# The Moderating Role of Conscientiousness in the Relationship between Education and Health in Later Life

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## Extended Abstract

## Introduction

The association between education and health is well documented: education is positively associated with good general health and longevity and also negatively associated with morbidity, mortality, and disability (House et al. 1994; Lantz et al., 2001). In short, those who are more educated tend to be healthier, primarily as education benefits to health typically accumulate over the life course (Cutler & Lleras-Muney, 2006; Herd, Goesling, & House, 2007; Mirowsky & Ross, 2005). Previous research has demonstrated that the effect of education on health goes beyond its economic benefits, such as higher occupational attainment and income, and has suggested that the benefits may also reflect psychosocial factors (Mirowsky & Ross, 2003). While prior literature suggests that psychological factors may mediate the link between education and health, few studies have considered the potential moderating effects of psychological resources (Chandola et al. 2006; Cutler & Lleras-Muney 2008; Gallo & Matthews, 2003; House et al., 1994; Schieman 2001). While education shapes health outcomes, not all individuals with lower levels of education will have poor health. Individual psychological factors may account for health discrepancies at the same or similar level of education, particularly in considering that the shaping of personality generally precedes educational and occupational attainment. Those with higher levels of conscientiousness and lower educational attainment, may be less vulnerable to the deleterious effects of low education for health than those with lower levels of conscientiousness.

This paper makes two main contributions to the literature on education and health: (1) First, I investigate the moderating effects of psychological resources using the Big Five personality taxonomy (Costa & McCrae's, 1985), with a focus on conscientiousness. There is rich evidence suggesting that conscientiousness is a key personality factor in maintaining health via its association with positive health behaviors and facilitation of socioeconomic attainment over life course (Shanahan, Hill, Roberts, Eccles, & Friedman, 2014; Sirois & Hirsch, 2015). Conscientiousness is closely related to self-control and self-regulation which affect impulsivity, planning, and effort-making (Caspi, Roberts, & Shiner, 2005). Individuals who exhibit high levels of conscientiousness are more likely to engage in health preventative behaviors such as exercise, healthy eating, non-smoking, and drinking in moderation, and less likely to be associated with drug use and a moderate negative association with heavy drinking, overeating and tobacco use (Bogg & Roberts, 2004). Given the significance of conscientiousness to health, however, there is little known about the moderating effect of conscientiousness in the relationship between education and health. In this research, I would like to explore the specific interaction effect of conscientiousness in the relationship between education and health.

This study also uses direct measures of physical functioning as a health outcome. Physical performance measures, particularly timed gait task or gait speed, are highly valid predictors of physical disability and mortality (Guralnik et al., 2000). The walking speed also better captures the fitness levels of older people (Hausdorff, Levy, & Wei, 1999; Studenski et al., 2011). To my knowledge, there is no study using these physical functioning outcomes to examine the relationship between education and health.

I thus hypothesize that conscientiousness is more important for the less-educated than for the well-educated in terms of health outcomes, particularly walking performance. Higher

educational attainment brings about a diverse array of benefits which may offset the influence of psychological resources. Conscientiousness, then, may not matter as much for those with higher levels of educational attainment. For those with lower levels of educational attainment, however, conscientiousness may be more influential in shaping physical functioning. Additionally, I hypothesize that the inclusion of psychosocial factors, such as health behaviors, social support, and stress, may not influence the moderating effect of conscientiousness in the relationship between education and health.

**Data, Variables, and Methods**

I use the data from the Wisconsin Longitudinal Study (WLS), a longitudinal study of randomly sampled 10,317 Wisconsin high school graduates in 1957, to explore my research questions. The surveys were conducted in 1957, 1964, 1975, 1992/94, 2003/5, and 2011 through phone and in-person interviews and follow-up mail questionnaires. The WLS includes detailed information about childhood, parental SES, education, occupation, wealth, psychological well-being, personality, health, and mortality (Herd, Carr, & Roan, 2014). Examination of respondents' daily physical functioning was also conducted by an interviewer in 2011. Due to mortality, non-response, and missing data, the final sample size is 3,264.

To estimate the moderating effect of conscientiousness in the relationship between education and health, I estimate ordinary least squares (OLS) regression models of physical functioning. The main health outcome of interest is gait speed, i.e. walking speed. Since the 2011 survey, the WLS collected measures of respondents' physical functioning, which were directly measured in a home setting by an interviewer multiple times, increasing the measure's accuracy

and reliability. To measure the gait speed, a predictor of functional dependence, respondents were asked twice to walk 2.5 meters in their normal walking pace, and the two times were then averaged. Higher values thus reflect worse health. As the distribution of gait speed is positively skewed, I use a logged transformation of the variable.

While the health outcome was ascertained in the 2011 survey (when the participants were 72 years old), information pertaining to educational attainment was collected from 1975 to 2003/5 and personality and the psychosocial resource measures are from the 2003/5 surveys (aged 65). As the main explanatory variable of interest, educational attainment is categorized into five categories: high school degree, associate's degree, bachelor's degree, master's degree, and doctoral or professional degree. The reference group is high school degree. Data on *conscientiousness* was collected from information on respondents' personalities in 1992 and 2003/5 mail questionnaires by measuring how much respondents "aligned" with each of the Big Five personality traits. Answer categories for the Big Five were scaled from "agree strongly" to "disagree strongly", mostly coded 1 to 6. The fact that this measure precedes the health outcome allows for stronger causal inference regarding the relationship between personality and health and the role of personality in moderating the education-health relationship.

All health behavior variables were collected in 2003/5 via mail questionnaires. Health behavior variables include *smoking*, *exercise hours* and *BMI*. Social support, for this paper, is defined by respondents' marital status and how many hours they spent their time with friends, both of which were also collected in 2003/5 survey. *Stress* was measured using an indicator of whether their children are divorced, as a part of family stress for older people. I control for respondent's demographic characteristics, childhood general health, high school rank, and

parental SES, which includes each parent's education years and marital status, father's occupation, whether the respondent's mother worked, and average income, in order to control the influence of family background and childhood health to adult health. Gender and age of respondents are included as demographic characteristics. Because data on respondents' racial background were not available on the publicly released data that I used and only less than 1% of respondents are classified as non-white in the WLS, race was not included in the regression models. The WLS is not well suited to provide insights into the relationship between education and health for racial and ethnic minorities but provides a rich source of life history data for non-Hispanic Whites who have at least a high school education.

To offer comprehensive insights into the moderation role of psychological resources in the relationship between education and health, I estimate five models. All models control for childhood health, high school rank, parental SES, and demographic characteristics:

- Model 1 is a basic model using educational attainment and other covariates to estimate the total effect of educational attainment on health (H1).
- Model 2 adds the measure of conscientiousness to Model 1 to test whether conscientiousness mediates the education and health relationship (H2).
- Model 3 adds the interaction terms to Model 2 to examine whether conscientiousness moderates the education and health relationship (H3).
- Models 4 and 5 test whether the addition of the psychosocial measures changes the moderating effect of conscientiousness on the relationship between education and health (H4).

**Preliminary Results**

Table 2 presents results of all models. The results from Model 1 provide support for the first hypothesis (H1), showing that education is significantly and positively associated with gait speed. Respondents at levels of education attainment greater than or equivalent to a bachelor's degree are have significantly faster walking speed than otherwise similar respondents with a high school degree. Having a bachelor's degree is associated with an average time decrease of walking time by 7% compared to the gait speed of those high school degree. (The ratio of gait speed is $e^{-0.053}$, which is approximately 0.95; thus, the gait speed decreases by about 5%.) Having a master's degree is associated with an average time decrease of the gait speed by 6.11%, and having a doctorate is associated with the decreased gait speed by 8.33%. Evidently, the higher the educational attainment, the faster the walking speed. The findings from Model 2 provide little support for the hypothesis (H2) that conscientiousness mediates the relationship between the education and gait speed, as the percentage change in coefficients at each education level ranges from 1 to 3%, and there is no change in significance in any education coefficients.

The results from Model 3 support for the hypothesis (H3) that conscientiousness moderates the association between education and gait speed. The inclusion of the interaction terms influences the association between educational attainment and the walking time and changes the statistical significance status of all educational gradients. The main effect of educational attainment becomes no longer statistically significant, whereas the main effect of conscientiousness is still statistically significant. This means that the health effect of having higher education is different depending on the scores of conscientiousness. For those with associate degree, they may have faster walking speed as the score of conscientiousness increases.

Findings from Models 4 and 5 do support the hypothesis (H4) that the inclusion of psychosocial factors may not change the moderating effect of conscientiousness in the relationship between education and health. While inclusion of psychosocial resources may explain the changed coefficient of interaction terms between conscientiousness and education, the significance status of the interaction terms remains the same.

**Preliminary Conclusions**

Data from the WLS confirms that there is a strong, significant relationship between educational attainment and health; specifically, those with post-secondary education have better physical functioning compared to those with an associate degree or less. I find evidence that conscientiousness influences the relationship between educational attainment and health in later life among respondents who were born in 1939 and graduated from Wisconsin high schools in 1957, while the analysis suggests that the mediation effect of conscientiousness is trivial, only 1 to 3%. The results may indicate that the benefits of high conscientiousness may outweigh the negative effect of low educational attainment. One who has lower educational attainment but positive, beneficial personality traits may have better physical functioning, and on the flip side of the coin, one who is also better educated but exhibit negative personality traits may have poor lifestyle choices, having poor health. However, as stated earlier, the ability to draw proper insights from the WLS is limited due to the lack of racial and educational diversity among the respondents. Longitudinal data that are more racially and educationally inclusive may lead to a different conclusion about the influence of conscientiousness in the relationship between education and health.

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**Table 1. Descriptive Statistics**

| | Year | Mean | Min | Max |
|---|---|---|---|---|
| *Outcome* | | | | |
| Gait speed | 2011 | 2.74 | 1.27 | 21.09 |
| *Educational Attainment* | 1975, 1992/93, 2003/5 | | | |
| High school degree | | 0.64 | 0 | 1 |
| Associate's degree | | 0.03 | 0 | 1 |
| Bachelor's degree | | 0.19 | 0 | 1 |
| Master's degree | | 0.11 | 0 | 1 |
| Doctoral/Professional degree | | 0.03 | 0 | 1 |
| *Personality* | | | | |
| Conscientiousness | 1992/93, 2003/5 | 30.21 | 14 | 36 |
| *Health Behaviors* | 2003/5 | | | |
| Smoking | | 0.54 | 0 | 1 |
| Exercise hours | | 38.30 | 0 | 720 |
| BMI | | 27.87 | 19 | 45 |
| *Social Support* | 2003/5 | | | |
| Going out with friends (hours) | | 2.20 | 0 | 28 |
| Marital status | | 1.51 | 1 | 5 |
| *Stress* | 2003/5 | | | |
| Family stress (children's divorce) | | 0.41 | 0 | 1 |
| *Confounding Covariates* | | | | |
| *Childhood general health* | 2003/5 | 3.46 | 1 | 4 |
| *High school rank* | 1957 | 103.90 | 61 | 139 |
| *Parental SES* | 1957, 1975 | | | |
| Father's education (years) | | 10.41 | 7 | 18 |
| Mother's education (years) | | 10.73 | 7 | 18 |
| Parents' marital status | | 0.93 | 0 | 1 |
| Father occupation | | 2.52 | 1 | 5 |
| Mother worked | | 0.36 | 0 | 1 |
| Average Parent's income | | 60.18 | 1 | 150 |
| *Demographic Characteristics* | | | | |
| Female | 1957 | 0.54 | 0 | 1 |
| Age | 2003/5 | 64.28 | 63 | 67 |
| *Observations* | | 3,246 | | |

**Table 2. Ordinary Least Squares (OLS) Regression of Walking Time (Gait Speed) (n = 3,246)**

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| *Educational Attainment* | | | | | |
| (reference = high school degree) | | | | | |
| Associate's degree | -0.050 | -0.051 | 0.020 | -0.049 | 0.070 |
| | (0.03) | (0.03) | (0.21) | (0.03) | (0.20) |
| Bachelor's degree | -0.053*** | -0.052*** | -0.121 | -0.045*** | -0.077 |
| | (0.01) | (0.01) | (0.10) | (0.01) | (0.09) |
| Master's degree | -0.063*** | -0.061*** | -0.137 | -0.057*** | -0.097 |
| | (0.02) | (0.02) | (0.14) | (0.02) | (0.13) |
| Doctoral/Professional degree | -0.087** | -0.088*** | -0.072 | -0.079** | -0.060 |
| | (0.03) | (0.03) | (0.21) | (0.03) | (0.20) |
| *Personality* | | | | | |
| Conscientiousness | | -0.004** | -0.004** | -0.002 | -0.002 |
| | | (0.00) | (0.00) | (0.00) | (0.00) |
| *Education*Conscientiousness* | | | | | |
| Associate's*Conscientiousness | | | -0.002 | | -0.004 |
| | | | (0.01) | | (0.01) |
| Bachelor's*Conscientiousness | | | 0.002 | | 0.001 |
| | | | (0.00) | | (0.00) |
| Master's*Conscientiousness | | | 0.002 | | 0.001 |
| | | | (0.00) | | (0.00) |
| Doctoral*Conscientiousness | | | -0.001 | | -0.001 |
| | | | (0.01) | | (0.01) |
| *Health Behaviors* | | | | | |
| Smoking | | | | 0.013 | 0.012 |
| | | | | (0.01) | (0.01) |
| Exercise | | | | -0.000 | -0.000 |
| | | | | (0.00) | (0.00) |
| BMI | | | | 0.012*** | 0.012*** |
| | | | | (0.00) | (0.00) |
| *Social Support* | | | | | |
| Going Out with Friends | | | | -0.003* | -0.003* |
| | | | | (0.00) | (0.00) |
| Marital Status | | | | | |
| (reference = Married) | | | | | |
| Separated | | | | -0.003 | -0.004 |
| | | | | (0.18) | (0.18) |
| Divorced | | | | 0.017 | 0.018 |
| | | | | (0.02) | (0.02) |
| Widowed | | | | -0.001 | -0.002 |
| | | | | (0.02) | (0.02) |
| Never married | | | | 0.047 | 0.047 |
| | | | | (0.03) | (0.03) |
| *Stress* | | | | | |
| Children's Divorce | | | | 0.002 | 0.003 |
| | | | | (0.01) | (0.01) |
| *Constant* | 0.430 | 0.553 | 0.561 | 0.017 | 0.021 |
| | (0.47) | (0.47) | (0.47) | (0.46) | (0.46) |
| BIC | 566.118 | 565.570 | 596.960 | 449.034 | 480.744 |

* p<0.05, ** p<0.01, *** p<0.001

Note: All models control for childhood health, high school rank, parental SES, and demographics. Standard errors in parentheses.