

ORIGINAL ARTICLE

TRADITIONAL FOODS AND PHYSICAL ACTIVITY PATTERNS AND ASSOCIATIONS WITH CULTURAL FACTORS IN A DIVERSE ALASKA NATIVE POPULATION

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Received 18 January 2008; Accepted 5 June 2008

ABSTRACT

Objectives. To determine the prevalence of traditional food and physical activity use and associations with cultural factors among 3,830 Alaska Native and American Indian (AN/AI) people enrolled in the Education and Research Towards Health (EARTH) Study in 3 regions of Alaska.

Study design. Cross-sectional analysis of baseline data from a cohort study.

Methods. Participants (2,323 women and 1,507 men) completed a computer-assisted self-administered questionnaire that included information on diet, physical activity, life-style and cultural factors.

Results. Over 92% of participants reported eating at least 1 traditional food in the past year. The top 3 traditional foods reported were fish, moose and *agutaq* (a mixture of berries and fat). The percentage of people who consumed traditional foods varied by region and age but not by sex ($p < 0.01$). Almost 70% of participants engaged in at least one traditional harvesting physical activity. Picking berries or greens, cutting/smoking fish or meat and fishing were the most common activities. Participation in traditional physical activity was highest in south-west Alaska and was higher among men than women, but did not differ by age ($p < 0.01$). Both traditional food and physical activity were associated with greater tribal self-identification, speaking a Native language at home, using traditional remedies and participating in or attending traditional events ($p < 0.05$).

Conclusions. The EARTH Study found relationships between traditional food use, physical activities, cultural activities and behaviours. Consumption of a variety of traditional foods and participation in traditional physical activities remain an important part of the contemporary Alaska Native life-style. Efforts to promote and sustain these foods and activities in AN/AI populations may lead to improved health outcomes. (*Int J Circumpolar Health* 2008; 67(4):335-348)

Keywords: Alaska Natives, traditional diet, physical activity

INTRODUCTION

Historically, Alaska Native peoples (AN) lived entirely on foods hunted, gathered, harvested, preserved and prepared directly from the land and sea (traditional foods). Some of the major foods consumed included deer, salmon and shellfish in the Aleutian chain and south-east Alaska, moose and caribou in the interior of the state and marine mammals (bowhead whale, seal species and walrus) in the Arctic and along the western coast. In all areas berries and fish were common in the diets of Alaska Natives.

Today, most Alaska Natives have diets made up of both traditional and store-bought foods (1). Harvesting, preserving and using traditional foods can perform a broad range of spiritual, mental, educational, economic and societal functions, and have been shown to be associated with increased energy expenditure (2–5). Studies among Indigenous peoples in Alaska and Canada have shown differences in intake of traditional foods by age, with younger adults, especially women, eating fewer traditional foods than their elders (3,6,7). The decreased use of traditional foods is associated with an increased proportion of carbohydrates and store-bought foods in the diet. A study among Indigenous peoples of the Canadian Arctic found that on days when no traditional foods were consumed participants had a significantly higher percentage of their energy intake as carbohydrate, fat and sucrose, suggesting lower dietary quality on days when no traditional foods were consumed (7). Traditional harvesting-related physical activity has also been declining with a shift to a more sedentary life-style among northern Indigenous peoples (8). While traditional food use and physical activity have been declining across the circumpolar north, the prevalence of chronic

diseases, such as obesity, diabetes and cancer, have increased (9–15). It has been postulated that traditional foods and the physical activity associated with harvesting traditional foods may protect against some of these conditions.

The Education and Research Towards Health (EARTH) Study is a multicentre study of Alaska Native and American Indian (AN/AI) peoples designed to examine risk and protective factors for chronic diseases. We have previously described the methods used to collect dietary data in this cohort (16) as well as describing its total physical activity patterns (17). The aim of this project was to examine the prevalence of traditional food use and physical activities and their relation to various sociodemographic characteristics among a contemporary AN/AI population. We further examined how adherence to selected traditional AN life-style and cultural factors related to traditional food use and harvesting physical activity.

MATERIAL AND METHODS

Study population

The study design, survey methods and measurement instruments for the EARTH Study have been described in detail elsewhere (16). This report examines data collected from 3,830 participants enrolled in the Alaska EARTH Study from March 2004 through August 2006. Alaska participants came from 26 communities in 3 regions. The south-central Alaska region included AN/AI peoples from many different ethnic groups living in or around Alaska's largest city (population 350,000). The south-east Alaska region included mostly Tlingit, Haida and Tsimshian Indian people living in smaller communities (population 500 to 30,000). The

south-west Alaska region included mostly Yup'ik people and was the most rural and remote of the 3 regions, with communities ranging in population size from 200 to 5,500. All of the south-east and south-west communities were located off the road system and were accessible only by airplane, with seasonal access by snowmobile or boat. Because of the extreme range of Alaskan geography, the available plants and animals vary widely and include a rich diversity of species: ocean fish, freshwater fish, sea mammals, land mammals, birds, bird eggs, berries and plants. In all areas berries and fish are common, especially salmon among the fish species. Some of the major species consumed in the south-east include deer, salmon and shellfish. In the south-central area moose and caribou are available. In the south-west, marine mammals including whale, seal species and walrus are available locally or are traded from farther north.

Methods of recruitment included presentations to tribal groups and health care providers, informational tables staffed by study personnel at community events, house-to-house recruiting, brochures and flyers in public locations and public service announcements on local radio and in local newspapers. Enrollment was available to all residents in the 26 communities who were American Indian and Alaska Native and eligible for health care through the Indian Health Service; at least 18 years of age; able to give informed consent; not currently pregnant; and not currently on chemotherapy.

Data collection

EARTH participants completed self- and interviewer-administered questionnaires on demographics, diet, physical activity, life-style and cultural practices, environmental exposures, cancer screening practices, medical and repro-

ductive history and family history of chronic diseases. Participants completed the diet and physical activity questionnaires by using computer-assisted self-interviews on touch-screen panels while listening to an audio version of the questionnaire by headphones in English or Yup'ik (18). Tribal leaders and local community members as well as experts in the field of Alaskan physical activity and wild foods were consulted in order to ensure that the questions included the major sources of traditional foods and physical activity among the AN/AI populations surveyed.

The study protocol was approved by the Alaska Area Institutional Review Board (IRB), the research and ethics committees and governing boards of each of the participating regional health corporations and the tribal councils of the participating communities. All participants provided informed consent before participating in the study.

Measurement of diet

The EARTH diet history questionnaire (DHQ) included area-specific modules in order to incorporate local food availability. The methods used to develop the DHQ are described elsewhere (19). The DHQ was a semi-quantitative method, consisting of main food group questions, specific food items within the main food group and food preparation practices. Foods commonly eaten by the general U.S. population as well as foods indigenous to Alaska were included in the DHQ. We measured both frequency as well as variety of traditional foods consumed. For each major food group, participants were asked if they ate the food at least once a month or more or at least 12 times in the past year. The DHQ listed the most commonly consumed traditional foods. Traditional foods were considered to be

all foods locally hunted, harvested, fished and gathered, including seafood, game meat, marine mammals and their fats, berries, greens and wild birds and bird eggs. There were 27 traditional foods incorporated into the questionnaire. We compared high versus lower consumers of traditional foods. Those consuming 10 or more traditional foods represented the highest quartile of traditional food consumption. For associations of traditional food consumption and sociodemographic characteristics we therefore divided participants into 2 groups: those who reported using less than 10 versus 10 or more different traditional foods in the past year.

Measurement of physical activity

The format for the EARTH Study physical activity questions was adapted from the Multi-Ethnic Study of Atherosclerosis (MESA) and the Taylor physical activity questionnaires (20,21). Participants recorded their total time spent in activities frequently performed followed by time spent on activities performed less frequently. Traditional physical activity was activity related to wild food procurement and harvesting. Many of the traditional activities queried, while common among these particular populations, are rare or non-existent in other populations. These activities include berry picking, fishing by hand or with a set net, hunting marine mammals, hunting big or small game, trapping, butchering game, cutting and/or smoking fish or meat, and working on animal skins or tanning hides. We compared high versus lower participation in traditional activities. Those doing 3 or more traditional activities represented the highest quartile of traditional activity. For associations of traditional activity and sociodemographic characteristics we therefore divided participants into 2 groups based on the number of traditional

physical activities they reported in the past year: less than 3 versus 3 or more.

Measurement of cultural characteristics

Prior to the EARTH Study no questionnaires were developed or validated that addressed cultural characteristics in this population. Therefore, study staff, along with tribal representatives and experts in the behavioural health characteristics of Alaska Native people developed questions related to culture and traditional life-style. Cultural variables included identification with Native culture (a lot/some/a little/not at all), Native language use at home (yes/no), participation in traditional events such as Native dancing, potlatch feasts or sweats (yes/no) and using traditional medicines when ill or to stay well (yes/no).

Statistical analysis

Summary statistics were calculated to provide an overview of the demographic characteristics of Alaska EARTH Study participants. The percentages of respondents reporting traditional activities and foods by sex, age and study region were described. Frequencies were calculated by sex, age, educational level, employment, marital status, annual household income and self-reported health status.

All analyses were conducted with the Statistical Packages for the Social Sciences (v. 15.0, SPSS Inc., Chicago, IL, USA); p-values ≤ 0.05 were considered to be statistically significant. Chi-square tests for proportion differences and odds ratios were calculated. Logistic regression was used to examine the relationship of traditional food use and physical activity with cultural factors adjusted for age, sex, study region, income, education and employment and marital status.

RESULTS

Demographic characteristics

This report examines data collected from 3,830 Alaska participants enrolled in the study from 1 March 2004 through 31 August 2006. Demographic characteristics for EARTH

participants (n=3830) are shown in Table I. Although the cohort was not randomly selected, the distribution of the population closely resembled the distributions of age and marital status reported by the 2000 U.S. Census for AN/AI in the respective regions (data not shown) (22). There were about equal numbers of participants

Table I. Characteristics of 3,830 participants in the Alaska EARTH Study.

	Total n (%) (n=3830)	Men n (%) (n=1507)	Women n (%) (n=2323)
Alaska Region			
South-central	1397 (36.5)	461 (30.6)	936 (40.3)
South-east	888 (23.2)	328 (21.8)	560 (24.1)
South-west	1545 (40.3)	718 (47.6)	827 (35.6)
Race/Ethnicity			
Aleut	323 (8.5)	111 (7.4)	212 (9.2)
Athabascan	390 (10.2)	146 (9.7)	244 (10.6)
Yup'ik	1889 (49.6)	813 (54.1)	1076 (46.6)
Inupiaq	404 (10.6)	142 (9.5)	262 (11.3)
Cupik	43 (1.1)	14 (0.9)	29 (1.3)
Siberian Yup'ik	21 (0.6)	4 (0.3)	17 (0.7)
Tlingit/Haida/Tsimshian	934 (24.4)	349 (23.2)	585 (25.2)
Non-Alaskan Tribes	205 (5.4)	71 (4.7)	134 (5.8)
Age, years			
18-34	1443 (37.7)	581 (38.6)	862 (37.1)
35-54	1730 (45.2)	686 (45.5)	1044 (44.9)
55+	657 (17.2)	240 (15.9)	417 (18.0)
Education			
Less than high school	890 (23.3)	390 (25.9)	500 (21.6)
High school graduate	1410 (36.8)	632 (41.9)	778 (33.5)
Some college or tech school	1315 (34.4)	438 (29.1)	877 (37.8)
College graduate	212 (5.5)	47 (3.1)	165 (7.1)
Employment Status			
Employed or self-employed	1720 (45.1)	539 (35.9)	1181 (51.0)
Not currently employed	2096 (54.9)	962 (64.1)	1134 (49.0)
Annual Household Income			
≤\$15,000	1343 (41.1)	623 (48.9)	720 (36.1)
>\$15,000	1926 (58.9)	652 (51.1)	1274 (63.9)
Marital Status			
Married/living as married	1633 (42.8)	516 (34.4)	1117 (48.3)
Single/divorced/widowed	2182 (57.2)	986 (65.6)	1196 (51.7)
Language spoken at home			
Native only	303 (7.9)	153 (10.2)	150 (6.5)
English only	2547 (66.6)	953 (63.3)	1594 (68.7)
Both Native and English	962 (25.1)	395 (26.2)	567 (24.4)

All characteristics differed significantly by sex ($p < 0.01$), except age and race/ethnicity.

coming from each of the three regions, with the most from the south-west region. The largest racial-ethnic group was the Yup'ik people. Other ethnicities represented included Inupiaq, Cupik, Siberian Yup'ik, Tlingit, Haida, Tsimshian, Athabascan, Aleut and American Indian peoples from the contiguous United States. Participants ranged in age from 18 to 94 at the time of recruitment (mean age 40.4 years). More women than men enrolled in the study (60.7% vs. 39.3%), but the sex ratio varied by region. The majority (76.7%) had a high school education or higher. About 45% of participants were employed for wages and more than half of participants reported household incomes greater than \$15,000 per year. Less than half were currently married, and about 33% spoke their Native language at home, either alone or in combination with English. There was a significant difference between the sexes in all demographic characteristics surveyed except for age and race/ethnicity ($p < 0.01$).

Traditional foods

Table II shows the top 10 traditional foods reported. Fish was the most frequently reported traditional food (80.2%), followed by moose (51.0%), *agutag* (a fat and berries mixture, sometimes with dried fish and other ingredients) (42.3%), gathered berries (38.7%) and herring eggs (38.7%). Women were more likely than men to report eating berries, herring eggs and shellfish, while men were more likely to report eating moose, *agutag*, caribou, seal or walrus and wild birds ($p < 0.01$ for all comparisons). Older participants (aged 55+) were the most likely of the 3 age groups to report eating traditional foods and ate significantly more fish, moose, shellfish, seal oil and seal and walrus than the two other age groups ($p < 0.01$ for all

comparisons). However, *agutag* was most highly reported by those in the 18–34-year-old age group ($p < 0.01$). There were large regional differences in the reported use of traditional foods ($p < 0.01$ for all regional comparisons). Those living in the south-west region were the most likely to report eating traditional foods overall and were more likely to report consumption of specific foods, including moose, *agutag*, gathered berries, caribou, seal oil, seal or walrus, and wild birds. South-east participants were more likely to report consuming herring eggs, fish and shellfish.

The largest major traditional food group reported was seafood (fish and shellfish), which comprised 29.6% of the total foods consumed, followed by berries and greens (23.9%), game and organ meats (23.7%), marine mammals (14.0%) and lastly birds and bird eggs (8.8%) (data not shown). Almost all participants (92.5%) reported eating at least 1 traditional food in the past year. Over half (53.8%) reported eating 7 or more different foods. A third of respondents (33.3%) reported eating 10 or more foods. Higher reporting of traditional food use (10+ foods) was significantly associated with each of the following categorizations: living in the south-west region (the most rural of the three), having a higher annual household income, completed high school, not married, and not currently employed ($p < 0.01$, data not shown).

Traditional harvesting physical activities

The number and percent of participants reporting traditional activities is shown in Table III. The leading traditional activities were picking berries or greens (49.2%), cutting and smoking fish or meat (44.6%) and fishing (40.9%). Men reported higher levels of participation than

Table II. Top 10 traditional foods reported in the past year by sex, age and EARTH Study region (n=3830).

	Total n (%)	Sex		Age 18-34 n (%)	Age 35-54 n (%)	Age 55+ n (%)	Region		
		Men n (%)	Women n (%)				South-central n (%)	South-east n (%)	South-west n (%)
Fish†	3071 (80.2)	1201 (79.7)	1870 (80.5)	1086 (75.3)	1436 (83.0)	549 (83.6)	1008 (72.2)	784 (88.3)	1279 (82.8)
Moose	1952 (51.0)	856 (56.8)	1096 (47.2)	774 (53.6)	864 (49.9)	314 (47.8)	550 (39.4)	111 (12.5)	1291 (83.6)
Agutag	1619 (42.3)	699 (46.4)	920 (38.0)	656 (45.5)	684 (39.5)	279 (42.5)	328 (23.5)	40 (4.5)	1251 (81.0)
Gathered berries	1482 (38.7)	489 (32.4)	993 (42.7)	545 (37.8)	688 (39.8)	249 (37.9)	447 (32.0)	347 (39.1)	688 (44.5)
Herring eggs	1481 (38.7)	548 (36.4)	933 (40.2)	457 (31.7)	707 (40.9)	317 (48.2)	306 (21.9)	631 (71.1)	544 (35.2)
Shellfish (crab, shrimp, clams, etc.)	1386 (36.2)	473 (31.4)	913 (39.3)	452 (31.3)	680 (39.3)	254 (38.7)	545 (39.0)	528 (59.5)	313 (20.3)
Caribou	1369 (35.7)	588 (39.0)	781 (33.6)	529 (36.7)	610 (35.3)	230 (35.0)	427 (30.6)	49 (5.5)	893 (57.8)
Seal oil	1277 (33.3)	512 (34.0)	765 (32.9)	376 (26.1)	634 (36.6)	267 (40.6)	265 (19.0)	192 (21.6)	820 (53.1)
Seal or walrus	1131 (29.5)	520 (34.5)	611 (26.3)	376 (26.1)	520 (30.1)	235 (35.8)	199 (14.2)	152 (17.1)	780 (50.5)
Wild birds	1094 (28.6)	510 (33.8)	584 (25.1)	420 (29.1)	482 (27.9)	192 (29.2)	189 (13.5)	49 (5.5)	856 (55.4)
Consumption of multiple traditional foods									
≥ 1 Foods	3543 (92.5)	1396 (92.6)	2147 (92.4)	1311 (90.9)	1613 (93.2)	619 (94.2)	1193 (85.4)	836 (94.1)	1514 (98.0)
≥ 7 Foods	2060 (53.8)	825 (54.7)	1235 (53.2)	677 (46.9)	975 (56.4)	408 (62.1)	516 (36.9)	525 (59.1)	1019 (66.0)
≥ 10 Foods	1274 (33.3)	523 (34.7)	751 (32.3)	382 (26.5)	623 (36.0)	269 (40.9)	294 (21.0)	280 (31.5)	700 (45.3)

†Fish includes smoked or dried fish (any kind), salmon/hooligan/herring, other fish like halibut or char, canned or jarred salmon, and fish soup. All differences between the sexes, age groups and regions with traditional foods were significant (p<0.01). The only non-significant associations were between sex and reported fish and seal oil consumption; and age and reported berries, herring eggs, caribou and wild bird consumption.

Table III. Number and percent of participants reporting traditional harvesting activities by sex, age and Alaska study region (n=3830).

Activity	Total		Sex		Age			Region		
	n (%)	Men n (%)	Women n (%)	18-34 n (%)	35-54 n (%)	55+ n (%)	South-central n (%)	South-east n (%)	South-west n (%)	
Picking berries or greens	1881 (49.2)	601 (40.0)	1280 (55.2)	663 (46.0)	870 (50.4)	348 (53.1)	430 (30.9)	415 (46.7)	1036 (67.2)	
Cutting/smoking fish/meat	1703 (44.6)	716 (47.6)	987 (42.6)	543 (37.7)	820 (47.5)	340 (52.0)	304 (21.8)	426 (48.0)	973 (63.1)	
Fishing	1568 (40.9)	842 (55.9)	726 (31.3)	619 (42.9)	746 (43.1)	203 (30.9)	421 (30.1)	322 (36.3)	825 (53.4)	
Game hunting	1031 (26.9)	769 (51.0)	262 (11.3)	456 (31.6)	454 (26.2)	121 (18.4)	130 (9.3)	215 (24.2)	686 (44.4)	
Marine mammal hunting	321 (8.4)	270 (18.0)	51 (2.2)	142 (9.8)	140 (8.1)	39 (6.0)	28 (2.0)	72 (8.1)	221 (14.3)	
Tanning hides	248 (6.5)	108 (7.2)	140 (6.0)	71 (4.9)	122 (7.1)	55 (8.4)	35 (2.5)	39 (4.4)	174 (11.3)	
Trapping	135 (3.5)	118 (7.8)	17 (0.7)	75 (5.2)	40 (2.3)	20 (3.1)	10 (0.7)	16 (1.8)	109 (7.1)	
Participation in multiple traditional activities										
≥1 Activities	2671 (69.7)	1107 (73.5)	1564 (67.3)	1005 (69.6)	1201 (69.4)	465 (70.8)	671 (48.0)	626 (70.5)	1374 (88.9)	
≥2 Activities	1968 (51.4)	910 (60.4)	1058 (45.5)	724 (50.2)	905 (52.3)	339 (51.6)	392 (28.1)	437 (49.2)	1139 (73.7)	
≥3 Activities	1314 (34.3)	741 (49.2)	573 (24.7)	512 (35.5)	614 (35.5)	188 (28.6)	207 (14.8)	274 (30.9)	833 (53.9)	

All differences between the sexes, age groups and regions with traditional activities were significant (p<0.05).

women in every traditional activity measured except for berry picking. Participants in the 55+ age group were more likely to report less vigorous physical activities such as cutting/smoking fish or meat (52.0%), berry picking (53.1%), and tanning hides or working on animal skins (8.4%), while participants in the youngest age group (18-34) reported more hunting of game (31.6%) and marine mammals (9.8%). The south-west region had the highest participation rates in all traditional activities queried (p<0.05 for all differences between the sexes, age groups and regions).

Participation in multiple traditional harvesting activities also was examined (Table III). The south-west region was the highest, with about three-quarters (73.7%) reporting participation in two or more activities, and over half (53.9%) reporting participation in 3 or more activities. Men were more likely to report multiple (≥3) traditional activities than women (49.2% vs. 24.7%, p<0.01). Significant association was found between multiple activity participation and age group (p<0.01). Persons over age 55 appeared to participate less frequently in 3 or more activities compared to their younger counterparts. Similarly to traditional food use, participants who engaged in traditional physical activities were more likely to live in the south-west region, have a higher annual household income, and not be currently employed (p<0.01 for each, data not shown).

Traditional foods, physical activities and cultural characteristics

There was a positive association between reported use of traditional foods and participating in traditional physical activities in the past year (Table IV). Participants who engaged in picking berries or greens, fishing and hunting game and marine mammals in the past year were more likely to report eating the foods produced by that activity ($p < 0.05$ for all comparisons).

As shown in Table V, individuals who reported consuming 10 or more traditional foods were more likely than those who

consumed fewer traditional foods to identify some or a lot with their tribal culture, speak their Native language at home, participate in or attend traditional events, and use Native remedies to stay well and when ill ($p < 0.05$ for all comparisons). Similarly to traditional foods, greater participation in traditional physical activities (3+) was significantly associated with increased tribal self-identification, an increased likelihood of speaking a Native language at home, participating or attending traditional events, and using Native remedies to stay well and when ill ($p < 0.05$ for all comparisons).

Table IV. Association of traditional food use and participation in traditional harvesting physical activities (n=3830).

	Ate traditional food†		OR (CI)*
	Yes n (%)	No n (%)	
Picked berries or greens			4.04 (3.4–4.8)
Yes	1636 (60.6)	245 (21.8)	
No	1064 (39.4)	877 (78.2)	
Hunted game (large and small)			4.00 (3.1–5.2)
Yes	942 (34.9)	89 (7.9)	
No	1755 (65.1)	1044 (92.1)	
Hunted marine mammals			5.94 (4.5–7.9)
Yes	261 (15.0)	60 (2.9)	
No	1479 (85.0)	2022 (97.1)	
Fished by hand or net			2.49 (2.0–3.0)
Yes	1384 (44.4)	184 (25.9)	
No	1736 (55.6)	526 (74.1)	

†Ate berries or greens if picked berries or greens, ate game if hunted game, ate marine mammals if hunted marine mammals, ate fish if reported fishing.

*Adjusted odds ratio (95% confidence interval) of reported use of traditional food and participating in traditional activity in the last year compared to the odds of eating that food when not participating in the associated activity adjusted for age, sex, study region, income, education, and employment and marital status.

Table V. Comparison of cultural characteristics by traditional foods consumed and traditional harvesting physical activities (n=3830).

	Traditional foods		OR (CI)*	Traditional harvest activities		OR (CI)*
	0-9 foods reported n=287 n (%)	10+ foods reported n=1274 n (%)		0-2 activities reported n=2516 n (%)	3+ activities reported n=1314 n (%)	
Identified with tribal tradition			1.28 (1.1-1.5)			1.22 (1.1-1.4)
Some/a lot	1417 (55.6)	789 (62.0)		1415 (56.4)	791 (60.2)	
Not at all/a little	1133 (44.4)	484 (38.0)		1094 (43.6)	523 (39.8)	
Spoke Native language at home			1.99 (1.7-2.4)			1.39 (1.1-1.7)
Yes	657 (25.7)	608 (47.7)		693 (27.6)	572 (43.5)	
No	1895 (74.3)	666 (52.3)		1819 (72.4)	742 (56.5)	
Participated/attended traditional events†			2.25 (1.8-2.8)			2.08 (1.7-2.6)
Yes	1886 (73.8)	1072 (84.1)		1884 (74.9)	1074 (81.7)	
No	670 (26.2)	202 (15.9)		632 (25.1)	240 (18.3)	
Used Native remedies to stay well			2.22 (1.9-2.7)			1.91 (1.6-2.3)
Yes	426 (18.9)	421 (37.3)		464 (20.6)	383 (33.8)	
No	1831 (81.1)	708 (62.7)		1790 (79.4)	749 (66.2)	
Used Native remedies when ill			2.33 (2.0-2.7)			2.22 (1.9-2.7)
Sometimes/usually	677 (28.4)	643 (53.0)		676 (28.7)	644 (51.8)	
Never	1707 (71.6)	571 (47.0)		1679 (71.3)	599 (48.2)	

†Traditional events include Native dances, powwows, potlatch feasts, chicken scratch dances and sweats.

*Adjusted odds ratio (95% confidence interval). Values greater than 1 indicate increased odds of traditional foods/activities being associated with cultural characteristic adjusted for age, sex, study region, income, education, and employment and marital status.

DISCUSSION

The EARTH Study is unique in that it included questions regarding AN/AI traditional diet and physical activities as well as foods and activities more commonly included in assessments of the general population. The study allowed assessment of traditional physical activity and dietary patterns among AN/AI peoples living in urban, rural and remote settings and associations with cultural factors. These data provide baseline information for further examination of changing patterns of traditional food use and physical activity.

Acculturation to a more Western life-style has been postulated as an important factor in the development of chronic diseases (23). One of the most common ways in which acculturation is evident is in the changing mixture of traditional and store-bought foods. Data are limited on food consumption of Alaska Native people. However, some general trends include substantial regional and seasonal variation in food-intake patterns, as well as an overall decline in consumption of traditional foods (24). An increasing reliance upon store-bought food sources has likely further decreased participation in traditional activities and tradi-

tional food consumption. Lending support to this is the finding by the EARTH Study that participants who consumed traditional foods and did traditional activities were also more likely to strongly identify with their cultural traditions and carry out more cultural practices.

The Alaska Traditional Diet Survey (ATDS, 2004) found a substantial reliance of Alaska Native peoples on many traditional foods such as fish, terrestrial mammals, marine mammals and wild plants. They found a similar percentage of people reporting fish use across regions as did the EARTH Study, but a much higher percentage of traditional foods reported overall, especially berries and wild greens across all areas, deer in the south-east region and marine mammals in the south-west (4). Differences between the 2 studies may have to do with the more limited sample size as well as the preponderance of rural communities surveyed by the ATDS, whereas the EARTH Study included over 1,000 Alaska Native participants in and near the largest city in Alaska, who reported fewer traditional foods than those in more remote areas. There were sex differences in reported use of specific traditional foods, but not in overall reported traditional food use by EARTH Study participants. This finding was similar to a study among the Belcher Island Inuit in Canada, which found no significant sex differences in household estimates of traditional foods, either combined or by food group (25). Older EARTH Study participants were also more likely to report consuming traditional foods, which has been noted in other studies of circumpolar Indigenous peoples (7).

Gender differences in overall physical activity have been noted previously in this cohort (17), and other studies have also classified AN/AI and First Nations women as less physically active than their male counterparts (8,26,27). A study of energy expenditure in the Yakut of Siberia found that more men than women participated in traditional tasks (5), a pattern that was also found among EARTH Study participants. Other factors associated with traditional activity participation were living in a rural area, speaking a Native language, having a higher annual income, and not being employed. While the association with both higher income and lack of employment might seem contradictory, there are several possible explanations. First, the cut-off point for income in the EARTH Study was \$15,000 per annum, so income levels categorized as high might still be considered low in other population-based studies. In addition, we examined total household income. Therefore, one member of the family could participate in traditional activities and not be in the work force while another was engaged in wage labour, in which case participants could be in the higher income group but still not be employed themselves. Our findings of the trade-offs between traditional activities and employment were in agreement with an econometric study of Alaska's North Slope Inupiat people which found an inverse relationship between active subsistence harvesting and wage labour time, although the authors noted that cash from employment was often used for subsistence inputs (i.e., gasoline, boats, ammunition), and redistribution of subsistence harvests played

an important role in cultural and community cohesion (28).

This study did not investigate possible social influences, such as the importance of sharing food among family and community members, or physical environmental influences on traditional physical activity and food use (26,27). Although qualitative research has shown that Native American people believe that the physical environment affects their physical activity participation (27), little quantitative data exists on environmental supports and barriers in the AN/AI populations surveyed by the EARTH Study. Even in AN communities that lack road access, mechanized transport for traditional activities (four-wheeled all-terrain vehicles, motorized boats) is increasingly common, and no research to date has examined the impact of mechanization in decreasing the physical intensity of traditional activities. A further issue is that climate change in the Arctic is beginning to effect available species and seasonality of harvesting activities, increasing both the risk and the cost of some traditional activities (29,30).

This study has several limitations. The first is the cross-sectional nature of the data, which came from the baseline visit of a prospective cohort study. These data allow for descriptive reporting but not for evaluating associations with health outcomes. We hope that a prospective follow-up of this cohort will help to resolve these issues in the future.

Participants were also not randomly selected, thus conclusions may not be generalizable. However, the distribution of the AN/AI populations surveyed closely resem-

bled the distributions of age and marital status reported by the 2000 U.S. Census (22), making it likely that the data are generalizable to these regions. Women were over-represented in the study, which may have skewed the total prevalence of foods and activities reported. Additionally, data were collected by self-report, and the current report does not provide quantification of traditional foods eaten, as validation of the diet portion of the EARTH questionnaires is ongoing. However, lending some credibility to the validity of the self-reported data is the consistency in responses; the majority of those who reported consuming traditional foods also reported doing traditional activities.

There have been few studies that have examined how cultural identification and behaviours might positively relate to health factors. A study of African-American men and women found that positive identification with African-American culture was associated with more leisure-time physical activity, lower-fat eating and not smoking (31). A study among the Omaha Tribe in Nebraska reported that high cultural identity was positively correlated with control of diabetes in terms of blood sugar levels (32), while another study of American Indian women found that cultural pride was a source of physical activity (33). A strong positive finding of the EARTH Study was the inter-relationship between traditional food use, traditional physical activities and tribal and cultural activities and behaviours.

Our findings show that traditional activities and foods are an important component of the physical activity and food intake of Alaska Native and American Indian peoples

in Alaska, and are associated with a stronger attachment to tribal and cultural identity. These data can be used to design health-promotion efforts with this population to improve overall health and wellness. Traditional harvesting activities and foods may play an important role in modifying health risks and protecting American Indian and Alaska Native peoples from increasingly common chronic diseases such as diabetes, heart disease, stroke and cancer.

Acknowledgments

This study was funded by grants CA88958 and CA96095 from the National Cancer Institute. The contents of this manuscript are solely the responsibility of the authors and do not necessarily represent the official view of the National Cancer Institute or the Indian Health Service. We would like to acknowledge the contributions and support of the Indian Health Service, the Alaska Native Tribal Health Consortium Board of Directors, Southcentral Foundation (SCF), Southeast Alaska Regional Health Consortium (SEARHC) and the Yukon-Kuskokwim Health Corporation (YKHC); Dr. Peter Holck, Dr. Ruth Etzel, Dr. Joseph Klejka, Kari Lundgren PA-C and Dr. Cindy Schraer; Tribal Advisory Board Members including George Ridley, Ileen Sylvester, Tim Gilbert and Fritz George; and the staff in Alaska including Katie Rose Hulett, Sharon Lindley, Cheri Hample, Maybelle Filler, Antoinette Thompson and Jaylene Wheeler.

REFERENCES

1. Bersamin A, Zidenberg-Cherr S, Stern JS, Luick BR. Nutrient intakes are associated with adherence to a traditional diet among Yup'ik Eskimos living in remote Alaska Native communities: the CANHR Study. *Int J Circumpolar Health* 2007;66:62–70.
2. Kuhnlein HV, Receveur O, Chan HM. Traditional food systems research with Canadian Indigenous peoples. *Int J Circumpolar Health* 2001;60:112–122.
3. Kuhnlein HV, Receveur O. Dietary change and traditional food systems of Indigenous peoples. *Annu Rev Nutr* 1996;16:417–442.
4. Final Report on the Alaska Traditional Diet Survey. Anchorage, AK: Alaska Native Epidemiology Center, Alaska Native Health Board; 2004. 162 pp.
5. Snodgrass JJ, Leonard WR, Tarskaia LA, Schoeller DA. Total energy expenditure in the Yakut (Sakha) of Siberia as measured by the doubly labeled water method. *Am J Clin Nutr* 2006;84:798–806.
6. Nobmann ED, Ponce R, Mattil C, Devereux R, Dyke B, Ebbesson SO, et al. Dietary intakes vary with age among Eskimo adults of Northwest Alaska in the GO-CADAN study, 2000–2003. *J Nutr* 2005;135:856–862.
7. Kuhnlein HV, Receveur O, Soueida R, Egeland GM. Arctic Indigenous peoples experience the nutrition transition with changing dietary patterns and obesity. *J Nutr* 2004;134:1447–1453.
8. Young TK, Katzmarzyk PT. Physical activity of Aboriginal people in Canada. *Can J Public Health* 2007;98 Suppl 2:S148–S160.
9. Murphy NJ, Schraer CD, Bulkow LR, Boyko EJ, Lanier AP. Diabetes mellitus in Alaskan Yup'ik Eskimos and Athabaskan Indians after 25 yr. *Diabetes Care* 1992;15:1390–1392.
10. Murphy NJ, Schraer CD, Theile MC, Boyko EJ, Bulkow LR, Doty BJ, et al. Hypertension in Alaska Natives: association with overweight, glucose intolerance, diet and mechanized activity. *Ethn Health* 1997;2:267–275.
11. Lanier A, Kelly J, Maxwell J, McEvoy T, Homan C. Cancer in Alaska Natives: thirty-five year report 1969–2003. Anchorage, AK: Office of Alaska Native Health Research and Alaska Native Epidemiology Center; 2006. 185 pp.
12. Naylor JL, Schraer CD, Mayer AM, Lanier AP, Treat CA, Murphy NJ. Diabetes among Alaska Natives: a review. *Int J Circumpolar Health* 2003;62:363–387.
13. Murphy NJ, Schraer CD, Thiele MC, Boyko EJ, Bulkow LR, Doty BJ, et al. Dietary change and obesity associated with glucose intolerance in Alaska Natives. *J Am Diet Assoc* 1995;95:676–682.
14. Gittelsohn J, Wolever TM, Harris SB, Harris-Giraldo R, Hanley AJ, Zinman B. Specific patterns of food consumption and preparation are associated with diabetes and obesity in a Native Canadian community. *J Nutr* 1998;128:541–547.
15. Receveur O, Boulay M, Kuhnlein HV. Decreasing traditional food use affects diet quality for adult Dene/Metis in 16 communities of the Canadian Northwest Territories. *J Nutr* 1997;127:2179–2186.

16. Slattery ML, Schumacher MC, Lanier AP, Edwards S, Edwards R, Murtaugh MA, et al. A prospective cohort of American Indian and Alaska Native people: study design, methods, and implementation. *Am J Epidemiol* 2007;166:606–615.
17. Redwood DG, Schumacher MC, Lanier AP, et al. Physical activity patterns of American Indian and Alaskan Native people living in Alaska and the southwestern United States. *American Journal of Health Promotion*; 2008 (in press).
18. Edwards SL, Slattery ML, Murtaugh MA, Edwards RL, Bryner J, Pearson M, et al. Development and use of touch-screen audio computer-assisted self-interviewing in a study of American Indians. *Am J Epidemiol* 2007;165:1336–1342.
19. Slattery M, Murtaugh M, Schumacher MC, Johnson J, Edwards S, Edwards R, et al. Development, implementation, and evaluation of a computerized self-administered diet history questionnaire for use in studies of American Indian and Alaska Native people. *J Am Diet Assoc* 2008;108:101–109.
20. Bild DE, Detrano R, Peterson D, Guerci A, Liu K, Shahar E et al. Ethnic differences in coronary calcification: the Multi-Ethnic Study of Atherosclerosis (MESA). *Circulation* 2005;111:1313–1320.
21. Taylor HL, Jacobs DR, Jr., Schucker B, Knudsen J, Leon AS, Debacker G. A questionnaire for the assessment of leisure time physical activities. *J Chronic Dis* 1978;31:741–755.
22. U.S. Census Bureau. Census 2000 American Indian Alaska Native Summary File; 2000 [cited 2008 Jan 18]. Available from: <http://factfinder.census.gov>.
23. Welty TK, Lee ET, Yeh J, Cowan LD, Go O, Fabsitz RR, et al. Cardiovascular disease risk factors among American Indians. The Strong Heart Study. *Am J Epidemiol* 1995;142:269–287.
24. Ballew C, RossTzilkowski A, Hamrick K, et al. The contribution of subsistence foods to the total diet of Alaska Natives in 13 rural communities. *Ecology of Food and Nutrition* 2006;45:1–26.
25. Wein E, Freeman MMR, Makus JC. Use of and preference for traditional foods among the Belcher Island Inuit. *Arctic* 1996;49:256–264.
26. Thompson JL, Wolfe VK, Wilson N, Pardilla MN, Perez G. Personal, social, and environmental correlates of physical activity in Native American women. *Am J Prev Med* 2003;25:53–60.
27. Coble JD, Rhodes RE. Physical activity and Native Americans: a review. *Am J Prev Med* 2006;31:36–46.
28. Kerkvliet J NW. Whaling and wages on Alaska's north slope: a time allocation approach to natural resource use. *Economic Development and Cultural Change* 1997;45:651.
29. Nuttall M, Forbes B, Kofinas G, Vlassova T, Wenzel G. Hunting, herding, fishing, and gathering: Indigenous peoples and renewable resource use in the Arctic. In: Symon C, Arris L, Heal B, editors. *Arctic climate impact assessment scientific report*. Cambridge: Cambridge University Press; 2005. pp. 649–690.
30. Fast H BF. Climate change, northern traditional and land-based economies. In: Mayer N AW, editor. *Canada country study: climate impacts and adaptation*. Ottawa: Environment Canada; 1998. pp. 206–226.
31. Airhihenbuwa CO, Kumanyika SK, TenHave TR, Morssink CB. Cultural identity and health lifestyles among African Americans: a new direction for health intervention research? *Ethn Dis* 2000;10:148–164.
32. Penn-Kennedy J BC. Cultural identity and control of diabetes among members of the Omaha Tribe in Nebraska. *Wicazo Sa Review* 1995;11:66–74.
33. Henderson KA, Ainsworth BE. Sociocultural perspectives on physical activity in the lives of older African American and American Indian women: a cross-cultural activity participation study. *Women Health* 2000;31:1–20.

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