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Physical Activity and Cervical Cancer Testing Among American Indian Women

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Abstract

Purpose—Studies have shown that women who engage in high levels of physical activity have higher rates of cancer screening, including Papanicolaou (Pap) tests. Because American Indian (AI) women are at high risk for cervical cancer morbidity and mortality, we examined Pap screening prevalence and assessed whether physical activity was associated with screening adherence among AI women from 2 culturally distinct regions in the Northern Plains and the Southwest.

Methods—A total of 1,979 AI women at least 18 years of age participating in a cross-sectional cohort study reported whether they received a Pap test within the previous 3 years. Physical activity level was expressed as total metabolic equivalent (MET) scores and grouped into quartiles. We used binary logistic regression to model the association of Pap testing and MET quartile, adjusting for demographic and health factors.

Findings—Overall, 60% of women received a Pap test within the previous 3 years. After controlling for covariates, increased physical activity was associated with higher odds of Pap screening (OR = 1.1 per increase in MET quartile; 95% CI = 1.1, 1.2).

Conclusions—This is the first study to examine physical activity patterns and receipt of cancer screening in AIs. While recent Pap testing was more common among physically active AI women, prevalence was still quite low in all subgroups. Efforts are needed to increase awareness of the importance of cervical cancer screening among AI women.

Keywords

aging; American Indians; cervical cancer screening; Papanicolaou testing; physical activity

Cross-sectional studies have found that persons who engage in higher levels of physical activity have higher odds of being tested for different types of cancer.^{1–3} One study found that higher rates of fecal occult blood testing corresponded with higher levels of physical activity among adults in the United States.¹ Similarly, a positive relationship between self-reported colorectal cancer screening and exercise was observed in a nationally representative survey of US adults aged 50 years or older.² A longitudinal study found that receipt of timely mammography and Papanicolaou (Pap) tests was more likely among women who engaged in vigorous exercise.⁴

Compared to urban populations, rural residents are less likely to obtain timely cancer screening.^{5–8} Rural residents are also more apt to be physically inactive,⁹ a factor that is similarly linked to less frequent cancer screening.¹ Rural dwellers of racial and ethnic minorities, such as American Indians (AI), have even lower rates of screening,^{10–12} due in part to the negative impact of higher rates of unemployment, poverty, and lack of health insurance.^{13,14}

Compared to white women, AI women have a lower prevalence of cervical cancer screening¹⁵ and lower 5-year cervical cancer incidence rates, but higher 5-year cervical cancer mortality rates.¹⁶ AI women also have higher rates of overweight and obesity than non-AI women^{17,18} and less frequent exercise than their majority culture counterparts.¹⁹ Despite substantial cervical cancer health disparities, no study has examined the relationship between physical activity and cervical cancer screening among AI women. We therefore analyzed data from a large epidemiological study of 1,979 AI women to (1) describe the prevalence of Pap test receipt in the past 3 years, and (2) determine whether physical activity level was associated with Pap test receipt after adjusting for potential confounding factors.

Methods

Sample Recruitment and Survey

Data for this work came from the Education And Research Towards Health (EARTH) study, a 5-year cross-sectional investigation of 5,207 individuals between the ages of 18 and 95 years residing on the Pine Ridge Indian Reservation (n = 2,025), the Cheyenne River Sioux Reservation (n = 1,528), and the Gila River Indian Community (n = 1,654). Detailed study methods have been previously described.²⁰ The Pine Ridge Indian Reservation, located in southwestern South Dakota, and the Cheyenne River Sioux Reservation, located in north-central South Dakota, are both home to members of Lakota Sioux tribes. These populations comprise the Northern Plains group, and both reservations are located in rural or non-metropolitan counties, as defined by Urban Influence Codes.²¹ The 372,000-acre Gila River Indian Community, located in southern Arizona between Phoenix and Tucson, is home to the Pima and Maricopa tribes. These populations comprise the Southwest group, and their community is located in a metropolitan county.²¹ The study was approved by each tribe and by the Phoenix and Aberdeen Area Indian Health Service Institutional Review Boards. All participants provided written informed consent.

Adult men and women enrolled in the EARTH study were examined between December 2003 and April 2006. Participants in the Northern Plains were initially recruited through advertising, community presentations, and word of mouth, followed by age- and sex-specific targeted recruitment to ensure that the final sample was representative within 5-year age cohort categories to $\pm 5\%$ of 2000 US Census data for Northern Plains reservations. Participants in the Southwest were recruited through a random, systematic household sampling pattern, made possible by detailed housing maps provided to the study team. A mobile van brought interviewers directly to participants' homes.

All study participants underwent clinical examinations and completed self-administered, computer-assisted intake questionnaires on demographics, dietary history, health history, lifestyle, physical activity, and cultural identity.²² Of the 5,207 total EARTH study participants examined by the Black Hills Center for AI Health, 1,979 were women aged 18 years or older with complete information on all variables in this study.

Pap Testing and Physical Activity Measures

Pap testing was assessed through self-report of ever having received a Pap test and self-reported date of last Pap test. Based on these variables, we derived a binary indicator of having received Pap testing in the past 3 years. Participants who reported receiving a Pap test but did not report a date for their most recent test were coded as missing. Physical activity was expressed as intensity-weighted minutes per week of self-reported activity using metabolic equivalent (MET) values from the Compendium of Physical Activities.^{23,24} Participants reported the number of minutes spent each week performing a wide variety of physical activities, each of which was assigned a known MET equivalent value. Activities with a MET value of 1 were considered sedentary activity, equivalent to sitting quietly, and those with a value of 6 were considered vigorous intensity, equivalent to jogging or running on a treadmill. For each activity, the MET equivalent was multiplied by the number of minutes spent on that activity per week, yielding the MET-weighted contribution to total minutes per week of physical activity. A total weighted MET value was computed for all non-sedentary activities (ie, leisure, household, and occupational) reported by each participant. We then categorized the MET values into low, medium, moderate, and high quartiles.

Covariates

Demographic factors included age in years, categorized as 18–29, 30–39, 40–49, 50–59, and 60–88. The sample included insufficient numbers of older women to separately evaluate ages 60–69 and 70–88 years. Other demographic factors included region (Northern Plains, Southwest), current marital status (married, not married), education (high school graduate or higher, 11th grade or less), employment status (employed at least part time, not employed), smoking status (current, former, never), and health status. We measured health status as the total number of endorsed physical conditions out of 14 possible conditions (eg, heart disease, asthma, diabetes), then created 3 categories of health conditions (none, 1–2, 3). Access to health care was ascertained by examining responses to the item, “To which hospital or clinic do you usually go?” Women who endorsed at least one facility were coded as having a primary health provider.

Statistical Analysis

As all women in our sample endorsed having a primary care provider, we dropped this variable from the analysis. We also excluded women reporting a history of cancer, because Pap tests for those women might be performed as part of surveillance or follow-up care for cancer, and not for screening. Preliminary analyses did not show a large difference in Pap testing between women aged 60–69 years and women aged 70–88 years (48% and 45%, respectively); therefore, given their low numbers, we included these women in a single age category (60–88 years). We required valid data for all study variables for inclusion in the analysis. If excluded women appeared to differ from included women for any study variable, we performed a sensitivity analysis in which we required complete data only for Pap testing status and MET minutes. If the conclusions did not change, we present results only from the complete case analysis.

We performed analyses stratified by region. Because no tribal differences were detected, we combined women from both regions into a single group, with region included as a demographic covariate. We calculated descriptive statistics as the range and mean for the continuous MET minutes per week variable, and frequency distributions for all categorical variables, with chi-square tests to compare the frequency distributions between women who did and did not receive Pap testing in the previous 3 years. We calculated the prevalence of Pap test adherence with 95% CIs for women in each MET quartile.

We used binary logistic regression to formally evaluate the association between physical activity and odds of Pap testing. We first considered MET quartile as a nominal variable, with 3 separate odds ratios comparing the higher quartiles to the lowest. Because the descriptive percentages strongly suggested a threshold effect for Pap screening compliance between the 3rd and 4th MET quartiles, we also considered a model that collapsed quartiles 1–3 into a single reference group. This model did not differ significantly from the expanded full nominal model (Wald $P = .52$), and so we present these more parsimonious results. We performed both an unadjusted model, with physical activity as the sole independent variable, and an adjusted model that accounted for the simultaneous influence of all demographic and health covariates. All analyses were performed using STATA version 10.0 software (StataCorp LP, College Station, Texas), and we considered an alpha error rate of 0.05 as the threshold for statistical significance.

Results

Of the original 2,827 women participating in EARTH, we excluded 100 with a previous history of cancer and 748 of the remaining women because of missing data for one or more study variables. Thus, 1,979 women (70%) of the original sample were included in our analysis. Excluded women had a higher rate of Northern Plains residence (70% vs 64%, $P = .003$) and a lower rate of high school graduation (62% vs 66%, $P = .02$) than included women. For the 3-category health conditions and MET quartile variables, excluded women had fewer health conditions than included women ($P = .001$). We found no significant difference in the distribution of MET quartiles or prevalence of Pap screening compliance (58% vs 61%) between excluded and included women. Sensitivity analyses requiring

complete data only for Pap testing adherence and MET quartile did not alter the conclusions of the complete case analysis.

Sixty percent of women included in our analysis received a Pap test within the previous 3 years. Total MET-adjusted minutes per week of physical activity ranged from 0 to 1,466, with means of 167 and 147 for women who had and had not received Pap testing in the past 3 years, respectively. MET quartile values were 0–44.0 minutes (low), 44.1–100.0 minutes (medium), 100.1–215.0 minutes (moderate), and 215.1–1,466.0 minutes (high). Table 1 displays descriptive frequencies for Pap testing by demographic factors, health factors, and MET quartile. Overall, women who adhered to screening guidelines were younger than nonadherent women. Higher percentages of adherent women were also Northern Plains residents, married, high school graduates, and employed. Pap testing was fairly consistent across the lower 3 MET quartiles (58%–61%), with a larger increase from the third to fourth quartiles (61% to 67%).

As shown in Figure 1, the unadjusted odds ratio comparing the highest MET quartile to the combined lower 3 quartiles was 1.4 (95% CI = 1.1 – 1.7; $P = .003$). We did not see strong evidence for confounding in the model that adjusted for all covariates described in Table 1, with an adjusted odds ratio of 1.3 (95% CI = 1.1 – 1.6; $P = .02$).

Discussion

We found that only 60% of AI women aged 18 and older received a Pap test within the previous 3 years. This figure is substantially lower than the 1998 prevalence of 72% for all AI/AN women aged 18 and older and the 2000 prevalence of 83% for US women of all races aged 18 and older.²⁵ Consistent with previous studies,^{1,3,26} women with the highest levels of physical activity had higher odds of adherence to Pap screening guidelines, even after adjusting for factors known to be associated with screening adherence in other populations. We speculate that this link results in part from a tendency of inactive people to be less health-conscious than more active people and thus less likely to value and partake in regular cancer screening. Other studies have found that unhealthy behaviors such as cigarette smoking and low fruit and vegetable consumption were associated with lower rates of cancer screening.^{1,27} However, low cancer screening rates are also related to socioeconomic factors such as low income and lack of medical insurance,^{26,28,29} making it difficult to ascertain the degree to which screening behavior is related to individual knowledge, attitudes, or choice rather than to factors beyond individual control.

Older age has previously been associated with absence of recent Pap testing.²⁵ In our study, adherent women tended to be younger than nonadherent women, but age did not appear to confound the relationship between Pap adherence and physical activity. Lower prevalence of Pap test receipt among older women might reflect, in part, the American Cancer Society's (2009) recommendation that women aged 70 and older with 3 or more normal Pap tests should no longer be screened.¹⁶ Given the limited sample size, we included all women aged 60–88 years in our oldest age category, but sub-category analysis showed similar Pap testing prevalence among women aged 60–69 (48%) and 70–88 (45%) years. Therefore, the American Cancer Society's age threshold does not appear to be a primary driving force in

the lower testing rates among older women, although it remains possible that patients or physicians generally perceive less need for Pap testing among post-menopausal women. Alternatively, older women might experience increased difficulties in accessing the health clinics where Pap tests are offered, particularly in remote reservations and communities.

Clearly, public health campaigns and clinic-based efforts are needed to improve cervical cancer screening rates among AI women in the Northern Plains and the Southwest. The National Cervical Cancer Early Detection Program³⁰ provides access to cervical cancer screening and diagnostic services to low-income, uninsured, and underserved women in all 50 states. However, only 8%–11% of US women of screening age are eligible for these services,³¹ and only 12 tribal organizations or communities are involved in this program.³² Of the 3 sites in our study, only the Cheyenne River Sioux Tribe participates in this program, which may explain the higher prevalence of recent Pap testing that we found in the Northern Plains group.

Efforts to increase access and use of cancer testing in tribal areas could also improve overall access and use of health care among all rural residents. For example, increased access to health insurance, as reflected in impending health reform measures, has been shown to coincide with improved cancer screening.³³ Other health reform measures intended to expand access to basic cancer screening for all US residents would especially benefit underserved individuals and families residing in remote regions.³⁴ Finally, increased funding for federal and state programs that increase the number of primary health providers practicing in rural and tribal areas (eg, Area Health Education Centers, Federally Qualified Health Centers, National Health Service Corps, State Loan Repayment Program, Student/Resident Experiences and Rotations in Community Health) may also bolster access to cancer preventive care for these underserved populations. Currently, approximately 19% of the US population lives in rural areas, but only about 11% of physicians practice in these areas.³⁵

Our study has several limitations. First, because we included AI women from only 2 regions, our findings cannot be extrapolated to all AI women in the United States. However, given the seriousness of the cervical cancer burden in AI populations and the shortage of nationally representative data on AI women, these findings represent a starting point both for future scientific inquiry and for achieving a better understanding of physical activity and cancer testing in this vulnerable population. Second, as is typical in large surveys, all test receipt data were self-reported, and we did not confirm participants' answers about Pap testing with a medical record review. Although some studies have shown that self-reported receipt of cancer screening relatively accurately reflected actual receipt,^{36,37} others have found that self-reports tend to overestimate receipt of screening.^{38–41} Third, the present study cannot establish whether the reasons behind the observed patterns of Pap test receipt are attributable to health care system, provider, or patient factors. Finally, we were unable to discriminate between Pap tests conducted for screening purposes and those conducted for some other reason, although our study's exclusion of women with a history of cancer somewhat mitigates this concern.

The strengths of this study include its large survey population, the comprehensiveness of its data, and the fact that the study population consisted of AI women in 2 geographically and culturally distinct regions. Our South Dakota cohort was age-representative, while the Arizona cohort was derived from a random, systematic household sampling frame. Overall, our study sample of AI women is among the largest ever reported. Our recruitment strategies afford us some assurance that we were able to avoid some or most of the selection bias inherent in simple convenience samples. Finally, the use of a computer-assisted personal interview to assess these and other pertinent behaviors may have reduced respondent burden and thus increased reliability of the data collected.

In summary, we have shown that AI women who were less physically active were more likely to delay or omit Pap testing, even after adjusting for covariates. Currently, the Indian Health Service is funded to address only about 52% of the health care needs of its service population, even though it is the mainstay of health care for a great many AIs.⁴² Tribal governments should therefore work in concert with the Indian Health Service to increase public education on cancer and healthy living, availability of cancer information, access to general preventive care, and access to cancer screening and treatment. Regardless of the directionality of the relationship, increasing both cancer screening and physical activity levels will benefit Native women.

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Figure 1.
Unadjusted and Covariate-Adjusted Odds Ratios Comparing Pap Testing in Highest MET Quartile to the 3 Lowest Quartiles Combined

^aAdjusted for age, region, marital status, education, employment, health conditions, and smoking status.

Table 1

Pap Test Adherence by Sociodemographic and Health Characteristics

	Pap test adherent (%)	Chi-square <i>P</i> value
Age, years		
18–29	64	.001
30–39	62	
40–49	60	
50–59	62	
60–88	48	
Region		
Southwest	56	.002
Northern Plains	63	
Married		
Yes	66	.02
No	60	
High school graduate		
Yes	63	.01
No	57	
Employed		
Yes	70	<.001
No	58	
Health conditions, ^a number		
0	61	.99
1–2	61	
3	61	
Smoking status		
Never	62	.62
Former	62	
Current	60	
Physical activity quartile, MET		
0–44	58	.02
44.1–100	58	
100.1–215	61	
215.1–1,466	67	

^a Conditions included hypertension, heart disease, high cholesterol, stroke, gallbladder disease, kidney failure, liver disease, thyroid disease, arthritis, asthma, chronic bronchitis/emphysema/chronic obstructive pulmonary disorder, glaucoma, cataracts, and diabetes.