Sex and Age Differences in the Association of Obesity and Smoking with Hypertension and Type 2 Diabetes in Southern California American Indians, 2002–2006

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Objective: Assess age and sex differences in the association of obesity and smoking with diabetes and hypertension and report the prevalence of these cardiovascular disease (CVD) risk factors in Southern California American Indian/Alaska Native (AIAN) adults.

Design: Cross-sectional study.

Setting: Visit data from 2002–2006 were extracted from one Southern California AIAN health clinic system.

Participants: 10,351 AIAN adults visiting the health clinic system.

Main Outcome Measures: Odds ratios were examined to assess the association of obesity and smoking with diabetes and hypertension and prevalence rates for obesity, smoking, diabetes, and hypertension were reported.

Results: Obesity (women: 53%, men: 55%), smoking (women: 16%, men: 18%), diabetes (women: 14%, men: 16%), and hypertension (women: 32%, men: 37%) were very prevalent. For women aged ≥35 years, increasing obesity was significantly associated with diabetes. For men aged ≥25 years, morbid obesity and smoking were significantly associated with diabetes for many age groups. Increasing overweight/obesity and smoking were associated with hypertension among adults aged 18–65 years.

Conclusions: Southern California AIANs had higher obesity, diabetes, and hypertension prevalence than the general Southern California population, and higher obesity prevalence compared to other AIANs. Highly prevalent risk factors create a great burden, as CVD is the leading cause of death among AIAN adults. AIANs are diverse and need interventions tailored to cultural customs and health problems most prevalent in each tribal community. (*Ethn Dis.* 2010;20:231–238)

Key Words: North American Indians, Obesity, Type 2 Diabetes Mellitus, Hypertension, Smoking, Imputation

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Introduction

Obesity, smoking, diabetes, and hypertension are modifiable risk factors for cardiovascular disease (CVD),[1] the leading cause of death among older American Indian/Alaska Natives (AIANs).[2,3] Compared to the overall US population, many AIANs have elevated obesity prevalence[4,5] resulting in disproportionately higher diabetes prevalence.[6,7] Obesity is associated with hypertension,[8] which is increasing in AIANs.[9,10] Hypertension occurs commonly with diabetes[11] and diabetes commonly with hypertension.[12] Moreover, the Centers for Disease Control and Prevention (CDC) report higher AIAN tobacco use compared to other US populations.[13]

Cardiovascular disease risk factor prevalence in cross-sectional studies of AIANs is similar to or higher than the overall US prevalence, with variation by sex and region.[14–17]American Indians from five states when compared to the general population from their respective state, had higher diabetes, hypertension, obesity, and current smoking prevalence,[15,16] with higher smoking and obesity prevalence but lower diabetes prevalence in men compared to women.[15] In the REACH 2010 survey from 2001–2002, AIANs had the highest diabetes, obesity, and current smoking prevalence compared to other minorities.[14] Among men, AIANs had the highest hypertension prevalence whereas among women, hypertension prevalence was second only to Blacks.[14]

The CVD risk factor prevalence differed by age and sex in the Strong Heart study of older American Indians from 1989–1999. Diabetes and hypertension prevalence increased with age whereas current smoking prevalence decreased.[18] In women, diabetes prevalence was consistently higher and current smoking lower compared to men. Hypertension prevalence was higher for men than women initially (mean age 56.3 years) but similar after four years of follow-up.[18] From 1999–2003, obesity, diabetes, and hypertension prevalence increased in Montana American Indian men whereas women only had an increase in hypertension prevalence.[17]

Our study assessed the association of obesity and smoking with diabetes and hypertension by sex and age in Southern California AIANs aged ≥18 years from one Indian health clinic system during 2002–2006…

Prospective studies, primarily among Caucasians, found that sex- and age-related differences in coronary heart disease (CHD) risk may be mostly explained by differential prevalence of CVD risk factors in sex and age groups.[19,20] Cardiovascular disease risk factor studies rarely account for ethnic

differences, although certain groups have disproportionate risk.[21] Sex and age differences are not well described in studies of AIANs. Our study assessed the association of obesity and smoking with diabetes and hypertension by sex and age in Southern California AIANs aged ≥18 years from one Indian health clinic system during 2002–2006, hereafter referred to as the Southern California American Indian Health Clinics (SCAIHC). Although CVD risk factor prevalence rates in some AIANs have been reported, there is much variation by tribe and region. Our study determined CVD risk factor prevalence and associations between them in a unique group of AIAN adults that have previously not been studied.

METHODS

Data Source

Visit data were managed by IHS Resource Patient Management System (RPMS) and stored in the Patient Care Component Package (PCC). The Native American Data Extraction and Surveillance (NADXS) software program, which has greater than 97% accuracy when compared with data reviewed from the actual paper chart,[22] extracted over 250 variables from 572,200 visits during 2002–2006, yielding a sample of 18,811 patients. Non-Indian patients (n=3,153), or those whose residence was outside of two designated Southern California counties (n=513) where the majority of patients from the clinic system reside, were excluded. From the remaining 15,145 eligible patients, 10,538 were aged ≥18 years. Of these, 74 had type 1 diabetes and 113 indicated diabetes with no ICD-9 codes to corroborate, leaving 10,351 patients. There were 3,231 patients who were missing weight and/or height data, primarily due to dental or vision visits where they were not measured. To include all patients in the analyses, an imputation method for height and/or weight was implemented (described below).

To protect confidentiality, tribes were not named. No patient names, addresses, or social security numbers were extracted. The Institutional Review Boards (IRB) of the University of California, San Diego, San Diego State University, a local federally-registered tribal-community IRB, and the tribal health board of the SCAIHC approved this study.

Measures

Type 2 diabetes diagnosis was determined by the presence of ICD-9 code 250 at any time during the five-year period, and confirmed by the diagnosis date. Hypertension was determined from the presence of one of the following criteria: 1) ICD-9 code=401, 402; 2) two visits with systolic blood pressure ≥140 or diastolic blood pressure ≥90; 3) hypertension indicated on the problem list where information is recorded at the practitioner's discretion; or 4) hypertension medication indicated by a prescription filled at the SCAIHC pharmacy.

Body mass index (BMI) (weight in kg divided by height in m^2) measurements from the five-year period were averaged. Mean BMI was categorized as underweight (<18.5), normal weight (≥18.5 and <25), overweight (≥25 and <30), obese (≥30 and <35), very obese (≥35 and <40), morbidly obese (≥40).[23] Under and normal weight categories were combined as patients had similar demographics, disease, and risk factors.

Current smoking was determined from four health factor variables, or from tobacco use indicated on the problem list. This method for determining smoking status from RPMS data has been previously established.[24] Age was derived as of June 30, 2004.

Data Analysis

Diabetes and hypertension prevalence were determined by BMI category and smoking status, stratified by sex. Direct age adjustment to the overall population was used.

Sex-specific multivariable logistic regression models stratified by age group were used to assess adjusted odds of diabetes and hypertension, associated with increasing BMI category (reference: under/normal weight) and smoking status, with either hypertension or diabetes included as a covariate. Preliminary modeling indicated age by BMI interaction and sex by smoking interaction resulting in stratifications by age and sex.

Analyses were conducted subsequent to imputation[25,26,27] of missing heights and/or weights using a multivariable normal regression model to generate five complete datasets. Logistic regression performed on each dataset generated parameter estimates that were averaged and standard errors that were pooled to account for variability between and within the five analyses. Imputed results were used for the analyses described above; however, analyses were performed without imputed data and resulted in similar trends in associations. All analyses used SAS Version 9.1.

RESULTS

Of the 10,351 subjects, 55% were women and mean age was 41.4 years with no difference by sex (Table 1). Men and women had similar mean BMI (~32 kg/m^2) but differed in distribution among BMI categories (P<.001). More women were under/normal weight (women: 23%, men: 16%) and morbidly obese (women: 16%, men: 12%), whereas more men were overweight (women: 24%, men: 29%) and obese (women: 22%, men: 27%). Other CVD risk factor prevalence was higher in men than women: diabetes (women: 14%, men: 16%, P=.033), hypertension (women: 32%, men: 37%, P<.001), both diabetes/hypertension

Table 1. Sample characteristics

Variable	Total (*N*=10,351) Mean (95%CI)	Women (*n*=5714) Mean (95%CI)	Men (*n*=4637) Mean (95%CI)	*P*-value*
Age (years)	41.4 (41.1–41.8)	41.2 (40.8–41.6)	41.7 (41.3–42.2)	.114
Mean BMI (kg/m^2)†	31.8 (31.6–31.9)	31.8 (31.5–32.0)	31.7 (31.5–31.9)	.752
	% (*n*)	% (*n*)	% (*n*)	
Age group (yrs)				.057
18–24	18 (1889)	19 (1095)	17 (794)	
25–34	21 (2163)	21 (1180)	21 (983)	
35–44	21 (2201)	21 (1208)	21 (993)	
45–54	18 (1829)	17 (990)	18 (839)	
55–64	12 (1233)	12 (696)	12 (537)	
≥65	10 (1036)	9 (545)	11 (491)	
BMI category†				<.001
Under/normal	20 (2067)	23 (1312)	16 (755)	
Overweight	26 (2718)	24 (1379)	29 (1339)	
Obese	24 (2484)	22 (1239)	27 (1245)	
Very obese	15 (1603)	15 (874)	16 (728)	
Morbidly obese	14 (1479)	16 (910)	12 (570)	
Disease status‡				
Type 2 diabetes	15 (1522)	14 (802)	16 (720)	.033
Hypertension	34 (3549)	32 (1848)	37 (1701)	<.001
Diabetes / hypertension	12 (1241)	11 (644)	13 (597)	.013
Current smoking	17 (1780)	16 (930)	18 (850)	.006

* Tests for sex differences using analysis of variance F-test for continuous variables and chi-square test for categorical variables.
† Mean BMI (kg/m^2) from 2002–2006. Under/Normal Weight: <25; Overweight: ≥25 and <30; Obese: ≥30 and <35; Very Obese: ≥35 and <40; Morbidly Obese: ≥40.
‡ Categories are not mutually exclusive.

(women: 11%, men: 13%, *P*=.013) and current smoking (women: 16%; men: 18%, *P*=.006). In total, 1522 patients had diabetes, with 82% hypertensive. In contrast, 3549 patients had hypertension, with diabetes in 35%.

Diabetes and hypertension prevalence increased with age (data not shown) and age-adjusted prevalence increased with increasing BMI (Table 2). Diabetes prevalence doubled in those of under/normal weight (6%) to those who were obese (15%) and nearly doubled again in the morbidly obese (28%). Similarly, hypertension prevalence doubled in those of under/normal weight (15%) to those who were obese (37%) and rose more than a third in the morbidly obese (52%).

Regardless of BMI, men had higher age-adjusted diabetes and hypertension prevalence than women (Table 2). Hypertension prevalence was higher in men compared to women until age 45 where prevalence was similar or higher in women for some BMI categories (data not shown). In all BMI categories, current smokers had higher age-adjusted diabetes and hypertension prevalence compared to non-current smokers (data not shown).

Using logistic regressions stratified by sex and age group, we found that increased BMI and smoking were associated with increased adjusted odds of diabetes and hypertension that varied by age group and/or sex. In women, increas-

Table 2. Age-adjusted prevalence of diabetes and hypertension (%) by BMI category*, sex, and current smoking

	Under/Normal (*n*=2067)		Overweight (*n*=2718)		Obese (*n*=2484)		Very obese (*n*=1603)		Morbidly obese (*n*=1479)	
	D	H	D	H	D	H	D	H	D	H
Total	6.0	15.4	9.6	28.4	14.7	37.2	20.2	44.0	28.3	51.8
Women	5.2	14.6	8.8	26.0	14.6	34.1	19.7	43.5	26.6	50.5
Men	7.2	16.7	10.5	30.9	14.9	40.4	20.9	44.5	30.9	53.8
Current smoking	8.8	30.6	13.1	44.7	20.2	53.4	32.4	63.5	38.4	72.3

D – diabetes; H - Hypertension.
* Mean BMI (kg/m^2) from 2002–2006. Under/Normal Weight: <25; Overweight: ≥25 and <30; Obese: ≥30 and <35; Very Obese: ≥35 and <40; Morbidly Obese: ≥40.

Table 3. Adjusted association of BMI and current smoking and hypertension with type 2 diabetes stratified by age group and sex

	Odds of type 2 diabetes*: OR (95%CI)					
	18–24 years (*n*=1889)	**25–34 years (*n*=2163)**	**35–44 years (*n*=2201)**	**45–54 years (*n*=1829)**	**55–64 years (*n*=1233)**	**≥65 years (*n*=1036)**
			Women			
BMI category†						
Under/normal	1.00	1.00	1.00	1.00	1.00	1.00
Overweight	.53 (.04–6.62)	.79 (.23–2.72)	1.21 (.41–3.58)	1.62 (.69–3.81)	1.33 (.62–2.86)	1.74 (.90–3.36)
Obese	2.04 (.34–12.28)	1.16 (.37–3.60)	1.78 (.78–4.05)	**2.84 (1.17–6.92)**	**2.41 (1.15–5.03)**	**2.88 (1.54–5.39)**
Very obese	1.88 (.32–11.02)	1.22 (.40–3.70)	**3.27 (1.33–8.06)**	**3.85 (1.61–9.23)**	**3.00 (1.37–6.54)**	**2.93 (1.41–6.07)**
Morbidly obese	3.90 (.83–18.17)	2.32 (.84–6.45)	**4.30 (1.80–10.29)**	**5.62 (2.44–12.95)**	**4.30 (2.02–9.16)**	**3.64 (1.62–8.18)**
Current Smoking						
Yes (vs no)	1.23 (.43–3.52)	1.02 (.51–2.03)	1.47 (.97–2.24)	1.21 (.80–1.81)	**2.00 (1.26–3.18)**	1.12 (.56–2.24)
Hypertension						
Yes (vs no)	**5.47 (2.04–14.69)**	**10.30 (5.61–18.92)**	**6.12 (4.13–9.08)**	**7.02 (4.54–10.84)**	**4.74 (2.95–7.62)**	**4.85 (2.97–7.90)**
			Men			
BMI category†						
Under/normal	Model invalid: 0 cases	1.00	1.00	1.00	1.00	1.00
Overweight	of diabetes in under/	.46 (.05–4.72)	1.36 (.45–4.15)	1.70 (.66–4.39)	.77 (.29–2.05)	.86 (.43–1.71)
Obese	normal category	1.01 (.19–5.24)	1.37 (.45–4.16)	1.74 (.71–4.26)	1.53 (.60–3.88)	1.32 (.67–2.57)
Very obese		3.65 (.75–17.91)	2.47 (.84–7.26)	**2.65 (1.02–6.92)**	1.58 (.59–4.23)	2.17 (.80–5.90)
Morbidly obese		**5.93 (1.26–28.01)**	**4.52 (1.51–13.60)**	**4.14 (1.65–10.36)**	**3.93 (1.47–10.52)**	**2.80 (1.12–7.01)**
Current Smoking						
Yes (vs no)	—	1.85 (.96–3.58)	**1.73 (1.10–2.73)**	**1.59 (1.04–2.41)**	1.00 (.61–1.63)	**1.97 (1.01–3.84)**
Hypertension						
Yes (vs no)	—	**6.03 (3.07–11.81)**	**6.04 (3.80–9.61)**	**8.92 (5.63–14.14)**	**6.60 (3.96–11.00)**	**7.73 (4.53–13.19)**

Note: Values are Odds Ratios (95% Confidence Interval). Odds ratios significant at $\alpha = .05$ in bold.

* Results of a logistic regression model stratified by age category and sex for the adjusted odds of type 2 diabetes.

† Mean BMI (kg/m^2) from 2002–2006. Under/Normal Weight: <25; Overweight: ≥25 and <30; Obese: ≥30 and <35; Very Obese: ≥35 and <40; Morbidly Obese: ≥40.

ing obesity was associated with increased odds of diabetes, a difference that was statistically significant after age 35 for the very and morbidly obese and after age 45 for the obese (Table 3). Being solely overweight was not associated with an increased likelihood of diabetes. In contrast, men aged ≥25 years who were morbidly obese had significantly higher odds of diabetes, with some indication of a trend for increased odds of diabetes with increasing level of obesity.

For women, current smoking was generally associated with more diabetes, however, the association was significant only among those aged 55–64. Men who reported current smoking were nearly twice as likely to have diabetes; the association was significant in three age groups.

For both men and women, the adjusted odds of hypertension increased as BMI increased, except in AIANs aged ≥65 years where the odds of hypertension at each level of overweight/obesity were generally twice that of under/normal weight, although not statistically significant for every category (Table 4). AIANs aged 55–64 years had increasing odds of hypertension from overweight up to the very obese category but odds did not continue to rise with morbid obesity. In those aged 18–34 years, women who were very and morbidly obese had considerably higher odds of hypertension compared to very and morbidly obese men.

In all age groups, men and women who currently smoked were more likely to have hypertension than non-smokers. Men tended to have greater odds of hypertension associated with current smoking than women, though differences were not statistically significant. In every age group, those with hypertension were more likely to also have diabetes, and vice versa.

American Indian/Alaska Native adults living in two Southern California counties and attending Indian Health clinics from 2002–2006 had high prevalence of four CVD risk factors: diabetes (15%), hypertension (34%), obesity (53%), and current smoking (17%).

DISCUSSION

American Indian/Alaska Native adults living in two Southern California

Table 4. Adjusted association of BMI and current smoking and diabetes with hypertension stratified by age group and sex

	Odds of hypertension*: OR (95%CI)					
	18–24 years (*n*=1889)	**25–34 years (*n*=2163)**	**35–44 years (*n*=2201)**	**45–54 years (*n*=1829)**	**55–64 years (*n*=1233)**	**≥65 years (*n*=1036)**
			Women			
BMI category†						
Under/normal	1.00	1.00	1.00	1.00	1.00	1.00
Overweight	1.53 (.44–5.40)	**2.60 (1.12–6.05)**	**3.10 (1.69–5.68)**	**2.42 (1.47–3.99)**	**2.18 (1.24–3.84)**	**2.05 (1.17–3.58)**
Obese	**6.72 (2.44–18.50)**	**5.61 (2.58–12.23)**	**4.21 (2.39–7.41)**	**4.21 (2.48–7.13)**	**2.85 (1.60–5.07)**	1.70 (.97–2.98)
Very obese	**13.69 (5.00–39.63)**	**9.66 (4.35–21.43)**	**6.04 (3.48–10.49)**	**5.83 (3.34–10.20)**	**4.70 (2.27–9.71)**	**2.58 (1.17–5.72)**
Morbidly obese	**14.78 (5.51–39.63)**	**14.35 (6.70–30.72)**	**7.30 (3.94–13.52)**	**9.74 (5.31–17.88)**	**4.94 (2.59–9.44)**	2.01 (.86–4.70)
Current smoking						
Yes (vs no)	**2.82 (1.66–4.82)**	**2.18 (1.41–3.37)**	**2.62 (1.88–3.65)**	**2.92 (2.02–4.22)**	**3.38 (1.90–6.01)**	**2.11 (1.01–4.40)**
Type 2 Diabetes						
Yes (vs no)	**5.29 (1.96–14.26)**	**10.36 (5.66–18.96)**	**6.17 (4.15–9.17)**	**6.99 (4.53–10.80)**	**4.85 (3.01–7.80)**	**4.86 (2.98–7.93)**
			Men			
BMI category†						
Under/normal	1.00	1.00	1.00	1.00	1.00	1.00
Overweight	1.70 (.81–3.59)	**2.51 (1.22–5.16)**	**3.73 (1.73–8.03)**	1.81 (.99–3.33)	**3.86 (1.75–8.51)**	**2.03 (1.06–3.90)**
Obese	**4.07 (1.95–8.47)**	**4.01 (1.96–8.21)**	**6.97 (3.41–14.25)**	**3.04 (1.59–5.79)**	**5.22 (2.34–11.62)**	**2.20 (1.04–4.65)**
Very obese	**4.15 (1.80–9.55)**	**4.78 (2.25–10.15)**	**7.76 (3.47–17.33)**	**3.83 (1.86–7.92)**	**9.70 (3.90–24.13)**	1.39 (.56–3.46)
Morbidly obese	**7.71 (3.44–17.26)**	**9.39 (4.56–19.34)**	**8.48 (3.71–19.41)**	**5.15 (2.55–10.41)**	**4.27 (1.69–10.80)**	1.99 (.68–5.79)
Current smoking						
Yes (vs No)	**3.92 (2.47–6.20)**	**3.65 (2.50–5.34)**	**2.55 (1.79–3.64)**	**4.94 (3.16–7.71)**	**5.03 (2.79–9.08)**	**4.05 (1.59–10.29)**
Type 2 diabetes						
Yes (vs No)	**4.25 (1.43–12.61)**	**5.99 (3.08–11.64)**	**6.08 (3.81–9.69)**	**8.95 (5.64–14.20)**	**6.66 (3.98–11.13)**	**7.65 (4.49–13.03)**

Note: Values are Odds Ratios (95% Confidence Interval). Odds ratios significant at $\alpha = .05$ in bold.

* Results of a logistic regression model stratified by age category and sex for the adjusted odds of hypertension.

† Mean BMI (kg/m^2) from 2002–2006. Under/Normal Weight: <25; Overweight: ≥25 and <30; Obese: ≥30 and <35; Very Obese: ≥35 and <40; Morbidly Obese: ≥40.

counties and attending Indian Health clinics from 2002–2006 had high prevalence of four CVD risk factors: diabetes (15%), hypertension (34%), obesity (53%), and current smoking (17%). Whereas sex and age differences were present in the association between obesity, smoking, and diabetes; the association between obesity, smoking, and hypertension was similar between sexes and among those aged less than 65 years. The likelihood of diabetes increased for older, hypertensive women, with increasing levels of obesity, and for older, hypertensive men who were morbidly obese and currently smoked. The likelihood of hypertension increased for all diabetic, men and women who currently smoked, and with increasing levels of obesity for AIANs less than 65 years.

Diabetes and hypertension associated with overweight/obesity found in this SCAIHC population was similar to other AIAN populations. Results from 1998 among 633 adults in the Catawba Indian Nation from the Carolinas found obesity was associated with increased age-adjusted odds of diabetes (OR: 2.6, 95% CI: 1.3–5.6) and hypertension (OR: 5.5, 95% CI: 3.0–9.9).[28] In a study of 2,006 Montana American Indian adults in 1999 and 2001 using an adapted BRFSS, overweight/obesity was associated with an increased sex and age-adjusted odds of diabetes (OR: 3.0, 95% CI: 2.0–4.5).[29] In both the Catawba and Montana population, diabetes, hypertension, and overweight prevalence were below SCAIHC rates.[28,29]

Diabetes and Hypertension Prevalence

The SCAIHC diabetes and hypertension prevalence rates were higher than estimates for the general United States population obtained from recent NHANES data.[30] The SCAIHC hypertension prevalence was higher compared to national data for men (36.7% and 29.0%, respectively) but similar for women (32.3% and 32.5%, respectively) and similar to recently published rates (26.3–37.5%) for similarly aged AIAN communities.[14–17,30] These national data showed women were more hypertensive than men,[30] but one AIAN community had the same sex difference as SCAIHC with men more hypertensive than women, 38% versus 31%.[17]

In the current study diabetes prevalence was higher (women: 14.0%, men: 15.5%) compared to national data (women: 7.1%, men: 7.2%) but similar to recently published rates (8.3–18.5%) for similarly aged AIAN communities.[14–17,24,30] The REACH 2010 survey of two AIAN communities showed

women more likely to have diabetes than men, 19.7% versus 16.8%, respectively.[14] According to the CDC, diabetes prevalence in 2005 was 16.5% in AIANs aged ≥20 years as calculated from IHS and age-adjusted to non-Hispanic whites,[31] with the highest age-adjusted rate in Arizona (29.3%). An age-adjusted diabetes prevalence of 10.3% was reported for AIANs from five states (excluding California) using IHS data from 1998–2003.[24]

Obesity Prevalence

Obesity prevalence in the current study was higher (women: 52.9%, men: 54.8%) compared to both national data (women: 33.2%, men: 31.1%) and recently published rates (27.5–39.0%) for other similarly aged AIAN communities.[14,15,17,32] In one AIAN community, men were more obese than women, similar to the SCAIHC community,[15] whereas in national data, men and women were similar.[32]

Smoking Prevalence

The SCAIHC adults had lower current smoking prevalence (women: 16.3%, men: 18.3%) than AIANs from other community and national surveys (ranging from 19.7%–39.2%)[13–17,24] and the overall 2006 US adult prevalence (women: 18.0%, men: 23.9%).[13] Similar to SCAIHC, some studies had higher current smoking prevalence among men.[13,14] However, SCAIHC women had a higher current smoking prevalence (16.3%) compared to all California women (11.4%), whereas SCAIHC men had similar prevalence (18.3%) to all California men (18.5%) as derived from the 2006 BRFSS.[33]

Cardiovascular Disease Risk Factor Prevalence within California

Adult residents of the same two Southern California counties that comprise the SCAIHC population (n=2,668) had diabetes, hypertension, obesity, and current smoking prevalence estimates from the 2005 California Health Information Survey (CHIS) lower than reported for SCAIHC adults.[34] However, prevalence from the 2005 CHIS for 872 AIAN adults residing in California varied.[34] Following are comparisons between SCAIHC and 2005 CHIS adults from the same two counties (referred to as CHIS County) and 2005 CHIS AIAN adults statewide (referred to as CHIS AIAN). Comparisons were not made to 2005 CHIS for AIAN adults residing in the same two Southern California counties as SCAIHC due to unreliable estimates from insufficient AIAN sample sizes (n<100).

The SCAIHC adults had higher diabetes prevalence (women: 14.0%, men: 15.5%) than both CHIS AIAN (women: 12.1%, men 12.9%) and CHIS County (women: 6.7%, men: 9.1%). In women, hypertension prevalence for SCAIHC (32.4%) was similar to CHIS AIAN (35.1%) but both were considerably higher than CHIS County (25.6%). In men, hypertension prevalence for SCAIHC (36.7%) was consistently higher than both CHIS AIAN (26.8%) and CHIS County (28.5%).[34]

Obesity prevalence (women: 52.9%, men: 54.8%) for the SCAIHC group was nearly twice the CHIS County prevalence (women: 24.4%, men: 28.4%) and still considerably higher than CHIS AIAN (women: 28.9%, men: 35.6%). Current SCAIHC smoking prevalence (women: 16.3%, men: 18.3%) was considerably lower than CHIS AIAN (women: 28.1%, men: 39.1%) but slightly above the CHIS County prevalence (women: 12.7%, men: 18.6%) for women.[34]

Other than regional and ethnic/racial differences, disparity between prevalence rates obtained from SCAIHC and CHIS may be due to collection methods. SCAIHC prevalence was derived from clinic visits and disease diagnoses along with measured height and weight, whereas CHIS data relied on self-report, which often has under-reporting of unfavorable behaviors. The CHIS determined diabetes and hypertension status based on whether or not a doctor ever told the subject he/she had diabetes or high blood pressure, respectively. Obesity status was determined from self-reported height and weight using the same BMI categories as in this study. Current smoking was based on smoking at least 100 cigarettes during their lifetime and currently smoking.[34]

Limitations and Strengths

A limitation of these results is that they represent AIANs living in only two Southern California counties who attended their local SCAIHC. Within the same tribe, some members attended SCAIHC and others visited off-reservation healthcare facilities, depending on insurance. Therefore, AIANs from all areas of Southern California are not represented. The California IHS estimates the registered population of AIANs residing in Southern California from 10/1/2003–9/30/2006 at approximately 40,000.[35] This study includes 10,351 AIANs residing in Southern California and consists of some of the best current data. Although not fully representative of all Southern California AIANs, generalizing these results to Southern California AIANs is not unreasonable. However, due to diversity present in California and results from 2005 CHIS,[34] results may not be generalizable to all California AIANs.

These results are very relevant as they arise from a current time period with a large sample size from an ethnic minority population that is underrepresented in national surveys. This large sample size allowed for informative comparisons between sexes and age groups. Disease status was based on actual diagnosis and obesity from measured height and weight rather than self-report. Of particular importance is that CVD risk factor prevalence and associations of obesity and smoking with diabetes and hypertension from AIANs residing in California have not been previously reported.

The large proportion of missing BMI information was a limitation. The impact was minimized by the use of multiple imputation allowing all subjects with disease to be included in analyses, regardless of available BMI. Imputation did not change resulting trends as indicated by comparison of imputed to non-imputed analyses.

CONCLUSION

Southern California AIANs had much higher obesity, diabetes, and hypertension prevalence than the overall US population and, more specifically, than residents from the same California region. Compared to other AIAN communities, SCAIHC diabetes and hypertension prevalence rates were at the mid-range but obesity prevalence was considerably higher. Current smoking prevalence shown in the SCAIHC data was lower then seen in other AIANs and less than the national rate, however, prevalence was higher in SCAIHC women compared to California women.

The high prevalence of modifiable CVD risk factors are a great burden on AIAN communities where CVD is the leading cause of death among AIANs aged ≥45 years.[2,3] American Indian/Alaska Natives are a diverse group with 562 federally recognized tribes further distinguished by language and cultural traditions, many of which affect current health behaviors.[36] This diversity is fundamentally evident in the substantial differences in CVD risk factor prevalence among AIAN communities. Such variation necessitates targeted interventions tailored to the cultural customs and health problems most prevalent in each tribal community.

ACKNOWLEDGMENT

We gratefully acknowledge the Southern California American Indian Health Clinics for providing data for this project, which would not have been possible without their willingness to participate.

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