Does Cognitive Functioning Mediate the Well-Documented Link between Education and Functional Disability in Middle-Aged Adults?

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Wide bodies of literature document gradients in the experience of disease and function by levels of education and other measures of socioeconomic status: The lower a person's education, the more likely the person will suffer from a greater variety and severity of diseases as well as functional disability arising from those diseases. It is unclear whether education proxies for other indicators of SES (income, net worth) or measures all the knowledge and skills accumulated over the life course that may be health protective. For example, because education and cognitive functioning are often perceived as two sides of the same coin, cognitive functioning may also measure life course knowledge and skills. The dimension of cognitive functioning that reflects a person's fluid or basic processing abilities promotes the acquisition of new information that, in turn, is reflected in the dimension of crystallized or knowledge-based abilities. Both dimensions of cognitive functioning are likely to influence the amount of education that a person achieves; conversely, the amount of education achieved (as well as other life course experiences) may influence a person's cognitive functioning. The moderate correlation between education and cognitive functioning ($r = 0.44$) in middle-aged adults suggests that although they are complementary, they may tap into different conceptual realms. Earlier research by the authors[1] demonstrated that high levels of cognitive functioning behave like high levels of education in associations with enhanced health outcomes in middle-aged adults. Further, cognitive functioning—like education—moderates the effects of some diseases on the reporting of functional disability.[2]

In this study, we examine more closely the relationships among education, cognitive functioning, and functional disability; and we hypothesize that cognitive functioning will mediate the link between levels of education and functional disability both cross-sectionally and longitudinally in middle-aged men and women. Using data from the nationally representative Health and Retirement Study (1992, 1994), we test this link in sequentially entered blocks of variables that include: (1) education; (2) cognitive functioning; (3) education and cognitive functioning; (4) education, cognitive functioning, demographic, disease, and health factors; and (5) the variables in (4) plus social and other education-related material resources. The

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models are tested in the full sample of middle-aged adults as well as stratified by income and sex. Results indicate that both education and cognitive functioning are significant negative predictors of functional disability in both 1992 and 1994. When tested together, the effects on functional disability of education and cognitive functioning are reduced but remain significant. Net of demographic factors, disease burden, health behaviors, and SES, higher cognitive functioning reduces the negative effect of lower education on functional disability for the full sample in 1992 (but not in 1994). Finally, cognitive functioning exerts a small negative effect on functional disability in both 1992 and 1994 over and above the effects of other measures of SES among middle-aged men in the lowest quartile for income. Here, cognitive functioning (but not education in 1994) appears to compensate for low income in reducing

TABLE 1. OLS regression estimates of functional disability in 1992 regressed on education, cognitive functioning, and selected predictors among U.S. adults age 51–61, by income quartile and sex

Characteristics		Lowest Quartile		Highest Quartile	
	All Parameter Estimate	Men Parameter Estimate	Women Parameter Estimate	Men Parameter Estimate	Women Parameter Estimate
Model 1					
Intercept	4.53^{***}	5.98^{***}	6.49^{***}	3.94^{***}	3.42^{***}
Education	-0.38^{***}	-0.18^{**}	-0.40^{***}	-0.18^{***}	-0.21^{***}
R^2	0.07	0.01	0.04	0.03	0.02
Model 2					
Intercept	4.32^{***}	5.48^{***}	6.50^{***}	3.83^{***}	3.07^{***}
Cognitive functioning	-0.11^{***}	-0.15^{***}	-0.16^{***}	-0.04^{***}	-0.07^{***}
R^2	0.03	0.02	0.04	0.01	0.02
Model 3					
Intercept	4.50^{***}	5.45^{***}	6.31^{***}	4.01^{***}	3.46^{***}
Education	-0.32^{***}	-0.10	-0.27^{***}	-0.17^{***}	-0.16^{***}
Cognitive functioning	-0.05^{***}	-0.13^{**}	-0.12^{***}	-0.01	-0.05^{**}
R^2	0.07	0.02	0.06	0.03	0.03
Model 4[a]					
Intercept	7.56^{***}	3.89^{***}	4.39^{***}	2.70^{***}	4.04^{***}
Education	-0.08^{***}	-0.01^{**}	-0.14^{***}	-0.12^{***}	-0.09^{*}
Cognitive functioning	-0.02^{***}	-0.05^{*}	-0.03^{*}	0.00	-0.01
R^2	0.42	0.41	0.41	0.27	0.37

KEY: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

[a]Net of age, sex, disease burden, self-care burden, irregular exercise, current smoker, income, net worth for overall analyses; net of all but income for stratified analyses.

functional disability among men, net of other demographic, health, and SES factors. Two potential explanations are considered: (1) compensation and (2) life course exposure.

First, it may be that for middle-aged adults with fewer socioeconomic resources upon which to draw, some resources (cognitive functioning) are drawn upon more heavily than are others (education), perhaps to compensate for the negative effects of lower income. In contrast, adults at high income levels may possess more education-related resources and experiences (higher status jobs with fewer physical demands, greater health benefits, safer living environments, longer time horizons) than do low-income men, increasing their ability to buffer the effects of disease on functional disability more successfully. Second, cognitive functioning may be less

TABLE 2. OLS regression estimates of functional disability in 1994 regressed on education, cognitive functioning, and selected predictors among U.S. adults age 51–61, by income quartile and sex

Characteristics		Lowest Quartile		Highest Quartile	
	All Parameter Estimate	Men Parameter Estimate	Women Parameter Estimate	Men Parameter Estimate	Women Parameter Estimate
Model 1					
Intercept	4.04^{***}	5.25^{***}	6.01^{***}	2.32^{***}	3.58^{***}
Education	-0.38^{***}	-0.19^{**}	-0.44^{***}	-0.17^{***}	-0.25^{***}
R^2	0.06	0.01	0.04	0.02	0.03
Model 2					
Intercept	3.84^{***}	4.78^{***}	6.17^{***}	1.97^{***}	3.26^{***}
Cognitive functioning	-0.10^{***}	-0.15^{***}	-0.13^{***}	−0.03	-0.05^{**}
R^2	0.02	0.02	0.02	0.00	0.01
Model 3					
Intercept	4.04^{***}	4.75^{***}	5.91^{***}	2.34^{***}	3.61^{***}
Education	-0.35^{***}	−0.09	-0.38^{***}	-0.16^{***}	-0.22^{***}
Cognitive functioning	-0.03^{***}	-0.13^{**}	-0.07^{*}	−0.00	−0.03
R^2	0.06	0.02	0.05	0.02	0.03
Model 4[a]					
Intercept	6.33^{***}	3.06^{***}	4.20^{***}	2.24^{***}	3.61^{***}
Education	-0.12^{***}	−0.02	-0.25^{***}	-0.11^{**}	-0.12^{**}
Cognitive functioning	−0.01	-0.08^{*}	0.00	0.00	0.00
R^2	0.36	0.34	0.33	0.24	0.32

KEY: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

[a]Net of age, sex, disease burden, self-care burden, irregular exercise, current smoker, income, net worth for overall analyses; net of all but income for stratified analyses.

of an education marker in low-income men than in high-income men. In particular, low-income men may have been exposed to fewer education-related resources and experiences over their entire life course than have high-income men, disadvantaging them in middle age and forcing them to draw more heavily on the resources they do possess. This study's results suggest that the pathways from disease to functional disability and links with SES are not straightforward nor easy to interpret.

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