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Hearing-Related Health Among Adult American Indians From a Pacific Northwest Tribe

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Abstract

Introduction—Hearing loss and tinnitus are common in most populations, although few data have addressed hearing-related health among tribal members and the need for public health interventions.

Methods—This cross-sectional study examined prevalence and risk factors for hearing loss and tinnitus among 217 adults in a Pacific Northwest tribe. Frequency measures were conducted for difficulty hearing certain sounds and hearing aid use. In 2006, risk factors were examined for two outcomes—hearing loss and tinnitus—with analysis conducted in the same year.

Results—Although self-reported hearing loss was more common in men (24%) than women (13%), a larger percentage of women compared with men reported difficulty hearing certain sounds. Only 8% of study participants reported hearing aid use. After age adjustment, significant noise exposure was associated with hearing loss (OR=8.30, 95% CI=1.84, 37.52). The overall prevalence of tinnitus was 33% (similar in men and women). After adjusting for age, the odds of tinnitus in individuals with more than four ear infections was 4.77 (95% CI=1.89, 12.02) times the odds in those who never had an ear infection. Tinnitus was also associated with significant noise exposure (OR=2.24, 95% CI=1.28, 6.73) even after age adjustment.

Conclusions—Increasing age and significant noise exposure were associated with hearing loss in this tribe. Tinnitus was associated with significant noise exposure and history of otitis media,

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SUPPLEMENTAL MATERIAL

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even after age adjustment. Public health efforts are needed to improve hearing-related health in this tribe through messages about noise exposure and use of hearing protection.

INTRODUCTION

Hearing-related problems among American Indians have not been studied extensively, despite the observation that American Indian or Alaska Native adults nationwide are nearly twice as likely (6.4%) as white adults (3.5%) and four times as likely as Asian adults (1.8%) and African-American adults (1.6%) to report moderate to severe hearing problems.¹ Prevalence and risk factors for tinnitus have not been documented in tribal populations, whereas tinnitus is commonly reported in many non-tribal populations and is most strongly linked to loud noise exposure.²

Members of many Northwest tribes work in occupations that involve regular and continuous exposure to significant noise, such as work on fishing boats, in construction, and in logging. Many of the tribes in the Pacific Northwest now have casinos that employ tribal members in locations that are typically very loud. Furthermore, recreational noise exposure for tribal men, in particular, often derives from hunting with high-powered rifles. In addition, Indian Health Service clinicians have reported the high incidence of otitis media in various tribal populations, which can potentially affect hearing health.³ Given the common exposures to significant noise and other hearing-related insults among Pacific Northwest American Indians, this survey was undertaken to assess the prevalence of and risk factors for hearing loss and tinnitus in one Northwest tribe.

METHODS

A survey was conducted based on the Behavioral Risk Factor Surveillance System survey (2006 English version), which was established in 1984 by the U.S. Centers for Disease Control and Prevention to monitor health risk behaviors.⁴ The interviews included the questions from this survey and an additional module of 11 questions that were specifically designed to assess hearing loss and tinnitus.

An adult sample of study participants aged 18 years was selected from one tribe that included 500 adult members. Two hundred and seventeen of the 350 tribal members who were contacted (62%) were included.

Trained interviewers conducted face-to-face interviews to collect data. Questionnaires were pretested with adult tribal members who were not members of the Northwest tribe engaged in this research. Interviewers used questionnaires that were reviewed by tribal health officials before the study began. The protocol included a scripted introduction that was read to each participant before the questions were asked of each participant. All questionnaire interviews were conducted in the English language in 2006, and participants were compensated monetarily for their participation. All tribal members who were included in the survey were fluent in English.

Information on hearing loss and tinnitus was obtained through questions asked of the participants during the interviews; no medical records were reviewed and hearing testing

was not conducted. Participants were asked if they had ever been diagnosed with hearing loss by a doctor, nurse, or other healthcare provider. Tinnitus was assessed through asking participants if they have ringing, hissing, buzzing, roaring, or clicking in their head or ears.

The 11 questions in the hearing health module focused on ringing in the ears; frequency of ringing in the ears; difficulty hearing sounds at work, school, home, or during family time; history of occupational loud noise exposure or recreational significant noise; history of ear infections; hearing loss diagnosis by a health professional; and use of a hearing aid.

Statistical Analysis

All of the variables were categorical, although where the relationship between age and the outcome was linear, age was included as a continuous variable. Age was categorized into five 10-year age groups to describe the prevalence of hearing loss and tinnitus across the adult life span. A risk factor variable was developed to capture history of any type of significant noise exposure, including recreational and occupational significant noise exposure. In the questionnaire, otitis media infections were also categorized into four categories (0, never had an ear infection; 1, one to two ear infections; 2, three to four ear infections; and 4, more than four ear infections) and this categorization was used when including otitis media as a risk factor in the modeling procedures. In analyses where otitis media was the main risk factor being examined, otitis media was defined as having more than four ear infections versus never having an ear infection. Unadjusted and age-adjusted ORs and 95% CIs were estimated using logistic regression for hearing loss and tinnitus.

Logistic regression models were built following the recommendations proposed by Hosmer and Lemeshow.⁵ Independent risk factors that were included in the adjusted models had an association with the outcome variables at a significance level of 0.1 in unadjusted analyses, or those considered to be potential confounders in previous literature (sex and age). All analyses were conducted in 2006 using SPSS, version 14.

RESULTS

Forty-five percent of participants were male, 32% were married, 39% had greater than high school education, and 60% were currently employed (Appendix Table 1, available online). Prevalence of hearing loss predictably increased with advancing age. Over all ages and both sexes, 18% reported provider-diagnosed hearing loss, with a higher proportion of men than women (24% vs 13%) reporting hearing loss (Figure 1, Appendix Table 1, available online). The prevalence of tinnitus was highest among those aged 46–59 years and lowest among those aged 18–35 years (Figure 2, Appendix Table 1, available online). Among all participants, the prevalence of tinnitus was 33% (comparable for men and women; Figure 2). Adjustment was made for history of any type of significant noise exposure, sex, and age in the logistic regression model for hearing loss. After age adjustment, significant noise exposure was associated with hearing loss (OR=8.30, 95% CI=1.84, 37.5; Table 1).

For tinnitus, the logistic regression model included the following covariates: otitis media, history of any type of significant noise exposure, age, and sex. After adjusting for age, the odds of tinnitus in individuals with more than four ear infections were 4.77 (95% CI=1.89,

12.02) times the odds in those who never had an ear infection. Tinnitus was also associated with significant noise exposure (OR=2.24, 95% CI=1.28, 6.73) even after age adjustment (Table 2).

DISCUSSION

Increasing age and history of significant noise exposure were associated with hearing loss in this tribe, consistent with findings on non-tribal participants.⁶ The prevalence of hearing loss in this study population (18%) was higher than that (10%) among the general U.S. population.⁷ The strongest risk factors for tinnitus were history of significant recreational noise exposure and history of otitis media even after adjustment for age and sex. The prevalence of tinnitus among tribal members (33%) was higher than that reported (15%) among the general U.S. population.⁷

Limitations

This study has limitations, including the potential for selection bias, as 62% of eligible adult tribal members were included, although demographic characteristics were similar in the study population when compared to the adult population of the tribe. Although information on risk factors and outcomes was collected through self-report and therefore subject to information bias, the questionnaire was pretested and used a standardized approach to improve the accuracy of data collection. Participants were not asked about medication use that could potentially affect hearing health, although this variable would not be included in the modeling procedures, as it may be considered an intermediate in the association between the exposures and outcomes of interest. All participants were from a single tribe, affecting generalizability of results to other Indian tribes in the Northwest and beyond.

CONCLUSIONS

Potential public health interventions should focus on improving tribal hearing-related health. The Dangerous Decibels® program, an evidence-based, primary prevention public health campaign aimed at reducing the incidence and prevalence of noise-induced hearing loss and tinnitus, could be involved in several aspects of potential public health interventions.^{8,9} Secondary prevention should focus on conducting hearing screening tests at tribal health fairs and other community forums. Providing hearing aids to tribal members with hearing loss could be implemented as a tertiary prevention effort to reduce the consequences of hearing loss.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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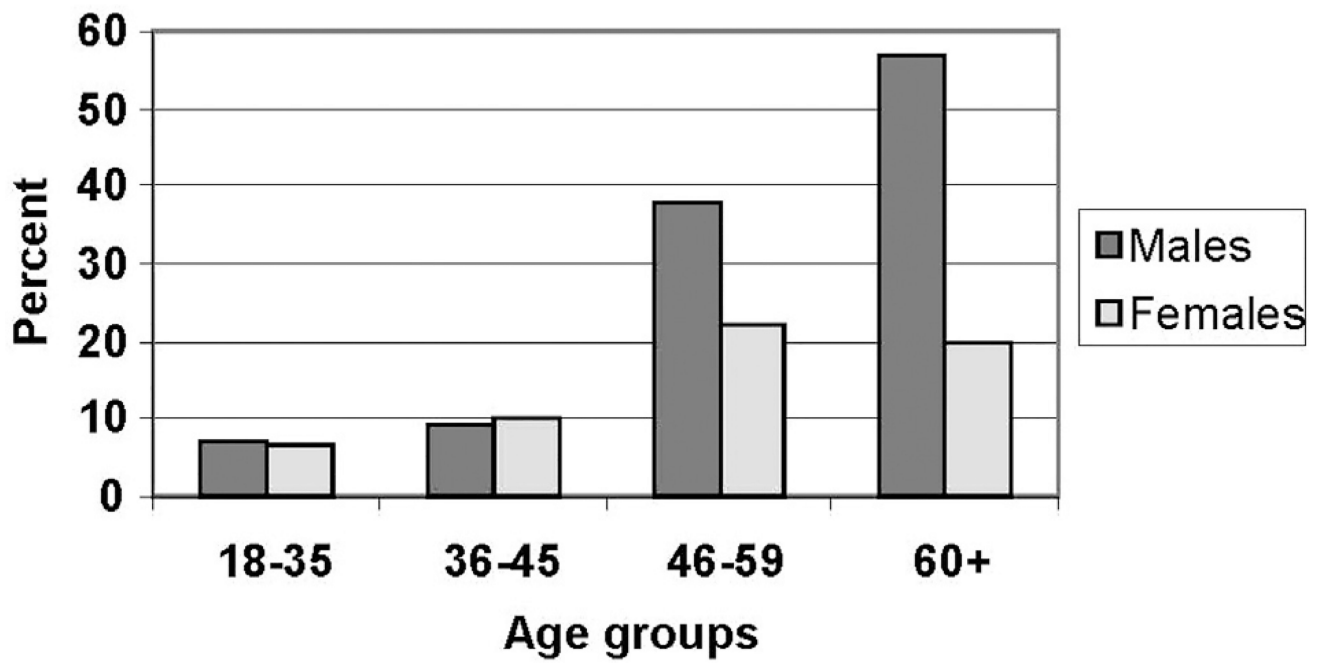


Figure 1.

Prevalence of hearing loss among male and female participants by age group: Survey of hearing-related health among American Indians from one Northwest tribe, 2006.

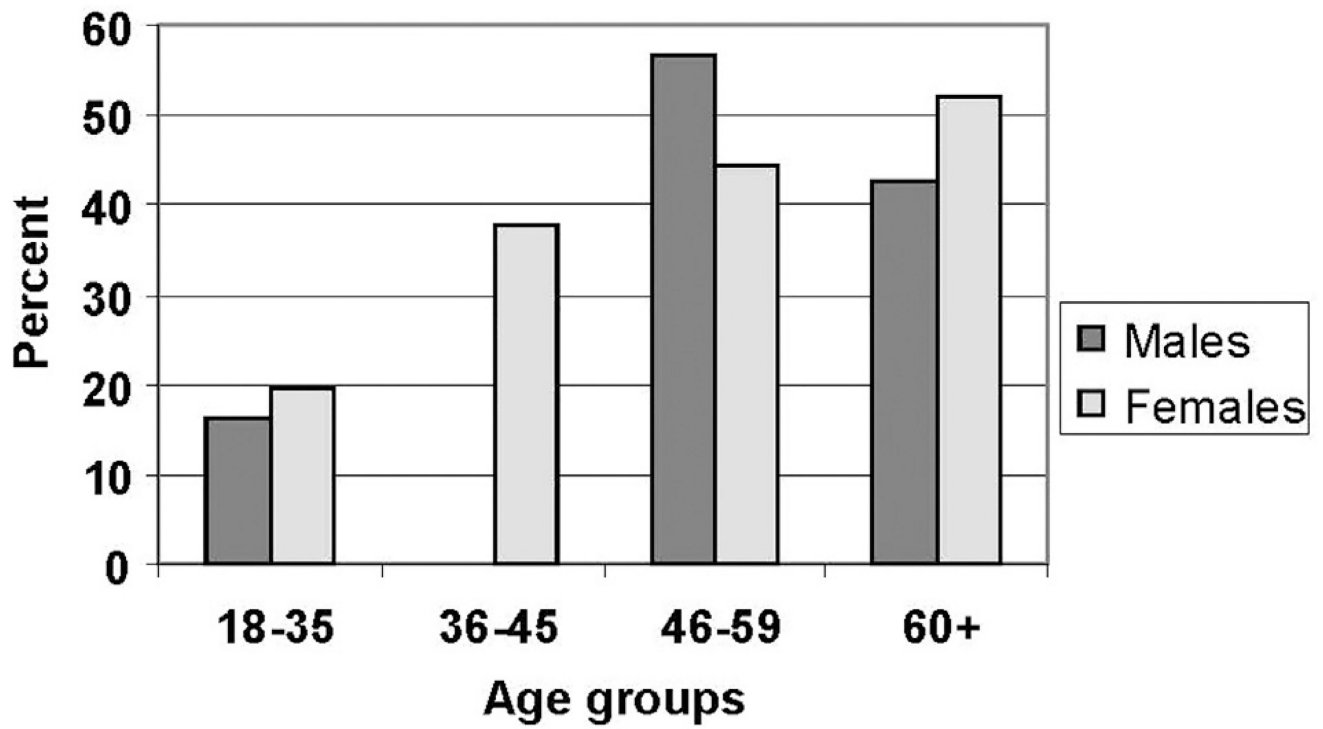


Figure 2.

Prevalence of tinnitus among male and female participants by age group: Survey of hearing related health among American Indians from one Northwest tribe, 2006.

Table 1
Risk Factors for Physician-Diagnosed Hearing Loss in a Pacific Northwest Tribe, 2006.

Exposure	Total (n=217)			Males (n=98)			Females (n=119)		
	No. of cases with exposure	Crude OR (95% CI)	Age-adjusted ^a OR (95% CI)	No. of cases with exposure	Crude OR (95% CI)	Age-adjusted OR (95% CI)	No. of cases with exposure	Crude OR (95% CI)	Age-adjusted OR (95% CI)
History of military service	10 ^b	2.99 (1.26, 7.10)	1.59 (0.61, 4.10)	10 ^c	3.30 (1.20, 9.04)	0.94 (0.27, 3.35)	0	NA	NA
Diabetes mellitus	3 ^d	1.42 (0.37, 5.44)	0.78 (0.20, 3.07)	NA	NA	NA	NA	NA	NA
Otitis media	27 ^e	1.19 (0.50, 2.84)	1.66 (0.66, 4.17)	16 ^f	1.35 (0.43, 4.22)	1.88 (0.52, 6.84)	11 ^g	1.14 (0.29, 4.44)	1.34 (0.33, 5.51)
Exposure to recreational noise	27 ^b	1.16 (0.54, 2.49)	2.35 (0.95, 5.82)	17 ^b	0.39 (0.12, 1.26)	0.56 (0.14, 2.28)	10	1.71 (0.55, 5.36)	3.14 (0.80, 12.30)
Exposure to work-related noise	31 ^b	4.14 (1.73, 9.89)	3.47 (1.42, 8.50)	22 ^b	6.56 (0.82, 52.31)	3.25 (0.38, 28.19)	9	2.96 (0.97, 8.98)	2.65 (0.86, 8.19)

Note: n=39 participants with hearing loss of a total of 217 surveyed.

^a Age as a continuous variable.

^b 1 missing.

^c 2 missing.

^d 3 missing.

^e 24 missing.

^f 13 missing.

^g 12 missing.

NA, not applicable.

Table 2

Risk Factors for Self-Reported Tinnitus in a Pacific Northwest Tribe, 2006.

Exposure	Total (<i>n</i> =217)			Males (<i>n</i> =98)			Females (<i>n</i> =119)		
	No. of cases with exposure	Crude OR (95% CI)	Age-adjusted ^a OR (95% CI)	No. of cases with exposure	Crude OR (95% CI)	Age-adjusted OR (95% CI)	No. of cases with exposure	Crude OR (95% CI)	Age-adjusted OR (95% CI)
History of military service	14 ^b	1.98 (0.91, 4.33)	1.18 (0.50, 2.77)	11	2.23 (0.87, 5.76)	1.19 (0.39, 3.64)	3 ^b	2.96 (0.47, 18.48)	1.83 (0.27, 12.55)
Diabetes mellitus	8 ^c	3.59 (1.13, 11.41)	2.22 (0.67, 7.33)	NA	NA	NA	NA	NA	NA
Otitis media	55 ^d	2.08 (0.98, 4.41)	2.82 (1.26, 6.30)	23 ^e	1.77 (0.61, 5.10)	2.17 (0.72, 6.60)	32 ^f	2.43 (0.83, 7.17)	3.63 (1.11, 11.87)
Exposure to work-recreational noise	53 ^b	1.55 (0.82, 2.92)	2.64 (1.27, 5.51)	26	1.25 (0.37, 4.31)	1.77 (0.46, 6.83)	27 ^b	1.98 (0.90, 4.34)	4.61 (1.66, 12.79)
Exposure to work-related noise	49 ^b	2.14 (1.17, 3.89)	1.82 (0.98, 3.38)	27	2.55 (0.68, 9.57)	1.74 (0.44, 6.91)	22 ^b	3.09 (1.40, 6.82)	2.68 (1.19, 6.06)

Note: *n*=71 participants with tinnitus of a total of 217 surveyed.^a Age as a continuous variable.^b 1 missing.^c 3 missing.^d 25 missing.^e 12 missing.^f 13 missing.

NA, not applicable.