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Early Socioeconomic Adversity, Youth Positive Development, and Young Adults' Cardio-Metabolic Disease Risk

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Objective: Recent research suggests that psychosocial resources, including self-esteem, personality, and educational attainment, may be mechanisms explaining the socioeconomic variation in health risks. However, less research has examined this possibility over the early life course. ***Method:*** A nationally representative sample of 12,424 respondents with data collected over a 13-year period from National Longitudinal Study of Adolescent to Adult Health (Add Health) was examined. This study utilized a cumulative measure of early socioeconomic adversity capturing multiple dimensions of adversity to test resource focused models in a structural equation framework estimating the influence of early adversity on young adults' (ages 25–34) risk for cardio-metabolic disease, as measured by metabolic and cardiovascular bio-markers, through psychosocial resources (i.e., self-esteem, personality, and educational attainment). Lastly, potential model differences by sex and race/ethnicity were examined. ***Results:*** The findings showed that early adversity contributed to young adults' cardio-metabolic disease risk directly. Additionally, early adversity increased young adults' cardio-metabolic disease risk indirectly through its' negative influence on the development of youths' psychosocial resources: self-esteem, positive personality, and educational attainment. The association between psychosocial resources and young adults' cardio-metabolic disease risk differed for men and women and across racial/ethnic groups. ***Conclusions:*** These findings contribute valuable knowledge to existing research by elucidating how early adversity exerts an enduring long-term influence on young adults' cardio-metabolic disease risk directly and indirectly through psychosocial resources. Furthermore, this information suggests that effective intervention and prevention programs should focus on early adversity and the development of youths' psychosocial resources.

Keywords: child health, ethnicity, gender, early life course, psychosocial factors

Prior studies have established the persistent influence of childhood socioeconomic adversities (hereafter, early adversity) on adults' health (Barker, 1997; O'Rand & Hamil-Luker, 2005). Particularly, young adults who have experienced childhood/adolescent socioeconomic adversity carry higher cardio-metabolic disease risk (e.g., chances of having diabetes, heart disease, or stroke), as indicated by elevated levels of regulatory bio-markers (Evans & Kim, 2010). Existing stress research has indicated the moderating, or buffering, effect of psychosocial resources on the association between stressful conditions and health outcomes. Meanwhile, recent studies implicating the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenocortical (HPA) axis have suggested the potential mediating role of psychosocial resources as well (Gallo, de los Monteros, & Shivpuri, 2009). However, the potential mediating role of psychosocial resources has been rarely explored (Matthews & Gallo, 2011). This possible mediating pathway may be particularly likely during the early life course, a period of rapid psychosocial development. Consequently, we aim to investigate psychosocial resources as a mechanism linking adversity during the early life course to later health outcomes.

Models assessing psychosocial pathways leading to health outcomes are considered "resource focused models." These models differ from the traditional "stress focused models" that have been assessed in most previous studies, which examine adverse, stressful mediators linking early adversity to poor health outcomes (Pearlin, Schieman, Fazio, & Meersman, 2005). Instead, resource focused models examine positive psychosocial mediators linking

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early life experiences to health outcomes. Early stressful conditions impair youths' development of psychosocial resources (Whitbeck et al., 1991) or erode available psychosocial resources (Donnellan, Conger, McAdams, & Neppl, 2009), which, in turn, has a detrimental effect on health outcomes. Previous studies have documented that psychosocial resources, such as positive affect, self-esteem, social integration, and education, positively influence individual cognitive functioning through enhanced brain neuroplasticity (McEwen & Gianaros, 2010; Steptoe, O'Donnell, Marmot, & Wardle, 2008). Furthermore, research has shown that one's positive feelings have health-protective biological correlates, such as a lower cortisol level, better ambulatory heart rate, reduced cardiovascular stress reactivity, and lower rate of disease (Steptoe et al., 2008; Steptoe, Wardle, & Marmot, 2005). Thus, we expect that impaired development of psychosocial resources among youth, influenced by early adversity, will have negative consequences for physiological and cognitive functioning of youth.

There is clear evidence that dysregulation in physiological systems often begins early in life, as reflected by elevated levels of biomarkers in adolescence and young adulthood, and is linked to cardiovascular, metabolic, and infectious diseases later in life (Goodman, McEwen, Huang, Dolan, & Adler, 2005). However, research linking socioeconomic conditions to health risks has not adequately investigated the mediating role of psychosocial resources, and most available studies have investigated adults or older adults.

Particularly, studies investigating psychosocial resource models in adolescence or young adulthood are rare. Little is known about how the development of psychosocial resources over the early life course link early socioeconomic conditions to their physical health in young adulthood. This paucity of research warrants examining through longitudinal life course models incorporating early socioeconomic conditions, the development of psychosocial resources in preadulthood, and young adults' health risk.

The Theoretical Framework and Hypotheses

Drawing from the psychosocial resource perspective and the developmental life course perspective (Elder & Giele, 2009; Gallo et al., 2009; Wickrama, Conger, Lorenz, & Jung, 2008), we hypothesize that (a) early socioeconomic adversity will be associated with young adults' cardio-metabolic disease risk; (b) individual psychosocial resources (adolescent self-esteem, young adults' educational attainment, and personality, as reflected by the general factor of big five personality traits) will mediate the association between early socioeconomic adversity and young adults' disease risk; and (c) there will be gender and racial/ethnic differences in these psychosocial pathways (see Figure 1).

Consistent with the life course developmental perspective (Elder & Giele, 2009), we incorporated psychosocial developmental processes in a life course model predicting young adults' cardio-metabolic disease risk. Self-esteem is a critical developmental outcome negatively influenced by early socioeconomic adversity (Bolger, Patterson, Thompson, & Kupersmidt, 1995), and poor self-esteem, in turn, is detrimental for the socioeconomic attainment of youth. Socioeconomic attainment, which is largely captured by educational level, has been shown to be a consistent factor

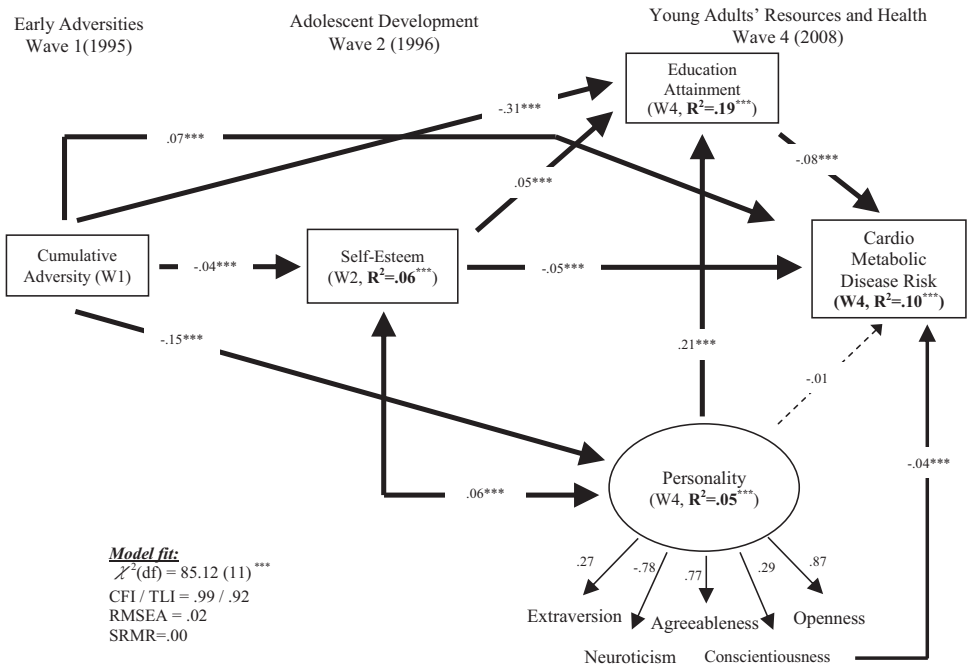

Figure 1. Indirect influence of early cumulative adversities on cardio-metabolic disease risk in young adulthood. Note: Standardized coefficients are shown. All factor loadings were significant ($p < .001$). Early physical illness (W1), sex, and race/ethnicity (i.e., African American, Hispanic, Asian, and Native American) were included as control variables. Dotted lines indicate nonsignificant paths. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$. CFI = comparative fit index; TLI = Tucker Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual.

that explains variation in health risk (Mirowsky & Ross, 2003). Thus, we incorporate this possibility within our resource model over the early life course (i.e., early adversity → lack of adolescent self-esteem → low young adult educational attainment → disease risk). As in the case of self-esteem, previous research also suggests that youth personality development may play a mediating role during this developmental period (Conger et al., 2012). Thus, while acknowledging the association between self-esteem and personality, we incorporate personality (a latent construct of the big five personality characteristics) as an additional psychosocial resource mediator (i.e., early adversity → less positive personality → low educational attainment → disease risk).

Early Socioeconomic Adversity

Previous developmental research has documented the detrimental influence of early family adversity reflected by family poverty and limited access to resources, the presence of frequent family conflict, and family stressors, such as parental separation or divorce, on youth psychological competency (e.g., self-esteem; Whitbeck et al., 1991) and young adults' educational attainment (Melby, Conger, Fang, Wickrama, & Conger, 2008). This influence may operate through strained parent–child relationships, material deprivation, community stress, and early mental and physical health problems (Wickrama & O'Neal, 2013).

Self-esteem is a consequence of individuals' propensity to compare themselves with others and make positive or negative self evaluations based on such comparisons (Festinger, 1954; Rosenberg, 1979). Thus, consistently experiencing failures in attempts to escape from socioeconomic hardship can erode disadvantaged youths' feelings of self-worth compared to socioeconomically advantaged youths (Donnellan et al., 2009).

Furthermore, socioeconomic adversity may negatively influence youth personality development directly and indirectly in several ways. First, youth from disadvantaged socioeconomic backgrounds may lack the necessary environmental exposure and interactions to develop the positive personality characteristics implicated in socially desirable beliefs and behaviors, which can have detrimental health consequences (Jonassaint, Siegler, Barefoot, Edwards, & Williams, 2011). For instance, lower-SES individuals may be more likely than higher-SES individuals to possess certain dispositional traits that are adaptive in the social environments in which they live but have negative health consequences. For instance, lower-SES individuals are more likely to reside in dangerous and threatening neighborhoods, where mistrust of others and cynicism may be beneficial. Thus, lower-SES individuals may be more hostile and less optimistic about their future than higher-SES individuals (Adler et al., 1994). Second, children reared in a disadvantaged family environment are more likely to be high on negative emotionality, less agreeable, and lack conscientiousness. This influence may largely operate through ineffective parenting practices and child maltreatment (Conger et al., 2012). Third, research has shown that early socioeconomic adversity negatively influences children's brain development, which has been shown to be related to all Big Five personality traits (Cremers et al., 2011; Hanson et al., 2013).

We also expect that early socioeconomic adversity will directly influence young adults' cardio-metabolic disease risk, over and above the mediating pathways examined. This is consistent with the early life hypothesis (Barker, 1997), which suggests that early adverse life experiences are "biologically imbedded" because they permanently "tune" developing physiological systems, even in the fetal stage (Coe & Laudenslager, 2007). These changes are irreversible and can lead to permanent physiological and cognitive damage (e.g., impaired neurological development, metabolic and endocrine abnormalities), which "incubate" and exact a toll on physical health in later life stages (Miller, Chen, & Parker, 2011).

Psychosocial Resources and Cardio-Metabolic Disease Risk

Adolescent self-esteem. Previous research suggests that self-esteem is associated with enhanced brain neuroplasticity and reduced HPA reactivity to stress (Creswell et al., 2005; McEwen & Gianaros, 2010). Also, high-esteemed individuals are more likely to engage in positive health behaviors (e.g., physical activity), which may also be linked to improved cognitive performance and physiological functioning (McEwen & Gianaros, 2010). Brain neuroplasticity and cognitive performance may contribute to higher educational attainment. Thus, we expect that impaired self-esteem will mediate the negative influence of early adversity on physiological functioning (allostatic control systems) directly and indirectly through educational attainment.

General factor of personality (GFP). Studies on personality increasingly show the existence of a single general factor (general factor of personality; GFP) underlying the Big Five personality traits (extraversion, neuroticism, conscientious, agreeableness, and openness; Van der Linden, Tsaousis, & Petrides, 2012). Individuals who score high on the GFP are emotionally stable, agreeable, conscientious, extraverted, and intellectually open. We posit that impaired positive personality development will mediate the negative influence of early adversity on physiological functioning (allostatic control systems) directly and indirectly by limiting the accumulation of other resources, such as education attainment (Matthews & Gallo, 2011; McEwen & Gianaros, 2010).

Previous research has documented the association between other psychosocial resources, namely self-esteem and education, and personality. In one study, the Big Five personality constructs collectively accounted for 34% of the variance in self-esteem (Robins, Tracy, Trzesniewski, Potter, & Gosling, 2001). They have shown that high self-esteem individuals are emotionally stable, extraverted, and conscientious and are somewhat agreeable and open to experience. The associations between self-esteem and the Big Five are largely stable across age, sex, ethnicity, and nationality. High self-esteem individuals tend to ascribe socially desirable personality traits to themselves. Individuals with more positive personality characteristics typically reach higher levels of educational attainment than individuals with generally negative personality characteristics (Hampson, Goldberg, Vogt, & Dubanoski, 2007). This association is, at least in part, due to documented links between personality traits and characteristics that are necessary for educational attainment, including characteristics of perseverance and willingness to achieve with conscientiousness (Zhang, 2003), self-regulation with emotional stability (Eysenck, 1992), openness with intellectual curiosity, creativity, and commitments to assignments (McCrae & Costa, 1999).

Young adults' educational attainment. We expect higher educational levels will promote physiological functioning (allostatic control systems) relative to lower educational levels (Mat-

thews & Gallo, 2011; McEwen & Gianaros, 2010). In an experimental study, higher social status was associated with better physiological performance (testosterone and cardiac reactivity) relative to lower status (Akinola & Mendes, 2008), whereas lower educational attainment is associated with the development of metabolic syndrome (Matthews, Raikkonen, Gallo, & Kuller, 2008). Also, less educated youth are more likely to engage in health risk behaviors (e.g., physical inactivity and excessive screen time), which are also linked to poor health (McEwen & Gianaros, 2010).

Gender and Racial/Ethnic Differences

Research suggests that the effects of SES on health outcomes are stronger for women than men (Thurston, Kubzansky, Kawachi, & Berkman, 2005) and for socioeconomically disadvantaged groups than higher SES individuals (Smith, 2000). For example, research has shown that African Americans have greater cardiovascular reactivity to adverse socioeconomic conditions compared with Whites, and this greater reactivity is associated with suppressed anger and hostility (Treiber et al., 1990). Furthermore, the salience of observed psychosocial resources may vary across ethnic groups. For example, Wickrama, O'Neal, and Lott (2012) have shown that African American young adults do not accrue the same health benefits of education (lower cardiovascular disease [CVD] risk) as Whites. Thus, we expect the mediating role of psychosocial resources to vary across racial/ethnic groups.

Method

Sample

Data for this study came from a nationally representative sample of adolescents participating in the National Longitudinal Study of Adolescent to Adult Health (Add Health). In 1995, baseline (Wave 1) data were derived from a complex stratified cluster-sampling of middle and high school students, yielding 20,745 respondents (M_{age} = 15.5 years; range = 12–20 years at baseline) from 134 middle and high schools. To ensure diversity, the sample was stratified by region (South, West, Midwest, and Northeast), urbanicity, school type (public vs. private), racial composition, and size. Wave 1 data from youth were collected in schools, and parent data were collected from in-home interviewer-administered questionnaires. The second and third waves of data were collected in-home in 1996 and 2001 (N_2 = 14,738; N_3 = 15,100). We used interview data from parents in Wave 1 and adolescents who participated in Waves 1, 2, 3, and 4 (2008; young adulthood). The study sample size was 12,424. Wave 1 sample weights were used. The final sample consisted of approximately 53% women, and 39% of respondents reported a minority racial/ethnic status with the largest percentages reporting for African American (15%), Hispanic (10%), Asian (6%), and Native American (2.8%), respectively. At Wave 4 (2008; M_{age} = 29.13 years; range = 25–34 years), bio-markers (e.g., blood pressure, pulse rate, blood glucose levels, weight, and height) were obtained from respondents (details in Measurement section). More information about Add Health is available at http://www.cpc.unc.edu/addhealth.

The analytical sample is based on available Wave 4 data. A total of 19.97% of the data were missing. Attrition and missing data analysis showed that adolescents who participated in all four waves were slightly younger but otherwise confirmed that there was little difference between adolescents with missing data in our study sample and those with complete data.

Measures

Early cumulative socioeconomic adversity. We contend that family and community socioeconomic adversities combine to exert a cumulative risk on the health outcomes of young adults. We constructed an index assessing cumulative socioeconomic adversity by adding dichotomous indicators of different adversity dimensions (see Table 1). This cumulative socioeconomic adversity index captures both material (e.g., family poverty, community poverty) and social (e.g., parents' education, marital stability) components of early socioeconomic adversity; both of which have

Table 1
Indicators of Cumulative Socioeconomic Adversity

Indicator (Wave of data used)	Description of composite variable	Range of responses
Parental education (Wave 1)	Composite score of mothers' and fathers' education levels[a].	1 (*eighth grade education or less*) to 9 (*professional training beyond 4-year college or university degree*)
Economic hardship (Wave 1)	Sum of 5 dichotomous items asking if any household member received social service benefits[b] (0 = no, 1 = yes).	0 (*received no social service benefits*) to 5 (*received all 5 of the social service benefits assessed*)
Parents' marital stability (Wave 1)	A binary variable to differentiate between consistently married parents and not consistently married parents; mothers reported their marital status each year from 1980 to 1995.	1 = *parents who have been consistently married or in a marriage like relationship for at least 15 years* 0 = *other parents*
Community adversity (Wave 1/ 1990 Census) (α = .78)	Sum of four dichotomized indicators asking about the high/low community proportions of families living in poverty, single-parent families, adults employed in the service industry, and unemployed men[c].	0 (*low community adversity in the four domains assessed*) to 4 (*high community adversity in the four domains assessed*)

[a] For single-headed families (n = 79) with no available data from fathers, maternal education served as the indicator of parental education. [b] Specific items are whether any member of the household received the following social service benefits: social security, supplemental security income, aid to families with dependent children, food stamps, or housing subsidies in the past month. [c] Adapted from Sucoff & Upchurch, 1998.

health implications for youth (e.g., Wickrama et al., 2008). Research has shown that the health risk of cumulative socioeconomic adversity is considerably stronger than the independent effect of individual dimensions of socioeconomic adversity (Bauman, Silver, & Stein, 2006). Except for marital stability (initially computed as a dichotomous variable), dichotomous indicators were created by conducting a mean split for each measure. Details of the indicators are presented in Table 1.

Self-esteem. At Wave 2 (1996), eight items from the Rosenberg Self-Esteem Scale were summed with higher scores indicating more self-esteem (Rosenberg, 1965). These items assessed adolescents' feelings of self-worth (e.g., "You have a lot of good qualities") on a scale ranging from 1 = *strongly disagree* to 5 = *strongly agree* (α = .90).

Personality. The Mini-IPIP, a 20-item short form of the 50-item International Personality Item Pool five-factor model (IPIP-BF; Goldberg, 1999), was administered at Wave 4 (2008). Respondents reported their agreement to items on a 5-point scale ranging from 1= *strongly agree* to 5 = *strongly disagree*. Items were coded so that higher scores indicate the presence of more extraversion, neuroticism, agreeableness, conscientiousness, and openness. Four items assessed each of the five factors. The scales had adequate internal consistencies ranging from .71 to .88.

Educational attainment. Young adults' educational attainment was measured at Wave 4 using an ordinal scale ranging from 1 = *completed eighth grade* to 11 = *completed doctoral degree*.

Young adults' cardio-metabolic disease risk. We measured young adults' disease risk by summing standardized, continuous scores (z scores) of nine bio-markers of cardiovascular and metabolic systems at Wave 4 (2008). Aggregate scores of bio-markers are typically computed as the number of markers for which a participant is in the highest risk quartile. However, prior research has shown that averaging the computed z-scores for each measure predicts health outcomes equally well (Seeman et al., 1997). Also, averaging continuous z-scores more accurately reflects the continuous nature of cardio-metabolic disease risk.

The bio-markers assessed in the current study include systolic blood pressure, diastolic blood pressure, pulse rate, glycohemoglobin (HbA1c), glucose, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and body mass index (BMI). *Systolic and diastolic blood pressure* (mmHg) and *pulse rate* measurements were taken on the right arm, absent contraindications in a rested/seated position by trained field interviewers using oscillometric blood pressure monitors. Using standard procedures, trained and certified interviewers obtained whole blood spots for dried blood analysis. From these samples, *HbA1c*, an integrated measure of blood glucose control over the preceding 2 to 3 months, total *glucose* values, *triglycerides*, *LDL*, and *HDL* were assayed. Trained interviewers also obtained measurements of respondents' height and weight, and this information was used to compute their *BMI*, the ratio of weight to height squared ([lbs*703]/inches^2).

Race/ethnicity. At Wave 1, adolescents reported their race/ethnicity. Dichotomous variables were then created to assess African American, Hispanic, Asian, Native American, and White racial/ethnic statuses. The dichotomous variables for each of the minority statuses were included as independent variables in the regression equation resulting in regression coefficients that can be interpreted with reference to Whites. For multiracial respondents, only their first choice of race/ethnicity category was considered.

Gender. Gender was coded as man (0) or woman (1).

Adolescent illness. We included adolescent illness as a control variable. From mothers' reports at Wave 1, an index of adolescent illness was created by summing the total number of diseases or serious health problems the youth experienced from six conditions (obesity, migraine headaches, allergies, asthma, and diabetes).

Analysis Plan

We tested the conceptual model using a structural equation modeling (SEM) framework. We utilized individual sample weights from Wave 1 to account for oversampling of smaller population groups. The TYPE = COMPLEX command accounted for potential bias in standard errors and chi-square computations due to the lack of individual independence between observations within schools in the Add Health data. Missing data were accounted for using Full Information Maximum Likelihood (FIML) procedures (Enders & Bandalos, 2001). We used the Comparative Fit Index (CFI $\geq$ .95) and Root Mean Square Error of Approximation (RMSEA $\leq$ .06) to evaluate model fit.

Results

Table 2 presents descriptive statistics of the study variables. On average, respondents experienced 1.57 of the four socioeconomic adversity events or environments assessed. More specifically, 48.7% of respondents had parents with low parental education, and 21.1% of respondents lived in families experiencing economic hardship. Only slightly over half of the respondents came from homes where the parents had been married to each other for 15+ years (53.0%), and one in three respondents lived in an adverse community environment (34.7%). The computed disease risk index, which is the sum of standardized scores from nine bio-markers, had a large amount of variation, with a range of approximately 5.5 standard deviation units (−2.13 to 3.33 standard deviation units).

An exploratory factor analysis supported the use of a GFP. The five personality scales loaded onto one factor (Root Mean Square off-Diagonal Residuals = .03, Eigenvalue = 1.65, Explained Variance = 32.95%). Factor loadings were .40, .32, .49, .55, and −.30 for openness, conscientiousness, extraversion, agreeableness, and neuroticism, respectively.

As shown in Figure 1, cumulative socioeconomic adversity at Wave 1 (1995) was negatively associated with psychosocial resources including poor self-esteem at Wave 2 (1996) and lack of educational attainment (assessed at Wave 4, 2008; β = −.04 and −.31, respectively). Individuals experiencing more socioeconomic adversity also reported a less positive general personality (Wave 4, 2008; β = −.15). Adolescent self-esteem and a positive general personality contributed to young adults' educational attainment (β = .05 and .21, respectively). In turn, adolescent self-esteem and educational attainment influenced young adults' cardio-metabolic disease risk (β = −.05 and −.08, respectively), as indicated by cardiovascular and metabolic bio-markers. Although the GFP did not exert a direct effect on young adults' cardio-metabolic disease risk, on average, more conscientious

Table 2
Descriptive Statistics of Study Variables (N = 12,424)

Variables (Wave)	Mean/proportion	Outlier %	*SD*	Range
Early cumulative socioeconomic adversity (W1)	1.57		1.11	.00–4.00
Low parental education	48.7%			
Economic hardship	21.1%			
Parents' marital stability	53.0%			
Community adversity	34.7%			
Physical illness (W1; control)	.72		.81	0–4.00
Self-esteem (W2)	19.70		1.89	6.00–31.00
Extraversion (W4)	5.69		2.19	1.00–13.00
Neuroticism (W4)	10.43		2.74	4.00–20.00
Agreeableness (W4)	15.25		2.41	4.00–20.00
Conscientiousness (W4)	14.64		2.69	4.00–20.00
Openness (W4)	14.49		2.45	4.00–20.00
Education attainment (W4)	5.69		2.19	1.00–13.00
Cardio-metabolic disease risk (z-score; W4)	.00		.51	−2.13–3.33
SBP (systolic blood pressure, mmHg)	124.20 (124.52)	.8%	12.84 (13.64)	74.00–165.50 (74.00–222.50)
DBP (diastolic blood pressure, mmHg)	78.94 (79.15)	.7%	9.71 (10.20)	30.00–109.50 (30.00–147.00)
PR (pulse rate, bmp)	73.97 (78.75)	.5%	11.47 (61.50)	40.00–109.50 (40.00–196.00)
BMI (body mass index)	28.76 (29.15)	1.3%	6.79 (7.50)	15.40–51.60 (15.40–97.40)
TG (triglycerides, decile)	5.50		2.87	1.00–10.00
HDL (high density lipoprotein, decile)	5.50		2.87	1.00–10.00
LDL (low density lipoprotein, decile)	5.50		2.87	1.00–10.00
HbA1c (glycosylated hemoglobin, %)	5.54 (5.61)	1.1%	.42 (.81)	3.80–8.00 (3.80–23.10)
Blood glucose (mg/dl)	104.87 (107.34)	1.1%	18.87 (32.33)	36.00–204.00 (36.00–688.00)

Note. HDL was reverse-coded. According to the Shiffler (1988) approach, z-scores that exceed 3 across the nine bio-marker indicators for cardio-metabolic disease risk were declared outliers and treated as missing. Only six bio-markers contained outliers. Original means, *SD*, and ranges for these six bio-markers (before removing outliers) are in parentheses.

youth exhibited less cardio-metabolic disease risk than less conscientious youth ($\beta = -.04$). The other four dimensions of personality did not show significant direct association with cardio-metabolic disease risk. Furthermore, cumulative socioeconomic adversity was implicated in a higher cardio-metabolic disease risk ($\beta = .07$), which supports the existence of unspecified mechanisms linking early socioeconomic adversity to the cardio-metabolic disease risk of young adults.

According to the Sobel test, there were several statistically significant indirect effects. Early cumulative socioeconomic adversity exerted statistically significant indirect effects on young adults' cardio-metabolic disease risk through their self-esteem, educational attainment, and personality. Multiple mediator effects were also found whereby cumulative socioeconomic adversity was implicated in both reduced self-esteem and less positive general personality, which in turn exerted a detrimental effect on young adults' educational attainment and, consequently, led to an increased disease risk (see Table 3).

Using a nested chi-square test ($df = 1$), we also assessed if the psychosocial pathways linking cumulative early socioeconomic adversity to cardio-metabolic disease risk varied by race/ethnicity and gender (see Table 4 for the complete findings). For women, all tested paths were statistically significant indicating that the model worked as expected. For men, although cumulative adversity was implicated in youth's psychosocial resources and personality, neither psychosocial resources nor personality accounted for a significant proportion of the variance in their disease risk as young adults. Consequently, the effect of early adversity on men's disease risk appears to be direct or through variables omitted from the model. Model differences also existed based on race/ethnicity. While certain paths were statistically significant for all racial/ethnic groups (e.g., the influence of cumulative adversity on educational attainment and the effect of education on cardio-metabolic disease risk), other paths were only statistically significant for select races/ethnicities (e.g., for Asians and Hispanics personality influenced disease risk, whereas for African Americans and Whites self-esteem influenced disease risk).

Discussion

Although an increasing number of studies suggest that resource focused models better explain the socioeconomic variation in

Table 3
Results of Indirect Tests for the Hypothesized Model

Structure path coefficients	β (SE)
Single mediator effects	
Cumulative adversity (W1) → Self-esteem (W2) → CDR (W4)	.01 (.00)**
Cumulative adversity (W1) → Personality (W4) → CDR (W4)	.00 (.01)
Cumulative adversity (W1) → Educational attainment (W4) → CDR (W4)	.03 (.00)***
Multiple mediator effects	
Cumulative adversity (W1) → Self-esteem (W2) → Educational attainment (W4) → CDR (W4)	.01 (.00)**
Cumulative adversity (W1) → Personality (W4) → Educational attainment (W4) → CDR (W4)	.01 (.00)***

Note. CDR = cardio-metabolic disease risk. Standardized coefficients.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4
Multi-Group Comparison of Hypothesized Model

	Structural equation model coefficients									
Grouping	Cumulative adversity → Self-esteem	$\Delta\chi^2$ (1*df*)	Cumulative adversity → Education attainment	(*f*)	Cumulative adversity → Personality	$\Delta\chi^2$ (1*df*)	Personality → Education attainment	$\Delta\chi^2$ (1*df*)	Self-esteem → Education attainment	$\Delta\chi^2$ (1*df*)
Gender difference										
Women	$-.05^{***}$	.28	$-.32^{***}$	.05	$-.11^{***}$	.32	$.16^{***}$	3.56	$.07^{***}$	.20
Men	$-.03^{*}$		$-.31^{***}$		$-.17^{***}$		$.25^{***}$		$.04^{*}$	
Race difference										
AA	.01	**7.93****	$-.25^{***}$	1.81	$-.20^{***}$	**9.14****	$.26^{***}$	.91	.02	**4.54***
Hispanics	$-.05^{*}$	.05	$-.17^{***}$	**9.08****	$-.02$	1.07	$.25^{***}$	.40	.02	1.95
Asians	$-.02$	**4.03***	$-.16^{***}$	**9.03****	$-.02$	**4.83***	$.24^{***}$	1.23	.02	.50
Whites (Reference)	$-.08^{***}$		$-.36^{***}$		$-.12^{***}$		$.17^{***}$		$.06^{***}$	

Grouping	Education attainment → CDR	$\Delta\chi^2$ (1*df*)	Self-esteem → CDR	$\Delta\chi^2$ (1*df*)	Personality → CDR	$\Delta\chi^2$ (1*df*)	Cumulative adversity → CDR	$\Delta\chi^2$ (1*df*)	Conscientiousness → CDR	$\Delta\chi^2$ (1*df*)
Gender difference										
Women	$-.10^{***}$	**4.12***	$-.11^{***}$	**4.58***	$-.03^{*}$	.03	$.12^{***}$	**4.12***	$-.04^{**}$	.05
Men	$-.01$		$-.02$			$-.02$	.02		$-.05^{**}$	
Race difference										
AA	$-.09^{***}$	.23	$-.09^{***}$	.38	.02	.09	.02	3.52	$-.01$	.98
Hispanics	$-.07^{**}$	.06	$-.02$	3.01	$-.07^{*}$	**3.87***	$-.01$	3.67	$-.05$	.02
Asians	$-.22^{***}$	**4.54***	$-.01$	2.54	$-.07^{*}$	**3.87***	$-.02$	**4.32***	.02	2.63
Whites (Reference)	$-.09^{***}$		$-.07^{***}$		$-.01$		$.07^{***}$		$-.04^{**}$	

Note. CDR = cardio-metabolic disease risk. AA = African Americans. Standardized coefficients are shown. For race/ethnicity comparisons, Whites are the reference group. Significant chi-values are shown in bold. R-square values for cardio-metabolic disease risk for men and women were .06, and .10, respectively. R-square values from cardio-metabolic disease risk for African Americans, Hispanics, Asians, and Whites were .07, .11, .09, and .15, respectively.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

health risks compared with stress focused models, these studies have focused almost exclusively on later life stages. Consequently, less is known about how youth psychosocial development over the early life course mediates the influence of early socioeconomic adversity on young adults' health risk. The present study responded to this paucity of research by examining youths' psychosocial resource development over the early life course, including self-esteem, educational attainment, and personality, as mediating pathways linking early adversity and later health risk.

Consistent with the early life hypothesis (Barker, 1997), early socioeconomic adversity directly influenced young adults' cardio-metabolic disease risk over and above the mediating pathways examined. It seems that early adverse life experiences get "under the skin" in youths, and take their toll in young adulthood (Hertzman & Power, 2006). Alternatively, the observed direct influence of early adversity on young adults' cardio-metabolic disease risk may also reflect previously discussed early physiological damages and other psychosocial mechanisms not investigated in this study, particularly for men. Also, consistent with the cumulative disadvantage perspective (Dannefer, 2003), the health effects of exposure (or the vulnerability) to early stressful circumstances may have magnified over time (age-by-exposure interaction).

The findings indicated that impaired self-esteem mediates the detrimental influence of early adversity on young adults' cardio-metabolic disease risk. This suggests that impaired development of self-esteem, influenced by early adversity, has adverse consequences for cognitive performance, educational attainment, and physiological processes (allostatic control systems). The health influence of self-esteem may also operate through youths' health behaviors, and, in turn, bio-behavioral processes, because youth with low self-esteem are more likely to engage in risky health behaviors (Hoyt, Chase-Landsdale, McDade, & Adam, 2012).

The results also indicated that youth personality is amenable to environmental influences. Adverse family and community environments hinder youths' development of emotional regulation and socially desirable behaviors, making them more hostile, less emotionally stable, and less optimistic about their future (Adler et al., 1994). Furthermore, the findings enhance existing knowledge by showing that GFP influences cardio-metabolic risk through educational attainment. Although, we primarily focused on a general factor of personality, a single personality trait, conscientiousness, was associated with young adults' cardio-metabolic disease risk.

Although the current findings indicate relatively small effect sizes, researchers have pointed out that a small shift in the distribution of risk throughout the population or small effects of a risk can make a large difference in health problems across the population (Berkman and Kawachi (2000); e.g., although small differences in the levels of self-esteem and educational attainment may have relatively small effects on an individual's health risk, these small differences can have a substantive impact on the overall health of a population). Simultaneous small differences in multiple bio-markers (e.g., blood pressure, cholesterol, and BMI) may accumulate and create a substantive health risk (e.g., CVD risk).

The results revealed an important gender difference in the association between psychosocial resources (self-esteem, educational attainment, and personality) and cardio-metabolic disease risk. This association was statistically significant for women but not men. It seems that these resources promote positive emotions, cognitive performance, and physiological processes (allostatic control systems) for women and, possibly, lower their engagement in risky health behaviors. That is, for women, but not men, impaired self-esteem, educational attainment, and personality development mediated the harmful influence of early adversity on cardio-metabolic disease risk. However, for men, early adversity impairs development of self-esteem, positive personality, and educational attainment, but these impaired psychosocial resources do not lead to cardio-metabolic disease risk. This difference suggests a gendered intraindividual psychosocial–physiological process.

Regarding race/ethnicity moderation, the results indicate that racial/ethnic minorities are less vulnerable to environmental adversity compared to majority Whites. In particular, early socioeconomic adversity exerts a weaker influence on the self-esteem and education of minorities. Also, the results show that socioeconomic characteristics are directly associated with health risks for Whites only. This may be due to ethnic minorities accruing less health benefits from positive socioeconomic characteristics. However, youth educational attainment appears to exert significant health benefits for all race/ethnicity categories.

Although findings from the present study are generally consistent with the hypothesized model, several factors potentially limit the scope and generalizability of the results. First, the present study used self-report measures of education and family adversity. Replication using more objective measures would alleviate concerns regarding potential self-report biases related to the measures used in this study. Second, the present study used only nine metabolic and cardiovascular bio-markers to create a measure of cardio-metabolic disease risk because of data availability constraints. Third, potential confounding variables may exist that were not considered in the present study, such as a disrupted adolescent transition (e.g., dropping out of school), which may influence both adolescent self-esteem or education and young adults' cardio-metabolic disease risk creating a spurious association. Fourth, longitudinal data afforded us the opportunity to test the impact of early adversity on health outcomes over a decade later, but the mediator variables of interest were only available at certain waves. Thus, personality and educational attainment were measured concurrently with health outcomes (Wave 4, 2008). Finally, although the examination of racial/ethnic moderation is a strength of the current study, only respondents' first selections for race were assessed. Consequently, model differences for multiethnic respondents are unknown.

Despite these limitations, the present study makes a unique contribution to our knowledge about the psychosocial resources mediating the association between early adversity and young adults' health risk. These findings emphasize the need for numerous federal, state, and local level policies and programs designed to protect young adults from long-term health risks. First, vulnerable groups of children with an adverse socioeconomic background can be identified early for appropriate intervention efforts. Such interventions should aim to protect adolescents from the harmful effects of exposure to early adversity by helping to develop their psychosocial resources and shape personality traits that convey resilience in coping with stressful experiences. Several recent intervention and prevention programs, such as Community Coalitions (Spoth, Greenberg, Bierman, & Redmond, 2004), have shown a certain degree of success and illustrate the importance of involving not only disadvantaged families but also local communities and schools in this effort.

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