Personality Change at Mid-Life is Associated with Changes in Self-Rated Health: Evidence from the Hawaii Personality and Health Cohort

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Abstract

Personality traits change across the lifespan, and trait change, in addition to trait level, may be related to health. Longitudinal data from the Hawaii Personality and Health Cohort were used to investigate associations between changes in traits and self-rated health (SRH). Participants ($N = 733$, $M_{age} = 44.4$) completed measures of the Big Five personality traits and SRH twice approximately 3 years apart. Personality trait changes were associated with SRH change. Additionally, increases on Agreeableness, Conscientiousness, and Openness, and decreases on Neuroticism, predicted increases in SRH, even when controlling for gender and education. Relating correlated trait change at mid-life, when traits reach peak stability, to a consequential health outcome such as SRH change, demonstrates the value of treating both traits and health indicators as dynamic variables.

Keywords

Big Five; mid-life; trait change; reliable change index; self-rated health

1. Introduction

The relation between personality trait change and change in self-rated health (SRH) at mid-life was investigated in the Hawaii Personality and Health cohort. Ratings of SRH are powerful predictors of health outcomes, even after accounting for objective health status, health behaviors, and sociodemographic factors. SRH, typically assessed by a single item, has been repeatedly found to predict mortality above and beyond objective health status in both community and patient samples (Benyamini, 2011; Benyamini & Idler, 1999; Heidrich, Liese, Lowel, & Keil, 2002; Idler & Benyamini, 1997; Khang & Kim, 2010; Lee, 2000). Single-item SRH was associated with the inflammatory markers interleukin-6 and C-reactive protein in a healthy community sample (Christian et al., 2011), and with modifiable health behaviors that are strongly associated with preventable causes of death (Mokdad, Marks, & Stroup, 2004).

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Personality traits are established predictors of health and longevity that are at least as strong as socioeconomic status and intelligence (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Although all the Big Five traits have been related to health, the two most consistent predictors of positive health outcomes including SRH, clinically assessed biomarkers, and longevity are high Conscientiousness and low Neuroticism (Chapman, Duberstein, & Lyness, 2007; Chapman, Duberstein, Sorensen, & Lyness, 2006; Goodwin & Friedman, 2006; Hampson, Edmonds, Goldberg, Dubanoski, & Hillier, in press; Kern & Friedman, 2008; Lockenhoff, Sutin, Ferrucci, & Costa, 2008; Martin, Friedman, & Schwartz, 2007; Mroczek, Spiro, & Turiano, 2009; Sutin et al., 2010; Wasylkiw & Fekken, 2002; Williams, O'Brien, & Colder, 2004). Openness to Experience also predicts adult health outcomes (Chapman et al., 2007; Richman et al., 2005) including mortality (Iwasa et al., 2008; Jonassaint et al., 2007; Swan & Carmelli, 1996; Turiano, Spiro, & Mroczek, 2012).

Although personality tends to increase in stability across the life course (Roberts & DelVecchio, 2000), there is non-trivial individual-level personality change into adulthood (Allemand, Zimprick, & Martin, 2008; Donnellan, Conger & Burzette, 2007; Roberts & Mroczek, 2008; Roberts, Walton, & Viechtbauer, 2006; Srivastava, John, Gosling, & Potter, 2003).Trait change as well as overall trait level may be relevant to health. Changes in Neuroticism predicted mortality in the very old (Mroczek & Spiro, 2003), and changes in Conscientiousness were correlated with changes in self-reported physical health over three years in a community sample (Takahashi, Edmonds, Jackson & Roberts, 2013). Decreases in Conscientiousness and increases in Neuroticism predicted poorer SRH (measured by a single item) across two assessments ten years apart in the Midlife in the United States study (age range 20-75; Human et al., 2012). Decreases in Conscientiousness and Extraversion and increases in Neuroticism predicted poorer self-reported physical health in a large-scale Australian study with assessments four years apart (age range 20-79; Magee, Heaven, & Miller, 2012). Magee et al. (2012) also found cohort differences in associations between trait change and health, with stronger associations for Neuroticism in younger and older cohorts, and for Conscientiousness in younger and middle-aged cohorts. One study found no associations between trait change among older adults (55-85 years) and changes in self-reported disease, disability and overall health over a six-year period (Small, Hertozog, Hultsch, & Dixon, 2003)

The previous studies suggest that the association between trait change and health change may be dependent on life stage. The present investigation examined these associations within a more age homogenous sample than studied hitherto. We examined change over a relatively short period (three years) from the mid to late 40's, a period when both personality and health are relatively stable. Thus this study provides a rigorous test of the hypothesis that trait change is associated with self-reported health change.

2. Method

2.1 Participants

Participants were members of the Hawaii Personality and Health Cohort (N = 2,418; Hampson et al., 2001). Teachers assessed the personalities of members of this cohort when they were elementary school children in Hawaii between 1959 and 1967. Beginning in 1998, the child participants, by then middle-aged adults, were located for an ongoing follow-up study of personality and health, which includes completing several self-report questionnaires. To date, 73% of the original childhood sample that could be located has been recruited for follow-up studies. The adult sample was representative of the child sample in terms of gender (50% female). Adult participants were about one tenth of a SD higher on childhood Conscientiousness (Cohen's $d = -.09$) and Openness (Cohen's $d = -.08$) than the full child sample.

The current article presents data from members of the adult sample who completed at least the first two assessments and the questions related to personality and self-rated health (N = 733). These were the only two assessments that measured personality using the same instrument, and also measured SRH.

These participants (357 men, 376 women) are from diverse ethnic backgrounds (19% Caucasian, 48% Asian-American, 18% Hawaiian/Pacific Islander, 8% Filipino) and levels of education (2.3% some high school or less, 17.1% high school graduates/GED, 3.1% some technical school, 3.5% technical or nursing school graduates, 26.3% some college/ community college, 27.4% college graduates, 19.9% postgraduate or professional degree, 0.3% unknown). The average age of participants was 44.14 years ($SD = 1.96$) at Time 1, and 46.85 years ($SD = 1.98$) at Time 2. Sample size at Time 1 was 1056 and at Time 2 was 934. Those who did vs. did not complete the Time 2 assessment only differed on one of the Big Five traits. Those who completed the Time 2 assessment ($M = 3.50$, $SD = .63$) were lower on Openness than those who did not ($M = 3.58$, $SD = .61$), $t(1258) = 2.37$, $p = .02$, d = .13; and also reported somewhat better health at Time 1($M = 2.57$, $SD = .95$) compared to those who did not complete the Time 2 assessment ($M = 2.71$, $SD = .98$)[1], $t(1049) = 2.24$, $p= .02$, d = .14). However, both of the effect sizes are small, indicating that the differences between the groups are unlikely to bias the results.

2.2 Measures

2.2.1 Personality—The Big Five Inventory (BFI; John, Naumann, & Soto, 2008) consists of 44 short descriptive items (e.g., "Is talkative") that assess the five broad personality traits of Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to Experience. Participants indicated how accurately each statement described themselves (1 = V*ery inaccurate*, 5 = *Very accurate*). In the current sample, the alpha reliabilities ranged from .79 for Openness at Time 1 to .85 for Neuroticism at Time 2.

2.2.2 Self-rated health—SRH was assessed with the widely used single-item measure "Compared to others of your same age and sex, would you say that in general your health is…" Response options were: Excellent, Very good, Good, Fair, and Poor. The test-retest correlation for SRH was .67 (see Table 1), which is evidence that the measure is fairly reliable but still includes some change over this time interval.

2.3 Procedures

Time 1 (1999-2004; age range 40-50) measures included the BFI, educational attainment, SRH, gender, and ethnicity. Time 2 (2002-2008; age range 43-53) measures were mostly collected during 2002 and included the BFI and SRH. The range in time between Time 1 and Time 2 was 619-1281 days ($M = 1001.77$, $SD = 73.54$).

Of the 731 participants who reported SRH at Time 1, 172 did not report SRH at Time 2. There were no differences on Time 1 SRH between those who did ($M = 2.59$, $SD = .95$) and did not ($M = 2.47$, $SD = .94$) provide Time 2 SRH, $t(729) = 1.56$, $p = .12$, $d = .12$, or on any of the five personality change scores, t's < 1.43, p's > 15. However, those with Time 2 SRH were more neurotic at both time points (Time 1: $t(729) = 1.09$, $p = .04$, $d = .08$; Time 2: $t(729) = 2.17$, $p = .03$, $d = .16$), less conscientious at Time 2 ($t(729) = 2.12$, $p = .03$, $d = .16$), and marginally less conscientious at Time 1 ($t(729) = 1.43$, $p = .054$, $d = .11$). However, note that the effect sizes of the differences are quite small, which suggests that the differences would not bias the results. Additionally, the interval between the Time1 and

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[1]Lower scores indicate better SRH.

Time 2 assessments was not related to personality change or SRH (r's $= -.02$ to $.03$, p's $> .42$).

3. Results

Table 1 shows the descriptive statistics for personality traits and SRH at Times 1 and 2. The only significant difference in mean level was for Neuroticism, which was slightly higher at Time 1, $t (732) = 2.53$, $p = .01$, $d = .08$.

3.1 Rates of Reliable Personality Change

Absence of mean level change can obscure change at the individual level, for example when equal numbers of individuals increase and decrease on a trait across the same period. To evaluate individual-level change across the two time points the reliable change index (RCI; Christensen & Mendoza, 1986; Jacobson & Truax, 1991; Roberts & Mroczek, 2008) was calculated for each individual on each trait by dividing the difference between the individual's scores by the standard error of the difference between the scores for the sample. [2] This represents a standardized metric for individual-level change where a value greater than 1.96 is considered to be statistically unlikely and therefore represents reliable change. When more than 5% of the sample demonstrates significant change this indicates reasonable certainty that the change is not due to random error. The RCI provides a conservative measure of whether an appreciable amount of individual-level change is present in a sample.

The amount of reliable change in the sample ranged from 7.77% (for Openness) to 14.60% (for Neuroticism; see Table 2). One hundred thirty-two participants (10.4%) changed reliably on one trait, 24 (1.9%) changed on two traits, 8 (.6%) changed on three traits, and 3 (.2%) changed on four traits. Additionally, 565 participants (44.4%) did not change reliably on any traits. The amount of change significantly differed from chance (95% unchanged, 2.5% increased, and 2.5% decreased) for extraversion, agreeableness, and neuroticism, $\chi^2 (2) = 6.04 - 19.68$, p's $< .05$ (see Table 2).

3.2 Associations between Changes in Personality and Health over the Same Time Period

Differences scores were calculated for each participant on SRH and each Big Five trait by subtracting Time 2 scores from Time 1 scores. In contrast to other methods, raw difference scores provide an unbiased estimate of true change over time and there are recent examples of the usefulness of raw difference scores as an index change (Human et al., 2012; Johnson et al., 2012; Rogosa, Brandt, & Zimowski, 1982). Increased SRH correlated significantly with increased Agreeableness, Conscientiousness, and Openness, and decreased Neuroticism (see Table 3).

To avoid problems associated with multicollinearity, separate hierarchical regressions were run to evaluate the degree to which personality change predicted SRH change. Gender and education were entered as control variables in step 1 and personality change was entered in step 2. Increased Agreeableness ($\beta = .10$, $p = .03$), Conscientiousness ($\beta = .08$, $p = .05$), and Openness ($\beta = .10$, $p = .02$), and decreased Neuroticism ($\beta = -.13$, $p = .002$) predicted increased SRH. However, changes in Extraversion ($\beta = .06$, $p = .13$) did not predict SRH change (see Table 4).

Regression analyses in which gender, ethnicity, and SRH change were used to predict personality change were also conducted. Separate regression equations were run for each trait. The findings were similar to the findings described above: increases in SRH were

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[2]Using the standard deviation of the trait scores at Time 1.

related to increases in Agreeableness and Openness, and to decreases in Neuroticism (absolute value of β's = .09 - .12, all p's < .05, details available upon request).

4. Discussion

It was expected that changes in health-relevant traits over mid-life, namely Conscientiousness, Neuroticism, and Openness, would predict changes in SRH over the same time period. Increased Agreeableness, Conscientiousness, and Openness, and decreased Neuroticism were correlated with improved SRH. These effects operated above and beyond effects of gender and education.

These findings expand on previous studies relating personality traits to SRH by showing that trait change was associated with SRH change even in an age-homogeneous sample at a stage in life when personality and health are relatively stable. These findings also extend previous analyses of the Hawaii cohort in which SRH and traits were only assessed at one time point. In those studies, higher levels of childhood Extraversion and Conscientiousness predicted higher SRH measured approximately 40 years later (Hampson, Goldberg, Vogt, & Dubanoski, 2006), and SRH in midlife was significantly correlated with an objective measure of health status based on biomarkers assessed during a clinic visit (Hampson, Goldberg, Vogt, Hillier, & Dubanoski, 2009). The present findings suggest that future studies will benefit from treating SRH and personality traits as dynamic variables.

These results demonstrate meaningful patterns of trait change over a short time span in mid-life. There continues to be disagreement regarding when in the lifespan personality reaches its peak of stability (Ardelt, 2000; Terracciano, Costa, & McCrae, 2006; Roberts & DelVecchio, 2000). However, there is a general consensus that the interval at mid-life studied here represents a period when rank-order stability is either at its peak or approaching its highest levels (Lucas & Donnellan, 2011), and when there is little mean level change (Roberts et al., 2006). Therefore, finding significant levels of individual-level change across less than three years at mid-life underscores the importance of looking beyond mean level change and rank order stability when studying trait change in relation to health outcomes.

4.1 Limitations and Future Directions

The association between trait change and SRH change is consistent with multiple causal interpretations. It is possible that changes in personality have a causal effect on health, or that changes in health have a causal effect on personality, or that changes in both personality and health may result in bi-directional effects. The regression analyses presented here are consistent with all three interpretations. Furthermore, changes in health and personality may jointly result from some other unmeasured source. Future longitudinal research is needed in order to observe change over time in individuals, and ultimately accumulate evidence regarding possible causal scenarios.

Another possible explanation for the relation between trait change and SRH change is a tendency for both to become increasingly positive over time due to social desirability bias. However, the failure of positive change on Extraversion to predict changes in SRH suggests that this bias does not adequately account for the findings. The analyses presented here are based on only two time points. While the majority of studies to date addressing personality change suffer from this limitation, multiple measurements of personality over time would permit the testing of more sophisticated models and could help explain inconsistencies between studies such as that between the results of the present study and those of Small et al. (2003). Their study, which did not find any associations between trait change on the Big Five and changes on self-reported health, included older participants with a wide age range (55-85 years) assessed across a 6-year interval. Evaluating change using multiple time points

allows for more accurate trajectories of change to be estimated, and enables the testing of non-linear models of change (Mroczek & Spiro, 2003). Small et al. also used a very different measure of health, which was a combination of health history and health perceptions, which may explain why they did not find relations between personality change and SRH change.

The current study did not address possible sources of trait change, which requires repeated measurement at frequent enough intervals to capture more precisely when changes occur so that they can be related to possible causal factors, such as health events. Future research would benefit from multiple measurements targeted at moments in the life course when potential sources of change are thought to be most salient, and should evaluate co-variation in change across multiple traits, as well as change in single traits.

The personality change studied here occurred over a relatively short span of time at a specific point in the life course. To fully understand how changes in personality traits are related to changes in SRH, it will be necessary to test these associations across different time intervals at different points in the life course. For example, the degree to which increases in Openness were positively associated with SRH change in the present study may be specific to the point in the life-course captured by our measurement occasions. In contrast, Conscientiousness has unequivocal associations with a variety of health behaviors and health outcomes across a wide range of ages, in both cross-sectional and longitudinal studies, and change in this trait is likely to be related to SRH change across more points in the life-course.

4.2 Conclusion

The present study identified significant individual-level trait change at mid-life when personality is typically viewed as stable. These changes were associated with changes in SRH at the zero-order level and provided incremental predictive validity beyond years of education and gender in multivariate analyses. The present findings underscore the significance of studying trait change in relation to changes in health outcomes in future longitudinal studies.

Acknowledgments

Abbreviations

SRH   self-rated health

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Highlights

- Individual-level personality change was found over about three years at mid-life.

- Personality change was associated with changes in self-rated health.

- Increased agreeableness, conscientiousness, and openness related to better health.

- Decreased neuroticism predicted better health.

Table 1

Descriptive Statistics and Correlations Between Time and Time 2 for the Big Five Personality Traits and Self-Rated Health

	Time 1			Time 2			Test-retest correlation
	Mean	SD	Range	Mean	SD	Range	
Extraversion	3.25	.76	1.00-5.00	3.26	.73	1.13-5.00	.79
Agreeableness	3.96	.56	2.00-5.00	3.95	.60	1.11-5.00	.67
Conscientiousness	4.00	.59	1.40-5.00	3.99	.60	1.00-5.00	.71
Neuroticism	2.53	.71	1.00-4.75	2.47[*]	.74	1.00-5.00	.69
Openness	3.50	.63	1.40-5.00	3.50	.67	1.30-5.00	.77
Self-Rated Health	2.56	.95	1.00-5.00	2.54	.94	1.00-5.00	.67

[*] *Note*. $p < .05$, $N = 733$ for the traits, 731 for SRH at Time 1, and 560 for SRH at Time 2. All test-retest correlations are significant at $p < .001$.

Table 2

Individual-Level Personality Change from Time 1 to Time 2 Assessed by the Reliable Change Index (RCI)

	% changed	% Increased (> 1.96)	% Decreased (< −1.96)	% Unchanged (−1.96 < RCI < 1.96)	χ^2 GOF
Extraversion	12.82	6.42	6.40	87.18	12.87[**]
Agreeableness	10.35	5.05	5.30	89.65	6.04[*]
Conscientiousness	9.58	5.48	4.10	90.42	4.71
Neuroticism	14.55	8.05	6.50	85.45	19.68[***]
Openness	7.77	4.37	3.40	92.23	1.80
SRH	4.48	2.33	2.15	95.52	.06

Note. χ^2 GOF = Chi-square goodness-of-fit test with 2 df. N = 733

[*]
$p < .05$

[**]
$p < .01$

[***]
$p < .001$.

Table 3

Correlations Between Personality Trait Change and Self-Rated Health Change

	Agr	Con	Neur	Open	SRH Change
Ext	.25	.19	−.21	.31	.06
Agr		.41	−.42	.18	.09
Con			−.29	.25	.08
Neur				−.03	−.12
Open					.10

Note. Ext = Extraversion, Agr = Agreeableness, Con = Conscientiousness, Neur = Neuroticism, Open = Openness, SRH = self-rated health. *N*'s = 559 - 733.

Correlations greater than .07 are significant at *p* < .05. No adjustment was made for multiple tests.

Table 4

Results of Hierarchical Multiple Regression Analyses Predicting SRH change from, Gender, Education, and Personality Change

Predictors	Ext		Agr		Con		Neur		Open	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	.01		.01		.01		.01		.01	
Gender		−.07		−.07		−.07		−.07		.07
Education		−.05		−.05		−.05		−.05		.05
Step 2	.004		.01*		.01*		.02**		.01*	
Gender		−.07		−.07		−.07		−.08		.06
Education		−.05		−.06		−.05		−.06		.05
Personality change		.06		.10*		.08*		−.13**		.10*

Note. Ext = Extraversion, Agr = Agreeableness, Con = Conscientiousness, Neur = Neuroticism, Open = Openness. $N = 559$.

$**$
$p < .01$

$*$
$p < .05$.