The role of time-varying social and behavioral risk factors for race-ethnic and gender disparities in hypertension among young adults

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ABSTRACT

More than 600,000 adults died of cardiovascular disease in 2007, and that nearly one in three adults in the United States experiences hypertension, an asymptomatic "silent killer" that often precedes heart attacks and strokes. Because hypertension is a modifiable risk factor cardiovascular disease, particularly for young people, this study draws from waves I-IV of the National Longitudinal Study of Adolescent to investigate mediating and moderating relationships between time-varying social and behavioral cardiovascular risk factors and race-ethnic disparities in hypertension among young adults ages 25-32. Discrete-time event history models take advantage of four waves of respondents' health behaviors, social support resources, socioeconomic status, and stress exposure to determine whether these resources mediate race-ethnic and gender differences in early onset of hypertension, as well as whether the influence of these resources on the risk of hypertension operates differently according to race-ethnicity and gender.

INTRODUCTION

More than 600,000 adults died of cardiovascular disease in 2007, and that nearly one in three adults in the United States experiences hypertension, an asymptomatic "silent killer" that often precedes heart attacks and strokes [1,2]. Despite the fact that cardiovascular disease is the leading cause of death in the United States, the severity, timing, and risk of experiencing the condition falls disproportionately on non-Hispanic blacks, who are diagnosed with hypertension more often and at younger ages than whites and Hispanics [3]. The central goal of the proposed research is to evaluate the mediating and moderating relationships between time-varying social and behavioral cardiovascular risk factors and race-ethnic disparities among young adults in hypertension, a primary indicator of cardiovascular disease risk. In order to understand the life-course etiology of cardiovascular health prior to middle age – when race-

ethnic health disparities are widest – it is necessary to investigate the ways that changes over time in social resources and health-related behaviors alter adolescent and young adults' risk of early onset of hypertension.

This extended abstract is the first stage of a yearlong project that will take advantage of all four waves of the National Longitudinal Study of Adolescent Health to evaluate the following research questions: First, what are gender and race-ethnic differences in incidence and timing of high measured blood pressure or physician-diagnosed hypertension among young adults ages 25-32? Second, what are the relative contributions of time-varying social and behavioral risk factors to race-ethnic and gender disparities in these outcomes by age 32? Third, does the role of social and behavioral mechanisms in structuring risk for cardiovascular disease vary according to gender or race-ethnicity? This study moves beyond previous research in three ways: First, this study considers biological markers of cardiovascular health in a longitudinal, nationally representative sample, and considers both physician diagnosed hypertension as well as high measured hypertension at the time of the interview. Second, this study includes a broad range of time-varying social support and socioeconomic resources and strains beginning in adolescence and continuing through adulthood, including socioeconomic status, stressful life events, social support resources, and family of origin characteristics. Third, this study examines both whether these resources explain (mediate) race-ethnic and gender differences in cardiovascular health as well as whether the resources operate differently (that is, moderate) according to race-ethnicity and gender.

BACKGROUND

Incidence of hypertension in the United States increases from 7% of adults ages 18-39 to 27% of adults ages 40-65, making young adulthood a critical opportunity for interventions aimed at reducing cardiovascular risk factors [3]. To do this, researchers must investigate the mechanisms through which risk of developing cardiovascular disease increases between early adolescence and adulthood [5]. Numerous studies have identified behavioral risk factors for hypertension among young people – notably, an increase in BMI and a diagnosis of diabetes [6] – but far less is known about the role of socioeconomic, social support, or psychosocial risk factors for hypertension and other indicators of

cardiovascular disease risk during young adulthood, and no study to my knowledge has examined how changes in these variables over time influences indicators of cardiovascular disease, or whether mechanisms may operate differently according to race-ethnicity or gender. Although Non-Hispanic black and Hispanic adolescents are more likely to report diabetes and obesity than whites, they are less likely to smoke and binge drink and more likely to exercise during adolescence and young adulthood, which may explain why behavioral factors alone cannot fully account for the observed race disparities in cardiovascular health at later ages [7].

Identifying non-behavioral mechanisms that influence young adults' risk of developing hypertension across race-ethnicity and over time is important for two reasons. First, social resources such as income and education, psychosocial health, and social support vary considerably across race-ethnicity and over time, and each is independently associated with hypertension [7,8]. Second, hypertension is a *modifiable risk factor for cardiovascular disease* among young adults [5], making it advantageous for scholars and policy makers to identify interventions that target the risk factors contributing to race-ethnic differences in timing and risk of hypertension, particularly before incidence increases during middle age. Methodologically, this study moves beyond previous research by integrating time-varying predictors of cardiovascular risk across four waves of data – including changes in socioeconomic resources, psychosocial characteristics, biological markers of disease risk such as BMI, incidence of stressful life events, social support resources, and health behaviors between ages 13 and 32 – in order to evaluate the relative contributions of each of these unique risk factors *over time* to the risk of experiencing hypertension as a young adult.

Social resources are often implicated in studies examining the origins of race-ethnic and gender disparities in disease, particularly in populations of middle-aged and older adults. This is because although Hispanics and non-Hispanic blacks are more likely to report obesity and diabetes than white peers as early as childhood [9], they are also far more likely to experience persistent poverty and high psychosocial stress from a young age, which are also known risk factors for hypertension that often precede and structure individuals' risks for experiencing weight gain, obesity, and diabetes [10,11]. Thus, although behavioral risk factors are a proximate cause of hypertension, it is likely the case that persistent,

pervasive poverty among non-Hispanic blacks (and to a lesser degree, Hispanics), combined with psychosocial resources such as self-esteem and depression and a greater burden of stressful life events act as fundamental causes of early onset of cardiovascular disease, thereby reorienting the scope of policy interventions from behavioral components of risk to the socioeconomic origins and psychosocial health of at-risk young adults. Previous studies separately examining time-varying measures of socioeconomic status [7] or psychosocial health [8] find that time-varying measures predict hypertension over and above cross-sectional measures, but have not used time-varying measures to make comparisons across race-ethnicity, and have not considered whether the roles of behavioral, psychosocial, social support, or socioeconomic resources vary according to race-ethnicity and gender.

A final innovation advancing previous research is the collection of hypertension biomarkers and prescription drug use in addition to self-reports of a hypertension diagnosis among Add Health respondents. Analyses will compare all results across two dependent variables: first, analyses will use self-reports of a physician diagnosis of hypertension at any age and age of diagnosis. Second, those who have high measured blood pressure at the wave IV interview (occurring between ages 24-32), combined with those taking prescription medications to control high blood pressure at the time of the interview will be compared with all others. Multidimensional measures of cardiovascular disease risk minimize bias related to disparities in health care.

DATA, METHODS, & ANALYTICAL APPROACH

Data

Analyses will use waves I-IV of The National Longitudinal Study of Adolescent Health (Add Health), a nationally representative panel study of respondents ages 11-21 at wave I (1994-1995) and ages 24-32 by wave IV (2008-2009) [4]. Respondents were selected from a school-based stratified random sample of 80 high schools and 52 feeder middle schools across the United States sampled with unequal probability of selection. In-home interviews occurred during years 1994-1995 for wave I (n=20,745), 1995-1996 for wave II (n=14,738, retention rate 71% of wave I respondents), 2001-2002 for wave III (n=15,197, retention rate 73% of wave I respondents), and 2008-2009 for wave IV (n=15,701, 75.7% of

wave I respondents). The proposed analytical sample will include over 14,000 respondents and will draw from four waves of data, with an age range of 13-32 across all four waves. The large sample size allows for subgroup analyses by race-ethnicity and gender, and the longitudinal nature of the data allow for an analysis of the relationships between time-varying socioeconomic, psychosocial, and behavioral variables and onset of hypertension.

Measures

Dependent variables

Hypertension is measured blood pressure during the wave IV interview of greater than 140 mmHg systolic and 90mmHg diastolic or currently taking medication to control BP. Separate models will use self-reports of a hypertension diagnosis and age of diagnosis as dependent variables. Respondents are asked at wave IV, "Has a doctor or other health care provider ever told you that you have or had: high blood pressure or hypertension {if female add, when you were not pregnant}?" followed by the question "How old were you when the doctor or other health practitioner diagnosed you with blood pressure or hypertension?" Respondents who report 'yes' are coded as hypertensive.

Mechanisms

Socioeconomic status during adolescence (wave I) is measured using parents' self-reported income and education and will be included in all models. Respondent SES at waves II-IV will be measured using respondent's employment status, educational attainment, and household income.

Psychosocial well-being assesses personal resources including depressive symptoms, mastery, and stress. *Depression* is measured using the nine-item Center for Epidemiologic Studies Depression Scale (CES-D). Higher scores indicate greater distress (alpha=.90). *Mastery* evaluates whether respondents agree with statements such as "There is little I can do to change the important things in my life" and "I have little control over the things that happen to me." Higher scores indicate greater mastery (alpha=.92). A multidimensional marker of *stress* includes a range of dichotomous indicators at each wave – both positive and negative – that are likely to influence cardiovascular disease risk by increasing psychosocial stress. Examples of major life events (measured at all four waves and retrospectively in between waves) include transitions into and out of marriage, crime victimization, the transition to [residential] parenthood,

the death of a parent, partner, sibling, or child, moving away from home, hospitalizations or major health events, schooling transitions, and work transitions. **Social support** measured at all waves, asks respondents whether they feel that parents, romantic partners, and friends care for and understand the respondent. **Health Behaviors**, measured at all four waves, evaluate whether the respondent binge drinks (reports 5 or more drinks in one sitting), smokes (smoked any tobacco in the last 30 days), has a sleep problem (self-reported), or is physically active (participates in any physical activity three or more times a week). All proposed mechanisms will be included in models as time-varying independent variables.

Models will also control for known factors associated with hypertension and the proposed independent variables, including BMI (time-varying), US nativity, family composition during adolescence, respondent's marital and cohabitation status, presence of a residential child, functional or self-care health limitations, parent obesity at Wave I, and self-rated health (time-varying).

Analytical Approach

Discrete-time event history models use dichotomous variables – here, a diagnosis of hypertension at age *X* or high measured hypertension at time of interview – and both time-varying and time-invariant independent variables. The inclusion of time-varying covariates makes discrete-time models preferred over logistic regression for the proposed analyses. Both pooled and race-ethnicity and gender stratified models will examine the relationships between socioeconomic, psychosocial, social support, and behavioral risk factors and the odds of developing hypertension (mediating models), while moderating models will examine whether the roles of the proposed mechanisms in influencing risk of hypertension and timing of onset varies according to race-ethnicity and gender.

Causality and Missing Data

There is very little missing data (<2%) for hypertension. Other variables will be imputed using the *ice* command in Stata 10 [12], and imputed models will be compared with models using listwise deletion. Regarding causal order, all independent variables will be measured prior to the age of diagnosis.

DESCRIPTIVE STATISTICS

I provide detailed descriptions of measures and T-tests and chi-square tests comparing selected variables of interest across race-ethnicity in Table 1.

Table 1. Selected descriptive statistics for proposed analyses, Add Health waves I and IV

	All Respondents	NH white	NH black	Hispanic
Dependent Variables, wave IV				
Ever diagnosed with hypertension	11.0%	10.0%	13.5%***	8.1%
Age diagnosed with hypertension	23.9	24.02	23.14	24.32
Hypertension at wave IV interview (measured during interview)	12.3%	11.5%	15.7%***	12.4%
Taking hypertension medication	3.1%	3.2%	3.6%	2.2%***
Socioeconomic status				
Any residential parent has BA, wave I	32.3%	36.7%	21.2%***	17.9%***
Parent income, wave I (1000s in 2007-2008 dollars)	46.0	46.04	28.99***	34.70***
R income, wave IV (1000s in 2007-2008 dollars)	38.1	40.7	33.9***	39.5
R has college degree at wave IV	31.3%	34.5%	27.0%***	22.0%
Psychosocial well-being, wave IV				
Depressive symptoms	2.59	2.47	3.02***	2.64**
Mastery	19.43	19.49	19.34	19.27
Stress	4.80	4.66	5.18***	4.86
Behavioral factors, wave IV				
R smokes	23.9%	27.9%	15.3%***	12.8%***
R binge drinks	13.0%	15.4%	5.5%***	9.2%***
R is physically active	15.0%	13.4%	22.3%***	15.9%***
R has sleep problems	11.3%	10.7%	11.9%	13.6%
N	14,017	8,324	3,254	2,439

Note: *p<.05 **p<.01 ***p<.001, two-tailed hypothesis tests comparing non-Hispanic whites to all others.
Although proposed models will use time-varying covariates, only waves I&IV are included in the above table. Measures not included in Table 1 were not available as the Investigator briefly lost access to Add Health while transitioning between universities.

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