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Mechanisms by Which Childhood Personality Traits Influence Adult Health Status: Educational Attainment and Healthy Behaviors

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Objective: The purpose of this study was to test a life span health behavior model in which educational attainment and health behaviors (eating habits, smoking, and physical activity) were hypothesized as mechanisms to account for relations between teacher ratings of childhood personality traits and self-reported health status at midlife. ***Design:*** The model was tested on 1,054 members of the Hawaii Personality and Health cohort, which is a population-based cohort participating in a longitudinal study of personality and health spanning 40 years from childhood to midlife. ***Outcome:*** Childhood Agreeableness, Conscientiousness, and Intellect–Imagination influenced adult health status indirectly through educational attainment, healthy eating habits, and smoking. Several direct effects of childhood traits on health behaviors and health status were also observed. ***Conclusion:*** The model extends past associations found between personality traits and health behaviors or health status by identifying a life-course pathway based on the health behavior model through which early childhood traits influence adult health status. The additional direct effects of personality traits indicate that health behavior mechanisms may not provide a complete account of relations between personality and health.

Keywords: childhood Big Five, life span health behavior model, longitudinal study, health behaviors, educational attainment

Despite the steady accumulation of evidence that personality traits prospectively predict adult health outcomes, including mortality, there are few studies of the mechanisms by which they do so (Friedman, 2000). Investigating these mechanisms would identify life-course pathways reflecting the interplay of variables internal and external to the individual that give rise to health status at any particular stage of life. In this study, we tested a life-course pathway by which childhood personality traits influence adult health status at midlife using data from the Hawaii Personality and Health cohort.

The broad traits comprising the Big Five or five-factor model of personality have each been associated with longevity. Introversion (e.g., Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004), low Conscientiousness (e.g., Friedman et al., 1993), low Agreeableness (e.g., Miller, Smith, Turner, Guijarro, & Hallet, 1996), Neuroticism (e.g., Alamada et al., 1991), and low intelligence (related, although not directly comparable, to Intellect–Imagination or Openness; e.g., Whalley & Deary, 2001) have all been identified as mortality risk factors. The life span health behavior model provides one theoretical account of the mechanisms by which personality traits affect morbidity and mortality: Personality influences on health status are mediated by patterns of health-enhancing and health-damaging behaviors over the life course (Smith & Spiro, 2002). Consistent with this model, there is evidence of associations between all of the Big Five traits and self-reported health practices (e.g., Booth-Keweley & Vickers, 1994; Lemos-Giráldez & Fidalgo-Aliste, 1997), although Conscientiousness has received the most attention. Low Conscientiousness has been associated with numerous behavioral risk factors, including unhealthy eating, tobacco use, and lower levels of physical activity (Bogg & Roberts, 2004). Furthermore, health behaviors such as these are associated with morbidity and mortality (e.g., Thompson, Edelsberg, Colditz, Bird, & Oster, 1999; U.S. Department of Health and Human Services, 2000).

There are few opportunities to test life span health behavior models within the same sample, one exception being the Terman Life Cycle study. Friedman et al. (1993) found support for smoking and alcohol use as partial mediators of the effects of childhood Conscientiousness on mortality. The Hawaii cohort enables the study of life-course pathways spanning four decades from person-

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ality in childhood to health status at midlife in a multiethnic population-based sample. In a previous study of this cohort, childhood personality traits predicted adult smoking, alcohol use, body mass index (BMI), and self-rated health (Hampson, Goldberg, Vogt, & Dubanoski, 2006). That study also demonstrated partial mediation of the effects of Conscientiousness on self-rated health by smoking and BMI. In the present study, we tested a more complete life span health behavior model involving all of the Big Five traits and two intervening mechanisms connecting childhood personality to adult health status over the life course: educational attainment and health behaviors.

Educational attainment is associated with longevity (Adler, Marmot, McEwen, & Stewart, 1999; Elo & Preston, 1996), and a healthy lifestyle may be one of the numerous benefits that education confers (Yen & Moss, 1999). Lower educational attainment is associated with less healthy eating habits (e.g., Kristal, Hedderson, Patterson, & Neuhauser, 2001), greater risk of cigarette smoking (e.g., Bergen & Caporaso, 1999), and less leisure-time physical activity (He & Baker, 2005). Educational attainment characterizes a person's life pathway in a single, summary variable. It is typically achieved in the early adult years and remains stable, so there is no question of reverse causality in its association with later outcomes. For the Hawaii cohort, in the absence of any data collection between elementary school and midlife, educational attainment provides a proxy for numerous intervening variables during those unobserved years. Moreover, childhood personality traits are reliable predictors of educational attainment both in this cohort and other longitudinal samples (Digman, 1989; Shiner, Masten, & Roberts, 2003). The health behaviors included in the model were the three key dimensions of a healthy lifestyle: healthy eating, tobacco use, and physical activity. Adult health status was measured by three indexes. Self-rated general health is a remarkably reliable predictor of mortality (Idler & Benyamini, 1997), and better self-rated health is associated with higher levels of Extraversion and Agreeableness (Goodwin & Engstrom, 2002) and lower levels of Neuroticism or negative affect (Costa & McCrae, 1987). Functional status, as an indicator of quality of life, is regarded as a major component of good health (Ware & Sherbourne, 1992), and obesity (BMI) has numerous health-damaging consequences, including increased risk for cardiovascular disease, cancer, and diabetes (Thompson et al., 1999).

It was hypothesized that a model depicting a life-course pathway from childhood personality traits to health status at midlife, with educational status and health behaviors serving as intervening variables, would prove a good fit to the data. In view of gender differences in the associations between personality traits and longevity (Friedman et al., 1993), the fit of the model was compared for men versus women.

Method

Participants

Of the 2,338 members of the original cohort for whom first and second names were available, 1,755 (75%) were found in the first phase of our location efforts.[1] Of those, 1,057 (60% of those located) completed the follow-up questionnaire from which the data analyzed here were derived. These participants are representative of the original children in terms of gender (47% women) and scores (gender normed) on the Big Five personality factors (Hampson et al., 2001). They ranged in age from 41–50 years (M = 45 years, SD = 2) at the time that they completed the follow-up survey. The adult sample for the present analysis was composed of 372 (35%) Japanese Americans; 225 (21%) Native Hawaiian or part-Hawaiian Americans; 194 (18%) European Americans; and 266 (25%) of Filipino, Chinese, Okinawan, Korean, or other Pacific Island ancestry. Three participants failed to complete the measures of eating habits, resulting in complete data for 1,054.

Measures

Teacher assessments of childhood personality traits were obtained between 1959 and 1967 when the children were in Grades 1, 2, 5, or 6. Self-reports of educational attainment, health behaviors, and health status were obtained between 1999 and 2000 when most participants were aged between 41–50 years.

Child personality traits. Teachers rank-ordered all the students in their classroom from lowest to highest on each of 36 to 63 personality attributes, derived from those used by Cattell and Coan (1957), using a fixed nine-step quasi-normal distribution. Definitions developed from focus groups with teachers were provided along with each trait (e.g., "Persevering: Keeps at his (her) work until it is completed; sees a job through despite difficulties, painstaking and thorough"). The five-factor structure was recovered from analyses of selected marker traits and from analyses of all the traits included in the assessments (for details, see Goldberg, 2001). For the present analyses, factor scores on five orthogonal childhood personality factors were derived for each participant on the basis of the analyses of all the traits available. (In contrast to some of our other reports about this cohort, these child factor scores were not separately normed for boys and girls.)

Educational attainment. Participants responded to the question, "What is the highest grade or year of school you completed?" by selecting one of nine levels: 1 = "eighth grade or less," 2 = "junior high or intermediate school," 3 = "some high school," 4 = "high school graduate or GED certificate," 5 = "some technical school," 6 = "technical or nursing school graduate," 7 = "some college or community college," 8 = "college graduate," or 9 = "postgraduate or professional degree."

Eating habits. Typical dietary patterns were assessed by a 22-item version of the Food Habits Questionnaire (Kristal, Shattuck, Henry, & Fowler, 1990) and by a 24-item modified Hawaii Food Frequency Questionnaire, both of which have been shown to correlate with more objective measures, including food records and cholesterol levels. Items assessed the frequency with which a wide variety of foods were consumed, including ones typical for various Hawaiian cultural groups (e.g., rice, spam, poi). Exploratory factor analysis of all these items was used to identify three oblique factors accounting for 29% of the variance. Three eating habits scales were formed using items with loadings higher than 0.40 on the target factor. The Fiber scale measured consumption of fruit, vegetables, and low-fat diary products (15 items; α = .83); the High-Fat scale measured consumption of meat and high-fat, high-carbohydrate foods (13 items; α = .80); and the Food-Preparation scale measured healthy practices such as removing skin from chicken before cooking (seven items; α = .69).

Smoking history. Questions on smoking history were modeled on those used in national health interview surveys. Participants were asked whether they had ever smoked at least 100 cigarettes in their lives. If they reported that they were current smokers, then they were asked how many cigarettes they smoked on an average day. From these questions, a scale assessing extent of smoking was constructed where 0 = "never smoked," 1 = "ex-smoker," 2 = "smokes less than half a pack a day," and 3 = "smokes half a pack a day or more."

[1] The findings reported here are from the first wave of adult recruitment. To date, we have now located 1,978 and recruited 1,241 members of the original cohort.

Physical activity. A physical activity variable was constructed from the Godin Exercise Questionnaire (Godin & Shephard, 1985) indicating the total amount of exercise over the past week, with strenuous, moderate, or mild activities weighted differently (higher scores indicated more physical activity). Godin and Shephard (1985) reported 2-week and 1-month test–retest correlations of .68 and .55, respectively, and correlations ranging between .32 (activity monitors) and .56 (maximum oxygen consumption) with more objective criteria.

Health status. Self-assessed general health status was measured with a widely used item from the Medical Outcomes Study–Short Form Health Survey (SF-36; Ware & Sherbourne, 1992): "Compared to others of your same age and gender, would you say that in general your health is (1) Poor, (2) Fair, (3) Good, (4) Very Good, or (5) Excellent?" Functional status was measured using five items from the SF-36 that assessed bodily pain, physical role functioning, work functioning, emotional role functioning, and social role functioning during the past 4 weeks; standard scores on each of these five variables were combined to form a composite functional status scale, with higher scores indicating better functional status ($\alpha = .88$). Participants reported their height and weight, which were converted to BMI (weight in kilograms divided by height in meters squared).

Statistical Analysis

The hypothesized life-course pathway was tested using structural equation modeling conducted with Mplus, Version 3 (Muthén & Muthén, 1998) using standard maximum likelihood estimation. The childhood Big-Five factor scores were treated as exogenous variables. Healthy eating was measured as a latent variable with three indicators (fiber, high fat, and food preparation). In preliminary analyses, healthy eating, smoking, and physical activity did not form a latent construct so they were included individually in the model but allowed to correlate. Health status was a latent construct with three indicators: self-assessed general health status, functional status, and BMI. Correlated error was allowed among indicators of the same construct but not across constructs. Indexes of fit of the model to the data included the root-mean-square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker–Lewis Index (TLI). The significance of parameter estimates was assessed by evaluating the critical ratio of the unstandardized estimate to the standard error. The chi-square difference test was used to compare the overall fit of two competing models. Multiple-group analyses were conducted to test the effects of gender. Starting with the final model, with the parameter estimates constrained to be equal between the genders, estimates were sequentially freed if freeing them significantly improved the fit of the model.

Results

Table 1 presents the means and standard deviations for all variables. The largest adult gender difference was on childhood Conscientiousness. Girls in this sample were viewed as almost half a standard deviation above the mean, whereas boys were somewhat below the mean on this trait. Women had healthier eating habits and smoked and exercised less than men.

In the final model (see Figure 1) with all nonsignificant paths removed, childhood Agreeableness, Conscientiousness, and Intellect–Imagination were positively related to educational attainment. Higher educational attainment predicted healthy eating and less smoking but, contrary to expectation, less physical activity. Healthy eating, less smoking, and more physical activity predicted better health status. Conscientiousness and educational attainment were also direct predictors of health status. In addition, Extraversion had a direct positive association with smoking and physical activity and Agreeableness had a direct negative association with smoking. The fit of the final model was satisfactory (RMSEA = .040, 90% confidence interval [CI] = .032–.048, CFI = .939, TLI = .908). The fit of the model without the direct path from childhood Conscientiousness to adult health status (RMSEA = .042, 90% CI = .034–.050, CFI = .932, TLI = .900) was significantly worse than the fit of the final model including this direct path, $\chi^2_{\text{difference}}(1, N = 1054) = 10.13$, $p < .01$. The fit of the model without the direct path from educational attainment to adult health status (RMSEA = .047, 90% CI = .039–.055, CFI = .915, TLI = .875) was significantly worse than the final model including this direct path, $\chi^2_{\text{difference}}(1, N = 1054) = 32.65$, $p < .001$.

Table 1
Means and Standard Deviations on all Variables for the Entire Sample (N = 1,054) and Separately for Men (n = 561) and Women (n = 493)

	Total		Men		Women		
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*p*
Age (in years)	45.00	2.00	45.00	2.00	45.00	2.02	*ns*
Educational attainment	6.74	1.87	6.60	1.92	6.89	1.80	<.01
Fiber	0.00	0.55	−0.09	0.52	0.10	0.56	<.001
High fat	0.00	0.55	0.08	0.57	−0.09	0.52	<.001
Food preparation	0.00	0.60	−0.07	0.59	0.08	0.59	<.001
Smoking	0.97	1.13	1.08	1.18	0.83	1.05	<.001
Physical activity	40.39	29.52	43.88	30.90	36.44	27.39	<.001
Self-rated health	3.39	0.96	3.34	0.94	3.45	0.97	*ns*
Functional status	0.00	0.69	0.04	0.64	−0.05	0.73	<.05
Body mass index	27.20	5.00	28.12	5.46	26.14	6.34	<.001
Childhood personality							
Extraversion	−0.00	1.02	0.12	1.03	−0.14	0.98	<.001
Agreeableness	0.02	0.97	−0.05	0.98	0.09	0.98	<.05
Conscientiousness	0.07	1.01	−0.23	1.01	0.41	0.89	<.001
Emotional Stability	0.02	1.00	0.10	0.97	−0.08	1.03	<.01
Intellect–Imagination	0.04	1.00	0.05	1.03	0.02	0.96	*ns*

Note. The *p* values are in reference to gender differences across variables. Extraversion, Agreeableness, Conscientiousness, Emotional Stability, Intellect–Imagination, fiber, high fat, food preparation, and functional status were measured in standard scores.

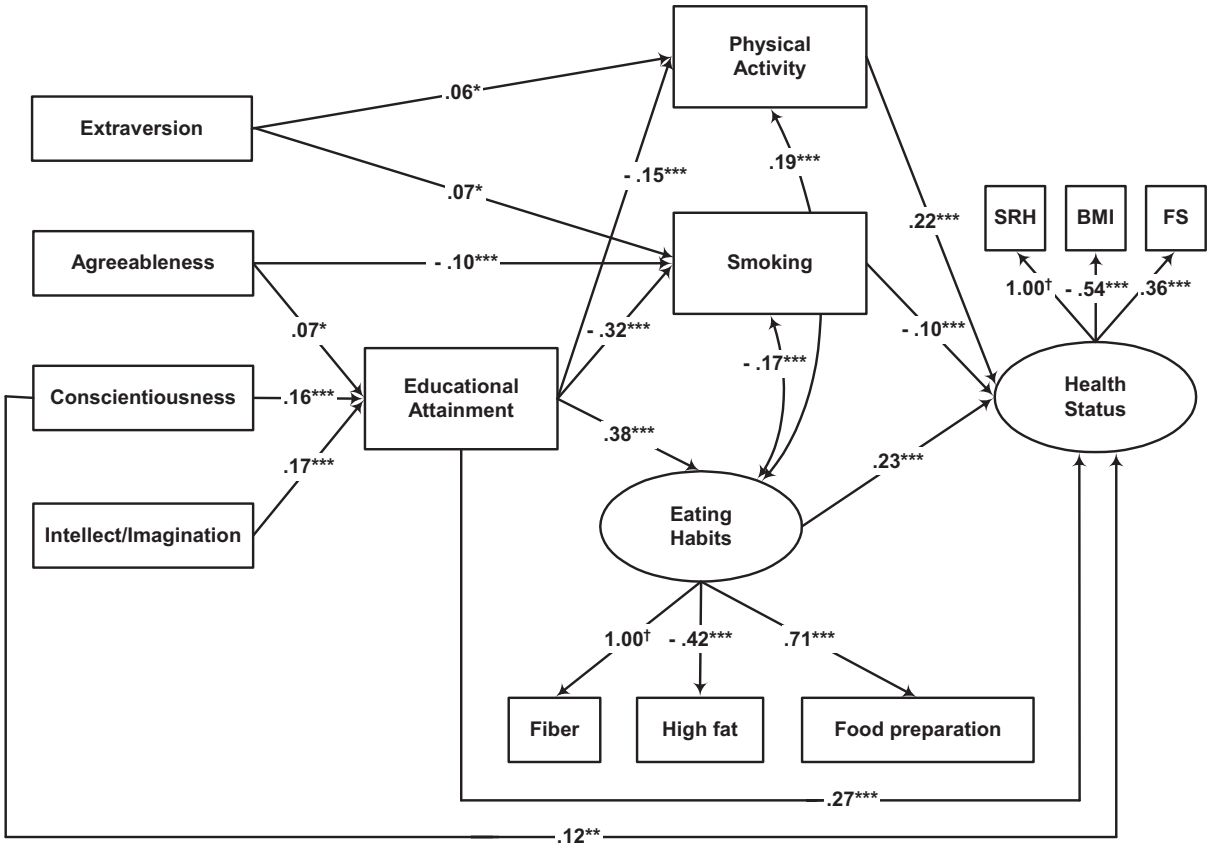

Figure 1. Structural model for the entire sample of direct and indirect influences of childhood personality traits on adult health status through educational attainment and health behaviors. Only significant paths are included, and standardized path coefficients are shown. SRH = self-rated health; BMI = body mass index; FS = function status. †Parameters fixed at 1.00. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Multiple-group analysis showed that only one path in the model differed significantly between genders. Women (but not men) who were less agreeable as children were more likely to smoke (–.21, $p < .001$).

Discussion

A life-course pathway was supported. Children whom teachers regarded as more agreeable, conscientious, and intellectual–imaginative went on to do better educationally and also to have healthier eating habits, to smoke less, and to report better health status at midlife. However, adult health status was also influenced by effects not involving this pathway. Conscientiousness had a direct effect, and educational attainment had a direct effect not involving health behaviors. Moreover, there were also direct effects of personality traits on health behavior that were not mediated by educational status (Extraversion on smoking and physical activity and Agreeableness on smoking). Despite men and women differing in levels of all three health behaviors, the same model (with the exception of just one path) applied equally well to them both.

This test of a life span model was limited by the measures available for the Hawaii cohort. The measures were all self-report and obtained concurrently in the same questionnaire, whereas the model postulates that health behaviors over a lifetime contribute to health status. However, given the difficulty of permanently changing eating and exercise habits (Katz, 2005), it is likely that reports of typical and recent health habits reflected more than a current fad. The smoking measure did not indicate amount of smoking since initiation, which would have been a more accurate measure of lifetime exposure. The measure of physical activity failed to distinguish between work-related and leisure-time activity over a 7-day period, which may account for the negative association between physical activity and educational attainment (He & Baker, 2005).

Despite these limitations, the model suggests that educational attainment and health behavior mechanisms (as studied here) explain some, but not all, of the influence of childhood personality on adult health status. The wider implication is that additional mechanisms are necessary. The main alternative to health behavior models of personality and health are biological ones that postulate personality pathways through physiological mechanisms (Weibe & Smith, 1997). Emotional Stability (Neuroticism) did not enter the present model, suggesting that its effects may be better explained by a biological model. The combination of direct and indirect effects of Conscientiousness found both here and by Friedman et al. (1993) suggests the intriguing possibility that this

trait, and perhaps others, may influence health through a combination of health behavior and other mechanisms. Further tests of personality and health models using a life span approach are necessary to more fully determine the multiple mechanisms by which childhood traits have their enduring effects on health.

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