Associations Among Body Mass Index, Waist Circumference, and Health Indicators in American Indian and Alaska Native Adults

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Abstract

Purpose—Little is known about obesity-related health issues among American Indian and Alaska Native (AIAN) populations.

Approach—A large cohort of AIAN people was assembled to evaluate factors associated with health.

Setting—The study was conducted in Alaska and on the Navajo Nation.

Participants—A total of 11,293 AIAN people were included.

Methods—We present data for body mass index (BMI, kg/m^2) and waist circumference (cm) to evaluate obesity-related health factors.

Results—Overall, 32.4% of the population were overweight (BMI 25–29.9 kg/m^2), 47.1% were obese (BMI ≥ 30 kg/m^2), and 21.4% were very obese (BMI, ≥ 35 kg/m^2). A waist circumference greater than 102 cm for men and greater than 88 cm for women was observed for 41.7% of men and 78.3% of women. Obese people were more likely to perceive their health as fair/poor than nonobese participants (prevalence ratio [PR]), 1.91; 95% CI, 1.71–2.14). Participants younger than 30 years were three times more likely to perceive their health as being fair or poor when their BMI results were 35 or greater compared with those whose BMI results were less than 25 kg/m^2. A larger BMI was associated with having multiple medical conditions, fewer hours of vigorous activity, and more hours of television watching.

Conclusions—Given the high rates of obesity in AIAN populations and the association of obesity with other health conditions, it is important to reduce obesity among AIAN people.

Keywords

American Indian; Alaska Native; Body Mass Index; Obesity; Physical Activity

INTRODUCTION

The prevalence of obesity has been increasing at alarming rates worldwide.[1] Obesity has been associated with type 2 diabetes as well as with other chronic diseases, including certain types of cancer, heart disease, and stroke.[1–5] Likewise, reports of greater depression, more injuries from accidents, and economic loss from unemployment linked to obesity magnify the impact of obesity on health.[6–10] As such, obesity is a major public health problem and may contribute to health disparities that exist in various populations.

Few studies of obesity among American Indian and Alaska Native (AIAN) populations have been conducted. One study of American Indian children living in the Aberdeen area showed that more than 40% of 5-year-old children were overweight, and 24% were obese.[11] Two surveys have examined the extent of obesity in various U.S. populations and have shown significant differences in the prevalence of obesity and overweight individuals among AIAN populations compared with non-Hispanic white populations.[12,13] However, these national surveys were limited primarily to samples of American Indian populations living in urban areas, and they included few AIAN people. It is unknown if the extent of the obesity problem extends to AIAN people living in more remote villages and on reservations. Although it has been suggested that developing means to prevent obesity would alleviate health disparities associated with chronic diseases in AIAN populations,[13,14] little is known about the extent of the problem in AIAN populations and the impact that obesity has on their health and well-being.

In this paper, we use data from the Alaska and Navajo field centers of the Education and Research Towards Health (EARTH) study to evaluate health, lifestyle, and medical conditions associated with obesity, as indicated by body mass index (BMI) and waist circumference. Data are available from more than 11,000 AIAN people aged 18 years and older and represent the largest study of adult AIAN people conducted. We report the prevalence of obesity in the population, and we evaluate traditional factors that may be associated with BMI and waist circumference in the population as well as the association between obesity, perceived health, and select medical conditions.

METHODS

The EARTH study was initiated in 2001 as a pilot study to explore the feasibility of establishing a cohort of AIAN people. The study methods have been described in detail.[15] Data presented in this paper come from 11,243 Navajo and Alaska Native study participants who completed a study visit between March 2004 and October 2007. In Alaska, participants were enrolled in three regions of the state: southcentral, southwestern, and southeastern Alaska; on the Navajo Nation, participants were recruited from the Fort Defiance and Shiprock Health Service Units. Within these regions, we defined urban by using the 2000 U.S. Census definition for an urbanized area that included communities with a population of at least 50,000 people. Tribal partnerships were established, and the study was approved by the Navajo Nation Institutional Review Board (IRB), the Alaska Area IRB, the Indian Health Service National IRB, and the University of Utah IRB. Additionally, regional, local, and village health boards and chapters within local health boards reviewed and approved the study.

Participant eligibility included age of at least 18 years; membership in an American Indian or Alaska Native tribe, as determined by eligibility for health care through the Indian Health Service; currently status as nonpregnant or not receiving chemotherapy; and physical and mental ability to read and understand the consent form. Although study participants

represent a sample of convenience rather than a random sample from participating communities, the age distributions were similar to the 2000 census data from which the populations were derived.[15]

Baseline study visits were conducted in a variety of settings, including stationary locations in the larger population areas, temporary study centers in remote villages, and a mobile van on the Navajo Nation. Clinics were set up to assure participant confidentiality for all study components. The baseline study visit consisted of informed consent, intake questionnaire, medical measurements, an audio computer-assisted self-interview diet histoiy questionnaire, an audio computer-assisted self-interview health and lifestyle questionnaire (HLPA), an exit interview, and individual feedback (i.e., health report to each participant at the conclusion of the study visit). The audio component of the questionnaire could be played in English, Navajo, or Yup'ik languages, depending upon the participant's preference.

Height, weight, and waist and hip circumference measurements were taken in duplicate when the participants wore loose clothing without shoes. Weight was recorded in pounds with a Tanita digital scale (BWP800/BWP627A, Tanita Corporation of America Inc., Arlington Hills, Illinois). Standing height was measured in inches with the Road Rod Stadiometer (Seca, Hamburg, Germany). If the two height measurements differed by more than 1.0 inch or if the weight measurements differed by more than 2.0 pounds, measurements were repeated; the average of the last two measurements was used. Waist and hip circumference measurements were recorded to the nearest 0.5 inch by using either the Novel Products Figure Finder tape (Novel Products Inc., Rockton, Illinois) or the Gulick II Plus tape (Country Technology Inc., Gays Mills, Wisconsin) when the participant was standing. Waist circumference was measured at the smallest point between the tenth rib and the iliac crest; hip circumference was measured at the level of maximum protrusion of the gluteal muscles. If the two waist or hip measurements differed by more than 1 inch, a third set of measurements was taken. The average of the closest two measurements was used when three measurements were taken. Quality assurance and quality control procedures were taken to help assure accuracy of measures. As part of the initial training, a detailed manual of procedures was provided to each staff, and the staff members were observed using a checklist for procedures taking five measurement sets on two separate volunteers on two different days by a certified staff member. All measurements had to be within 0.5 inch and were verified by the gold standard certified staff member. On a quarterly basis, a field center quality control supervisor observed one set of body size measurements performed by each staff and measured and compared them to gold standard measurements. If staff failed to pass the ongoing quality control, they had to be recertified to take measurements.

The HLPA included information on a variety of self-reported medical conditions diagnosed by a physician or health care provider prior to the baseline study visit. Medical conditions included in the HLPA that were used to define medical conditions in this study were heart attack, stroke, cancer, diabetes, kidney disease, liver disease, asthma, arthritis, chronic obstructive pulmonary disease (COPD), depression, high blood pressure, high cholesterol, gall bladder disease, and bone fractures after age 18 years.

A detailed physical activity questionnaire was a central component of the HLPA questionnaire and included information on a variety of activities that were performed at moderate and vigorous levels of intensity and the frequency and amount of time that these activities were performed.[16] Vigorous physical activities were defined as activities performed at metabolic equivalent values of 6 or more and were assessed as the total hours of vigorous activities performed per week. Vigorous activity was used in these analyses, because it has been shown to be the most valid indicator of activity in this population

(Murtaugh, unpublished data, 2008). Additionally, we asked participants to report the amount of time they spent watching television per week as an indictor of physical inactivity.

A 12-item, short-form health survey (SF12)[17] was included as part of the HLPA. From the SF12 questionnaire, we assessed the question of perceived health as well as derived summary scores. The perceived health question was "In general would you say your health is excellent, very good, fair, or poor?" The SF12 physical component summary (PCS) and mental component summary (MCS) scores were calculated by using the standard algorithms for the 1998 U.S. population reference group17; with this algorithm, higher scores indicate greater physical and mental functioning.

Other information collected as part of the HLPA were age; marital status; employment status during the past year; education level achieved; cigarette smoking practices; and several questions about affiliation to traditional Native lifestyle and culture, including language usually spoken at home (i.e., native only, both Native and English, or English only) and how much the participants identified with their own tribal traditions (i.e., not at all, a little, some, or a lot).

STATISTICAL METHODS

BMI was calculated by using the formula of kg/m^2; cut-points used to analyze BMI were less than 25 kg/m^2 for normal weight (includes underweight); 25 to 29.9 kg/m^2 for overweight; 30 to 34.9 kg/m^2 for class I obesity; and more than 35 kg/m^2, which included both class II obesity (BMI 35.0–39.9 kg/m^2) and class 111 obesity (BMI $\geq$ 40 kg/m^2).[18–20] A waist circumference of greater than 102 cm or 40 inches for men and greater Lhan 88 cm or 35 inches for women was defined as a large waist circumference.[21]

Associations between BMI and waist circumference and medical conditions were considered in two ways. First, we combined all medical conditions previously stated in the methods and analyzed anthropometric associations between those with two more medical conditions versus less than two medical conditions. We also assessed associations between category of BMI with self-reported diabetes, arthritis, COPD, depression, asthma, high blood pressure, high cholesterol, bone fracture after age 18 years, and gall bladder disease to provide an indication of the broader health conditions associated with BMI. We assessed BMI and waist circumference as categorical variables with perceived health in addition to actual health conditions previously diagnosed by a physician, and we categorized the reported perceived health into three categories of excellent/very good, good, or fair/poor.

SAS statistical program version 9.1 was used for all statistical analyses (SAS Institute, Cary, North Carolina). Chi-square tests were used to test for differences in proportions of variables of interest across categories of BMI and waist circumference. For continuous variables, such as hours of vigorous physical activity performed per week, hours of television watching per week, and physical and mental component scores from the SF12, we assessed the difference in mean levels across BMI and waist circumference categories by using analysis of covariance. In all models, age, gender, and region (i.e., three Alaska locations and Navajo) were adjusted by using the analysis of covariance test for mean levels and the Mantel-Haenzel test for categorical variables. To test for associations between various health conditions and BMI level, we calculated prevalence ratios (PR) by using the proportional hazards SAS program adjusted for age, gender, and region.[22] Results include data from the 11,243 AIAN participants enrolled through July 2007. The total number of participants included for each variable varies slightly because of missing values for some variables.

RESULTS

Of the study population, 47.1% were obese (BMI ≥ 30), and almost 80% were either overweight or obese (Table 1). The percentage of the study population that was overweight and obese (BMI 30–34.9 kg/m^2) increased with age, and obesity was more prevalent among women than men. Southwestern Alaska had the lowest percentage of the population who were obese. Living in a rural versus an urban area was not associated with the prevalence of obesity. Those achieving higher levels of education were less likely to have a BMI of 35 kg/m^2 or more. Similar associations were observed for those with a high waist circumference as for those with a high BMI, with the exception og the association with participants' income levels; BMI was associated with income level, whereas waist circumference was not. The Pearson correlation coefficients between BMI and waist circumference and hip circumference measurements were .89 and .90, respectively. The mean waist and hip circumference measurements for men were 100.6 cm (standard error [SE], .23) and 106.0 cm (SE, .19), respectively, and for women were 100.1 cm (SE, .18) and 112.47 cm (SE, .15), respectively.

Current cigarette smokers were less likely to be obese than those who had never smoked cigarettes or who were former cigarette smokers (Table 2). Those with higher BMI levels were more likely to report their perceived health as being fair or poor versus excellent or very good among those with a BMI of less than 25 kg/m^2. Neither language spoken at home nor identification with tribal traditions was associated with BMI. The SF12 PCS decreased with increasing levels of obesity, which indicated lower levels of physical functioning, whereas the MCS score did not. Study participants with higher BMI levels reported fewer hours of vigorous activity and more hours of watching television. High waist circumference measurements (>102 cm for men and >88 cm for women) were observed in 41.7% of men and in 78.3% of women. Participants whose waist circumferences were considered high were more likely to report their health as fair/poor rather than excellent/very good (Table 2). As with BMI, people who had larger waist circumferences had lower SFI2 PCS scores, were involved in fewer hours of vigorous activity per week, and spent more time watching television or playing video games than people who had smaller waist circumference measurements. These associations were similar for men and women and for location of study visit, with one exception—the association between BMI and smoking was seen only among men.

Although both obese men and women were more likely to perceive their health to be good or fair/poor, this was especially true for men (Table 3). Associations between previously diagnosed medical conditions and obesity were generally stronger among men than women. Meu were 75% more likely to have two or more medical conditions if they had a BMI of 35 kg/m^2 or more, whereas women were only 36% more likely to have two or more medical conditions with a BMI of 35 kg/m^2 or more. The magnitude of the association between high blood pressure, high cholesterol, prior history of gall bladder disease, arthritis, and type 2 diabetes with obesity was much greater for men than for women. For other health conditions previously diagnosed by a physician, such as asthma, bone fracture after age 18 years, chronic obstructive pulmonary disease, and depression, associations were similar for men and women and were not associated with obesity. Because of the high correlation between high waist circumference and obesity, we only present data for BMI, although similar associations were observed for high waist circumference.

Figure 1 shows the percentage of the population who reported excellent or very good health by BMI level and by age. Individuals younger than 30 years of age were three times as likely to perceive their health as fair/poor versus excellent or good if their BMI was greater than 35 kg/m^2 (PR, 3.01; 95% CI, 2.39–3.81). For everyone except for those aged 60 years

or older, those who were more obese were less likely to perceive their health to be excellent or very good. The difference across categories was statistically significant for all groups except for those who were 60 years or older. Likewise, the proportion of people reporting two or more medical conditions increased as the BMI category increased across all age groups (Figiue 2).

DISCUSSION

We observed that close to 50% of the population were obese and that 80% had a BMI above the normal range of less than 25 kg/m^2. Obesity and overweight levels occur at a young age in this population: only 30% of study participants who were younger than 30 years of age had a BMI less than 25 kg/m^2, and by 30 to 40 years of age, only 16.7% of participants had a BMI in a normal range. The consequences of obesity at a young age included poorer perceived health as well as more physician diagnosed medical (conditions before age 30 years. Participants younger than 30 years of age were three times as likely to perceive their health as fair/poor compared with people who had normal BMIs. Obese participants younger than, 30 years of age were 70% more likely to have two or more physician-diagnosed medical conditions, despite their younger age. BMI was associated with perceived health, number of medical conditions overall, and with specific medical conditions.

In addition to a high prevalence of overall obesity, the AIAN population included in this study had a high prevalence of central obesity, as indicated by high waist measurements. Overall, 47.1% of men and 78.3% of women had waist circumference measurements greater than 102 cm and 88 cm, respectively; the mean waist circumference for men was 100.6 cm and for women was 100.1 cm. These are much higher than those reported in a summary of 18 populations, in which the mean waist circumference for men between 55 and 64 years of age ranged from 85 to 99 cm and for women ranged from 80 to 96 cm.[23] Studies have shown increased risk of several chronic diseases associated with central obesity, including kidney disease, some cancers, heart disease, and respiratory diseases.[24–31] Even among people who are obese, central obesity in some populations increases the risk of additional health problems beyond the risk from obesity alone.[32] Given both the high rates of obesity and the high waist circumference observed in this population, a greater threat to health may exist than if noncentral obesity were present.

Individuals in our study who were overweight and obese reported more health problems than those who had a BMI less than 25 kg/m^2. A report from the National Health and Nutrition Examination Survey (NHANES) showed that, between 1999–2000, 30.6% of U.S. adults had a BMI of 30 kg/m^2 or more.[33] This figure, although high, is considerably lower than the 47.1% of AIAN participants in this study, despite our population being younger than that in the NHANES. As in the study by McDowell[33] of mainly non-Hispanic while people, people with a BMI of more than 30 kg/m^2 were more likely to perceive their health as fair/poor than people with a lower BMI.

Assessment of specific medical conditions associated with obesity showed that, among the very obese (i.e., those with a BMI of 35 kg/m^2 or more), participants were significantly more likely to report having had physician-diagnosed arthritis, high blood pressure, high cholesterol, gall bladder disease, and type 2 diabetes. It is important to note the gender differences in associations with specific medical conditions, such as having two more medical conditions, high blood pressure, and high cholesterol. The strength of the associations was generally stronger for men than for women for these conditions. Because the population was generally younger than 50 years of age, it is possible that women who are premenopausal and exposed to estrogen are less likely to have some medical conditions despite their obesiiy. Likewise, asthma was only significantly associated with obesity among

women. Bone fractures, chronic obstructive pulmonary disease, and depression were not associated with obesity. High BMI has been associated with higher bone mineral density[34]; thus, not seeing an association is not unexpected. On the other hand, depression has been associated with obesity in large national surveys.[35] It is interesting to note that, in one study, perceived weight was associated with depression whereas actual weight was not.[35] These results need further exploration and follow-up to obtain a better understanding of the observed associations.

Those who were most obese in this population reported less vigorous activity and more time spent watching television. Other data indicate that ethnic minorities in the United States, includiug American Indians, report less physical activity than non-Hispanic whites.[36–38] In other studies of American Indian women,[38,39] 55% of participants did not participate in the recommended three or more 20-minute sessions of leisure-time physical activity per week. Of these, 50% of participants reported no leisure-iime physical activity at all. Data also have shown that physical activity levels among American Indian populations have substantially decreased over recent decades,[40,41] which most likely contributes to the high percentage of the population who are overweight and obese.

There are many aspects of tribal culture and lifestyle, aud in the EARTH study we used two indicators of traditional Native lifestyle and cultural affiliation, language used at home and identification with tribal traditions. These were of interest in part because of trends in increasing rates of obesity and diabetes that parallel the adoption of a more Western lifestyle by AIAN people. We did not observe an association between the crude indicators of a more traditional lifestyle that were available to us and either BMI or waist circumference measurements. It is possible that our inability to fully capture activity related to traditional lifestyle may have impacted our ability to measure the association between traditional lifestyle and BMI.

This study has limitations. Because of the cross-sectional nature of the study, it is impossible to determine if associations are causal. Additionally, we have measured height, weight, and girth measurements, but we are unable to correlate those measurements to actual body fat. Participants self-reported lifestyle and medical conditions, leaving room for error in reporting that would misclassify individuals in terms of exposures. To obtain a better understanding of obesity in this population, it is necessary to evaluate both genetic and lifestyle factors over time and their interplay in the development of obesity.

The EARTH study is one of only a few studies that has examined obesity and associated factors among AIAN people. The results of this study provide a more complete picture of the degree of obesity and central obesity in this population than has existed to date. It also provides insight into the cross-sectional association of obesity with medical conditions and the impact of obesity on perceived health. This study provides valuable baseline data for future prospective studies and for health promotion efforts in these populations. It is important to identify the factors that lead to obesity in this population and to develop methods to alleviate the obesity problem. These data show the need to start at young ages to prevent obesity, given the number of people younger than 30 years who are obese and the related medical conditions that have developed in those young people.

Acknowledgments

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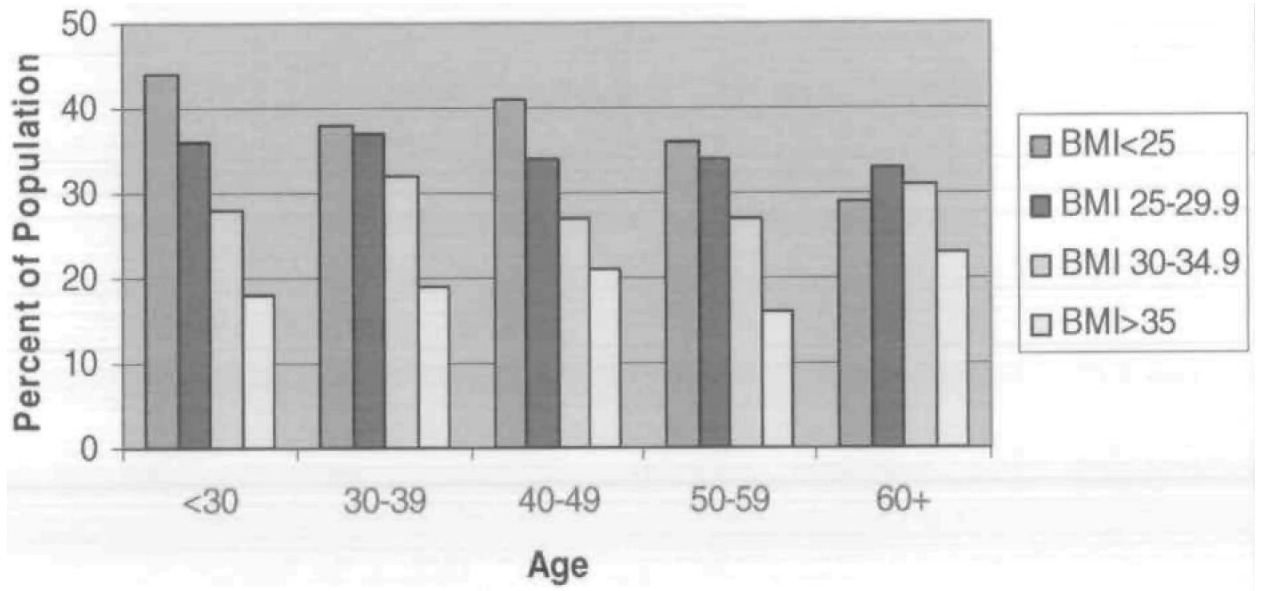
Figure 1.
Percent of the Population Reporting Excellent/Very Good Health by Body Mass Index Level and Age
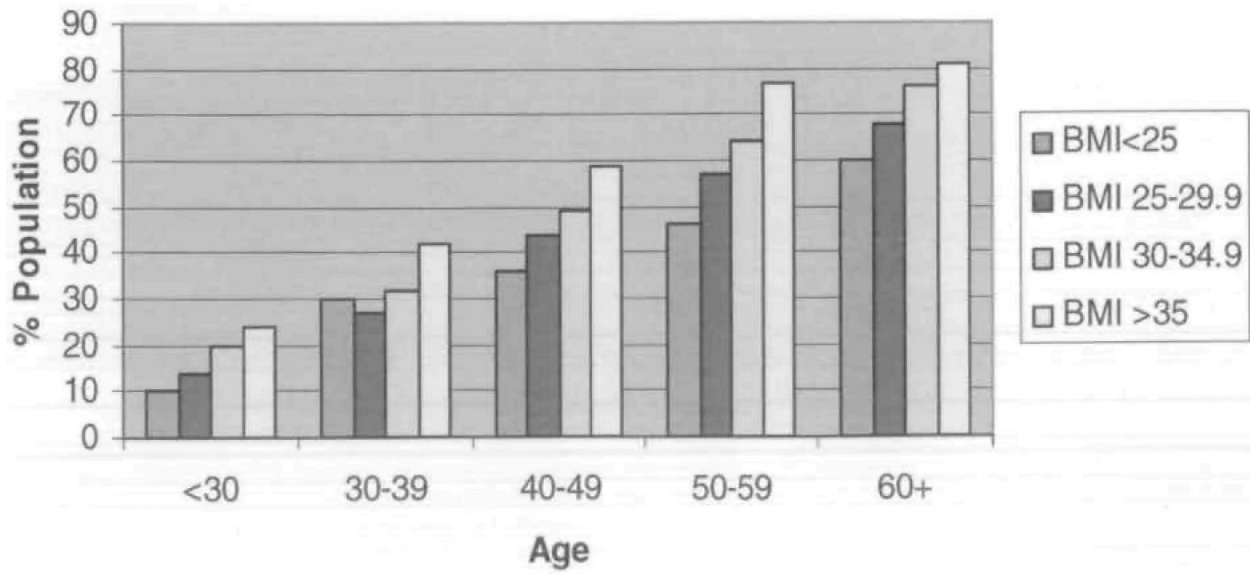
Figure 2.
Percent of the Population With Two or More Medical Conditions by Body Mass Index
Level and Age

Table 1

Description of Population Demographics

	Overall Mean (SE)	BMI (kg/m²)†					Waist Circumference (cm)‡		
		<25 Mean (SE)	25–29.9 Mean (SE)	30–34.9 Mean (SE)	≥35 Mean (SE)	p*	Acceptable Mean (SE)	High Mean (SE)	p
BMI, kg/m²									
Men	29.0 (0.10)	22.6 (0.07)	27.5 (0.06)	32.2 (0.08)	39.8 (0.10)	<0.01	25.4 (0.08)	34.1 (0.10)	<0.01
Women	31.2 (0.08)	22.4 (0.08)	27.6 (0.06)	32.3 (0.06)	40.0 (0.07)	<0.01	23.7 (0.14)	33.3 (0.07)	<0.01
Waist circumference, cm									
Men	100.5 (0.23)	84.9 (0.22)	97.3 (0.18)	100.2 (0.23)	124.7 (0.30)	<0.01	90.8 (0.18)	114.1 (0.22)	<0.01
Women	100.1 (0.18)	80.5 (0.23)	93.1 (0.17)	103.6 (0.18)	117.5 (0.19)	<0.01	80.5 (0.28)	105.5 (0.15)	<0.01
Total	11,243	20.5%	32.4%	25.7%	21.4%	11,236	35.4%	64.6%	
Age, y									
<30	3249	30.1	30.5	21.3	18.0	<0.01	48.2	51.8	<0.01
30–39	2320	16.7	28.4	26.5	28.4		30.2	69.8	
40–49	2734	16.7	35.8	26.4	21.1		32.0	67.1	
50–59	1796	16.1	33.7	28.9	21.3		28.2	71.8	
>60	1143	16.6	36.1	30.1	17.1		27.2	72.8	
Gender									
Men	4228	25.8	36.5	23.9	13.8	<0.01	58.3	41.7	<0.01
Women	7015	17.3	30.0	26.9	25.9		21.7	78.3	
Location									
Alaska	3822	26.0	31.8	22.2	20	<0.01**	43.8	56.2	<0.01**
Southcentrat	1394	22.2	32.0	23.9	22	<0.01***	38.3	61.7	<0.01***
Southeast	885	20.1	28.8	23.1	28		40.7	59.3	
Southwest	1543	32.9	33.2	20.2	13.7		50.5	49.5	
Navajo	7421	17.6	32.8	27.6	22		31.1	68.9	
Urban/airal location									
Urban	1745	21.3	32.0	24.5	22.2	0.42	36.7	63.3	0.23
Rural	9142	20.4	32.5	26.0	21.1		35.2	64.8	
Income									
≤$15,000	4698	21.3	31.8	25.4	21.4	<0.01	37.6	62.4	<0.01

| | BMI (kg/m²)† | | | | | | Waist Circumference (cm)‡ | | |
	Overall Mean (SE)	<25 Mean (SE)	25–29.9 Mean (SE)	30–34.9 Mean (SE)	≥35 Mean (SE)	p*	Acceptable Mean (SE)	High Mean (SE)	p
$15,001–35,000	2770	18.3	31.4	27.6	22.7		32.8	67.2	
>$35,000	2062	16.9	34.3	25.8	22.9		34.3	65.7	
Education									
<High school	2800	23	31.7	25.3	20.1	<0.01	37.6	62.4	<0.01
High school or GED	3746	22.5	32.0	25.4	20.2		38.5	61.5	
Voc/tech/assoc/col	4028	17.1	32.9	26.4	23.6		31.4	68.6	
Bach/Master/PhD	569	18.8	35.5	26.2	19.5		33.8	66.2	
Employed within the past year									
Yes	7023	19.9	32.9	26	21.2	<0.01	37.0	63.0	<0.01
No	3382	22.5	31.0	24.5	21.9		33.8	66.2	
Retired	702	17.0	36.5	28.3	18.2		28.6	71.4	

† BMI indicates body mass index; SE, standard error; GED, general education degree; voc, vocational; tech, technical; assoc, associate's degree; col, college degree; bach, bachelor's degree; master, master's degree; PhD, doctorate degree.

‡ Acceptable waist circumference is ≤102 cm for men and ≤88 cm for women; values above this are considered high.

* The p values are χ^2 p values for difference in proportion of categorical variable compared with BMI level and waist circumference level. For continuous variable of BMI and waist circumference, the p value is the difference in means across level of BMI and waist by using analysis of covariance.

** This p value is for Alaska and Navajo with BMI categories.

*** This p value is for difference with Alaska region with BMI categories.

Table 2

Associations Among Self-Reported Health and Lifestyle Factors and Body Mass Index and Waist Circumference

Factor	BMI (kg/m²)*,†						Waist Circumference (cm)*,‡			
	Overall N	<25 %	25–29.9 %	30–34.9 %	≥35 %	p	Overall N	Acceptable %	High %	p
Total	11,243	20.47	32.43	25.74	21.36		11,236	35.43	64.57	
Cigarette smoking status										
Never	7679	18.26	32.80	27.06	21.88	0.01	7676	31.51	68.49	0.02
Former	664	12.50	31.63	27.71	28.16		662	29.46	70.54	
Current	2803	28.43	31.57	21.58	18.41		2801	47.63	52.37	
Self-reported health										
Excellent/very good	3435	26.55	36.45	23.64	13.36	<0.01	3430	44.99	55.01	<0.01
Good	4687	19.31	32.66	26.61	21.42		4686	34.23	65.77	
Fair/poor	2974	15.16	27.34	26.73	30.77		2972	26.31	73.69	
Language used at home										
Native	1159	19.84	35.63	25.11	19.41	0.87	1159	38.05	61.95	0.87
English	4667	22.48	30.88	24.68	21.96		4663	37.79	62.21	
Both	5270	18.82	33.06	26.85	21.27		5267	32.79	67.21	
Identify with tribal tradition										
A lot	4425	19.14	34.24	25.58	21.04	0.97	4422	34.89	65.11	0.17
Some	3804	20.53	32.05	26.00	21.42		3804	36.12	63.88	
A little	2239	22.69	29.43	25.90	21.97		2234	35.63	64.37	
Not at all	676	21.30	32.25	24.85	21.60		677	34.12	65.88	
	N	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	p	N	Mean (SE)	Mean (SE)	p
SF12 PCS†	11,009	50.5 (0.21)	50.1 (0.18	49.5 (0.20)	47.6 (0.22)	<0.01	11,009	50.6 (0.17)	48.7 (0.15)	<0.01
SF12 MCS†	11,009	46.3 (0.19)	46.6 (0.16	46.9 (0.18)	46.4 (0.20)	0.27	11,009	46.5 (0.16)	46.6 (0.14)	<0.01
Vigorous activity	11,160	4.9 (0.22)	3.8 (0.18	3.14 (0.20)	2.3 (0.22)	<0.01	11,168	4.6 (0.17)	2.8 (0.16)	<0.01
TV/video games†	11,111	13.4 (0.30)	13.2 (0.25)	14.1 (0.28)	15.1 (0.30)	<0.01	11,119	13.1 (0.24)	14.4 (0.21)	<0.01

*
Analysis was adjusted for age, gender, and region as described in the methods for continuous and categorical variables.

†
BMI indicates body mass index; SF12 PCS, 12-question short-form survey physical component summary; SF12 MCS, 12-question short-form survey mental component summary; TV, television.

‡
Acceptable waist circumference is ≤102 cm for men and ≤88 cm for women; values above this are considered high.

Table 3

Association Between Body Mass Index and Various Health Conditions by Gender[*]

	Men						Women					
	BMI, kg/m²											
	25–29 vs. ≤25		30–34.9 vs. ≤25		≥35 vs. ≤25		25–29 vs. ≤25		30–34.9 vs. ≤25		≥35 vs. ≤25	
Factor	PR[*,†]	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
General health perception												
Excellent/very good	1.00		1.00		1.00		1.00		1.00		1.00	
Good	1.08	0.97–1.21	1.21	1.05–1.40	2.09	1.65–2.64	1.11	1.01–1.23	1.25	1.12–1.40	1.44	1.27–1.63
Fair/poor	1.05	0.91–1.20	1.30	1.10–1.53	2.88	2.27–3.65	1.13	1.01–1.27	1.34	1.19–1.52	1.70	1.50–1.93
Two or more medical conditions‡												
Yes	1.08	0.96–1.21	1.28	1.11–1.47	1.75	1.46–2.09	1.10	0.99–1.21	1.19	1.07–1.32	1.36	1.23–1.51
High blood pressure												
Yes	1.28	1.12–1.46	1.56	1.35–1.82	2.57	2.13–3.10	1.18	1.04–1.32	1.30	1.16–1.46	1.47	1.31–1.64
High cholesterol												
Yes	1.30	1.11–1.52	1.59	1.33–1.90	2.24	1.80–2.80	1.12	0.98–1.27	1.17	1.02–1.33	1.26	1.10–1.45
Gall bladder disease												
Yes	1.20	0.93–1.55	1.34	1.01–1.79	1.59	1.11–2.30	1.14	1.01–1.29	1.23	1.09–1.39	1.39	1.24–1.55
Bone fracture after age 18 y												
Yes	0.95	0.85–1.07	0.94	0.81–1.08	0.86	0.71–1.04	1.03	0.92–1.16	1.03	0.91–1.16	1.05	0.93–1.19
Arthritis												
Yes	1.03	0.88–1.21	1.18	0.99–1.42	1.47	1.18–1.84	1.02	0.90–1.16	1.04	0.91–1.18	1.15	1.01–1.30
Asthma												
Yes	0.92	0.74–1.13	1.19	0.97–1.45	1.24	0.95–1.61	1.03	0.90–1.19	1.12	0.98–1.28	1.29	1.15–1.45
Chronic obstructive pulmonary disease												
Yes	0.95	0.73–1.24	1.10	0.80–1.50	1.13	0.77–1.64	1.08	0.88–1.33	1.14	0.92–1.40	1.16	0.95–1.42
Depression												
Yes	1.01	0.85–1.18	1.05	0.86–1.28	1.17	0.92–1.50	0.99	0.88–1.11	1.01	0.90–1.14	1.05	0.94–1.18
Type 2 diabetes												
Yes	1.14	0.94–1.37	1.34	1.09–1.64	1.74	1.37–2.21	1.19	1.01–1.40	1.28	1.11–1.48	1.47	1.29–1.68

[*] BMI indicates body mass index; PR, prevalence ratio; CI, confidence interval.

[†]PRs adjusted for age, region, and smoking status.

[‡]Risk of having the condition versus not having it by level of BMI.