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Wide Educational Disparities in Young Adult Cardiovascular Health

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Article

Wide educational disparities in young adult cardiovascular health

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ABSTRACT

Widening educational differences in overall health and recent stagnation in cardiovascular disease mortality rates highlight the critical need to describe and understand educational disparities in cardiovascular health (CVH) among U.S. young adults. We use two data sets representative of the U.S. population to examine educational disparities in CVH among young adults (24–34) coming of age in the 21st century: the National Health and Nutrition Examination Survey (2005–2010; N = 689) and the National Longitudinal Study of Adolescent to Adult Health (2007–2008; N = 11,200). We employ descriptive statistics and regression analysis. The results show that fewer than one in four young adults had good CVH (at least 5 out of 7 ideal cardiovascular indicators). Young adults who had not attained a college degree demonstrate particularly disadvantaged CVH compared with their college-educated peers. Such educational disparities persist after accounting for a range of confounders, including individuals' genetic propensity to develop coronary artery disease. The results indicate that the CVH of today's young adults is troubling and especially compromised for individuals with lower levels of educational attainment. These results generate substantial concern about the future CVH of the US population, particularly for young adults with a low level of education.

Introduction

Cardiovascular disease (CVD) is the leading cause of death in the United States, accounting for one in three deaths (Benjamin et al., 2017). Further, CVD has the highest medical costs of any chronic disease in the US, with expenses projected to rise in the future (AHA & ASA, 2017). While CVD mortality in the United States exhibited impressive declines between the 1960s and 2000s, improvements in CVD mortality have stagnated, with some evidence of an increasing rate among young women (Mensah et al., 2017; Wilmot, O'Flaherty, Capewell, Ford & Vaccarino, 2015). The worrisome trends appear to be driven by younger cohorts who have worse cardiovascular health than older generations had when they were young (Masters et al., 2018; Preston et al. 2018). Moreover, US young adults are in worse cardiovascular health (CVH) than those in peer nations (Murray et al., 2013; NRC & IOM, 2013). Thus, there have been many calls for increased attention to the troubling trends in CVH (Havranek et al., 2015; Huffman et al., 2012; Lloyd-Jones, 2012), and in particular to the CVH of young adults as harbingers of future trends (Ford & Capewell, 2007; George et al., 2017). Researchers have projected that the long-term cardiovascular risk among U.S. young adults is sizable, and that few young adults had optimal CVH (Clark et al., 2014; Gooding et al., 2016). Young adults are also characterized by differences in cardiovascular risk by race/ethnicity and gender, with males and Black or American Indian young adults exhibiting the highest risks (Clark et al., 2014).

While much is known about the persistent educational gradients in CVD, we know little about educational disparities in CVH among U.S. young adults. Generally, there is a dose-response relationship such that additional years of education are associated with less CVD and more favorable CVH (Kubota, Heiss, MacLehose, Roetker & Folsom, 2017). However, educational disparities in CVH may differ among the contemporary cohort of U.S. young adults. Indeed, educational disparities in US health and all-cause mortality have been widening in the 21st century (Bor et al., 2017; Hayward et al., 2015; Murray et al., 2013; Sasson, 2016; Singh, Siahpush, Azuine & Williams, 2015) and recent gains in health and mortality, including CVH, have been concentrated among the highly educated (Benjamin et al., 2017). Further, there is some evidence of declines in health and increases in mortality among those with a high school degree or less (Bound, Geronimus, Rodriguez &

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Waidmann, 2015; Case & Deaton, 2017; Montez & Zajacova, 2014). Thus, we expect that CVH will be substantially better among young adults with more education, with degrees serving as important thresholds. Documenting and understanding educational differences in CVH among young adults will be crucial in future efforts to reduce disparities and improve population health.

Additionally, understanding educational disparities in young adult CVH can provide insight into when, how, and why differences emerge. Observed educational disparities in adult health are likely the result of both differences in health behaviors by educational attainment over time as well as physiological "imprinting" of prior health profiles across the life course (Montez & Hayward, 2011). We therefore employ a life course perspective that conceptualizes educational disparities in adult health as the culmination of prior experiences and circumstances (Zajacova & Lawrence, 2018). We consider factors from multiple domains and life course stages. First, we control for socioeconomic background, an influential factor for adult CVH (Galobardes et al., 2006). Prior research has shown that health behaviors in adolescence are related to adult cardiovascular functioning (Ames et al., 2018; Gooding et al., 2016; Lawrence, Mollborn, & Hummer, 2017), and we thus examine the extent to which these factors explain some of the young adult educational disparities in CVH. We also examine young adult socioeconomic and social factors related to educational attainment and cardiovascular health, including household income, employment, health insurance status, family structure, population density at residential location, and religiosity (Harper et al., 2011; Lawrence, Hummer, & Harris, 2017). Finally, genetic predisposition has been shown to be important in the development of cardiovascular conditions (Polderman et al., 2015), and thus may play a role in setting in motion pre-disease pathways over the early adult life course (Nikpay et al., 2015). We thus examine the extent to which genetic predisposition can account for the young adult education-CVH relationship.

We first document basic educational disparities in CVH among US young adults using two nationally representative datasets: the National Health and Nutrition Examination Survey (NHANES) and the National Longitudinal Study of Adolescent to Adult Health (Add Health). We use data from both studies to strengthen our conclusions and mitigate the sensitivity of our results to study-specific issues of data collection and measurement error. Second, we examine disparities in young adult CVH using the more detailed educational attainment data in Add Health. Third, we assess the extent to which the detailed educational disparities are shaped by individuals' genetic propensity for coronary heart disease, background SES, and young adult socioeconomic and social factors that have been shown to be associated with cardiovascular risk or disease and that may shape educational disparities. Because most young adults have yet to experience serious cardiovascular events, we assess CVH using a prospective measure of Ideal Cardiovascular Health suggested by the American Heart Association (AHA). The AHA introduced this metric to better monitor progress toward improvements in overall cardiovascular well-being; it has been shown to be a strong predictor of future morbidity and mortality (Benjamin et al., 2017; Ommerborn et al., 2016; Yang et al., 2012).

Methods

Data

We used two nationally representative data sources: NHANES and Add Health. These two datasets both offered health behavior reports, biomarkers of cardiovascular function, and medication information that could be used to identify CVH patterning among U.S. young adults. For some measures, NHANES provided more detailed information, but its cross-sectional design precluded insight into life course mechanisms. Further, NHANES sampled Americans of all ages, and thus the number of young adults was relatively small. Add Health, in contrast, included a much larger sample of young adults and longitudinal data, thus facilitating the understanding of life course mechanisms. We therefore employed both datasets.

NHANES collects detailed information on the health of Americans using questionnaires and physical examinations on a periodic cross-sectional basis (CDC and NCHS, 2017). To ensure comparability between NHANES and Add Health, we used NHANES data from the same time period as the young adult data collection in Add Health. We combined NHANES data from 2005–2010 to assess the CVH of young adults coming of age at the turn of the century. Our NHANES sample included young adults ages 24–34 who were U.S.-born, participated in the Mobile Examination Component and fasting subsamples of the NHANES survey, were not missing data on any CVH component, and were not pregnant (N = 689). See Appendix Fig. 1 for information on the construction of this analytic sample.

Add Health is a longitudinal study that first collected information on adolescents (ages 12–19) in 1994–1995 (Wave I), and were then followed up one year later (Wave II), seven years later in 2001–2002 (Wave III), and thirteen years later in 2008–2009 (Wave IV; Harris, 2010). Our outcome variable was from this last wave of data when respondents were young adults aged 24–34. Because Add Health is longitudinal, we incorporated data from earlier waves to conduct more detailed analyses of life course predictors of CVH. We analyzed a sample that included those Wave IV respondents who had a valid sampling weight, were US-born, were not pregnant or "probably pregnant," and were not missing information on the CVH indicators (N = 11,200). Appendix Fig. 1 provides information on how this analytic sample was constructed. Supplemental analyses used Add Health respondents who had genetic information collected at Wave IV and who were of European ancestry (N = 4201) (Harris et al., 2013).

Measures

Outcome

As defined by the AHA, CVH comprises seven factors: BMI, smoking, physical activity, diet, blood pressure, glucose, and cholesterol (Lloyd-Jones et al., 2010). We defined ideal, intermediate, and poor categories for each of these indicators in line with the AHA, making accommodations given available data. See supplemental materials (Appendix Table 1) for details on the thresholds and definitions for each of the indicators for both datasets. Add Health and NHANES measured height, weight, and blood pressure from the respondents, obtained blood samples for cholesterol and glucose, and asked respondents to report on their smoking, diet, and physical activity. See http://www.cpc.unc.edu/projects/addhealth/documentation/guides and https://www.cdc.gov/nchs/nhanes/nhanes_questionnaires.htm for additional information on the collection of these data.

We combined these seven metrics in one composite that characterized each individual as having good, fair, or risky CVH overall. We defined individuals as having *good CVH* if they met 5 of 7 ideal health metrics. Few individuals (1.1%) met all 7 metrics. Prior research indicates a general dose-response relationship such that more ideal metrics translates into lower cardiovascular risk (Wilmot et al., 2015). Similarly, individuals had overall *fair CVH* if they met 5 of 7 intermediate health metrics (but not 5 of 7 ideal factors). Individuals therefore had *risky CVH* if they did not meet at least 5 of 7 intermediate metrics (which is equivalent to having 3 or more poor metrics). Results using 6 instead of 5 metrics as the threshold, or using a scoring system (ideal = 2 points; intermediate = 1 point; poor = 0 points) to create a continuous measure with a range of 0 to 14, produced the same substantive conclusions to those presented here.

Education measures

For NHANES, educational attainment consisted of four categories: less than high school, high school diploma or GED, some college or associate's degree, and college degree or more. We used an identically-coded measure in Add Health, but also utilized a more detailed measure that further subdivided the categories: less than high school, GED, high school diploma, high school and vocational certification, associate's degree, other college experience, four-year college degree, and advanced degrees.

Covariates

For both datasets, we examined the association between educational attainment and CVH while controlling for age, gender, and race/ethnicity, the latter of which included the mutually exclusive categories of Non-Hispanic White, non-Hispanic Black, Hispanic, and other race/ethnicity. In further analysis using Add Health data, we included variables for confounders (background socioeconomic status [SES] and adolescent health) and potential mediators (young adult SES [other than education] and social factors). For background SES, we used Wave I highest reported parent education categories (less than high school, high school, some college, college degree, and advanced degree [referent]) and income-to-needs ratio based on reported household income and the poverty threshold for that year and household size. For adolescent health, we used Wave I measures of weight status (normal, overweight, or obese based on gender, age, and BMI; Cole, Bellizzi, Flegal & Dietz, 2000), a depressive symptoms score, smoking status, self-rated health (scale from 1 to 5, with one equivalent to poor and five equivalent to excellent), a sum of the reported weekly physical activities, and alcohol consumption status. For young adult SES, we used Wave IV indicators of household income, employment status, and health insurance. Young adult social factors consisted of marital status, whether or not the respondent lives with children, logged population density of residential Census tract, and religiosity, all taken from Wave IV.

Heart functioning is highly heritable (Polderman et al., 2015), leaving genetics as one possible mechanism through which observed disparities occur. To assess the role of genetic predisposition, we utilized a genetic propensity score to control for individuals' risk of developing coronary artery disease (Dudbridge, 2013). We used propensity for coronary artery disease because it is a general indicator of heart health and is related to a number of cardiovascular outcomes, including myocardial infarction and stroke. This score was created using SNPs in the Add Health genetic database that were matched to SNPs with reported results in a genome-wide association study (GWAS) (Nikpay et al., 2015). For this supplemental analysis, we focused on a genetically homogeneous group of respondents with European ancestry due to difficulties in score interpretations in diverse samples (Martin et al., 2017). See Supplemental materials for details on the methods and results of this analysis.

Statistical analyses

We first describe overall CVH among young adults and across educational attainment categories for both datasets. Second, we present differences in CVH across more detailed educational categories using Add Health data. Third, also using Add Health, we assess the extent to which confounders (family background and adolescent health) explain educational attainment disparities in CVH, using logistic regression. Supplemental models consider the extent to which young adult factors account for these disparities. We also describe results from supplementary models that included an additional variable for the genetic propensity to develop coronary heart disease. Finally, we evaluate whether the relationship between educational attainment and CVH differed for gender and race/ethnic groups. All analyses adjusted for the complex sampling designs as instructed by NHANES and Add Health to ensure national representation. Standard errors were calculated using the sample size, not the weighted N. Add Health analysis incorporating detailed adolescent and young adult factors used multiple imputation to account for item missingness on predictor variables and retain the full sample. See Supplemental materials for details on the implementation of multiple imputation.

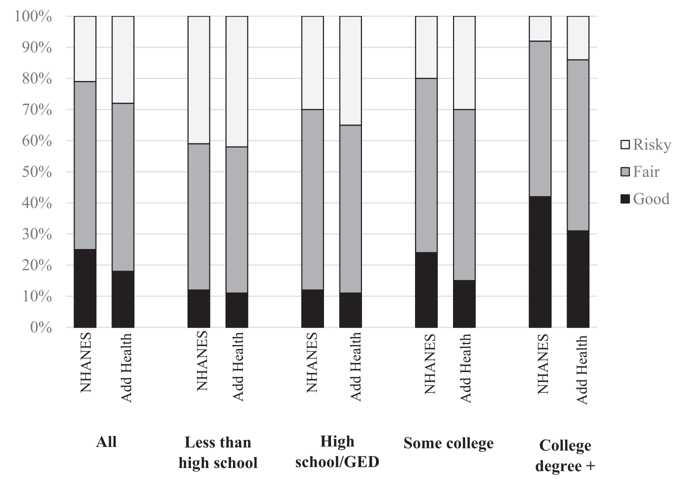

Fig. 1. Prevalence of CVH categories by educational attainment, U.S. born young adults.
Source: Add Health; NHANES NOTES: Analyses adjust for complex sampling design. NHANES (2005–2010) N = 689; Add Health N = 11,200 (2007–2008)

Results

How wide are educational disparities in young adult CVH?

Fig. 1 depicts CVH among young adults in Add Health and NHANES. Because data collection and sample selection differed across the two datasets, we do not compare prevalence rates or draw conclusions about specific population prevalence of certain conditions (for information on this, see Nguyen et al., 2011; Nguyen et al., 2014). Between 18% (Add Health) and 25% (NHANES) of young adults met five of seven ideal CVH criteria (good), with just over half in each data set meeting five of seven intermediate CVH criteria (fair). In each study, more than one in five young adults had three or more poor CVH indicators (risky). On average, young adults exhibited about one-half of the 7 ideal metrics, with a mean of 3.62 for NHANES and 3.20 for Add Health. Respondents in both datasets displayed very wide educational gradients in CVH. Those with more education were much more likely to be categorized in the good category: 31–42% of college graduates have good CVH compared to just 11–12% of those without high school diplomas. Moreover, risky CVH was much more common among those with lower educational attainment: over two in five individuals who have not completed high school had risky CVH compared to 8–14% of college graduates. High school graduates in each dataset also exhibited a relatively high level of risky CVH: 30% (NHANES) and 34% (Add Health) of young adults were categorized as having risky CVH. See Appendix Table 2 for more detailed descriptive statistics.

Disparities across more detailed educational categories

To examine these educational disparities in CVH in more detail, we used Add Health data. Descriptive statistics for variables are available in Table 1. These results demonstrate that those who were less educated represent a greater share of those with fair/poor, compared to good CVH. Further, parent education and adolescent income-to-needs was higher and adolescent health was generally better among young adults with good rather than fair/poor CVH. Those with good CVH also had higher household income and lived in areas with greater population density. Appendix Fig. 2 displays the proportions of individuals who exhibit ideal, intermediate, and poor CVH health for each of the seven indicators across educational attainment categories.

Fig. 2, Panel A displays the odds ratios of individuals having good CVH (vs. fair/risky) for a large set of educational attainment categories compared to those with a high school education, controlling for age,

Table 1
Means of independent variables across levels of CVH among U.S. born young adults 2007–2008 (N = 11,200).
Source: Add Health

	All	Fair/poor CVH	Good CVH
Educational attainment (Wave IV)			
No degree	0.09	0.10	0.06
GED	0.03	0.03	0.01
HS diploma	0.15	0.16	0.08
HS + vocational	0.09	0.10	0.07
Other college	0.27	0.29	0.21
Associate's	0.07	0.07	0.07
College degree	0.23	0.20	0.37
Advanced degree	0.07	0.05	0.13
Demographics			
Age at Wave IV (24–34)	28.35	28.39	28.19
Female	0.49	0.44	0.70
Race/ethnicity			
NH White	0.72	0.70	0.77
NH Black	0.15	0.16	0.11
Hispanic	0.04	0.04	0.04
Other	0.09	0.09	0.08
Background SES (Wave I)			
Parent education			
Less than high school	0.11	0.12	0.08
High school	0.39	0.42	0.30
Some college	0.20	0.20	0.19
College degree	0.17	0.16	0.22
Advanced degree	0.13	0.11	0.20
Adolescent income-to-needs (0–103)	2.93	2.78	3.58
Adolescent health (Wave I)			
BMI			
Normal	0.70	0.66	0.85
Overweight	0.21	0.23	0.12
Obese	0.09	0.11	0.03
Depressive symptoms (−1.4–5.8)	-0.07	-0.04	-0.16
Smoker	0.29	0.31	0.19
Self-rated health (1–5)	3.86	3.83	4.02
Physical activities (0–15)	5.48	5.43	5.74
Drinker	0.49	0.50	0.43
Young adult SES (Wave IV)			
Household income-to-needs (0.1–18.5)	3.73	3.57	4.43
Employed	0.82	0.82	0.82
Insurance status			
No insurance	0.23	0.25	0.15
Medicaid	0.11	0.10	0.15
Has insurance	0.66	0.65	0.70
Young adult social factors (Wave IV)			
Population density, logged (−1.6–11.3)	6.10	6.03	6.39
Marital status			
Married	0.42	0.41	0.45
Cohabiting	0.21	0.22	0.18
Not married/cohabiting	0.36	0.36	0.37
Living with kids	0.46	0.47	0.43
Religious attendance			
Never	0.33	0.34	0.27
< weekly	0.33	0.32	0.33
weekly	0.20	0.19	0.22
> weekly	0.15	0.14	0.19

NOTES: Analysis adjusts for complex sampling design. For continuous variables, ranges are provided in parentheses.

gender, and race/ethnicity. See Appendix Table 3 for full results of regression models. Most of the educational attainment categories had odds ratios above one, indicating they were more likely to have good CVH compared to high school graduates. However, those who have not graduated high school and those with a GED were not statistically different from high school graduates. Further, the odds ratios were substantially higher among four-year college and advanced degree holders; these individuals were 3.5 to 5 times more likely to have good CVH compared with high school graduates. These results show that the educational difference in CVH was especially wide when we compare those with an advanced degree to those with a high school degree or less.

To what extent are these disparities shaped by family background, adolescence, and young adult factors?

We next consider potential explanations of these educational disparities in CVH using the refined measures of educational attainment in Add Health. Fig. 2, Panel B shows the odds ratios from a model that includes confounders (family background and adolescent health). Individuals with relatively high levels of educational attainment levels (i.e., more than high school) generally exhibited higher odds of having good CVH compared with those with a high school degree, even after controlling for the set of family background and adolescent health factors. The odds ratios in Panel B were attenuated compared to those in Panel A, indicating that the factors included in Panel B accounted for some of the educational disparities in CVH. Supplemental models including young adult factors indicated further attenuation; adolescent socioeconomic status, adolescent health, young adult SES, and young adult social factors each contributed to explaining some of the educational gradient (see full results in Appendix Table 3). Yet, even after considering this large set of factors from different stages of the life course, the odds of good CVH exhibited wide variation across categories of educational attainment. Direct comparison across logistic regression models can be problematic, but sensitivity analyses (using linear probability models and Poisson regression with a scoring system that combined ideal and intermediate thresholds, see Appendix Tables 4 and 5) corroborated our conclusions.

Does genetic propensity for coronary heart disease matter for the association between educational attainment and CVH?

We did not find evidence that genetic propensity for coronary heart disease is a potential mechanism underlying the education-CVH relationship. Among Add Health respondents of European ancestry, the estimated associations between levels of educational attainment and good CVH were unchanged after accounting for the polygenic score for coronary heart disease (see Supplementary materials, Appendix Table 6). These results suggest that the observed educational disparities are not due to disparities in the genetics associated with cardiovascular disease.

Are there differences in the relationship between educational attainment and CVH by gender and race/ethnicity?

Fig. 3 displays educational disparities in good CVH for specific demographic subgroups, with predicted probabilities of having good CVH displayed for each group on a scale from 0 to 1. These predicted probabilities were derived from the same model as Exhibit 2, Panel B, but were calculated separately for NH White females, NH White males, NH Black females, NH Black males, Hispanic females, and Hispanic males.

There were not large differences in the education-CVH relationship across gender or race/ethnic categories. Women exhibited higher probabilities of having good CVH than men in every race/ethnic group. Non-Hispanic white and Hispanic individuals were about equally likely to have good CVH within every level of educational attainment, while non-Hispanic Black individuals exhibited the lowest probabilities of having good CVH within every level of educational attainment. When we formally tested for statistical differences in the relationship between educational attainment and CVH between groups, there were not strong systematic differences that were robust to different specifications. We therefore did not find support for the hypothesis that educational

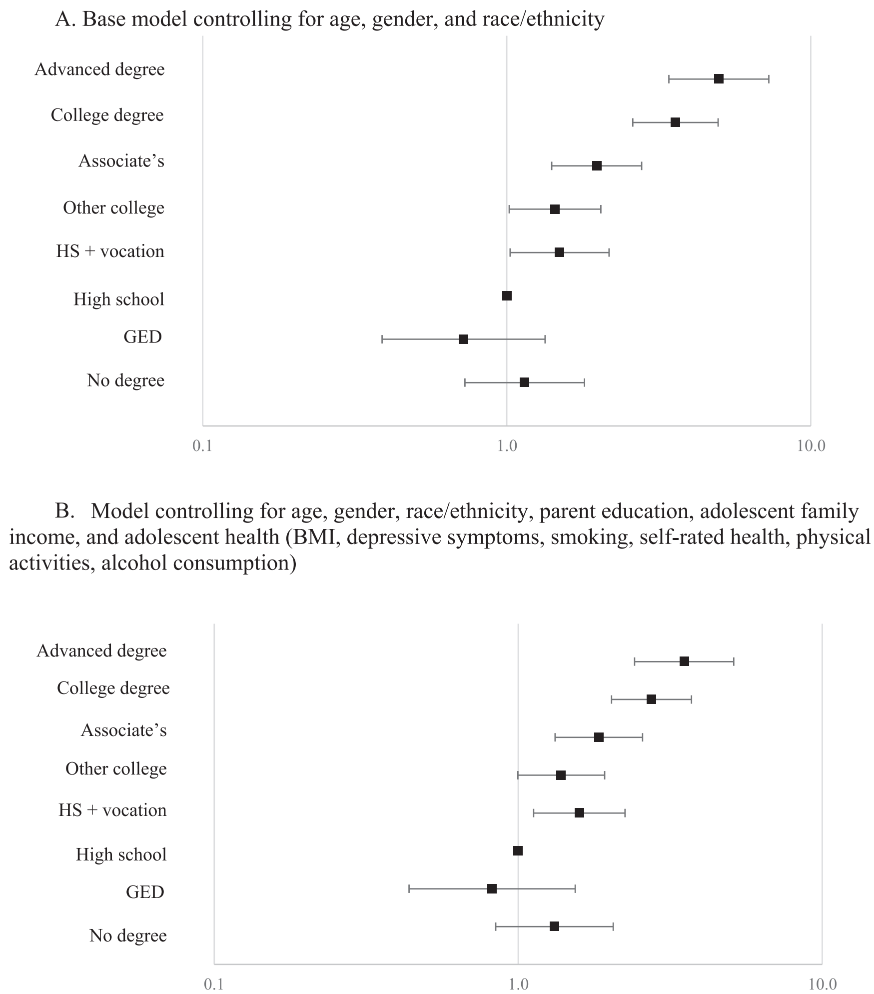

Fig. 2. Odds ratios for good CVH (vs. fair/risky) with 95% confidence intervals across detailed educational attainment, U.S. born young adults 2007–2008 (N = 11,200).
Source: Add Health NOTES: Analysis adjusts for complex sampling design

disparities in CVH are being driven by patterns in a particular subgroup. Rather, educational disparities in CVH were quite consistent across subgroups.

Discussion

A sizable fraction of today's US young adults aged 24–34 did not display the CVH recommended by experts. Despite their young ages, fewer than one in four young adults had good heart health (i.e., they had at least 5 of the 7 ideal cardiovascular indicators). Further, educational disparities in CVH are alarmingly wide. Socioeconomic background, adolescent health and health behaviors, and young adult socioeconomic and social factors contribute to these disparities, but differences persisted beyond these characteristics. These results, alongside other studies projecting increases in CVD in the coming decades (Pandya, Gaziano, Weinstein & Cutler, 2013), generate substantial concern about the future health and longevity of this young adult generation, and for cardiovascular morbidity and mortality of middle-aged adults in the near future.

Our results reveal three important findings about educational differences in CVH. First, our results demonstrate that there is an urgent need to better understand the relatively poor CVH health among those without college degrees. Indeed, all categories of individuals who had not reached this level of educational attainment lagged well behind the college-educated in their CVH profiles. Compared to high school graduates, the odds of good CVH were about 3.5 times greater for college graduates compared to high school graduates, net of confounders. The differences in CVH are perhaps unsurprising in the context of generally divergent social and economic trends among college graduates and their less-educated peers. However, this conclusion should be interpreted in light of the ages of these young adults (24–34 years old). Given their stage in young adulthood, their educational attainment may not yet be completed. In particular, many young adults may go on to earn advanced degrees. These young adults who complete their education later may have different social roles that prevented completion of their education earlier, and future health disparities research should consider timing to shed light on the mechanisms of education's health benefits (Frech, 2014; Walsemann et al., 2018).

Second, the more detailed measures of education in Add Health indicate that there is additional heterogeneity within the broader attainment categories usually employed in health research. Among high school graduates, those with vocational certification had better CVH compared to those without and individuals holding associate's degrees may fare better than those who attended some college but attained no degree. Third, the strong, robust educational differences in CVH cannot be explained by differences in the genetic propensity for coronary heart disease, adolescent health, socioeconomic, or other sociodemographic factors. The magnitude and robustness of these differences suggest that educational attainment has very important health consequences for today's young adults.

These conclusions should spur further research to continue documenting patterns in education and CVH, examine the causes of these

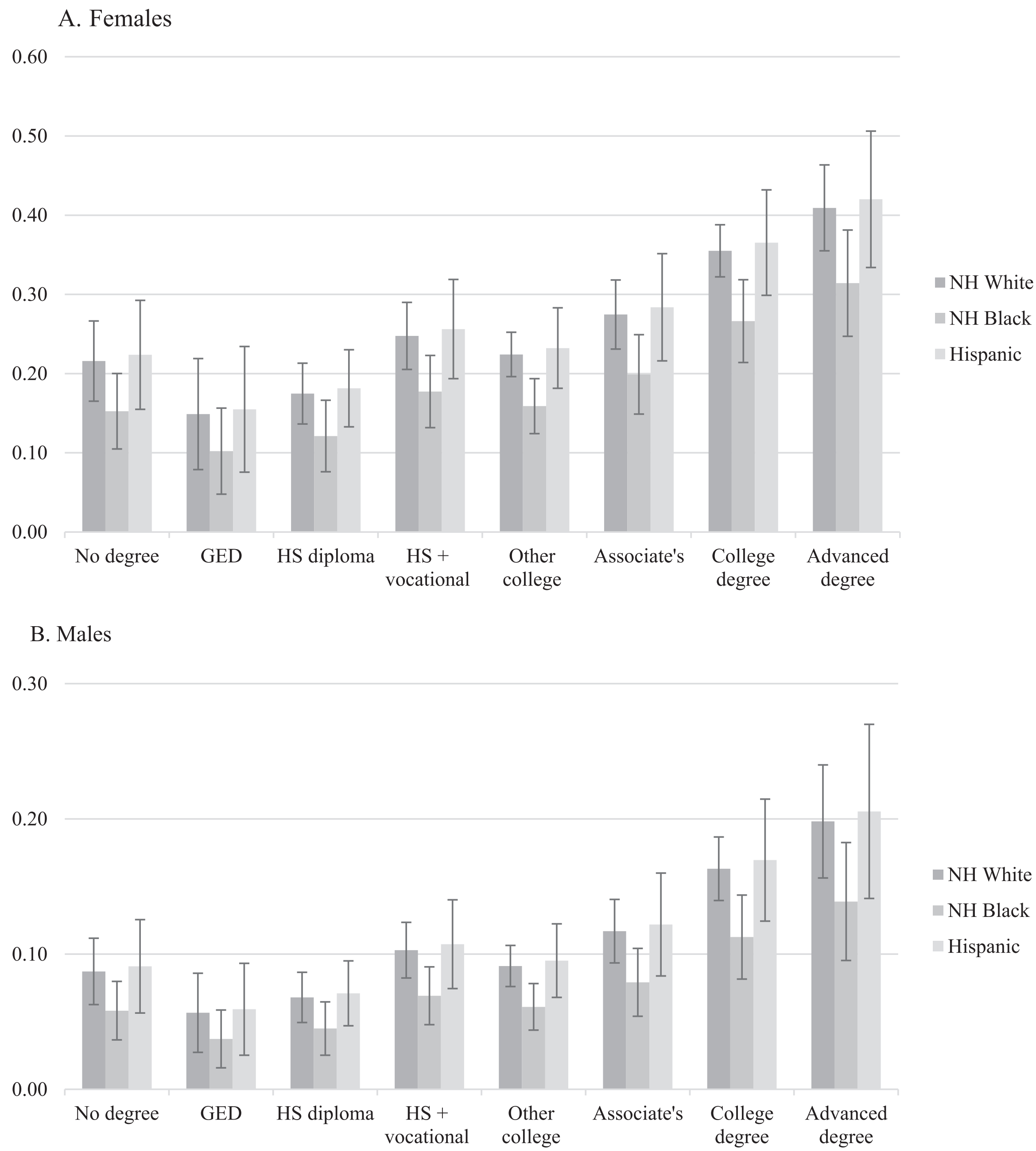

Fig. 3. Predicted probabilities for good CVH (vs. fair/risky) with 95% confidence intervals across detailed educational attainment, U.S. born young adults 2007–2008 (N = 11,200). Panel A. Females. Panel B. Males.
Source: Add Health NOTES: Analysis adjusts for complex sampling design, and includes full set of controls (age, parent education, adolescent family income, and adolescent health [BMI, depressive symptoms, smoking, self-rated health, physical activities, alcohol consumption]).

disparities, and evaluate policies to reduce them. First, it will be particularly important to document the CVH of even more recent cohorts of young adults who grew up in the obesogenic environment of the early 21st century. Capturing pre-disease and asymptomatic pathways will be paramount to early detection of cardiovascular health risks among young adults. Second, research is needed to analyze the social processes that create educational disparities in CVH, especially beyond those factors that we considered in our models (such as income or marital status). In particular, research on the physical environment, lifestyle choices, social contexts, or institutions could shed light on the persistence of educational disparities in health.

This study has several limitations. First, some of the Add Health cardiovascular indicators (e.g., measures of diet and physical activity) are not as specific or detailed as suggested in the AHA guidelines (or in NHANES). However, the similarity in educational disparities across NHANES and Add Health help mitigate concerns of bias in these measures. Second, the data we used were strictly observational; thus, we could not make any causal claims about the relationship between educational attainment and CVH. The development of educational disparities in young adult health is the result of both selection and causal processes operating over the early life course (Kane, Harris, Morgan & Guilkey, 2018). Third, there may be other important factors related to both educational attainment and CVH, such as health literacy, which are unavailable in our datasets and may help to explain educational disparities in CVH. Lastly, our outcome variable combined together multiple indicators, and thus the extent to which education operates similarly for the different indicators may vary. For example, BMI and smoking appear to be strongly rooted in adolescence

(Andersson & Maralani, 2015; Maralani, 2014; von Hippel & Lynch, 2014). Yet, we argue that our outcome brings together these indicators in an important and meaningful way, since it is this ensemble that shapes CVH.

Our study has important policy implications, and we highlight here three considerations. First, we argue that the wide educational disparities in CVH we document are in need of immediate, intentional action. More than one in three Americans are estimated to have one or more types of CVD, with this proportion projected to increase to 43.9% in 2030 (Benjamin et al., 2017). Further, educational differences have widened during a time of unprecedented technological advancements and increases in education; simply increasing educational levels and/or creating even more advanced technology do not appear to be effective solutions.

Second, policies and programs should simultaneously aim to improve population CVH and reduce educational disparities. Population-level improvements could lead to widening differences because more highly educated individuals are better positioned to take advantage of new advancements (Phelan et al., 2010). Policymakers will therefore need to proactively and specifically address disparities, perhaps through targeting those with the lowest educational levels with specific interventions.

Third, policies targeting individual behavior may have limited scope for improving disparities in CVH. In our study, the majority of young adults were fair or poor (rather than ideal) on at least three of the seven indicators; most individuals need to improve multiple behaviors. Further, individual behaviors are not isolated, but rather cluster in meaningful ways, driven by social identities (Lawrence et al., 2017; Saint Onge & Krueger, 2017; Skalamera & Hummer, 2016). Identifying and addressing social processes underlying multiple behaviors may be more efficient and effective than addressing single behaviors.

Conclusion

The levels of poor and fair CVH among US young adults are troubling and educational disparities in young adult CVH are very wide. The future life expectancy and well-being of the American population will depend on how we address CVH, particularly among the less educated segments of American society. Policies are urgently needed to improve CVH health among young adults with relatively low levels of education.

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Declaration of interest

We have no financial or any other conflicts of interest.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ssmph.2018.07.006.

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