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Industry of employment and occupational class in relation to cardiovascular health by race/ethnicity, sex/gender, age and income among adults in the USA: a cross-sectional study

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Abstract

Background—Racially minoritised groups tend to have poorer cardiovascular health (CVH) than non-Hispanic (NH)-White adults and are generally more likely to work in labourer or support service positions where job strain—associated with cardiovascular disease—is often high. Yet, few studies have included racially/ethnically diverse samples.

Methods—Using 2004–2018 National Health Interview Survey cross-sectional data, we investigated standardised occupational classifications in relation to 'ideal' CVH using a modified 'ideal' CVH (mICVH) metric among US adults (n=230 196) by race/ethnicity, sex/gender, age, and income. mICVH was defined as a report of 'yes' to the following: never smoked/former smoker; body mass index (≥18.5–25 kg/m^2); physical activity (≥150–300 min/week moderate or ≥75–150 min/week vigorous); sleep duration (7–9 hours/night); and no prior diagnosis of dyslipidaemia, hypertension, or diabetes/pre-diabetes. Adjusting for sociodemographic, clinical

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Competing interests None declared.

factors, and health behaviour confounders, we used Poisson regression with robust variance to estimate prevalence ratios (PRs) and 95% CIs of mICVH overall and by race/ethnicity and performed Wald tests for interaction.

Results—Latinx (53%) and NH-Black (37%) adults were more likely than NH-White adults (29%) to report labourer positions and had the lowest prevalence of mICVH (5.2% (Latinx) and 3.9% (NH-Black)). Labourer versus professional/management occupational class positions were associated with a lower mICVH prevalence among NH-Asian (PR=0.60 (0.46–0.79)), NH-White (PR=0.80 (0.74–0.87)) and NH-Black (PR=0.77 (0.58–1.01)), but with no evidence of an association among Latinx (PR=0.94 (0.78–1.14) adults; p interaction <0.001).

Conclusions—In conclusion, working in labourer versus professional/management positions was associated with lower mICVH, except among Latinx adults. Given the higher likelihood of labourer occupations and lower prevalence of mICVH among minoritised racial/ethnic groups, social determinants related to occupational class should be considered in future studies of racial and ethnic disparities in CVH.

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality among adults in the USA.[1] While the overall rates of CVD incidence and mortality have declined in recent decades, CVD disparities have persisted among minoritised racial and ethnic groups. For instance, non-Hispanic (NH)-Black adults have higher rates of myocardial infarction, are twice as likely to have a stroke, and are 30% more likely to die from CVD compared with NH-White adults.[2–4] Elucidating CVD risk factors has been prioritised in public health research. In fact, the American Heart Association (AHA) has developed *Life's Essential 8*, a key metric to identify and intervene on CVD risk factors, which details eight key measures for achieving 'ideal' cardiovascular health (ICVH) including diet, physical activity, smoking status, body mass index (BMI), fasting glucose, total cholesterol, blood pressure and sleep duration, a previously understudied but now increasingly recognised important CVD risk factor.[5 6]

While some individual-level risk factors for CVD, such as dietary patterns, physical activity and cigarette smoking, are well established, risk factors in the social and physical environment are also important, although they are less studied.[7] A growing body of literature has sought to understand the contribution of the work environment and workplace practices to chronic disease disparities. For example, findings from recent studies suggest that workplace environment and occupation may promote serious psychological distress (SPD), which is associated with increased CVD risk.[8 9] Another potential pathway is through structural racism, which can manifest in the workforce. For example, discriminatory hiring practices towards racially minoritised groups seeking employment may contribute to SPD[10 11] and overall racial/ethnic health disparities.[12 13] In fact, labour and support service workers are more likely to be NH-Black and Hispanic/Latinx and are likely to encounter job strain (high work demand and low decision latitude, otherwise known as the *Karasek and Theorell demand-control model*),[14] which has been associated with CVD risk factors.[15–17] Similarly, institutionalised sexist practices in the workplace environment and occupational hierarchies have often confined women to work in support service roles and receive less compensation

and fewer promotions than their male counterparts.[18–20] Racially minoritised women may be more likely to encounter harassment in the workplace than men or NH-White women, creating an even higher disadvantage.[21] Combined with societal occupational structure, limitations in job availability to racially minoritised groups, along with women of any group, ultimately determine opportunities for livelihood and the distribution of positive along with negative exposures encountered in the work environment.[22]

Some epidemiological evidence suggests that ICVH prevalence varies by key sociodemographic characteristics. ICVH prevalence has been shown to be one-third lower among NH-Black and Hispanic/Latinx adults compared with NH-White adults.[23] Higher ICVH prevalence has also been observed when comparing women and men.[24 25] Additionally, prior studies have observed that the likelihood of achieving ICVH decreases during middle and older adulthood,[25 26] and that there is a direct positive proportional association between annual household income and ICVH.[25 27] Although some evidentiary support from the literature observed racial and ethnic differences for achieving ICVH based on environmental context (eg, neighbourhood environment),[23 28] to our knowledge, prior studies have not yet used a large, racially/ethnically diverse US sample to assess the relationship between occupational characteristics and ICVH prevalence using the new ICVH metric with sleep, a key indicator of CVD risk. Therefore, we sought to use nationally representative data from the National Health Interview Survey (NHIS) to investigate associations between industry of employment and occupational status in relation to a modified ‘ideal’ CVH (mICVH) metric among adults by race/ethnicity, sex/gender, age, and income. We hypothesised that mICVH is associated with industry of employment and occupational class, with labourers and support service workers less likely than those in professional/management positions to achieve mICVH. Moreover, considering that discriminatory hiring practices may have limited racially minoritised groups to labour and support positions where job strain is high, we also hypothesised that the associations between industry of employment and occupational class with having mICVH will be stronger among racial/ethnic minorities (eg, NH-Black and Hispanic/Latinx individuals) compared with NH-White individuals.[8 9] The hypothesis is predicated on the Gee and Payne-Sturges’ *Exposure-disease-stress* conceptual framework, which states that individual-level health risk is inter-related with community (eg, neighbourhood dynamics) and structural factors (eg, structural racism, economic, employment and educational opportunities) which are disadvantageous to racially minoritised groups and largely attributed to residential segregation and restricted social mobility.[29–35] Consequently, exposure to multiple stressors among minoritised racial/ethnic groups could contribute to stronger relative associations between industry of employment and occupational class in relation to mICVH. Additionally, because of potential differing discriminatory policies and practice experiences across sex/gender, age and socioeconomic status, we hypothesised that mICVH prevalence is lower when comparing men to women, adults that are middle aged and older to those who are younger, and those with lower incomes compared with higher incomes.

METHODS

Patient and public involvement

Patients were not involved in the current study. The NHIS datasets used in the current study are publicly available and can be retrieved from https://www.cdc.gov/nchs/nhis/index.htm. We used 2004–2018 serial cross-sectional NHIS data. NHIS participants were recruited and administered interviews. In-person interviews were conducted by trained US Census interviewers among individuals residing in the USA to procure a nationally representative sample of the non-institutionalised US population. Further details on NHIS study design and recruitment have been previously described.[36] Written informed consent was obtained for all NHIS study participants. Additionally, approval for the use of non-identifiable, publicly available NHIS data was waived by the National Institute of Environmental Health Sciences Institutional Review Board. The final response rate among sampled adults was 61.4% (range: 72.4% (2004)–53.1% (2018)).

NHIS participants were included in our study if they were ≥18 years of age and identified as NH-Asian, Hispanic/Latinx, NH-Black or NH-White due to the small sample size of other races/ethnicities (eg, NH-multiple race (2.9%) and NH-Native American/Alaskan Native (1.4%), listed in online supplemental table 1) and within-group heterogeneity if combined, resulting in a sample of n=434 914. NHIS participants were excluded from our study if they were missing data for the following: age, sex/gender, race/ethnicity, mICVH metrics (smoking status, BMI, physical activity, dietary patterns, total cholesterol, blood pressure, and fasting glucose), marital status, or alcohol use (n=35 473). Additionally, participants were excluded from our analysis if they were missing data on sex/gender, reported being unemployed, or were not currently working or were missing data on employment status (n=159 537) or occupational class/industry of employment (n=5068). Age-standardised sociodemographic, health behaviour and clinical characteristics of NHIS participants included in and excluded from our study (including other minoritised racial/ethnic groups) are provided in online supplemental table 1. The final analytical sample comprised 230 196 adults (a flow chart detailing excluded participants is provided in online supplemental figure S1).

Exposure assessment: industry of employment and occupational class

Participants were categorised by industry of employment based on the North American Industry Classification System codes using the following groups: (1) professional, administrative and management; (2) agriculture, manufacturing and construction; (3) retail trade; (4) finance, information and real estate; (5) educational services; (6) healthcare and social assistance; (7) accommodation and food services; and (8) public administration, arts and other services.[37] Additional details about industries of employment are provided in online supplemental figure S2.

Using the Standard Occupational Classification System, 23 major occupational groups for NHIS participants were trichotomised into the following occupational classes: (1) ‘Professional/Management’; (2) ‘Support Services’; and (3) ‘Laborers’.[38] Details are provided in online supplemental figure S2.

Outcome assessment: ICVH

Using a total of seven measures, a summed score of four health behaviours and three clinical factors was used to construct a dichotomised (yes/no) mICVH metric, which included the following: (1) never smoked/quit >12 months prior to the interview; (2) BMI ≥18.5 kg/m^2 and <25 kg/m^2); (3) meet physical activity guidelines for Americans (≥150–300 min/week moderate or ≥75–150 min/week vigorous[39]); (4) recommended habitual sleep duration (7–9 hours of sleep each night); and no prior diagnosis of (5) dyslipidaemia, (6) hypertension or (7) diabetes/pre-diabetes. Participants who responded 'yes' to each metric were considered to have mICVH.[6] The mICVH metric is considered to be modified because the NHIS did not collect data on diet—an established risk factor for CVD.

Potential confounders

Sociodemographic, clinical factors and health behaviour confounders were selected a priori based on prior literature.[6 9 40] Sociodemographic variables included sex/gender (women or men); age (18–30, 31–39, ≥50 years); educational attainment (<high school, high school graduate, some college, ≥college); marital/cohabiting status (married/living with partner or cohabitating, divorced/widowed/separated, single/no live-in partner); and region of residence (North-East, Midwest, South, West).[6 40] We considered the health behaviour, alcohol consumption (never, former, current).[6 40] Clinical factors included self-reported health status (excellent/very good/good or fair/poor), cancer (ever diagnosed), and SPD (yes or no).[6 9 40]

Potential effect modifiers

We evaluated associations between occupational class and industry of employment in relation to mICVH by different sociodemographic characteristics based on prior literature, demonstrating that race/ethnicity, sex/gender, age, and income may modify the magnitude of associations (ie, discriminatory treatment attributed to sociodemographic characteristics).[2–4 8 9 15–17 23–26] The selected potential effect modifiers included race/ethnicity (NH-Asian, Hispanic/Latinx, NH-Black or NH-White), sex/gender (male or female), age (18–30, 31–49 and ≥50 years), and annual household income (<$35 000, ≥$35 000 and <$75 000, and ≥$75 000).

Statistical analysis

Descriptive statistics for the study population were calculated by occupational class and race/ethnicity. We reported mean±SE for age and age-standardised (based on the 2010 US Census population) weighted percentages (accounting for the study design) for categorical variables. Poisson regression with robust variance was used to estimate prevalence ratios (PRs) and 95% CIs for associations between occupational class and employment industry with mICVH, adjusting for sociodemographic, clinical, and health behaviour confounders. Professional/management positions were used as the reference group to make comparisons with support service and labourer positions, as well as the eight industries of employment, and mICVH. We investigated potential differences in associations between occupational class and employment industry in relation to mICVH, stratified by race/ethnicity and sex/gender by including multiplicative interaction terms in the models and testing their significance with Wald tests. Further, we used Poisson regression to estimate PRs and 95%

CIs for associations between occupational class and industry of employment in relation to individual mICVH metric components separately (see online supplemental tables 2–9). Additionally, we estimated the prevalence of mICVH by each occupational class and industry of employment overall and by individual mICVH metrics (see online supplemental table 10). Using a two-sided alpha level of 0.05 to determine statistical significance, all data were analysed using *Stata Statistical Software* V.15 (StataCorp, College Station, Texas).

RESULTS

Industry of employment, occupational class and mICVH

Among the 230 196 participants included in our study, 21.7% reported professional/management occupations, 45.2% reported support services and 33.1% reported labourer occupations (table 1). The prevalence for mICVH was 8.1% (online supplemental table 11). The mean±SE age was 43.7±0.1, 41.5±0.1, and 40.5±0.1 years for participants reporting working in professional/management, support service, and labourer positions, respectively (table 1). Hispanic/Latinx (53%) and NH-Black (37%) adults were more likely than NH-White adults (29%) to report labourer positions and had the lowest prevalence of mICVH (5.2% (Hispanic/Latinx) and 3.9% (NH-Black)) (online supplemental table 11). mICVH prevalence was 9.7% for participants in professional/administrative/management industries of employment (figure 1) and lower for participants working in positions within labourer (4.1%) and support service (9.8%) compared with professional/management (10.5%) occupational classes (figure 2). The proportions of participants who had mICVH by occupational class were as follows: professional/management, 10.5%; support services, 9.8%; and labourers, 4.1% (figure 2). Compared with NH-White and NH-Asian adults, mICVH prevalence was lower among NH-Black and Hispanic adults for working in professional/management (4.3% and 6.7% vs 11.1% and 12.4%), support service (3.8% and 7.2% vs 10.9% and 11.8%) and labourer (2.3% and 3.5% vs 4.5% and 6.2%) positions (figure 2). Most NHIS participants excluded from this study were NH-White (64.8%), women (58.8%), ≥50 years (57.0%) and had an annual household income of ≥US$35 000–74 999 (46.9%) (see online supplemental table 1). Characteristics of participants based on occupational class and industry of employment stratified by mICVH and race/ethnicity are shown in online supplemental table 11.

Industry of employment, occupational class and mICVH, overall

Working in labourer versus professional/management positions was associated with a lower prevalence of mICVH (PR=0.82 (95% CI 0.77 to 0.87)) (online supplemental table 12). Working in other versus professional/administrative/management industries was associated with lower mICVH prevalence: manufacturing/construction (PR=0.77 (95% CI 0.71 to 0.83)); retail trade (PR=0.91 (95% CI 0.84 to 0.99)); and healthcare/social assistance (PR=0.83 (95% CI 0.77 to 0.90)). However, working in educational service versus professional/administrative/management positions was associated with a 10% higher prevalence of mICVH (PR=1.10 (95% CI 1.03 to 1.18)). Working in labourer versus professional/administrative/management positions was associated with lower mICVH prevalence within manufacturing/construction (PR=0.75 (95% CI 0.66 to 84)), educational service (PR=0.69 (95% CI 0.50 to 0.94)), healthcare/social service

(PR=0.65 (95% CI 0.45 to 0.93)) and public administrative/arts/other service (PR=0.75 (95% CI 0.64 to 0.89)) industries (online supplemental table 12). Working in labourer versus professional/management occupations was associated with a lower prevalence ofmICVH, despite achieving individual mICVH component recommendations for sleep duration (PR=0.92 (0.91–0.93)), smoking status (PR=0.83 (0.82–0.83)), BMI (PR=0.85 (0.83–0.86)) and physical activity (PR=0.73 (0.72–0.74)) (online supplemental tables 3–6). mICVH prevalence was the lowest among those working labourer versus support service and professional/management positions even after meeting individual mICVH metric components (eg, labourers meeting physical activity guidelines had an mICVH prevalence of 40.5% compared with those in support service (50.0%) or professional/management (58.4%) positions; see online supplemental table 10).

Industry of employment, occupational class and mICVH, by race/ethnicity

Working in labourer versus professional/management positions was associated with a lower mICVH prevalence among NH-Asian (PR=0.60 (95% CI 0.46 to 0.79)), NH-Black (PR=0.77 (95% CI 0.58 to 1.01)) and NH-White (PR=0.80 (95% CI 0.74 to 87)), but not Hispanic/Latinx (PR=0.94 (95% CI 0.78 to 1.14)) adults; p interaction <0.001. Compared with those working in the professional industry, working in the healthcare/social assistance industry was associated with a decrease in mICVH prevalence for NH-Asian (PR=0.70 (95% CI 0.54 to 0.90)), Hispanic/Latinx (PR=0.78 (95% CI 0.62 to 0.99)) and NH-White (PR=0.85 (95% CI 0.78 to 0.93)) participants. Similarly, participants working in labourer positions within manufacturing/construction, educational services and public administration/arts/other service industries versus professional/management positions who were NH-White had a lower prevalence of mICVH (PR=0.73 (95% CI 0.63 to 0.84), PR=0.61 (95% CI 0.42 to 0.89), and PR=0.78 (95% CI 0.64 to 0.94), respectively). Additional associations between occupational class, industry of employment and mICVH prevalence stratified by race/ethnicity and sex/gender are shown in online supplemental table 13. For example, among NH-Black men, being employed in labourer versus professional/management positions was associated with a 36% lower prevalence of mICVH (PR=0.64 (95% CI 0.44 to 0.92)).

Industry of employment, occupational class and mICVH, by sex/gender

Compared with those working in professional/management positions, working in a labourer position was associated with a lower prevalence of mICVH for both women (PR=0.85 (95% CI 0.76 to 0.94)) and men (PR=0.74 (95% CI 0.67 to 0.81)); p interaction <0.001 (online supplemental table 12). Among women, being employed in retail trade and healthcare/social assistance versus professional/administrative/management industries was associated with a lower prevalence of mICVH (PR=0.83 (95% CI 0.74 to 0.93) and (PR=0.82 (95% CI 0.75 to 0.90), respectively). Working as a labourer within manufacturing/construction versus professional/administrative/management industries was associated with a decreased prevalence of mICVH women (PR=0.75 (95% CI 0.59 to 0.95)) and men (PR=0.73 (95% CI 0.62 to 0.85)). Among men, being employed in educational service versus professional/administrative/management industries was associated with a 15% higher prevalence of mICVH (PR=1.15 (95% CI 1.01 to 1.30)). Compared with women working in professional/administrative/management industries, women working as labourers in educational service and healthcare/social assistance industries had a lower prevalence of mICVH (PR=0.51

(95% CI 0.33 to 0.78) and PR=0.57 (95% CI 0.37 to 0.87), respectively). Among men, working in support service versus professional/administrative/management positions within accommodation/food service industries was associated with a 53% higher prevalence of mICVH (PR=1.53 (95% CI 1.04 to 2.25)).

Industry of employment, occupational class and mICVH, by age

Associations between working in labourer versus professional/management positions and having a lower prevalence of mICVH were the strongest among those ≥50 years (PR=0.77 (95% CI 0.67 to 0.88); p interaction <0.001) compared with those 18–30 years and 31–49 years of age (PR=0.81 (95% CI 0.73 to 0.90) and PR=0.80 (95% CI 0.73 to 0.89), respectively) (online supplemental table 12). Being employed in manufacturing/construction versus professional/administrative/management industries was associated with a lower prevalence of mICVH for each age group: 18–30 years old (PR=0.77 (95% CI 0.67 to 0.89)); 31–49 years old (PR=0.76 (95% CI 0.68 to 0.84)); and ≥50 years old (PR=0.83 (95% CI 0.72 to 0.96)) (online supplemental table 12). Compared with those working in professional/administrative/management industries, being employed in finance/information/real estate industries was associated with a lower prevalence of mICVH (PR=0.79 (95% CI 0.69 to 0.91)) among those 18–30 years old. However, working in educational services was associated with an 18% higher prevalence of mICVH (PR=1.18 (95% CI 1.03 to 1.34)) among those 18–30 years old. Working in labourer versus professional/administrative/management industries within educational services was associated with a 61% lower prevalence of mICVH (PR=0.39 (95% CI 0.22 to 0.67)) among those ≥50 years old. Compared with those employed in professional/administrative/management positions, working in employment as a labourer was associated with a 56% higher prevalence of mICVH (PR=1.56 (95% CI 1.02 to 2.41)) among those aged 31–49 years. Working in labourer versus professional/management positions was associated with lower mICVH prevalence among NH-Asian adults <50 years old (PR=0.57 (95% CI 0.42 to 0.77)) (online supplemental table 14). Additional associations between occupational class and industry of employment and mICVH stratified by race/ethnicity and age are shown in online supplemental table 14.

Industry of employment, occupational class and mICVH, by income

Compared with those working in professional/management positions, working in labourer positions was associated with a lower prevalence of mICVH for participants with household incomes of <US$75 000 (PR=0.84 (95% CI 0.77 to 0.91)) and ≥US$75 000 (PR=0.76 (95% CI 0.68 to 0.85)); p interaction <0.001 (online supplemental table 12). Similarly, being employed in manufacturing/construction versus professional/administrative/management industries was associated with a lower prevalence of mICVH for participants with household incomes of <US$75 000 (PR=0.74 (95% CI 0.66 to 0.83)) and ≥US$75 000 (PR=0.79 (95% CI 0.71 to 0.87)). Among participants with household incomes of <US$75 000, being employed in retail trade or finance/information/real estate versus professional/administrative/management industries was associated with a decreased prevalence of mICVH (PR=0.84 (95% CI 0.72 to 0.94) and PR=0.82 (95% CI 0.72 to 0.93), respectively). Being employed in healthcare/social assistance versus professional/administrative/management industries was associated with a decreased prevalence of

mICVH for participants with household incomes of <US$75 000 (PR=0.79 (95% CI 0.71 to 0.88)) and ≥US$75 000 (PR=0.86 (95% CI 0.77 to 0.95)). Among participants with household incomes of <US$75 000 who were labourers, being employed in finance/information/real estate, educational services or public administration/arts/other service versus professional/administrative/management industries was associated with a decreased prevalence of mICVH (PR=0.64 (95% CI 0.43 to 0.97), PR=0.63 (95% CI 0.44 to 0.90) and PR=0.79 (95% CI 0.63 to 1.00), respectively). Providing support services within retail trade versus professional/administrative/management industries was associated with a 44% higher prevalence of mICVH for participants with household incomes of <US$75 000 (PR=1.44 (95% CI 1.03 to 2.02)). Associations between occupational class and industry of employment and mICVH stratified by race/ethnicity and annual household income are shown in online supplemental table 15.

DISCUSSION

In this large, nationally representative study, we investigated associations between industry of employment and occupational class in relation to mICVH prevalence and found that working in labourer versus professional/management positions was associated with a lower mICVH prevalence. Similarly, lower mICVH prevalence was observed when comparing those working in manufacturing/construction, retail trade and healthcare/social service assistance versus professional/administrative/management positions after adjustment for sociodemographic, health behaviour and clinical characteristics. For example, being employed in manufacturing/construction versus professional/administrative/management industries was associated with a lower prevalence of mICVH. We also observed that labourer versus professional/administrative/management occupational class was associated with lower mICVH prevalence within most industries. Incidentally, we observed that being employed in educational service versus professional/management positions was associated with a higher prevalence of mICVH. Additionally, we assessed potential modification by sex/gender and age. As it relates to other potential modifiers, associations were stronger when comparing NH-Whites adults to other racial/ethnic groups, middle-aged and older to younger participants and those within annual household incomes of <US$75 000 compared with those earning ≥US$75 000.

We observed that working in labourer compared with professional/management positions was associated with lower mICVH prevalence. Disparate working conditions of labourer versus professional/management positions may introduce adverse physical and environmental exposures contributing to low mICVH prevalence. For example, if the occupational health and safety measures governing organisations are not adequately regulated, working conditions can present deleterious physical hazard exposures (eg, asbestos exposure without personal protective equipment among construction workers) associated with poor CVH,[41] which are more likely to be experienced by individuals in labourer versus professional/management positions, further driving disparities in mICVH prevalence.[22 41 42] No differences in associations were observed when comparing those working in support service versus professional/management positions. However, results differed when assessing associations between those working in support service versus professional/administrative/management positions and mICVH prevalence within some

industries of employment. For example, we observed that being employed in support service versus professional/management positions within retail/trade industries was associated with a 44% higher mICVH prevalence among those earning <US$75 000. Similarly, we saw that being employed in support service versus professional/management positions within accommodation/food service industries was associated with a 53% higher mICVH prevalence. Those findings align with observations made in one Northern English study, which found that individuals employed in *pink-collar positions*—characterised as administrative, clerical, assistant or otherwise 'support service' work—experienced lower rates of CVD mortality under the age of 75 in comparison to *white-collar* workers (eg, professional/management).[43] Considering our finding that being employed in support service versus professional/management positions within retail/trade industries among those earning <US$75 000, occupational class (eg, *pink-collar* vs *white-collar positions*) may be a stronger indicator of mICVH prevalence than income alone.

We also observed racial/ethnic differences in the associations between occupational class, industry of employment and mICVH prevalence. For example, we found that Hispanic/Latinx (53%) and NH-Black (37%) adults were more likely than NH-White adults (29%) to report labourer positions and had the lowest prevalence of mICVH (5.2% (Hispanic/Latinx) and 3.9% (NH-Black)). Interestingly, we observed intraracial differences when comparing those employed in professional/management versus labourer positions among NH-Asian, Hispanic/Latinx and NH-White participants. However, mICVH prevalence among males employed in labourer versus professional/management positions was the only intraracial difference observed when comparing NH-Black participants. Considering that finding, along with mICVH prevalence being the lowest among NH-Black participants, NH-Black adults may not benefit from working in occupational classes and industries of employment that we found to be associated with mICVH prevalence. One potential explanation is that high job strain experienced by minoritised racial/ethnic groups (irrespective of occupational class or industry of employment) may attenuate CVH benefits that tend to be observed among individuals in professional/management positions.[8–10] In fact, one recent UK-based study reported that compared with their White counterparts, workers from minoritised racial/ethnic groups persistently experienced lower job control (one component of job strain) across occupations (eg, labour, managerial, professional).[44] Considering that adults with food security among minoritised racial/ethnic groups (compared with NH-White adults) still have a lower prevalence of individual mICVH components, relative associations for a single adverse exposure may appear to be weaker. We also observed an inverse relationship between employment professional responsibility and sleep duration among NH-Black adults but not among NH-White adults in 2013 study that used NHIS data, partially explaining why intraracial mICVH prevalence did not vary by occupational class or industry of employment among NH-Black adults in our study described here.[45] Our findings are congruent with a 2021 study that found no association between employment status and education and higher attainment of mICVH among NH-Black men.[46] Similarly, a prior study found that NH-Black adults had an 82% lower odds of having ≥5 of AHA's mICVH metrics compared with NH-White adults after adjusting for sex/gender, age, and income (OR=0.18, 95% CI 0.10 to 0.34).[47] That suggests that correlates of mICVH prevalence among NH-Black men

and women may include social and environmental contextual factors beyond socioeconomic indicators commonly used for predicting cardiometabolic health status.

Our findings support Gee and Payne-Sturges' *Exposure-disease-stress* framework, which describes the way in which individual-level and community-level health vulnerabilities are inter-related. Predicated on residential segregation, Gee and Payne-Sturges have argued that such health vulnerabilities (eg, low 'ideal' CVH prevalence) are exacerbated by differential levels of exposures (eg, community stress and pollutants) as well as inequities in access to high-quality community resources among racial/ethnic minority communities.[31] Taken together, the stark intraracial differences in associations between occupational class and mICVH prevalence comparing NH-Black adults to other racial/ethnic groups warrant the consideration of social and community contextual-level factors while employing future studies seeking to better understand disparities in mICVH prevalence among adults in the USA.

While prior literature suggests sex/gender disparities exist in mICVH prevalence, our study found that associations between occupational class and mICVH prevalence were similar when comparing men and women.[24 25] In fact, we observed that working in labourer versus professional/management positions was associated with lower mICVH prevalence among men and women. That finding suggests that sex/gender differences in mICVH prevalence may be attenuated by occupational class. However, some differences were observed for occupational class within each industry of employment. For example, working in support service versus professional/management positions within accommodation/food service industries among women was associated with a 54% higher mICVH prevalence. However, no statistically significant associations for higher mICVH prevalence were observed among men after stratifying industry of employment by occupational class.

Consistent with our other study findings regarding working labour versus professional/management positions being associated with lower mICVH prevalence, that remained true irrespective of age category. However, we observed some differences when examining industry of employment as well as occupational class within each industry of employment by age group. We observed that working in educational services was associated with an 18% higher mICVH prevalence among younger adults but was not true for middle-aged and older adults. We also observed that working in labour versus professional/management positions within accommodation/food service industries was associated with a 56% higher mICVH prevalence only among middle-aged adults. Interestingly, working in healthcare/social assistance versus professional/administrative/management industries was associated with lower mICVH prevalence among younger, middle-aged, and older participants. A body of literature has described the phenomenon of 'burn out', consisting of long work hours and insufficient sleep and is relatively common among those employed in healthcare industries.[48–50] Considering that sleep was included in the mICVH for our study, if 'burn out' was experienced by those employed in healthcare/social service industries included in our analytical sample, there is reason to believe that insufficient sleep may partially explain why lower mICVH prevalence was observed, regardless of age.

Findings from our study on associations between occupational class, industry of employment and mICVH prevalence modified by income were generally consistent with our hypothesis of there being a direct proportional association between mICVH prevalence and income.[25 27] However, lower mICVH prevalence was associated with working in labourer versus professional/management positions for both low-income and high-income earners. We did not observe any statistically significant associations between mICVH prevalence and working in labourer or support service versus professional/management positions within the healthcare/social assistance industries for low-income and high-income earners. That may suggest income may not serve as a buffer against sleep deprivation experienced during 'burn out' among healthcare/social assistance professionals, making achieving mICVH less likely.[48–50]

There were limitations to our study. First, NHIS employs a cross-sectional study design, precluding causal interpretations. Next, NHIS does not routinely collect data on more granular aspects of work environments (eg, job strain, job satisfaction, job security) that go beyond industry of employment and occupational class. Then, NHIS data did not include diet, which is why our mICVH measure was not modelled based on the AHA's Life's Essential 8 metric, which includes an assessment of diet. Further, individual components of the mICVH metric were self-reported, introducing possible bias, including social desirability bias. However, while general self-reported data can introduce bias, self-reported health status has been described in the literature as a strong indicator of mortality using NHIS data.[51] Similarly, individuals outside of our inclusion criteria (based on race/ethnicity, being institutionalised and sex/gender) were excluded from our study, potentially introducing potential selection bias to our findings.

Despite these limitations, our study has several important strengths. For instance, our study includes data from a large, nationally representative sample. Prior studies describing mICVH by sex/gender, race/ethnicity, income and age have largely been among individuals of European and Asian ancestry.[26 27] However, the racial/ethnic diversity included in our analytical sample permitted between and within racial/ethnic group comparisons in associations between industry of employment and occupational class in relation to mICVH, which also serves as an important strength of the study. As revealed, working in labourer versus professional/management occupations was associated with a lower prevalence of meeting mICVH prevalence, even after individual mICVH metric component recommendations for sleep duration, smoking status, BMI and physical activity. Considering that workers in labourer versus professional/management positions were more likely to be from minoritised racial/ethnic groups and have a lower prevalence of mICVH, centring public health interventions around modifying occupational structures (ie, addressing racial/ethnic and sex/gender inequities in the science, technology, engineering and math workforce) may help eliminate racial/ethnic CVH inequities. Additionally, to our knowledge, our study is the first to explore associations between occupational class, industry of employment and mICVH prevalence with sleep duration as an mICVH metric. By including sleep duration as an mICVH metric, our study findings may help leverage health promotion strategic initiatives at both individual and population levels aimed at meeting sleep objectives set by Healthy People 2030.[52] There is a need for population health studies assessing correlates of mICVH with sleep duration among adults in the USA. Additionally,

those studies should oversample historically under-represented racial/ethnic groups (eg, Native Americans) and sexual minorities (eg, non-gender conforming individuals) during study recruitment to ascertain more heterogenous mICVH prevalence data.

CONCLUSIONS

Working in labourer versus professional/management positions was strongly associated with a lower prevalence of mICVH. Given the higher likelihood of labourer occupations and lower prevalence of mICVH among minoritised racial/ethnic groups, social determinants related to occupational class should be considered in future studies of racial disparities in mICVH.

Our study is among the first to use the updated mICVH, with sleep, to explore associations between occupational class, industry of employment and mICVH prevalence at a population level in the USA. Finally, results from our study may be used as a tool to mitigat population and individual-level CVD risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

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Data availability statement

Data are available in a public, open access repository. The datasets analysed during the current study are from the National Health Interview Survey, which is publicly available and was retrieved from https://www.cdc.gov/nchs/nhis/index.htm. Blewett LA, Rivera Drew JA, King ML, et al. IPUMS Health Surveys: National Health Interview Survey, Version 7.3 [dataset]. Minneapolis, MN: IPUMS, 2023. DOI: 10.18128/D070.V7.3.

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WHAT IS ALREADY KNOWN ON THIS TOPIC

- Minoritised racial and ethnic groups tend to have poorer cardiovascular health (CVH) than non-Hispanic (NH)-White adults and are generally more likely to work in labourer or support service positions where job strain is often high.

WHAT THIS STUDY ADDS

- We found that working in labourer compared with professional/management positions was associated with a lower ideal CVH prevalence using the updated ideal CVH metric that now includes sleep duration.
- The magnitudes of associations between working in labourer versus professional/management positions and lower ideal CVH prevalence were stronger among adults ≥50 years old compared with adults who were <50 years older.
- Hispanic/Latinx and NH-Black adults were more likely than NH-White adults to report labourer positions and had the lowest prevalence of ideal CVH.
- The magnitudes of associations between working in labourer versus professional/management positions and lower ideal CVH prevalence were also stronger for adults with annual household incomes of <US$75 000 compared with adults with annual household incomes of ≥US$75 000.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- Given the higher likelihood of labourer occupations and lower prevalence of ideal CVH among minoritised racial/ethnic groups, social determinants related to occupational class should be considered in future studies of racial disparities in CVH.
- Results from our study may serve as a primer for using sleep health promotion as a tool for mitigating population and individual-level cardiovascular disease risk.

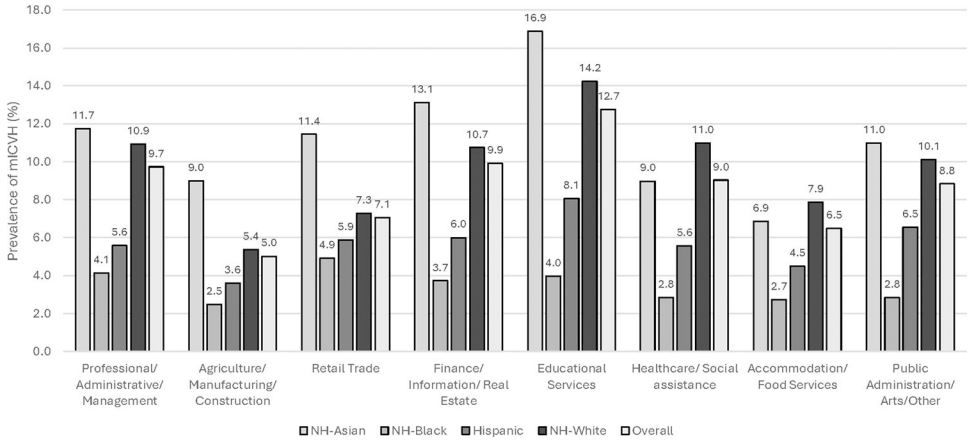

Figure 1.

Age-standardised (All estimates are weighted for the survey's complex sampling design and are age standardised to the US 2010 population) prevalence of modified ideal cardiovascular health (mICVH) by industry of employment among US adults overall and by race/ethnicity, National Health Interview Survey, 2004–2018 (n=230 196). Professional/administrative/management includes the following North American Industry Classification System (NAICS Association, Rockaway, New Jersey) industry categories: professional, scientific and technical services; management of companies and enterprises; and administrative support and waste management and remediation service industries. Agriculture/manufacturing/construction includes the following NAICS industry categories: agriculture, forestry, fishing and hunting; mining; utilities; construction; manufacturing; wholesale trade; and transportation and warehousing. Finance/information/real estate includes the following NAICS industry categories: information; finance and insurance; and real estate rental and leasing. Public administration/arts/other services includes the following NAICS industry categories: arts, entertainment, and recreation; and other services (except public administration). Ideal cardiovascular health includes yes versus no for all of the following: habitual daily sleep duration of 7–9 hours; never smoking/quit >12 months prior to interview; body mass index (BMI) 18.5 to <25 kg/m^2; meeting physical activity guidelines for Americans; and no prior diagnosis of dyslipidaemia, hypertension, or diabetes/pre-diabetes. NH, non-Hispanic.

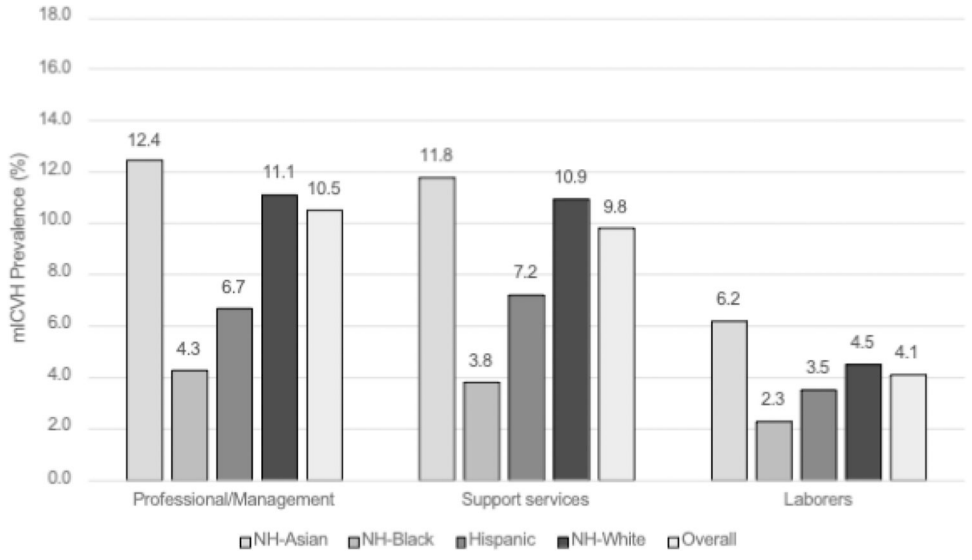

Figure 2.

Age-standardised (All estimates are weighted for the survey's complex sampling design and are age standardised to the US 2010 population) prevalence of modified ideal cardiovascular health (mICVH) by occupational class among US adults overall and by race/ethnicity, National Health Interview Survey, 2004–2018 (n=230 196). mICVH includes yes versus no for all of the following: habitual daily sleep duration of 7–9 hours; never smoking/quit >12 months prior to interview; body mass index (BMI) 18.5 to <25 kg/m^2; meeting physical activity guidelines for Americans; and no prior diagnosis of dyslipidaemia, hypertension or diabetes/pre-diabetes. NH, non-Hispanic.

Table 1

Age-standardised sociodemographic, health behaviour, and clinical characteristics among US adults overall, by occupational class and stratified by modified ideal cardiovascular health (mICVH), National Health Interview Survey, 2004–2018 (n=230 196)*

	Occupational class								
	Professional/management n=50 033 (21.7%)			Support services n=103 980 (45.2%)			Labourers n=76 183 (33.1%)		
	All n=50 033	No mICVH n=43 887	With mICVH n=6146	All n=103 980	No mICVH n=92 541	With mICVH n=11 439	All n=76 183	No mICVH n=72 454	With mICVH n=3729
mICVH (% yes)†	10.5			9.8			4.1		
Sociodemographic characteristics									
Age, mean±SE (years)	43.7±0.1	44.3±0.1	39.4±0.2	41.5±0.1	42±0.1	37.2±0.2	40.5±0.1	41±0.1	32.3±0.3
18–30	17.7	15.9	30.3	27.7	26.1	40.4	28.8	27.2	57.1
31–49	48.2	48.4	46.7	41.1	41.5	38.3	42.5	43.3	28.8
≥50	34.1	35.7	23	31.2	32.5	21.3	28.7	29.5	14.1
Race/ethnicity									
NH-Asian	7.0	6.8	8.3	4.9	4.8	5.7	3.5	3.5	6.0
NH-Black	6.4	6.8	2.5	10.6	11.4	4.1	11.9	12.1	5.7
Hispanic/Latinx	6.6	6.8	4.3	9.7	10.0	7.3	20.2	20.3	17.2
NH-White	80.1	79.5	84.8	74.8	73.8	82.9	64.4	64.1	71.0
Women	35.7	34.2	48.8	65.6	64.8	74.0	25.0	24.6	34.5
Living in poverty‡	1.7	1.7	1.6	5.2	5.4	3.9	8.8	8.8	7.8
Other government assistance	1.9	2.0	0.6	5.5	5.9	2.1	8.9	9.1	4.9
Annual household income									
<US$35 000	8.3	8.4	6.5	21.5	22.2	14.4	31.9	32.0	28.4
US$35 000–74 999	23.6	24.3	17.7	33.7	34.6	26.1	40.1	40.3	36.9
≥US$75 000	68.1	67.3	75.7	44.8	43.3	59.5	28.0	27.7	34.7
Educational attainment									
<High school	1.8	1.9	0.5	3.7	3.9	1.6	18.2	18.5	9.9
High school graduate	12.7	13.5	5.9	22.7	23.8	12.9	41.7	42.1	33.6
Some college	23.9	24.8	16.1	33.5	34.2	26.6	30.0	29.7	36.2
≥College	61.7	59.9	77.5	40.1	38.1	58.9	10.1	9.8	20.2

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Industry of employment									
Professional/administrative/ management[§]	25.2	24.9	27.7	6.4	6.3	7.7	9.1	9.1	8.4
Agriculture/manufacturing/ construction[¶]	28.3	29.1	20.7	11.6	12.0	8.2	49.2	49.6	42.6
Retail trade	2.8	2.8	2.7	17.1	17.5	12.3	6.4	6.3	8.7
Finance/information/real estate[**]	16.1	15.8	19.6	10.2	10.2	9.6	2.9	2.9	2.8
Educational services	5.3	5.2	6.3	16.1	15.3	23.4	4.8	4.9	3.6
Healthcare/social assistance	6.7	6.6	8.2	23.8	24.0	22.7	3.7	3.7	2.3
Accommodation/food services	3.6	3.8	2.2	1.4	1.4	1.6	10.6	10.4	14.5
Public administration/arts/other services[††]	11.9	11.8	12.6	13.3	13.2	14.6	13.2	13.1	17.0
Marital/cohabiting status									
Married/living with partner or cohabitating	72.8	73.2	70.3	63.5	63.3	66.2	65.1	65.5	57.8
Divorced/widowed/no live-in partner	15.6	15.7	15	20.4	20.9	15.7	19.0	19.1	17.3
Single/no live-in partner	11.6	11.1	14.6	16.1	15.8	18.1	15.9	15.3	24.9
Region of residence									
North-East	19.3	18.9	22.6	19.4	19.3	20.9	17.1	17.1	17.9
Midwest	23.0	23.4	18.4	23.8	24.1	21.4	25.3	25.4	24.1
South	34.0	34.6	29.2	35.2	35.8	30.5	37.0	37.2	31.6
West	23.7	23.1	29.8	21.5	20.9	27.2	20.6	20.4	26.4
Health behaviours									
Sleep duration, hours									
<6	6.2	6.9	0.0	7.3	8.2	0.0	9.2	9.6	0.0
<7	29.3	32.9	0.0	30.2	33.6	0.0	33.2	34.6	0.0
7–9 (recommended)[‡‡]	69.7	66	100	68	64.4	100	64.3	62.7	100

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>9	1.0	1.1	0.0	1.8	2.0	0.0	2.6	2.7	0.0
Trouble falling asleep (≥3 nights)	13.9	14.8	7.8	17.5	18.6	8.7	15.7	16.1	8.2
Trouble staying asleep (≥3 nights)	24.4	25.6	16	26.5	27.7	16.9	22.5	22.9	10.6
Woke up feeling unrested (≥3 days)	42.1	43.8	29.7	44.0	45.9	29.0	41.1	41.9	26.5
Sleep medication use in the past week (≥3 nights)	6.5	6.6	5.5	8.5	8.8	6.2	6.2	6.3	3.6
Smoking status									
Never/quit >12 months prior‡‡	87.9	86.4	100	85	83.2	100	75.4	74.2	100
Quit ≤12 months ago	1.1	1.3	0.0	1.2	1.3	0.0	1.7	1.8	0.0
Current	11.0	12.3	0.0	13.8	15.5	0.0	22.9	24	0.0
Leisure-time physical activity									
Never/unable	21.5	24	0.0	28.5	31.5	0.0	42.2	43.9	0.0
Does not meet PA guidelines§§	20.0	22.4	0.0	21.5	23.8	0.0	17.4	18.1	0.0
Meets PA guidelines‡‡	58.4	53.7	100	50.0	44.7	100	40.5	38	100
Alcohol status									
Never	10.6	10.8	9.0	17.6	17.8	15.1	17.6	17.4	18.1
Former	10.2	10.6	6.0	12.4	12.7	9.2	17	17.1	14.3
Current	79.3	78.7	85.0	70.0	69.5	75.7	65.5	65.5	67.6
Heavy alcohol consumption	27.9	26.6	39.8	22.5	21.4	33.0	18.5	18.5	20.2
Clinical characteristics									
Body mass index¶¶									
Recommended (18.5 to <25 kg/m^2)‡‡	32.4	24.7	100	35.6	28.8	100	27.1	24.0	100
Overweight (25–29.9 kg/m^2)	41.3	45.9	0.0	36.2	39.9	0.0	41.8	43.5	0.0
Obesity (≥30 kg/m^2)	26.3	29.3	0.0	28.2	31.2	0.0	31.2	32.5	0.0
Health status									

	Occupational class								
	Professional/management n=50 033 (21.7%)			Support services n=103 980 (45.2%)			Labourers n=76 183 (33.1%)		
	All n=50 033	No mICVH n=43 887	With mICVH n=6146	All n=103 980	No mICVH n=92 541	With mICVH n=11 439	All n=76 183	No mICVH n=72 454	With mICVH n=3729
Excellent/very good	74.1	72.3	90.5	68.5	66.5	88.6	58.4	57.4	82.3
Good	21.4	22.8	8.2	25.3	26.9	9.8	31.9	32.6	14.5
Fair/poor	4.5	4.9	1.3	6.2	6.7	1.6	9.7	9.9	3.2
Cancer (any)	11.0	10.9	12.5	9.7	9.7	10.2	7.2	7.2	7.3
Dyslipidaemia (yes)‡‡***	52.9	55.9	0.0	50.8	53.4	0.0	51.7	52.8	0.0
Hypertension (yes)‡‡	30.8	33.9	0.0	31.4	34.3	0.0	33.9	35	0.0
Pre-diabetes/diabetes (yes)‡‡	12.5	13.6	1.2	13.1	14.1	2.1	14.4	14.7	2.8
Serious psychological distress (yes)†††	0.9	0.9	0.4	1.6	1.7	0.6	1.7	1.8	0.4

*All estimates are weighted for the survey's complex sampling design. All estimates except for age are age standardised to the US 2010 population. Percentages may not sum to 100 due to missing values or rounding.

†Ideal cardiovascular health includes yes versus no for all of the following: habitual daily sleep duration of 7–9 hours; never smoking/quit >12 months prior to interview; body mass index (BMI) 18.5 to <25 kg/m^2; meeting physical activity guidelines for Americans; and no prior diagnosis of dyslipidaemia, hypertension or diabetes/pre-diabetes.

‡<100% federal poverty level.

§Includes the following North American Industry Classification System (NAICS Association, Rockaway, New Jersey) industry categories: information; finance and insurance; and real estate rental and leasing.

¶Includes the following NAICS industry categories: agriculture, forestry, fishing and hunting; mining; utilities; construction; manufacturing; wholesale trade; and transportation and warehousing.

**Includes the following NAICS industry categories: professional, scientific and technical services; management of companies and enterprises; and administrative support and waste management and remediation service industries.

††Includes the following NAICS industry categories: public administration; arts, entertainment and recreation; and other services (except public administration).

‡‡Indicator of mICVH.

§§Meets PA guidelines for Americans defined as ≥150 min/week of moderate-intensity or ≥75 min/week of vigorous-intensity or ≥150 min/week of moderate+vigorous-intensity physical activity.

¶¶Self-reported weight and height were used to calculate (weight (kg)/height (m^2)) body mass index.

***Dyslipidaemia defined as high cholesterol in the 12 months prior to interview. Available for survey years 2011–2017.

†††Kessler-6 Psychological Distress Scale score ≥13.

NH, non-Hispanic; PA, physical activity.