



Original article

Cardiovascular disease risk factors among Latino farmworkers in Oregon

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ABSTRACT

Purpose: Cardiovascular diseases (CVDs) are a leading cause of death among Latinos in the United States. The present study examines the prevalence of four CVD risk factors (diabetes, hypertension, hypercholesterolemia, and obesity) in a large sample of Latino farmworkers in Oregon.

Methods: We pooled secondary, cross-sectional data from Latino vineyard and winery farmworkers ($n = 3382$), in the north Willamette valley, Oregon, between 2004 and 2012. Prevalence was estimated for the four CVD risk factors under study. Multivariable logistic regression analyses were conducted to examine the association between CVD risk factors, sex, and other sociodemographic factors.

Results: Hypercholesterolemia (21.6%) and obesity (22.8%) were the most prevalent CVD risk factors among Latino farmworker participants. In multivariable analyses, men and women, aged 45–64 years, were more likely to have all four CVD risk factors than those aged 18–44. Living in the United States for ten years or more was associated with higher odds of hypertension (OR = 1.72, 95% CI: 1.17–2.54), and obesity (OR = 2.08, 95% CI: 1.57–2.76) among Latino farmworker men. Among Latino farmworker women, living in the United States for ten years or more increased the odds of obesity (OR = 1.81, 95% CI: 1.07–3.06).

Conclusions: Our findings highlight the higher prevalence of CVD risk factors among Latino farmworkers and the need to address CVD risk factors in this population.

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Most of the estimated 1.1 million hired farmworkers in the United States are foreign-born (73%) and of Mexican descendant (68%) [1,2]. In Oregon, the most recent estimates indicate that there are 172,611 farmworkers and their families [3] and has been suggested that up to 40% of them have an indigenous background [4]. Oregon's Willamette valley is one of the largest agricultural regions in the state, producing over 170 different crop and livestock items, including grass seeds, tree fruits and nuts, wine grapes, and berries [5].

Latino farmworkers are essential to the U.S. farming economy, and to their communities back in Mexico and Central America. However, they continue to experience health disparities due in part

to societal factors, such as poor working conditions, legal residence status, stigma, discrimination, and language/cultural barriers [6]. Farmworker populations in the United States are particularly vulnerable to economy's cyclical economic trends, social and economic policies, and hostility toward immigrants. Such challenges make it difficult for farmworkers to access health care services, and engage in health promotion, and disease prevention efforts [7].

Although heart disease, stroke, and diabetes are among the top five leading causes of mortality among Latinos in the United States [8], there is a paucity of studies focused on cardiovascular disease risk factors among Latino farmworkers. The only major national study of cardiovascular disease among Latinos in the United States, the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), recently found that hypercholesterolemia (36.9%, women; 51.7%, men) and obesity (42.6%, women; 36.5%, men) were the most prevalent among Latino adults [9]. However, no rural or farmworker populations were part of this study.

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In California, a study using the California Agricultural Workers Survey found higher prevalence of overweight, obesity, high blood pressure, and hypercholesterolemia among farmworkers, compared with the U.S. adult population [7]; whereas in Michigan, another study found that obesity was the most prevalent cardiovascular disease (CVD) risk factor among Latino farmworkers (47.4% women, 28.3% men) [10]. Both of these Latino farmworker studies, with relatively small sample sizes (Michigan, $n = 282$ [10]; California, $n = 684$ [7]), compared with the HCHS/SOL study ($n = 15,079$ [9]), found that the prevalence of obesity among Latino farmworkers was significantly higher among women than men [7,10]. On the other hand, obese men were more likely to have high blood pressure and diabetes than nonobese men [7]. In the HCHS/SOL “urban” study, Mexican men (the more comparable group to the predominantly Mexican, male Latino farmworker population [1]) had the highest prevalence of diabetes, and second highest of hypercholesterolemia compared with other Hispanic/Latinos in the United States. [9].

Besides the studies in California and Michigan [7,10], no other studies addressing the prevalence of CVD risk factors among Latino farmworkers have been published to date. Therefore, the objective of this study was to examine the prevalence of four CVD risk factors (diabetes, hypertension, hypercholesterolemia, and obesity) in a relatively large sample of Latino farmworkers in Oregon.

Methods

Study design

We pooled secondary, cross-sectional data from Latino vineyard and winery farmworkers ($n = 3382$), in the north Willamette valley, Oregon, between 2004 and 2012. Data come from *¡Salud!* Services Tuality Healthcare medical records database. *¡Salud!* Services staff collect survey and screening results at their wellness clinics held at participating wineries and vineyards across the north Willamette Valley, between May and September of each year. Based in Hillsboro, Oregon, the *¡Salud!* Services program provides approximately 800 onsite wellness clinics annually. Referrals are made to community-based clinics for patients with abnormal test results. The 2004–2012 *¡Salud!* Services database included 13,208 records. Our study was limited to Latino farmworkers in the database who attended wellness clinics for the first time ($n = 3382$). We focused only on the first time visits, to exclude the influence that *¡Salud!* Services programming may have on CVD risk factors. In addition, the database did not include a reliable measure of the number of times participants were seen by *¡Salud!* Services during the study period. Participants were excluded from the study if they had any of the following characteristics: were aged less than 18 years, had attended a wellness clinic previously, or had missing values on any of the four CVD risk factors. In addition, we excluded U.S.-born farmworkers as they made up less than 0.1% of our sample. The final data set comprised 2709 men and 673 women farmworkers, 18–74 years of age.

Measures

Outcome variables included four chronic disease risk factors, following national guidelines and similar to related studies [7,10,11]: diabetes (nonfasting blood glucose ≥ 200 mg/dL), hypertension (systolic blood pressure, ≥ 140 mm Hg; diastolic blood pressure, ≥ 90 mm Hg), hypercholesterolemia (total cholesterol ≥ 200 mg/dL), and obesity (BMI ≥ 30). Sociodemographic correlates included sex, age, marital status, health insurance status, and years living in the United States. Years in the United States was obtained by subtracting year of arrival from first health

screening year and classified into three groups: 0–5 years, 6–9 years, and >10 years.

Statistical analyses

All statistical analyses were conducted using Stata IC 14.0 software (College Station, TX). Summary statistics were calculated for all study variables, including the prevalence of CVD risk factors by sex. Multivariable logistic regression models examined the association between CVD risk factors by sex, while adjusting for sociodemographic factors and screening year. Only characteristics that were associated with CVD risk factors at the level P value less than .10 in bivariate associations were included in multivariable analyses. Criterion utilized for selecting best-fitting model was based on a nonsignificant Hosmer–Lemeshow test using backward selection. A significant statistical P -value less than .05 was used for all relationships between sociodemographic factors and outcomes variables. Available case analysis was used to handle missing data, as only two variables had more than 10% missing (marital status, 12.7%; obesity, 10.3%). This secondary data study was exempted for review by the Oregon State University Institutional Review Board.

Results

Summary statistics, including CVD risk factors prevalence, are presented in Table 1. Most were men (80.1%), between the ages of 18 and 44 years (84.5%), and uninsured (93.6%). Over half were married (55.8%) and living in the United States for less than 5 years (75.7%). The mean age for the group was 34.2 years. Seventy-five percent of farmworkers were recent immigrants, living in the United States for 5 years or less (75.7%), followed by those residing in the United States for more than 10 years (14.7%). Considering the sample as a whole, the prevalence of obesity was the highest in this sample (22.8%), followed by hypercholesterolemia (21.6%). There were significant differences in CVD risk factors prevalence by sex on three of the four CVD risk factors studied. Diabetes prevalence was not significantly different among men and women (5.0% vs. 4.8%, $P = .825$). In turn, hypertension (11.4% vs. 6.3%, $P < .001$) and hypercholesterolemia (23.1% vs. 15.9%, $P < .001$) were more prevalent among men than women. On the other hand, obesity was more prevalent among women than men (33.9% vs. 20.1%, $P < .001$). Supplemental Tables 1 and 2 present prevalence estimates separately for men and women, by sociodemographic factors.

The association of sociodemographic variables and CVD risk factors for men is shown in Table 2. Middle-age farmworker men (aged 45–64 years), were more likely to have all four CVD risk factors: diabetes (odds ratio [OR] = 3.62, 95% CI: 2.38–5.11), hypertension (OR = 2.85, 95% CI: 2.08–3.90), hypercholesterolemia (OR = 2.53, 95% CI: 1.96–3.28), and obesity (OR = 1.82, 95% CI: 1.37–2.41), compared with younger farmworker men (aged 18–44 years). Older farmworker men (aged 65–74 years) were more likely to have diabetes (OR = 5.77, 95% CI: 1.84–18.12), and hypertension (OR = 12.30, 95% CI: 4.79–31.60). Farmworker men who were married/living with a partner were more likely to have hypercholesterolemia (OR = 1.37, 95% CI: 1.10–1.72), and obesity (OR = 1.72, 95% CI: 1.35–2.21), compared with unmarried farmworker men. Farmworker men living in the United States for more than ten years were more likely to have hypertension (OR = 1.89, 95% CI: 1.36–2.65), and obesity (OR = 2.29, 95% CI: 1.74–3.01).

The association of sociodemographic factors with CVD risk factors for women is presented in Table 3. Similar to farmworker men, women aged 45–64 years were more likely to have all four CVD risk factors: diabetes (OR = 7.46, 95% CI: 3.27–17.03), hypertension (OR = 5.07, 95% CI: 2.29–11.17), hypercholesterolemia (OR = 3.77, 95% CI: 2.07–6.86), and obesity (OR = 1.88, 95% CI: 1.11–3.19).

Table 1
Summary profile of Latino farmworkers in the North Willamette valley, Oregon, 2004–2012 (n = 3382)

Characteristics	Total sample n = 3382	Men n = 2709 (80.11%)	Women n = 673 (19.89%)	P*
	n (%)	n (%)	n (%)	
Sociodemographic factors				
Age (y)				
18–44	2584 (84.5)	2084 (84.4)	500 (84.8)	.587
45–64	447 (14.6)	359 (14.6)	88 (14.9)	
64–74	27 (0.9)	25 (1.0)	2 (0.3)	
Marital status, n %				
Single	1306 (44.2)	1055 (44.5)	251 (43.1)	.530
Married/living with a partner	1648 (55.8)	1316 (55.5)	332 (56.9)	
Uninsured	3166 (93.6)	2528 (93.3)	643 (94.8)	.160
Years living in the U.S., n (%)				
0–5 y	2490 (75.7)	1994 (75.7)	496 (75.8)	.446
6–9 y	317 (9.6)	243 (9.2)	74 (11.3)	
≥10 y	482 (14.7)	398 (15.1)	84 (12.9)	
CVD risk factors				
Diabetes	167 (5.0)	135 (5.0)	32 (4.8)	.825
Hypertension	337 (10.37)	297 (11.37)	40 (6.25)	<.001
Hypercholesterolemia	718 (21.6)	613 (23.1)	105 (15.9)	<.001
Obesity	691 (22.8)	490 (20.1)	201 (33.9)	<.001

* χ^2 test.

Married farmworker women and those living in the United States for 10 or more years were more likely to have obesity (OR = 1.57, 95% CI: 1.05–2.37; OR = 1.86, 95% CI: 1.11–3.12, respectively). Uninsured farmworker women were more likely to have hypercholesterolemia (OR = 2.89, 95% CI: 1.17–7.14).

Discussion

Since the 1990s, researchers have pointed out the limited monitoring and treatment of cardiovascular disease conditions among farmworkers in the United States [12–14]. Although there have been a few studies addressing the prevalence of such conditions, their sample sizes have been relatively small [7,10]. To our knowledge, our study is the first to examine the prevalence of four major CVD risk factors in a relatively large Latino farmworker sample. We found that hypercholesterolemia and obesity were the two most prevalent CVD risk factors, followed by hypertension and diabetes.

When comparing CVD risk factors by sex, obesity was markedly higher among women compared with men. The obesity prevalence was similar to the Latino farmworker studies conducted in California and Michigan [7,10]. However, we found a higher prevalence

of hypercholesterolemia than these two studies. Such findings may be due in part to the lower threshold used in our study (total cholesterol \geq 200 mg/dL), compared with the two previous studies (total cholesterol \geq 240 mg/dL) [7,10]. However, a more recent study assessing the feasibility of longitudinal monitoring of CVD risk among farmworker populations used the same threshold that we utilized [11].

Interestingly, rates of diabetes and hypertension were lower in our study compared with the HCHS/SOL [9] and the California [7] studies, while showing similar hypertension prevalence with the Michigan study [10]. Differences may be due in part to the hypertension measure, which focused only on systolic blood pressure. The use of systolic blood pressure as a better marker of hypertension risk has been noted in the literature [15]. Nonetheless, these findings concur with prior research indicating that CVD risk factors are a growing health concern among farmworker populations [7,10,14,16].

As with other Latino populations, years of living in the United States played a significant role in CVD risk prevalence, more so among farmworker men (hypertension, hypercholesterolemia, obesity) than farmworker women (obesity). Previous studies have

Table 2
Multivariable logistic regression of CVD risk factors among Latino farmworker men in the North Willamette valley, Oregon, 2004–2012

Sociodemographic factors	Diabetes (n = 2138)*	Hypertension (n = 2091)*	Hypercholesterolemia (n = 2120)*	Obesity (n = 1963)*
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (y)				
18–44	1	1	1	1
45–64	3.62 (2.38–5.11) [§]	2.85 (2.08–3.90) [§]	2.53 (1.96–3.28) [§]	1.82 (1.37–2.41) [§]
65–74	5.77 (1.84–18.12) [‡]	12.30 (4.79–31.60) [§]	1.78 (0.69–4.56)	1.31 (0.45–3.81)
Marital status				
Single	1	1	1	1
Married/living with a partner	1.29 (0.83–1.99)	1.32 (0.97–1.80)	1.37 (1.10–1.72) [‡]	1.72 (1.35–2.21) [§]
Uninsured	1.01 (0.50–2.03)	0.75 (0.44–1.29)	1.40 (0.96–2.04)	0.93 (0.62–1.39)
Years living in the U.S.				
0–5 y	1	1	1	1
6–9 y	1.08 (0.55–2.10)	0.74 (0.44–1.27)	1.00 (0.71–1.41)	1.34 (0.94–1.91)
≥10 y	1.49 (0.93–2.40)	1.89 (1.36–2.65) [‡]	1.37 (1.05–1.81) [‡]	2.29 (1.74–3.01) [§]
Hosmer–Lemeshow test (Nonsignificance indicates good model fit).	$\chi^2 = 194.3, P = .02.$	$\chi^2 = 145.0, P = .73.$	$\chi^2 = 201.32, P = .01.$	$\chi^2 = 154.31, P = .47.$

* Sample sizes vary because of missing data on individual models for each CVD risk factor. All models adjusted for screening year.

† P < .05.

‡ P < .01.

§ P < .001.

Table 3
Multivariable logistic regression of CVD risk factors among Latino farmworker women in the North Willamette valley, Oregon, 2004–2012

Sociodemographic factors	Diabetes (n = 514) [*]	Hypertension (n = 478) [*]	Hypercholesterolemia (n = 511) [*]	Obesity (n = 483) [*]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age (y)				
18–44	1	1	1	1
45–64	7.46 (3.27–17.03) [§]	5.07 (2.29–11.17) [§]	3.77 (2.07–6.86) [§]	1.88 (1.11–3.19) [†]
65–74	Empty	Empty	Empty	Empty
Marital status				
Single	1	1	1	1
Married/living with a partner	1.52 (0.64–3.59)	1.54 (0.69–3.46)	1.07 (0.62–1.85)	1.57 (1.05–2.37) [†]
Uninsured	2.29 (0.58–9.07)	Omitted	2.89 (1.17–7.14) [†]	1.36 (0.61–3.04)
Years living in the U.S.				
0–5 y	1	1	1	1
6–9 y	0.63 (0.17–2.29)	0.39 (0.09–1.78)	1.33 (0.64–2.74)	1.18 (0.68–2.06)
≥10 y	0.98 (0.36–2.67)	2.17 (0.93–5.09)	0.99 (0.48–2.01)	1.86 (1.11–3.12) [†]
Hosmer–Lemeshow test (Nonsignificance indicates good model fit).	$\chi^2 = 82.84, P = .81.$	$\chi^2 = 58.62, P = .85.$	$\chi^2 = 111.62, P = .12.$	$\chi^2 = 91.53, P = .47.$

Empty = Not available data; Omitted = 29 observations.

^{*} Sample sizes vary because of missing data on individual models for each CVD risk factor. All models adjusted for screening year.

[†] $P < .05.$

[§] $P < .001.$

found that time lived in the United States significantly increased risk for diabetes and hypertension among immigrants of diverse ethnic backgrounds [17,18], including Latinos [9]. Although Latino farmworkers aged 45–64 years comprised only 15% of our study, they were more likely to have all four CVD risk factors. This is important to consider for future targeted efforts to farmworker populations in this age group. Similar to previous studies with farmworker populations [7,14,19], we found most farmworkers were uninsured (94%). By comparison, only 10% of the U.S. adult population and 19% of adult Latinos do not have health insurance [20]. Efforts to address CVD risk factors in this population needs to consider the disproportionate burden that Latino farmworkers may face when accessing the health system without having health insurance.

There are several limitations that need to be considered. First, analyses were limited to first-visit data for the years 2004–2012. Hence, the cross-sectional nature of data prevents us from examining causation, while the period studied may not depict current CVD risk issues among farmworkers today. Second, years of living the United States did not account for time spent outside of the United States. The database collected no information regarding participants leaving the country for periods, or living in the United States year-round or only during growing season, which may introduce bias in our results regarding its association with CVD risk factors. Third, unlike studies in California and Michigan [7,10], our data were limited to farmworkers of a single industry: vineyard and winery workers. Although grapes for wine are the ninth most valuable commodity in Oregon, accounting for over \$170 million across 24,000 acres [21], the results of this study may not be generalizable to other vineyard/winery workers, farmworkers harvesting other commodities, or other Latino farmworkers in Oregon or elsewhere in the United States. In addition, the database did not include a variable distinguishing migrant from seasonal farmworkers, which prevent us from exploring difference across these groups [10]. Fourth, the hypertension measure partly differed from previous studies (i.e., lacked data on receiving antihypertensive medication), and does not take into account recent changes to blood pressure thresholds at the national level (e.g., systolic blood pressure ≥ 130 mm Hg) [22]. Fifth, available case analysis was applied to addressing missing data, which can introduce bias in our prevalence and multivariable estimates. Sixth, other CVD risk factors such as smoking or physical inactivity were not studied here, but should be considered in future research.

Nevertheless, this study is the first to examine the prevalence of four CVD risk factors in a relatively large panel of Latino

farmworkers. Although it may seem difficult to monitor and follow-up CVD risk factors in rural and mobile populations, community-based partnerships may make it more feasible to carry out this work among Latino farmworkers. Recent research has positively explored the feasibility of longitudinal monitoring of CVD risk factors among farmworkers in Minnesota [11], while other researchers in Virginia found that Latino community health workers can be effectively deployed to screen for CVD risk factors among farmworkers [23]. Ultimately, more robust monitoring of CVD risk factors among farmworker populations in the United States is needed. Such efforts can then inform the implementation of more culturally responsive prevention and intervention efforts for Latino farmworkers, who continue to contribute significantly to our nation's economic well-being.

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Appendix

Supplemental Table 1

Prevalence of CVD risk factors among men by sociodemographic characteristics, Oregon, 2004–2012

Sociodemographic factors	Diabetes (n = 2709) [*]	Hypertension (n = 2611) [*]	Hypercholesterolemia (n = 2659) [*]	Obesity (n = 2440) [*]
	Proportion (95% CI)	Proportion (95% CI)	Proportion (95% CI)	Proportion (95% CI)
Age (y)				
18–44	0.04 (0.03–0.05)	0.09 (0.08–0.10)	0.20 (0.19–0.22)	0.18 (0.17–0.20)
45–64	0.14 (0.11–0.18)	0.23 (0.19–0.28)	0.39 (0.34–0.44)	0.34 (0.29–0.39)
65–74	0.16 (0.06–0.36)	0.54 (0.34–0.73)	0.36 (0.20–0.56)	0.30 (0.15–0.52)
Marital status				
Single	0.03 (0.02–0.05)	0.08 (0.07–0.10)	0.18 (0.15–0.20)	0.13 (0.11–0.16)
Married/living with a partner	0.06 (0.05–0.08)	0.14 (0.12–0.16)	0.26 (0.24–0.29)	0.27 (0.24–0.29)
Health insurance				
Insured	0.05 (0.04–0.06)	0.11 (0.10–0.13)	0.22 (0.21–0.24)	0.20 (0.18–0.21)
Uninsured	0.06 (0.03–0.11)	0.13 (0.09–0.19)	0.32 (0.25–0.39)	0.27 (0.21–0.35)
Years living in the U.S.				
0–5 y	0.04 (0.03–0.05)	0.10 (0.09–0.11)	0.21 (0.20–0.23)	0.16 (0.15–0.18)
6–9 y	0.05 (0.03–0.08)	0.07 (0.04–0.11)	0.21 (0.16–0.27)	0.21 (0.16–0.27)
≥10 y	0.09 (0.07–0.13)	0.20 (0.17–0.25)	0.32 (0.28–0.37)	0.37 (0.32–0.42)

* Sample sizes vary because of missing data on individual models for each CVD risk factor.

Supplemental Table 2

Prevalence of CVD risk factors among women by sociodemographic characteristics, Oregon, 2004–2012

Sociodemographic factors	Diabetes (n = 673) [*]	Hypertension (n = 640) [*]	Hypercholesterolemia (n = 660) [*]	Obesity (n = 593) [*]
	Proportion (95% CI)	Proportion (95% CI)	Proportion (95% CI)	Proportion (95% CI)
Age (y)				
18–44	0.03 (0.02–0.05)	0.05 (0.03–0.07)	0.11 (0.09–0.15)	0.33 (0.29–0.37)
45–64	0.17 (0.11–0.27)	0.20 (0.12–0.30)	0.31 (0.22–0.41)	0.48 (0.37–0.59)
65–74	Empty [†]	Empty [†]	Empty [†]	Empty [†]
Marital status				
Single	0.04 (0.02–0.08)	0.05 (0.03–0.09)	0.14 (0.11–0.19)	0.28 (0.22–0.34)
Married/living with a partner	0.06 (0.04–0.09)	0.07 (0.04–0.10)	0.14 (0.10–0.18)	0.39 (0.34–0.44)
Health insurance				
Insured	0.05 (0.03–0.07)	0.07 (0.05–0.09)	0.15 (0.13–0.19)	0.34 (0.30–0.38)
Uninsured	0.09 (0.03–0.24)	Empty [†]	0.24 (0.12–0.41)	0.39 (0.24–0.57)
Years living in the U.S.				
0–5 y	0.05 (0.03–0.07)	0.05 (0.04–0.08)	0.16 (0.13–0.19)	0.30 (0.26–0.34)
6–9 y	0.04 (0.01–0.12)	0.03 (0.01–0.10)	0.16 (0.09–0.27)	0.37 (0.27–0.49)
≥10 y	0.08 (0.04–0.17)	0.13 (0.07–0.22)	0.17 (0.10–0.26)	0.51 (0.40–0.61)

* Sample sizes vary because of missing data on individual models for each CVD risk factor.

† No observations.