College completion predicts lower depression but higher metabolic syndrome among disadvantaged minorities in young adulthood

Lauren Gaydosh[a], Kristen M. Schorpp[b], Edith Chen[c,d], Gregory E. Miller[c,d], and Kathleen Mullan Harris[a,e,1]

[a]Carolina Population Center, University of North Carolina at Chapel Hill, Chapel Hill, NC 27516; [b]Department of Sociology, Roanoke College, Salem, VA 24153; [c]Institute for Policy Research, Northwestern University, Evanston, IL 60208; [d]Department of Psychology, Northwestern University, Evanston, IL 60208; and [e]Department of Sociology, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599

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Individuals with higher educational attainment live healthier and longer lives. However, not everyone benefits equally from higher education. In particular, the black–white gap in life expectancy is greater at higher levels of educational attainment. Furthermore, recent research suggests that disadvantaged African Americans in the rural Southeast who attend college have worse physical health than their similarly disadvantaged peers who do not attend college. The extent to which this pattern generalizes to a nationally representative, mixed-race sample is unknown. Using data from the National Longitudinal Study of Adolescent to Adult Health, we test whether the health benefits associated with college completion vary by level of childhood disadvantage for depression and metabolic syndrome in young adulthood, across race/ethnicity. We find uniform lower depression associated with college completion regardless of childhood disadvantage, and across non-Hispanic white, non-Hispanic black, and Hispanic young adults. College completion is associated with lower metabolic syndrome for whites across all levels of childhood disadvantage. In contrast, college completion is associated with higher metabolic syndrome among black and Hispanic young adults from disadvantaged childhood environments. Our findings suggest that, for minorities from disadvantaged backgrounds, finishing college pays substantial dividends for mental health but simultaneously exacts costs with regard to physical health. This pattern contrasts starkly with whites and minorities from more privileged backgrounds, for whom college completion is associated with benefits to both mental and physical health. These results suggest that racial disparities in health may persist in part because the health of upwardly mobile minorities is compromised in young adulthood.

social mobility | health disparities | race and ethnic disparities | young adulthood

Income and wealth inequality in the United States is high and has been growing since the 1970s, with an increasing concentration of fortunes in the top of the distribution (1–4). Upward intergenerational income mobility has become less likely over this period (5). While access to education has expanded, increasing population levels of college attainment have been met with a simultaneous intensification of differentiation within categories of educational attainment according to the quality of the educational degree (6). Alongside the rise in income inequality, increases in income segregation mean that the affluent are increasingly isolated in affluent communities, concentrating high-quality public goods, including schools, in restricted geographic locations (7). Income segregation combined with racial segregation results in black and Hispanic individuals living in more disadvantaged neighborhoods and attending lower-quality schools than whites with the same level of income and assets (8–10). Furthermore, there is evidence that the returns to housing and educational investments are lower for blacks and Hispanics than they are for whites (11, 12).

This context of inequality has been reflected in socioeconomic gradients in health. The socioeconomic gradient in health and mortality in the United States is large, persistent, and increasing over time (13–16). While greater levels of socioeconomic resources broadly defined are associated with better health, education demonstrates the most consistently robust association (17). More-educated individuals live healthier and longer lives; individuals with a college degree can expect to outlive their less-educated counterparts by about a decade (18).

However, higher socioeconomic status (SES) is not equally beneficial for all individuals; within SES categories, non-Hispanic whites enjoy better health outcomes than non-Hispanic blacks, and this gap is wider at higher levels of SES (19, 20). Weathering is a conceptual framework that has been proposed to explain this pattern (21). Minorities face greater exposure to stressors, including discrimination and institutionalized racism, that requires sustained coping (22–25). Another conceptual framework relevant to these patterns is John Henryism, which suggests that individual characteristics such as self-control, grit, and perseverance promote psychosocial well-being and achievement but can be physiologically taxing because they result in sustained activation of the stress-response system (26–28). This results in biological wear and tear, accelerated aging, and accumulated risk, also referred to as allostatic load (29, 30). Such stress-related deterioration is manifested in physiological risk across biological systems (29). Alongside this increasing emphasis on the importance of accumulated stressors

Significance

College graduates enjoy healthier, longer lives compared with individuals who do not graduate from college. However, the health benefit of educational attainment is not as great for blacks as it is for whites. Moreover, college completion may not erase the detrimental effects of early-life disadvantage for blacks and Hispanics. We use nationally representative data on young adults to test whether American minorities experience differential returns to educational attainment. We find that college completion predicts lower rates of depression for all racial groups. It also predicts lower metabolic syndrome among whites. However, college completion predicts higher metabolic syndrome among black and Hispanic adults from disadvantaged backgrounds, suggesting upward mobility may come at a health cost to young minorities in America.

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[1]To whom correspondence should be addressed. Email: kathie_harris@unc.edu.

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has been the recognition of the role of early-life environments in shaping adult health outcomes (31–33).

In a recent set of papers, Brody, Chen, Miller, and colleagues investigate the health consequences of the intersection of high-effort coping and early-life disadvantage among young adult African Americans living in the rural Southeast. They document a pattern of "skin-deep resilience" among African Americans from severely disadvantaged backgrounds wherein those who evince high levels of self-control prospectively demonstrate better school outcomes and mental health than those with lower levels of self-control, suggesting that they are psychologically resilient to disadvantage. However, these psychologically resilient individuals simultaneously display signs of compromised physical health, including higher allostatic load, greater cardiometabolic risk, more epigenetic aging of leukocytes, and greater susceptibility to respiratory infection (34–37).

These findings suggest that for African Americans from severely disadvantaged backgrounds, upward mobility may have divergent consequences for mental and physical health. However, the generalizability of this phenomenon is unclear; most of the findings come from small cohorts of African Americans in the rural Southeast, and whether the same pattern unfolds with upward mobility in other ethnic and racial groups across the United States is unknown. The majority of existing research has concentrated on black–white differences in health (20, 38, 39). However, the stress induced by upward mobility is likely greater among any minority group for whom systems of inequality constitute additional and compounding barriers to achieving upward mobility. Indeed, the experience of young adulthood and the process of becoming socially mobile vary by race/ethnicity. Both African Americans and Hispanics are more likely to be incarcerated, live in poverty, be unemployed, and have lower incomes for a given level of education compared with whites (40–42). Differences in the life course markers and transitions among minority young adults not only affect their prospects for becoming upwardly mobile but also affect the amount of distress and sustained effort required to achieve upward mobility. These differences have important implications for the experience and potential health consequences of mobility for minorities.

We consider that possibility here, using a large, nationally representative study with longitudinal data spanning 14 y that include young adults from all race, ethnic, socioeconomic, and geographic contexts in America. Drawing from the literatures on weathering, John Henryism, and skin-deep resilience, we predicted there would be racial and ethnic disparities in the mental and physical health benefits associated with a college degree. We used self-reported depressive symptoms as a measure of mental health, as it is a mental health problem that increases during adolescence and remains prevalent for young adults (43–46). Morbidity and mortality are unusual in 24- to 32-y-olds, so we measured physical health in terms of metabolic syndrome, a cluster of signs that is common in midlife and forecasts risk for later diabetes, heart attack, stroke, and premature mortality (47, 48). Among whites from all socioeconomic backgrounds, we hypothesized that finishing college would be associated with uniformly positive returns in adulthood, as reflected in fewer depressive symptoms and better cardiometabolic health at ages 24–32 y. However, among ethnic and racial minorities, we hypothesized there would be mixed returns to finishing college, particularly for those from the most severely disadvantaged backgrounds, who are likely to face racism, discrimination, and isolation as they progress through education. Specifically, we predicted these individuals will go on to have better mental health, as reflected in fewer depressive symptoms at ages 24–32 y, but simultaneously worse cardiometabolic health.

Results

The data were drawn from the nationally representative National Longitudinal Study of Adolescent to Adult Health (Add Health), an ongoing study of the social, behavioral, and biological linkages in health and developmental trajectories. Our analysis examined non-Hispanic white, non-Hispanic black, and Hispanic young adults interviewed in adolescence (wave I, age 12–18 y) and early adulthood (wave IV, age 24–32 y). From these data we generated a composite indicator of exposure to disadvantage in adolescence by summing the number of top quintile values across household, neighborhood, and school contexts (see details in *Materials and Methods*). Table 1 shows that black and Hispanic individuals experienced significantly higher levels of disadvantage in adolescence compared with white peers. By early adulthood, both race/ethnic minorities were also significantly less likely to complete a college degree than whites.

We measured adult depressive symptoms at wave IV using a subset of nine items from the Center for Epidemiologic Studies Depression scale (CES-D) (see details in *Materials and Methods*). Whites reported the fewest depressive symptoms on average (4.55), followed by Hispanics (5.65) and blacks (6.07). The measurements were collected in home visits during wave IV. We constructed an indicator of metabolic syndrome, modifying slightly the National Cholesterol Education Program guidelines to accommodate the available Add Health biomarkers. We used measures of blood pressure, glycosylated hemoglobin, HDL cholesterol, triglycerides, and waist circumference (see details in *Materials and Methods*). Similar to the pattern observed for depression, and consistent with the broader epidemiologic literature, whites were the least likely to have metabolic syndrome (26%) compared with Hispanics (32%) and blacks (35%).

We tested for psychosocial resilience using Poisson regression for the count of the number of depressive symptoms reported with models stratified by race/ethnicity (Table S2). In all models, sex and age were modeled as covariates. Individuals from disadvantaged childhood backgrounds reported more depressive symptoms in adulthood, and those who completed a college degree reported fewer depressive symptoms. To test whether the association between college education and depression varies by level of adolescent disadvantage we included an interaction term. There was no evidence that the depression-buffering association of college completion varies by exposure to disadvantage in adolescence for whites ($P = 0.32$) or Hispanics ($P = 0.24$). Furthermore, among black young adults, a college degree was associated with even

Table 1. Descriptive statistics by race/ethnicity, mean (SD) or percent

Variable	White	Black	Hispanic	Black–white difference*	Hispanic–white difference*
Female	51.43	54.50	51.54	$P = 0.414$	$P = 0.400$
Age (wave IV)	28.24 (1.66)	28.51 (2.23)	28.39 (2.22)	$P = 0.243$	$P = 0.523$
Adolescent disadvantage index	3.65 (3.18)	10.13 (5.23)	7.15 (5.35)	$P < 0.001$	$P < 0.001$
College degree	32.58	20.77	19.27	$P < 0.001$	$P < 0.001$
Depressive symptoms	4.55 (3.71)	6.07 (5.24)	5.65 (4.85)	$P < 0.001$	$P = 0.004$
Metabolic syndrome	25.81	34.70	32.08	$P < 0.001$	$P < 0.001$
N	6,901	2,482	1,403		

*P values of two-tailed t tests for continuous variables; χ^2 tests for dichotomous or categorical variables.

fewer depressive symptoms for individuals from increasingly disadvantaged childhood backgrounds ($P < 0.05$). Controlling for baseline depressive symptoms in adolescence does not substantively alter the conclusion. As Fig. 1 illustrates, the results were consistent with the hypothesis that greater educational attainment is associated with psychosocial benefits for individuals from all socioeconomic backgrounds and of varying race/ethnicity.

We tested the differential benefits of college completion for physical health using logistic regression to predict the odds of having metabolic syndrome with models stratified by race/ethnicity (Table S3). In all models, sex and age were modeled as covariates. Among white young adults, each SD increase in adolescent disadvantage was associated with a 10% increase in the odds of metabolic syndrome ($P < 0.05$). College completion was associated with a 37% decrease in the odds of metabolic syndrome ($P < 0.001$). There was no evidence that this health-protective association of college completion varied by level of adolescent disadvantage ($P = 0.33$). Results are substantively similar when controlling for measures of physical health in adolescence.

As demonstrated in Fig. 2, the results were different for black and Hispanic adults compared with whites. At low levels of exposure to adolescent disadvantage college completion predicted a lower probability of metabolic syndrome compared with those without a college degree. However, as exposure to adolescent disadvantage increased, the health benefit associated with college completion declined. In fact, at high levels of disadvantage (>1 SD above mean), black and Hispanic adults with a college degree were predicted to be more likely to have metabolic syndrome compared with their similarly disadvantaged peers who did not complete college. For example, a black adult exposed to an adolescent environment of disadvantage two SDs above the mean who completed college had a predicted probability of metabolic syndrome 9% points higher than a peer who did not complete college (0.43 compared with 0.34).

Follow-up analyses verified that the physical health benefit associated with college completion was significantly different for Hispanic and black adults compared with whites (Table S4). Specifically, we tested for race/ethnic differences in a single logistic regression model pooling the three groups and including additional indicators for black/Hispanic identity interacted with adolescent disadvantage and college degree (i.e., a three-way interaction). The main effect of college degree indicated that college completion is associated with lower odds of metabolic syndrome [odds ratio (OR) = 0.59, $P < 0.001$]. The interaction between adolescent disadvantage and college completion—relevant for the reference group of whites—was not statistically significant ($P = 0.54$). However, the three-way interaction between adolescent disadvantage, college completion, and black/Hispanic identity was positive (OR = 1.44) and marginally significant ($P < 0.10$). These findings indicate that for black and Hispanic adults the metabolic "benefit" associated with college completion diminishes—and indeed appears to become a liability—with increasing levels of exposure to adolescent disadvantage.

Discussion

Upward social mobility is a tenet of the American dream. Scholars and policymakers interested in health and inequality would hope that greater social and economic advantage attained in adulthood would improve health outcomes compared with remaining disadvantaged. Indeed, many social policies are premised on the belief that by promoting socioeconomic success among the disadvantaged we can improve their well-being and physical health, creating a healthier and more productive population. Consistent with these aspirations, we found that young adults from disadvantaged backgrounds who achieve upward mobility by attaining a college degree report fewer depressive symptoms compared with their similarly disadvantaged peers who do not complete college. This relationship holds for non-Hispanic whites, blacks, and Hispanics. In contrast, for metabolic syndrome we found that individuals do not uniformly benefit from a college degree; black and Hispanic adults from the most disadvantaged backgrounds face higher levels of metabolic syndrome with a college degree than those without a college degree. While whites from across the socioeconomic spectrum enjoy a physical health benefit associated with college completion, blacks and Hispanics from disadvantaged backgrounds see no benefit and at higher levels of disadvantage may actually experience a cost. If this relationship persists through adulthood and older age it has the potential to undermine the individual and social benefits of upward mobility.

This is the first evidence documenting the psychological benefit and physiological deficit of college completion in both disadvantaged African American and Hispanic American young adults in a nationally representative sample. Our findings are consistent with a pattern of skin-deep resilience among upwardly mobile

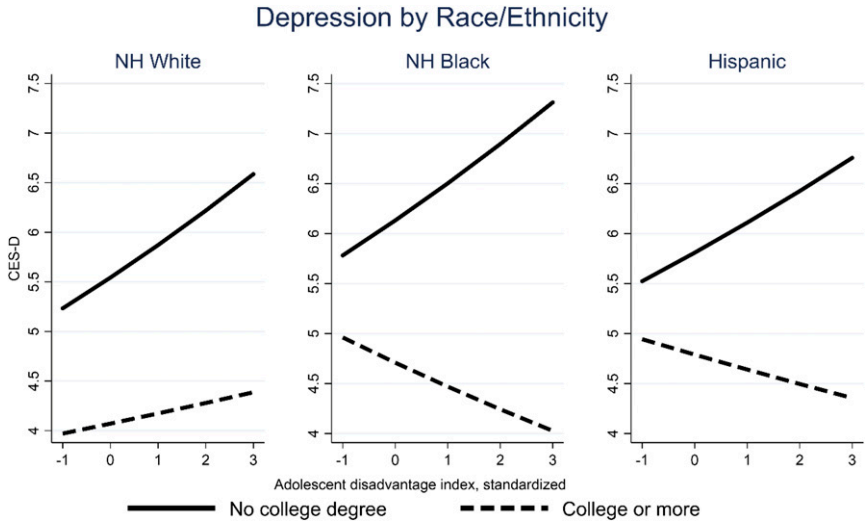

Fig. 1. Predicted number of depressive symptoms from race-stratified Poisson regression models allowing for an interaction between adolescent disadvantage and college completion. The association between college completion and depression does not vary according to level of exposure to disadvantage in adolescence for whites ($P = 0.32$) and Hispanics ($P = 0.24$) and increases with disadvantage for blacks ($P < 0.05$).

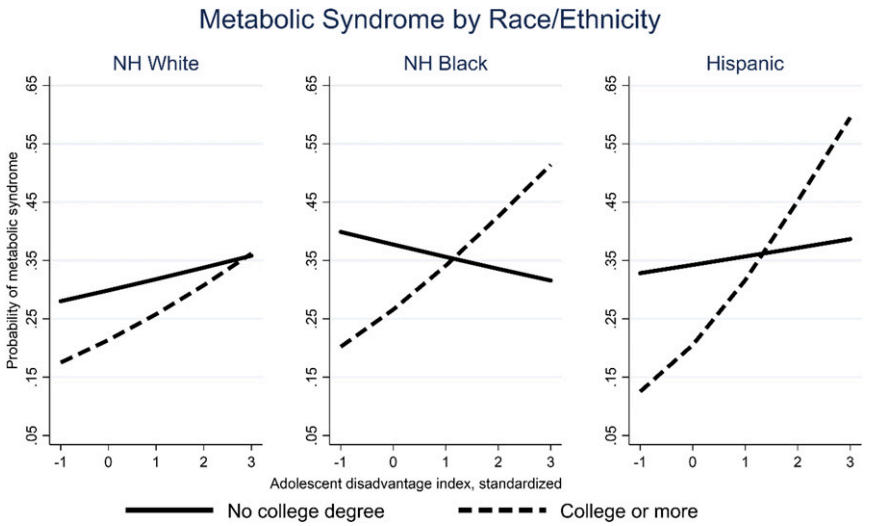

Fig. 2. Predicted probability of metabolic syndrome from race-stratified logistic regression models allowing for an interaction between adolescent disadvantage and college completion. The association between college completion and metabolic syndrome does not vary according to level of exposure to disadvantage in adolescence for whites ($P = 0.33$) but increases with disadvantage for blacks ($P < 0.01$) and Hispanics ($P < 0.01$). There is evidence that the physical health benefits of education in early adulthood vary by level of exposure to disadvantage earlier in life only for black and Hispanic adults.

minorities from severely disadvantaged backgrounds (35, 37). What might underlie these patterns? We speculate that these upwardly mobile minority youth are psychologically hardy. However, when young adults from disadvantaged backgrounds achieve upward mobility the higher-status environment in which they find themselves may differ greatly from their social environment of origin (49, 50); such incongruence can lead to isolation and a lack of social support (20, 51–53). Furthermore, conditions in the environment of arrival may be inhospitable or hostile, particularly given discriminatory social structures. Upwardly mobile minorities may also feel that their achieved position is tenuous (54, 55). To cope with these stressors, individuals may deploy strategies that are effective in alleviating mental strife but are harmful for physical health (51, 56). Despite such challenges, these young adults complete their degrees and maintain good mental health. As they do so, however, a wear and tear on bodily systems from hard-driving effort may accrue.

In supplementary analyses of metabolic syndrome (Table S5) we tested the mediating role of four potential mechanisms: individual psychosocial characteristics of striving in adolescence and perseverance in adulthood, social isolation in adolescence and adulthood, experience of stressful life events in adolescence and adulthood and perceived social stress in adulthood, and adolescent body mass index. Accounting for differences in individual levels of striving and exposure to social stressors does not explain the elevated health risk observed among disadvantaged minority college graduates. Future research must consider both more nuanced measures of the social context in which upward mobility occurs as well as more complicated intersections of stress exposure and response.

The absence of a physical health benefit to college completion for young adult minorities suggests important implications for the labor force, health care, and the future of inequality. If they do not experience the expected health benefits of educational attainment, upwardly mobile minorities may spend less time in the labor force, limiting their resource accumulation and the intergenerational transfer of wealth, consequently stunting potential for reducing inequality within and across generations. Furthermore, accelerated physiological deterioration may mean that they will need more health care at earlier adult ages. Greater health-care costs could divert investment from future human capital development in themselves and their children. Finally, given the persistence of inequality and the difficulty of mobility in the United States, it is troubling if the individuals who manage to achieve upward mobility experience health costs. Perhaps more troubling still is that this pattern is limited to black and Hispanic individuals, potentially making it more challenging to close existing racial disparities in health.

However, it would be erroneous to conclude from our findings that upward mobility is bad for your health and should therefore be avoided. Rather, policies are needed that promote upward mobility, making it more common and less stressful, and supporting the upwardly mobile individual's ability to translate his or her additional education into health-promoting resources. This should include increased attention to educational quality in addition to access. Recent publicity of the challenges faced by first-generation college students provides an opportunity to examine how supportive interventions affect not only completion, but mental and physical health. Online communities, such as *I'm First!*, provide student testimonials and information to support first-generation students in accessing and completing college. Many colleges and universities are beginning to offer programs tailored to the needs of first-generation students, such as the Harvard College First Generation Student Union. Such programs may increase feelings of belonging and reduce stress; for example, a social-belonging intervention not only reduced the achievement gap but also demonstrated physical health improvements among minority students (57). Design and evaluation of other interventions, with specific attention to the potential physical health risks of college completion among disadvantaged minorities, is a fruitful area for future research.

Future research can also address a limitation of this study by following individuals across the life course to better understand how elevated health risk at this age shapes health and aging trajectories among the upwardly mobile. We examined a composite measure of metabolic syndrome in early adulthood, when respondents were aged 24–32 y. The use of biomarker measurements allows us to investigate risk before disease onset when many conditions are asymptomatic or undetected via traditional clinical screening. Nevertheless, it remains unknown whether such risk will ultimately manifest in morbidities, or if upwardly mobile individuals will be able to translate their accumulating advantage into better health as they age. Documenting the health consequences associated with social mobility in early adulthood provides a

foundation from which to understand different aging trajectories for those from disadvantaged backgrounds that begin during the transition to adulthood. In addition, the elevated health risk associated with upward mobility for disadvantaged minority young adults may partially explain the persistent racial disparity in health across place and time among older adults at the same level of SES (58).

Materials and Methods

Sample and Design. Add Health is an ongoing national longitudinal study representative of American adolescents in grades 7–12 in 1994–1995. The initial sample included 20,745 adolescents aged 12–20 y; since the start of the study, participants have been interviewed in home at four data collection waves. At wave IV in 2008–2009, respondents were aged 24–32 y (n = 15,701, 80.3% response rate) and asked to participate in biological specimen collection (over 95% provided specimens, almost 15,000).

We limited our analytic sample to respondents who participated in both waves I and IV in-home interviews, were from schools that participated in the in-school and school administrator surveys, and had valid sampling weights (n = 14,167). From this sample, we conducted listwise deletion to exclude those without complete data for all predictors and demographic covariates used in the analysis, leaving us with a final sample size of n = 13,009 for the depressive symptoms analysis. An additional 20% of respondents had missing data for at least one biological indicator of metabolic syndrome, yielding a sample size of n = 10,786 for the metabolic syndrome analysis. All data were analyzed with institutional review board approval from the University of North Carolina at Chapel Hill. Information on how to obtain the Add Health data files is available on the Add Health website (www.cpc.unc.edu/addhealth).

Race/Ethnicity. At wave I, individuals were asked, "What is your race?" and instructed to indicate as many categories as applied. They were also asked a separate question, "Are you of Hispanic or Spanish origin?" We classified any individual who indicated yes as Hispanic. We classified individuals as non-Hispanic white if they did not identify as Hispanic and reported their race as white only. We classified individuals as non-Hispanic black if they did not identify as Hispanic and reported their race as black only; 135 individuals identified as both white and black, and were excluded from analysis, and 370 foreign-born individuals were also excluded from analysis.

Adolescent Disadvantage. To measure childhood disadvantage, we constructed a count of 22 binary indicators that capture cumulative exposure to household, school, and neighborhood disadvantage over childhood and/or during adolescence (wave I; Table S1). Household disadvantage indicators include a binary indicator of single-parent family structure at birth, experience of any family structure change across childhood and adolescence, parent education less than high school, and a retrospective measure of household welfare receipt during childhood or adolescence. Neighborhood disadvantage indicators were taken from the 1990 US Census to best approximate neighborhood conditions during wave I of the Add Health study. Neighborhood disadvantage measures include the tract-level proportion of households receiving welfare, proportion of unemployed adults, proportion of households below poverty line, proportion of adults with less than a high school education, proportion female-headed households, proportion black residents, proportion vacant homes, and the county-level infant mortality rate and violent crime rate. Each item was recoded so those residing in neighborhoods at the top quartile of the distribution were coded as disadvantaged. Finally, indicators of school disadvantage at wave I included school-level aggregated measures of the proportion of households receiving welfare, the proportion of unemployed parents, the proportion of parents with less than a high school education, and the proportion of single-parent households. All items were recoded as binary indicators, with the top quartile coded as disadvantaged. School disadvantage was also captured using wave I school administrator reports of grade retention, the school dropout rate, class sizes, the proportion of teachers with a master's degree, and daily school attendance. Consistent with other items in the index, school administrator items were recoded as binary indicators, with the top quartile of grade retention, dropout rate, and class size coded as disadvantaged and the bottom quartile of teachers with a master's degree and daily school attendance coded as disadvantaged. We summed all of the indicators to create a score ranging from 0 to 22. We standardized the score, so that the coefficients associated with the disadvantage index can be interpreted as the change in health risk associated with a one-SD increase in disadvantage.

Depression. At wave IV, respondents were asked how often they "were bothered by things that usually don't bother you," "could not shake off the blues," "felt you were as good as other people," "had trouble keeping your mind on what you were doing," "felt depressed," "felt that you were too tired to do things," "enjoyed life," "felt sad," and "felt that people disliked you" over the past 7 d. Response categories ranged from 0 to 3 and included "never or rarely," "sometimes," "a lot of the time," and "most of the time or all of the time." Items were summed to produce a continuous scale with a possible range of 0–27.

Metabolic Syndrome. For each biomarker measured at wave IV we defined the high-risk threshold according to the guidelines established by the National Cholesterol Education Program (NCEP) Expert Panel when possible. High-risk blood pressure was defined as measured blood pressure greater than 130/85 mmHg, or self-report of doctor-diagnosed hypertension or antihypertensive medication. A measured waist circumference of 88 cm or greater for women and 102 cm or greater for men was defined as high risk.

NCEP guidelines specify cut points of HDL and triglycerides for risk thresholds; however, Add Health only releases lipid measurements in deciles due to detrending and interconversion procedures (59). As an alternative classification, we relied on previous estimates from the same time period on the prevalence of hypertriglyceridemia and low HDL in similarly aged males and females (60). This approach has been used previously to create a modified measure of metabolic syndrome in Add Health (61). The top three deciles of triglycerides were defined as high-risk for males, and the top two for females. The bottom two deciles of HDL were defined as high-risk for males, and the bottom three for females. Finally, the NCEP guidelines use fasting blood glucose; due to differences in fasting time, we used glycated hemoglobin (HbA1c) as a measure of glycemic homeostasis. HbA1c levels at 5.7% or greater were defined as high-risk (62). Metabolic syndrome is an indicator, defined as having high risk levels on three or more of the component risk factors. Detailed Add Health data collection procedures and biomarker validation are available elsewhere (63–65).

Mediators. We tested the mediating role of four sets of potential mechanisms. Striving was measured in adolescence (wave I) using a four-item scale drawing from educational expectations, educational aspirations, hopefulness about the future, and belief in hard work. We measured perseverance in adulthood (wave IV) using nine personality items such as optimism, planning for the future, and sense of control over one's life. We tested the role of social isolation using scales of social isolation in adolescence (lack of social connections with family, friends, and schoolmates and in the community) and adulthood (lack of social connections with family, friends, community, and other social institutions). Social stress was measured using a count of the number of stressful life events reported in adolescence and adulthood, and the Cohen perceived stress scale measured at wave IV. Finally, we investigated the role of obesity using a measure of adolescent body mass index derived from adolescent report of height and weight at wave I.

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