Anomaly in the Education-Health Gradient: The Health Penalty for College Noncompleters.

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ABSTRACT

A recent study has found an anomaly in the health gradient: college noncompleters report more health problems than adults with high school (HS) diploma. The aim of this project is to test whether this finding holds when we eliminate potential reporting differences by examining biomarker levels in the subbaccalaureate group.

Using the restricted 1999-2012 NHANES, we estimate models of biomarkers for cardiovascular and metabolic diseases as a function of a HS diploma, bachelor's degree (BA), and three subbaccalaureate levels: "some college," vocational associate degree (AA), and academic AA.

Results indicate that the anomalous findings are real rather than due to reporting differences: those with "some college" or vocational AA have no systematic advantage over HS graduates in most biomarkers. In contrast, academic AA is linked to better risk profile. The findings emphasize the need to understand this anomalous health pattern that concerns 28% of American adults in this educational-attainment group.

Anomaly in the Education-Health Gradient: The Health Penalty for College Noncompleters.

A recent study (Zajacova, Rogers and Johnson-Lawrence 2012) found a startling anomaly in the education gradient in health: adults who attended college but did not earn a bachelor's degree reported *more* health problems than high school graduates who never attended college. This finding contradicts the well-established gradient literature, which refers to the positive monotonic relationship between educational attainment and health. The gradient has been understood to be universal across populations, health outcomes, and across the entire range of attainment. The fact that the gradient may not hold for the 17% of American adults who are college dropouts (and possibly for an additional 10% with associate's degrees) may provide important clues about the mechanisms of the relationship between educational attainment and the complex, multidimensional construct of health. The study used self-reported health measures, however. We know that respondents across population groups sometimes differ systematically in how they report their health (Bago d'Uva et al. 2008, Kaplan and Baron-Epel 2003, Layes, Asada and Kephart 2012, Manjer, Merlo and Berglund 2004, Zajacova et al. 2010). If the adults at the subbaccalaureate level report their health differently, in particular if they overreport their health problems relative to high school graduates, then the findings from the Zajacova et al. (2012) study could be biased.

The present study aims to eliminate the potential reporting differences across the educational groups. We analyze the biological risk marker levels at the HS to BA education levels in the U.S. population, using the only data source with nationally-representative sample large enough to analyze the subbaccalaureate adults separately: the continuous NHANES 1999-2012. The subbaccalaureate groups are available only in the restricted data, to which the authors already have gained access.

Conceptual background.

Two competing theories have been used to study the education-health association. The human capital (HC) model suggests additional years of education increase the "resources within people" (Becker 1964, Mincer 1974), which they can then use for the production of goods, including health. The signaling or credential model (Arrow 1973, Spence 1973) proposes that attainment operates via diplomas that enable entry to specific labor markets (Belman and Heywood 1991, Ferrer and Riddell 2002, Frazis 2002, Hungerford and Solon 1987, Jaeger and Page 1996) with different social statuses.

According to the human capital theory, any college education should translate to better health compared to just a high school diploma. According to the signaling perspective, only the attainment of an AA should be associated with better health. Neither theory offers predictions

on whether the two types of AA degrees, a vocational and academic AA, should differ. However, the vocational AA is a terminal degree that prepares students for specific careers, such as in medical or technical fields. In contrast, the academic AA is just a stepping stone for a 4-year degree and thus failing to complete the additional 2 years toward a BA could be construed as making the academic AA as "dropping out." On the other hand, adults who earn the academic AA may be more like those enrolled in a 4-year college in their intention to eventually earn a BA, compared to the vocational AA students who may be more like HS students in their intention to work in blue-collar or lower-prestige white-collar occupations.

DATA AND METHODS

Data

The analyses are based on data from the National Health and Nutrition Examination Survey (NHANES), 1999-2012. The continuous survey collects an extensive range of sociodemographic, lifestyle, and health-related information from a nationally representative sample of the noninstitutionalized civilian US population, using a complex probability sampling design with an oversample of African American and Mexicans. Respondents completed a household survey, followed by a physical examination at a mobile examination center.

Variables

Educational attainment. Information about schooling was collected in all survey waves as educational credential, including some college, vocational/technical associate degree (AA), academic AA, and bachelor's degree (BA). "Some college" includes adults who attended college but did not earn any postsecondary credential. There are two types of associate degrees, both requiring about 60 credit-hours of study. The first is a technical/vocational degree that prepares students directly for specific occupations, such as paralegal, computer or lab technician, medical transcriptionist, or a teacher's aide. The second type is academic, sometimes referred to as a transfer associate degree, designed to provide a general two-year preparation toward a bachelor's degree.

Health measures. Three clinically defined biomarker based measures and a self-reported measure of disease risk were used to measure poor health: (1) cardiovascular risk index; (2) metabolic syndrome; (3) a cumulative biologic risk measure; and (4) self-rated health.

The cardiovascular risk disease (CVD) index was calculated based on the Framingham Risk Score and assigned weighted scores associated with older age (weight range of 2-12 units), lower high density lipoprotein (HDL) cholesterol levels (weight range of -2 to 2 units), higher total cholesterol (weight range of 0-5 units), high blood pressure (weight range of -3 to 5 units), smoking status (weight range of 0-3 units), and blood glucose levels (weight range of 0-4 units).

Higher scores, based on the sum of the weights associated with the biomarker level for each respondent, were indicative of greater CVD risk.

The metabolic syndrome measure was based on the National Cholesterol Education Program's Adult Treatment Panel III report (ATP III) criterion (Grundy, 2004), and was a count of the presence of five cardiovascular risk factors: high waist circumference (88 cm or greater for men, or 102 cm or greater for women), low HDL (1.04 mmol/L or lower), high triglyceride levels (1.7 mmol/L or greater, high blood pressure (defined as systolic of 140 mmHg or greater or diastolic of 90 mmHg or greater), and high blood glucose levels (6.1 mmol/L or greater). The measure used in the analyses was dichotomized based on having 3 or more of these risk factors.

The cumulative risk measure was based on the count of the presence of eight measures used in previous research on allostatic load (Seeman et al, 2008) and cumulative biologic risk (Schulz et al, 2013). The measures included high systolic blood pressure (140 mmHg or greater), high diastolic blood pressure (90 mmHg or greater), high waist circumference (88 cm or greater for men, or 102 cm or greater for women), high blood glucose levels (6.1 mmol/L or greater), high triglyceride levels (1.7 mmol/L or greater), high cholesterol (mmol/L or greater), low HDL (1.04 mmol/L or lower), and high levels of C-reactive protein (CRP; 0.3 mg/dL or greater).

The self-rated health measure was based on responses to the question: "In general, would you say your health is excellent, very good, good, fair, or poor?" For these analyses, the measure was dichotomized to include excellent/very good/good and fair/poor.

Controls. All models controlled for age (in single years), sex, race (non-Hispanic white=referent, non-Hispanic black, and other), and region of residence (dichotomized as South versus other).

Analysis

For our first findings, we estimated a series of logistic regression models of each dichotomized biological risk marker, controlling for basic covariates. We also estimated OLS models of the biological risk marker indices where the individual markers were combined for a CVD index, metabolic index, and a total or cumulative risk index. The estimation adjusted for the complex sampling design of NHANES using the svy suite in Stata 13 (StataCorp 2013).

RESULTS

Tables 2a and 2b show results from regression models of individual biomarkers (2a) and biomarker summary indices (2b). The coefficients from logistic regression (not exponentiated) indicate the difference in the log odds of individual biomarkers, and the level of summary indices, for the three subbaccalaureate groups and the BA relative to the HS group, which serves as the reference category.

While the models are somewhat underpowered but clear patterns emerge across the individual biomarkers. The some college, relative to HS, is largely not significant with the exception of low HDL and elevated total cholesterol levels. However, in four biomarkers the direction of the difference is toward a "some college" penalty relative to HS and in three biomarkers the direction of the difference points to the noncopleter advantage.

The vocational AA appears to be largely similar to the HS graduates: the only significant difference, for elevated triglyceride level, is in the direction of AA penalty. For individual biomarkers, the academic AA is also not statistically different from the HS group – none of the nine models shows a significant difference between these two educational groups. For the summary indices, however, the HS-AA difference remains zero among the vocational AA group. Among the academic AA group, both the metabolic syndrome and the CVD risk index show a significantly better biological risk profile relative to the HS group.

Finally, the BA results are all in the expected direction (more advantageous risk profile) and largely significant, both for the individual biomarkers and for the risk indices.

SUMMARY

The preliminary findings indicate that the biological risk profile of adults with some college or those with the AA degrees are not substantively better than the profiles of HS graduates, despite the additional years of postsecondary education. The findings corroborate the previous result by Zajacova, Johnson-Lawrence, and Rogers (2012) for self-reported health measures where the subbaccalaureate group also failed to link the additional schooling to improved health, and extend them by showing that the patterns are not due to differential reporting patterns.

The findings have implications for the field of population health research and also more directly for health policy: 1) About 28% of American adults age 25 and older, or about 54 million people, fall into the subbaccalaureate category. Poorer health than expected among this group must be addressed in health care policy and planning. 2) For population health research, these steps toward understanding why more than a quarter of the adult population fails to follow the health gradient will provide critical new knowledge toward understanding the relationship between schooling and health in general.

Table 2a. Differences across the subbaccalaureate and BA educational-attainment levels relative to a HS diploma, for key CVD and metabolic biomarker indicators.

	CRP	Glucose	Triglycerides	Low HDL	High Cholesterol	BMI>30	Waist circumference	Elevated Systolic BP	Elevated Diastolic BP
High school diploma (reference)									
Some college, no degree	0.09	0.20	-0.08	-0.30*	-0.41*	0.02	0.11	-0.09	-0.23
Vocational AA	0.17	-0.02	0.39*	-0.16	-0.21	-0.02	0.13	0.16	0.21
Academic AA	-0.23	-0.51	-0.38	-0.41	0.12	0.04	0.11	-0.70	-0.72
Bachelor's (BA) degree	-0.22†	-0.36†	-0.59**	-0.53*	-0.65***	-0.47***	-0.27*	-0.35	-0.10

† p<.1 * p<.05 ** p<.01 *** p<.001

Results from logistic models of each biomarker. All models control for age, gender, race/ethnicity, and region of residence. The estimation adjusts for the complex sampling design of the NHANES 1999-2012.

Table 2b. Differences across the subbaccalaureate and BA educational-attainment levels relative to a HS diploma, for key CVD and metabolic indices.

	Metabolic Syndrome	CVD	Cumulative Biological Risk
High school diploma (reference)			
Some college, no degree	-0.35	-0.48†	-0.11
Vocational AA	0.10	-0.25	0.13
Academic AA	-1.53***	-1.16**	-0.26
Bachelor's (BA) degree	-0.77**	-1.74***	-0.43***

† p<.1 * p<.05 ** p<.01 *** p<.001

Results from OLS models of each index of biological risk. All models control for age, gender, race/ethnicity, and region of residence. The estimation adjusts for the complex sampling design of the NHANES 1999-2012.

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