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Differential Consequences: Racial/Ethnic and Gender Differences in the Enduring Impact of Early Disadvantage on Heavy Drinking in Midlife

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Abstract
We use a "chain of risks" model to identify risk factors for prolonged heavy drinking in a nationally representative US sample followed from adolescence to middle age, focusing on educational mediators and differential consequences of early exposure to family poverty and area-level disadvantage. Using data from the 1979 National Longitudinal Survey of Youth (civilian respondents ages 14–19 at baseline, $N = 5781$), longitudinal path models assessed racial/ethnic and gender differences in indirect effects of early disadvantage (duration of exposure to family poverty and area-level disadvantage during adolescence) on midlife heavy drinking. Educational mediators were high school academic performance (taking remedial coursework), high school completion, and attaining a college education. Subgroups were based on race/ethnicity (50.7% White, 30.5% Black, 18.8% Hispanic respondents) and gender (49.6% males). There was a significant indirect path from family poverty during adolescence to poor high school academic performance, lower educational attainment, and more heavy drinking in midlife. For Black respondents, there was an additional direct effect of early area-level disadvantage on greater midlife heavy drinking that was not seen for other groups. The effect of family poverty on reduced high school graduation was stronger for males than females. Enduring impacts of family poverty duration during adolescence on educational attainment have consequences for health risk behaviors in midlife. Due to differential exposure to early adversity, intersectoral interventions are needed to reduce disparities in alcohol outcomes and to promote health equity among high-risk populations.

Keywords Alcohol use · Racial/ethnic disparities · Socioeconomic disadvantage · Education

Recent research has highlighted racial/ethnic disparities in heavy drinking and alcohol-related consequences in midlife (Chartier et al. 2013). In this study, we pursue two goals. First, we identify factors that increase risk for midlife heavy drinking in a nationally representative, racially and ethnically diverse US sample followed from adolescence to middle age. Second, we explore differential consequences of early exposure to family poverty and area-level disadvantage, emphasizing how pathways from early disadvantage to educational attainment and midlife heavy drinking vary for key population subgroups.

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Heavy Drinking over the Lifecourse

Heavy drinking typically declines rapidly from the late 20s and early 30s and into middle adulthood (Maggs and Schulenberg 2005), but there are important racial/ethnic and gender differences in patterns of heavy drinking over the lifecourse (Mulia et al. 2017). Some evidence suggests Black/African American (hereafter, Black) and Hispanic/Latino/Latina (hereafter, Hispanic) drinkers begin heavy drinking later than White/Caucasian (hereafter, White) drinkers (Williams et al. 2018), but Black drinkers also are more likely to persist in frequent heavy drinking beyond young adulthood (Mulia et al. 2018) and they have later onset of alcohol use disorder than Whites (Grant et al. 2012). Perhaps due to differences in timing and duration of heavy drinking, there are many racial/ethnic disparities in alcohol-related consequences in middle and later adulthood, such as

notably higher rates of alcohol-attributable mortality among Black and Hispanic people, as well as disparities in cirrhosis and other alcohol-related health conditions (Chartier et al. 2013). Interestingly, these disparities exist despite higher population abstinence rates for Black and Hispanic people compared to Whites (Delker et al. 2016).

Pathways from Early Disadvantage: a Chain of Risks

To date, the important body of research describing lifecourse drinking largely reflects the developmental psychopathology perspective, giving less attention to potential influences of socioeconomic conditions and associated experiences, such as educational attainment, which also are related to drinking. In addressing our first research goal, we draw from lifecourse epidemiology, and propose a "chain of risks" model (Braveman and Barclay 2009; Kuh et al. 2003) for examining how early disadvantage contributes to midlife heavy drinking. In this framework, early conditions of socioeconomic disadvantage are linked to subsequent negative experiences, such as difficulty in school, and each successive exposure increases the risk of later adverse outcomes, such as heavy drinking or substance use (Dodge et al. 2009; Sitnick et al. 2014). We focus here on the enduring impacts of early exposure to family poverty and area-level disadvantage on two key educational outcomes: poor academic performance and low educational attainment (Ainsworth 2002; Crowder and South 2011; Harding 2003; Owens 2010; Rendón 2014; Wodtke et al. 2016). In some cases, poor academic performance includes proficiency below grade level that requires remedial coursework. Such academic problems are an early step on the pathway from family poverty and area-level disadvantage to (under)achievement of important educational milestones such as graduating from high school and attaining a college degree. These later academic achievements have long-term protective health effects (Zimmerman et al. 2015).

In relation to adult alcohol use, lower levels of education predict increases in drinking in the early 20s (Casswell et al. 2002; Muthén and Muthén 2000) and alcohol problems after the mid-20s (Muthén and Muthén 2000), as well as alcohol use disorders and alcohol-related mortality throughout adulthood (Budhiraja and Landberg 2016; Crum et al. 2006; Gauffin et al. 2015). Thus, in our chain of risks model, we examine educational outcomes as key mediators by which early disadvantage may be linked with alcohol use later in life (Obradović et al. 2010; Roisman et al. 2004).

We include both family poverty and area-level disadvantage as distal predictors of later educational and alcohol outcomes. Growing up poor and in disadvantaged areas not only affects educational outcomes but also affects adult health (Kravitz-Wirtz 2016). Place effects may be independent of impacts of family poverty on both educational and health outcomes (Karriker-Jaffe et al. 2018; Robert 1999). Further, education funding and policies are determined at the metropolitan and county levels (Osypuk and Galea 2007; Zimmerman et al. 2015), rendering these areas highly relevant for understanding pathways from early disadvantage through education to heavy drinking later in life.

Differential Consequences

Our second goal in this study is to evaluate differential consequences of early exposure to family poverty and area-level disadvantage, emphasizing how pathways from early disadvantage to educational attainment and midlife heavy drinking vary for population subgroups defined by race/ethnicity or gender. Our conceptual model is premised on the understanding that race/ethnicity is a social status in the USA which is associated with differential opportunities and resources (Williams and Collins 1995; Williams et al. 1994). Therefore, while there may be core pathways through which education affects heavy drinking and alcohol problems in general, racial/ethnic subgroups may differ in their cumulative exposure to risk factors as well as in the health consequences of that cumulative exposure.

In the USA, Black and Hispanic youth are more likely to grow up in disadvantaged areas (Cellini et al. 2008; Crosnoe 2005), even compared to low-income White youth, in part due to residential racial and economic segregation (Osypuk and Acevedo-Garcia 2010; Williams 1999; Williams and Collins 1995). This has negative implications for the kinds of schools that Black and Hispanic youth are able to attend, resources to support their educational achievement, and their long-term academic performance. Further, disadvantaged youth may be less likely than their more advantaged peers to overcome negative effects of low academic performance on later educational attainment (Albrecht and Albrecht 2010). Although Blacks and Hispanics overall attain less education than Whites, there also appear to be differences in the benefits of education, including lower income returns (Williams 1996, 1999) and reduced health benefits (Walsemann et al. 2008) for Blacks as compared to Whites with similar educational attainment. Nonetheless, prior analyses of heavy drinking using the current dataset showed robust protective effects of higher levels of education for women and men of all racial/ethnic backgrounds (Mulia et al. 2017). Here we expand on prior analyses by examining distal predictors of educational attainment by race/ethnicity.

In addition to revealing racial/ethnic differences in drinking patterns in adulthood, prior work with these data show marked gender differences in trajectories of heavy drinking for all racial/ethnic groups (Mulia et al. 2017). A study using Swedish population registry data to examine pathways from

early exposure to neighborhood disadvantage to later development of alcohol use disorder showed important gender differences as well: While neighborhood disadvantage was more strongly associated with lower school achievement for young men than for young women, low family socioeconomic status was more strongly associated with lower school achievement for young women than for young men (Karriker-Jaffe et al. 2018). Additionally, reduced social functioning in young adulthood (including lower educational attainment) was more strongly associated with early alcohol use disorder for young men than for young women (Karriker-Jaffe et al. 2018). Here we test a similar model, using longitudinal data from a large, US national survey that allows for testing of gender and racial/ethnic differences.

Study Aims and Hypotheses

Building on our prior work with these and other data sources, we identify pathways from early disadvantage to midlife heavy drinking, emphasizing the role of key educational mediators. Extending prior models, we also test for differential consequences of early exposure to disadvantage, emphasizing how enduring effects of disadvantage on heavy drinking vary by race/ethnicity and gender. We expected that there would be an overall indirect effect of early disadvantage on midlife heavy drinking, with both family poverty and area-level disadvantage associated with subsequently less educational success (indicated by remedial coursework during high school, lower rates of high school graduation, and lower rates of college graduation), and with the educational markers being associated with later heavy drinking (see Fig. 1). Based on prior research, we also expected enduring effects of early disadvantage would be more pronounced for Blacks and Hispanics compared to Whites, and for men compared to women.

Methods

Dataset

Data are from the public access and restricted-use files of the 1979 National Longitudinal Survey of Youth (NLSY), a nationally representative study of civilian respondents followed for over 30 years (Rothstein et al. 2019). We used data from up to 25 interviews, which were conducted annually through 1994 and then biennially through 2012. The 2012 interview had a response rate of 79% among respondents remaining eligible for follow-up (Rothstein et al. 2019). We excluded the military sample and the oversample of low-socioeconomic status White respondents, because they were not followed into midlife. We focus on remaining respondents who were between ages 14 and 19 at baseline and who also had information on family poverty and area-level disadvantage during adolescence ($N = 6400$; 98.6% of eligible 14–19-year-olds interviewed in 1979). Our final analytic sample included 4226 respondents who self-identified as either White, Black, or Hispanic and who had data on baseline covariates and midlife heavy drinking. Given resultant sample sizes and preliminary analyses, analytic subgroups were based on race/ethnicity (50.7% White, 30.5% Black, 18.8% Hispanic) and gender (49.6% males).

Measures

The key outcome was *midlife frequency of heavy drinking*, defined as the average number of days drinking 6 or more drinks in past month, which was reported at ages 36–52 on 5 surveys conducted between 2002 and 2012. We also included a measure of *frequency of heavy drinking during young adulthood*, also defined as the average number of days drinking 6 or more drinks in the past month, which was reported at ages 25–35 on up to 3 surveys (depending on respondents' age at baseline) conducted between 1988 and 1994. The response options changed in 2006, so following prior work with these data (Mulia et al. 2017), we used a four-category variable (never, less than once a week, 1–2 times per week, more than 2 times per week) coded using the weighted empirical means of the midpoints for each response category, and limiting the upper value to be consistent across both measures of heavy drinking. Assigned category values were 0, 1.8 (mean of once and 2–3 times per month from pre-2006 response options), 5.1 (mean of 4–5 times and 6–7 times per month), and 11.0 (mean of 8–9 times and 10 or more times per month), and the outcome was treated as a continuous variable. In our analytic sample, the mean frequency of

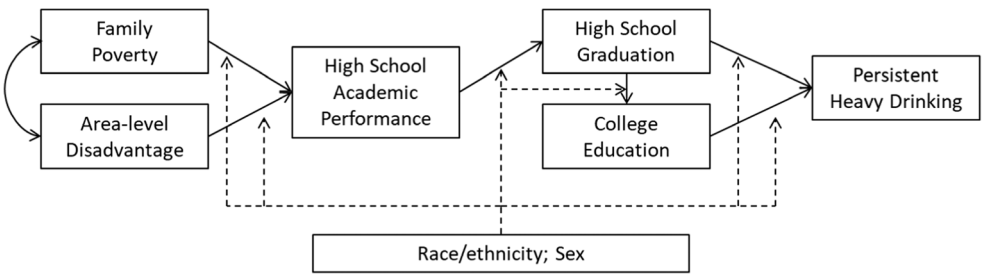

Fig. 1 Conceptual model: key educational pathways from early disadvantage to heavy drinking in middle adulthood. Note: Dashed arrows represent hypothesized moderation effects whereby the relationships would vary by race/ethnicity and/or gender

heavy drinking in young adulthood was 1.27 times per month (SD = 2.06), with means of 0.66 (SD = 1.33) for women and 1.89 (SD = 2.45) for men; for midlife heavy drinking, it was 0.65 (SD = 1.60), with means of 0.30 (SD = 0.99) for women and 1.01 (SD = 1.98) for men.

Early disadvantage included two variables averaged across all surveys a respondent completed between ages 14 and 19, with the number of surveys depending on age at baseline (14-year-olds had data from up to six surveys; 19-year-olds had data from one survey). *Family poverty duration* was the proportion of time during adolescence (ages 14–19) respondents were exposed to family poverty. Reports of family income were for the prior calendar year, and poverty status was based on family size. In our analytic sample, average family poverty duration was 23.9% (SD = 35.9), with averages of 10.4% (SD = 24.1) for White respondents, 42.4% (SD = 41.5) for Black respondents, and 32.3% (SD = 38.3) for Hispanic respondents. *Area-level disadvantage* was based on proportions of county families living below the poverty level, the unemployed civilian labor force, and female-headed households. These data came from the restricted-use files containing data from the 1980 US Census; information on smaller areas (such as Census tracts) was not available. County-level indicators were averaged into a composite score for each year, and these composites were then averaged across each respondent's adolescent period (ages 14–19). In our analytic sample, the average area-level disadvantage score was 9.3% (SD = 3.4), with averages of 8.2% (SD = 2.7) for White respondents, 10.6% (SD = 3.5) for Black respondents, and 10.2% (SD = 3.7) for Hispanic respondents.

We included three dichotomous educational mediators. *High school academic performance* was indicated by enrollment in remedial math or English classes during high school. Approximately one-quarter of the sample (22.5%) was enrolled in at least one remedial class during high school, which was more common among minority students (13.8% for White, 34.2% for Black and 34.7% for Hispanic respondents). *High school graduation* was indicated by completing 12 years of education by age 19. Almost three-quarters (73.2%) had achieved a high school education by age 19, but there were stark racial/ethnic differences (81.9% for White, 67.9% for Black, and 57.0% for Hispanic respondents). *College education* was indicated by completing at least 4 years of college or university education by age 25, as the majority of 4-year college students complete their degree within 6 years (National Center for Education Statistics n.d.). Less than one-fifth (16.9%) had achieved a college education by age 25, again, with large racial/ethnic differences (24.0% for Whites, 10.0% for Blacks, and 7.9% for Hispanics).

Sociodemographic controls were age at baseline, gender, race/ethnicity (Black or Hispanic versus White), mother's and father's highest level of education (using two dichotomous variables for less than high school and more than high school versus high school graduate; assessed separately for each parent at baseline), whether respondent was living with both parents at baseline, marital status at age 25 (married or single), as well as childbearing and parenting, which included three indicators for having at least one child by age 18, by age 22, and between ages 25 and 35. We also adjusted for early onset of alcohol use (prior to age 15) and family history of alcohol problems, which was represented by a mean weighted score for all first- and second-degree relatives with alcohol problems (Chartier et al. 2017).

Analysis

Longitudinal path models assessed indirect effects of early disadvantage on midlife heavy drinking, controlling for demographics. Modeling was conducted with Mplus (Muthén and Muthén 2013), following recommendations of MacKinnon (2008) for assessment of mediated effects using the MODEL INDIRECT sub-command. We used the robust weighted least squares estimator (WLSMV), because the model contains both continuous and categorical variables (MacKinnon 2008) and this estimator does not assume normally distributed variables. The final, most parsimonious path model was chosen based on comparisons of nested models using the DIFFTEST procedure (Muthén and Muthén 2013). For each path in the overall model, control variables that were not statistically significant were trimmed to preserve degrees of freedom. Model fit was assessed using difference testing and fit indices, including the comparative fit index (CFI) and the root mean square error of approximation (RMSEA).

After the full model was specified, we examined subgroup differences by conducting simultaneous multivariate path models with multiple groups analysis, which also used the DIFFTEST procedure. Similar to the overall model, all subgroup models included control variables to address potential confounders of the associations between early disadvantage and subsequent outcomes. Models assessing racial/ethnic differences did not include relationships of the control variables with family poverty or area-level disadvantage, nor the correlation between the two indicators of early disadvantage, due to non-convergence. We were unable to examine differences in the hypothesized relationships for groups defined by both race/ethnicity and gender due to small subsample sizes.

All analyses used weights generated using the NLSY custom weighting program (Bureau of Labor Statistics 2016), which adjusts for sampling design (including probability of selection, cooperation rates, and oversampling) and includes post-stratification weighting to represent the 1979 Census. These custom weights also account for use of data from multiple surveys.

Results

Early disadvantage was more strongly correlated with educational mediators than with drinking outcomes (Table 1). The

Table 1 Correlation matrices

	(1)	(2)	(3)	(4)	(5)	(6)
All respondents (weighted $N = 4226$)						
(1) Family poverty (ages 14–19)	–					
(2) Area-level disadvantage (ages 14–19)	0.289	–				
(3) Remedial classes in high school (ages 15–19)	0.281	0.184	–			
(4) High school education (by age 19)	− 0.307	− 0.176	− 0.544	–		
(5) College education (by age 25)	− 0.294	− 0.140	− 0.507	0.735	–	
(6) Young adult heavy drinking (ages 25–35)	0.004	− 0.050	0.104	− 0.130	− 0.182	–
(7) Midlife heavy drinking (ages 36–52)	0.006	− 0.012	0.029	− 0.077	− 0.168	0.519
White respondents (weighted $N = 2395$)						
(1) Family poverty (ages 14–19)	–					
(2) Area-level disadvantage (ages 14–19)	0.125	–				
(3) Remedial classes in high school (ages 15–19)	0.155	0.010	–			
(4) High school education (by age 19)	− 0.261	− 0.154	− 0.599	–		
(5) College education (by age 25)	− 0.185	− 0.055	− 0.518	0.763	–	
(6) Young adult heavy drinking (ages 25–35)	0.013	− 0.081	0.167	− 0.131	− 0.186	–
(7) Midlife heavy drinking (ages 36–52)	0.007	− 0.026	0.014	− 0.076	− 0.179	0.538
Black respondents (weighted $N = 1091$)						
(1) Family poverty (ages 14–19)	–					
(2) Area-level disadvantage (ages 14–19)	0.205	–				
(3) Remedial classes in high school (ages 15–19)	0.239	0.069	–			
(4) High school education (by age 19)	− 0.275	− 0.048	− 0.438	–		
(5) College education (by age 25)	− 0.284	− 0.009	− 0.426	0.665	–	
(6) Young adult heavy drinking (ages 25–35)	0.053	0.016	0.082	− 0.206	− 0.333	–
(7) Midlife heavy drinking (ages 36–52)	0.078	0.080	0.071	− 0.123	− 0.235	0.458
Hispanic respondents (weighted $N = 740$)						
(1) Family poverty (ages 14–19)	–					
(2) Area-level disadvantage (ages 14–19)	0.291	–				
(3) Remedial classes in high school (ages 15–19)	0.263	0.249	–			
(4) High school education (by age 19)	− 0.277	− 0.112	− 0.423	–		
(5) College education (by age 25)	− 0.249	− 0.181	− 0.420	0.658	–	
(6) Young adult heavy drinking (ages 25–35)	0.034	0.035	0.061	− 0.117	− 0.209	–
(7) Midlife heavy drinking (ages 36–52)	− 0.011	− 0.021	0.146	− 0.070	− 0.185	0.518
Female respondents (weighted $N = 2182$)						
(1) Family poverty (ages 14–19)	–					
(2) Area-level disadvantage (ages 14–19)	0.276	–				
(3) Remedial classes in high school (ages 15–19)	0.319	0.224	–			
(4) High school education (by age 19)	− 0.303	− 0.167	− 0.542	–		
(5) College education (by age 25)	− 0.220	− 0.099	− 0.541	0.724	–	
(6) Young adult heavy drinking (ages 25–35)	0.004	− 0.080	0.068	− 0.109	− 0.209	–
(7) Midlife heavy drinking (ages 36–52)	− 0.007	− 0.014	− 0.002	− 0.082	− 0.261	0.453
Male respondents (weighted $N = 2044$)						
(1) Family poverty (ages 14–19)	–					
(2) Area-level disadvantage (ages 14–19)	0.303	–				
(3) Remedial classes in high school (ages 15–19)	0.259	0.167	–			
(4) High school education (by age 19)	− 0.320	− 0.192	− 0.533	–		
(5) College education (by age 25)	− 0.326	− 0.188	− 0.495	0.747	–	
(6) Young adult heavy drinking (ages 25–35)	0.021	− 0.020	0.075	− 0.114	− 0.197	–
(7) Midlife heavy drinking (ages 36–52)	0.031	0.007	0.001	− 0.054	− 0.169	0.493

educational mediators were modestly correlated with drinking outcomes ($r = 0.08$ to -0.31), with correlations varying somewhat by race/ethnicity and gender.

Full Sample

Significant coefficients for the full sample are shown in Fig. 2, and all pathways, including those for covariates, are included in Table 2. In the full sample, early family poverty was positively associated with poor academic performance during high school and negatively associated with attaining a high school education. Area-level disadvantage was positively associated with attaining a college education. Poor academic performance during high school was negatively associated with attaining a high school education and with college education, as well as with midlife heavy drinking, but it was not associated with heavy drinking during young adulthood. Attaining a high school education was positively associated with attaining a college education, and it was not significantly associated with heavy drinking. Attaining a college education was negatively associated with heavy drinking during young adulthood and midlife.

As shown by bold arrows on Fig. 2, there was a significant indirect path from family poverty during adolescence to heavy drinking in midlife that included poor academic performance in high school, lower educational attainment, and more heavy drinking in young adulthood (standardized coefficient, std. coef = 0.002, SE = 0.001, $p = .002$). The residual direct effect of family poverty during adolescence on heavy drinking in midlife was not significant (std coef = 0.01, SE = 0.02, $p = .60$). The indirect path from area-level disadvantage during adolescence to heavy drinking in midlife was not significant (std coef = 0.001, SE = 0.001, $p = .23$).

Subgroup Models and Multiple-Group Analysis

Racial/Ethnic Differences Coefficients from path models for the racial/ethnic subgroups are shown in Table 3. Paths that varied by race/ethnicity (according to chi-square difference tests) also are shown in Fig. 2.

Multiple-group analysis showed that the model fit was significantly improved by allowing the associations of area-level disadvantage with the heavy drinking outcomes to vary across groups. Area-level disadvantage was negatively associated with heavy drinking in young adulthood for White respondents only (not statistically significant for either Black or Hispanic respondents), and area-level disadvantage was positively associated with heavy drinking in midlife for Black respondents only (not statistically significant for either White or Hispanic respondents). For White respondents, neither the indirect nor direct effects of area-level disadvantage during adolescence on heavy drinking in midlife were statistically significant. For Black respondents, the direct effect of area-level disadvantage during adolescence on heavy drinking in midlife was statistically significant (std coef = 0.09, SE = 0.03, $p = .002$), but the indirect effect through the educational mediators was not. For Hispanic respondents, neither the indirect nor direct effects of area-level disadvantage were significant.

The indirect pathway from family poverty during adolescence to academic performance in high school, educational attainment, and heavy drinking in midlife was marginally significant for both White (std coef = 0.002, SE = 0.001, $p = .06$) and Black respondents (std coef = 0.003, SE = 0.002, $p = .07$). The residual direct effect of family poverty during adolescence on heavy drinking in midlife was not statistically significant for either White or Black respondents, suggesting full mediation for both groups. For Hispanic respondents, neither the indirect nor direct effects of family poverty during adolescence on heavy drinking in midlife were significant.

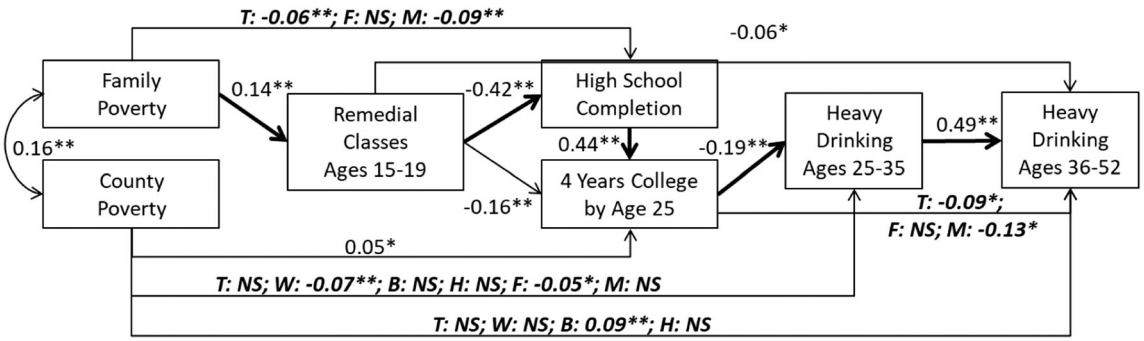

Fig. 2 Standardized coefficients for statistically significant paths for the total sample and key subgroups. Notes: model for the total sample controls for gender, race/ethnicity, age at baseline, parental education, living with both parents, having children (at age 18, age 22 and between ages 25 and 35), being married at age 25, onset of drinking by age 15, and family history of problem drinking. See Table 2 for additional coefficients and indicators of model fit for the total sample. Bold arrows indicate the significant indirect effect of family poverty on midlife heavy drinking through the educational mediators. Bold italic text indicates coefficients that vary significantly across racial/ethnic groups or by gender; see Tables 3 and 4 for additional coefficients for each subgroup. T: total sample; W: White respondents; B: Black respondents; H: Hispanic respondents; F: female respondents; M: male respondents; NS = not statistically significant

Table 2 Standardized coefficients from overall path model

	Family poverty (ages 15–19)	Area-level disadvantage (ages 15–19)	Remedial classes in high school (ages 15–19)	High school education by age 19	Completed 4 years college by age 25	Young adult heavy drinking (ages 25–35)	Midlife heavy drinking (ages 36–52)
Age at baseline interview	− .030**						
Male			.361*	− .253**	.074	.577**	.204**
Race/ethnicity[a]							
Black	.552**	.574**	.292**	.249**	− .033	− .218**	− .074
Hispanic	.313**	.488**	.400**	− .007	− .029	− .150**	− .045
Mother's education[b]							
Less than high school	.328**	.230**	.148*	− .203**	− .179**		
More than high school	− .079	− .027	− .187*	.218**	.156*		
Father's education[b]							
Less than high school	.213**	.176**	.219**	− .220**	.052		
More than high school	.003	.012	− .040	.255**	.234**		
Lived with both parents	− .388**	− .033	.053	.354**	− .248		
Family alcoholism history					− .466*	.281†	
Onset of drinking by age 15						.176**	
Children by age 18				− .344**			
Married by age 25					− .082†	− .211**	
Children by age 22					− .876**		
Children at ages 25 to 35						− .080*	
Family poverty duration [c]		.161**	.142**	− .064**	− .020	.004	.009
Area-level disadvantage			.036	− .005	.048*	− .027	.023
Remedial classes				− .422**	− .157**	.003	− .065*
High school education					.438**	− .019	.020
Completed 4 years college						− .192**	− .088*
Young adult heavy drinking							.487**
R-square	.199	.135	.188	.451	.652	.147	.284

Fit statistics: estimated degrees of freedom = 85, CFI = 0.974, RMSEA = 0.021

**$p < 0.01$; *$p < 0.05$; †$p < 0.10$

[a] White as referent

[b] High school completion as referent

[c] Association between family poverty and area-level disadvantaged assessed using WITH statement

Table 3 Standardized coefficients, presented by racial/ethnic group

	Remedial classes in high school (ages 15–19)	High school education by age 19	Completed 4 years college by age 25	Young adult heavy drinking (ages 25–35)	Midlife heavy drinking (ages 36–52)
White respondents ($N = 2363$)					
Family poverty duration	.116**	− .058*	− .005	− .015	− .010
Area-level disadvantage	− .008	− .073*	.042	− *.069***	*.011*
Remedial classes		− .497**	− .163*	.030	− .156**
High school education			.426**	− .064	− .028
Completed 4 years college				− .137**	− .111*
Young adult heavy drinking					.517**
R-square	.091	.490	.709	*.138*	*.324*
Black respondents ($N = 1073$)					
Family poverty duration	.182**	− .116*	− .067	.007	.032
Area-level disadvantage	.004	.043	.083	*.046*	*.089***
Remedial classes		− .308**	− .186†	− .078	− .042
High school education			.451**	− .024	.099
Completed 4 years college				− .284**	− .190*
Young adult heavy drinking					.397**
R-square	.124	.347	.547	*.174*	*.243*
Hispanic respondents ($N = 734$)					
Family poverty duration	.084	− .095*	− .001	.001	− .037
Area-level disadvantage	.124†	.042	− .032	*.027*	− *.057*
Remedial classes		− .284**	− .227*	− .137†	.105
High school education			.464**	.107	.075
Completed 4 years college				− .374**	− .115
Young adult heavy drinking					.471**
R-square	.237	.394	.575	.264	.307

Notes. Model controls for gender, age at baseline, parental education, living with both parents, having children (at age 18, age 22 and between ages 25 and 35), being married at age 25, onset of drinking by age 15, and family history of problem drinking. Italics indicate coefficients that vary significantly across racial/ethnic groups. Model specifications varied slightly from those used for Tables 2 and 4. See "Analysis" for details

**$p < 0.01$; *$p < 0.05$; $^{\dagger}p < 0.10$

Gender Differences Coefficients from path models by gender are shown in Table 4. Chi-square difference tests showed significant gender heterogeneity in several specific paths (also see Fig. 2). Family poverty during adolescence was associated with lower odds of high school graduation only for males (not for females). We were unable to test whether the association of area-level disadvantage and college education varied by gender, as the difference test was not estimable. Area-level disadvantage was associated with less heavy drinking in young adulthood for only females, and attaining a college education was associated with less heavy drinking in midlife only for males.

The indirect pathway from family poverty during adolescence to academic performance in high school, educational attainment, and heavy drinking in midlife held for both genders. The indirect effect was statistically significant for both women (std coef = 0.002, SE = 0.001, $p = .02$) and men (std coef = 0.002, SE = 0.001, $p = .04$), and the residual direct effect of family poverty during adolescence on heavy drinking in midlife was not statistically significant, suggesting full mediation for both gender subgroups. Neither the indirect nor direct effects of area-level disadvantage during adolescence on heavy drinking in midlife were statistically significant for either women or men.

Discussion

Building on our prior work showing strong relationships between heavy drinking trajectories and educational attainment (Mulia et al. 2017), we used data from a nationally representative US sample of adolescents followed into midlife to identify pathways from early disadvantage to later heavy drinking, emphasizing the role of key educational mediators. There was a significant indirect path from family poverty during adolescence to heavy drinking in midlife that included lower academic performance (remedial coursework in high school), lower educational attainment, and more heavy drinking in young adulthood. This pathway was statistically significant for both males and females, but it was only marginally significant for White and Black respondents (not significant for Hispanics). Counter to our expectations based on prior literature, the indirect path from area-level disadvantage through the educational mediators to heavy drinking in midlife was not significant for any group. Our findings emphasize the importance of the early family context for later educational success, suggesting that families living in chronic poverty need additional services to support children's educational development. Fortunately, successful intervention models exist (Hahn et al. 2015; Werner and Smith 1992). These include

Table 4 Standardized coefficients, presented by gender

	Remedial classes in high school (ages 15–19)	High school education by age 19	Completed 4 years college by age 25	Young adult heavy drinking (ages 25–35)	Midlife heavy drinking (ages 36–52)
Females ($N = 2184$)					
Family poverty duration[a]	.171**	− *.036*	.007	.003	− .016
Area-level disadvantage	.074[†]	*.005*	.077*[,b]	− *.053**	.033[†]
Remedial classes		− .471**	− .227**	− .015	− .103[†]
High school education			.311**	− .070	− .017
Completed 4 years college				− .192**	− *.108*
Young adult heavy drinking					.441**
R-square	.177	.470	.660	.101	.224
Males ($N = 2044$)					
Family poverty duration[a]	.117**	− *.094***	− .047	.004	.019
Area-level disadvantage	.003	− *.012*	.019[b]	− *.020*	.019
Remedial classes		− .400**	− .119	− .004	− .060
High school education			.515**	− .012	.060
Completed 4 years college				− .216**	− *.126**
Young adult heavy drinking					.479**
R-square	.167	.418	.624	.057	.256

Notes. Model controls for race/ethnicity, age at baseline, parental education, living with both parents, having children (at age 18, age 22, and between ages 25 and 35), being married at age 25, onset of drinking by age 15, and family history of problem drinking. Italics indicate coefficients that vary significantly by gender

[a] Association between family poverty and area-level disadvantaged assessed using WITH statement; standardized coefficients = .150 ($p < .01$) for females and .174 ($p < .01$) for males

[b] The difference test for whether the association of area-level disadvantage and college education varied by gender was not estimable

**$p < 0.01$; *$p < 0.05$; [†] $p < 0.10$

programs that provide reading support in the earliest elementary grades; involve youth in a stable, caring relationship with an adult (relative or non-kin) who they view as a mentor; provide social/emotional skills training; and provide case management and linkages for students and their families to build connections with community mental health and financial services. The long-term impacts of such interventions may reach far into midlife.

We tested for differential consequences of early exposure to family poverty and area-level disadvantage, expecting that enduring effects of early disadvantage would be most pronounced for Black and Hispanic respondents compared to White respondents and for men compared to women. We only found partial support for these hypotheses. Specifically, for Black respondents, there was an additional direct effect of early area-level disadvantage on midlife heavy drinking that was not seen for either Hispanic or White respondents. This suggests a differentially negative and enduring effect of early exposure to disadvantaged communities for Black youth, who have a lower likelihood of mobility out of these areas, and thus greater lifecourse exposure to economically distressed environments, even across generations (Sharkey 2008). Disadvantaged communities often suffer from a proliferation of alcohol outlets (LaVeist and Wallace 2000), and this type of environment can foster heavy drinking. Future work should explore sources of resilience for low-income communities that may help support Black adolescents as they transition to adulthood.

There also was no evidence of indirect effects of area-level disadvantage through the educational pathways for any of the groups studied here. Although in bivariate analyses area-level disadvantage was negatively correlated with attaining a college education for most subgroups, in the path models, suppression effects are present with regard to educational attainment, as the sign of the coefficient changes (MacKinnon et al. 2000). There are likely to be many pathways from early exposure to disadvantage to midlife health risk behaviors such as heavy drinking, and only one is emphasized here. Other pathways may include social norms (Karriker-Jaffe et al. 2016), as well as psychological, physiological, and neuroendocrine mechanisms resulting from—and interacting with (Hussong et al. 2013)—prolonged exposure to a variety of stressors that were not captured by our models. Although some studies suggest Black and Hispanic people may have lower health returns on education compared to their White counterparts (Walsemann et al. 2008), we did not find strong evidence that the protective effect of college education on heavy drinking varied systematically by race/ethnicity. Our findings suggest education still is an important protective resource, but future studies could examine alternate pathways to midlife heavy drinking.

Regarding hypothesized gender differences, adolescent family poverty was more strongly linked to reduced likelihood of high school graduation for males than for females. These findings are counter to some studies suggesting that the family environment may be more influential for girls than for boys (Karriker-Jaffe et al. 2018; Kroneman et al. 2004). Although the adjusted gender differences were not significant, the correlation between family poverty and enrollment in remedial coursework was stronger for high school girls ($r = 0.32$) than for boys ($r = 0.26$), which may indicate that young women are more likely to get support from their schools in response to poor academic performance than their male counterparts, although this speculation deserves further study. However, in this sample, receipt of remedial coursework was associated with significantly reduced likelihood of high school graduation for both females and males (as well as with significantly reduced likelihood of college education for young women), so other support services for high-risk students are needed to reduce long-term impacts of family poverty. Such services might include college programs that provide social support and mentoring by faculty members and older, successful students from similar backgrounds.

Strengths and Limitations

Our study has many notable strengths, such as the large sample size and the long follow-up period spanning adolescence to midlife. There are few longitudinal data resources available for multilevel studies of the long-term impacts of early exposure to disadvantage, and the NLSY data are unique in their comprehensive measures of educational outcomes as well as alcohol use over time. One limitation of these data, however, is a lack of small-area measures of exposure to neighborhood disadvantage. Although counties are important for determining policies and funding for education (Osypuk and Galea 2007), local communities vary in terms of educational resources and quality. Historically in the USA, Black and Hispanic people have been subjected to discrimination, which results in segregation to lower-income areas (Cellini et al. 2008; Crosnoe 2005; Osypuk and Acevedo-Garcia 2010; Williams 1999; Williams and Collins 1995). In this sample, there were not large differences in exposure to area-level disadvantage during adolescence for White, Black, and Hispanic respondents, with average scores ranging from 8% disadvantaged residents in the counties where White adolescents lived, to just over 10% for the counties where Black and Hispanic adolescents lived. This may have contributed to the unexpected null findings for indirect effects of area-level disadvantage on education and heavy drinking. Additionally, we note that our measure of heavy drinking used a threshold of six or more drinks per occasion, which is higher than the recommended daily limits for men (no more than four drinks) and women (no more than three drinks) (National Institute on Alcoholism and Alcohol Abuse 2009). Thus, we are underrepresenting heavy drinking in this sample, especially for women. Due to

the timing of the alcohol consumption measures, we also were unable to account for heavy drinking during adolescence, which may impact educational outcomes. We did include an indicator of early onset (prior to age 15) of drinking; although predictive of heavy drinking in young adulthood, early onset was not related to any educational outcomes. Finally, despite the relatively large number of Black and Hispanic respondents, we did not have sufficient power to assess differential pathways across racial-gender subgroups, and we encourage future research to build upon these results.

Conclusions

Enduring impacts of exposure to family poverty during adolescence on educational attainment have consequences for health risk behaviors in midlife. Due to differential exposure to early adversity, intersectoral interventions are needed to reduce disparities in alcohol outcomes and to promote health equity among high-risk population subgroups.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in the National Longitudinal Survey of Youth (NLSY) involving human participants were in accordance with ethical standards described in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The current study is a secondary analysis of NLSY data. The Institutional Review Board of the Public Health Institute reviewed the study protocol and found it to be exempt.

Informed Consent Informed consent was obtained from all individual participants included in the NLSY study.

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