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Depression Prevalence and Associated Factors Among Alaska Native People: The Alaska Education and Research Towards Health (EARTH) Study

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Abstract

Background—Few studies have investigated depression among Alaska Native people (ANs). Depression prevalence and associated factors among EARTH Alaska study participants is described.

Methods—The nine-item Patient Health Questionnaire (PHQ-9) assessed depression among 3,771 ANs. Participants with PHQ-9 scores ≥ 10 out of 27 were classified as positive for depression. Logistic regression analyses evaluated odds of scoring positive versus negative for depression by demographic, cultural, then health and lifestyle factors.

Results—Twenty percent of women and thirteen percent of men scored positive for depression. Univariate and multivariate models were fit separately for men and women. Among demographic factors, below median income was associated with positive depression scores for both genders. Among men, odds of depression were higher if unmarried and/or if highest educational level was less than high school. Women 34 to 59 years of age had increased odds of scoring positive. Little or no identification with tribal tradition was associated with increased odds of depression in women and decreased odds in men. For both genders, chronic physical conditions and poorer self-reported health were associated with positive depression scores then binge alcohol drinking and current tobacco use increased odds of depression among women only.

Limitations—Factors analyzed were self-reported without clinician follow-up in a non-random convenience sample of adults.

Conclusions—Depression is common among ANs with rates comparable to other indigenous cross-sectional investigations. Depression is associated with lower income and poorer physical

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Author Lanier was the Principal Investigator of the Alaska EARTH study, assisted with the introduction, design, analyses, and discussion sections of the manuscript, and provided overall guidance through manuscript development.

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health. Prevention and intervention efforts should consider gender as other associated factors varied between men and women.

Keywords

Depressive Disorder; Alaska; North American Indians; Adult

1. Introduction

According to the Behavioral Risk Factor Surveillance Survey, clinically significant depression affects eight to nine percent of community-dwelling adults in the United States (Kroenke et al., 2009). Depression is associated with mortality through suicide as well as increased morbidity given higher rates of physical disorders among those with depression (Paykel, 2006). Obesity, physical inactivity, tobacco, and alcohol use are also strongly associated with depression (Graham et al., 2007; Marmorstein, 2009; Pedersen and von Soest, 2009; Rosemann et al., 2008). The economic impacts of depression are additionally noteworthy and include higher use of healthcare services, work absenteeism, and reduced work productivity (Donohue and Pincus, 2007).

Although widespread, depression affects some groups more than others. Depression is more likely to occur in women than men and among individuals who are single, divorced, or widowed versus currently married (Kessler et al., 2003). Increased odds of depression are associated with being unemployed or unable to work due to disability, having less than 12 years of education, and an income below the poverty level (Kessler et al., 2003; Pratt and Brody, 2008). Depression also varies according to race and ethnicity with higher rates among Hispanic and non-Hispanic African American people than non-Hispanic White people (Kessler et al., 2003).

A review of the literature identified few published studies about depression among American Indian (AI) or Alaska Native (AN) people,¹ two of the indigenous populations of the United States. The limited numbers of studies in existence predominantly include AIs and have insufficient sample sizes ($N < 150$) to support investigation of associated factors to guide depression prevention and intervention efforts (Napholz, 1999; Somervell et al., 1993; Wilson et al., 1995). Other limitations include samples with limited generalizability given sole inclusion of women (e.g., (Duran et al., 2004; Napholz, 1999), individuals with diabetes (e.g., (Bell et al., 2005; Sahota et al., 2008), or AIs on or near home reservations (Beals et al., 2005).

Even more limited than studies with AIs are large studies with adequate representation of ANs. According to the 2008 Alaska Behavioral Risk Factor Surveillance Survey (BRFSS), ten percent of 349 adult ANs met criteria for moderate to severe depression as assessed with the Patient Health Questionnaire (PHQ-8) (Centers for Disease Control and Prevention, 2008). In another effort, 17% of ANs screened positive for depression at time of a primary care visit in Anchorage, Alaska. However, the full nine-items of the instrument (PHQ-9) were administered only if one of the first two items (depressed mood or anhedonia) were endorsed (Dillard and Christopher, 2007). Thus, depression may have been underreported.

Data from the enrollment visit of the Alaska Education and Research Towards Health (EARTH) study thus provides critical information. Funded by the National Cancer Institute, the aim of the Alaska EARTH study was to understand how diet, physical activity, body

¹“AI” is used throughout this paper to denote indigenous people residing in the contiguous United States. “AN” denotes indigenous people residing in Alaska which may include people of AI descent.

size, lifestyle, and cultural factors related to the development and progression of chronic disease including depression. The PHQ-9 was administered to 3,827 AN participants permitting robust and in-depth analysis. We report the prevalence of positive depression scores and the association of depression with demographic, cultural, and health and lifestyle factors.

2. Methods

The Alaska EARTH study population and methods are described in detail elsewhere (Slattery et al., 2007). Briefly, participants were recruited in 26 communities across three regions of Alaska. Using the 2000 United States Census definition, all communities were rural except the southcentral city of Anchorage (U.S. Census Bureau, 2000). Individuals were eligible to participate if aged 18 years of age or older, AI/AN and eligible for healthcare through the Indian Health Service, not pregnant, not undergoing chemotherapy, and physically and mentally capable of consenting, completing questionnaires, and providing select medical measurements including height and weight. Computer-assisted self-report instruments were available in English and Yupik. Alaska Area Institutional Review Board approval as well as approval from regional, local, and village health boards was obtained.

2.1 Measures

2.1.1. Dependent Variable—The PHQ-9 (Kroenke et al., 2001) assessed symptoms of depression in the two weeks prior to study enrollment. Nine items corresponding to diagnostic criteria for a depressive disorder (American Psychiatric Association, 2000) were scored 0 to 3 according to both presence and duration (0=not at all, 1=several days, 2=more than half the days, 3=almost every day). A final score was computed by summing the nine items, with a possible range of 0 to 27. A binary variable was calculated using the most consistently reported cut point for a level of depression warranting clinical intervention, specifically 10 or above (Gilbody et al., 2007). We also calculated depression severity amongst those scoring positive (moderate 10 – 14, moderately severe 15 – 19, severe 20 – 27) and finally calculated the presence of a major depressive episode using a diagnostic algorithm. This algorithm requires the endorsement of 5 or more PHQ-9 items at 2 (“more than half the day”) or 3 (“almost every day”), at least one being depressed mood or anhedonia (Spitzer, 1999).

2.1.2. Independent variables

Demographic factors: Gender, categorical age, marital status, education level, employment status, and income were based on self-report. Individuals who were married or living together as married were combined into one category. Chronic unemployment was defined as being out of work for more than one year and also included individuals who were homemakers, students, or retired. A binary variable for income was developed based on value at or below the median versus above the median. Education level was also categorized as a binary variable: less than high school versus high school or greater education.

Cultural factors: Region of Alaska, identification with tribal tradition, identification with non-Native culture, participation in traditional events, and language spoken at the home were included. Degree of identification with Native culture was categorized according to response to “How much do you identify with your own tribal tradition?” Those who reported “not at all” and “a little” were combined into one category, and compared to those responding “some” or “a lot.” Degree of non-Native identification was similarly categorized according to responses to “How much do you identify yourself with non-Native culture.”

Other binary variables were created based on responses to questions assessing participation in traditional events (“yes” or “no”) and AI/AN language spoken at home (“yes” or “no”).

Health and Lifestyle Factors: Number of chronic physical conditions, general health status, physical activity, tobacco use, and alcohol use were assessed via self-report. Participants indicated if they had ever been diagnosed by a doctor or healthcare provider with any of fifteen physical conditions (high blood pressure, heart disease, high cholesterol, stroke, gallbladder disease, kidney disease, liver disease, thyroid disease, asthma, cataracts, glaucoma, arthritis, diabetes, cancer, chronic obstructive pulmonary disease). Number of conditions was summed for each participant and categorized into “none,” “1 or 2,” and “3 or more.” Participants also indicated if they had ever been told by a health care provider that they had depression requiring treatment with medication. The SF-12 was also administered and the physical component summary (PCS) and mental component summary (MCS scores) calculated using the standard algorithms for the 1998 United States population reference group (Ware et al., 1996). Responses to the SF-12 item assessing general health were grouped into two categories, those reporting “poor” or “fair” health versus those reporting “good”, “very good”, or “excellent” health. Number of hours per week of vigorous activity (6.0 metabolic equivalents or higher) were used to classify participants into three categories (none, 0 to 1.9 hours, 2 or more hours) (Ferucci et al., 2008). Participants were also classified into three mutually exclusive categories of tobacco use based upon smoking and use of smokeless tobacco: never smoked 100 cigarettes and never used smokeless tobacco at least 20 times, former smoker or smokeless tobacco user, and current smoker or smokeless tobacco user. The number of times a participant reported drinking 5 or more alcoholic drinks on an occasion in the past year formed three categories of binge drinking: none, 1 to 10 times, and more than 10 times.

Height and weight measured at time of enrollment was used to calculate body mass index (BMI) based on the standard formula. BMI was then categorized as normal (less than 24.9), overweight (25.0-29.9), or obese (≥ 30).

2.2 Analyses

Data were analyzed using SAS software, version 9.1 (SAS Institute Inc). Participants missing one or more of the PHQ-9 items were excluded. Mean scores and standard deviations for each PHQ-9 item were calculated then prevalence of depression estimated using the cutoff score of 10, by severity (moderate 10 -14, moderately severe 15 -19, and severe 20 – 27), and the diagnostic algorithm. The binary depression score using the cutoff score of 10 was the primary dependent variable.

Other measures of mood disturbance were then analyzed to assess whether the PHQ-9 was performing as expected. These measures included provider-diagnosed depression requiring medication, the MCS score, and individual SF-12 items. Demographic, cultural, and health and lifestyle factors were next compared in participants with positive and negative depression scores using row percents and chi-square analyses or anovas. Odds of a positive depression score for individuals with each chronic physical condition were compared to those with negative depression scores in univariate logistic regression models.

Finally, logistic regression analyses occurred in several steps. The univariate association of demographic, cultural, and health and lifestyle factors with depression was determined. Then factors significant in univariate models were included in multivariate models if the *p* value was 0.25 or less (Hosmer and Lemeshow, 1989). Logistic regression models also assessed associations of factors with depression severity (mild, moderate, and severe versus none).

3. Results

A total of 3,771 individuals were included. Fifty-six individuals were excluded due to one or more missing PHQ-9 items.

3.1. Prevalence

3.1.1 PHQ-items—Table 1 presents the percent of the 3,771 participants endorsing the nine symptoms of depression, mean scores (range 0 to 3), and standard deviations in order of presentation in the PHQ-9. The two items endorsed most frequently were sleep difficulties and low energy. Thoughts of death or suicide were infrequently endorsed.

3.1.2 Depression prevalence—The mean PHQ-9 score across all participants was 4.8 (sd 5.4) out of a possible score of 27. Eighty-three percent ($N=3,126$) of participants scored negative ($N=1287$ male, $N=1839$ female) and seventeen percent ($N=645$) scored positive using the PHQ-9 cutoff score of 10 ($N=195$ male, $N=450$ female). Of those with a positive score, ten percent ($N=370$) scored in the moderate severity category ($N=117$ male, $N=253$ female), five percent ($N=191$) in the moderately severe category ($N=55$ male, $N=136$ female), and two percent ($N=84$) in the severe category ($N=23$ male, $N=61$ female). When using the diagnostic algorithm, nine percent ($N=323$) met criteria for a major depressive episode ($N=100$ male, $N=223$ female).

3.2 Performance of the PHQ-9

Of those not reporting provider-diagnosed depression requiring medication, almost ninety percent scored negative for depression on the PHQ-9 (Table 2). Of those who “felt downhearted or blue” most or all the time, sixty-nine percent scored positive. In contrast, eight percent of those with “lots of energy” most or all of the time scored positive. Of those accomplishing less or doing work or daily activities less carefully due to feeling depressed or anxious, approximately half scored positive for depression. The mean MCS score was 10 points lower amongst those scoring positive versus negative (38.0 vs. 48.4).

3.3 Descriptive statistics

The distribution of demographic, cultural, and health and lifestyle factors by depression score category is presented in Table 3.

Demographic factors—Twenty percent of women scored positive for depression versus thirteen percent of men ($X^2 = 26.8$ ($df = 1$), $p < 0.0001$). The percent within each age category scoring positive increased until age 60 when the percent dropped ($X^2 = 9.16$ ($df = 3$), $p = 0.03$). Of those with less than a high school education ($X^2 = 15.9$ ($df = 1$), $p < 0.0001$), who experienced chronic unemployment ($X^2 = 21.0$ ($df = 1$), $p < 0.0001$), and with an income below the median ($X^2 = 44.8$ ($df = 1$), $p < 0.0001$), higher percentages of ANs scored positive for depression. Marital status was borderline significant ($X^2 = 3.7$ ($df = 1$), $p = 0.05$).

Cultural factors—Region ($X^2 = 4.1$ ($df = 2$), $p = 0.13$), AI/AN language ($X^2 = 2.4$ ($df = 1$), $p = 0.12$), and participation in traditional events ($X^2 = 0.3$ ($df = 1$), $p = 0.56$) were not significantly associated with depression score. In addition, identification with tribal tradition ($X^2 = 1.1$ ($df = 1$), $p = 0.28$) and non-Native culture ($X^2 = 0.8$ ($df = 1$), $p = 0.37$) did not have significant associations.

Health and lifestyle factors—Of those with 3 or more chronic conditions, twenty-seven percent scored positive versus twelve percent with none of the assessed chronic physical conditions ($X^2 = 78.6$ ($df = 6$), $p < 0.0001$). ANs who were current tobacco users were more likely than those who were never a regular tobacco user to score positive ($X^2 = 16.5$ ($df = 2$),

$p = 0.003$). General health ($X^2 = 188.8$ ($df = 1$), $p < 0.0001$) and vigorous physical activity ($X^2 = 13.0$ ($df = 2$), $p = 0.002$) were significantly associated with depression score. The mean PCS score decreased (indicating poorer physical functioning) between those scoring negative for depression and those scoring positive for depression ($F = 259.3$ ($df = 1$), $p < 0.0001$). Neither BMI ($X^2 = 3.8$ ($df = 2$), $p = 0.15$) nor alcohol use ($X^2 = 5.4$ ($df = 2$), $p = 0.07$) were associated with depression score.

Table 4 shows odds of scoring positive versus negative for depression amongst those with the following chronic conditions: high blood pressure ($X^2 = 23.7$ ($df = 1$), $p < 0.0001$), heart disease ($X^2 = 13.3$ ($df = 1$), $p < 0.0003$), high cholesterol ($X^2 = 17.9$ ($df = 1$), $p < 0.0001$), gallbladder disease ($X^2 = 13.9$ ($df = 1$), $p = 0.0002$), liver disease ($X^2 = 7.2$ ($df = 1$), $p = 0.007$), thyroid disease ($X^2 = 17.7$ ($df = 1$), $p < 0.0001$), asthma ($X^2 = 36.6$ ($df = 1$), $p < 0.0001$), cataracts ($X^2 = 7.5$ ($df = 1$), $p = 0.006$), glaucoma ($X^2 = 17.9$ ($df = 1$), $p < 0.0001$), arthritis ($X^2 = 73.0$ ($df = 1$), $p < 0.0001$), and chronic obstructive pulmonary disease ($X^2 = 45.0$ ($df = 3$), $p < 0.0001$). There was a borderline significant association for diabetes ($X^2 = 3.7$ ($df = 1$), $p = 0.053$). No association was found between depression score and stroke ($X^2 = 2.1$ ($df = 1$), $p = 0.146$), kidney disease ($X^2 = 0.5$ ($df = 1$), $p = 0.496$), or cancer ($X^2 = 0.01$ ($df = 1$), $p = 0.939$).

3.4 Univariate logistic regression models

Univariate models were fit separately by gender given different patterns of associations and significant changes in the likelihood ratio test when males or females were excluded as compared to a model with the full sample. Univariate results are presented in tables only for the sake of brevity. Models using the depression score categories of positive and negative with the PHQ-9 cutoff score of 10 did not significantly vary from models using depression severity categories so only the former are presented.

3.5 Multivariate logistic regression models

Factors were included in multivariate models if the univariate p value was 0.25 or less in separately fit male and female models. Language and BMI were excluded from all models. In addition, the PCS factor was excluded given overlap with the SF-12 general health item. Given the salience of age in other depression prevalence efforts, age was included regardless of univariate significance.

3.5.1 Males. (Table 5)

Demographic factors: Males who were not married or living together as married had odds of a positive depression score 1.9 times higher than those who were not married. ($X^2 = 9.1$ 2 ($df = 1$), $p = 0.003$). Men with less than a high school education ($X = 3.9$ ($df = 1$), $p = 0.049$) and with an income of \$25,000 or less ($X^2 = 5.4$ ($df = 1$), $p = 0.020$) respectively had 1.5 to 1.6 times higher odds of a positive score. Age and employment remained not significant in the multivariate model. ($X^2 = 2.6$ 2 ($df = 3$), $p = 0.457$) ($X = 0.02$ ($df = 1$), $p = 0.879$).

Cultural factors: The multivariate association between depression and language spoken in the home ($X^2 = 1.4$ ($df = 1$), $p = 0.243$) was not significant. Males who self-reported “none” or “a little” tribal tradition at lower odds of positive versus negative depression scores ($X^2 = 5.4$ ($df = 1$), $p = 0.020$).

Health and lifestyle factors: Number of health conditions ($X^2 = 12.6$ ($df = 2$), $p = 0.001$) and self-reported general health ($X^2 = 22.5$ ($df = 1$), $p < 0.0001$) were significantly associated with depression score category. Men with 3 or more chronic physical conditions and of “poor” to “fair” general health had odds of a positive score 2.4 times higher than those with no physical conditions and with “good” to “excellent” health.

3.6.1 Females. (Table 6)

Demographic factors: As with male multivariate models, income ($X^2 = 22.8$ ($df = 1$), $p < 0.0001$) remained significant and employment ($X^2 = 0.9$ ($df = 1$), $p = 0.343$) was statistically insignificant when other factors were taken into account. Unlike males, marital status ($X^2 = 0.1$ ($df = 1$), $p = 0.750$) and education ($X^2 = 2.7$ ($df = 1$), $p = 0.102$) were statistically insignificant for females. Age was also associated with depression score only amongst women. Odds of scoring positive versus negative was significantly elevated among women aged 34 to 44 (OR 1.9, $p = 0.012$) and 45 to 59 years (OR 1.7, $p = 0.031$) versus 60+ years.

Cultural factors: The association between depression score and identification with non-Native culture was not significant ($X^2 = 1.2$ ($df = 1$), $p = 0.281$) when adjusted for other factors. Identification with tribal tradition remained significant ($X^2 = 10.9$ ($df = 1$), $p = 0.001$) but in the opposite direction of males. Women less strongly identified with tribal tradition had odds of positive score 1.5 times higher than women with stronger identification with tribal tradition.

Health and lifestyle factors: Like males, number of physical conditions ($X^2 = 21.0$ ($df = 2$), $p < 0.0001$) and general health ($X^2 = 89.9$ ($df = 1$), $p < 0.0001$) remained significant in multivariate models. Compared to those with no physical conditions, women with 1 to 2 conditions then with 3 or more conditions had odds of positive score 1.5 and 2.4 times higher ($p < 0.001$). Women with poorer self-reported general health had odds of a positive score 3.4 times higher. Unlike males, binge alcohol use was significant. ($X^2 = 12.5$ ($df = 2$), $p = 0.002$). More specifically, drinking 5 or more alcoholic drinks on an occasion one or more times versus never was significant among women (ORs 1.3, $p < 0.0001$ and < 0.05 respectively). Also unlike males, tobacco use was significant ($X^2 = 11.0$ ($df = 2$), $p = 0.004$) with women who were current tobacco users at elevated odds of scoring positive compared to women classified as never users. The association of depression with BMI ($X^2 = 0.9$ ($df = 2$), $p = 0.625$) and vigorous physical activity ($X^2 = 0.1$ ($df = 2$), $p = 0.965$) was not statistically significant.

4. Discussion

This effort involves the largest number of ANs to date in an investigation of depression across 3 regions of varying size. In brief, we found that seventeen percent of ANs had depression scores at a level typically considered to warrant clinical intervention. Patterns of scores on other measures of emotional distress according to positive (≥ 10) and negative (≤ 9) PHQ-9 score categories were as expected. Demographic factors were strongly associated with increased odds of positive depression scores. More women than men scored positive and depression was associated with income below the median. Then age affected odds amongst women with marital status and education level affecting odds in men. Amongst the cultural variables, only stronger identification with tribal tradition affected likelihood of depression (higher odds amongst women, lower amongst men). General health factors affected odds in both genders with tobacco use and binge drinking associated with depression only amongst women.

Direct comparison of the prevalence of depression to other published studies is complicated given measurement and sampling differences. We present comparisons, however, to place our findings in context of other literature. According to national BRFSS estimates, eight to nine percent of community-dwelling adults in the United States score positive for depression using the PHQ-9 cutoff score of 10 (Kroenke et al., 2009). In Alaska, the 2008 BRFSS depression estimate using the PHQ-8 was eleven percent among ANs and eight percent among non-Native Alaskans, a non-statistically significant difference (Centers for Disease Control and Prevention, 2008). BRFSS rates among ANs by gender are not available.

However, of all female Alaskans, eleven percent scored positive versus five percent of Alaskan males or a female to male ratio of 2.2 to 1 (Centers for Disease Control and Prevention, 2008). Our overall estimated prevalence of seventeen percent amongst ANs is clearly higher than the 2008 Alaska BRFSS estimate. Our gender ratio of 1.5:1 (20% female to 13% male) is slightly lower. Like other states, Alaska BRFSS uses a stratified random sampling design and telephonic data collection. Thus, ANs may have been underrepresented in BRFSS given lower socioeconomic status among ANs and potentially lower probabilities of having a telephone. Our estimate may also be higher given the non-random sampling design. Higher estimates of depression are typically found in primary care samples, for instance, than community-based samples given comorbidity between depression and physical conditions (Coyne et al., 1994). In fact, our estimated prevalence of depression of seventeen percent matches the percent of ANs scoring positive on the PHQ-9 in a local primary care setting (Dillard and Christopher, 2007). To our knowledge, there are no studies which have compared rates of depression between ANs and non-Native peoples in primary care. Remaining studies with AIs or other indigenous populations produced similar prevalence rates (Beals et al., 2005; Froese et al., 2008; Parker et al., 1997) with one exception of a higher rate in a primary care study with urban AI women (Duran et al., 2004). In sum, our estimated prevalence is equal to or higher than other AI or AN community-based estimates then equal to or lower than AI or AN primary care samples. We cannot definitively comment on the presence or absence of a disparity. However, depression appears to impact the AN population at least to the same degree as other populations and is therefore an important public health issue.

This study is one of very few AI or AN studies which possess sufficient sample size to enable investigation of associated factors. Many of the demographic factors associated with depression have been documented in studies amongst other populations. For instance, women are affected by depression than males across many studies (Kessler et al., 2003; Linzer et al., 1996; Maier et al., 1999). The association of more limited economic resources and depression has been found in many other efforts (Kessler et al., 2003; Pratt and Brody, 2008). Marriage is additionally associated in other efforts with reduced risk of onset of depression only among men (Scott et al., 2009) then men also appear to be more sensitive to the depressogenic effects of divorce or separation (Kendler et al., 2001). Increasing rates of depression among women until onset of menopause have also been documented (Accortt et al., 2008; Noble, 2005). There was no association for employment for either gender in our study. However, less than a high school education increased odds of depression among men as a similar but not directly comparable indicator of socioeconomic status.

Studies specific to ANs have also found that male and female ANs differ in terms of coping and stress according to cultural identity. More specifically, stronger acculturation to Western culture (more predominant among AN males than females) has been associated with greater perceived stress and more use of alcohol and drugs as a coping mechanism. Stronger enculturation or Yupik identity (more predominant among AN women) has been associated with more happiness and use of religion and spirituality to cope. Authors postulated aversive consequences of acculturation, namely loss of cultural meaning and viable socioeconomic opportunities, “suggest that this identity shift may be more problematic for men than women (Wolsko et al., 2007)”. Once again, our results are not directly comparable given different measurement instruments and different regions of Alaska sampled. We found no association between non-Native identification and depression for either gender. Then little to no identification with tribal tradition was protective for men only. At this point, the scientific basis for a nuanced understanding of how cultural identification impacts health and other domains of functioning are limited. It does appear, however, that cultural identification is another domain where gender differences warrant additional exploration given potential effects on health.

Gender also played a role with respect to how lifestyle factors were associated with depression. In other studies, depression has also been related to drinking larger quantities per occasion with stronger effects noted for women versus men (Graham et al., 2007). Women with nicotine dependence have also been found to be more likely than men to have significant depressive symptoms in other studies (Brown et al., 2000). Gender did not play a role in the relationship between depression, total number of chronic physical conditions, and poorer health in our study. This is consistent with many other investigations (Bruce, 2008; Chun et al., 2008; Ferucci et al., 2008; Freeman et al., 2009; Jackson, 1998; Lippi et al., 2009; Noel et al., 2004; Putman-Casdorff and McCrone, 2009; Van Lieshout et al., 2009). Depression may affect health habits such as diet which in turn increase risk of developing illnesses (Ohayon, 2007; Pedersen and von Soest, 2009). Depression also affects adherence to regimens and coping with symptoms of other illnesses thus posing additive functional impairment (Katon et al., 2007; Lin et al., 2004). We did not find some of the positive associations between depression and individual conditions we expected, namely the associations with stroke, kidney disease, and cancer found in other efforts (Egede, 2007; Hedayati et al., 2009; Jolly et al., 2009). However, the exclusion of individuals undergoing chemotherapy or those physically or mentally unable to complete the self-report instrumentation could have contributed to lack of the associations. We also found a positive association with glaucoma for which there is contradictory evidence (Mabuchi et al., 2008; Wilson et al., 2002).

Our effort has several other limitations which should be noted. Factors with the exception of BMI were assessed via self-report. The impact of non-random sampling of ANs on prevalence estimates and the association of factors with depression cannot be definitively determined. Additionally, not all regions of Alaska participated and significant variation in culture and lifestyle exists between Alaskan regions. Potential biases due to the exclusion of ANs undergoing chemotherapy and those not physically able to complete instruments have already been described. In addition, although cultural identification is widely theorized to impact adjustment and health among indigenous and other groups, measurement science lags behind. It is also important to note depressive symptoms were assessed via self-report with an instrument not formally validated amongst ANs. We also used a cutoff that has not specifically been validated amongst ANs. Finally, the cross-sectional nature of our study does not permit elucidation of which factors pose risk for or protection against depression.

Despite these limitations, this study informs ongoing work about potential ethnic and racial differences in depression. Studying depression within racially and ethnically diverse groups like AN/AIs is important for several reasons. First, the United States is becoming increasingly diverse (United States Census Bureau, 2004), so projecting the potential future burdens on health is important. There is also evidence that racially and ethnically diverse populations are less likely to engage in some types of depression treatment (e.g., medication) (Miranda and Cooper, 2004; Ward, 2007) and have worse outcomes when they do participate (Miranda et al., 2003). Therefore, existing health disparities could increase. This is of particular concern among the AI/AN population given persistent and pronounced disparities in suicide mortality (Indian Health Service, 2006) and other chronic diseases potentially made worse by depression. Assessing the universality of depression across cultures also helps inform the potential contribution of biological versus environmental factors in mood disorders with important treatment implications. Other reviews have concluded depression occurs across all cultures and nations while recognizing differences in symptom presentation and prevalence estimates (Ballenger et al., 2001). Although this effort was not intended to study instrument performance, a gross assessment of PHQ-9 performance seemed prudent to support results. Although the two-component PRIME-MD has been validated in the AI population (Parker et al., 1997), the PHQ-9 alone has not been. We found the overall mean PHQ-9 score of our sample was comparable to other PHQ-9

studies (Huang et al., 2006; Martin et al., 2006) and patterns of scores on other emotional distress measures were as expected. Many studies have demonstrated the PHQ-9 total score functioned similarly across racially and ethnically diverse populations even when completed in a language other than English (Chen et al., 2006; Gilbody et al., 2007; Huang et al., 2006). For instance, in a meta-analysis of 17 validation studies, sensitivity was good (92%) and specificity adequate (80%).

In summary, we found depression to be common among AN people and to be associated with demographic, cultural, and health and lifestyle factors with noted variability by gender. Depression prevention and intervention efforts with ANs should consider these factors as potential areas of focus. Additional study is needed to validate measures of depression as well as measures of cultural identity and to prospectively evaluate risk and protective factors for depression.

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Table 1Patient Health Questionnaire Items ($N = 3771$)

	% Endorsement ^a	Mean ^b	SD ^c
Depressed mood	44	0.66	0.88
Anhedonia	35	0.56	0.89
Insomnia or hypersomnia	50	0.86	1.04
Decreased energy or tiredness	45	0.72	0.95
Change in appetite	28	0.45	0.83
Feelings of failure or inappropriate guilt	28	0.43	0.80
Trouble concentrating	30	0.47	0.84
Psychomotor retardation or agitation	35	0.54	0.86
Thoughts of hurting self	7	0.10	0.43

^a At any value greater than 0 (1 = “several days”, 2 = “more than half the days”, 3 = “almost every day”)

^b Range of 0 to 3

^c Standard deviation

Table 2Other mood disturbance measures by depression score category ($N = 3771$)

	<i>N</i>	Missing	Depression Score Category	
			Negative^a (<i>N</i> = 3126)	Positive^a (<i>N</i> = 645)
			%	%
Self-reported depression ^b		97		
No	2856		89	11
Yes	818		62	38
Time downhearted and blue ^c		4		
None or a little	2442		94	6
Some or a good bit	1101		69	31
Most or all	224		31	69
Time had lots of energy ^d		2		
None or a little	387		56	44
Some or a good bit	1731		80	20
Most or all	1651		92	8
Accomplished less ^e		6		
No	2764		93	7
Yes	1001		54	46
Activities less carefully ^f		6		
No	3016		91	9
Yes	749		51	49
			<i>Mean</i>	<i>Mean</i>
MCS98 score ^g	3754	17	48.4	38.0

^aBased on total score for nine-item version of Patient Health Questionnaire (PHQ-9): negative ≤ 9 , positive ≥ 10 .^bResponse to item "Did a doctor or other health care provider ever tell you that you had depression which required treatment with medication?"^cResponse to SF-12 item "How much of the time during the past 4 weeks have you felt downhearted and blue?"^dResponse to SF-12 item "How much of the time during the past 4 week did you have a lot of energy?"^eResponse to SF-12 item "During the past 4 weeks, have you accomplished less than you would like as a result of any emotional problems, such as feeling depressed or anxious?"^fResponse to SF-12 item "During the past 4 weeks, did you do work or other regular daily activities less carefully than usual as a result of any emotional problems, such as feeling depressed or anxious?"^gMental Composite Summary score of SF-12.

Table 3Demographic, cultural, health and lifestyle factors by depression score category ($N=3771$)

	<i>N</i>	Missing	Depression Score	
			Negative ^a (<i>N</i> =3126)	Positive ^a (<i>N</i> =645)
			%	%
Demographic factors:				
Gender ***		0		
Male	1482		87	13
Female	2289		80	20
Age *		0		
18 to 29 years	1072		85	15
30 to 44 years	1279		83	17
45 to 59 years	1004		80	20
60+ years	416		84	16
Marital status		15		
Not married or living together	2144		82	18
Married or living together	1612		84	16
Highest level of education ***		3		
Less than high school	866		78	22
High school, GED, or greater	2902		84	16
Employment status ***		14		
Chronically Unemployed	1250		79	21
Employed	2507		85	15
Income level ***		541		
\$25,000 or less	1847		79	21
\$25,001 or more	1383		88	12
Cultural Factors:				
Region of Alaska		0		
Southcentral	1377		81	19
Southeast	880		84	16
Southwest	1514		83	16
AN/AI language spoken at home		1		
No	2525		84	16
Yes	1245		82	18
Traditional event participation		5		
No	2001		83	17
Yes	1765		82	18
Identification with tribal tradition ^b		4		
Not at all or a little	1131		82	18
Some or a lot	2636		83	17

	N	Missing	Depression Score	
			Negative ^a (N=3126) %	Positive ^a (N=645) %
Identification with non-Native culture ^c		10		
Not at all or a little	1244		82	18
Some or a lot	2517		83	17
Health and Lifestyle Factors:				
Number of chronic conditions ^{d***}		0		
None	1509		88	12
1 or 2	1529		83	17
3 or more	733		73	27
General health ^{e***}		0		
Fair or poor	939		68	32
Good to excellent	2832		88	12
Body Mass Index		0		
<25.0	982		84	16
≥25.0 to <30.0	1194		84	16
≥30	1595		82	18
Vigorous physical activity ^{**}		65		
None	1365		80	20
>0 to <1.9 hour/week	1340		85	15
≥1.0 hour/week	1001		85	15
Tobacco use ^{***}		5		
Never a regular user	1032		86	14
Former user	985		84	16
Current user	1749		80	20
Times drank 5+ alcoholic drinks ^{***}		26		
Never	1937		84	16
1 to 10 times	1396		82	18
More than 10 times	412		81	19
			<i>Mean</i>	
PCS score ^{f***}	3754	17	51.7	45.2

^a Based upon total score for nine-item version of Patient Health Questionnaire (PHQ-9): negative ≤ 9, positive ≥ 10.

^b Based on responses to item "How much do you identify with your own tribal tradition?"

^c Based on response to item "How much do you identify yourself with non-Native culture?"

^d Includes high blood pressure, heart disease, high cholesterol, stroke, gallbladder disease, kidney failure, liver disease, thyroid disease, asthma, chronic obstructive pulmonary disease (COPD), glaucoma, cataracts, diabetes, and cancer.

^e Based on SF-12 item assessing general health.

^f Physical Composite Score from the SF-12.

*
 $p < 0.05$

**
 $p < 0.01$

 $p < 0.001$

Table 4Odds of depression by self-reported chronic physical conditions ($N=3771$)

Chronic physical condition ^a	Missing N	OR ^b	95% CI ^c
High blood pressure	214	1.6***	(1.3 – 1.9)
Heart disease	102	1.7***	(1.3 – 2.2)
High cholesterol	671	1.6***	(1.3 – 2.0)
Stroke	42	1.5	(0.9 – 2.5)
Gallbladder disease	63	1.6***	(1.3 – 2.1)
Kidney disease	61	1.3	(0.6 – 2.6)
Liver disease	85	1.5**	(1.1 – 2.0)
Thyroid disease	119	2.2***	(1.5 – 3.2)
Asthma	87	1.9***	(1.6 – 2.4)
Cataracts	91	1.6**	(1.1 – 2.2)
Glaucoma	110	2.6***	(1.7 – 4.0)
Arthritis	129	2.3***	(1.9 – 2.7)
Diabetes	299	1.4	(1.0 – 2.0)
Cancer	63	1.0	(0.6 – 1.6)
Chronic obstructive pulmonary disease	171	2.2***	(1.7 – 2.8)

^a Self-reported diagnosis of chronic physical condition by doctor or other health care provider.^b Odds ratio comparing odds of scoring in the positive (PHQ-9 ≥ 10) versus negative (PHQ-9 ≤ 9) depression scoring category among those with self-reported chronic physical condition.^c 95% confidence interval of odds ratio.**
 $p < 0.01$,***
 $p < 0.001$

Table 5

Logistic regression models examining odds of scoring in the positive versus negative depression score category among male ANs

	Univariate		Multivariate	
	OR (95% CI) ^a	<i>p</i>	OR (95% CI) ^a	<i>p</i>
Age (ref. 60+ years)		0.276		0.457
18 to 29 years	0.8 (0.4 – 1.3)		1.6 (0.7 – 3.3)	
30 to 44 years	0.8 (0.5 – 1.4)		1.8 (0.9 – 3.6)	
45 to 59 years	1.1 (0.6 – 1.8)		1.6(0.8 – 3.0)	
Marital status (ref. married)	1.7 (1.2 – 2.3)	0.004	1.9 (1.2 – 2.8)	0.003
Education status (ref. high school or greater)	1.6 (1.2 – 2.3)	0.003	1.5 (1.0 – 2.2)	0.049
Employment status (ref. employed)	1.5 (1.1 – 2.1)	0.011	1.0 (0.7 – 1.4)	0.879
Income (ref. \$25,001 or greater)	2.1 (1.4 – 3.1)	<0.001	1.6 (1.1 – 2.5)	0.020
Region of Alaska (ref. Southwest)		0.628		
Southcentral	1.1 (0.8 – 1.6)			
Southeast	0.9 (0.6 – 1.4)			
AN/AI language spoken at home (ref. yes)	0.8 (0.6 – 1.0)	0.070	0.8 (0.6 – 1.1)	0.212
Traditional event participation (ref. yes)	0.8 (0.6 – 1.1)	0.277		
Identification with tribal tradition (ref. some or lot)	0.7 (0.5 – 1.0)	0.030	0.6 (0.4 -0.9)	0.020
Identification with non-native culture (ref. not at all or a little)	1.0 (0.7 – 1.4)	0.908		
Number of physical conditions (ref. none)		<0.001		0.002
1 to 2	1.3 (0.9 – 1.8)		1.1 (0.8 – 1.7)	
3 or more	2.6 (1.8 – 3.9)		2.4 (1.4 – 3.9)***	
General health (ref. good to excellent)	3.0 (2.2 – 4.0)	<0.001	2.4 (1.7 – 3.5)	<0.001
Body mass index (ref. <25.0)		0.352		
≥25.0 to <30.0	0.8 (0.5 -1.1)			
≥30	0.8 (0.6 – 1.2)			
Vigorous physical		0.349		

	Univariate		Multivariate	
	OR (95% CI) ^a	<i>p</i>	OR (95% CI) ^a	<i>p</i>
activity (ref. ≥ 2.5 hour/week)				
0 hours/week	0.9 (0.6 – 1.3)			
>0 to <2.5 hours/week	0.8 (0.5 – 1.1)			
Tobacco status (ref. never)		0.451		
Former tobacco user	1.1 (0.7 – 1.8)			
Current tobacco user	1.3 (0.8 – 1.9)			
Times drank 5+ drinks (ref. never)		0.637		
1 to 10 times	0.9 (0.7 – 1.3)			
10 or more times	1.2 (0.7 – 1.8)			

^a Odds ratio and 95% confidence interval (CI) comparing odds of scoring in the positive depression score category (PHQ-9 ≥ 10) versus negative (PHQ-9 ≤ 9) in the non-reference versus reference group.

p < 0.001

Table 6

Logistic regression models examining odds of scoring in the positive versus negative depression score category among female ANs

	Univariate		Multivariate	
	OR (95% CI) ^a	<i>p</i>	OR (95% CI) ^a	<i>p</i>
Age (ref. 60+ years)		0.072		0.020
18 to 29 years	1.1 (0.8 – 1.6)		1.3 (0.8 – 2.3)	
30 to 44 years	1.3 (0.9 – 1.9)		1.9 (1.1 – 3.1) *	
45 to 59 years	1.5 (1.0 – 2.2)		1.7 (1.1 – 2.7) *	
Marital status (ref. married)	1.1 (0.9 – 1.4)	0.198	1.0 (0.8 – 1.3)	0.750
Education status (ref. high school or greater)	1.5 (1.1 – 1.8)	0.002	1.3 (0.9 – 1.8)	0.102
Employment status (ref. employed)	1.5 (1.2 – 1.8)	0.001	1.1 (0.9 – 1.5)	0.343
Income (ref. \$25,001 or greater)	2.1 (1.7 – 2.7)	<0.001	1.9 (1.5 – 2.5)	<0.001
Region of Alaska (ref. Southwest)		0.341		
Southcentral	1.1 (0.8 – 1.4)			
Southeast	0.9 (0.7 – 1.2)			
AN/AI language spoken at home (ref. yes)	0.9 (0.7 – 1.1)	0.320		
Traditional event participation (ref. yes)	1.1 (0.9 – 1.3)	0.642		
Identification with tribal tradition (ref. some or lot)	1.4 (1.1 – 1.7)	0.006	1.5 (1.2 – 2.0)	0.001
Identification with non-Native culture (ref. not at all or a little)	0.9 (0.7 – 1.1)	0.197	1.2 (0.9 – 1.5)	0.281
Number of physical conditions (ref. none)		<0.001		<0.001
1 to 2	1.6 (1.2 – 2.1)		1.5 (1.1 – 2.0) ***	
3 or more	2.6 (2.0 – 3.5)		2.4 (1.7 – 3.5) ***	
General health (ref. good to excellent)	3.5 (2.8 – 4.4)	<0.001	3.4 (2.7 – 4.4)	<0.001
Body mass index (ref. <25.0)		0.206		0.625
≥25.0 to <30.0	1.2 (0.9 – 1.6)		1.2 (0.8 – 1.7)	
≥30	1.3 (1.0 – 1.7)		1.1 (0.8 – 1.5)	

	Univariate		Multivariate	
	OR (95% CI) ^a	<i>p</i>	OR (95% CI) ^a	<i>p</i>
Vigorous physical activity (ref. ≥ 2.5 hour/week)		0.008		0.965
0 hours/week	1.5 (1.1 – 2.0)		1.0 (0.7 – 1.5)	
>0 to <2.5 hours/week	1.1 (0.8 – 1.5)		1.0 (0.7 – 1.4)	
Tobacco status (ref. never)		<0.001		0.004
Former tobacco user	1.2 (0.9 – 1.6)		1.1 (0.8 – 1.6)	
Current tobacco user	1.8 (1.4 – 2.3)		1.6 (1.2 – 2.2) ^{**}	
Times drank 5+ drinks (ref. never)		<0.001		0.002
1 to 10 times	1.5 (1.2 – 1.9)		1.6 (1.2 – 2.1) ^{***}	
10 or more times	1.5 (1.1 – 2.2)		1.6 (1.0 – 2.5) [*]	

^aOdds ratio and 95% confidence interval (CI) comparing odds of scoring in positive depression score category (PHQ-9 ≥ 10) versus negative (PHQ-9 ≤ 9) in the non-reference versus reference group.

*
 $p < 0.05$

**
 $p < 0.01$

 $p < 0.001$