Breast and Cervical Cancer Screening Patterns Among American Indian Women at IHS Clinics in Montana and Wyoming

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ABSTRACT

Objectives. We investigated factors associated with primary and secondary breast and cervical cancer screening among American Indian (AI) women receiving care from the Indian Health Service (IHS) in Montana and Wyoming.

Methods. Rates of primary screening (i.e., screening without evidence of a prior abnormal) and secondary screening during a three-year period (2004–2006) were determined in an age- and clinic-stratified random sample of 1,094 women at six IHS units through medical record review.

Results. Three-year mammography prevalence rates among AI women aged ≥ 45 years were 37.7% (95% confidence interval [CI] 34.1, 41.3) for primary and 58.7% (95% CI 43.9, 73.5) for secondary screening. Among women aged ≥ 18 years, three-year Pap test prevalence rates were 37.8% (95% CI 34.9, 40.6) for primary and 53.2% (95% CI 46.0, 60.4) for secondary screening. Primary mammography screening was positively associated with number of visits and receiving care at an IHS hospital (both $p < 0.001$). Primary Pap test screening was inversely associated with age and positively associated with the number of patient visits (both $p < 0.001$). Secondary mammography screening was inversely associated with driving distance to an IHS facility ($p = 0.035$).

Conclusion. Our results are consistent with other surveys among AI women, which report that Healthy People 2010 goals for breast (90%) and cervical (70%) cancer screening have not been met. Improvements in breast and cervical cancer screening among AI women attending IHS facilities are needed.

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There are significant regional differences in breast and cervical cancer incidence among American Indian/Alaska Native (AI/AN) women in the United States. Among AI/AN women, American Indian (AI) women living in the Northern Plains region have the second highest incidence of both breast cancer (115.9 per 100,000 population) and cervical cancer (12.5 per 100,000 population).^{1,2} The Northern Plains region, as defined by the National Institutes of Health, includes the Aberdeen, Bemidji, and Billings Areas of the Indian Health Service (IHS) that encompass several states (Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, South Dakota, Wisconsin, and Wyoming). In the U.S. overall, compared with non-Hispanic white women, AI/AN women have a lower incidence of breast cancer, a higher incidence of cervical cancer, and a risk of death that is 50%–80% higher once diagnosed with cancer.^{1,3–5} For both cancer sites, AI/AN women are more likely than non-Hispanic white women to be diagnosed with a late-stage cancer.^{1,4–7}

In the Northern Plains, AI women have an incidence of metastatic cervical cancer that is six times higher than for non-Hispanic white women in the same region.⁵ Rates of screening among women in Montana and Wyoming without a prior abnormal result (primary screening) and with a prior abnormal result (secondary screening) have not been described.

The purpose of this study was to estimate the three-year prevalence of primary and secondary mammography and Papanicolaou (Pap) test screening for breast and cervical cancer, respectively, and to determine factors associated with primary cancer screening among AI women receiving care from the IHS in Montana and Wyoming.

METHODS

Study population and sampling frame

The study population consisted of AI women aged ≥ 18 years who received care at IHS facilities on five reservations in Montana and one reservation in Wyoming. These reservations serve a clinic population of approximately 6,554 women aged ≥ 45 years and 9,980 women aged 18–44 years.⁸ Each reservation contains one IHS service unit that provides administrative oversight of one or more IHS clinic and/or hospital locations. A stratified random sampling was conducted by service unit ($n=6$ service units) and age group (18–44, 45–64, and ≥ 65 years of age). The study was powered to determine the prevalence of screening ($\pm 10\%$) within each age group and service unit. The Breast Cancer Screening Study (BCSS) sample is a subset of

the Cervical Cancer Screening Study (CCSS). Compared with U.S. Census Bureau population estimates, the IHS active user population was approximately 75% (16,534/22,136) of AI women aged ≥ 20 years in Montana and Wyoming at the time of this study.⁹

Women who were aged ≥ 18 years during the study period (January 1, 2004, to December 31, 2006), with at least two clinic visits (excluding visits to the emergency room) to the same facility during a 78-month period (between January 1, 2001, and July 1, 2007), were included in the study. Women having a mastectomy and/or hysterectomy prior to January 1, 2004, were excluded from the analysis of breast cancer screening and cervical cancer screening.

Chart review and data entry

We reviewed electronic and paper copies of charts at all hospitals and clinics at the participating reservations. A standardized data-collection instrument was used to record the following: age, percent AI blood quantum, ZIP code of residence, facility type (hospital vs. clinic), date of last visit, purpose of last visit (e.g., preventive, follow-up for chronic disease, inpatient stay, or urgent care), total number of medical visits to the health facility during the study period (excluding dental and pharmacy visits), hysterectomy, mastectomy, dates of all mammograms and Pap tests during the study period, and the reason for the mammogram and/or Pap test (e.g., screening, diagnosis of symptoms, or abnormal follow-up).

The study period for determination of mammogram, Pap test, and number of visits was January 1, 2004, to December 31, 2006. For medical history prior to the study period (i.e., prior hysterectomy, prior mastectomy, prior abnormal mammogram result, and prior abnormal Pap test result), we reviewed all available chart and electronic records at each IHS facility. A 10% subsample of abstraction instruments was verified for quality assurance of electronic data entry, and no errors in data entry were found.

Distance to nearest IHS facility and mammogram

Lists of facilities approved to provide mammography were obtained for 2004–2006 from the U.S. Food and Drug Administration. IHS facilities included hospitals and outpatient clinics. All facilities were mapped using ArcGIS 9.0.¹⁰ Because the majority of women did not have street addresses, the distances to the nearest mammography facility and the nearest IHS facility for each participant were calculated using the ZIP code centroid of residence (i.e., the geometric center of the ZIP code area).

Statistical analysis

We stratified the analysis by type of screening (breast or cervical) and also by history of a previous abnormal Pap test or mammogram. We calculated differences in categorical and continuous bivariate statistics using Chi-square and t-test statistics, respectively. We used the Wilcoxon rank-sum test to determine the statistical significance of differences in median age. To adjust for the independent effects of several factors, we conducted multivariable analyses using logistic regression. All *p*-values were two-sided, and $p \leq 0.05$ was considered statistically significant. We used the Hosmer-Lemeshow (H-L) goodness-of-fit test statistic to determine the fit of the multivariable models. We considered $p \leq 0.15$ to indicate a significant lack of fit.

RESULTS

We identified 1,278 women aged ≥ 18 years (723 women aged ≥ 45 years) meeting the study inclusion criteria at the six reservations in Montana and Wyoming. Excluded from the respective analyses were 16 women with a prior mastectomy, 177 women with a prior hysterectomy (including three women with a supracervical hysterectomy), and seven women with both a prior mastectomy and hysterectomy, resulting in a total study population of 1,094 women for the CCSS (i.e., women aged ≥ 18 years) and 700 women for the BCSS (i.e., women aged ≥ 45 years).

The demographic characteristics of the study population are summarized in Table 1. Women in the BCSS

Table 1. Characteristics of American Indian women ≥ 18 years of age receiving care from the IHS in Montana and Wyoming, 2004–2006

Characteristic	Breast Cancer Screening Study sample aged ≥ 45 years (<i>n</i> = 700)	Cervical Cancer Screening Study sample aged ≥ 18 years (<i>n</i> = 1,094)
Median age (in years)	60.5	45.0
Age group (in years): <i>N</i> (percent)		
18–44	NA	540 (49.4)
45–64	440 (62.9)	358 (32.7)
≥ 65	260 (37.1)	196 (17.9)
Blood quantum: <i>N</i> (percent)		
None recorded	316 (45.1)	493 (45.1)
<50%	163 (23.3)	224 (20.5)
$\geq 50\%$	221 (31.6)	377 (34.5)
Type of IHS facility: <i>N</i> (percent)		
Hospital	320 (45.7)	501 (45.8)
Clinic	380 (54.3)	593 (54.2)
Mean distance in miles (range)		
Nearest IHS facility	13.1 (0.0–176.3)	12.7 (0.0–176.3)
Nearest mammography facility	16.1 (0.0–79.9)	15.8 (0.0–79.9)
Surgery during the study period: <i>N</i> (percent)		
Mastectomy	2 (0.3)	NA
Hysterectomy	NA	7 (0.6)
Purpose of last visit: <i>N</i> (percent)		
Preventive	211 (30.1)	351 (32.1)
Chronic disease management	223 (31.9)	265 (24.2)
Inpatient	5 (0.7)	10 (0.9)
Emergency room	220 (31.4)	390 (35.6)
Missing/unknown	41 (5.9)	78 (7.1)
Number of visits: <i>N</i> (percent)		
≤ 2	142 (20.3)	286 (26.1)
3–9	129 (18.4)	257 (23.5)
10–25	187 (26.7)	284 (26.0)
≥ 26	242 (34.6)	267 (24.4)

IHS = Indian Health Service

NA = not applicable

had a mean age of 60.5 years, with 31.6% having a recorded blood quantum of $\geq 50\%$, 45.7% receiving care through an IHS hospital, and 54.3% receiving care through an IHS clinic. Women in this study were on average 13.1 miles (range: 0.0–176.3) from the nearest IHS facility and 16.1 miles (range: 0.0–79.9) from the nearest mammography facility. Women in the CCSS had a median age of 45.0 years, 34.5% had a recorded blood quantum of $\geq 50\%$, 45.8% received care primarily at an IHS hospital, and 54.2% received care primarily at an IHS clinic. The average distance to the nearest IHS facility was 12.7 miles (range: 0.0–176.3).

Among BCSS women aged ≥ 45 years, 37.7% (95% CI 34.1, 41.3) had a mammogram during the three-year study period, of whom 8.0% had an abnormal result (Table 2). Among women receiving a mammogram during the three-year period, the reason for receiving a mammogram was predominantly screening (82.2%), followed by prior abnormal mammogram (5.3%), symptoms (3.8%), or baseline mammogram (3.4%). Among women with a prior abnormal mammogram, 58.7% received a mammogram during the three-year study period.

Among CCSS women aged ≥ 18 years, the prevalence of Pap test screening was 37.8% (95% CI 34.9, 40.6), of whom 6.3% had an abnormal Pap result. The predominant reason for a Pap test was screening (91.5%). A total of 188 women (17.2% of the total study sample) had documentation of a prior abnormal Pap test, of whom 53.2% received a Pap test. During the three-year study period, 7.4% of women were recorded as having a referral for a Pap test (Table 2).

Prevalence of screening by prior status (normal vs. abnormal)

In bivariate statistics among women without a prior history of an abnormal mammogram, the prevalence of mammogram was higher among women with blood quantum recorded as $\geq 50\%$ (44.1%, $p=0.004$), those receiving care predominantly from hospitals (44.1%, $p<0.001$), and those having a greater number of visits (55.3% of those having ≥ 26 visits, $p<0.001$) (Table 3). Distance to mammography was also associated with the prevalence of screening; screening was greatest among women living in a town with a mammography facility (40.0%) and lowest among women residing 1–14 miles

Table 2. Prevalence of breast and cervical cancer screening among American Indian women ≥ 18 years of age receiving care from the Indian Health Service: Montana and Wyoming, 2004–2006

Variable	Breast Cancer Screening Study (aged ≥ 45 years) prevalence Percent (95% CI)	Cervical Cancer Screening Study (aged ≥ 18 years) prevalence Percent (95% CI)
Three-year screening prevalence		
Mammogram	37.7 (34.1, 41.3)	NA
Percent abnormal	8.0 (4.7, 11.2)	NA
Pap test	NA	37.8 (34.9, 40.6)
Percent abnormal	NA	6.3 (3.9, 8.6)
Reason for Pap test/mammogram		
Baseline (mammogram only)	3.4 (1.2, 5.6)	NA
Screening	82.2 (77.6, 86.8)	91.5 (88.8, 94.2)
Symptomatic	3.8 (1.5, 6.1)	1.5 (0.3, 2.6)
Abnormal	5.3 (2.6, 8.0)	1.7 (0.4, 2.9)
Unknown/missing	5.3 (2.6, 8.0)	5.3 (3.2, 7.5)
Prevalence of an abnormal test result prior to study		
Prior abnormal Pap test	NA	17.2 (14.9, 19.4)
Prevalence of Pap test among women with prior abnormal Pap test	NA	53.2 (46.0, 60.4)
Prior abnormal mammogram	6.5 (4.7, 8.4)	NA
Prevalence of mammogram among women with prior abnormal mammogram	58.7 (43.9, 73.5)	NA
Referral during three-year study period		
Pap test	5.3 (3.6, 6.9)	7.4 (5.9, 9.0)
Mammogram	1.3 (0.4, 2.1)	NA

CI = confidence interval

NA = not applicable

Pap = Papanicolaou

Table 3. Three-year prevalence of mammogram according to prior abnormal mammogram status among American Indian women ≥ 45 years of age receiving care from the IHS: Montana and Wyoming, 2004–2006

Characteristic	No prior abnormal mammogram (n=654)		Prior abnormal mammogram (n=46)	
	Women with a mammogram in last three years (percent)	P-trend	Women with a mammogram in last three years (percent)	P-trend
Age group (in years)				
45–64	35.7		56.5	
≥ 65	37.1	0.720	60.9	0.764
Blood quantum				
None recorded	29.8		54.5	
<50%	39.0		44.4	
$\geq 50\%$	44.1	0.004	65.4	0.519
Type of IHS facility				
Hospital	44.1		66.7	
Clinic	30.0	<0.001	43.8	0.132
Number of visits				
≤ 2	8.8		33.3	
3–9	28.5		50.0	
10–25	38.3		70.0	
≥ 26	55.3	<0.001	57.1	0.416
Distance to nearest mammography facility				
Same town	40.0		73.9	
1–14 miles	27.9		0.0	
15–29 miles	35.3		35.7	
≥ 30 miles	30.5	0.019	55.6	0.071
Distance to nearest IHS facility				
Same town	40.0		70.0	
1–14 miles	27.9		66.7	
15–29 miles	35.3		28.6	
≥ 30 miles	30.5	0.112	0.0	0.035

IHS = Indian Health Service

away from a mammography facility (27.9%, $p=0.019$). There was no association between the prevalence of mammography and distance to the nearest IHS facility.

Among women with a prior abnormal mammogram, there was a statistically significant association with residing nearest an IHS facility: 70.0% of the women were screened at a facility in the same town, 66.7% of the women were screened at a facility 1–14 miles away, and 28.6% of women lived 15–29 miles from an IHS facility ($p=0.035$) (Table 3). In contrast with women without a prior abnormal mammogram, among women with a prior abnormal mammogram, there was no association with blood quantum, type of IHS facility, number of visits, or distance to the nearest mammography facility.

Cervical cancer screening among women without a prior abnormal Pap test was inversely associated with age ($p<0.001$) (Table 4). Among women aged ≥ 65 years, 19.3% received a Pap test during the three-year period compared with 41.2% of women aged 18–44 years. In addition, cervical cancer screening was also

positively associated with the total number of visits, with a higher prevalence of screening among women having a greater number of visits ($p<0.001$), and inversely associated with the distance to the nearest IHS facility: more than 30.0% of women living in the same town or <30 miles from a facility received a Pap test during the three-year period compared with only 21.4% of those living ≥ 30 miles away ($p=0.012$).

Among women with a prior abnormal Pap test, 45.0% of women aged ≥ 65 years received a Pap test during the three-year period compared with 52.8% of women aged 18–44 years, although this difference was not statistically significant (Table 4). As with women who did not have a prior abnormal Pap test, the prevalence of receiving a Pap test during the three-year period was associated with the number of visits ($p<0.001$). Women with ≤ 2 visits during the three-year period had an 18.4% prevalence of Pap test, compared with 69.8% of women with 10–25 visits and 68.3% of women with ≥ 26 visits during the three-year period.

Unlike women without a prior abnormal Pap test, there was no association with distance to the nearest IHS facility among women with a prior abnormal Pap test.

Adjusted odds of not receiving screening

Among women aged ≥ 45 years without a prior abnormal mammogram, there was an independent association between the number of visits ($p < 0.001$) and type of facility, adjusting for age, blood quantum, and distance to mammography screening (H-L goodness-of-fit test, $p = 0.296$). The likelihood of receiving a mammography was inversely associated with the number of visits during the three-year period, with the highest risk of not being screened among women with ≤ 2 visits during the study period (OR = 16.9, 95% CI 8.6, 33.3). Women who received their care primarily at an IHS clinic (OR = 1.8, 95% CI 1.2, 2.8) were more likely not to have been screened compared with women receiving care primarily at an IHS hospital. After adjusting using multiple

logistic regression, there was no longer a statistically significant association with blood quantum (Table 5).

Among women aged ≥ 18 years without a prior abnormal Pap test, there was an independent association between age ($p < 0.001$) and number of visits ($p < 0.001$), adjusting for blood quantum, type of facility, and distance to screening (H-L goodness-of-fit test, $p = 0.165$) (Table 5). Women who were aged ≥ 65 years were 5.7 times (95% CI 3.5, 9.3) more likely not to have received a Pap test during the three-year period compared with women aged 18–44 years. The risk of not receiving a Pap test was highest among women with ≤ 2 visits during the three-year period (OR = 20.8, 95% CI 11.9, 36.4), and decreased monotonically with a greater number of visits (3–9 visits: OR = 4.9, 95% CI 3.1, 7.6; 10–25 visits: OR = 1.9, 95% CI 1.3, 2.9). After adjusting using multiple logistic regression, there was no significant association with blood quantum, type of IHS facility, or distance to the nearest IHS facility.

Table 4. Three-year prevalence of Pap test according to prior abnormal Pap test status among American Indian women ≥ 18 years of age receiving care from the IHS: Montana and Wyoming, 2004–2006

Characteristic	Women without a prior abnormal Pap test (n=900) ^a		Women with a prior abnormal Pap test (n=185) ^a	
	Women with a Pap test in last three years (percent)	P-trend	Women with a Pap test in last three years (percent)	P-trend
Age group (in years)				
18–44	41.2		52.8	
45–64	32.7		54.4	
≥ 65	19.3	<0.001	45.0	0.765
Blood quantum				
None recorded	33.5		48.7	
<50%	28.5		40.5	
$\geq 50\%$	39.2	0.057	57.7	0.172
Type of IHS facility				
Hospital	31.9		53.5	
Clinic	35.6	0.242	50.0	0.663
Number of visits				
≤ 2	8.9		18.4	
3–9	28.6		41.9	
10–25	46.4		69.8	
≥ 26	55.7	<0.001	68.3	<0.001
Distance to nearest IHS facility				
Same town	37.2		55.5	
1–14 miles	32.0		58.3	
15–29 miles	35.8		36.0	
≥ 30 miles	21.4	0.012	50.0	0.335

^aNumbers do not total 1,094 because there were women with “unknown” status regarding whether or not they had an abnormal pap test.

Pap = Papanicolaou

IHS = Indian Health Service

Table 5. Multivariable odds of not receiving cervical or breast cancer screening without a prior abnormal Pap test or mammogram for American Indian women ≥18 years of age receiving care from the IHS: Montana and Wyoming, 2004–2006

Characteristic	No mammogram OR (95% CI)	No Pap test OR (95% CI)	Mammogram P-trend	Pap test P-trend
Age group (in years)			0.073	<0.001
18–44	NA	Ref.		
45–64	Ref.	2.0 (1.4, 2.9)		
≥65	1.3 (0.9, 1.9)	5.7 (3.5, 9.3)		
Blood quantum category			0.908	0.242
None recorded	1.4 (0.9, 2.2)	1.5 (1.0, 2.3)		
<50%	0.8 (0.5, 1.4)	1.5 (0.9, 2.3)		
≥50%	Ref.	Ref.		
Number of visits			<0.001	<0.001
≤2	16.9 (8.6, 33.3)	20.8 (11.9, 36.4)		
3–9	4.4 (2.6, 7.4)	4.9 (3.1, 7.6)		
10–25	2.1 (1.4, 3.2)	1.9 (1.3, 2.9)		
≥26	Ref.	Ref.		
Type of IHS facility			NA	NA
Hospital	Ref.	Ref.		
Clinic	1.8 (1.2, 2.8)	0.8 (0.5, 1.2)		
Distance to screening facility				
Same town	Ref.	Ref.		
1–14 miles	2.9 (1.2, 7.0)	1.2 (0.8, 2.0)		
15–29 miles	1.0 (0.7, 1.6)	0.7 (0.4, 1.0)		
≥30 miles	0.7 (0.4, 1.1)	1.1 (0.6, 2.0)	0.105	0.536
Hosmer-Lemeshow goodness-of-fit p-value	0.296	0.165		

Pap = Papanicolaou

IHS = Indian Health Service

OR = odds ratio

CI = confidence interval

NA = not applicable

Ref. = reference group

DISCUSSION

Primary cancer screening

Healthy People 2010 (now Healthy People 2020) objectives were to achieve Pap tests for at least 90% (now 93%) of women aged ≥18 years within the preceding three years and a mammogram among 70% (now 81%) of women aged ≥40 years within the preceding two years.¹¹

Our results are consistent with reports that find AI women have among the lowest breast and cervical cancer screening rates in the United States.^{12–16} The prevalence of mammography and Pap tests identified by our study of existing IHS patient records is similar to a reservation-based survey in the Northern Plains of self-reported breast (51%) or cervical (50%) cancer screening,¹⁷ but roughly half that of estimates based on a telephone survey.¹³ There are several reasons why telephone surveys may estimate a higher prevalence

of cancer screening among AI women, including the comparatively lower percentage of AI households in this region with landline telephones (approximately 30%–60%);^{18,19} greater health status and preventive health behaviors among members of households with phones, compared with those without phones;¹⁸ response bias (i.e., women who respond to telephone surveys may also be more likely than women who do not respond to telephone surveys to have been screened);²⁰ inaccurate recall during the time period in question;^{21,22} and social desirability bias (i.e., respondents report the most socially desirable answer to questions and may, therefore, overreport a history of cancer screening).^{23–25} Compared with medical records, self-reported cancer screening prevalence may be inflated by as much as 20 percentage points—a phenomenon that appears to be independent of race/ethnicity.^{21,26} Finally, it should be noted that, although we identified women with at least

two nonemergency clinic visits to the same IHS facility, our medical record review may have underestimated the true prevalence of cancer screening because care received at non-IHS hospitals and clinics was not captured in our dataset.

The mammogram prevalence rate reported in this study is consistent with mammogram prevalence rates among Medicaid recipients (31.7%–38.5% for two-year rates),^{27,28} uninsured women (32.2% for annual rates),²⁰ women reporting having no personal health-care provider (45.4% for two-year rates),²⁹ AI women in the Southwest (44.0% for two-year rates),³⁰ and AI women reporting perceived medical discrimination (33.9% for annual rates).³¹ Chlebowski et al. reported in 2005 significantly lower breast cancer screening rates among AI women enrolled in the Women's Health Initiative.¹² Similarly, in a cohort of low-income women with breast cancer receiving care through California's Breast and Cervical Cancer Treatment Program, Thind et al. reported in 2009 that 64% of breast cancers were found as a result of symptomatic presentation and not through mammography screening.³² In a case-series review at an urban IHS hospital, Tillman and colleagues reported that 79% of AI women with breast cancer first presented with physical symptoms and/or a palpable mass on initial exam.³³

Pap test prevalence rates found by this study were similar to those found among Medicaid recipients (31.6% for three-year results)²⁷ and uninsured women (42.2% for annual results).²⁰ A 2006 Government Performance and Results Act internal review, comprising the same IHS facilities used in this study, identified a 58% prevalence of Pap tests among women aged 22–64 years with at least two visits to the same facility within the past year (Personal communication, Diane Jeanotte, IHS Billings Area, October 2006). Despite the differences in estimates across studies, however, nearly all studies found that screening rates among AI women were lower than most other racial/ethnic groups and have not met Healthy People 2010 goals.

Secondary cancer screening

Among women with an abnormal mammogram or Pap test result, our study suggests that more than 40% are not receiving annual follow-up screening. Fewer than half of the women receiving services through the National Breast and Cervical Cancer Early Detection Program were followed according to established guidelines for management of equivocal or mildly abnormal cervical cytology.³⁴

Referral rates

Existing IHS hospital records do not indicate high rates of referral for either mammogram (1.3%) or Pap test (7.4%). It is possible that we did not fully capture referrals that were made but not recorded in the electronic or paper chart. During the time period of this study, electronic referrals were used at some IHS facilities, while referrals were tracked by hard copy at other facilities. In the U.S., rates of referral among women who have not been screened are generally low. Coughlin et al. reported that among women with a doctor visit in the last year but no recent Pap test, 86.7% reported that their doctor had not recommended a Pap test.³⁵ Using the National Health Interview Survey, Sabatino et al. reported in 2006 that 71% of recently unscreened women seen by a health-care provider in the prior year reported no recommendation for mammography.³⁶

Age and cancer screening

Among young (aged <30 years) and older (aged ≥65 years) age groups, AI women in the Northern Plains have the highest incidence of cervical cancer in the U.S. Notably, a recent national cancer surveillance project reported that cervical cancer incidence rates among AI women in the U.S. are highest in those aged ≥65 years.⁵ The comparatively low screening rates reported in our study (19.3% of women aged ≥65 years vs. 41.2% of women aged 18–44 years) suggest that the higher incidence rates in this age group are related to lower rates of Pap test screening.

Tobacco use and high parity have been associated with a higher risk of cervical cancer among women infected with human papillomavirus.³⁷ Among AI women in the Northern Plains, the prevalence of current smokers is 37.7%, which is considerably higher than the prevalence reported for non-Hispanic white women (22.2%).¹³ The combination of higher tobacco use and lower screening rates among older women may also explain the higher incidence and mortality from late-stage cervical cancer among AI women in the Northern Plains.

Distance to screening facility

Our study did not find a significant association between distance from participant residence to the nearest screening facility and likelihood of receiving primary cancer screening. This finding is consistent with an analysis of Surveillance, Epidemiology, and End Results Program (known as SEER) and Medicare linked data in California, which reported that the number of mammography facilities per 1,000 women in each residential area was not as important as other factors, including a higher likelihood of screening among AI women who

lived in areas with a higher AI population density.³⁸ It is likely that distance still influences decisions about seeking cancer screening, as it may require separate visits, particularly for follow-up of abnormal results. For example, in this study, secondary mammography screening was inversely associated with driving distance to IHS facility ($p=0.035$).

Limitations

This study had several limitations. First, because our study inclusion criteria required two visits to the same facility during the six-year period prior to the start of the study, the women selected for this study may not be representative of women who did not seek medical care during the same time period. Second, we were unable to account for care provided at other non-IHS locations or for migration of women in and out of the study population during the study period. Therefore, breast and cervical cancer screenings given in other IHS areas and through private providers were not accounted for in this study.

Third, because the majority of AI women in this study lived at rural route addresses and did not have street addresses, it is likely that the distance to the closest IHS hospital/clinic and mammography facility determined using the ZIP code centroid did not accurately estimate the true distance. However, because we analyzed distance by categories of distance, if there was a substantial influence of distance upon screening in this study population, one would have expected to see a difference between residing in the same town and living, for example, 30 or more miles away. In addition, this study did not account for the medical practice environment,^{39,40} physician characteristics,^{41,42} or physician-patient relationships²⁹ that may influence recommendations for patient screening, as well as other patient characteristics (e.g., family history of breast or cervical cancer, patient knowledge regarding cancer screening, or willingness to accept care from a male provider)⁴³ and community characteristics that may influence the likelihood of receiving cancer screening services.^{35,44}

Another limitation of our study was that the Compacted Tribes in this region, which control their own medical care apart from IHS, were not represented due to time limitations on data collection. Finally, this study had no information regarding the status of initiation of sexual activity; cervical cancer screening guidelines recommend the initiation of screening among women after the initiation of sexual activity.

Strengths

This study also had several strengths, including (1) its use of a representative sample of women receiving care at the Billings Area IHS, (2) investigation of characteristics associated with both primary and secondary cancer screening, and (3) being one of a few studies of breast and cervical cancer among AI women that did not rely upon self-reported screening behavior, but identified screening procedures through existing hospital and clinic records during a three-year period.

CONCLUSION

Our results are consistent with other surveys that indicate Healthy People 2010 goals for breast and cervical cancer have not been met for AI women. Improvements in breast and cervical cancer screening among AI women attending IHS facilities are needed. Randomized studies may help clarify whether improvement efforts should best be targeted to clinicians, patients, and/or communities.

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