderliness and actor industriousness each were associated with fewer chronic illnesses. Partner orderliness was associated with fewer chronic illnesses; actor conscientiousness was associated with fewer chronic illnesses as well. The remaining associations—for both actors and partners—were relatively small and near-zero (often with con-

Table 1. Multi-level tables predicting mental and physical health from conscientiousness and its facets.

	Global Health					Number of chronic illnesses					Depression				
	b	*SE*	*t*	*p*	*r*	*b*	*SE*	*t*	*p*	*r*	*b*	*SE*	*t*	*p*	*r*
Intercept	3.073	.065	47.536	< .001	.463	.421	.167	2.516	.012	.038	2.076	.167	12.426	< .001	.183
Time	-.026	.005	-5.162	< .001	-.121	.086	.002	54.218	< .001	.708	.033	.003	12.397	< .001	.249
Actor Conscientiousness	.223	.017	12.907	< .001	.133	-.132	.043	-3.080	.002	-.038	-.265	.042	-6.258	< .001	-.081
Partner Conscientiousness	.045	.017	2.636	.008	.027	-.029	.043	-.668	.504	-.008	-.050	.042	-1.174	.240	-.015
Actor Self-Control	-.021	.008	-2.692	.007	-.028	-.046	.020	-2.360	.018	-.029	-.051	.019	-2.667	.008	-.034
Partner Self-Control	-.005	.008	-.655	.512	-.007	-.021	.020	-1.082	.279	-.013	.011	.019	.552	.581	.007
Actor Orderliness	.061	.008	7.876	< .001	.083	-.111	.020	-5.657	< .001	-.070	-.118	.019	-6.127	< .001	-.078
Partner Orderliness	.026	.008	3.356	.001	.035	-.086	.020	-4.394	< .001	-.055	-.032	.019	-1.700	.089	-.022
Actor Industriousness	.090	.008	11.430	< .001	.119	-.105	.020	-5.254	< .001	-.065	-.127	.020	-6.431	< .001	-.082
Partner Industriousness	.007	.008	.910	.363	.010	.010	.020	.509	.611	.006	-.014	.020	-.694	.487	-.009
Actor Traditionalism	-.014	.008	-1.789	.074	-.019	-.023	.020	-1.183	.237	-.015	-.028	.019	-1.447	.148	-.019
Partner Traditionalism	-.018	.008	-2.291	.022	-.024	.001	.020	.037	.970	.0005	-.029	.019	-1.505	.132	-.019
Actor Virtue	-.004	.008	-.519	.604	-.005	.016	.020	.783	.433	.010	-.008	.020	-.401	.689	-.005
Partner Virtue	-.007	.008	-.859	.390	-.009	.039	.020	1.951	.051	.024	-.007	.020	-.348	.728	-.004
Actor Responsibility	.060	.010	6.238	< .001	.066	-.011	.024	-.463	.644	-.006	-.122	.024	-5.127	< .001	-.065
Partner Responsibility	.046	.010	4.825	< .001	.051	-.008	.024	-.329	.742	-.004	-.049	.024	-2.078	.038	-.027
Age	-.012	.001	-14.878	< .001	-.161	.039	.002	18.611	< .001	.281	-.001	.002	-.251	.802	-.004
Gender	.027	.007	4.117	< .001	.048	-.040	.016	-2.463	.014	-.042	.142	.015	9.214	< .001	.157
Education	.070	.002	29.714	< .001	.305	-.037	.006	-5.964	< .001	-.080	-.066	.006	-10.936	< .001	-.148

Note. Gender: -1 = men; 1 = women. *r* = partial correlation coefficient (i.e., effect size)

Table 2. Multi-level tables predicting health behavior from conscientiousness and its facets.

	Light exercise					Moderate exercise					Vigorous exercise				
	b	*SE*	*t*	*p*	*r*	*b*	*SE*	*t*	*p*	*r*	*b*	*SE*	*t*	*p*	*r*
Intercept	4.524	.093	48.497	< .001	.603	3.871	.121	32.037	< .001	.431	3.005	.128	23.392	< .001	.323
Time	-.039	.002	-21.090	< .001	-.385	-.037	.002	-16.401	< .001	-.306	-.027	.002	-11.999	< .001	-.219
Actor Conscientiousness	.187	.025	7.464	< .001	.094	.194	.031	6.322	< .001	.080	.169	.032	5.205	< .001	.065
Partner Conscientiousness	-.029	.025	-1.188	.235	-.016	-.011	.031	-.350	.726	-.004	.065	.032	2.014	.044	.026
Actor Self-Control	-.033	.011	-2.896	.004	-.038	-.017	.014	-1.231	.218	-.016	-.031	.015	-2.139	.032	-.027
Partner Self-Control	.006	.011	.572	.567	.007	.011	.014	.794	.427	.010	.020	.015	1.356	.175	.017
Actor Orderliness	.030	.011	2.569	.010	.034	.034	.014	2.420	.016	.030	.039	.015	2.648	.008	.033
Partner Orderliness	.024	.011	2.101	.036	.028	.041	.014	2.912	.004	.037	.032	.015	2.156	.031	.027
Actor Industriousness	.097	.012	8.360	< .001	.108	.132	.014	9.264	< .001	.116	.104	.015	6.941	< .001	.087
Partner Industriousness	.026	.012	2.288	.022	.030	.006	.014	.443	.658	.006	.011	.015	.754	.451	.009
Actor Traditionalism	-.026	.011	-2.322	.020	-.030	-.020	.014	-1.414	.158	-.018	-.032	.015	-2.209	.027	-.028
Partner Traditionalism	-.016	.011	-1.372	.170	-.018	-.023	.014	-1.650	.099	-.021	-.021	.015	-1.418	.156	-.018
Actor Virtue	-.001	.012	-.048	.961	-.001	-.010	.014	-.687	.492	-.009	-.016	.015	-1.062	.288	-.013
Partner Virtue	-.004	.012	-.361	.718	-.005	-.003	.014	-.188	.851	-.002	-.019	.015	-1.291	.197	-.016
Actor Responsibility	.078	.014	5.533	< .001	.072	.043	.017	2.470	.014	.031	.006	.018	.353	.724	.004
Partner Responsibility	.000	.014	.024	.981	.0003	.013	.017	.724	.469	.009	.007	.018	.395	.693	.005
Age	-.025	.001	-21.530	< .001	-.328	-.023	.002	-15.321	< .001	-.232	-.022	.002	-13.439	< .001	-.201
Gender	.243	.010	23.636	< .001	.377	-.087	.011	-7.664	< .001	-.130	-.162	.012	-13.865	< .001	-.229
Education	.030	.003	8.540	< .001	.120	.050	.004	11.362	< .001	.152	.038	.005	8.145	< .001	.106

Note. Gender: -1 = men; 1 = women. *r* = partial correlation coefficient (i.e., effect size)

Table 3. Summary of multi-level model results.

	Global Health	Chronic Illness	Depression	Light Exercise	Moderate Exercise	Vigorous Exercise
Actor Conscientiousness	.133 (.113, .153)	-.038 (-.063, -.014)	-.081 (-.106, -.056)	.094 (.069, .119)	.080 (.055, .105)	.065 (.041, .089)
Partner Conscientiousness	.027 (.006, .048)	-.008 (-.033, .017)	-.015 (-.040, .010)	-.016 (-.042, .010)	-.004 (-.029, .021)	.026 (.001, .051)
Actor Self-Control	-.028 (-.049, -.007)	-.029 (-.053, -.005)	-.034 (-.059, -.009)	-.038 (-.063, -.013)	-.016 (-.041, .009)	-.027 (-.052, -.002)
Partner Self-Control	-.007 (-.028, .014)	-.013 (-.037, .011)	.007 (-.018, .032)	.007 (-.019, .033)	.010 (-.015, .035)	.017 (-.008, .042)
Actor Orderliness	.083 (.062, .104)	-.070 (-.094, -.046)	-.078 (-.103, -.053)	.034 (.008, .060)	.030 (.005, .055)	.033 (.009, .057)
Partner Orderliness	.035 (.014, .056)	-.055 (-.079, -.031)	-.022 (-.047, .003)	.028 (.002, .054)	.037 (.012, .062)	.027 (.003, .051)
Actor Industriousness	.119 (.099, .139)	-.065 (-.089, -.041)	-.082 (-.107, -.057)	.108 (.083, .133)	.116 (.092, .140)	.087 (.063, .111)
Partner Industriousness	.010 (-.011, .031)	.006 (-.018, .030)	-.009 (-.034, .016)	.030 (.005, .055)	.006 (-.019, .031)	.009 (-.016, .034)
Actor Traditionalism	-.019 (-.040, .002)	-.015 (-.039, .009)	-.019 (-.044, .006)	-.030 (-.055, -.005)	-.018 (-.043, .007)	-.028 (-.053, -.003)
Partner Traditionalism	-.024 (-.045, -.003)	.001 (-.024, .025)	-.019 (-.044, .006)	-.018 (-.044, .008)	-.021 (-.046, .004)	-.018 (-.043, .007)
Actor Virtue	-.005 (-.026, .016)	.010 (-.014, .034)	-.005 (-.030, .020)	-.001 (-.026, .024)	-.009 (-.034, .016)	-.013 (-.037, .011)
Partner Virtue	-.009 (-.030, .012)	.024 (-.0004, .048)	-.004 (-.029, .021)	-.005 (-.031, .021)	-.002 (-.027, .023)	-.016 (-.041, .009)
Actor Responsibility	.066 (.045, .087)	-.006 (-.030, .018)	-.065 (-.090, -.040)	.072 (.047, .097)	.031 (.006, .056)	.004 (-.020, .028)
Partner Responsibility	.051 (.030, .072)	-.004 (-.028, .020)	-.027 (-.052, -.002)	.0003 (-.025, .026)	.009 (-.016, .034)	.005 (-.020, .030)

Note. Effect sizes (r) with 95% confidence intervals are listed in each cell.

fidence intervals that were near or included zero). Chronic illnesses increased over time on average.

Depression. For depression, higher levels of actor conscientiousness, actor self-control, actor orderliness, actor industriousness, and actor responsibility each were associated with less depression. The remaining effects—for both actors and partners—were near zero or included confidence intervals that were near (or included) zero. Depression increased over time on average.

Light Exercise. For light exercise, higher levels of actor conscientiousness, actor orderliness, actor industriousness, and actor responsibility each were associated with more light exercise. Higher levels of partner industriousness were associated with light exercise. Some partner effects were seen (e.g., partner orderliness), although they were very small and their confidence intervals were often very close to zero. Surprisingly, higher levels of actor self-control and actor traditionalism were associated with less light exercise. Light exercise declined over time on average.

Moderate Exercise. For moderate exercise, higher levels of actor conscientiousness, actor orderliness, actor industriousness, and actor responsibility each were associated with more moderate exercise. Partner orderliness was associated with more moderate exercise, and the remaining partner associations were near-zero in size. Moderate exercise declined over time on average.

Vigorous Exercise. For vigorous exercise, higher levels of actor conscientiousness, actor orderliness, and actor industriousness each were associated with more vigorous exercise. Some partner effects (e.g., broader conscientiousness, orderliness) were also seen but their confidence intervals were closer to zero. Vigorous exercise declined over time on average.

Summary. A summary of the results and effect sizes and confidence intervals from the multi-level analyses can be found in Table 3. Actor effects of conscientiousness facets were the most consistently non-zero associations seen with health and health behavior. For actor effects, broader conscientiousness, orderliness, industriousness, and responsibility were the most reliable correlates of better health and health behavior. Among the more puzzling associations were negative associations between actor self-control and light exercise, but most actor self-control associations were very small and had confidence intervals close to zero.

There were fewer partner effects overall, but partner orderliness was the most reliable correlate of health and health behavior. Being married to a partner high in responsibility was also associated with better global health. Although there were many bivariate correlations between partner conscientiousness (facets), health, and health behavior (in Table S1), these associations were smaller or near zero after controlling for all the actor and partner conscientiousness (facets) and socio-demographic characteristics.

Additional analyses: Are the effects of conscientiousness (facets) moderated by time, gender, and cross-partner conscientiousness?

First, we examined whether any of the effects reported above were moderated by time. To test this, we reran the models above including interactions between the actor/partner conscientiousness facets and the linear effect of time. Worth noting, out of the 84 estimates across the six models reported above (14 conscientiousness constructs x 6 outcomes), the vast majority (n=78; 93%) were not moderated by time. The six exceptions are listed in Table 4.

Second, we examined whether actor/partner conscientiousness facets were moderated (i.e., distinguishable) by gender. To test this possibility, we reran each of the models in Tables 1 and 2 with all possible interactions with gender. Out of the 102 estimates across the six models reported above (14 conscientiousness constructs, age, time, and education across 6 outcomes), the vast majority (*n*=82; 80%) were not moderated by gender; 90% of the effects involving conscientiousness facets (76/84) were not moderated by gender (all of which were actor effects, no partner effects differed by gender). The twenty exceptions and their decomposition are listed in Table 5.

Finally, we examined whether there were any multiplicative effects of conscientiousness and its facets. To examine this, we computed the seven cross-partner interactions that were possible within each trait (e.g., actor orderliness × partner orderliness) and reran the models in Tables 1 and 2 with these additional interactions. We did not test for cross-partner cross-trait interactions as this would lead to an unruly model with too many estimates and complexity. Of the 42 possible cross-partner interactions (7 cross-partner interactions across 6 outcomes), the vast majority (*n*=37, 88%) were not significant. The five exceptions are listed in Table 6. Based on the recommendation from the editor, we chose not to devote much space to discussing the results of these three additional analyses, given how few of these moderation tests were significant.

Discussion

The current study is the only one of its kind to examine the dyadic effects of conscientiousness facets on health and well-being longitudinally. Along the lines of previous research, some facets were more reliably associated with outcomes than others. For instance, actor effects of orderliness, industriousness, and responsibility were most commonly associated with the outcomes, but associations between traditionalism and virtue and the outcomes were near zero in nearly every case. This pattern of associations is consistent with research at the individual level showing differential associations for the facets of conscientiousness. For example, strong associations were reported for responsibility and orderliness with preventive health behaviors (Roberts, Chernyshenko, et al., 2005), cognitive functioning (Sutin et al., 2018), and global health and fewer chronic illnesses over time (Chopik, 2016). Additionally, we extended this research by showing that among conscientiousness facets, *partner* orderliness was associated with better individual health over a 10-year period. Other partner facets had near-zero associations with health and health behavior. These associations were largely invariant over time, between men and women, and in the context of multiplicative cross-partner interactions.

We can only speculate as to why these particular facets of conscientiousness are related to health and well-being over time. The design of our study was not sufficient for delin-

Table 4. Summary of estimates that vary over time.

		Slope of time for those +1 SD				Slope of time for those -1SD				Moderation test			
	Estimate	*b*	*SE*	*p*	*r*	*b*	*SE*	*p*	*r*	*b*	*SE*	*p*	*r*
Chronic Illnesses	Partner Self-control	.082	.002	< .001	.46	.091	.002	< .001	.50	-.005	.002	.008	-.04
	Partner Traditionalism	.092	.002	< .001	.50	.081	.002	< .001	.47	.006	.002	.001	.04
Depression	Partner Virtue	.042	.004	< .001	.16	.025	.004	< .001	.10	.009	.003	.005	.04
Light Exercise	Actor Industriousness	-.035	.003	< .001	-.19	-.044	.003	< .001	-.23	.004	.002	.044	.03
Moderate Exercise	Actor Self-control	-.030	.003	< .001	-.14	-.044	.003	< .001	-.21	.008	.003	.003	.04
	Actor Traditionalism	-.042	.003	< .001	-.20	-.033	.003	< .001	-.15	-.005	.003	.045	-.03

Table 5. Summary of estimates that were distinguishable by gender.

		Effect for Men				Effect for Women				Test for Distinguishability			
	Estimate	*b*	*SE*	*p*	*r*	*b*	*SE*	*p*	*r*	*b*	*SE*	*p*	*r*
Global Health	Time	-.042	.002	< .001	-.39	-.035	.002	< .001	-.34	.003	.001	.017	.05
	Actor Industriousness	.134	.018	< .001	.13	.085	.017	< .001	.09	-.025	.012	.047	-.03
	Actor Traditionalism	.012	.017	.470	.01	-.040	.017	.019	-.04	-.026	.012	.032	-.03
	Actor Responsibility	.021	.022	.345	.02	.094	.021	< .001	.08	.037	.015	.015	.03
	Education	.060	.005	< .001	.22	.076	.005	< .001	.24	.008	.003	.023	.03
Chronic Illnesses	Time	.094	.002	< .001	.62	.080	.002	< .001	.58	-.007	.001	< .001	-.09
	Actor Traditionalism	-.066	.028	.019	-.04	.017	.027	.532	.01	.042	.020	.035	.03
	Actor Responsibility	.053	.036	.133	.03	-.072	.034	.034	-.04	-.063	.025	.012	-.03
	Age	.044	.003	< .001	.26	.035	.003	< .001	.22	-.005	.002	.009	-.04
	Education	-.024	.008	.003	-.05	-.053	.009	< .001	-.11	-.015	.006	.009	-.04
Depression	Education	-.051	.007	< .001	-.13	-.092	.009	< .001	-.18	-.020	.005	< .001	-.06
Light Exercise	Time	-.045	.003	< .001	-.32	-.035	.002	< .001	-.28	.005	.002	.005	.06
	Actor Industriousness	.139	.019	< .001	.13	.074	.015	< .001	.09	-.033	.012	.007	-.04
	Age	-.033	.002	< .001	-.30	-.020	.001	< .001	-.23	.007	.001	< .001	.09
	Education	.046	.005	< .001	.16	.016	.005	.001	.06	-.015	.003	< .001	-.06
Moderate Exercise	Time	-.044	.003	< .001	-.28	-.031	.003	< .001	-.20	.006	.002	.002	.06
	Actor Traditionalism	.010	.019	.622	.01	-.055	.021	.007	-.05	-.032	.014	.023	-.03
	Actor Responsibility	.005	.024	.846	.003	.089	.025	< .001	.06	.042	.018	.018	.03
	Education	.043	.005	< .001	.14	.061	.006	< .001	.16	.009	.004	.022	.04
Vigorous Exercise	Age	.032	.006	< .001	.09	.044	.006	< .001	.12	.003	.001	.030	.04

Table 6. Multiplicative effects of actor and partner conscientiousness and its facets

		Slope of partner effect for those +1 SD in the actor trait				Slope of partner effect for those -1 SD in the actor trait				Multiplicative effect			
	Estimate	*b*	*SE*	*p*	*r*	*b*	*SE*	*p*	*r*	*b*	*SE*	*p*	*r*
Chronic Illnesses	Actor Traditionalism x Partner Traditionalism	-.042	.027	.117	-.02	.045	.027	.098	.02	-.047	.020	.019	-.04
Depression	Actor Responsibility x Partner Responsibility	.005	.035	.890	.002	-.089	.030	.003	-.04	.059	.027	.029	.04
Light Exercise	Actor Orderliness x Partner Orderliness	-.001	.016	.952	-.001	.046	.014	.001	.04	-.025	.010	.013	-.04
Moderate Exercise	Actor Orderliness x Partner Orderliness	.005	.020	.789	.004	.070	.018	< .001	.05	-.034	.013	.011	-.05
	Actor Traditionalism x Partner Traditionalism	.007	.019	.712	.01	-.052	.020	.008	-.04	.032	.015	.030	.04

eating causal processes between these variables. Future research can employ more deliberate designs to examine why conscientiousness facets and health and well-being are associated. Previous research provides some guidance as to why partner orderliness might be associated with individual health and well-being. For example, research on social control, and how it affects health and well-being, is particularly informative. Health-related social control refers to interpersonal interactions that involve the modulation of health behaviors of one person by another person (Craddock et al., 2015; Lewis & Butterfield, 2007). Many of the tactics through which one person modulates another person's behavior can be categorized into *positive* (e.g. persuasion, modeling, and positive reinforcement) or *negative* (e.g. disapproval, guilt) and *direct* (e.g. discussion) or *indirect* tactics (e.g., dropping hints; Lewis & Butterfield, 2007). Meta-analyses suggest that the use of positive social control in close relationships is associated with greater psychological well-being and relationship satisfaction; negative social control is associated with greater negative affect and backfiring behaviors (Craddock et al., 2015).

To this end, is it possible that orderly and responsive partners might be especially likely to exert social control over their partner's behavior? Again, our design was not sufficient to test this exact question. Conceptually, a highly responsible individual might be more likely to remind their partner about their medication regimen, keep their physician appointments, encourage annual check-ups (Hill & Roberts, 2015), or help avoid deleterious health behavior (e.g., smoking, unhealthy eating). A highly ordered individual might encourage their partners to maintain a regular sleep and exercise schedule. A repeated routine of physical activity and healthy sleep cycles is recommended to lower risk of chronic illnesses and functional limitations (Haskell et al., 2007; Nelson et al., 2007; Ohayon & Vecchierini, 2005). Given that the health-promoting effects of social control are most often present for positive tactics (e.g., modeling, making structural changes, and engaging in the behavior with one's spouse; Lewis et al., 2004), future research should test the link between conscientiousness facets and the use of different social control tactics to see if their use might explain why partner conscientiousness (facets) and health are associated. Future research can more formally model these processes between actor and partner personality on one hand and health and well-being on the other (Manne et al., 2013, 2015).

Strengths and Limitations

Our study used a large sample of middle-aged and older couples who completed facet-level measures of conscientiousness, health, well-being, and health behavior over time. Nevertheless, our study had some limitations that should be mentioned.

First, many of the effects in the current study were small in magnitude, albeit similar to previous work (Kim et al., 2014; Roberts et al., 2009). With large sample sizes, smaller effects can be captured and more precise effect sizes can be estimated. Although we had a large number of couples, large sample sizes may yield findings that are statistically significant but of little practical significance (Cohen, 1990; Funder & Ozer, 2019). Therefore, findings should be interpreted in light of how constructs operate in the real world and how they may lead to the accumulation of positive assets across the life span (Abelson, 1985), if that indeed is the process occurring here. Although associations between personality and health over short intervals of time can be important, any asset-related processes probably accumulate over long periods of time, although this an open question. As such, an important next step would be to examine associations between personality facets and health over longer intervals.

Second, a related point is that we conducted many tests in a very exploratory way. Our approach to describing the results in terms of effect sizes and confidence intervals was meant to be a more even-handed approach that relies less on statistical significance testing. A more traditional approach of significance testing would have led to a great proliferation of findings, possibly misleading readers because they would be near-zero but nevertheless significant and would have been discussed prominently. However, many studies examining associations between personality and health outcomes (and perhaps any outcome) rely on many tests and implicates a risk of missing something that is a real, genuine effect or finding something that is not a real, genuine effect (or both). Being mindful about statistical significance testing and shifting toward an effect size/confidence interval-type of inference criteria (among other, non-significance testing criteria) is a consideration for future work.

Third, HRS only assessed conscientiousness facets at one point in time, precluding our ability to examine how changes in actor and partner conscientiousness facets are associated with changes in health and well-being over time. This is particularly important in establishing the causal links we think exist between conscientiousness facets and health. A more ideal study would involve carefully mapping out how conscientiousness, the proposed mechanisms (e.g., partner control/encouragement, other health behavior), and the outcomes change together over time (although see Hamaker et al., 2015; Lucas, 2022 for discussions about how difficult this is even at the individual, let alone dyadic, level). In this way, researchers often make strong causal assumptions about the role of personality on health, while being relatively agnostic about potential third variables, alternative explanations, or inappropriately controlling for a key cog in the causal process unknowingly. In short, it can be difficult to know why we find the associations we find at the individual level, even when it seems ostensibly reasonable that conscientiousness might cause better health.

These same considerations plague the romantic relationships literature, where even stronger assumptions about one person's psychological (or social or communication) characteristics affect another person are made. Most papers using the actor-partner model of interdependence assume that predictors do not vary over time, despite several studies suggesting that personal characteristics change over time (Roberts & Mroczek, 2008). There is also evidence that these changes are consequential for an individual's health and health behavior over time (Chopik et al., 2015, 2018; Takahashi et al., 2013). Future research can more formally model how actor and partner psychological characteristics

and health behavior change in concert with one another (Hoppmann, Gerstorf, & Hibbert, 2011; Hoppmann & Gerstorf, 2009). In this work, particular attention needs to be paid to establishing the conditions under which causal claims about partner influence and personality can be made.

Conclusion

In conclusion, the present research examined dyadic associations between conscientiousness facets on changes in health and health behavior over time for older couples. Specifically, broad conscientiousness, orderliness, industriousness, responsibility, and partner's orderliness had the most consistent non-zero associations with health and health behavior. Future research can more carefully map out why actor and partner conscientiousness facets might be linked with health and well-being by employing more appropriate designs to examine causal processes between these variables.

Author contributions

WC conceptualized the idea, analyzed the data, and interpreted the results; JHL provided critical feedback. All authors approve the content of this paper.

Competing interests

There were no competing interests. WC is an associate editor at Collabra: Psychology. He was not involved in the review process of this article.

Data accessibility statement

The data use agreement of HRS does not allow for the public sharing of data. However, we have uploaded our syntax and output files at https://osf.io/q6fvh/. Full details on the methodology and previously published papers using the data can be found on the HRS website (https://hrs.isr.umich.edu/).

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Supplementary Materials

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Table S1. Bivariate correlations and descriptive statistics for all study variables

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