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Adherence to screening mammography among American Indian women of the northern plains

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Abstract

Breast cancer is a burden for American Indian (AI) women who have younger age at diagnosis and higher stage of disease. Rural areas also have had less access to screening mammography. An Indian Health Service Mobile Women's Health Unit (MWHU) was implemented to improve mammogram screening of AI women in the Northern Plains. Our purpose was to determine the past adherence to screening mammography at a woman's first presentation to the MWHU for mammogram screening. Date of the most recent prior non-MWHU mammogram was obtained from mammography records. Adherence to screening guidelines was defined as the prior mammogram occurring 1–2 years before the first MWHU visit among women < 41 years, and was the main outcome, whereas, age and clinic site were predictors. Adherence was compared with national data of the Breast Cancer Surveillance Consortium (BCSC). Among 1,771 women < 41 years, adherence to screening mammography guidelines was 48.01 % among < 35 years, 42.05 % among 35–40 years, 33.43 % among 41–49 years, and varied with clinic site (25.23–65.93 %). Age ($p < 0.0001$) and clinic site ($p < 0.0001$) were associated with adherence. Overall, adherence to screening mammography guidelines was found in 39.86 % (706/1771) of MWHU women versus 74.34 % (747,095/1,004,943) of BCSC women. The majority (60.14 %) of women at first presentation to the MWHU had not had mammograms in the previous 2 years, lower screening adherence than nationally (25.66 %). Adherence was lowest among women ages 41–49, and

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Conflict of interest Drs. Roubidoux and Joe were part of nine radiologist group at the University of Michigan Health System (UMHS) who interpreted the mammograms for the Mobile Women's Health Unit, under a contract for mammography services between the UMHS and the Aberdeen Area Indian Health Service (AAIHS). Tina R. Russell was employed by AAIHS. Manuscript was approved by the AAIHS Internal Review Board on Jan 18, 2013.

varied with clinic site. Findings suggest disparities in mammography screening among these women.

Keywords

Screening mammography; Health mobile; American Indians; Mammography adherence; Health disparities

Introduction

Breast cancer is a major health concern for women in the United States with 226,870 new cases and 39,510 attributable deaths estimated for 2012 [1]. Breast cancer mortality rates have declined in the last 20 years, but not all racial groups have equally benefitted from this change. American Indian/Alaska Native (AI/AN) women have been more likely than non-Hispanic White (NHW) women to be diagnosed with later-stage breast tumors and experience a higher risk of mortality [2–5]. The mean age of diagnosis for AI/AN women is 10 years younger than NHW women (53.5 vs. 63.4 years, respectively), a difference that may reflect the younger age distributions of the AI/AN population compared to the older NHW population [4]. However, these trends are not fully understood [4–10].

Mammography allows for early detection of breast cancer, leading to lower mortality rates and reduced costs associated with treatment [11–13]. However, AI/AN women have had the lowest mammography screening rates in the United States [14, 15] and are less likely than NHW women to adhere to the follow-up guidelines [16]. Disparities exist in mammogram screening for rural women in the United States, many of whom are AI/AN [14, 17]. Lower screening rates in rural areas may relate to longer distance for access [18].

There is regional variability in breast cancer incidence among AI/ANs, and AI women of the Northern Plains region have a higher incidence of breast cancer than other regions. In these women, the proportion that is diagnosed with a breast cancer at <50 years is 1.5 times that of NHW women [4, 19]. In addition, the Northern Plains AI women have lower rates of mammography screening than NHW women in this area and among AIs nationally [19–21]. Mobile mammography units have been used since the 1980s to increase access to mammography screening, but no studies have reported data about AI women and mobile mammography.

In 2006, the Aberdeen Area Indian Health Service initiated a mobile mammography unit (Indian Health Service Mobile Women's Health Unit—MWHU) equipped with digital mammography and satellite transmission http://www.ihs.gov/aberdeen/index.cfm?module=ab_ao_programs_mwhu. Up to that time, most Indian Health Service (IHS) clinics did not have fixed mammography units. Implementing the MWHU was aimed to improve access to screening mammography in this large Northern Plains region. Our purpose was to determine the past adherence to screening mammography at a woman's first presentation to the MWHU for mammogram screening.

Materials and methods

This retrospective study was Health Insurance Portability and Accountability Act compliant, approved with waiver of patient consent and deemed minimal risk by the University of Michigan and the Aberdeen Area Indian Health Institutional Review Boards.

The MWHU visited 18 IHS rural and small-urban clinic sites up to 800 miles apart among reservations in North Dakota, South Dakota, Nebraska, and Iowa. Telemammography was

performed by transmitting digital mammogram images via satellite and internet to the University of Michigan Breast Imaging Center. All IHS eligible women were candidates for screening at the MWHU and were referred by providers, with scheduled appointments. The schedule of the MWHU varied, with some clinics receiving more visits or more days than other sites, due to factors such as function of the truck, personnel, adequate patient scheduling, weather, and efficient travel. The MWHU was in service from 2006 to 2009.

We retrospectively reviewed the mammogram records of women who had screening mammography at the MWHU to determine dates of the prior outside mammogram, i.e., before the patient presented to the MWHU for mammography. The mammogram records from the first year of service, 2006, were limited, and did not have patient information forms for the majority of women, because only patients who had incomplete (BI-RADS-0) mammogram reports had had the patient information sheets retained in the mammogram record. Therefore, the women of 2006 with normal mammograms did not have the information about prior mammography. Consequently, we selected the women of 2007–2009 for full retrospective review because all of these women had patient information forms which had been retained in the mammogram record.

From these, the information about date of prior mammography and clinic locations of the MWHU were obtained from the mammogram records. Patient age at first MWHU visit, responses regarding prior mammography, and dates of visits to the MWHU were recorded into an EXCEL spreadsheet. Patient responses to prior mammograms or date of last prior mammogram that were ambiguous, including “1 year ago?”, “2 years ago?”, or “2–3 years ago”, or dates indicating a mammogram less than 1 year ago were categorized as “uncertain” and were excluded from final analysis. Of the women in 2007–2009, some had their last prior mammogram at the MWHU in 2006. These patients were excluded from analysis because our purpose was to evaluate the women whose last prior mammogram was “outside” the MWHU, i.e., mammogram screening adherence that existed before the patient’s first visit to the MWHU. To analyze past screening adherence, we selected women ages ≥ 41 years with complete prior non-MWHU mammogram information and MWHU clinic site location. Figure 1 outlines the exclusion and inclusion criteria applied. In total there were 2,179 women who presented to the Aberdeen area MWHU between 2007 and 2009. Those excluded were 186 women < 41 (younger than screening age), 55 with incomplete mammogram information, and 165 whose last prior mammogram was not “outside” but was at the MWHU in 2006, and 2 that had incomplete clinic site information.

Adherence to screening guidelines was defined as the prior mammogram occurring 1–2 years before the first MWHU visit. This time interval is consistent with the screening guidelines set forth by the U.S. Preventive Services Task Force, which were in effect during the study time period [22]. Responses to date of prior mammogram, which were either “1 year ago”, “2 years ago”, “1–2 years ago” or a date that was within 1–2 years of their MWHU visit were categorized as adherent. Those who reported never having a previous mammogram or whose previous mammogram date was more than 2 years ago were categorized as “nonadherent.” Responses to date of last prior mammogram, which were blank or with only question marks were counted as nonadherent. These criteria are similar to those previously published and described as “on schedule repeat mammography” [23]. The variables used for final analysis were the patient age, previous mammogram status (yes, no, unknown), time since last prior non-MWHU mammogram, and first MWHU clinic site.

Statistical analyses

Descriptive statistics were generated for all women who presented at the MWHU in 2007–2009 ($N = 2,179$) and also only for those ages ≥ 41 with complete MWHU clinic site and prior mammogram information with no record of a 2006 MWHU visit as the final sample (N

= 1,771). Adherence to mammogram guidelines was the main outcome variable whereas age group (41–49, 50–64, and 65+) and MWHU clinic site were the predictor variables. The χ^2 test was applied to assess for statistically significant differences between women considered “adherent” and “nonadherent” among age groups and MWHU clinic sites. Logistic regression was used to assess the relationship among adherence status, age group, and MWHU clinic site adjusting for both predictors. Adjusted odds ratios (AOR) and 95 % confidence intervals were calculated. To calculate the AOR for first visit clinic site, the clinic site with the median percentage of women adherent was defined as the reference group. Although there were two clinic sites with median levels of adherence (Flandreau, SD and New Town, ND) due to the even number of clinic sites, New Town was arbitrarily chosen as the reference group. All analyses were conducted using SAS 9.3 (SAS Institute, Inc., Cary, NC, USA), and the database was compiled using Microsoft Excel 2010.

To benchmark our data, national mammogram data of the same years 2007–2009 for comparison was obtained from the Breast Cancer Surveillance Consortium (BCSC) Research Resource, a national mammography registry supported by the National Cancer Institute which collects mammographic and demographic information from women undergoing mammography from seven registries of various community-based facilities. More information regarding this resource is available at: <http://breastscreening.cancer.gov/> [24].

We requested from this registry and they provided data of screening mammography among women ages 41 years who had prior screening 1–2 years previously. The BCSC excluded patients with missing data, those who had no information about prior mammography or a missing date since the prior mammogram. These adjustments all coincided with our methods, thereby making them comparable.

Results

Table 1 summarizes all 2,179 women who presented to the Aberdeen area MWHU for mammography between 2007 and 2009, ages 23–91 years (mean = 53.27 year). The largest subgroup by age was the 50–64 age group (42.59 %) and the fewest women were in the <41 age group (8.53 %). Nearly all women knew whether they had a previous mammogram or not (99.59 %). 84.49 % of women reported having had a prior mammogram.

Table 2 summarizes the final sample of 1,771 women of those eligible for screening at age 41 having prior mammogram information. Adherence to screening mammography guidelines was found in 39.86 % of patients, and 12.42 % had no prior mammograms. The number of women at each clinic site ranged from 254 women at Belcourt, ND (Turtle Mountain Reservation) to 26 at Niobrara, NE (Santee Sioux Nation).

Table 3 compares adherent with nonadherent groups by age and clinic site. The bivariate analysis shows that both age ($\chi^2 = 24.32$, $p < 0.0001$) and first MWHU clinic site ($\chi^2 = 101.38$, $p < 0.0001$) were significantly associated with adherence status in χ^2 analysis at the 0.05 level of significance. The proportion of women adherent to screening increased with older age groups, i.e., for ages 41–49, 33.43 % were adherent versus 48.01 % of those ages 65+. Adherence also varied by clinic site. Those sites with over 50 % adherence included Trenton, ND (65.93 %), Ft. Thompson, SD (53.85 %), Eagle Butte, SD (63.96 %) and Niobrara, NE (64 %). The remaining clinic sites had adherence that ranged from 42.86 % (Kyle, SD) to 25.23 % (Wanblee, SD).

Table 4 demonstrates the multivariate analysis, using logistic regression to test for a relationship between one predictor and adherence status while controlling for the other predictor. When adjusting for clinic site, those in the 41–49 age group had 35 % lower odds

of previous mammogram guideline adherence as compared to women in the 65+ age group (AOR = 0.65, 95 % CI = 0.482, 0.874). The AOR for women ages 50–64 compared to women ages 65+ was not statistically significant. There were five clinics with significant AORs. Four sites had greater odds of adherence as compared to the median level including Ft. Thompson (AOR = 1.961, 95 % CI = 1.132, 3.397) Trenton (AOR = 3.193, 95 % CI = 1.755, 5.810), Niobrara (2.958, 95 % CI = (1.182, 7.402), and Eagle Butte (AOR = 2.727, 95 % CI = 1.538, 4.836). The Wanblee site (AOR = 0.546, 95 % CI = 0.299, 0.994) had lower odds of adherence.

Table 5 compares the mammogram adherence of the MWHU women to 1,004,943 total women in the BCSC of age 41 years during same time period. Of MWHU women, 39.86 % were adherent, which is lower than the AI/AN women in the BCSC data (59.83 %), and much lower than of the BCSC white women (77.65 %) or all BCSC women (74.34 %). No prior mammograms were reported among 12.42 % of MWHU women, lower than the AI/AN women in the BCSC data (17.23 %), but higher than that of BCSC white women (6.29 %).

Discussion

We report the past screening mammogram adherence at the time AI women came to the MWHU for screening. Before presenting to the MWHU, the majority of these women had not had a prior mammogram in the previous 2 years, although most (~87 %) had some prior mammography. Adherence to screening varied by patient age and by clinic site. Adherence to screening increased with older age, with those in the 41–49 age group having lower odds of mammogram screening adherence than those in the 65+ age group. Overall, as compared with national data, AI women had a much lower rate of mammogram adherence (39.86 %) versus the BCSC white women subgroup (77.65 %), or the BCSC AI/AN subgroup (59.83 %). Of MWHU AI women, 12.42 % had no prior mammograms, somewhat similar but lower than the AI/AN subgroup of the BCSC (17.23 %), but twice as high as the BCSC white women subgroup (6.29 %). The reason for these disparities could be related to rural location and less access to mammogram screening.

National mammography screening estimates are commonly based on self-reported telephone surveys such as the Behavior Risk Factor Surveillance System [25]. However, women at the MWHU were self-selected, i.e., those who present for screening mammography, our data are not directly comparable to the BRFSS which can estimate prevalence of mammography in an entire population, nor the IHS Government Performance and Review Act data which are based on IHS medical records in one selected age group [20, 25]. The MWHU data are more comparable to data of the BCSC, a national mammography registry of the National Cancer Institute which collects mammographic and demographic information from women undergoing mammography from seven registries of various community based facilities [24].

Similar to other studies, we found that younger women were less likely to be adherent to mammography screening guidelines than older women [17, 26–28]. This also reflects national BRFSS data indicating that older woman are more likely to have had mammograms with the highest prevalence of mammography use within 2 years among those aged 60–69 years (81.3 %) and 70–74 years (82.4 %) [29]. Reasons for this difference may relate to patient and physician confusion about which age to start screening, since there has been much controversy over the years about the benefits of mammography for women ages 40–49 [30]. Multiple organizations recommend that routine mammography screening begin at age 40, although there are still differing opinions regarding the intervals, of 1 versus 2 years. Although previous studies report that a higher proportion of AI women are diagnosed with

breast cancer at age <50 than white women, the AI women in the 41–49 age group had the lowest screening adherence of the three age groups [4].

Among clinic sites, adherence ranged from 65.93 to 25.23 %; four had a significantly greater proportion of women (54–66 %) that were adherent to screening guidelines than the median level of adherence, with one site showing the opposite. There did not appear to be any geographic pattern to adherence differences by clinic site. The four sites with higher than average adherence were in northwestern North Dakota, central South Dakota (two sites), and northern Nebraska. Three of the 18 clinic sites had screening adherence of 60 %, similar or higher than the BCSC AI/AN rate. Differences between clinics may reflect previous availability of mammography from fixed mammography facilities at some IHS clinics or intermittent screening programs from mobile units from regional non-IHS health centers.

Nationwide, AI/AN women have the lowest mammography screening rates in the United States [14, 15], and although IHS data shows an upward screening trend, IHS rates are lower than national rates. In 2011, the IHS reached their goal of at least biennial screening for 49.6 % of all AI/AN women ages 52–64, much lower than national screening rates [20, 31]. Region-specific studies are important for AI/AN populations due to the uniqueness of the culture and the variable regional incidence of breast cancer among AI/AN women [4]. Based on IHS data, the Aberdeen Area has slightly lower rates of mammography among women ages 52–64 than all IHS areas combined (43.3 vs. 49.8 % in 2011, unchanged since 2008) [20]. Based on BRFSS data, fewer AI/AN women receive mammograms in the prior 2 years than white women [26, 29]. A study of mammography adherence in AI women in Colorado found an odds of annual mammography 0.5 times that of NHW women [16]. Mammography screening varies greatly among IHS regions [17, 19], with AI women in the Eastern U.S. having higher screening mammography rates (72.7 %) compared to those in the Southwest (62.2 %). AI women in every IHS region had mammography rates lower than NHW women (76.2 %) [19].

Many factors affect mammography screening adherence in AI women. In the Northern Plains region, a recommendation for mammography from a healthcare provider was the only significant predictor for having received a mammogram [32], whereas another study in Colorado found annual household income and a family history of breast cancer to correspond with mammography adherence [16]. AI women from a specific reservation in the Northern Plains who had not had a mammogram in the previous year were less likely to know that older women had a higher breast cancer risk, less likely to have a mammogram even if recommended by a healthcare provider, and less willing to travel long distances to receive screening. These negative views might coincide with a chronic distrust in the healthcare system observed among many AI/AN populations [33]. No single solution to increase mammography screening exists for all AI/AN individuals, and differences among regions and tribes need to be considered [32].

Our study makes a contribution to the scarce literature about AI/AN women, screening adherence, and the significance of mobile mammography in rural areas. The patient sample group represents a large-geographic area. There were limitations to our study. The study group is small, and is a selected group because it is women who chose to come for screening mammography. Therefore these women are more likely to have been adherent to mammogram screening. For example, about 85 % of these women reported having ever had a mammogram, which is substantially higher than a cancer screening study reported by Pandhi, wherein only 51 % of a sample of women in the Northern Plains reported ever having had any kind of breast cancer screening (mammography or clinical examination) [32]. In addition, the mobile unit was only intermittently available, and not equally available to all clinics which may result in some selection bias among the clinic sites.

In conclusion, the majority (60.14 %) of women at first presentation to the MWHU had not had mammograms in the previous 2 years, which was lower adherence to screening than national rates (25.66 %). Adherence was lowest among women ages 41–49, and varied with clinic site. Findings suggest health disparities and importance of mobile mammography. Continued efforts to provide mobile mammography to these women and greater focus in certain IHS clinic locations that may help change these screening mammography disparities.

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Abbreviations

AAIHS	Aberdeen Area Indian Health Service
AI	American Indian
AI/AN	American Indian/Alaska Native
AOR	Adjusted odds ratio
BCSC	Breast Cancer Surveillance Consortium
BI-RADS	American College of Radiology Breast Imaging-Reporting and Data System®
BRFSS	Behavior Risk Factor Surveillance System
GPRA	Government Performance and Review Act
HIPAA	Health Insurance Portability and Accountability Act
IHS	Indian Health Service
MWHU	Indian Health Service Mobile Women's Health Unit
NHW	Non-Hispanic White
USPSTF	U.S. Preventive Services Task Force
UMHS	University of Michigan Health System

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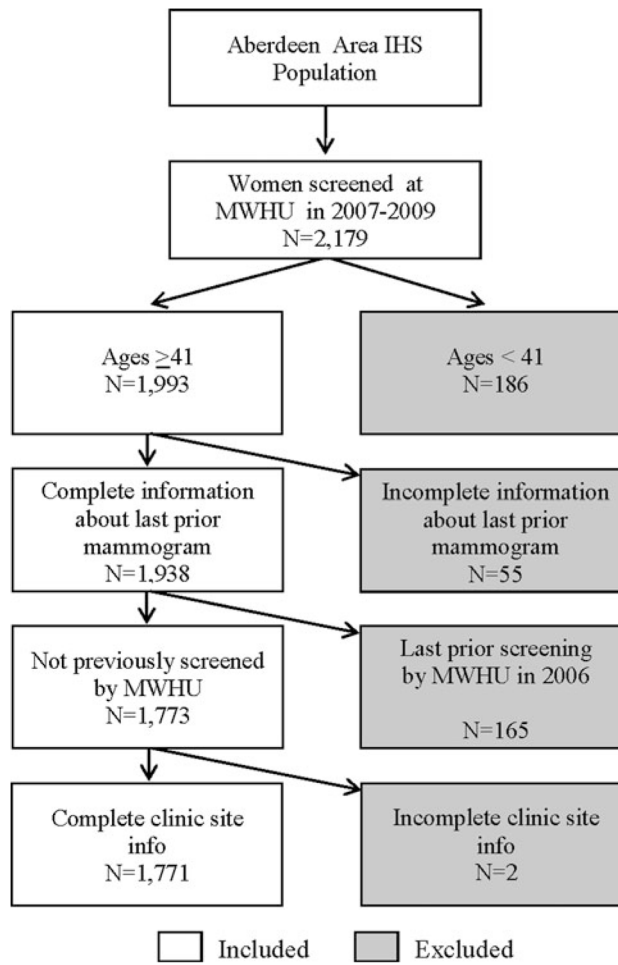


Fig. 1.
Patient inclusion criteria

Table 1

All women having screening mammograms at the Aberdeen Area Women's Mobile Health Unit (MWHU) during 2007–2009

	Mean (SD)	Range
Age (years)	53.27 (10.44)	23–91
	<i>N</i> (number of women)	%
Age group (years)		
<41	186	8.53
41–49 ^a	723	36.39
50–64 ^a	928	42.59
65+ ^a	342	15.70
Previous mammogram?		
Yes	1841	84.49
No	329	15.10
Unknown	9	0.41
Previously adherent to mammography guidelines? ^b		
Yes	706	32.40
No	665	30.52
Uncertain	55	2.52
Without evidence of adherence	402	18.45
Not applicable (age <41 years)	186	8.53
Not applicable (ages 41+ with last prior screening at MWHU 2006)	165	7.57
Clinic site (2007–2009)		
Belcourt	254	11.66
Fort Yates	184	8.44
Fort Thompson	166	7.62
Wagner	154	7.07
Winnebago	148	6.79
Trenton	133	6.10
Eagle Butte	128	5.87
Macy	120	5.51
Wanblee	117	5.37
New Town	117	5.37
McLaughlin	116	5.32
Kyle	108	4.96
Pierre	107	4.91
Flandreau	86	3.95
Lower Brule	83	3.81
Tama	76	3.49
Aberdeen	54	2.48
Niobrara	26	1.19

	Mean (SD)	Range
Age (years)	53.27 (10.44)	23–91
	<i>N</i> (number of women)	%
Unknown	2	0.09

N = 2,179

^aAge group recommended for screening mammography

^bAdherence defined as reporting last previous mammogram 1–2 years prior for women ages 41+ years, based on U.S. Preventative Services Task Force Guidelines effective during study period years

Table 2

Women having screening mammograms ages 41 years with prior mammogram and clinic site information ($N = 1,771$)

	Mean (SD)	Range
Age (years)	54.64 (9.90)	41–91
	<i>N</i> (number of women)	%
Age group		
41–49	658	37.15
50–64	811	45.79
65+	302	17.05
Previous mammogram?		
Yes	1,551	87.58
No	220	12.42
Evidence of adherence to mammography guidelines ^a		
Yes	706	39.86
No	1,065	60.14
First MWHU visit clinic site		
Belcourt	217	12.25
Wagner	137	7.74
Winnebago	136	7.68
Ft. Yates	108	6.10
Ft. Thompson	117	6.61
Eagle Butte	111	6.27
Wanblee	107	6.04
Macy	106	5.99
Newtown	98	5.53
Kyle	98	5.53
Trenton	91	5.14
Pierre	85	4.80
McLaughlin	76	4.29
Flandreau	75	4.23
Lower Brule	72	4.07
Tama	63	3.56
Aberdeen	49	2.77
Niobrara	25	1.41

^aAdherence defined as reporting last previous mammogram 1–2 years prior for women ages 41+ years, based on U.S. Preventative Services Task Force Guidelines effective during study period years

Table 3

Adherent versus nonadherent groups from Table 2, by age and clinic site

	Adherent		Nonadherent		χ^2	p value
	N	%	N	%		
Age (years)					24.32	<0.0001*
41-49	220	33.43	438	66.57		
50-64	341	42.05	470	57.95		
65+	145	48.01	157	51.99		
First MWHU visit clinic site					101.3882	<0.0001*
Belcourt	87	40.09	130	59.91		
Wagner	58	42.34	79	57.66		
Winnebago	41	30.15	95	69.85		
Ft. Yates	34	31.48	74	68.52		
Ft. Thompson	63	53.85	54	46.15		
Eagle Butte	71	63.96	40	36.04		
Wamblee	27	25.23	80	74.77		
Macy	32	30.19	74	69.81		
Newtown	37	37.76	61	62.24		
Kyle	42	42.86	56	57.14		
Trenton	60	65.93	31	34.07		
Pierre	28	32.94	57	67.06		
McLaughlin	22	28.95	54	71.05		
Flandreau	26	34.67	49	65.33		
Tama	20	31.75	43	68.25		
Lower Brule	23	31.94	49	68.06		
Aberdeen	19	38.78	30	61.22		
Niobrara	16	64.00	9	36.00		

N= 1,771

* Statistically significant

Table 4

Adjusted odds ratio and 95 % confidence interval from logistic regression of adherence to mammography guidelines among women ages 41+ years

Model 1		
Adherent		
	Adjusted odds ratio	95 % confidence interval
Age		
41–49	0.649	(0.482, 0.874)*
50–64	0.954	(0.717, 1.270)
65+	Reference	Reference
First MWHU visit clinic site		
Belcourt	1.094	(0.551, 2.279)
Ft. Yates	0.785	(0.440, 1.400)
Wagner	1.199	(0.704, 2.043)
Trenton	3.193	(1.755, 5.810)*
Newtown	Reference	Reference
Winnebago	0.697	(0.401, 1.209)
Ft. Thompson	1.961	(1.132, 3.397)*
McLaughlin	0.684	(0.358, 1.304)
Eagle Butte	2.727	(1.538, 4.836)*
Macy	0.723	(0.403, 1.297)
Wanblee	0.546	(0.299, 0.994)*
Pierre	0.820	(0.444, 1.512)
Kyle	1.224	(0.690, 2.174)
Flandreau	0.896	(0.477, 1.682)
Tama	0.778	(0.397, 1.524)
Lower Brule	0.830	(0.477, 1.682)
Aberdeen	1.121	(0.551, 2.279)
Niobrara	2.958	(1.182, 7.402)*

* Statistically significant at 0.05 level

Adherence to screening mammography guidelines, women 41 years: American Indian women of the MWHU compared to women of the Breast Cancer Surveillance Consortium

Table 5

Adherence to mammography guidelines	MWHU ^b (n = 1,771)		BCSC		White (n = 732,719)		All ethnicities (n = 1,004,943)	
	#	%	#	%	#	%	#	%
Yes ^a	706	39.86	1,868	59.83	568,976	77.65	747,095	74.34
No prior mammogram	220	12.42	538	17.23	46,100	6.29	83,031	8.26

^aLast prior mammogram 1–2 years ago

^bSee Table 2