Prevalence and correlates of tobacco use among middle and high school students in western Alaska

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ABSTRACT

Objectives. Tobacco use is the leading cause of preventable death in the United States and contributes to increased incidence, morbidity and mortality from cancer, heart disease, stroke, complications of pregnancy and respiratory illness. Tobacco use rates are highest among American Indians and Alaska Natives. This study examined the prevalence and correlates of tobacco use among youth residing in rural western Alaska.

Study design. Data were analysed from the 2003 Youth Risk Behavior Survey (YRBS) administered to a regional sample of adolescents attending school in western Alaska.

Methods. Data were analysed from 260 middle school (52% female, 87% Alaska Native) and 258 high school (48% female, 93% Alaska Native) students.

Results. Among middle school students, 39% reported current use of ST, 24% reported cigarette smoking and 50% reported current use of any tobacco product. On multivariate analysis, independent correlates of current use of any tobacco were Alaska Native ethnicity (p=0.002) and ever use of marijuana (p<0.001). Among high school students, 38% reported current ST use, 43% reported cigarette smoking and 60% reported current use of any tobacco product. Independent correlates of current use of any tobacco were increasing age (p=0.007), ever use of marijuana (p<0.001), current use of marijuana (p=0.005) and reporting a suicide attempt within the past 12 months (p=0.003). No significant gender differences on tobacco use emerged for middle or high school students.
Conclusions. This study documents the high tobacco use rates among youth residing in western Alaska, with over half of the adolescents reporting tobacco use. Developing interventions to promote tobacco use prevention and cessation is an essential step towards reducing tobacco-related health disparities in this rural population. Expanded efforts are needed to address tobacco use among youth residing in this region of Alaska.

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INTRODUCTION

Tobacco use is the leading cause of preventable death in the United States and contributes to increased incidence, morbidity and mortality from cancer, heart disease, stroke, complications of pregnancy and respiratory illness (1). Approximately 438,000 persons die annually from tobacco-related diseases (2), and some U.S. minority racial and ethnic populations bear a disproportionate burden of tobacco-related health disparities. Cancer is the leading cause of death among Alaska Native people, with lung cancer being the leading cause of all cancer deaths among both Alaska Native men and women (3,4). Among adolescents, cigarette smoking is associated with cough and phlegm production, an increase in the number and severity of respiratory illnesses and reduced rates of lung growth and function (5). Among 377 Alaska Native children residing in western Alaska, Lewis and colleagues (6) found that after adjustment for demographic factors, children with asthma-like symptoms and productive cough were significantly more likely to report current smoking and environmental tobacco smoke exposure. Smokeless tobacco (ST) use is also associated with documented health risks. A recent study among adults comparing 182 ST (oral snuff) users with 420 cigarette smokers found that after adjusting for age and gender, ST users had higher cotinine levels and were exposed more so than smokers to higher levels of the nitrosamine NNK (nicotine-derived-nitrosamino-ketone; 4-[methylnitrosamino]-1-[3-pyridyl]-1-butane) (7) NNK is a human carcinogen known to produce lung cancer as well as cancers of the pancreas, nasal mucosa and liver in laboratory animals, and precancerous lesions of the teeth and periodontal mucosa (8,9).

The reduction of tobacco-related health disparities among American Indian and Alaska Native people is a major national health objective (4,10). The prevalence of cigarette smoking among youth aged 12-17 in the U.S. is currently highest among the American Indian and Alaska Native people (28%) compared with whites (16%), Hawaiian or other Pacific Islanders (11%) and Blacks (7%) (11). In addition, the rates of smokeless tobacco use are markedly higher among Native American youth than adolescents nationally (12). A survey of Native American high school students found the rate of current ST use was 20% (3), in contrast to the rate of 6% reported...
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among high school students nationally (4). Initial studies indicate a high tobacco prevalence rate among Alaska Native youth residing in western Alaska. Using a convenience sample of 377 Alaska Native people from this region in Grades 6 through 9, Lewis et al. (6) reported that 34% currently smoked cigarettes. Using data from youth seen for a Well Child Assessment in western Alaska, Angstman et al. (13) found that 29% of 11-14 year-olds and 63% of 15-18 year-olds reported using tobacco. The respective rates of ST use were 26% and 44%. Despite these high use rates, tobacco cessation interventions developed and evaluated for Alaska Native and other youth in this region do not exist (14-16). The current investigation uses data from the CDC Y Research Risk Behavior Survey (YRBS) administered in 1 of the largest school districts in western Alaska.

A common form of ST used by Alaska Native people of western Alaska is Iqmik, a mixture of tobacco leaves and fungus ash (17). Importantly, Alaska Natives do not use Iqmik or other tobacco products for religious or ceremonial purposes (18,19). Iqmik is most commonly prepared by mixing fungus ash with tobacco leaves and then pre-chewing it in the mouth, or mixing it in a bowl with water, where it is cut and stirred with a knife (20). Because of the high pH (10.9) of the fungus ash, almost 100% of the nicotine in Iqmik is in the “freebase” form (20). This allows for rapid absorption of nicotine across the buccal mucosa, which likely contributes to addiction. Individual interviews and focus groups with Alaska Native people in this region indicate that Iqmik use is thought to be less harmful than other forms of tobacco because it contains mostly natural ingredients (20,21). Approximately 79% of Alaska Native women from this region use ST or smoke ciga-
rettes during pregnancy (22), and Alaska Native parents and other family members often give Iqmik to their children or obtain it for them. Iqmik is commonly used by children as young as 3 years old (21).

Studies conducted among youth in the general population indicate that current tobacco use is associated with peer and family social influences (23-25,12), including maternal current use of tobacco (26) during pregnancy (27); low parental support for the adolescent’s cessation efforts; (28) peer offers to use; and availability of tobacco (29). Other factors include depressive symptoms (30), low academic achievement (31) and proclivity towards risky behaviours, including substance use and physical fighting (32). Few studies have examined correlates of tobacco use among Alaska Native youth. The purpose of this study was to examine youth tobacco use prevalence and correlates using the YRBS, a well-established national surveillance survey conducted in 2003 in a large school district in western Alaska. Understanding tobacco use among youth in this rural Alaskan population is an essential step towards developing interventions to promote tobacco use prevention and cessation among these at-risk youth.

MATERIAL AND METHODS

Study setting
The Yukon-Kuskokwim Delta (YKD) region of western Alaska is about the size of the state of Ohio, with a total population of 25,000. The population is young, with a median age of 23.5 years versus the U.S. median age of 36.2 (33). Approximately 94% of the population is Alaska Native - either Yup’ik or Cup’ik, and is gener-
ally homogenous with respect to language and culture. Most Alaska Native people of this region live subsistence lifestyles (34). The 56 villages of this region are not linked by a common road system, and are accessible only by boat, airplane or snowmobile.

**Study design**

We analyzed data from the 2003 Youth Risk Behavior Survey (YRBS). The YRBS is part of an epidemiological surveillance system established in 1988 by the Centers for Disease Control and Prevention (CDC). The YRBS consists of a school-based survey administered in cooperation with the Alaska Department of Education and Early Development and the Department of Health and Social Services. The overall goal of the YRBS national survey was to document the prevalence of behaviors that put youth at risk for significant health and social problems in order to assist in prevention, intervention planning and evaluation. The YRBS accomplished this using multistage cluster randomized sampling to survey youths from all 50 U.S. states and 2 territories. Active (written) parental consent was required for the student’s participation in the 2003 YRBS survey.

Because only a very small percentage (only 2-3 schools) could be expected to be randomly chosen to participate in the Alaska statewide YRBS survey, a local YRBS survey was administered in 2003 to a large school district in western Alaska. This school district includes 27 schools, with most village-based schools serving all grades. The regional survey collected data on both Alaska Native and non-Alaska Native youth attending school and residing in the district. Although the survey and administration methodology was exactly the same for the statewide YRBS survey, the sampling method was different. At the local level a census sampling frame was used, making all schools and all students eligible to take the survey.

Opportunity to decline participation could occur at any level (i.e., school district, individual school, student’s parents or the individual student). An overall participation rate of at least 60% (i.e., school and student participation rates multiplied) was required to provide weighted responses that could be considered representative of the student body within a district.

**Procedures**

Teachers in each eligible classroom read to students a script detailing the guidelines for student privacy and anonymity and the importance of the survey. After completing the survey, students were instructed to place it in an unmarked envelope, seal it and turn it in. To ensure anonymity, no personal identifiers were recorded on the surveys or sealed envelopes.

**Statistical methods**

Survey sampling. The sampling of schools and classes for the YRBS statewide estimate was made using probability sampling. Thus the size of the sample was directly related to the size of the qualified population, the projected student response rate and the preferred precision of the results. For example, the sample selected for the 2003 YRBS was based upon the 2002 Alaska Department of Education and Early Development enrollment counts of traditional students in Grades 9 through 12. School lists were edited to exclude students in non-traditional study (i.e., boarding schools, correspondence programs, home study, alternative, correctional schools). Therefore, for Grades
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9-12, the statewide survey data apply only to students attending public high schools.

Following the CDC procedure, a 2-stage sample design was used to select students for participation in the statewide YRBS. The first stage included the selection of schools. School selection was based upon probability proportions related to the size of school student enrollment. Given that Alaska has a large number of schools with a small number of enrolled students, more schools were needed to obtain the number of students required. The second stage involved the selection of classes to sample. Eligible classes included those in which a student could only be enrolled in only 1 class at a time. Opportunity to decline participation could occur at any level (i.e., school district, individual school, student’s parents or the individual student).

The numbers selected in each stage were adjusted upward in anticipation that some schools and students would fail to participate. To ensure that sample results could be generalized to the total population of interest, an overall participation rate of at least 60% was required to be eligible for inclusion (that is, school and student participation rates were multiplied). The conclusive number of students was selected to enable a 5% margin of error for each question. The results were weighted to represent all students enrolled in Alaska public schools.

Each survey was reviewed for inconsistencies during edit checks using criteria developed by the CDC and Westat, Inc. When inconsistencies were identified, responses were excluded from analysis. For the 2003 survey, on average, inconsistencies occurred with a frequency of less than 2%. Only 14 questions were found to include logic inconsistencies higher than 5%. Inconsistencies were removed pairwise from the respondent’s survey and thus do not adversely influence the final prevalence estimates.

Data analysis. Tobacco use was summarized using point estimates and 95% exact confidence intervals. Tobacco use was compared across gender and age groups using a chi-square test or exact test where appropriate. Logistic regression was used to examine the association of current tobacco use with demographic (gender, age and ethnicity), and health behaviour variables described in Table III. Variables found to be significant in the bivariate models (p<0.10) were included in a multivariate model using backward elimination to identify a set of independent correlates. In all cases, p-values <0.05 were considered statistically significant.

Measures
Tobacco use. The YRBS used standard, validated questions to assess tobacco use among youth (32). To ascertain “ever having tried cigarettes,” students were asked, “Have you ever tried cigarette smoking, even 1 or 2 puffs?” to which students responded “Yes” or “No.” All students were also asked, “During the past 30 days, on how many days did you smoke cigarettes?” Adolescents who smoked on 1 or more days during the previous 30-day period were classified as “current smokers,” and adolescents who responded that they smoked 20 or more of the past 30 days were classified as “frequent current smokers.” Identical questions were asked regarding the adolescent’s use of “chewing tobacco or snuff” and “cigars, cigarillos, or little cigars,” respectively.

Health behaviours. Based on prior literature, select health risk behaviours were assessed in the survey to examine their asso-
association with tobacco use. These included asking the student whether they had (1) suicidal ideation in the previous 12 months: (a) suicidal thoughts - seriously considered attempting suicide, (b) made a plan about how they would attempt suicide, and (c) suicide attempt; (2) participated in a physical fight: in the past 12 months, either in a physical fight 1 or more times, were injured in a physical fight and had to be treated by a doctor or nurse 1 or more times or were in a physical fight on school property 1 or more times; (3) body mass index (BMI): obesity status; (4) taken part in regular physical activity: exercised or participated in physical activities for at least 20 minutes that made them sweat and breathe hard on 3 or more of the past 7 days; (5) participated in sports teams (high school students only): played on 1 or more sports teams during the past 12 months; (6) ever alcohol use: at least 1 drink of alcohol on 1 or more days during their life; (7) current alcohol use: at least 1 drink of alcohol on 1 or more of the past 30 days; (8) ever marijuana use: used marijuana 1 or more times during their life; (9) current marijuana use: used marijuana 1 or more times during the past 30 days; (10) ever inhalant use: sniffed glue, breathed the contents of aerosol spray cans or inhaled any paint or spray to get high 1 or more times during their life; and (11) current inhalant use: sniffed glue, breathed the contents of aerosol spray cans or inhaled any paint or spray to get high during the past 30 days.

Respondents

Forty-two schools from 19 districts were included in the statewide survey, resulting in 2,175 completed questionnaires. The overall response rate was 62%, with 90% of the schools and 68% of the students participating. Gender and age were used to calculate the final weighted value. The final sample included 260 middle school students (87% Alaska Native, 52% female) and 258 high school students (93% Alaska Native, 48% female).

RESULTS

Tobacco use

Table I shows the tobacco use prevalence data (lifetime and current use) overall and by gender for middle and high school students in 2003. There were no significant gender differences for any tobacco use variable among middle or high school students.

We examined age differences on current tobacco use for middle and high school students (see Table II). Among middle school students, a significant association was detected between age and current use of any tobacco (p<0.001); ST (p<0.001); cigarette smoking (p=0.019); and cigar use (p=0.011). The prevalence rates generally increased with older age. However, the proportion reporting ST use and any tobacco use was highest in the youngest (12 years) and oldest (15 years) age groups. Among high school students, a significant association was detected between age and current use of any tobacco (p<0.001) and cigarette smoking (p=0.014). The prevalence rates were higher with increasing age.

Correlates of current tobacco use

Table III presents a descriptive summary of the health characteristics and behaviours of both middle and high school students completing the survey.
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### Table I. Current tobacco use by gender among middle and high school students in western Alaska, 2003.

| Tobacco use | Middle school (n=260) | High school (n=258) |
|-------------|-----------------------|---------------------|
|             | Overall % exact CI | Female % exact CI | Male % exact CI | Overall % exact CI | Female % exact CI | Male % exact CI |
| Any tobacco |                     |                     |                |                    |                     |                |
| Ever        | 69.6, 75.2          | 60.3, 76.7         | 70.0, 78.0     | 85.7, 89.8         | 81.2, 93.5         | 75.5, 89.1     |
| Current     | 50.2, 58.6          | 52.0, 56.6         | 47.9, 53.7     | 60.3, 63.7         | 64.0, 69.7         | 56.9, 67.8     |
| Frequent    | 17.1, 20.3          | 17.0, 20.3         | 11.0, 20.0     | 36.5, 51.9         | 35.3, 58.5         | 31.5, 52.6     |
| Iqmik/ST    |                     |                     |                |                    |                     |                |
| Current     | 39.4, 45.8          | 31.5, 49.0         | 29.6, 47.6     | 31.9, 44.6         | 35.4, 53.4         | 23.6, 40.4     |
| Frequent    | 12.7                | 14.6               | 10.0           | 20.5               | 24.6               | 16.3           |
| Cigarettes  |                     |                     |                |                    |                     |                |
| Current     | 24.0, 29.5          | 14.1, 29.9         | 18.8, 36.2     | 36.8, 50.1         | 36.0, 55.7         | 33.0, 51.4     |
| Frequent    | 3.2                 | 2.7                | 3.7            | 14.2               | 11.4               | 16.8           |
| Cigars      |                     |                     |                |                    |                     |                |
| Current     | 7.7                 | 5.2                | 9.8            | 5.5                | 6.6                | 4.5            |
| Frequent    | 0.4                 | 0.0                | 0.0            | 0.0                | 0.1               | 0.0            |

*p-values are from Fisher’s exact test. All values are % (n).

### Table II. Current tobacco use by age group among middle and high school students in western Alaska, 2003.

| Tobacco use | Middle school students | High school students | p-value* |
|-------------|------------------------|----------------------|----------|
|             | Age group              |                      |          |
| Any tobacco use | <12 years n=57 | 13 years n=80 | 14 years n=82 | 15 years n=41 | <0.001 |
| Iqmik/other ST use | 50% (27) | 25% (19) | 34% (27) | 63% (26) | <0.001 |
| Cigarette smoking | 21% (9) | 19% (14) | 20% (14) | 44% (16) | 0.019 |
| Cigar use | 7% (4) | 3% (2) | 7% (6) | 20% (8) | 0.011 |
| High school students | 15 years n=73 | 16 years n=69 | 17 years n=65 | >18 years n=51 | p-value* |
| Any tobacco use | 41% (28) | 65% (40) | 62% (38) | 79% (38) | <0.001 |
| Iqmik/other ST use | 32% (23) | 46% (29) | 39% (24) | 35% (15) | 0.38 |
| Cigarette smoking | 29% (19) | 44% (26) | 47% (28) | 60% (25) | 0.014 |
| Cigar use | 4% (3) | 3% (2) | 6% (4) | 10% (5) | 0.38 |

*p-values are from Fisher’s exact test. All values are % (n).
Table III. Descriptive summary of health behaviours among middle and high school students in western Alaska, 2003.

| Variable                        | Middle school (n=260) (%) | High school (n=258) (%) |
|---------------------------------|---------------------------|-------------------------|
| **Body Mass Index (BMI)**       |                           |                         |
| 0 to 24.9                       | 83% (203)                 | 72% (178)               |
| 25 to 29.9                      | 11% (28)                  | 18% (44)                |
| 30 and above                    | 6% (15)                   | 10% (25)                |
| **Regular physical activity**   |                           |                         |
| Participates in team sports     | -                         | 64% (158)               |
| **Ever used alcohol**           |                           |                         |
| Current use of alcohol          | -                         | 25% (60)                |
| **Ever used inhalants**         |                           |                         |
| Current use of inhalants        | -                         | 1% (2)                  |
| **Ever used marijuana**         |                           |                         |
| Current use of marijuana        | -                         | 35% (83)                |
| **Participated in a physical fight** |                       | 28% (68)                |
| **Attempted suicide**           |                           |                         |
| Made plans to commit suicide    |                           |                         |
| Suicidal thoughts               |                           |                         |

*a Missing data ranged from 0 to 26 observations.
*b Missing data ranged from 0 to 56 observations.
*c Variable assessed for the past 12 months.
- Variable not assessed among middle school students.

Table IV. Odds ratio estimates of current tobacco use and demographic and health behaviours among LKSD middle school students.

| Characteristic                        | n (%)       | Odds ratio estimate | 95% CI        | p-value |
|---------------------------------------|-------------|---------------------|---------------|---------|
| **Age group**                          |             |                     |               |         |
| 12 years old or younger               | 32 (59.3)   | 1.08 (0.88, 1.32)   | 0.459         |         |
| 13 years old                          | 26 (35.6)   |                     |               |         |
| 14 years old                          | 32 (42.7)   |                     |               |         |
| 15 years old or older                 | 32 (78)     |                     |               |         |
| **BMI**                               |             | 1.02 (0.97, 1.06)   | 0.431         |         |
| 0 to 24.9                             | 95 (48.5)   |                     |               |         |
| 25 to 29.9                            | 12 (52.2)   |                     |               |         |
| 30 and above                          | 6 (54.5)    |                     |               |         |
| **Male gender**                       | 57 (47.9)   | 0.85 (0.51, 1.4)    | 0.521         |         |
| **Native American**                   | 117 (55.5)  | 6.72 (2.49, 18.12)  | <.001         |         |
| Ever used alcohol                     | 48 (64.9)   | 2.61 (1.47, 4.64)   | 0.001         |         |
| **Ever used marijuana**               | 58 (84.1)   | 12.30 (5.91, 25.6)  | <.001         |         |
| Ever used inhalants                   | 20 (90.9)   | 11.78 (2.69, 51.63) | 0.001         |         |
| Attempted suicide                     | 25 (78.1)   | 4.29 (1.78, 10.35)  | 0.001         |         |
| Made plans to commit suicide          | 26 (76.5)   | 3.91 (1.69, 9.06)   | 0.001         |         |
| Had suicidal thoughts                 | 34 (72.3)   | 3.40 (1.69, 6.85)   | <.001         |         |
| Participated in a fight               | 69 (61.6)   | 2.47 (1.47, 4.16)   | <.001         |         |
| Regular exercise                      | 46 (44.7)   | 0.67 (0.4, 1.14)    | 0.142         |         |

*a Modelled as a continuous variable. Odds ratios are from logistic regression predicting current tobacco use.
*b Independent predictor of current tobacco use in multivariate analyses.
Middle school students. As detailed in Table IV, among middle school students bivariate logistic regression indicated that current tobacco users were more likely to report Alaska Native ethnicity (p<0.001); ever use of alcohol (p=0.001), ever use of marijuana (p<0.001) and ever use of inhalants (p=0.001). They were also more likely to report a suicide attempt (p=0.001), plans to commit suicide (p=0.001) and suicidal thoughts in the past 12 months (p<0.001); and having participated in a physical fight within the past 12 months (p<0.001).

On multivariate analysis, independent correlates of current tobacco use were Alaska Native ethnicity (OR=7.28, 95% CI 2.10-25.16, p=0.002) and ever use of marijuana (OR=12.63, 95% CI 5.85-27.28, p<0.001).

High school students. Among high school students as detailed in Table V, current tobacco users were more likely to be older (p<0.001), and to report ever use of alcohol (p<0.001), current use of alcohol (p<0.001), ever use of inhalants (p=0.022), ever use of marijuana (p<0.001) and current use of marijuana (p<0.001). High school students were also more likely to report a suicide attempt (p=0.002), plans to commit suicide (<0.001) and suicidal thoughts (p=0.013) in the past 12 months.

On multivariate analysis, independent correlates of current tobacco use were age (OR=1.53, 95% CI 1.12-2.08, p=0.007), ever use of marijuana (OR=4.32, 95% CI 1.86-10.02, p<0.001), current use of marijuana (OR=3.69, 95% CI 1.48-9.19, p=0.005) and a suicide attempt within the past 12 months (OR=7.13, 95% CI 2.00-25.39, p=0.003).

**Table V.** Odds ratio estimates of current tobacco use and demographic and health behaviours among LKSD high school students.

| Characteristic                      | n (%)   | Odds ratio estimate | 95% CI     | p-value |
|-------------------------------------|---------|---------------------|------------|---------|
| **Age group**                       |         |                     |            |         |
| 15 years old or younger             | 28 (41.2)| 1.54                | (1.23, 1.94)| <.001   |
| 16 years old                        | 40 (64.5)|                     |            |         |
| 17 years old                        | 38 (62.3)|                     |            |         |
| 18 years old or older               | 38 (79.2)|                     |            |         |
| **BMI**                             |         |                     |            |         |
| 0 to 24.9                           | 94 (57.7)| 1.05                | (0.98, 1.12)| 0.143   |
| 25 to 29.9                          | 29 (69)  |                     |            |         |
| 30 and above                        | 13 (56.5)|                     |            |         |
| Male gender                         | 70 (56.9)| 0.74                | (0.44, 1.25)| 0.263   |
| Native American                     | 137 (62) | 2.56                | (0.96, 6.87)| 0.061   |
| Ever tried alcohol                  | 106 (73.6)| 6.38                | (3.39, 12) | <.001   |
| Currently uses alcohol              | 44 (83)  | 4.45                | (2.05, 9.69)| <.001   |
| Ever tried marijuana                | 19 (82.6)| 3.66                | (1.2, 11.14)| 0.022   |
| Currently uses inhalants            | 2 (100)  | -                   | -          | -       |
| **Ever tried marijuana**            | 115 (74.7)| 7.37                | (3.99, 13.61)| <.001   |
| **Currently uses marijuana**        | 68 (87.2)| 8.79                | (4.2, 18.39)| <.001   |
| Participated in a fight             | 43 (68.3)| 1.75                | (0.95, 3.23)| 0.074   |
| **Attempted suicide**               | 26 (86.7)| 5.82                | (1.94, 17.43)| 0.002   |
| Made plans to commit suicide        | 40 (87)  | 5.80                | (2.35, 14.34)| <.001   |
| Had suicidal thoughts               | 41 (74.5)| 2.35                | (1.2, 4.61) | 0.013   |
| Participates in sports teams        | 86 (57.7)| 0.82                | (0.48, 1.42)| 0.488   |
| Regular exercise                    | 71 (60.2)| 1.07                | (0.63, 1.8) | 0.809   |

*Modelled as a continuous variable. Odds ratios are from logistic regression predicting tobacco use. **Independent predictor of current tobacco use in multivariate analyses.
DISCUSSION

This study documents the high rate of tobacco use among youth residing in western Alaska, with over half of the adolescents reporting tobacco use. This is the first study to examine tobacco use rates among school-attending youth in this region. Our study also adds to the literature by examining correlates of current tobacco use in this population.

We found that the prevalence of current use of tobacco in 2003 was 50% for middle school students and 60% for high school students. The findings are consistent with our prior study, which examined tobacco use prevalence among Alaska Native youth of this region who were seen for a Well Child Assessment (13). The prevalence rates of adolescent tobacco use in this region are much higher than those found among youth in the general U.S. population. The CDC National Youth Tobacco Survey (NYTS) conducted in 2004 found that current tobacco use was reported among approximately 12% of middle school students and 28% of high school students nationally (35). For example, among middle school students nationally, 8.1% reported current cigarette smoking and 2.9% reported use of smokeless tobacco, whereas in our middle school student sample, the respective rates of cigarette and smokeless tobacco use were 24% and 39%. Similarly, among high school students nationally, 22% smoked cigarettes and 6% used ST (35). The corresponding rates for our high school sample were 43% and 38%, respectively.

The rates of tobacco use in our regional sample were also higher than those reported for the State of Alaska YRBS conducted in 2003 (36). The 2003 statewide survey was only administered to high school students (20% Alaska Native/American Indian, 48% female). Data reported from that survey indicated that overall 19% currently smoked cigarettes and 16% of boys and 6% of girls use ST.

National data (37,35) indicate higher rates of ST use among males compared with females. In contrast, a previous study among Alaska Native youth in western Alaska found that females were more likely than males to report Iqmik and other ST use (13). However, the current investigation found no gender differences in tobacco use. The discrepancy in findings across studies may be accounted for by the ethnic and regional composition of the sample. The prior study included only Alaska Native youth, whereas the YRBS included all youth within the selected school district.

Current tobacco prevention and cessation programs for adolescents have not adequately addressed diverse populations or health disparities (14,4). Thus, culturally appropriate interventions need to be developed that are feasible and acceptable to youth in western Alaska.

Two recent meta-analyses (14,16) reviewed the state of the science for treatment of youth tobacco users. Sussman and colleagues (16) reviewed the efficacy of 48 intervention studies conducted with cigarette smokers ages 12-19. These trials included a control condition (standard care or minimal programming), and most were conducted in school-based settings. Relatively higher quit rates were found in programs that
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included cognitive behavioural techniques, a motivation enhancement component or social influence approaches. Grimshaw and Stanton (14) reviewed 15 intervention trials that included an active or minimal control condition. A total of 3,605 young people 20 years of age or younger who used tobacco participated in the 15 trials. The interventions tested were primarily school-based. The authors concluded that there was not sufficient evidence to recommend widespread implementation of any 1 model. However, motivational enhancement and cognitive-behavioural approaches appeared to be most effective.

Limitations
This study has several limitations that should be considered when interpreting the results. First, the study relied on a relatively small, isolated population, limiting the applicability and generalizability of the results. Nonetheless, it is important to address health disparities in such rural communities. We also relied on a survey conducted in only 1 of 7 school districts in western Alaska. However, it is 1 of the largest school districts within that region. Future studies using larger, more representative sample sizes are needed to examine the prevalence of, and correlates of, tobacco use in this population. For some tobacco use variables the confidence intervals are fairly wide, which limits the interpretation of some results. Another drawback is that we relied on self-reported tobacco use, and biochemical verification was not obtained. Some studies indicate that the misreporting of tobacco use among adolescents is less likely when tobacco use is assessed by an anonymous, self-administered questionnaire in contrast to face-to-face interview methods (38). A major limitation is that Iqmik use was not differentiated from commercial ST use on the YRBS survey. We recommend that future surveys assessing tobacco use among youth of this region assess Iqmik and other forms of ST use. Another drawback is that the cross-sectional design limited any causal interpretations of associations observed with tobacco use and the other health behaviours assessed.

Implications and future directions
Developing tobacco use prevention and cessation interventions to decrease tobacco use initiation and ongoing use are essential steps towards achieving national health objectives, and for ultimately reducing tobacco-related health disparities in this rural population. We suggest future research target both prevention and cessation intervention efforts among Alaska Native youth. Given that tobacco use was associated with marijuana use and suicide attempts, corrections agencies and school counsellors might be advised to consider tobacco use interventions when working with youth presenting with these associated risk factors. With findings from the current study, the schools in this region are now in a much better position to address the issues of tobacco use, both in schools and in the communities of western Alaska. These findings will enable schools and policymakers to identify the priority areas for school-based tobacco prevention education, policy development and tobacco control efforts.
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