



Disparities in Prevalence, Treatment, and Control of Hypertension among Low Wage Immigrant Workers beyond Health Insurance Coverage: The Las Vegas Hotel Room Cleaners Blood Pressure Study

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Abstract

Objective: To identify disparities in hypertension prevalence, treatment and control among female hotel room cleaners (HRC) compared to the U.S. population that may persist beyond health insurance coverage.

Methods: A community-based participatory research project obtained resting blood pressure readings and information on antihypertensive medication from 866 Las Vegas HRCs. Their rates of hypertension prevalence, awareness, treatment, and control were compared with national survey data (NHANES) stratified by age, nativity, ethnicity, and health insurance status.

Results: HRCs with health insurance reported a lower prevalence of hypertension (22.7%) than the general population (27.7%), but U.S. born HRCs had a higher prevalence (31.3%). The prevalence among 20-39 year old HRCs was twice as high than in the general U.S. population (9.7% versus 4.7%). Awareness of hypertension (61.7% versus 71.3%), anti-hypertensive medication (49.2% versus 60.3%) and hypertension control (21.4% versus 40.9%) were consistently lower among all HRCs. The youngest (20-39 years) and oldest (> 60 years) age groups reached less than 1/3 of comparable national hypertension control rates.

Conclusions: Low wage immigrant workers, even if covered by health insurance, may experience substantial disparities in hypertension prevalence, awareness, and management. Control rates among HRCs and the general population fell short of the national public health target of 50%. Coordinated efforts of insurance plans, medical providers, and stakeholders at work are recommended to identify and modify the specific cognitive, language, financial, and structural (including work organizational) barriers to prevention, detection, and control of hypertension in such vulnerable populations.

Keywords

Cardiovascular disease, Minority health, Immigrant health, Race, Ethnicity, Hispanic health paradox

Abbreviations

ABP: Ambulatory blood pressure, ACA: Affordable Care Act, ACE-inhibitor: Angiotensin-Converting Enzyme Inhibitor, CBPR:

Community-Based Participatory Research, HCHS/SOL: Community Health Study/ Studio of Latinos, HHANES: Hispanic Health and Nutrition Examination Survey, HRC: Hotel Room Cleaners, NHANES: National Health and Nutrition Examination Survey, RBP: Resting Blood Pressure

Introduction

The estimated global costs of high blood pressure in terms of health care and welfare expenditures alone were \$ 372 billion in 2001 [1] and costs borne by U.S. employers for related health insurance, short-term disability, absenteeism and presenteeism were estimated to be \$392 annually per employee [2]. In the United States, 1 out of every 3 adults has high blood pressure [3]. Approximately 41% of U.S. adults are projected to have hypertension by the year 2030 [3]. Hypertension is a major risk factor for cardiovascular disease, heart disease, stroke, and kidney disease [3,4]. While the exact causes of hypertension in individuals remain mostly unknown, age, gender, socio-economic status, and race/ethnicity-related disparities of hypertension prevalence, awareness, treatment and control have been reported in several populations [3,5,6]. Occupational risk factors for hypertension have also been described including exposure to noise [7], lead [8], other chemicals [9] and psychosocial risk factors [10].

Hypertension has been identified as the most prevalent chronic condition in older adults (≥ 65 years) [11,12]. Between 1988 and 2000, only 31% of hypertensive individuals in the U.S. had their blood pressure controlled, corresponding to over 40 million U.S. adults with uncontrolled hypertension [13]. The estimated direct cost attributable to uncontrolled hypertension per year is nearly US \$1 billion [14]. In the U.S., awareness of hypertension is lowest among 18-39 year olds [15]. Moreover, despite improving hypertension control over the past 10 years, medication use remains low for hypertensives aged 18 to 39 years compared to those aged 40+ years [3].

Disparities in hypertension prevalence across racial / ethnic groups have persisted at least since 1960, with prevalence remaining highest among non-Hispanic black adults [1-4]. Among Hispanic/

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Latinos living in the U.S., the prevalence varied by country of origin [16]. Hispanics were less aware of their hypertension than non-Hispanic blacks and less likely to take medication compared to non-Hispanic black and non-Hispanic whites [17].

Health disparities in hypertension have been ascribed to a variety of factors including health insurance coverage and access to medical care that have been traditionally limited for low wage immigrant worker populations. For example, in the general U.S. population of 2004, 36.2% of Hispanics were uninsured compared to 14.5 percent for non-Hispanic whites [18]. To what extent cardiovascular health disparities exist beyond disparities in access to medical care is not well understood. While the Affordable Care Act (ACA) may provide better access to health insurance for immigrant and other low-wage workers in the U.S., any persisting health disparities among the insured constitute a need for additional interventions addressing those disparities.

This study of low wage immigrant hotel room cleaners who have been covered by health insurance through their employers already before the ACA, aims to determine the extent of any disparities in hypertension prevalence, awareness, treatment, and control that may persist beyond the provision of health care access through insurance coverage in this vulnerable population.

Hotel room cleaners (HRC) constitute about a quarter of the ca. 1.8 million low-wage, predominantly female immigrant housekeeping workers in the U.S. traveller accommodation industry [19] whose work is characterized by physically demanding job tasks, low job control, increasing use of contingency employment, and few opportunities for career advancement [20].

Several health-related disparities have been reported for cleaners who carry an overall high burden of chronic musculoskeletal and cardiovascular disease and associated disability [20-24]. However, little is known about disparities related to hypertension [25], a highly prevalent and modifiable major risk factor for cardiovascular disease and premature death [3,4].

Data from two representative national surveys, the National Health and Nutrition Examination Survey (NHANES) and the Hispanic Community Study/ Study of Latinos (HCHS/SOL), provide comparison data on hypertension prevalence, awareness, treatment, and control rates in the general U.S. female working population by age and race/ethnicity subgroups for our study.

Study materials and protocols, including surveys and implicit consent, were approved by the Institutional Review Boards at the University of California at Berkeley and San Francisco.

Subjects and Methods

Las Vegas hotel room cleaner study population and design

A community-based participatory research (CBPR) study of health and working conditions was conducted in Las Vegas in 2002 as a collaborative effort of the Las Vegas Culinary Workers Union Local 226 (Hotel Employees and Restaurant Employees Union), the Labor Occupational Health Program of the University of California, Berkeley, and the Department of Medicine of the University of California, San Francisco. One goal of that study was to assess the prevalence, awareness, treatment, and control of hypertension as an important aspect of cardiovascular health in this population that may be amenable to worksite-based primary prevention and health promotion efforts to reduce the burden of chronic disease and associated health care costs in this population. Rising health care costs had become an increasing concern for both employers and unions who had to renegotiate labor contracts that determine the cost-sharing of the jointly administered comprehensive company health insurance plan.

The eligible study population consisted of all 1276 day-shift hotel room cleaners from five unionized hotels in Las Vegas. The hotels were selected based on recommendations from union leaders to

assure diversity in terms of services offered by hotels, diversity of workforce and likelihood of workforce participation. Two partially overlapping study samples were recruited, the first comprising participants in the main worker survey ($n = 941$, participation rate = 74%) and the second consisting of 589 participants in a separate ambulatory blood pressure (ABP) study. Although more workers had expressed interest to participate in the ABP study, recruitment had to be curtailed after two weeks due to limited resources in terms of research staff time and availability of ambulatory blood pressure instruments. All participants in the ABP study received a 2-hour training in ABP measurement. During the training, research staff measured resting blood pressures (RBP) and administered a short 2-page questionnaire recording information on demographics, history and treatment of hypertension, and current workload. Right after the training, participants recorded their heart rate and blood pressure several times at home and during the next working day. More details and results from this ABP study will be reported elsewhere. In this report, we only use the RBP readings taken by researchers during the ABP study training. In addition, we use RBP measurements taken by research staff during the main survey administration among 290 female participants (13 of whom also participated in the ABP study), yielding a total study sample of 866 workers with RBP measures (81% of all study participants; 68% of the total eligible study population).

All workers of these unionized hotels were covered by the same comprehensive health insurance plan as part of their wage benefits during their entire employment in these hotels. During the time of the study, unionization rates in the U.S. have been low in general (13.2%) and even lower (7.6%) for traveller accommodation industry [26,27]. In 2002, 15% of the total U.S. population and 23.5% of those with household incomes below \$25,000 had no health insurance (neither private, employer-based, or government-funded), and 18 % of the working population aged 18-64 years old who worked were uninsured during that year [28].

Survey instrument development and administration

The details of the methodology of the participatory research process have been described elsewhere [29,30]. Briefly, 26 room cleaners participated in an advisory group and were involved in all aspects of the project, including the formulation of the research questions, survey development, implementation of the study, and interpretation of results.

The main comprehensive survey of work conditions and health among room cleaners was a combination of items developed in focus group discussions following the CBPR approach and standardized instruments used by the authors in an earlier study of San Francisco hotel room cleaners [31]. A draft questionnaire was pilot tested with 30 HRCs. The room cleaner advisory council evaluated questions for content validity and reading level. The questionnaire was translated into Spanish and Serbo-Croatian in order to reach both the largest ethnic group and a relatively new group the union wished to reach out to. The final 29-page instrument included 68 questions assessing physical workload, psychosocial working conditions, ergonomic problems, interactions with medical professionals, health status and behavior, care for dependents at home, and work-related pain, injury, and injury reporting. Three items assessed past doctor's diagnosis of hypertension, its treatment, and if treated, barriers to adherence to treatment. A shorter 2-page survey administered to participants in the ABP training included the first two items on hypertension, demographic information, and also assessed general health and current physical workload.

Main survey questionnaires were collected in a meeting room only accessible to university researchers, participants, and survey administrators to ensure an anonymity. The survey administrators were local college students and HRC from non-participating hotels. They received half-day training from university researchers. Most administrators spoke Spanish, Serbo-Croatian, or one or more Asian languages; they served as translators and read the questions to illiterate participants. Completion of the main survey took on average

1 to 2 hours. Completed surveys were collected in sealed envelopes by university researchers. The short surveys were administered by university research assistants during the ABP training sessions.

Comparison populations

NHANES 1999-2004: We use raw data (n = 29,402) from 1999-2004 NHANES, a stratified multistage probability sample of the civilian, non-institutionalized U.S. population with oversampling of Mexican Americans. We restricted data to the non-pregnant female subpopulation, aged ≥ 20 years, who were currently working at a job or business [32] and calculated age-standardized (to the 2000 U.S. census [33]) prevalence rates of hypertension, awareness, treatment, and control, separately for those with and without health insurance, foreign-born, U.S. born, and by ethnicity and age group. We used the average of all RBP readings to determine hypertension. This method allowed for direct comparisons with respective prevalence rates among HRCs.

Hispanic Community Health Study (HCHS)/ Study of Latinos (SOL)

Because HRCs self-identified predominantly as Hispanic and because hypertension rates differ by country of origin [16], we also compared prevalence rates by country of birth. However, the NHANES study included too few Hispanic workers for stable estimates by birth-place. Therefore we used instead the HCHS/SOL survey based on 16,415 self-identified Hispanic/Latinos aged 18 to 74 randomly selected within census block groups in four U.S. communities (Bronx, New York; Chicago, Illinois; Miami, Florida; San Diego, California). Areas with a high concentration of Hispanic/Latino residents and persons aged 45-74 years old were oversampled. Sampling weights adjusted for sampling probability and non-response. Countries and regions of origin were coded as Cuba, Dominican Republic, Mexico,

Puerto Rico, Central America, and South America. Respective age-standardized (to 2000 U.S. census) hypertension prevalence rates were obtained from published reports [16]. In contrast to HRC and NHANES, HCHS/SOL hypertension prevalence was based only on the average of the last two of three RBP readings and from a later time period (2008-2011).

Statistical analyses

The prevalence of hypertension, awareness, treatment, and control as percent of HRC workers was calculated for all workers and by age and race/ethnicity subgroups. Additional stratification by health insurance status and country of birth allowed for more specific comparisons with respective general population estimates based on the national surveys NHANES and HCHS/SOL [16]. To estimate general population prevalence, we analyzed publicly available raw data from the National Health and Nutrition Examination Surveys (NHANES) for the years 1999-2004 that bracket the year of our HRC study. We used population sample weights provided by NHANES and used U.S. 2000 census data for age-standardization by 10-year intervals [33]. In contrast to NHANES recommendations followed by authors of previous publications of NHANES hypertension estimates that disregarded the first blood pressure reading when calculating averages, we used all available blood pressure readings in order to obtain more reliable estimates [32] and to be more comparable with our HRC estimates that also used all readings. In a sensitivity analyses we compared both methods using the same NHANES data and found that differences in prevalence estimates were in the expected direction but negligible (122.7/77.2 mmHg excluding the first reading versus 123.0/77.3 mmHg including all readings). Prevalence data in the SOL study were obtained from reports based on estimates excluding the first reading. All analyses were performed in STATA version 13.1 (StataCorp, College Station, TX).

Table 1: Characteristics of female hotel room cleaners with resting blood pressure measures. Total sample (N = 846), main survey (N = 278) and ambulatory blood pressure (ABP, N = 580) subsamples, Las Vegas, 2002

Individual Characteristic	Total Sample				Main Survey				ABP Study			
	No.	%	Mean	S.D.	No.	%	Mean	S.D.	No.	%	Mean	S.D.
Age	843		41.9	9.7	276		42.4	9.9	579		41.5	9.6
20-39	330	39.2			102	37.0			230	39.7		
40-59	484	57.4			164	59.4			329	56.8		
≥ 60	29	3.4			10	3.6			20	3.5		
Missing	3				2				1			
Race/ Ethnicity												
Mexican American	341	47.9			108	38.8			240	53.8		
Other Hispanic	228	32.0			83	29.9			149	33.4		
White, non-Hispanic	28	3.9			18	6.5			10	2.2		
Black, non-Hispanic	32	4.5			12	4.3			20	4.5		
Other	83	11.7			57	20.5			27	6.1		
Missing	134				-				134			
Born in the U.S.												
Yes	96	13.6			44	16			52	9.0		
No	609	86.4			231	84			390	67.2		
Missing	141				3				138	23.8		
Smoking status												
No	621	86.9			227	81.7			405	90.2		
Yes	94	13.1			51	18.4			44	9.8		
Missing	131				-				131			
BMI (kg/m ²)	701		28.2	5.3	271		27.3	5.2	442		28.7	5.3
Doctor's diagnosis of hypertension												
Yes	172	24.5			70	25.7			104	23.6		
No	529	75.5			202	74.3			336	76.4		
Missing	145				6				140			
Resting blood pressure (mmHg)												
Systolic	846		123.0	16.9	278		126.4	19.1	580		121.5	15.6
Diastolic	846		77.3	10.5	278		78.5	11.8	580		76.8	9.7

Table 2: Prevalence of hypertension by age and ethnicity among female hotel room cleaners (Las Vegas 2002, n = 846) compared to the female U.S. working population (NHANES, 1999-2004, n = 29,402) by nativity and health insurance coverage.

	With health insurance												Without health insurance	
	Las Vegas hotel room cleaners						NHANES						NHANES	
	All		Foreign born		U.S. born		All		Foreign born		U.S. born		All	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Total	22.7	19.9-25.7	23.5	20.2-27.1	31.3	22.2-41.5	27.7	25.7-29.6	27.5	20.8-35.5	27.7	25.8-29.7	21.1	16.1-27.1
Age group (yrs)														
20-39	9.7	6.7-13.4	10.7	7.1-15.4	13.6	5.2-27.4	4.7	3.3-6.9	3.5	1.2-9.7	4.9	3.3-7.2	5.5	3.4-8.6
40-59	30.2	26.1-34.5	30.8	26.0-35.9	42.9	28.8-57.8	30.4	26.7-34.5	28.2	19.1-39.6	30.7	26.6-35.1	22.5	15.2-32.0
≥ 60	48.3	29.4-67.5	45.0	23.1-68.7	100	–	62.4	56.2-68.3	67.6	43.3-85.1	62.1	55.4-68.3	45.5	25.2-67.4
Race/Ethnicity														
Mexican American ^a	22.9	18.5-27.7	22.9	18.5-27.7	–	–	25.2	20.1-31.2	19.7	13.2-28.3	28.3	22.2-35.4	31.8	28.3-35.4
Other Hispanic ^b	21.9	16.7-27.9	22.7	16.8-29.4	16.7	7.0-31.4	30.2	21.7-40.4	30.2	20.7-41.7	29.5	23.0-36.8	17.5	8.6-32.4
White, non-Hispanic	35.7	18.6-55.9	28.6	3.7-71.0	38.1	18.1-61.6	26.5	24.4-28.6	24.7	13.4-40.9	26.6	24.5-28.8	16.3	9.9-25.7
Black, non-Hispanic	40.6	23.7-59.4	0	–	50.0	29.9-70.1	40.1	35.9-44.4	38.8	24.4-55.4	40.1	35.7-44.7	30.6	20.2-43.4
Other ^c	30.1	20.5-41.2	29.7	19.7-41.5	28.6	3.7-71.0	19.7	10.4-34.2	25.1	12.6-43.9	14.1	5.6-31.1	49.1	37.1-61.2
Missing	11.9	7.0-18.7	–	–	–	–	–	–	–	–	–	–	–	–

^a Mexican American: Participants self identified as Mexican American (n = 341)

^b Other Hispanic: Participants self identified as Latino but not Mexican American.

^c Other: Participants self identified as neither Mexican American nor as other Hispanic, white or black

Table 3: Prevalence of hypertension by country of origin among Hispanic female hotel room cleaners (Las Vegas 2002, N = 846) compared to the Hispanic U.S. female working population (Hispanic Community Health Study (HCHS)/ Study of Latinos (SOL) 2008-2011, N = 9100, cited from Daviglus et al. 2012)

Country of Origin	Hispanic Female Hotel Room Cleaners (Las Vegas 2002) N = 846		U.S. Hispanic Female Working Population (HCHS/SOL 2008-2011) N = 9100	
	%	95% CI	%	95% CI
All	22.7	19.9-25.7	23.5	22.4-24.5
Mexico	22.9	18.5-27.7	19.5	17.8-21.3
Other Hispanic countries	22.6	16.7-29.5	23.1	22.2-24.0
Cuba	29.6	13.8-50.2	26.4	24.5-28.3
Dominican Republic	25.0	0.6-80.6	26.1	23.2-29.3
Puerto Rico	100.0	–	29.1	26.4-31.9
Central America	19.7	13.3-27.5	25.6	22.9-28.4
South America	30.8	9.1-61.4	15.9	13.2-19.0
Other countries	27.4	18.2-38.2	–	–
Unknown	20.9	16.0-26.5	–	–

Table 4: Awareness of hypertension by age and ethnicity among hypertensive female hotel room cleaners (Las Vegas 2002, n = 846) compared to the hypertensive female U.S. working population (NHANES, 1999-2004, n = 29,402), by health insurance coverage.

	With health insurance						Without health insurance	
	Las Vegas hotel room cleaners			NHANES			NHANES	
	%	95% CI	%	95% CI	%	95% CI		
Total	61.7	54.1-68.9	71.3	63.9-77.8	63.0	48.6-75.4		
Age group (years)								
20-39	35.5	19.2-54.6	66.7	49.8-80.2	44.4	20.9-70.6		
40-59	65.9	57.2-73.9	77.8	71.9-82.8	64.2	45.0-79.7		
≥ 60	83.3	51.6-97.9	68.7	61.9-74.8	92.9	81.8-97.5		
Race/Ethnicity								
Mexican American ^a	61.5	49.8-72.3	68.3	46.8-84.1	43.9	25.2-64.4		
Other Hispanic ^b	64.0	49.2-77.1	81.1	57.1-93.3	87.0	62.0-96.5		
White, non-Hispanic	40.0	12.2-73.8	69.0	58.4-77.9	65.4	41.8-83.2		
Black, non-Hispanic	69.2	38.6-90.9	77.3	64.4-86.5	50.6	41.6-59.7		
Other ^c	62.5	40.6-81.2	75.7	59.9-86.6	64.1	32.0-87.1		

^a Mexican American: Participants self identified as Mexican American.

^b Other Hispanic: Participants self identified as Latino but not Mexican American.

^c Other: Participants self identified neither Mexican American nor as other Hispanic, white or black

Results

Characteristics of the study population

A total of 866 hotel room cleaners had at least one resting blood pressure reading. After excluding 7 male and 13 participants with missing information on gender, the final analytic sample included 846 female HRCs. All study participants were unionized and covered by an employer-sponsored health insurance plan. Other socio-demographic characteristics of the study sample are shown in table 1 for all participants and by two subsamples (participants in the main survey and participants in the ABP training). More than 86 percent of all participants were foreign born, 80 percent were of Hispanic origin with the majority being Mexican American. Only 15.7 % were current smokers. The ABP training subsample included relatively more Mexican Americans and other Hispanics and more current smokers than the main survey subsample. The proportion of workers reporting a doctor's diagnosis of hypertension was similar in both subsamples.

Prevalence of hypertension

Table 2 shows hypertension prevalence by age and ethnicity for HRCs and the general U.S. female working population stratified by health insurance and nativity. In the general population, the insured had higher rates of diagnosed hypertension (27.7%) than the uninsured (21.1%). Among HRCs, prevalence was higher in U.S.

born (31.3%) versus foreign born (23.5%). Total prevalence among HRCs (22.7%) was lower compared to the insured general population (27.7%); this was mostly due to relative low rates among foreign-born Mexican Americans. Foreign-born Mexican American HRCs had a lower prevalence (22.9%) compared to insured Mexican Americans (25.2%) but higher compared to foreign-born Mexican Americans in the general population (19.7%). Non-Hispanic black U.S.-born HRCs had the highest prevalence (50%), 10 points higher than the respective group in the U.S. general population (40%).

The younger age group experiences the greatest relative disparities with prevalence rates among 20-39 year-old HRCs (9.7%) more than twice as high compared to the general population (4.7%).

Table 3 shows hypertension prevalence for Hispanic HRCs and the U.S. Hispanic working population by nativity. Prevalence varies across samples; however HRCs born in Mexico, Cuba, or Central America had a higher prevalence than their comparison groups in the general population.

Awareness of hypertension

Table 4 shows awareness of hypertension by age and ethnicity

Table 5: Treatment of hypertension^a by age and ethnicity among hypertensive female hotel room cleaners (Las Vegas 2002, n = 846) compared to the hypertensive female U.S. working population (NHANES, 1999-2004, n = 29,402), by health insurance coverage.

	With health insurance				Without health insurance	
	Las Vegas hotel room cleaners		NHANES		NHANES	
	%	95% CI	%	95% CI	%	95% CI
Total	49.2	41.9-56.6	60.3	52.6-67.6	50.3	34.9-65.7
Age group (years)						
20-39	22.6	9.6-41.1	52.0	34.2-69.3	35.9	14.5-64.9
40-59	52.8	44.3-61.1	68.0	61.6-73.8	46.8	29.5-64.8
≥ 60	71.4	41.9-91.6	62.2	53.7-70.0	80.7	56.7-93.1
Race/Ethnicity						
Mexican American ^b	46.8	35.3-58.5	50.7	32.1-69.1	35.4	19.4-55.6
Other Hispanic ^c	49.0	34.4-63.7	81.1	57.1-93.3	80.2	57.3-92.5
White, non-Hispanic	50.0	18.7-81.3	58.3	48.3-67.6	49.2	26.4-72.3
Black, non-Hispanic	69.2	38.6-90.9	60.7	44.9-74.6	37.7	26.3-50.7
Other ^d	58.3	36.6-77.9	73.9	57.9-85.3	48.8	29.8-68.2

^a Hypertension treatment defined as currently taking blood pressure lowering medication

^b Mexican American: Participants self identified as Mexican American

^c Other Hispanic: Participants self identified as Latino but not Mexican American

^d Other: Participants self identified neither Mexican American nor as other Hispanic, white or black

for HCRs and the general U.S. female working population stratified by health insurance and nativity. Overall, HCRs awareness of hypertension (61.7%) was 10 points lower compared to insured U.S. workers (71.3%). Awareness was lowest among white non-Hispanic HCRs (40%) while Mexican American HCRs (61.5%) were comparable to all Mexican Americans (68.3%) and foreign-born Mexican Americans (59.8%, data not shown) in the general population. The lowest awareness (35.5%) was observed in 20-39 year old HCRs, more than 30 points lower than in the insured U.S. workforce of the same age. The awareness of hypertension prevalence among the HCR increased with age and reached 83.3% in HCRs over 60 years old, in contrast to the insured U.S. population where awareness was lowest in this age group (68.7%). The uninsured workers over 60 years old though had the highest awareness (92.9%) in the U.S. population.

Treatment of hypertension

Table 5 shows the proportion of hypertensive workers who report treatment with anti-hypertensive medication. HCRs had lower levels of treatment (49.2%) compared to insured U.S. workers in general (60.3%), and those born outside the U.S. in particular (66.5%, data not shown). Hypertension treatment increased steadily with age among HCRs but peaked in the 40-59 year olds among the insured general population.

Mexican American HCRs had a lower prevalence of treatment (46.8%) compared to the same ethnic group in the general U.S. worker population (50.7%), but much higher when compared to the foreign-born subgroup (22.1%, data not shown), however, the population estimates for the latter subgroup showed very wide confidence intervals. The proportion of Other Hispanic HCRs receiving treatment (49%) was consistently lower compared to insured workers (81.1%) and the foreign-born subgroup in the general population (77.7%, data not shown).

Control of hypertension

As displayed in table 6, hypertension was controlled in 21.4% of HCRs with hypertension compared to national rates twice as high among all insured workers (40.9%), and foreign born insured workers (43.5%, data not shown). HCRs in the youngest and oldest age groups reached less than a third of comparable national control rates.

Table 6: Control of hypertension by age group and ethnicity among hypertensive female hotel room cleaners (Las Vegas 2002, n = 846) compared to the hypertensive female U.S. working population (NHANES, 1999-2004, n = 29,402), by health insurance coverage

	With health insurance				Without health insurance	
	Las Vegas hotel Room Cleaners		NHANES		NHANES	
	%	95% CI	%	95% CI	%	95% CI
Total	21.4	15.8-27.8	40.9	33.3-48.9	36.8	23.0-53.1
Age group (years)						
20-39	15.6	5.3-32.8	43.7	26.6-62.3	26.3	8.7-57.3
40-59	23.3	16.7-31.0	44.0	38.3-49.9	30.3	15.9-50.1
≥ 60	14.3	1.8-42.8	31.2	23.8-39.7	65.1	34.4-86.9
Race/Ethnicity						
Mexican American ^a	20.5	12.2-31.2	37.6	21.3-57.2	23.8	11.5-42.9
Other Hispanic ^b	20.0	10.0-33.7	63.3	43.9-79.1	62.8	—
White, non-Hispanic	30.0	6.7-65.2	41.0	30.9-51.8	39.7	26.0-55.4
Black, non-Hispanic	53.9	25.1-80.8	31.0	21.3-42.8	11.9	5.2-25.0
Other ^c	20.0	6.8-40.7	56.8	42.6-69.9	38.4	—

^a Mexican American: Participants self identified as Mexican American

^b Other Hispanic: Participants self identified as Latino but not Mexican American

^c Other: Participants self identified neither Mexican American nor as other Hispanic, white or black

Mexican American (20.5%) and Other Hispanic (20.0%) HCRs had lower hypertension control compared to national rates (37.6% and 63.3%, respectively). The smallest percentage of control of hypertension was found for the foreign-born NHANES Mexican American females with health insurance (3.2%, data not shown). Non-Hispanic white HCRs had relatively low (30%) and non-hispanic black HCRs relatively high (54%) rates of control compared to national rates of 40% and 31%, respectively.

Discussion

Disparities in hypertension prevalence

Prevalence of hypertension assessed by surveillance methods independently from health care providers in both Las Vegas hotel workers and the general U.S. population was not consistently associated with health insurance coverage. Several disparities were observed within and between insured populations. HCRs' hypertension prevalence was lower (22.7%) compared to the insured U.S. general population (27.7%); but U.S. born HCRs had a higher prevalence (31.3%) than the general population and the youngest HCR age group had a prevalence twice as high than the general population. This pattern is consistent with the acculturation hypothesis derived from epidemiological studies showing that disease patterns of immigrant populations tend to become more similar to disease rates in the U.S. over time, and especially among second-generation immigrants [34-36]. For example, Morales [37] reported that among females with Mexican background who participated in the NHANES 1999-2004 and the Hispanic Health and Nutrition Examination Survey (HHANES) 1982-1984 survey, first-generation immigrants had lower hypertension prevalence compared to second-generation immigrants and that blood pressure increased with duration of residence in the U.S.. The lower hypertension prevalence observed in Mexican American HCRs are part of a common phenomenon called the "Hispanic Health Paradox" [see p. 247-248 [36]], that implies that lower hypertension rates among Hispanic immigrant HCRs may not persist and instead shift to an increased risk with longer U.S. residence. Future studies need to investigate to what extent time in the U.S. and specific working conditions, acculturation, and changes in dietary and other life-style factors contribute to changing disparities in cardiovascular health among the Hispanic worker population. Our previous research with Las Vegas HCRs indicates that stressful working conditions including ethnicity- and language-based hazard disparities among HCRs may be powerful drivers of health disparities observed in such immigrant workers [38]. For example, among these Las Vegas HCRs, high levels of psychosocial job stress were associated with higher smoking intensity [39].

Non-Hispanic blacks had the highest prevalence among both HRCs and NHANES workers in agreement with previous studies of racial disparities in the U.S. [15,32,40].

Disparities in awareness of hypertension

Awareness of hypertension was more frequent among workers with health insurance than without, however, substantial disparities were observed even within the insured populations. Awareness of hypertension among HRCs (61.7%) was lower compared to both U.S. born (71.3%) and foreign-born U.S. workers (70.2%), particularly in the youngest age group (35.5%). Lower awareness has been attributed to infrequent health care utilization. An analysis of adults < 45 years from NHANES (1999-2012) found that infrequent health care utilization was the main contributor to undiagnosed and untreated hypertension in this group [40]. The observed higher hypertension awareness among older HRCs exceeding national rates (83% versus 69%) may be the result of more frequent health care utilization, in turn possibly due to frequent age- and work-related musculoskeletal pain. For example, the 1-month prevalence of severe low back pain among HRCs (60%) is about twice as high than in general population samples. This pain has been strongly associated with physical workload, work intensification, and ergonomic problems in the studied hotels and nearly two thirds of cases visited a doctor because of this pain [22]. Regardless of the specific causes, our findings suggest that young and middle age HRCs are at elevated risks for undiagnosed hypertension.

Disparities in treatment of hypertension

Treatment of hypertension was more frequent among workers with health insurance than without; however, large disparities persist even between insured populations. Anti-hypertensive treatment with medication among hypertensive HRCs was lower (49.2%) compared to hypertensive workers in the insured general population (60.3%). Disparities were largest (2.3 fold: 22.6% versus 52%) for the youngest HRC age group, while those in the oldest group showed a higher proportion of treated hypertension (71% versus 62%). More recent national surveys observed the same pattern, youngest participants had the lowest proportion of treatment and oldest participants the largest ones [17,41]. Similar to lack of awareness, low health care utilization may be a reason for lack of medical treatment. Analyses of 2003-2006 NHANES data found a positive association between having a usual source of care (defined as "a regular place to go when you are sick or in need of medical advice") and receiving anti-hypertensive treatment among adults ≥ 35 years, even among individuals with health insurance [42]. Young people in general use health services less frequently and are therefore less likely to have a usual source of care. According to the Medical Expenditure Panel Survey (2001-2004), adults without a usual source of care were more likely to be younger, male, and Hispanic, indicating ethnicity- and gender-based disparities possibly mediated by health care utilization. In our study of insured HRCs, treatment rates among Mexican Americans (47%) and Other Hispanics (49%) were lower compared to the general population (50.7% and 81.1%, respectively), consistent with ethnicity-based disparities.

Disparities in control of hypertension

As expected, control of hypertension was higher among workers with health insurance than without, however, our study shows that large disparities may persist even among those covered by health insurance. Among the insured HRCs, hypertension control rates (21%) were only about 1/2 of the national rate (41%), and the greatest disparities were experienced by younger HRCs with treatment rates reaching only about 1/3 of national rates.

In contrast to prevalence and awareness, treatment rates of hypertension were comparatively low in older HRCs (14% versus 31% nationally), however, these data are unreliable because of the small size of this subgroup (n = 14) and corresponding wide confidence intervals.

Disparities were consistent across all ethnic groups except for black non-Hispanic workers, who had higher control rates (53.9%)

than observed in national samples (31%), possibly pointing to differences in quality of health care provided to black and Hispanic HRCs in Las Vegas. However, observed differences were based on rather small numbers of black hypertensive HRCs (n = 13), and need to be interpreted with caution until confirmed with larger samples.

The observed hypertension control rates in both the general population and - to a much larger degree - among Las Vegas hotel room cleaners are far below the national target of 50% published in 2000 by the U.S. Office of Health, Disease Prevention, and Health Promotion in its "Healthy People 2010" report [43]. Based on analyses of NHANES III data, the direct cost attributable to uncontrolled hypertension in the U.S. were estimated to be nearly US \$1 billion per year [14]. Such high costs for untreated hypertension and the observed wide disparities in hypertension control among insured worker populations call for interventions beyond the provision of health insurance coverage alone.

How to reduce hypertension disparities among low wage immigrant workers?

The Affordable Care Act (ACA) also known as "Obama-care" helped to reduce financial barriers to health care by expanding Medicaid eligibility for more low-income people, by providing financial assistance for individuals and small business, and by covering preventive services without copays [44]. In fact, one of the main goals of the ACA is to extent health insurance coverage for low-wage workers using two mechanisms. First, subsidizing low cost health insurance coverage for workers who work for small employers through the new health insurance exchange market. Secondly, making those with an income below the poverty level eligible for Medicaid in the states that approved to expand that coverage [44-46]. According to the U.S. Census Bureau, during 1999 to 2011, the average percentage of insured low-wage workers was 74.6% [47]. In 2013, three years later after the ACA implementation, the proportion of insured increased to 78.4% [48]. However, increased health insurance coverage alone does not guarantee better health care utilization and quality. Additional modifiable financial, structural, and cognitive barriers to health care access associated with health care disparities need to be addressed [49]. Low income workers even with health insurance are struggling to get necessary health care as a result of unaffordable co-pays for office visits, high insurance deductibles, and high drug costs [50]. Those costs have been associated with patients who postponed getting needed health care, skipped a recommended test or treatment, did not fill a prescription, cut pills or skipped doses of medicine. These behaviors have a negative impact on the treatment of chronic diseases [44]. Structural barriers such as inconvenient office hours for medical appointments, waiting time for a medical appointment, or lack of transportation also impact health care utilization by these workers many of whom also have children and other dependents at home to care for. Financial and structural barriers alone or in combination with cognitive barriers like language barriers, limited health literacy, etc, that prevent the patient from acquiring the knowledge to follow successfully a therapeutic treatment are also associated with decrease use of preventive programs, delayed diagnosis, and lack or in appropriate treatment [50].

Clearly, while health insurance coverage is associated with higher hypertension control rates, substantial disparities within the insured working population like those observed in our study require additional strategies to achieve better hypertension control. Such strategies have been developed and used with great success in other populations. For example, a large-scale hypertension program of a Northern California health care company increased hypertension control from 44% to 80% over an eight-year period [51]. The five major components of that program were: a comprehensive hypertension registry, development and sharing of performance control rates, evidence-based practice guidelines, medical assistant visits for follow-up measurements without co-payment charges, and promotion of a single-pill combination (SPC) therapy. The health plan identified patients with hypertension using different sources such as outpatient records, pharmacy data, and hospitalization

records. Internal hypertension control reports were developed for quality improvement. Evidence-based guidelines were developed to aid clinicians and standardize treatment protocols. Medical assistant visits were scheduled 2-4 weeks after any medication adjustment. They informed the primary care physician, who prescribed treatment changes and a follow-up plan. To improve treatment adherence and reduce cost, an ACE-inhibitor / thiazid-diuretic SPC was incorporated into the practice guidelines.

Low-wage workers may experience additional barriers to adequate hypertension control due to specific barriers at the workplace. For example, recommended hypertension control with diuretics may not be followed by HRCs because their work rules typically do not allow them to use guest room toilets. Access to designated employee bathrooms often involves travel across several floors or even buildings potentially further increasing the time pressure at work reported by HRCs [23]. To address such organizational barriers at work, health care providers need to work together with employer and labor representatives to design worksite interventions with tailored strategies for hypertension prevention, screening, treatment and follow-up. The National Institute for Occupational Safety and Health promotes that such health promotion strategies are combined with primary prevention efforts in so-called "Total Worker Health Programs" [52]. Primary prevention strategies may address time pressure and other psychosocial job stressors that have been linked with elevated blood pressure [53,54]. In our study population, An average of 75 percent of all guest room attendants reported that their jobs requires them to work very fast, and 88% report having constant time pressure due to a heavy work load. HRCs in our study were primarily foreign-born, Spanish speaking women who shared in focus groups that both supervisors at work and health care providers off work often talked to them only in English thus limiting effective communication. Both low levels of English proficiency and low-wages may be in part responsible for inadequate health services utilization in this population. Others identified that Latinos with limited English proficiency are at risk for experiencing decreased access to care [55,56]. Provision of translation services and culturally competent health care delivery may be important additional key elements of successful hypertension control programs tailored to the needs of low wage immigrant workers [57].

Study strengths and limitations

This is the first study of hypertension disparities in this large predominantly female immigrant worker HRC population covered by health insurance. A major strength of this study are the comparisons with commensurate age-standardized population samples taking health insurance coverage, working status, age, gender, nativity and ethnicity into consideration and thereby increasing the validity of observed disparities. The assessment of hypertension based on only one occasion of repeated RBP measurements may be considered a limitation since medical guidelines recommend at least two separate doctor visits to diagnose hypertension [58]. However, since hypertension rates in the comparison populations were similarly determined on a single occasion, our method facilitates direct comparisons and reduces the possibility of differential misclassification of hypertension. Non-differential misclassification of hypertension probably attenuated any disparities. Our study was limited to a convenience sample of unionized, health-insured hotel room cleaners in Las Vegas. The distribution of age, gender, nativity, race/ethnicity, and access to and quality of health care may differ for non-unionized workers and other locations and may result in different prevalence rates. However, disparities for HCRs employed without health care benefits can be expected to be even larger than observed in this study and the need for interventions tailored to these worksites may even be greater.

Non-unionized hotels are less likely to provide health insurance coverage, and unionization rates in the U.S. in general are relatively low (11.1% in 2014), including the traveller accommodation industry (8.9%) [26,27]. The ACA reduced the proportion of uninsured among the Hispanic U.S. population from 30.1% in 2002 to 24.3%

in 2013 and among non-citizens from 44.2% to 38.1% [28,48]. This may have helped to reduce health disparities in immigrant worker populations, however, the remaining insurance gap plus the even greater gap in hypertension control between insured low wage HRCs and the insured general working population described in our study call for additional targeted interventions that go beyond the necessary expansion of health insurance coverage.

Conclusions

Substantial disparities in hypertension prevalence, awareness, treatment and control were identified for unionized health-insured low wage immigrant female HCRs in Las Vegas. While disparities in hypertension prevalence varied by age and ethnic subgroup, HRCs in general exhibited lower rates of awareness, treatment, and control of hypertension than respective comparison groups in the U.S. working population. Particularly, control rates were only about one half compared to the insured U.S. worker population. More research is needed to identify the determinants of hypertension and barriers to its control in this population. Primary prevention addressing risk factors for hypertension and secondary prevention to increase awareness of the condition and to improve access to and quality of the clinical management of hypertension overcoming the specific barriers experienced by immigrant workers at their workplaces need to be developed. Such a comprehensive "Total Worker Health" [52] approach to the control of cardiovascular disease risks will require collaborations of health insurance and medical care providers, and employers and employees to identify and meet the particular needs in such vulnerable immigrant worker population.

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