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Enculturation, Perceived Stress, and Physical Activity: Implications for Metabolic Risk among the Yup'ik – The Center for Alaska Native Health Research Study

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Abstract

Objectives—American Indians and Alaska Natives report among the lowest levels of physical activity in the U.S, but there is very little systematic research examining the determinants of physical activity patterns in these populations. This study investigated the relationships between enculturation (or, cultural traditionality), psychosocial stress, and physical activity in a community-based sample of Yup'ik women and men living in rural Alaska Native communities. Associations between these variables and several metabolic risk factors were also examined.

Design—A sample of 488 Yup'ik participants (284 women and 204 men) from 6 villages in the Yukon-Kuskokwim Delta region completed a wellness survey and an array of physiological

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¹We conducted one additional set of regression analyses in which steps per day was included in the set of control variables. Thus, each risk factor was regressed onto perceived stress, enculturation, age, sex, smoking status, *and* steps per day. In these models, perceived stress was no longer a significant predictor of any risk factors. Thus, the effects of stress on cardiovascular risk in our sample appear to be mediated by physical activity.

assessments (e.g., BMI, blood pressure). A subset of 179 participants also completed a 3-day pedometer assessment of physical activity.

Results—Multivariate linear regression models indicated that participants who were more enculturated (i.e. living more of a traditional lifestyle) and who experienced lower levels of psychosocial stress were significantly more physically active. In turn, lower levels of psychosocial stress and higher levels of physical activity were both associated with lower BMI, lower percent body fat, and lower waist circumference.

Conclusions—Findings underscore the importance of gaining a culturally-specific understanding of physical activity patterns in indigenous groups in order to inform effective health promotion strategies.

Keywords

Pedometers; Physical activity; Alaska Natives; Enculturation; Obesity

Introduction

Substantial racial and ethnic health disparities in obesity and related chronic diseases persist in the United States (Kumanyika, 2008). Health disparities are particularly pronounced among American Indian and Alaska Native (AI/AN) populations who experience significantly higher rates of obesity, diabetes, and cardiovascular disease than non-Hispanic whites (Barnes et al., 2005). Although physical activity is widely recognized as critical in the prevention and treatment of obesity and related chronic diseases (Carroll & Dudfield, 2004; Fogelholm & Kukkonen-Harjula, 2000), AI/ANs are underrepresented in physical activity research (Coble & Rhodes, 2006). Current data indicate that AI/ANs report some of the lowest levels of physical activity out of all racial/ethnic groups in the U.S. (CDC, 2005; Denny et al., 2005; Duncan et al., 2009).

Any concerted effort to comprehend and improve physical activity patterns among AI/ANs must inevitably consider the influence of psychosocial stress and cultural identity. Life in many AI/AN communities is impacted by a disproportionately high stress load (Zahran, et al., 2004), due in large part to historical trauma and forced acculturation (Duran & Duran, 1995; Whitbeck et al., 2004). AI/ANs are disproportionately likely to experience numerous stressors, including violent crime, personal injury, poverty, family disruption, discrimination, specific trauma (e.g., violent or unexpected death of a loved one), and cumulative historical trauma (e.g., coercive boarding school placement) (Dinges & Joos, 1988; Manson, et al., 2005; Robin, et al., 1997). The experience of these stressors among AI/ANs is associated with increased substance abuse and a higher incidence of depressive and anxiety-related disorders (Beals, et al., 2005; Bechtold, et al., 1994; Dinges & Duong-Tran, 1993; Gray & Nye, 2001; Manson, 1996). Such mental and behavioral states have, in turn, been shown to have detrimental effects on pathways toward obesity, diabetes, and cardiovascular disease (Anda, et al., 1993; Bell, et al., 1998; Miller, et al., 2003). These relationships, possibly mediated through physical activity, may help explain the increased prevalence of chronic, lifestyle-related diseases in AI/AN communities witnessed over the last several decades.

Social scientists have observed that for many people in indigenous communities, the myriad of negative health consequences of acculturative stress may be regarded as a “crisis of the spirit,” characterized by the erosion of traditional practices and cultural identity (Duran, et al., 1998; Torres Stone, et al., 2006). In our previous work in Alaska Native communities, we have heard many subjective accounts of such a crisis, in which the loss of traditionality and the experience of psychosocial stress co-occur with a more sedentary lifestyle (Wolsko, et al., 2006, 2007). Core stressors include reduced access to subsistence resources and the profound disruption of a long-standing way of life. As a result, the culturally-relevant motivation for physical activity has been undermined and the elaborate meaning systems that sustain mental health have been diminished. As one interviewee from our research among the Yup’ik, of the Yukon-Kuskokwim (Y-K) Delta region in southwest Alaska, remarked, “The state and federal government restrict us from hunting the traditional food that we’ve always eaten. Right now we are about to begin to have a 5-year moratorium in our area for moose... For our life that is pretty much like in between a rock and hard place. This situation causes a lot of stress for some people. Stress can affect your health, too, mentally and physically.” In this cultural context, hunting is not simply a recreational activity, easily replaced with a jog on a treadmill or a walk to the grocery store. Instead it is an integral component in a complex system of identity, meaning, and physical and mental engagement with one’s social and natural surroundings. Another community member, when asked about what it meant to live a happy, healthy life, described this union of physical activity, traditional lifestyle, and cultural meaning: “To live a good life? ... is the lifestyle itself. It’s like going out fishing, trapping... getting ice, going out hunting, or logging... The lifestyle connects us with our personal identity, our history, our culture, our connections with the land, our families, our relations, and believing that everything has a spirit.” Such experiential reports support the contentions of *indigenist, post-colonial* models of wellness in Native communities (Walters & Simoni, 2002; Zimmerman, et al., 1998), suggesting that *enculturation* – the process of learning about, identifying with, and practicing one’s traditional culture – may have positive impacts on important health behaviors.

The present investigation extends our health research with Yup’ik communities by more systematically and objectively assessing the correlates of physical activity in this population. A primary hypothesis was that individuals who reported greater levels of enculturation (or, traditionality) would also be more physically active. Landrine & Klonoff’s (2004) operant theory of cultural change and ethnic minority health behavior provides a coherent framework for making this prediction. Central to their analysis is the presence or absence of specific cultural metacontingencies (e.g., norms, symbols, practices, environmental contexts) which act as the discriminative stimuli that evoke specific behaviors. Prior high-prevalence behaviors are thought to increase with enculturation and decrease with acculturation. In the Yup’ik context, traditionally high levels of physical activity appear to be sustained through adherence to certain cultural norms and practices – such as using traditional food and medicine, respecting elders, speaking Yup’ik, and engaging in spiritual practices – that embed community members in a subsistence way of life, which past ethnographic and survey research in the region describes as physically demanding (Fienup-Riordan, 2000; Redwood et al., 2008; Wolsko et al., 2006). The current investigation utilizes a comprehensive, quantitative measure of enculturation and an objective pedometer

assessment of physical activity in order to more systematically delineate the relationship between these constructs.

We also hypothesized that individuals who reported experiencing lower levels of psychosocial stress should be more physically active. Although research has been somewhat inconsistent regarding this relationship, a number of studies do provide evidence of a negative correlation (Ng & Jeffery, 2003; Holmes et al., 2010). This may be accounted for by the capacity of physical activity to support stress reduction (Dienstbier, 1989; Holmes et al., 2010; Salmon, 2001), as well as the tendency for increased stress to undermine the ability and/or motivation to physically engage the world (Steptoe, et al., 1998). Subjective accounts of the latter pathway from our previous experience in the field (Wolsko et al., 2006, 2007) reinforced our expectation that perceived stress and physical activity would be negatively correlated.

Another important goal of this work was to provide data, currently lacking for this study population, on the associations between physical activity and health indicators. Thus, we assessed relationships between physical activity and a number of metabolic risk factors, including adiposity, lipid profile, fasting blood glucose concentration, and blood pressure. We also examined the utility of both enculturation and psychosocial stress as predictors of these same risk factors. While the influence of enculturation is unknown, there is some indication of a bi-directional relationship between greater stress and greater adiposity (Björntorp, 2001; Carroll et al., 2008; Heslop et al., 2001; Rosen-Reynoso et al., 2011; Spencer & Tilbrook, 2011; van Jaarsveld et al., 2009).

Methods

Background and Participants

The Center for Alaska Native Health Research (CANHR) was established in 2001 to address increasing health disparities among Alaska Native people in the context of their unique geographic and cultural environment. The data presented in this article are drawn from an interdisciplinary, cross-sectional CANHR study investigating genetic, nutritional, and behavioral risk factors among Yup'ik Eskimos living in seven remote communities in the Yukon-Kuskokwim (YK) Delta region of Alaska (Boyer et al., 2005; Mohatt et al., 2007). The YK Delta is located in southwestern Alaska, and is populated predominately by Alaska Native people (81.9%) living in rural villages, most with between 150 and 600 inhabitants. The communities are remote and accessible only by air, or in some cases by snow machine in the winter and four-wheelers and boats in the summer. The median age is 25.3 years, compared with 35.9 years in the US population. According to the US Census 2000, 20.6% of families fall below the national poverty level and per capita income is \$12,603 per year. Yup'ik is the first language for most adults and a majority of the population, particularly the younger generation, is bilingual in Yup'ik and English.

Men and non-pregnant women who identified themselves as Yup'ik Eskimo and were 14 years of age or older were recruited from seven communities in the YK Delta. The study was designed to achieve a representative sample of Yup'ik participants through a number of strategies described in detail by Mohatt et al. (2007). A total of 488 individuals (284 women

and 204 men) completed a written survey (which included measures of enculturation and perceived stress) and had a physical health evaluation (which included assessments of adiposity, lipid profile, fasting blood glucose concentration, and blood pressure). All participants were invited to complete a 3-day pedometer assessment of physical activity. A subset of 261 participants elected to do so and, of these 261, 179 had complete data that included 3 days of pedometer recordings with at least 8 hours of wear time on each day. There were no significant demographic or health differences between the larger sample and the subsets. All participants were paid \$25 and received feedback on their current health information from a licensed physician in exchange for their participation. Those individuals completing the pedometer assessments received an additional \$20 for their time. Study protocols were approved by the University of Alaska Institutional Review Board, the National and Alaska Area Indian Health Service Institutional Review Boards, and the Yukon Kuskokwim Health Corporation Human Studies Committee.

Materials and Procedure

Enculturation—Level of enculturation was assessed with a 23-item survey measure designed specifically for the Yup'ik cultural context through an extensive period of item development and pretesting (Lardon et al., 2011; Wolsko et al., 2006). Survey items required participants to indicate how frequently they engaged in particular traditional behaviors, such as speaking Yup'ik, using traditional medicine (e.g., herbs, teas, salves), eating traditional Native foods, engaging in spiritual practices, and respecting elders. Participants responded to each item on a 3-point scale (1 = *never or almost never*, 2 = *sometimes*, 3 = *often*). Each individual was then assigned an *enculturation* score by calculating the mean of responses across all items. Higher numbers reflect greater enculturation.

Perceived Stress—Stress was assessed with the extensively validated *Perceived Stress* scale, consisting of 10 items that examine the extent to which people have experienced difficult or challenging situations in their lives in the last month (e.g., “In the last month, how often have you felt nervous or ‘stressed’? In the last month, how often have you found that you could not cope with all the things that you had to do?”) (Cohen et al., 1983). Responses to each item were given on a 3-point scale (1 = *never*, 2 = *sometimes*, 3 = *often*). Each participant was assigned a *perceived stress* score (calculated as the average of responses across all items), and higher numbers reflected greater stress.

Physical Activity—Pedometers were used to measure physical activity. Pedometers have previously been found to correlate well with accelerometers (Le Masurier & Tudor-Locke, 2003; Tudor-Locke et al., 2002) and self-reported physical activity questionnaires (Speck & Looney, 2006). Participants were instructed to wear a pedometer (Yamax Digiwalker, model SW-200, Yamax Corporation, Tokyo, Japan) on their hip during waking hours for three days, and were given instruction on proper attachment of the device. Tudor-Locke et al. (2005) reported that 3 days of pedometer data is sufficient to reliably estimate physical activity. The Yamax pedometer was selected because of its accuracy (Basset et al., 1996) and good agreement with other objective physical activity instruments (Tudor-Locke et al., 2002). Participants were provided with a log in which to record the following: (1) day of the

week; (2) the time the pedometer was put on; (3) the number of counts accrued at the end of the day; and (4) the time the pedometer was removed (Tudor-Locke & Myers, 2001). Participants were instructed to reset the pedometer each morning and record if the pedometer was removed for any reason during the day. Local field research assistants made daily VHF radio announcements to remind participants to wear their pedometer.

Body Composition & Adiposity—Anthropometric measurements were obtained by trained staff using protocols from the NHANES III Anthropometric Procedures Manual (Lohman, et al., 1988) as previously described (Boyer, et al., 2007). Weight and percent body fat were assessed using a portable scale and bioelectrical impedance analyzer (Tanita TBF-300A, Tanita Corporation, Arlington Heights, IL). All measurements were obtained by trained researchers.

Blood Analysis—Blood specimens were collected after at least 8 hours of fasting and were analyzed for high- and low-density lipoprotein cholesterol (HDL & LDL), triglycerides, and blood glucose. Analyses were performed in the field using a lipid and glucose analyzer (Cholestech LDX) for immediate participant feedback.

Energy Intake—Energy intake was assessed using a 24-hour recall and a 3-day food record, the results of which have been described previously (Bersamin et al., 2007, 2008). Food and beverage intake were recorded by certified interviewers using the computer-assisted Nutrition Data System for Research (NDSR software version 4.06). Although the majority of participants were bilingual, a native Yup'ik speaker also trained in the use of NDSR software assisted non-English speakers.

Results

Descriptive Statistics

Our overall analytic strategy focused on examining the prevalence and correlates of physical activity. Descriptive statistics for the set of 179 participants with complete pedometer data are presented in Table 1. Data are presented separately for women and men, along with p values from two sample t tests comparing gender groups on all variables. Participants' 3 day pedometer averages ranged from 133 to 18,657 steps per day, with an overall mean of 7366 steps and median of 7249 steps. Men were significantly more physically active than women. Forty-two percent of women were classified as sedentary, compared to 9% of men.

Enculturation, Perceived Stress, & Physical Activity

We conducted a single multivariate linear regression in order to examine the independent contributions of enculturation and perceived stress in predicting physical activity. In this model, participants' mean steps per day were regressed onto enculturation, perceived stress, age, and sex. Results indicated that more steps per day were associated with higher enculturation, $\beta = .17$, $t = 2.39$, $p = .02$; and lower perceived stress, $\beta = -.16$, $t = -2.23$, $p = .03$. In addition, physical activity was greater among men, $\beta = -.38$, $t = -5.35$, $p < .001$; and among younger participants, $\beta = -.36$, $t = -5.12$, $p < .001$. Using the coefficients from this model, we compared the mean levels of physical activity for participants in the upper and

lower quartiles of enculturation and perceived stress (data not shown). On average, individuals in the upper quartile for enculturation walked 1,465.3 more steps than those in the lower quartile. Conversely, individuals who reported the highest level of stress walked 1,530.4 fewer steps than individuals who reported the lowest levels of stress.

Physical Activity & Metabolic Risk Factors

Multivariate linear regression models were used to examine the independent effects of physical activity on metabolic risk factors, over and above control variables. For each model, the given risk factor was regressed onto mean pedometer counts per day, age, sex, smoking status, and energy intake. Table 2 presents the parameter estimates and significance levels for pedometer counts in each model. Pedometer counts had unique predictive effects on all three measures of adiposity: BMI, percent body fat and waist circumference. Using the coefficients from these models, we calculated that an increase of 3755 steps per day (equal to one standard deviation for the entire sample) was associated with a 1.9 point reduction in BMI (equivalent to approximately 13 pounds for a 5 ft. 8 in. individual), a 2.4% reduction in body fat, and a 4.3 cm reduction in waist circumference. Higher levels of physical activity were also associated with lower levels of triglycerides and fasting glucose. No significant associations were observed between steps per day and other risk factors. Results did not differ when a step X sex interaction term was included in the models.

Enculturation, Perceived Stress, & Metabolic Risk Factors

Multivariate linear regression models were also used to examine the independent effects of perceived stress and enculturation on metabolic risk factors, over and above control variables. For each model, the given risk factor was regressed onto perceived stress, enculturation, age, sex, and smoking status. Given prior research (e.g., Björntorp, 2001; Carroll et al., 2008; Spencer & Tilbrook, 2011), we were primarily interested in testing for the unique effects of perceived stress on measures of adiposity. Results indicated that higher levels of perceived stress were associated with greater BMI, $\beta = .11$, $t = 2.42$, $p = .01$; greater percent body fat, $\beta = .07$, $t = 2.00$, $p = .04$; greater waist circumference, $\beta = .09$, $t = 2.07$, $p = .04$; and greater diastolic blood pressure, $\beta = .11$, $t = 2.48$, $p = .03$. Enculturation was not associated with any of the risk factors.

Discussion

To our knowledge, this is the first published study to examine relationships between psychosocial stress, cultural identity, and objectively measured physical activity in an Alaska Native study population. Our findings that Yup'ik people who report living a more traditional lifestyle and lower levels of psychosocial stress are more physically active highlight the importance of gaining a valid and culturally-specific understanding of physical activity levels in indigenous groups to inform effective health promotion strategies.

Interventions aimed at increasing physical activity are likely to succeed to the extent that they are meaningfully embedded in the local cultural context. The positive association between enculturation and physical activity observed in the present research suggests that Yup'ik people have many intrinsic strengths to draw upon when it comes to facilitating

health and wellness. The findings reported in the current paper are supported by our ethnographic experiences in the field, where we have seen how aware Yup'ik individuals are of the interdependence between living a traditional lifestyle, engaging in physical activity, and experiencing optimal health. For example, in an unpublished interview excerpt from research described by Wolsko et al. (2006), a young man in his late 20s spoke of a recent overnight hunting trip. His words demonstrate profound feelings of generational continuity and respect, in the context of reflection about the traditional, physically active ancestors before him:

When we were out there, we had to hike miles and miles. It was hard. I was thinking about my dad and how our ancestors used to live like that all the time. They'd hike for miles and miles with a big pack on their back, you know? They didn't have one of those fancy REI bags. When I was walking, I was getting ready to tire, but I thought about my dad and my ancestors. They had it harder, so I'm not going to complain or wimp out. I'm just going to keep going. It was a good two days. I thought about a lot of things out there.

In another prototypic example, a Yup'ik elder in her 60s recounted her experience of walking outside over the years:

Ever since I grew up I walk all summer. I walk all the time remembering what my mother used to tell me: people that go out walking in the wilderness, sickness doesn't get to them as much. And I think it's true. Every summer I go out when the plants start to grow, pick some wild celery, sourdocks, buttercups, and beach greens. I do all those things and seems like I never get sick.

In essence, to be enculturated in this Yup'ik cultural context is to experience a deep sense of belongingness and participation in the relationships that permeate the community and landscape. A large part of engaging in these relationships – through walking, gathering, hunting, or completing chores – requires substantial physical activity. Similar explanations have been offered for the greater levels of physical activity observed among traditional vs. Westernizing Pima Indian groups (Esparza et al., 2000; Ravussin et al., 1994; Schulz et al., 2006).

Thus, when considering interventions in communities such as those studied here, one might reasonably hypothesize that facilitating a traditional lifestyle will yield healthier levels of physical activity. These applied implications of our research are clearly consistent with Landrine and Klonoff's (2004) operant theory of culture change and ethnic-minority health behavior, including their contention that "interventions that reinforce and maintain minority cultures and pride in them... may be useful in preventing the extinction of culturally normative, health-promoting behaviors" (p. 547). The mixed methods approach adopted by our research program has helped to identify the specific culturally traditional behaviors – such as being active – that most resonate with contemporary biomedical models of optimal health.

There are substantial challenges associated with maintaining or restoring traditional cultural practices in indigenous communities. Due to the cumulative effects of colonization, historical trauma, and forced acculturation (Duran & Duran, 1995; Whitbeck et al., 2004),

many Yup'ik individuals in the Y-K Delta can neither fully engage the diverse components of a traditional subsistence lifestyle nor can they fully enter into modern wage-earning society (without abandoning their homeland). As one research participant quoted in the introduction of this article remarked, "For our life that is pretty much like in between a rock and hard place. This situation causes a lot of stress for some people." Data from the present study demonstrate that such stress is correlated with considerable health impacts. Higher perceived stress was associated with lower levels of physical activity and higher adiposity. Existing research indicates that the relationship between physical activity and stress is likely bi-directional: increased exercise supports stress reduction (e.g. Holmes et al., 2010; Salmon, 2001); and stress compromises the ability and/or motivation to physically engage the world (e.g. Steptoe, et al., 1998). In the Yup'ik case, if stress undermines one's ability to engage in physical activity, effective interventions will require a local understanding of the complex social structural features that both create and ameliorate stressful life circumstances. To the extent that physical activity itself may serve as an effective strategy for stress reduction, it is important to recognize that, in the sub-arctic geography of the Yup'ik, few opportunities for outdoor physical activity exist apart from subsistence-related behaviors (Deutch et al., 2005). Given continued patterns of profound cultural change, it will be critical to identify meaningful alternative activities to potentially help ameliorate stress, and prevent weight gain and associated metabolic risk.

The inverse relationships observed between steps per day and adiposity and metabolic risks are important for a number of reasons. First, the findings support the construct validity of using pedometers to measure physical activity in this population. Similar conclusions have been observed among other diverse groups (Chan et al., 2003; Hornbuckle et al., 2005; Krumm et al., 2006; Tudor-Locke et al., 2001). Second, findings from this study suggest that ambulatory behaviors contribute to physical activity levels among Alaska Native people. Consequently, an intervention promoting walking-based activities may be an effective strategy to improve health outcomes. Such interventions have been shown to significantly increase walking and decrease adiposity among overweight/obese sedentary individuals (Tudor-Locke et al., 2004), and, when used in conjunction with dietary intervention to produce weight loss, to prevent or delay the onset of type 2 diabetes (Tuomilehto et al., 2001).

Limitations

We acknowledge several limitations of the current study. First, although construct validity appears to be supported by our findings, pedometer-determined steps per day were not validated against other methods which may be more able to capture pattern, intensity, or type of physical activity. Second, the reliability of pedometers worn while riding a motor vehicle has only been assessed on paved roads (Le Masurier & Tudor-Locke, 2003). The terrain in rural Alaska is rough, and four-wheelers and snowmachines are commonly ridden. Although it is possible that some individuals' high step counts may be an artifact of riding on the rough terrain, this would likely attenuate the observed relationship between steps per day and health indicators. Third, pedometers are unable to capture specific types of physical activity. Thus, we do not know the exact patterns of traditional activities that were engaged in by participants who were more physically active. Clarifying the health benefits of specific

activities will be important for effective use of the enculturation construct in subsequent interventions. Finally, this study was cross-sectional in nature, and we are therefore prohibited from making causal inferences about the significant relationships described. Perhaps the most suitable next step is to pursue a translational research strategy that simultaneously examines the nature of basic causal mechanisms (e.g. the effect of increased physical activity on psychosocial stress) and intervenes in a manner that has high value in the local cultural context (e.g. increasing traditional subsistence activities).

Conclusions

Physical activity is difficult to assess accurately in free living populations given its large variation in type, intensity, frequency, and duration (Wareham et al., 2005). This study supports the use of pedometers as a simple, cost-effective means to objectively measure physical activity in a Westernizing Alaska Native population. Our analysis suggests that local patterns of stress and enculturation are vitally important to consider in the design of effective and sustainable behavioral health interventions. Landrine and Klonoff's (2004) operant theory of cultural change, in conjunction with post-colonial models of wellness in Native communities (Walters & Simoni, 2002; Zimmerman, et al., 1998), provides a powerful framework for identifying and promoting traditionally healthy behaviors in indigenous communities. In addition to targeting specific physical activities, this approach may also focus on reinforcing the cultural metacontingencies (e.g., using traditional food and medicine, respecting elders, engaging in spiritual practices) that anchor community members in a persistently vigorous way of life. A mixed methods research program (Creswell & Plano Clark, 2011), including at least some level of ethnography, is most likely to attain the level of cultural understanding required for informing sustainable improvements in health behavior and reductions in metabolic risk.

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Key Messages

- Yup'ik people who report living a more traditional lifestyle and lower levels of psychosocial stress are more physically active.
- Yup'ik people who were more physically active had a lower BMI, percent body fat and waist circumference than those who were less physically active.
- The positive association between enculturation and physical activity observed suggests that Yup'ik people have many intrinsic strengths to draw upon when it comes to facilitating health and wellness.

Table 1

Characteristics of Yup'ik Women and Men.

	Women (n=101)		Men (n=78)		p
	Mean	SD	Mean	SD	
Age (years)	33.6	(14.9)	38.3	(16.9)	.21
Energy intake (kcal)	1892.1	(623.1)	2356.6	(842.7)	<.001
Smoking (no) ¹	75	(75.8)	43	(55.1)	.04
Physical activity (counts/day)	6240.0	(3674.6)	8823.7	(3413.0)	<.001
Activity level ^{1, 2}					
Sedentary	43	(42.6)	7	(9.0)	
Moderately active	43	(42.6)	46	(59.0)	
Active	15	(14.9)	25	(32.1)	
Enculturation	2.37	(.25)	2.35	(.28)	.31
Stress	1.97	(.39)	1.85	(.33)	.04
BMI (kg/m ²)	29.1	(6.7)	26.2	(4.8)	.02
Percent body fat (%)	35.7	(8.4)	21.8	(7.7)	.20
Waist circumference (cm)	90.6	(15.8)	90.1	(14.1)	.28
HDL (mg/dL)	61.0	(16.1)	55.6	(15.1)	.64
LDL (mg/dL)	130.0	(35.1)	137.8	(34.7)	.80
T-cholesterol (mg/dL)	206.8	(43.0)	212.7	(42.9)	.71
Triglyceride (mg/dL)	79.4	(45.4)	97.2	(89.1)	.03
Glucose (mg/dL)	93.3	(12)	95.3	(10.3)	.34
Systolic blood pressure (mmHg)	118.3	(15.5)	125.2	(13.4)	.51
Diastolic blood pressure (mmHg)	72.3	(11.3)	72.3	(9.5)	.21

Note:

¹ values are n (percent)

² Activity levels are categorized as: Sedentary (<5000 steps/day); Moderately active (5000–9999); Active (10,000)

Table 2
Regression Models Predicting Cardiovascular Disease Risk Factors with Pedometer Counts

Model	β	B	SE	p	R ²
BMI (kg/m ²)	-.31	-.51	.13	<0.001	.20
Percent body fat (%)	-.22	-.65	.17	<0.001	.54
Waist circumference (cm)	-.29	-1.16	.32	<0.001	.20
HDL (mg/dL) ^d	.13	.61	.34	.13	.16
LDL (mg/dL) ^d	.09	.69	.76	.23	.25
T-cholesterol (mg/dL) ^d	.06	.58	.85	.51	.42
Triglyceride (mg/dL) ^{d,e}	-.19	-.02	.01	.03	.09
Glucose (mg/dL)	-.17	-.50	.24	.04	.19
Systolic blood pressure (mmHg) ^b	-.07	-.35	.32	.10	.16
Diastolic blood pressure (mmHg) ^b	.12	-.35	.24	.15	.10

Note: β = standardized coefficient; B = unstandardized coefficient, SE = standard error;

- ^a $n = 174$, except where otherwise noted
- ^b Each model includes: age, sex, smoking status, energy intake
- ^c Variables are expressed per 1000 pedometer steps
- ^d $n = 175$
- ^e Variable was log transformed because of non-normality