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Occupational Exposures and Metabolic Syndrome Among Hispanics/Latinos:

Cross-Sectional Results From the Hispanic Community Health Study/Study of Latinos (HCHS/SOL)

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Abstract

Objective—We assessed the cross-sectional relationships of self-reported current occupational exposures to solvents, metals, and pesticides with metabolic syndrome and its components among 7127 participants in the Hispanic Community Health Study/Study of Latinos.

Methods—Metabolic syndrome was defined as a clustering of abdominal obesity, high triglycerides, low high-density lipoprotein cholesterol, high blood pressure, and/ or high fasting glucose. Regression models that incorporated inverse probability of exposure weighting were used to estimate prevalence ratios.

Results—Solvent exposure was associated with a 32% higher prevalence of high blood pressure (95% confidence interval: 1.09 to 1.60) than participants not reporting exposure. No associations

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were observed for occupational exposures with abdominal obesity, high triglycerides, low high-density lipoprotein, or metabolic syndrome.

Conclusion—Our findings suggest that solvent exposure may be an important occupational risk factor for high blood pressure among Hispanics/Latinos in the United States.

BACKGROUND

Hispanic/Latino adults in the United States are over-represented in occupations that are considered high risk because of exposure to physical and chemical hazards.[1,2] Hispanic/Latino workers, especially those foreign-born, may be especially vulnerable to occupational hazards due to low socioeconomic status and language barriers.[3] Several studies have observed associations between occupational exposures to solvents,[4,5] metals,[6–8] and pesticides[9,10] with cardiovascular disease risk factors and endpoints. For example, employees at a car manufacturing plant exposed to mixed organic solvents were found to have an increased prevalence of hypertension compared with office workers at the same plant.[4] Other studies have observed associations of occupational exposure to solvents, metals, and pesticides in relation to insulin resistance and type 2 diabetes.[11,12]

Metabolic syndrome is a risk factor for cardiovascular disease[13] and is characterized as the co-occurrence of insulin resistance, obesity, dyslipidemia, and hypertension.[14] There is no single cause of metabolic syndrome, but several pathways have been identified, including mitochondrial defects, inflammation, and endothelial dysfunction.[15,16] Studies suggest that occupational exposures may be associated with individual components of metabolic syndrome, although the underlying mechanisms are unclear. Metals, such as arsenic, cadmium, and lead, have been shown to either directly or indirectly cause oxidative stress, which promotes pancreatic islet cell dysfunction that can lead to insulin resistance.[17,18] Other studies suggest that solvents and pesticides, in addition to metals, may be endocrine disruptors and lead to weight gain.[19,20] Some pesticides have also been shown to induce insulin resistance through multiple mechanisms, including the formation of advanced glycation end products, accumulation of lipid metabolites, activation of inflammatory pathways, generation of oxidative stress, and increased biosynthesis of triglycerides.[21] These occupational exposures have also been linked to changes in blood pressure.[4,5,7,20]

As the largest and fastest growing minority group in the U.S., the prevalence of occupational exposures to contaminants within the Hispanic/Latino population represents a significant issue for the public and occupational health of this workforce. Moreover, to our knowledge, these workplace hazards have not yet been systematically evaluated as risk factors for adverse cardiometabolic health. Therefore, in this study, we present the prevalence of occupational exposures to solvents, metals, and pesticides, and further assess cross-sectional associations with metabolic syndrome and its component factors among a large and diverse cohort of Hispanic/Latino adults in the U.S.

METHODS

Study Population

The Hispanic Community Health Study/Study of Latinos (HCHS/SOL) is a prospective cohort study of 16,415 self-identified Hispanic/Latino adults, aged 18 to 74 years at enrollment. Participants were recruited using population-based multistage probability sampling of households within census blocks across 4 field centers (Bronx, NY; Chicago, IL; Miami, FL; and San Diego, CA). Details of sampling methods used have been published elsewhere, and sample weights reflect the probability of selection at each stage.[22,23] Enrollment examinations were performed between 2008 and 2011. All study participants provided written informed consent, and all field centers, the coordinating center, central laboratories, and reading centers obtained approval from their respective institutional review boards. For the present study, we restricted our analyses to participants reporting current employment at the enrollment interview ($n = 8156$).

Exposure Assessment

An interviewer-administered occupational questionnaire designed to assess current work environments was administered to participants who indicated full-time or part-time employment. The questionnaire was administered in either English or Spanish, based upon the participants' preference. The Spanish translation of the questionnaire was certified by an independent translator, and tested by focus groups at each field center. Specifically, participants were asked "At the job you currently work the majority of your work hours per week, how often are you exposed to any type of organic solvents, for example styrene, trichloroethylene, toluene, or xylene?" and "At the job you currently work the majority of your work hours per week, how often are you exposed to metals such as manganese, lead, or mercury?". Responses were recorded as 0%, 25%, 50%, 75%, or 100% of the time or occasional. Due to data sparseness of responses, exposures to solvents and metals were dichotomized as exposed (reported occasional exposures or reported exposures between 25% and 100% of the time) or unexposed (reported exposures 0% of the time). If participants were unfamiliar with the given terms (eg, styrene), responses were recorded as none of the time. Participants were also asked, "In your current job(s), are you exposed to pesticides?". Responses to this question were recorded as yes or no. Approximately 10% of participants reported they worked at least one secondary job, for an average of 15 hours per week; pesticide exposure was ascertained with respect to primary and secondary jobs.

Outcome Assessment

Participants underwent a standardized clinical examination at enrollment that included anthropometric and laboratory measurements performed by trained research technicians. Participants were asked to fast, abstain from smoking for 12 hours, and abstain from vigorous physical activity the morning of the clinical examination. Waist circumference was used to describe abdominal obesity and was measured at the uppermost lateral border of the right ilium using measuring tape and recorded to the nearest 0.1 cm. Participants were asked to sit for 5 minutes before taking three systolic and diastolic blood pressure measurements each at 1-minute intervals using an automated sphygmomanometer (Omron model

HEM-907 XL; Omron Healthcare Inc., Bannockburn, IL). The averages of the second and third readings were used.

Fasting blood samples were collected and shipped to the HCHS/SOL Central Laboratory for processing. High-density lipoprotein cholesterol (HDL) was measured using a direct magnesium/dextran sulfate method (Roche Diagnostics, Indianapolis, IN). Serum triglycerides were measured via a Roche Modular P chemistry analyzer using a glycerol blanking enzymatic method. Fasting glucose was measured using a hexokinase enzymatic method (Roche Diagnostics). Participants were instructed to bring all medications taken in the past month (prescription and nonprescription) with them to the enrollment examination. Medications were scanned using Universal Product Code barcodes where available. Otherwise, medications were recorded using centralized manual coding. Medications were then inventoried and classified using a Master Drug Data Base (Medispan MDDB©).

Metabolic syndrome was defined as the presence of at least three of following five risk factors, based on the American Heart Association/National Heart, Lung, and Blood Institute 2009 Joint Scientific Statement (AHA/NHLBI) criteria[13,24]: abdominal obesity (waist circumference of ≥88 cm for women or ≥102 cm for men), high triglyceride levels (≥150 mg/dL), low HDL cholesterol levels (<50 mg/dL for women or < 40 mg/dL for men), high blood pressure (systolic blood pressure ≥130 mm Hg, diastolic blood pressure ≥85 mm Hg, or current use of medication to treat high blood pressure), or high fasting blood glucose levels (≥100 mg/dL or current use of medication to treat hyperglycemia).

Covariates

Sociodemographic, health behavior, and occupational covariates derived from the interviewer-administered enrollment questionnaire were included in our analyses. Hispanic/ Latino background groups were categorized as Dominican, Central American, Cuban, Mexican, Puerto Rican, South American, and more than one heritage/other heritage. Nativity was categorized as birth within the U.S. (excluding territories) or outside of the U.S. Years of residence within the U.S. (excluding territories) and language preference (Spanish or English) were used as proxy measures for acculturation. Educational attainment was categorized as not having a high school diploma or GED, having a diploma or GED, or attaining an education beyond a high school equivalent (ie, college or vocational). Current health insurance coverage was assessed as coverage through an employer, individual plan, Medicaid/Medicare, military, Indian Health Services, or other coverage. Alcohol intake was categorized as none, low/moderate (defined as fewer than seven drinks per week for females or fewer than 14 drinks per week for males), or heavy (seven or more drinks per week for females or 14 or more drinks per week for males). Cigarette smoking status was categorized as never, former, or current. Cigarette pack-years were calculated as the number of years smoked multiplied by the average number of cigarettes smoked daily, divided by 20.

Full-time employment was defined as working more than 35 hours per week in one job or more than one job; part-time employment was defined as working 35 hours per week or fewer. The types of occupations ascertained in the HCHS/SOL were selected to reflect common occupational groups in the Hispanic/ Latino population, based on NIH-funded studies in developing countries. The occupations were categorized into five groups:

nonskilled workers, service workers, skilled workers, professional/technical workers, and other. Participants were additionally asked to self-report their individual job titles.

Statistical Analyses

The weighted prevalence of current occupational exposures to solvents, metals, and pesticides, as well as metabolic syndrome and its individual components were calculated. The Rao–Scott Chi-squared test was used to compare occupational exposures and metabolic syndrome endpoints across categories.

To control for potential confounding, we used propensity score models to estimate the probability of self-reported occupational exposure to solvents, metals, or pesticides in the participant's current job. Survey-weighted logistic regression models were defined a priori and included field center, age, sex, Hispanic/Latino background, country of birth, years residing in the U.S., educational attainment, language preference, alcohol use level, cigarette pack-years, smoking status, health insurance status, employment status (full- or part-time), and occupational group. Age and years residing in the U.S. were modeled using restricted cubic splines with four knots, at the 5th, 35th, 65th, and 95th percentiles to allow for nonlinearity and improve comparability between the exposed and unexposed.[25] Cigarette pack-years was modeled as a continuous variable. Center, gender, Hispanic/Latino background, country of birth, educational attainment, health insurance status, language preference, smoking status, alcohol consumption level, employment status, and occupational group were modeled categorically using indicator variables.

Inverse probability of exposure weights was calculated using the predicted probabilities from the propensity score model. For participants currently occupationally exposed to solvents, metals, or pesticides, the inverse probability of exposure weight was equal to 1/probability of exposure. For participants not currently occupationally exposed to solvents, metals, or pesticides, the inverse probability of exposure weight was equal to 1/(1 − probability of exposure). Extreme inverse probability of exposure weights (ie, those below the 1st and above the 99th percentiles) was truncated. Analytic weights were then created by multiplying the inverse probability of exposure weights by the sampling weights.[26] Balance between those exposed and unexposed was assessed using standardized differences, weighted by sampling weights and the analytic weights.[27] Standardized differences less than 10% when using the analytic weights were considered to have an acceptable balance; in the event that a baseline covariate had a standardized difference greater than 10%, the covariate was additionally adjusted for in outcome models.

Prevalence ratios and their 95% confidence intervals (95% CIs) for metabolic syndrome and components were calculated using a modified Poisson regression model.[28] Weighted means were calculated for continuous endpoints. The primary sampling unit, two-stage sampling design strata, and weights (sampling or analytic) were used in all analyses. As our hypotheses were specified a priori, we did not adjust for multiple comparisons. Finally, we coded self-reported job titles to a standard system (2010 Standard Occupational Classification, SOC 2010) using the Occupational Information Network (O*NET) database to further characterize the work of participants reporting occupational exposures of interest.[29] Data management was performed using SAS 9.3 software (SAS Institute, Cary, NC), and all statistical analyses were conducted using Stata Statistical Software, Release 13 (StataCorp LP, College Station, TX).

RESULTS

After excluding participants missing data on occupational exposures and other covariates, 7127 (weighted prevalence: 89.0%) of the 8156 participants who reported employment at the enrollment visit were included in analyses (Fig. 1). The weighted prevalence of metabolic syndrome and components among the selected study sample are summarized in Table 1. Abdominal obesity (49.2%) was the most common component of metabolic syndrome. The prevalence of high triglycerides, low HDL, high blood pressure, and high fasting glucose ranged from 26.9% to 38.4%. Metabolic syndrome was prevalent in 27.3% of participants.

Participant characteristics associated with occupational exposures are displayed in Table 2. The prevalence of self-reported current occupational exposure to solvents, metals, and pesticides was 6.3% ($n = 484$), 8.6% ($n = 571$), and 4.7% ($n = 321$), respectively. Individuals with the highest prevalence of self-reported exposure to solvents in their primary job included those from the Chicago field center, of Central American background, who were male, preferred speaking Spanish, consumed alcohol, were current smokers, worked full-time, and were employed as skilled workers. Occupational metal exposure was most prevalent among the Chicago field center, Mexican background, younger age (25 to 34 years old), male sex, high school graduate/GED, no health insurance, Spanish language preference, heavy alcohol consumer, current tobacco consumer, full-time worker, and skilled worker participants. Prevalence of pesticide exposure was significantly associated with the Bronx field center, other/mixed background, male sex, living in the U.S. for at least 10 years, having health insurance, low/ moderate alcohol consumption, and current smoking.

Standardized differences were used to assess balance in baseline covariates between those exposed and unexposed using sampling weights (Fig. 2) and analytic weights (Fig. 3). After implementing the analytic weights, the balance for most covariates was greatly improved (ie, <10%). As adjustments for covariates that had standardized differences greater than 10% (field center, sex, language preference, educational attainment, smoking status, employment status, and occupation) did not appreciably change our estimates, the presented results are unadjusted for residual confounders. We observed a significantly increased prevalence of high blood pressure (prevalence ratio = 1.32; 95% CI: 1.09 to 1.60) among individuals reporting occupational exposure to solvents (Table 3). This relationship was driven by higher systolic blood pressure among those reporting exposure to solvents (mean systolic blood pressure: 122 vs 119 mm Hg, *P*e = 0.01) rather than diastolic blood pressure (mean diastolic blood pressure: 72 vs 72 mm Hg, $P = 0.83$) or differences in antihypertensive medication use (10.2% vs 8.6%, $P = 0.33$). All other cross-sectional associations between current occupational exposures to solvents, metals, and pesticides and metabolic syndrome and components were near null.

Among the 484 participants who self-reported exposure to solvents in their current job, the 10 most common titles based on O*NET-SOC 2010 taxonomy were as follows: construction laborer ($n = 50$, 10.3%); maintenance and repair workers ($n = 31$, 6.4%); maids and housekeeping cleaners (*n* = 29, 6.0%); janitors and cleaners (*n* = 24, 4.9%); painters, construction, and maintenance (*n* = 20, 4.1%); automotive master mechanics (*n* = 19, 3.9%); carpenters (*n* = 13, 2.7%); production workers (*n* = 12, 2.5%); automotive body and related repairers (*n* = 11, 2.3%); and computer-controlled machine tool operators (*n* = 11, 2.3%). The remaining job titles and frequencies are provided in the Supplemental Digital Content (see Supplemental Table 1, http://links.lww.com/JOM/A353).

DISCUSSION

In this large, population-based study of Hispanic/Latino adults in the U.S., we observed a significantly elevated prevalence of high blood pressure among individuals reporting occupational exposure to solvents. Several prior studies have observed higher blood pressures among solvent-exposed workers than control groups across a variety of industries, including manufacturing and construction.[4,5,30–33] While not specifically assessed within this study, exposure durations and intensities appear to be important factors with longer durations and higher levels of exposure commensurate with higher systolic blood pressures reported in the literature.[5,30,33] Positive associations of solvent exposures with diastolic blood pressures have also been observed, although this relationship is less consistent than that of systolic blood pressures.[4] Two small cross-sectional studies (*n* = 433; *n* = 471) conducted in Iran further assessed the associations of solvent exposures with fasting blood sugar and lipid profiles.[4,5] Both found null associations with these endpoints, comporting with our observed results. To our knowledge, this is the first study to evaluate occupational exposures to solvents with cardiometabolic health within the U.S. Organic solvents are common in products such as paints, adhesives, glues, coatings, and degreasing/cleaning agents, and are routinely used in the production of dyes, polymers, plastics, textiles, printing inks, agricultural products, and pharmaceuticals; thus, workplace exposures may be important risk factors for high blood pressure among American workers.

In an effort to validate self-reported occupational exposure to solvents, we classified reported job titles based on the O*NET-SOC 2010 taxonomy. Among the HCHS/SOL participants who self-reported occupational exposure to solvents, individuals were most commonly employed in construction, maintenance, and housekeeping/janitorial jobs. Intensity ratings developed by O*NET, using data from the U.S. Department of Labor, suggest that these job environments have moderate-to-high levels of exposures to contaminants (ie, require working with pollutants, gases, dusts, or odors at least once a month).[34] Therefore, we deem the self-reported exposure metric used in this analysis to be generally consistent with occupations having high likelihood of exposure to solvents.

Organic solvents represent a diverse group of chemicals with varying chemical structures and properties. They are often used in mixtures in industrial settings, rendering estimates of associated health effects difficult. The physiologic mechanisms by which solvent exposure could raise blood pressure are unclear. Animal studies suggest that solvents could inhibit endothelial nitric oxide synthase (eNOS).[35] eNOS produces nitric oxide gas, an important regulator of vasorelaxation and consequently blood pressure.[36] Alternatively, solvent exposure may cause changes in blood pressure through nephrotoxic effects and subsequent kidney damage.[37]

Our analysis has several important limitations. Occupational exposures to solvents, metals, and pesticides were qualitatively assessed through self-report, and may be subject to misclassification. However, it is likely that exposure misclassification was nondifferential, possibly resulting in underestimations of the underlying associations. Furthermore, the exposures were assessed as broad classes (solvents, metals, and pesticides), which did not enable us to evaluate the effects of specific compounds. We restricted our analyses to participants who were currently employed. This was done for practical reasons; unemployed and retired participants underwent a less detailed occupational interview due to survey skip patterns. Although these participants were asked about exposures to solvents/degreasers and pesticides in their longest held job, these data were not analyzed because of low response rates and concerns about recall bias. As a result of focusing on those employed at enrollment, our estimates may be further attenuated because of the healthy worker survivor effect. In addition, our data are cross-sectional precluding causal inferences. We specifically focused on chemical exposures in participants' current job(s), which may not have entirely captured chronic exposures to solvents, metals, and pesticides or exposure from sources outside employment such as from dwellings. However, 69.6% of participants reported their current job was also their longest held job. Finally, we were unable to assess the dose–response relationships between exposures and metabolic syndrome because of sparse data.

Strengths of this study include the large and diverse population-based sample of Hispanics/Latinos, clinical assessments of metabolic syndrome components, and use of inverse probability weighting to control for confounding. Historically, studies of occupational health have largely ignored racial and ethnic minorities. Of the few occupational studies focused on Hispanic/Latino workers in the United States, most have been limited by industry or geographic location. The HCHS/SOL offered a unique opportunity to investigate associations between occupational exposures and metabolic syndrome, and the complex sampling design methodology used allows for the generalizability of findings to the U.S. Hispanic/Latino population aged 18 to 74 years living in the Bronx, Chicago, Miami, and San Diego.

CONCLUSION

This study examined cross-sectional associations of current occupational exposures to solvents, metals, and pesticides with metabolic syndrome and its components among a population-based cohort of Hispanics/Latinos in the U.S. Occupational exposure to solvents was associated with a greater prevalence of high blood pressure after controlling for potential confounders. Prospective analyses are needed to confirm these results.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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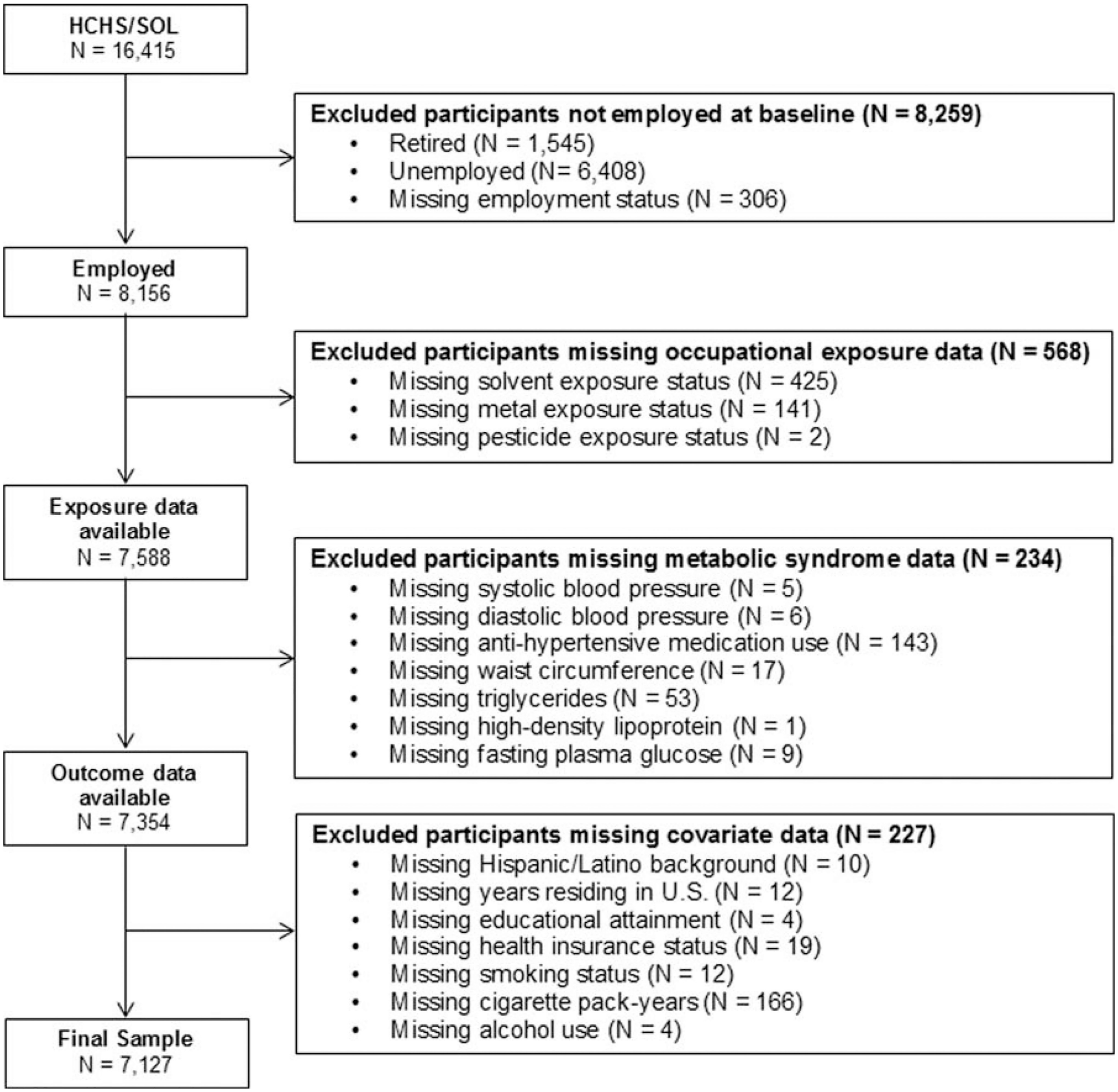

FIGURE 1.
Inclusion/exclusion criteria flow diagram.

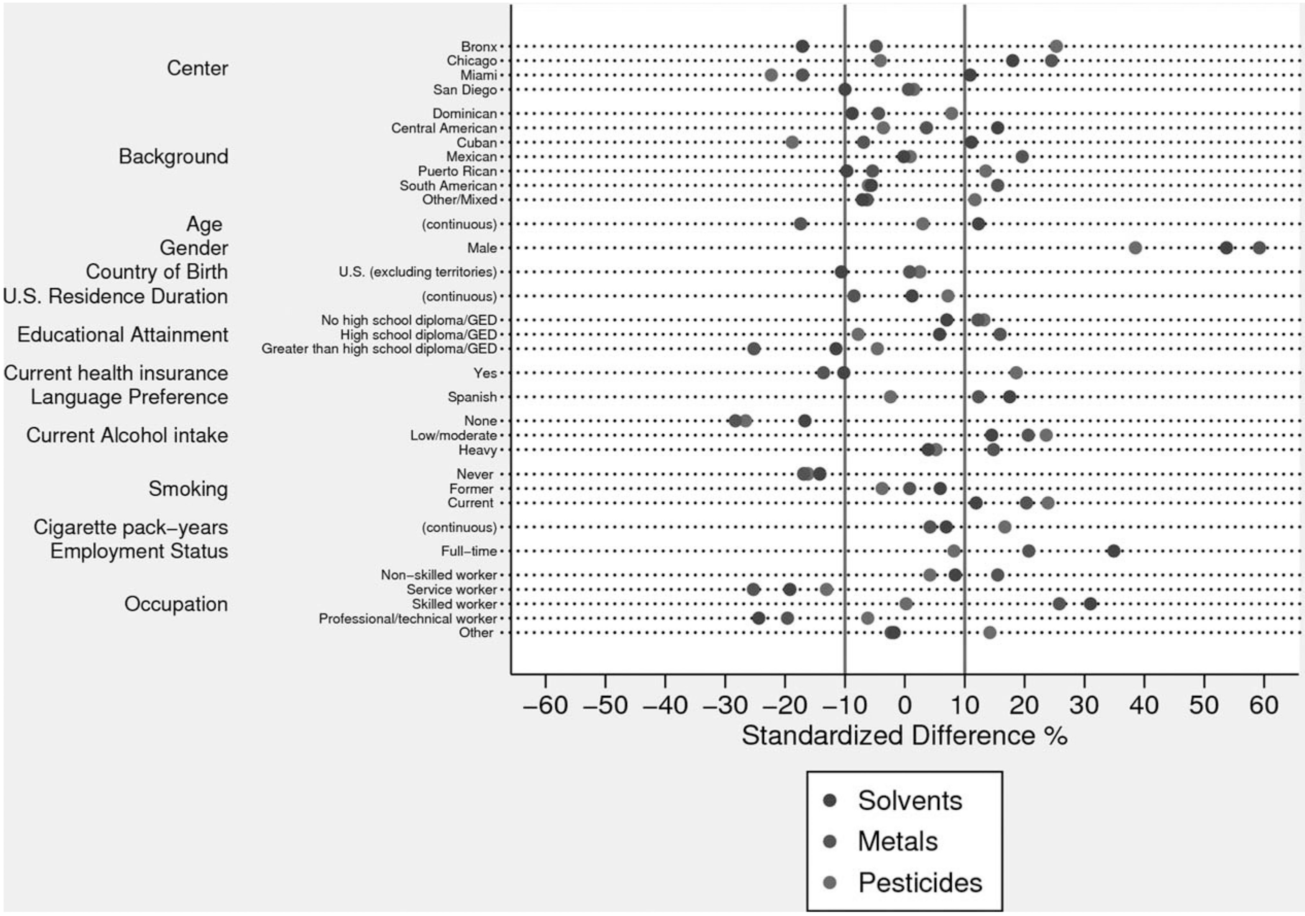

FIGURE 2.

Standardized differences of covariates using sample weights.

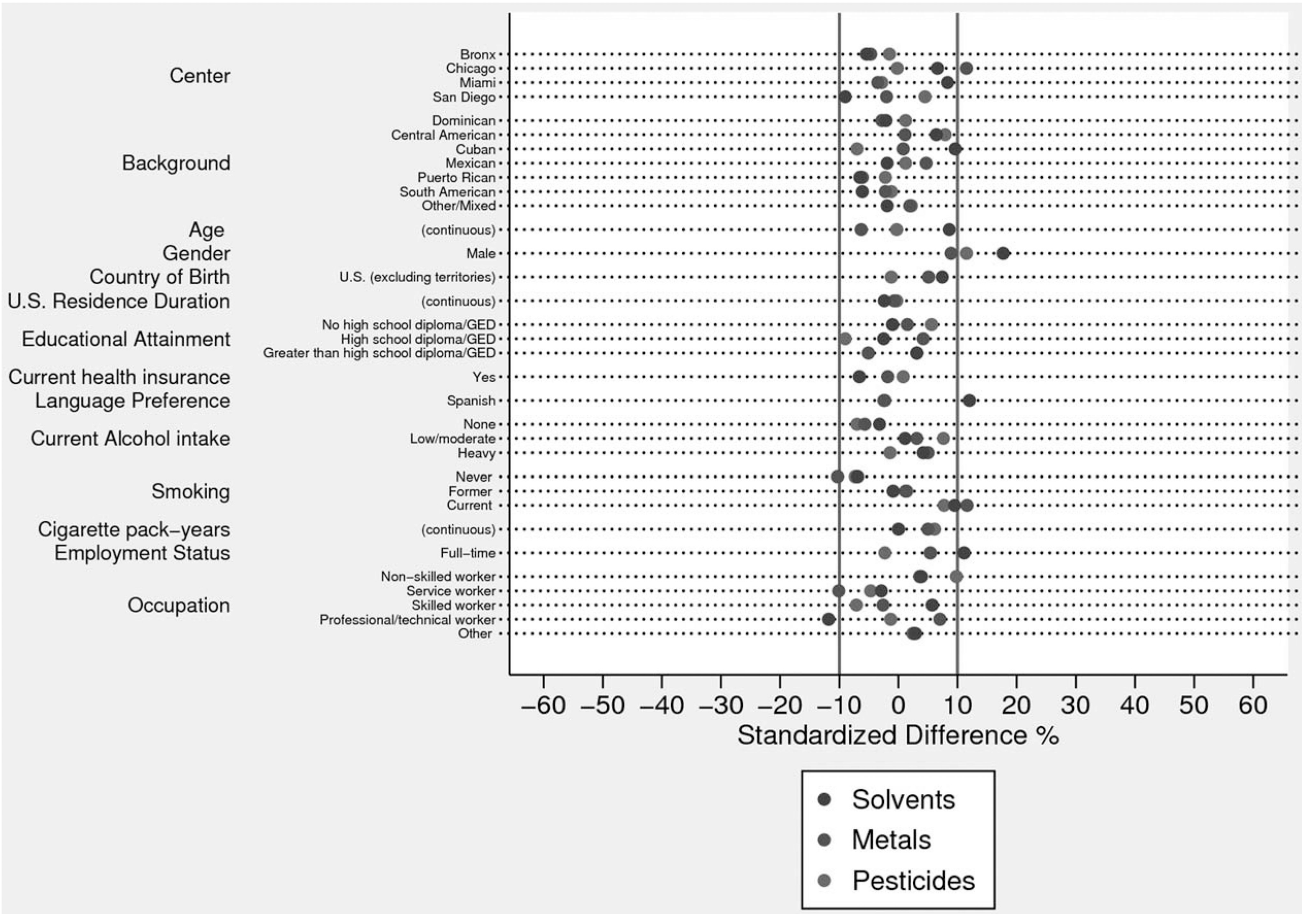

FIGURE 3.
Standardized differences of covariates using analytic weights.

TABLE 1

Selected Characteristics in Relation to Metabolic Syndrome Prevalence Among Participants Currently Employed in HCHS/SOL (n = 7,127)

	Abdominally Obese*		High Triglycerides†		Low HDL‡		High Blood Pressure§		High Fasting Glucose//		Metabolic Syndrome¶	
	%	***P***	%	***P***	%	***P***	%	***P***	%	***P***	%	***P***
Overall	49.2		26.9		38.4		27.2		28.5		27.3	
Center		<0.01		<0.01		0.09		<0.01		0.45		0.02
Bronx	46.8		19.2		35.9		27.5		26.5		24.4	
Chicago	45.5		28.6		42.0		19.7		29.5		24.7	
Miami	49.0		29.4		39.4		33.2		29.4		29.6	
San Diego	54.1		30.2		37.1		25.9		28.7		29.2	
Background		0.04		<0.01		<0.01		<0.01		<0.01		<0.01
Dominican	51.6		12.0		30.9		31.1		20.8		20.9	
Central American	48.3		33.2		42.3		26.0		25.4		27.6	
Cuban	49.3		30.1		38.6		38.3		32.3		32.2	
Mexican	50.6		29.1		39.6		22.9		30.6		27.6	
Puerto Rican	49.0		22.8		40.7		31.3		29.2		29.0	
South American	37.6		27.7		32.1		18.0		22.6		19.2	
Other/Mixed	48.1		22.6		35.8		19.9		23.2		23.8	
Age, years		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01
18–24	33.5		10.4		34.5		7.5		11.6		7.4	
25–34	43.2		22.3		40.0		13.7		17.7		18.3	
35–44	53.2		32.7		42.7		23.8		30.9		30.9	
45–54	55.6		34.3		37.3		39.5		37.5		36.6	
≥55	60.8		31.9		33.5		62.8		50.0		45.8	
Gender		<0.01		<0.01		<0.01		<0.01		<0.01		0.39
Female	69.4		19.5		44.2		23.3		20.4		26.6	
Male	32.5		32.9		33.5		30.4		35.2		27.8	
Country of Birth		0.81		<0.01		0.63		<0.01		<0.01		<0.01
U.S. (excluding territories)	49.5		19.4		37.6		19.9		21.6		21.5	
Foreign	49.0		28.9		38.6		29.3		30.4		28.9	

	Abdominally Obese*		High Triglycerides†		Low HDL‡		High Blood Pressure§		High Fasting Glucose//		Metabolic Syndrome¶	
	%	P	%	P	%	P	%	P	%	P	%	P
U.S. Residence Duration		<0.01		0.81		0.41		<0.01		0.01		<0.01
<10 years	40.8		27.2		37.2		23.9		25.5		23.4	
≥10 years	52.7		26.7		38.9		28.6		29.8		28.9	
Educational Attainment		0.52		<0.01		0.28		<0.01		<0.01		<0.01
No high school diploma/GED	50.0		31.0		38.1		30.5		35.8		31.9	
High school diploma/GED	47.5		25.4		40.4		23.1		26.6		24.4	
Greater than high school/GED	49.7		25.4		37.2		27.9		25.5		26.3	
Current health insurance		0.42		<0.01		0.22		0.01		0.94		0.93
No	48.4		29.3		39.4		25.5		28.6		27.3	
Yes	50.0		24.0		37.2		29.1		28.4		27.2	
Language preference		0.85		<0.01		0.29		<0.01		<0.01		<0.01
Spanish	49.1		28.7		39.0		29.2		30.4		29.1	
English	49.4		21.0		36.4		21.0		22.5		21.7	
Current alcohol intake		<0.01		0.14		<0.01		0.08		0.96		0.17
None	53.9		25.3		42.6		27.9		28.6		28.6	
Low/Moderate	45.4		27.6		35.8		26.0		28.3		25.9	
Heavy	48.3		30.9		30.7		32.5		29.2		29.3	
smoking		0.04		<0.01		0.09		<0.01		<0.01		<0.01
Never	50.2		23.6		38.6		24.9		25.6		24.6	
Former	50.2		35.3		34.8		37.5		40.4		35.6	
Current	44.4		30.9		40.9		25.8		27.8		29.0	
Cigarette pack-years		0.18		<0.01		0.35		<0.01		<0.01		<0.01
0	50.2		23.6		38.6		24.9		25.6		24.6	
1–9	48.0		31.5		36.6		25.7		30.7		28.5	
≥10	45.7		36.2		40.6		43.2		40.5		39.8	
Employment status		<0.01		<0.01		0.05		<0.01		<0.01		0.47
Part-time (≤35 hours/week)	54.1		23.9		40.7		23.6		24.1		26.5	
Full-time (>35 hours/week)	46.6		28.4		37.2		29.1		30.8		27.7	
Occupation		<0.01		0.79		0.24		0.14		0.05		0.62

	Abdominally Obese[*]		High Triglycerides[†]		Low HDL[‡]		High Blood Pressure[§]		High Fasting Glucose[//]		Metabolic Syndrome[¶]	
	%	*P*	%	*P*	%	*P*	%	*P*	%	*P*	%	*P*
Nonskilled worker	47.9		26.9		41.0		25.1		29.4		26.8	
Service worker	56.0		27.0		38.7		29.9		28.5		29.2	
Skilled worker	45.5		28.0		36.4		28.3		31.6		27.8	
Professional/technical	52.5		24.6		38.6		25.2		24.1		25.2	
Other	45.6		26.9		36.1		27.7		26.6		26.9	

[*] Abdominal obesity was defined as a waist circumference ≥88 cm for women or ≥102 cm for men.

[†] High triglycerides was defined as ≥150 mg/dL.

[‡] Low HDL was defined as <50 mg/dL for women or <40 mg/dL for men.

[§] High blood pressure was defined as systolic blood pressure ≥130 mm Hg, diastolic blood pressure ≥85 mm Hg, or current use of medication to treat high blood pressure.

[//] High fasting blood glucose was defined as ≥100 mg/dL or current use of medication to treat hyperglycemia.

[¶] Metabolic syndrome was defined using the AHA/NHLBI definition of meeting at least 3 of the 5 criteria (abdominal obesity, high triglycerides, low HDL, high blood pressure, or high fasting blood glucose).

TABLE 2

Selected Characteristics in Relation to Occupational Exposures Among Participants Currently Employed in HCHS/SOL ($n = 7,127$)

	Current Occupational Exposure					
	Solvents		Metals		Pesticides	
	%	***P***	%	***P***	%	***P***
Overall	6.3		8.6		4.7	
Center		<0.01		<0.01		<0.01
Bronx	4.6		7.9		6.6	
Chicago	8.5		12.6		4.3	
Miami	7.3		6.5		3.1	
San Diego	5.3		8.7		4.8	
Background		0.03		0.01		0.13
Dominican	4.7		7.5		5.8	
Central American	9.2		9.5		4.2	
Cuban	7.7		7.4		2.9	
Mexican	6.3		10.4		4.7	
Puerto Rican	4.8		7.4		6.3	
South American	5.0		3.8		3.6	
Other/Mixed	4.4		6.4		7.0	
age, years		0.32		<0.01		0.68
18–24	4.6		8.8		3.5	
25–34	6.6		11.1		5.1	
35–44	6.0		8.6		5.0	
45–54	7.4		6.9		4.6	
≥55	6.5		5.8		4.9	
Gender		<0.01		<0.01		<0.01
Female	2.8		3.5		2.8	
Male	9.1		12.7		6.2	
Country of birth		0.16		0.90		0.78
U.S. (excluding territories)	5.1		8.5		4.9	

	Current Occupational Exposure					
	Solvents		Metals		Pesticides	
	%	***P***	%	***P***	%	***P***
Foreign	6.6		8.6		4.6	
U.S. residence duration		0.64		0.99		0.03
<10 years	6.0		8.6		3.5	
≥10 years	6.4		8.6		5.2	
Educational attainment		0.24		<0.01		0.36
No high school diploma/GED	7.0		10.2		5.7	
High school diploma/GED	6.8		10.6		4.1	
Greater than high school/GED	5.6		6.4		4.5	
Current health insurance		0.11		0.02		0.03
No	6.9		9.6		3.9	
Yes	5.7		7.4		5.6	
Language preference		<0.01		0.03		0.78
Spanish	6.9		9.1		4.6	
English	4.5		6.9		4.9	
Current alcohol intake		0.04		<0.01		<0.01
None	5.1		6.0		3.3	
Low/Moderate	7.1		10.1		5.7	
Heavy	7.2		12.9		5.6	
Smoking		0.07		<0.01		0.04
Never	5.7		7.6		4.2	
Former	7.1		8.7		4.3	
Current	7.8		12.0		7.0	
Cigarette pack-years		0.05		<0.01		0.15
0	5.7		7.6		4.2	
1–9	7.3		11.4		5.2	
≥10	7.8		8.4		6.6	
Employment status		<0.01		<0.01		0.32
Part-time (≤35 hours/week)	4.3		6.3		4.2	

	Current Occupational Exposure					
	Solvents		Metals		Pesticides	
	%	*P*	%	*P*	%	*P*
Full-time (>35 hours/week)	7.4		9.7		4.9	
Occupation		<0.01		<0.01		0.33
Nonskilled worker	7.1		10.5		5.0	
Service worker	4.0		4.5		3.5	
Skilled worker	9.7		12.3		4.7	
Professional/technical	2.7		4.8		4.0	
Other	6.1		8.2		6.1	

TABLE 3

Adjusted* Associations Between Current Occupational Exposures and Metabolic Syndrome Endpoints

	Abdominal Obesity† PR (95% CI)	High Triglycerides‡ PR (95% CI)	Low HDL§ PR (95% CI)	High Blood Pressure// PR (95% CI)	High Fasting Glucose¶ PR (95% CI)	Metabolic Syndrome# PR (95% CI)
Solvents	1.00 (0.85–1.16)	1.00 (0.80–1.26)	0.81 (0.66–1.00)	1.32 (1.09–1.60)	1.01 (0.82–1.26)	0.95 (0.75–1.20)
Metals	1.00 (0.88–1.14)	1.04 (0.86–1.27)	1.06 (0.90–1.24)	1.04 (0.86–1.27)	0.99 (0.80–1.22)	1.07 (0.88–1.31)
Pesticides	0.98 (0.82–1.16)	1.03 (0.80–1.31)	0.93 (0.74–1.18)	1.02 (0.81–1.30)	1.13 (0.92–1.39)	1.09 (0.87–1.38)

95% CI, 95% confidence interval.

*Adjusted for confounders using the analytic weights.

†Abdominal obesity was defined as a waist circumference ≥88 cm for women or ≥102 cm inches for men.

‡High triglycerides was defined as ≥150 mg/dL.

§Low HDL was defined as <50 mg/dL for women or <40 mg/dL for men.

//High blood pressure was defined as systolic blood pressure ≥130 mm Hg, diastolic blood pressure ≥85 mm Hg, or current use of medication to treat high blood pressure.

¶High fasting blood glucose was defined as ≥100 mg/dL or current use of medication to treat hyperglycemia.

#Metabolic syndrome was defined using the AHA/NHBLI definition of meeting at least 3 of the 5 criteria (abdominal obesity, high triglycerides, low HDL, high blood pressure, or high fasting blood glucose).