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Special Issue: Cumulative Dis/Advantage: Innovations in Research and Theory: Research Report

Is College Completion Associated with Better Cognition in Later Life for People Who Are the Least, or Most, Likely to Obtain a Bachelor's Degree?

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Abstract

Objectives: Drawing on insights from theorizing on cumulative dis/advantage (CDA), we aimed to advance understanding of educational attainment as a protective factor for later-life cognition by examining whether associations between obtaining a bachelor's degree and later-life cognition differ according to individuals' likelihood of completing college based on characteristics in adolescence.
Methods: We conducted a propensity score analysis with data from the Wisconsin Longitudinal Study (WLS). Measures to predict college completion were assessed prospectively in adolescence, and a global measure of later-life cognition was based on cognitive assessments at age 65.
Results: College completion by age 25 (vs high school only) was associated with better later-life cognition for both men and women. Among men specifically, associations were stronger for those who were less likely as adolescents to complete college.
Discussion: Results indicate the utility of a CDA perspective for investigating the implications of interconnected early life risk and protective factors for later-life cognition, as well as ways in which college education can both contribute to, as well as mitigate, processes of CDA.

Keywords: Cumulative advantage/disadvantage, Education, Gender, Life course, Propensity score

Studies have found that greater educational attainment is associated with better cognition in later life (Lenehan, Summers, Saunders, Summers, & Vickers, 2015), with researchers generally conceptualizing sources of dis/advantage before college as factors that require statistical control to reduce bias in causal inferences (for a discussion, see Fletcher & Frisvold, 2014). Nevertheless, there is growing evidence within research on other adult outcomes that the implications of postsecondary education might differ based on individuals' likelihood of completing college in the first place (Hout, 2012). Our study addresses the need for research on heterogeneous treatment effects of postsecondary education on later-life cognition, given that obtaining a bachelor's degree is contingent upon a constellation of interconnected individual, family, and social-structural conditions (Kurlaender & Hibel, 2018), which also serve as risk and protective factors for later-life cognition (see Greenfield & Moorman, 2019, for a review).

Unique to a cumulative dis/advantage (CDA) perspective is the idea that inequitable exposures early in life serve to sustain and increase inequality as members of a cohort age (DiPrete & Eirich, 2006). (For a discussion on ways in which processes of accumulation can entail both the amplification and stability of inequalities over time, see Ferraro

& Morton, 2018.) Prior health-focused research on CDA and education largely has examined the extent to which associations between educational attainment and individual health grow in size as cohorts progress throughout adulthood (see Mirowsky & Ross, 2008, for a review). No studies, to our knowledge, have used a CDA perspective to examine how differential selection into obtaining a college degree potentially influences the relationship between educational attainment and later-life cognition.

Schafer, Wilkinson, and Ferraro (2013) describe two competing theoretical viewpoints on whether individuals with greater dis/advantage before college benefit the most, or least, from a college education. The "added protection" hypothesis posits a "Matthew effect," which suggests the amplification of dis/advantage over the course of an individual's life (Dannefer, 2018). Individuals whose adolescent advantages make them most likely to complete college might gain the most from graduating college—being maximally situated to capitalize upon the biopsychosocial advantages that college affords. On the other hand, the "compensatory leveling" hypothesis suggests that those who face the greatest disadvantage in youth have the most to gain from college completion. For example, obtaining a bachelor's degree might be especially important for optimizing neurophysiological development among individuals with poor access to such resources through their parents, schools, and communities in adolescence (Seifan, Schelke, Obeng-Aduasare, & Isaacson, 2015).

Using propensity score methods, we tested potential heterogeneous treatment effects within associations between college completion and later-life cognition. We further oriented to gender differences, given that especially for contemporary cohorts of older adults, the meaning of postsecondary education varied for men and women. For example, shortly following World War II, men were generally encouraged to obtain a college degree to establish their careers, whereas college was viewed as less relevant for women's long-term futures (Eisenmann, 2006). Accordingly, we examined whether heterogeneous treatment effects differed for men and women.

Methods

Data

The Wisconsin Longitudinal Study (WLS) is a random sample of one-third of students who graduated from a Wisconsin high school in 1957 (N = 10,317). Because the original WLS sample included insufficient numbers of persons of color for statistical analysis, participants comprise a White sample (Herd, Carr, & Roan, 2014). The analysis was limited to participants with no educational attainment past high school and those who graduated from college by the age of 25. Excluded analytic groups included (a) 1,327 people who had missing data on educational attainment; (b) 1,425 people who had missing data on cognition at age 65 (mostly because the WLS administered five of the six cognitive assessments to only a random subset of participants; see Supplementary Appendix A); (c) participants who attended college but did not complete a four-year college degree (n = 1,474); and (d) participants who completed a four-year college degree after the age of 25 (n = 702). Our final analytic sample was 5,389 participants, including 2,434 men and 2,955 women.

Measure of Later-Life Cognitive Function

At age 65, participants completed a battery of six cognitive tests, including a similarities tasks, two fluency tasks, two recall tests, and a digit ordering test. (For information about these measures, refer to Supplementary Appendix A.) We calculated the percent of maximum possible scores (Cohen, Cohen, Aiken, & West, 1999) for each test, and averaged the scores (α = 0.65).

Measures of Dis/Advantage Before College

Measures of dis/advantage before college included *parental socioeconomic status* (mother's and father's highest level of education as reported in 1957, father's occupational status based on tax filings, and household income averaged across the participants' high school years based on tax filings); whether participants *did not live with both parents* most of the time until 1957; *number of siblings* in 1957; *geographic setting* of the participant's high school (rural, urban, or suburban based on 1960 U.S. Census data); and *scholastic aptitude* (based on the Wisconsin State Testing Service's administration of the Henmon-Nelson Test of Mental Ability [Henmon & Nelson, 1954]). Additional measures were necessary to model women's likelihood of college graduation, including *parental encouragement for college* (assessed in 1957 regarding whether parents wanted the participant to attend college), *proximity to a college* (whether there was a college or university within 15 miles of the participant's high school), and *rank in high school class* (based on information that the high schools provided to the WLS). Missing data on rank in class (7% of the sample) were multiply-imputed by chained equations (Rubin, 1987).

Analytic Approach

Our aim was to predict men's and women's cognitive performance in older adulthood as a function of whether they completed college. We calculated propensity scores and used them in two ways: adjusted inverse probability weighting (Glynn & Quinn, 2010) and heterogeneous treatment effect analysis (Xie, Brand, & Jann, 2012). Adjusted inverse probability weighting tested the hypothesis that college completion has similar effects on adult cognitive function regardless of social advantages that predispose one to obtain a college degree. Heterogeneous treatment effect analysis tested whether college completion yielded greater cognitive benefits to someone who already had precollege advantages (Matthew effect) or to someone who lacked advantages (compensatory leveling effect). See Supplementary Appendix B for additional information about our analytic approach.

Results

Table 1 presents descriptive statistics, and Table 2 includes nine empirically derived strata of probabilities of graduating from college, by gender and realized educational attainment. The results from adjusted inverse probability weighting appear in Model 1 of Tables 3 (for men) and 4 (for women). The average estimated return to college completion was an improvement of 10 percentage points in later-life cognition scores (95% confidence interval [CI]: 7–12) for men, and 6 percentage points in later-life cognition scores (95% CI: 3–8) for women.

The results from heterogeneous treatment effect analysis appear in Model 2 of Tables 3 (for men) and 4 (for women) and are plotted against strata rank in Figures 1 and 2, respectively. For men, returns to cognition were largest for participants who completed college despite being less likely to do so. The effect of completing college on later-life cognition was statistically significant for all strata except the two that had the highest likelihood of attending college. There was a statistically significant negative linear trend to the point estimates (−0.013, $p < .05$). For women, returns to later-life cognition did not vary with propensity to obtain a college degree. While the estimates for each stratum were positive for women, ranging between 0.03 and 0.11, only five out of nine were statistically significantly different from zero ($p < .05$), and the point estimates did not form a significant linear trend.

Discussion

Our analyses replicate associations between adolescent dis/advantage and likelihood of college completion (Elman & O'Rand, 2007), as well as between college completion and better later-life cognition (Lenehan et al., 2015). Moreover, we found that men with lower propensity to complete college demonstrated larger later-life cognitive gains from college completion compared to men in the highest propensity groups. These results suggest that, for this cohort of White high school graduates, college completion was especially important for enhancing later-life cognitive function among men who were the least likely to complete college. These men's higher levels of cognition at age 65 suggest that college completion is a long-term source of cognitive reserve, or ability to withstand age-related threats to neurophysiology and cognition (Stern, 2003), likely helping them to preserve functional abilities as they progress in age.

Overall, our findings are consistent with a "chains of risk" perspective on how inequalities at one point in the life course are part of sequences of dis/advantages that extend across the life course (Pavalko & Caputo, 2013). However, we did not find evidence of a "Matthew Effect," whereby college completion would be the most advantageous for the later-life cognition of those who were the most likely to complete college. Instead, results implicated a compensatory mechanism for men: Men who were the least likely as adolescents to complete college demonstrated the greatest long-term cognitive advantages of obtaining a bachelor's degree. These results are consistent with a growing number of studies using propensity score analysis to examine other adult outcomes—including heart disease, hypertension, mortality, depression, fertility, income, and volunteerism (Bauldry, 2014; Brand, 2010; Brand & Davis, 2011; Brand & Xie, 2010; Schafer et al.,

Table 1. Descriptive Statistics for High School and College Graduates by Gender

	Men		Women		
	High school graduates (n = 1,665)	College graduates (n = 769)	High school graduates (n = 2,365)	College graduates (n = 590)	
Global cognition at age 65	0.43	0.56	0.49	0.61	a, b
Measures from Adolescence					
Scholastic aptitude	−0.36	0.84	−0.19	0.86	a, b
Parental socioeconomic status	−0.32	0.57	−0.24	0.75	a, b
Did not live with both parents most of the time until 1957 (%)	10.3	5.7	10.6	6.9	a, b
Number of siblings	3.3	2.4	3.3	2.2	a, b
Rural residence (%)	61.3	44.3	55.0	39.8	a, b
College within 15 miles (%)			43.3	55.8	a, b
Parents encouraged college (%)			29.5	91.5	a, b
High school rank (percentile)			51.9	80.4	a, b

Note: Data are from the Wisconsin Longitudinal Study. Cognition scores are percent of maximum possible scores, and scholastic aptitude and parental socioeconomic status are standardized.

[a]Differences by education are statistically significant among men, $p < .05$.

[b]Differences by education are statistically significant among women, $p < .05$.

Table 2. Number of Cases by Degree Completion and Propensity Score Stratum

	Men		Women	
	High school graduates	College graduates	High school graduates	College graduates
Propensity score				
(0, .05)	547	21	1,462	22
(.05, .1)	204	17	245	11
(.1, .15)	172	12	137	15
(.15, .2)	140	26	86	17
(.2, .3)	202	53	121	38
(.3, .4)	124	71	66	53
(.4, .6)	163	159	136	115
(.6, .8)	77	182	80	198
(.8, 1)	20	223	17	119

Note: Data are from the Wisconsin Longitudinal Study. Propensity score for college graduation was estimated by a logistic regression model accounting for parental socioeconomic status, living in a two-parent family, number of siblings, rural residence in adolescence, and adolescent scholastic aptitude for both sexes, and also parental encouragement for college, proximity to a college, and high school rank among women.

Table 3. Effects of Completing a College Degree on Age 65 Global Cognition among Men

	Adjusted Inverse Probability Weighting Model 1		Heterogeneous Treatment Effects Model 2	
Average predicted global cognition for high school graduates (percent of maximum possible)	0.45*	(0.44, 0.46)		
Average treatment effect (ATE) of college completion	0.10*	(0.07, 0.12)		
Propensity score strata rank			ATE within stratum	
1 – (0, .05)			0.12*	(0.06, 0.17)
2 – (.05, .1)			0.11*	(0.05, 0.18)
3 – (.1, .15)			0.20*	(0.13, 0.27)
4 – (.15, .2)			0.08*	(0.04, 0.14)
5 – (.2, .3)			0.07*	(0.03, 0.12)
6 – (.3, .4)			0.09*	(0.05, 0.13)
7 – (.4, .6)			0.07*	(0.05, 0.10)
8 – (.6, .8)			0.03	(−0.01, 0.06)
9 – (.8, 1)			0.04	(−0.02. 0.09)
Linear trend of ATEs by strata rank				
Slope			−0.01*	(−0.02, −0.01)
Constant			0.15*	(0.12, 0.20)

Note: Data are from the Wisconsin Longitudinal Study. Numbers in parenthesis are 95% confidence intervals.
*$p < .05$.

Table 4. Effects of Completing a College Degree on Age 65 Global Cognition among Women

	Adjusted Inverse Probability Weighting Model 1		Heterogeneous Treatment Effects Model 2	
Average predicted global cognition for high school graduates (percent of maximum possible)	0.51*	(0.50, 0.51)		
Average treatment effect (ATE) of college completion	0.06*	(0.03, 0.08)		
Propensity score strata rank			ATE within stratum	
1 – (0, .05)			0.05	(−0.01, 0.10)
2 – (.05, .1)			0.11*	(0.02, 0.19)
3 – (.1, .15)			0.05	(−0.01, 0.13)
4 – (.15, .2)			0.10*	(0.03, 0.16)
5 – (.2, .3)			0.03	(−0.01, 0.07)
6 – (.3, .4)			0.08*	(0.04, 0.13)
7 – (.4, .6)			0.03*	(0.01, 0.07)
8 – (.6, .8)			0.03	(−0.01, 0.05)
9 – (.8, 1)			0.06*	(0.01, 0.13)
Linear trend of ATEs by strata rank				
Slope			−0.01	(−0.01, 0.00)
Constant			0.07*	(0.03, 0.12)

Note: Data are from the Wisconsin Longitudinal Study. Numbers in parenthesis are 95% confidence intervals.
*$p < .05$.

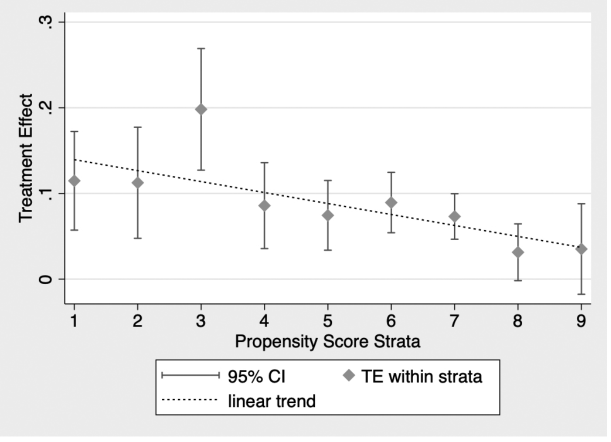

Figure 1. Among men, effects of completing a college degree on age 65 global cognition by propensity of completing college, with stratum 1 indicating the lowest probability of completing college and stratum 9 indicating the highest probability of completing college (CI = Confidence Interval; TE = Treatment Effect).

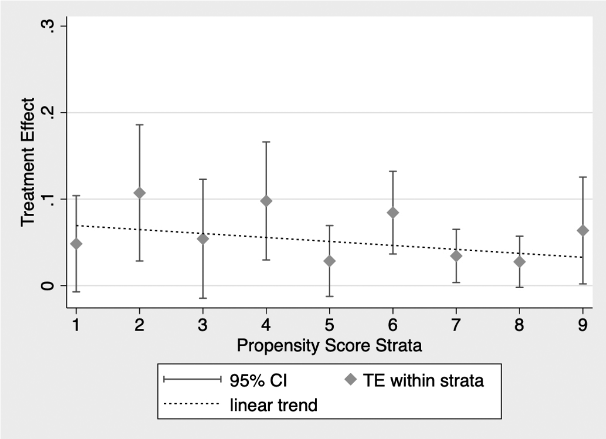

Figure 2. Among women, effects of completing a college degree on age 65 global cognition by propensity of completing college, with stratum 1 indicating the lowest probability of completing college and stratum 9 indicating the highest probability of completing college (CI = Confidence Interval; TE = Treatment Effect).

2013)—which generally have found that college completion is associated with more favorable outcomes among people the least likely to obtain a bachelor's degree. It also is congruent with research on child development, suggesting that children from disadvantaged backgrounds generally have poorer access to additional schooling, but demonstrate larger benefits when such schooling is attained (van Huizen & Plantega, 2018).

It is important to note that heterogeneous treatment effects were specific to men: Associations between college completion and later-life cognition did not differ by propensity stratum for women. We interpret these differences from a gendered perspective on the life course, which orients to "men's and women's different locations in the social fabric of roles and relationships at different life stages" (Moen, 2001, p. 179). The experience and sequelae of obtaining a college degree might have been qualitatively different for men and women of this cohort, with men more consistently benefiting from postsecondary education alone and women's benefits perhaps being more conditional on other social roles throughout the life course (e.g., those within families and employment opportunities). Overall, these findings suggest continued attention to how CDA processes might operate differently based on individuals' social positions beyond socioeconomic status, with particular attention to how education, health, and CDA differ for men versus women (e.g., Leopold & Leopold, 2018).

Several methodological features limit the interpretation of results. First, the WLS sample consists only of White individuals from a single cohort who completed high school in Wisconsin. The "rising importance" hypothesis, which posits that education is becoming a more powerful influence on later-life health over historical time, suggests the need for future research with more recent birth cohorts (Mirowksy & Ross, 2008). Such studies are especially important in light of evidence regarding growing inequalities that influence young people's transition to adulthood (Dannefer & Huang, 2017), as well as growing inequalities among successive cohorts of older adults (Crystal, Shea, & Reyes, 2017). Moreover, given evidence that college education might yield more robust, long-term health benefits for White Americans in contrast to Black (Shuey & Wilson, 2008), future studies using data from other racial/ethnic groups in the United States are necessary. Also, it is important to note that associations reported in this study are correlational, which limit causal interpretations. It is possible, for example, that men who were the least likely to complete college, but who still did so, constitute an especially hardy group of people, which accounts for their better later-life cognition as opposed to college completion per se.

Despite these limitations, results affirm a seeming paradox that college education might both contribute to, and mitigate, processes of CDA. Although obtaining a bachelor's degree is more likely among individuals with greater advantage as adolescents, our results contribute to a growing body of empirical evidence that college completion is an especially important asset for individuals who faced relatively greater disadvantage in youth. Overall, such findings support the importance of attention not only to "old age" policies that aim to address inequalities resulting from past CDA processes, but also to policies for youth, such as those related to education, which could affect subsequent CDA processes for future cohorts of older adults.

Supplementary Material

Supplementary data is available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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Author Contributions

E. A. Greenfield conceptualized the study, wrote the introduction and discussion sections, and organized the data for analysis. A. Akincigil developed the analytic approach, conducted the analysis, wrote the data analytic and results section, and created the statistical tables and figures. S. M. Moorman wrote about the data and measures, contributed to the literature review, and assisted with conducting the data analysis and writing about the analytic framework and results.

Conflict of Interest

None reported.

References

Bauldry, S. (2014). Conditional health-related benefits of higher education: An assessment of compensatory versus accumulative mechanisms. *Social Science & Medicine (1982),* **111**, 94–100. doi:10.1016/j.socscimed.2014.04.005

Brand, J. E. (2010). Civic returns to higher education: A note on heterogeneous effects. *Social Forces; A Scientific Medium of Social Study and Interpretation,* **89**, 417–433. doi:10.1353/sof.2010.0095

Brand, J. E., & Davis, D. (2011). The impact of college education on fertility: Evidence for heterogeneous effects. *Demography,* **48**, 863–887. doi:10.1007/s13524-011-0034-3

Brand, J. E., & Xie, Y. (2010). Who benefits most from college? Evidence for negative selection in heterogeneous economic returns to higher education. *American Sociological Review,* **75**, 273–302. doi:10.1177/0003122410363567

Cohen, P., Cohen, J., Aiken, L. S., & West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behavioral Research*, **34**, 315–346. doi:10.1207/S15327906MBR3403_2

Crystal, S., Shea, D. G., & Reyes, A. M. (2017). Cumulative advantage, cumulative disadvantage, and evolving patterns of late-life inequality. *The Gerontologist,* **57**, 910–920. doi:10.1093/geront/gnw056

Dannefer, D. (2018). Systemic and reflexive: Foundations of cumulative dis/advantage and life-course processes. *The Journals of Gerontology: Psychological and Social Sciences*. Online advance access. doi:10.1093/geronb/gby118

Dannefer, D., & Huang Mgs, W. (2017). Precarity, inequality, and the problem of agency in the study of the life course. *Innovation in Aging,* **1**, igx027. doi:10.1093/geroni/igx027

DiPrete, T. A., & Eirich, G. M. (2006). Cumulative advantage as a mechanism for inequality: A review of theoretical and empirical developments. *Annual Review of Sociology*, **32**, 271–297. doi:10.1146/annurev.soc.32.061604.123127

Eisenmann, L. (2006). *Higher education for women in postwar America, 1945-1965*. Baltimore, MD: Johns Hopkins University Press.

Elman, C., & O'Rand, A. M. (2007). The effects of social origins, life events, and institutional sorting on adults' school transitions. *Social Science Research*, **36**, 1276–1299. doi:10.1016/j.ssresearch.2006.11.001

Ferraro, K. F., & Morton, P. M. (2018). What do we mean by accumulation? advancing conceptual precision for a core idea in gerontology. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences,* **73**, 269–278. doi:10.1093/geronb/gbv094

Fletcher, J. M., & Frisvold, D. E. (2014). The long run health returns to college quality. *Review of Economics of the Household*, **12**, 295–325. doi:10.1007/s11150-012-9150-0

Glynn, A. N., & Quinn, K. M. (2010). An introduction to the augmented inverse propensity weighted estimator. *Political Analysis*, **18**, 36–56. doi:10.1093/pan/mpp036

Greenfield, E. A., & Moorman, S. M. (2019). Childhood socioeconomic status and later life cognition: Evidence from the Wisconsin Longitudinal Study. *Journal of Aging and Health,* **31**, 1589–1615. doi:10.1177/0898264318783489

Henmon, V. A. C., & Nelson, M. J. (1954). *The Henmon-Nelson tests of mental ability: Manual for administration*. Boston, MA: Houghton-Mifflin Company.

Herd, P., Carr, D., & Roan, C. (2014). Cohort profile: Wisconsin longitudinal study (WLS). *International Journal of Epidemiology,* **43**, 34–41. doi:10.1093/ije/dys194

Hout, M. (2012). Social and economic returns to college education in the United States. *Annual Review of Sociology,* **38**, 379–400. doi:10.1146/annurev.soc.012809.102503

van Huizen, T., & Plantenga, J. (2018). Do children benefit from universal early childhood education and care? A meta-analysis of evidence from natural experiments. *Economics of Education Review*, **66**, 206–222. doi:10.1016/j.econedurev.2018.08.001

Kurlaender, M., & Hibel, J. (2018). Students' educational pathways: Aspirations, decisions, and constrained choices along the education lifecourse. In B. Schneider(Ed.), *Handbook of the sociology of education in the 21st century* (pp. 361–384). Cham, Switzerland: Springer International Publishing. doi:10.1007/978-3-319-76694-2_16

Lenehan, M. E., Summers, M. J., Saunders, N. L., Summers, J. J., & Vickers, J. C. (2015). Relationship between education and age-related cognitive decline: A review of recent research. *Psychogeriatrics,* **15**, 154–162. doi:10.1111/psyg.12083

Leopold, L., & Leopold, T. (2018). Education and health across lives and cohorts: A study of cumulative (dis)advantage and its rising importance in Germany. *Journal of Health and Social Behavior,* **59**, 94–112. doi:10.1177/0022146517751206

Mirowsky, J., & Ross, C. E. (2008). Education and self-rated health: Cumulative advantage and its rising importance. *Research on Aging*, **30**, 93–122. doi:10.1177/0164027507309649

Moen, P. (2001). The gendered life course. In R. H. Binstock& L. K. George(Eds.), *Handbook of aging and the social sciences* (pp. 179–196). San Diego, CA: Academic Press.

Pavalko, E. K., & Caputo, J. (2013). Social inequality and health across the life course. *American Behavioral Scientist*, **57**, 1040–1056. doi:10.1177/0002764213487344

Rubin, D. R. (1987). *Multiple imputation for nonresponse in surveys*. New York: John Wiley & Sons.

Schafer, M. H., Wilkinson, L. R., & Ferraro, K. F. (2013). Childhood (Mis)fortune, educational attainment, and adult health: Contingent benefits of a college degree? *Social Forces; A Scientific Medium of Social Study and Interpretation,* **91**, 1007–1034. doi:10.1093/sf/sos192

Seifan, A., Schelke, M., Obeng-Aduasare, Y., & Isaacson, R. (2015). Early life epidemiology of Alzheimer's Disease–a critical review. *Neuroepidemiology,* **45**, 237–254. doi:10.1159/000439568

Shuey, K. M., & Willson, A. E. (2008). Cumulative disadvantage and black-white disparities in life-course health trajectories. *Research on Aging*, **30**, 200–225. doi:10.1177/0164027507311151

Stern, Y. (2003). The concept of cognitive reserve: A catalyst for research. *Journal of Clinical and Experimental Neuropsychology,* **25**, 589–593. doi:10.1076/jcen.25.5.589.14571

Xie, Y., Brand, J. E., & Jann, B. (2012). Estimating heterogeneous treatment effects with observational data. *Sociological Methodology,* **42**, 314–347. doi:10.1177/0081175012452652