Temporal Racial Trends in Cardiovascular Health: Cohort and Period Trends and Explanations.

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Abstract. We examine demographic trends in cardiovascular health using cross-classified random effect models (CCREM) for age, period, and cohort. Specifically, we identify trends for White and Black men and women for more than a century of cohort members by looking at measures of cardiovascular health, including: blood pressure, hypertension, triglycerides, and cholesterol. We utilize a unique data file that combines eight waves of NHANES data, merged for time-trend analysis (the Integrated Health and Nutrition Examination Survey--IHANES, created by the Center for Health Equity Research and Policy at San Diego State University). While our current results only describe these trends along three time-dimensions, we are in the process of identifying relevant cohort and period characteristics that will help to explain these trends. Cohort characteristics include: segregation, infectious disease rates, and relative cohort size. Period characteristics include: levels of prejudice and rates of racial intermarriage.

Extended Abstract.

We sought to explore three temporal dimensions of cardiovascular trends for racial disparities by employing demographic age, period, cohort models for repeated cross-sectional surveys. Specifically, we simultaneously estimated cohort and period trends, controlling for age by employing cross-classified random effect regression models, recently introduced by Yang and Land (2008). We use six waves of the NHANES data set normalized to a single data file with comparable biomarker measures, including: blood pressure, hypertension, cholesterol, and triglycerides—each unique measures of cardiovascular health. By using repeated cross-sections of this survey, we are able to look at cohort trends by race/gender for a number of biomarkers.

Demographically speaking, time can be captured by three unique temporal dimensions: age, period, and cohort. Specifically, age (A) is a proxy for biological processes that ultimately lead to disease, disability, and/or death. On the other hand, period (P), or survey year, reflects changes in socio-cultural, economic, technological, and environmental factors that may affect the entire population at a given time simultaneously, but perhaps not equally. For example, a drought may lead to increased food prices, which largely affects those with lower incomes. Cohort (C), on the other hand, describes a unique set of individuals who are both born into a social system during a similar time period and experience similar formative social experiences over their life course (Yang and Land 2008). Each aspect of A-P-C has a unique contribution to make for the study of population health, including disability. Aging has an obvious relationship with population health while period itself can capture the current burden of morbidity, disability, and mortality in the entire population at a given time. Cohort, on the other hand, reflects the health of successive generations and is an important dimension for understanding how population health is changing over time. Overall, failure to isolate trends across these

three dimensions risks substantial bias and provides an incomplete picture of population health trends.

Our integrated NHANES (IHANES) dataset consists of demographic variables, age, period, cohort, self-rated health and many other important biomarker variables including body mass index, pulse rate, blood pressure, serum cholesterol, serum triglycerides, cholesterol-to-HDL ratio, blood glucose, and serum albumin. These variables were harmonized across eight waves of NHANES (1971-2008)[1] data collections which allow consistent coding for each variable. We restrict our sample to those aged 25 and older and exclude those missing on cardiovascular health outcomes; our analytic sample includes 4,164 Black women, 18,638 White women, 3,322 Black men, and 15,827 White men.

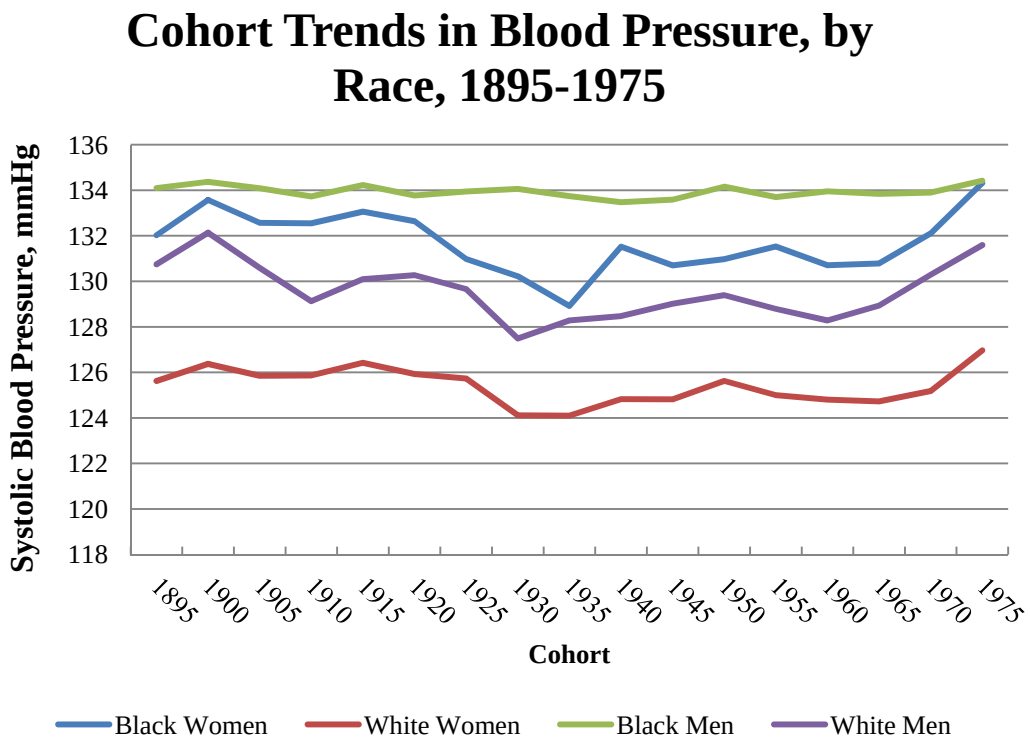
We examine a number of cardiovascular health outcomes; with respect to blood pressure, we examine systolic and diastolic blood pressure as well as the predicted probability of being hypertensive (either Stage 1 or Stage 2) and the predicted probability of being either pre-hypertensive or hypertensive. We also examine trends in the ratio of HDL to total cholesterol for both men and women. Our unadjusted models (illustrated in the figures below) include controls for age and age-squared. For adjusted models (not shown), we will include a set of socioeconomic and demographic characteristics which are consistently available across waves; these include measures of educational attainment, marital status, and poverty status. We will also include available controls for medications taken for these conditions, as well a control for whether the female respondent is pregnant. In terms of cohort characteristics, we will test measures such as, but not limited to, relative cohort size, the nonmarital fertility ratio, and segregation measures.

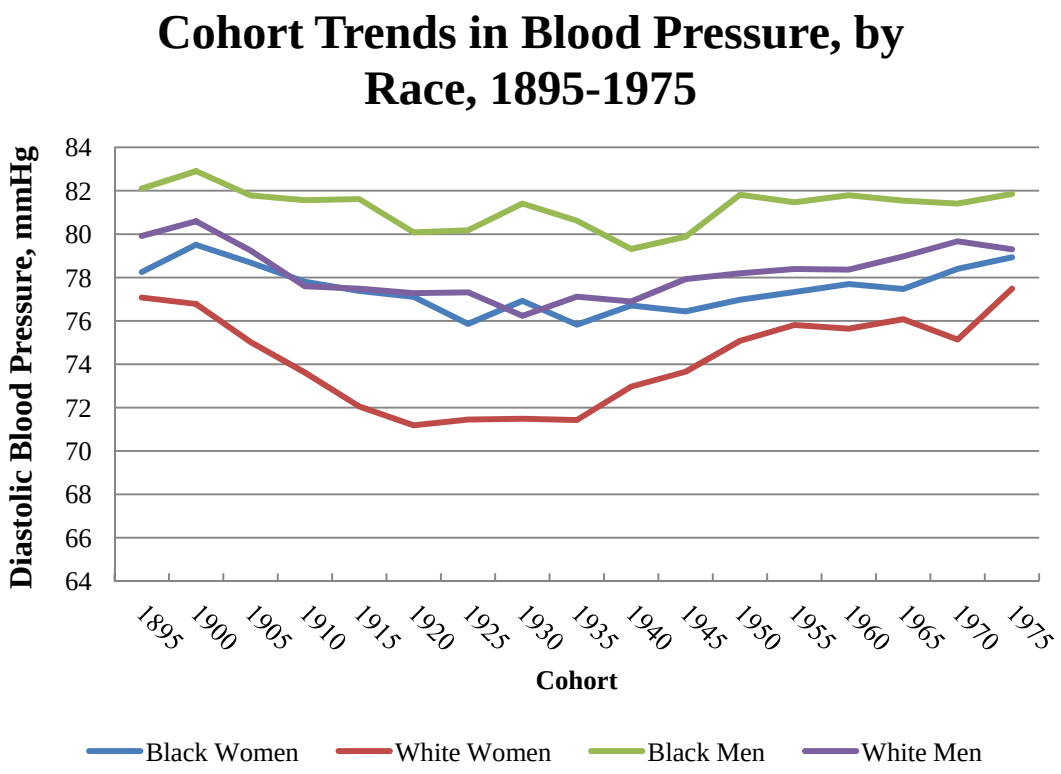
In terms of systolic blood pressure, Black men are the most disadvantaged, followed by Black women, White men and White women, respectively. The disparity has remained relatively stable for women across cohorts; however, lower blood pressure among post-1900 cohorts of White men have served to widen the Black-White disparity among men. The disparity remained relatively constant for post-1930 cohorts, but shows some evident of convergence in the most recent cohort. Cohort trends are rather similar for Black women and White men with respect to diastolic blood pressure. Among women, the largest disparities in diastolic blood pressure exist for cohorts born before 1945. Substantial racial disparities are also evident in the predicted probability of hypertension with both Black men and women having a higher probability of being considered as Stage 1 or 2 hypertensive, relative to their White counterparts. If we also consider the probability of being pre-hypertensive in addition to hypertensive, White men suddenly have a higher predicted probability than Black women across all cohorts, indicating their strong presence in the pre-hypertensive category. Comparing the two means of delineating cardiovascular health risk, we also see elevated probabilities for cohorts of White women born in the 1920s as well as for the Baby Boom cohorts when we consider pre-hypertension relative to when we only consider hypertension. Finally, in a divergence from the disadvantage illustrated in the blood pressure outcomes, we find some evidence that cholesterol as measured by a ratio of HDL to total cholesterol is more favorable among Blacks than Whites. Although the ratio of "good" to total cholesterol is similar among women from the

[1] NHANES 1 (1971-1975); NHANES 2 (1976-1980); NHANES 3 (1988-1994); NHANES 4 (1999-2000); NHANES 5 (2001-2002); NHANES 6 (2003-2004); NHANES 7 (2005-2006); NHANES 8 (2007-2008).

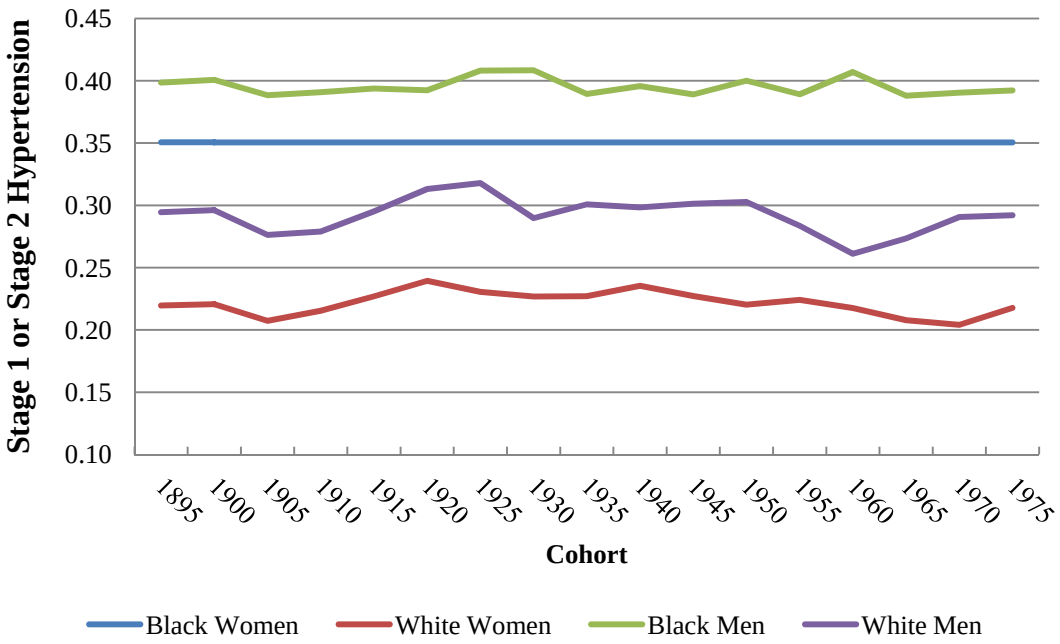
1925 through 1960 cohorts, there is a greater disadvantage for cohorts of White women born before and after this period. White men have a consistently worse ratio of cholesterol relative to Black men across cohorts. Future analyses will examine the contribution of individual-level and period/cohort characteristics to understanding these trends and disparities.

Yang Y, Land KC. Age-period-cohort analysis of repeated cross-section surveys: Fixed or random effects? *Sociol Method Res* 2008;36(3):297-326.

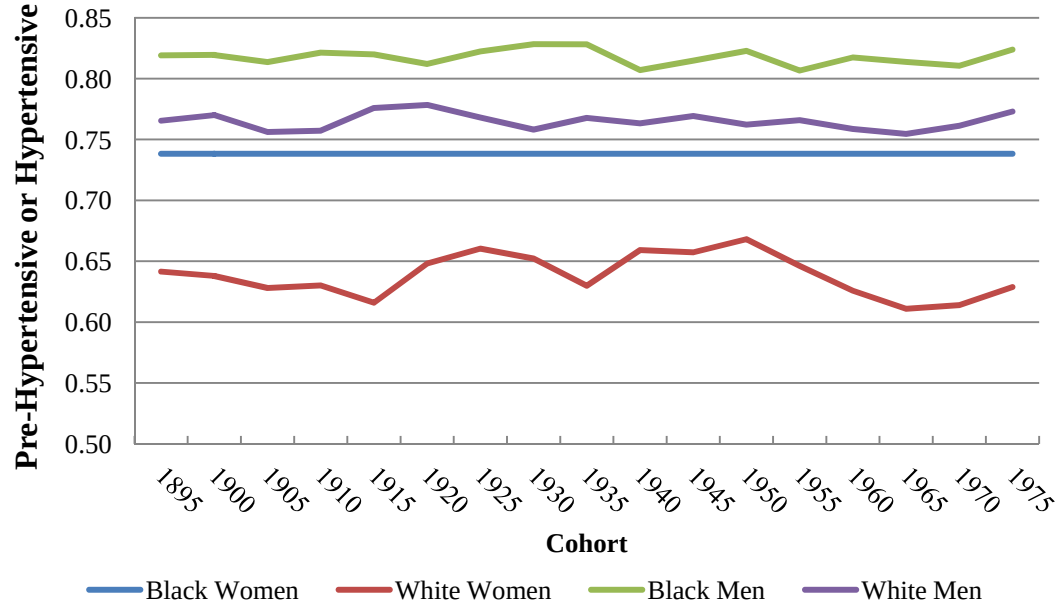

Cohort Trends in Blood Pressure, by Race, 1895-1975
Systolic Blood Pressure, mmHg
136
134
132
130
128
126
124
122
120
118
1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975
Cohort
Black Women
White Women
Black Men
White Men

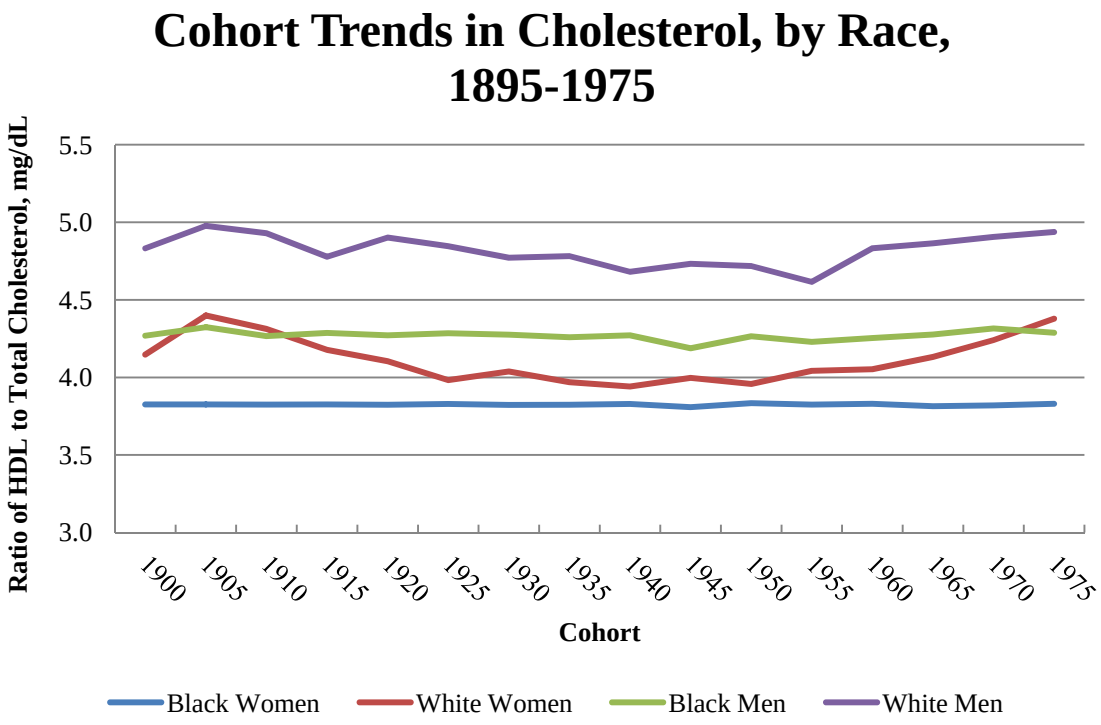

Cohort Trends in Blood Pressure, by Race, 1895-1975
Diastolic Blood Pressure, mmHg
84
82
80
78
76
74
72
70
68
66
64
1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975
Cohort
Black Women
White Women
Black Men
White Men

Cohort Trends in the Predicted Probability of Hypertension Stage, by Race, 1895-1975



Cohort Trends in the Predicted Probability of Hypertension Stage, by Race, 1895-1975




Cohort Trends in Cholesterol, by Race, 1895-1975
Ratio of HDL to Total Cholesterol, mg/dL
5.5
5.0
4.5
4.0
3.5
3.0
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
Cohort
Black Women
White Women
Black Men
White Men