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Use of Mammographic Screening by HIV-Infected Women in the Women's Interagency HIV Study (WIHS)[1]

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Background. **Although HIV-positive women may be less likely than women in general to receive mammography due to socioeconomic disadvantage, HIV diagnosis may increase opportunities for medical interactions which encourage mammography.**

Methods. **HIV-positive (2,059) and HIV-negative (569) Women's Interagency HIV Study (WIHS) participants reported ever/never history of mammography at baseline (in 1994, 1995) and, at each 6-month follow-up visit, if they had been screened since their last visit. National Health Interview Survey (NHIS) data for 1994 were used to compare WIHS participants to U.S. women. Factors independently related to mammography were determined using logistic regression for baseline data and proportional hazards for follow-up data. Results were adjusted for age.**

Results. **Among women ≥40, fewer WIHS women, regardless of HIV status, reported screening than U.S. women (67% HIV-positive, 62% HIV-negative, 79% NHIS; $P < 0.0001$). First-time screening while on study was associated with being HIV-positive [rate ratio (95% confidence interval) = 1.6 (1.1, 2.3)]. Factors independently associated with screening were related to health care access and usage.**

Conclusions. **WIHS women, a disadvantaged population, reported less mammography than the general population. HIV-positive women reported more screening than HIV-negative women, possibly because of greater opportunity to interact with the health care system.**

Key Words: **HIV; mammography; cohort study; health services accessibility.**

INTRODUCTION

Breast cancer screening practices among women with HIV infection are unknown. Based on data from the Women's Interagency HIV Study (WIHS), a high proportion of HIV-positive women are Hispanic, are living in poverty, or have other disadvantages that are typically negative correlates of mammography use. Because these characteristics have been shown to relate to lower screening rates one might also expect low screening among HIV-infected women. However, HIV-positive women are unique in that they have regular contact with health professionals and may, therefore, be more likely to receive recommendations from their physicians to seek screening. Since life expectancy for many of these women has been prolonged due to new antiretroviral therapies, it is important to understand cancer screening practices among HIV-positive women and to ensure that they receive recommended early detection tests. In 1997, the National Cancer Institute and the American Cancer Society recommended regu-

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lar mammography for women ages 40 years and older, although the recommended screening interval varied somewhat [*1,2*]. Over the past 15 years, mammography use has risen dramatically in the United States. In 1987, fewer than one-third of women had ever received a mammogram [*3*]. By 1998, about two-thirds of women 40 and older reported receiving a mammogram in the past 2 years. Many of the substantial differences in use by race/ethnicity previously reported (e.g., Black versus White) have now disappeared on a national level, although the rates are still lower for some ethnic groups (e.g., Hispanics, some Asian groups), for some areas of the country, for some age groups, and for recent immigrants [*4–11*]. Lack of a regular physician or health insurance and lower levels of education (especially, less than a high school education) also have been associated with lower mammography rates [*10,12–15*]. Knowledge and access barriers are important for some women, especially those with lower income levels and who are disadvantaged [*16*]. One of the strongest predictors of mammography use is physician recommendation [*17,18*]. Screening tends to be increased among women in their fifties and sixties compared to older (above age 65) and younger women [*10*].

We used data from the WIHS to compare HIV-positive women to demographically similar HIV-negative women on use of mammography. We also compared mammography use between WIHS women and U.S. women in general using National Health Interview Survey (NHIS) data. Variables of particular interest in our analysis included ethnicity, age, level of education, income, health insurance status, and factors related to health care, including having a regular primary care physician, a doctor visit in the past 2 months, a Papanicolaou (Pap) test in the previous 12 months, dental care in the past 6 months, and a cancer history. Our findings are based on self-report, which has been shown to provide an acceptably accurate assessment of mammographic screening [*19–21*].

METHODS

Study Population

Details about the WIHS study design, methods, and participants are published elsewhere [*22*]. Briefly, 2,059 HIV-positive and 569 HIV-negative women were enrolled between October 1994 and November 1995 by six clinical consortia: Bronx/Manhattan, New York; Brooklyn, New York; Metropolitan Washington, D.C.; Northern California; Southern California and Hawaii; and Chicago, Illinois. Participants were recruited from HIV primary care clinics, hospital-based programs, research programs, community outreach sites, women's support groups, drug rehabilitation programs, HIV testing sites, and referrals from enrolled participants. HIV-positive and -negative cohorts were recruited from similar sources and frequency-matched on age, race/ethnicity, and risk for acquisition of HIV infection (e.g., number of sexual partners, injection drug use). At enrollment, participants ranged in age from 16 to 73 years; about one-half self-identified as African American, one-quarter as Latina/Hispanic, and fewer than 20% as Caucasian. More than half of all participants lived below federally defined poverty levels. This report includes follow-up data through September 2000 and includes only women who were at least 40 years old at baseline, as this is the age group for whom mammography is recommended by most major medical organizations [*1,2*].

Data Collection

At baseline and at each 6-month follow-up visit, participants were interviewed at the study clinics in each of the six geographic areas, given a physical and gynecological examination (including a breast exam), and had blood and other specimens collected. Participants were asked at baseline if they had ever had a mammogram and, at each follow-up visit, if they had a mammogram (and its results) since their last visit. It was not possible to calculate frequency rates since participants were not asked about screening frequency and some participants missed several follow-up visits. To compare screening between women entering the WIHS and U.S. women in general, we used data from the 1994 NHIS, a nationwide sample of households in the civilian noninstitutionalized population of the United States. Comparisons were made within racial/ethnic and age groups.

Statistical Analysis

Chi-square tests were used to compare the proportion of WIHS women and all U.S. women reporting mammograms. Factors selected for analyses of correlates of mammography use were based on the large body of existing literature on predictors of mammography use and on the availability of data collected by the WIHS. To evaluate factors related to baseline report of past mammography screening, chi-square tests of association or Fisher's exact tests were used for univariate associations and logistic regression was used for multivariate associations. Proportional hazards models were constructed to estimate rate ratios (RRs) and 95% confidence intervals (CIs) for factors associated with time to first self-reported mammogram while on study, with women censored at their last study visit if they never reported a mammogram while on study. Tests were two-sided with a 0.05 significance level.

RESULTS

The HIV-positive and -negative WIHS cohorts were similar in age, ethnicity, education, income, and cancer history (data not shown) [*22*]. At baseline, significantly

TABLE 1

Proportions of WIHS HIV-Positive and HIV-Negative Women at Baseline (Oct 1994–Nov 1995) and 1994 NHIS Women with Self-Reported Prior Mammography by Age and Ethnicity

Age	Ethnicity	% WIHS HIV-positive	% WIHS HIV-negative	% NHIS
40–49	African-American[a]	62 (218/352)	56 (47/84)	82
	Latina/Hispanic	64 (63/98)	48 (12/25)	64
	Caucasian	73 (69/94)	79 (15/19)	81
50+	African-American	78 (54/69)	79 (11/14)	80
	Latina/Hispanic	89 (17/19)	100 (7/7)	72
	Caucasian	85 (18/19)	50 (1/2)	79

[a] Significantly lower proportion among HIV-positive and HIV-negative women compared to NHIS women ($P < 0.0001$ for both).

more HIV-positive than -negative women reported having any health insurance (82 vs 59%), having Medicaid/MediCal (61 vs 41%), having a primary health care provider (93 vs 67%), having seen a physician in the past 2 months (84 vs 54%), having had a Pap smear in the past 12 months (80 vs 61%), or having received dental care in the past 6 months (37 vs 27%) ($P < 0.0001$ for all comparisons).

Among women ages 40 and over, fewer WIHS than U.S. women reported ever having had mammograms (67% HIV-positive, 62% HIV-negative, 79% NHIS; $P < 0.0001$). However, most of the WIHS women were 40 to 49 years old (84%). Within this age group, 64% of HIV-positive women and 58% of HIV-negative women entering the WIHS reported ever having had a mammogram compared to 79% of all U.S. women ages 40 to 49 ($P < 0.0001$ for both HIV-positive and -negative compared to U.S. women). Upon stratification by age and ethnicity, the largest discrepancies in screening rates for both HIV-positive and -negative women compared to U.S. women were among African Americans ages 40 to 49 years (Table 1). Differences in baseline screening prevalence between HIV-positive and -negative women were not significant.

Demographic and health care usage factors associated with screening prevalence at baseline among all WIHS participants combined are shown in Table 2. Increasing age was strongly related to increasing screening prevalence (P value for trend < 0.0001); thus, analyses of all other factors were age-adjusted. As shown in Table 2, all factors univariately related to increased screening were also independently related in the multivariate analysis: ethnicity (Caucasian vs African American), annual income >$6,000, having a primary care physician, having had a recent doctor visit, and having had a recent dental visit. In women <50, results were similar except the variables representing recent doctor visit and dental visit were replaced by recent Pap in the multivariate analysis (data not shown). In women 50 and older, the same factors were related to increased screening but only annual income >$6,000 was independently significant. Also, both Latinas/Hispanics and Caucasians were more likely to have been screened than African Americans (data not shown).

TABLE 2

Sociodemographic and Health Care Utilization Predictors of Baseline Screening Status of HIV-Positive and -Negative Women in the WIHS with Associated Odds Ratios (OR) and 95% Confidence Intervals (CI)[a]

Factor	Ever screened (n = 499) No. (%)	Never screened (n = 249) No. (%)	Univariate model[b] OR (95% CI)	Best model[c] OR (95% CI)
Age (years)				
40–49	398 (80)	229 (92)	1.0	1.0
50+	101 (20)	20 (8)	2.9 (1.8, 4.8)	3.3 (1.9, 5.5)
Ethnicity				
African-American	306 (61)	177 (71)	1.0	
Latina/Hispanic	93 (19)	44 (11)	1.2 (0.8, 1.8)	
Caucasian	100 (20)	28 (18)	2.1 (1.3, 3.3)	1.7 (1.1, 2.8)
HIV-positive	409 (82)	196 (79)	1.2 (0.8, 1.8)	
Completed high school	343 (69)	162 (65)	1.3 (0.9, 1.7)	
Annual income >$6000	378 (76)	146 (59)	2.3 (1.7, 3.3)	2.1 (1.5, 2.9)
Health insurance	428 (86)	199 (80)	1.5 (1.0, 2.2)	
Medicaid/MediCal	285 (57)	173 (69)	0.6 (0.4, 0.8)	
Has primary care physician	461 (92)	211 (85)	2.2 (1.3, 3.5)	1.8 (1.1, 3.0)
Doctor visit past 2 months	410 (82)	201 (81)	1.1 (0.8, 1.7)	
Pap past 12 months	387 (78)	161 (65)	1.8 (1.3, 2.6)	1.8 (1.2, 2.5)
Dental care past 6 months	203 (41)	74 (30)	1.7 (1.2, 2.4)	1.5 (1.0, 2.1)
Cancer history[d]	35 (7)	22 (9)	0.7 (0.4, 1.2)	

[a] Only participants with all covariates nonmissing were included.
[b] Age included in all models.
[c] Based on stepwise logistic regression with a critical P value of 0.05.
[d] Self-reported history of any cancer.

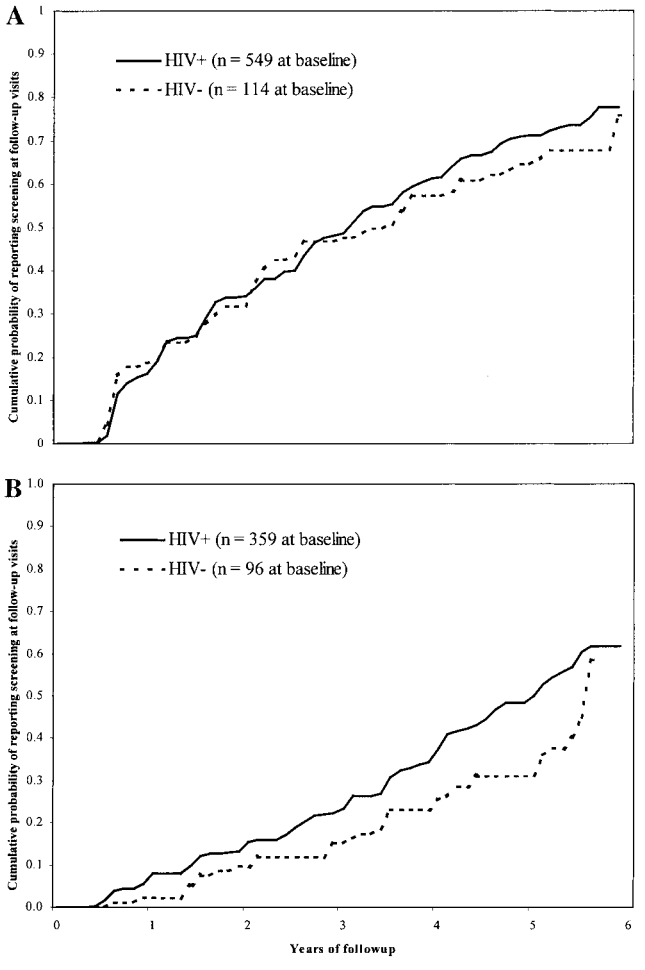

FIG. 1. Kaplan–Meier curves of cumulative probability of reporting screening while on study, by HIV status. (A) Women with prior screening (reported at the baseline visit). (B) Women with no prior screening.

Differences in screening practices between HIV-positive and -negative women while they were participating in the WIHS depended on whether they had been previously screened before entering the WIHS. In women who had been previously screened, increasing age was related to increasing on-study screening incidence (P value for trend = 0.02). Therefore, analyses of all other factors for both groups defined by previous screening status were age-adjusted, with age as a time-dependent covariate. Among women with prior screening, HIV-positive and -negative women had similar incidence of screening while in the WIHS [RR (CI) = 1.1 (0.9, 1.5); Fig. 1A]. After adjustment for age, factors associated with screening incidence were having health insurance, a recent doctor visit, a recent Pap, and recent dental care; all were associated with greater probability of screening and all but recent doctor visit were independently significant (Table 3). Results were similar in women <50 (data not shown). In women ages 50 and older, Latinas/Hispanics were more likely than African Americans to have been screened, and recent Pap was also associated with increased screening incidence. Factors associated with decreased screening incidence were completion of high school and having a primary care physician; in multivariate analysis, these were the only factors that remained significant (data not shown). Reasons for mammography did not differ by age (data not shown).

Among women with no prior screening, HIV-positive women were more likely to obtain mammograms while participating in the WIHS than HIV-negative women [RR (CI) = 1.6 (1.1, 2.3); Fig. 1B]. After adjustment for age, factors associated with increased screening incidence among those without prior mammograms were being HIV-positive, receiving Medicaid/MediCal, having had a recent doctor visit, having had a recent Pap, and having had recent dental care; of these, only recent doctor visit and Pap were independently significant (Table 3). In women <50, independent significant predictors of increased screening incidence were being HIV-positive, recent doctor visit, and recent Pap (data not shown). In women 50 and older, only education was independently significant, with women who completed high school less likely than less educated women to have been screened while on study (data not shown). Reasons for first-time mammography while on study significantly differed by age ($P = 0.0007$); women <50 were more likely to have been screened for nonroutine reasons (23%) than were women 50 and older (13%).

Among all WIHS women who reported mammograms while on study, rates of abnormal mammography results did not differ by HIV status (11% in HIV-negative, 16% in HIV-positive).

DISCUSSION

Women enrolled in the WIHS were less likely to have had mammograms than other U.S. women. This difference was greatest among African Americans 40 to 49 years old, regardless of HIV status, with African American WIHS participants reporting relatively lower use of screening compared to the U.S. population. The gap in mammography use between Whites and African Americans ages 50 years and older is closing, particularly in low-income populations [*23,24*]. Recent data show that mammography use is greatest nationally among women ages 50–64 [*10*]. Our data are consistent with this trend but also suggest that the gap still remained among low-income women in their forties as of 1994 and that this gap exists for Latinas/Hispanics as well as African Americans. There is an ongoing debate on whether this gap is due to sociodemographic differences or is instead related to characteristics of the women themselves, such as fear of radiation or breast cancer detection [*25–27*].

Although WIHS HIV-positive and -negative women were similar in education and income, HIV-positive

TABLE 3

Sociodemographic and Health Care Utilization Predictors of Mammography While on Study among HIV-Positive and -Negative Women in the WIHS with Associated Rate Ratios (RR) and 95% Confidence Intervals (CI), by Baseline Screening Status[a]

	Baseline status = previously screened		Baseline status = previously unscreened	
Factor	Univariate model[b] RR (95% CI)	Best model[c] RR (95% CI)	Univariate model[b] RR (95% CI)	Best model[c] RR (95% CI)
Age (years)				
40–49	1.0	1.0	1.0	
50+	1.2 (1.0, 1.6)	1.4 (1.1, 1.7)	1.0 (0.7, 1.7)	
Ethnicity				
African-American	1.0		1.0	
Latina/Hispanic	1.1 (0.8, 1.4)		1.1 (0.8, 1.5)	
Caucasian	1.0 (0.7, 1.2)		1.4 (1.0, 2.1)	
HIV-positive	1.1 (0.9, 1.5)		1.6 (1.1, 2.3)	
Completed high school	1.0 (0.8, 1.2)		1.0 (0.7, 1.3)	
Annual income >$6000	1.1 (0.9, 1.4)		0.8 (0.6, 1.1)	
Health insurance	1.5 (1.1, 1.9)	1.5 (1.1, 2.0)	1.2 (0.9, 1.7)	
Medicaid/MediCal	1.1 (0.9, 1.3)		1.3 (1.0, 1.8)	
Has primary care physician	0.9 (0.6, 1.3)		1.3 (0.9, 2.0)	
Doctor visit past 2 months	1.6 (1.1, 2.3)		2.8 (1.4, 5.2)	2.2 (1.1, 4.1)
Pap past 12 months	1.7 (1.4, 2.1)	1.7 (1.4, 2.1)	1.9 (1.4, 2.5)	1.7 (1.3, 2.3)
Dental care past 6 months	1.4 (1.2, 1.7)	1.4 (1.1, 1.7)	1.5 (1.1, 2.0)	
Cancer history[d]	1.1 (0.8, 1.6)		0.8 (0.4, 1.5)	

[a] Only participants with all covariates nonmissing were included.
[b] Time-dependent age included in all models.
[c] Based on stepwise Cox regression with a critical P value of 0.05.
[d] Self-reported history of any cancer.

women were more likely than HIV-negative women to have health insurance and to have used other health care resources (visits to primary care physicians and dentists, Pap smears). Among women who had not been screened previously, HIV-positive women were more likely to have received first-time mammograms while on study. This supports prior research that increased use of health care, in general, is related to increased screening [*28–34*]. Lack of significant difference in on-study screening by HIV status among women previously screened suggests that these women were a more homogenous subgroup in terms of use of health care resources. As in previously published studies, we generally found that health care usage factors, rather than ethnicity, were independent predictors of screening [*30,33,34*].

We observed a seemingly paradoxical effect in women 50 and older (both HIV-positive and -negative); namely, on-study screening was more likely among women who had not completed high school and, in women who had been previously screened, among those with primary care physicians. We surmise that these findings are either due to confounding by unknown or unmeasured factors or are the results of random variation.

Our research was limited by the scope of mammography data collected and by reliance on self-reported screening use. While comparisons of screening rates would have been preferred, we were confined to analyses of use vs nonuse, since screening frequency data were unavailable. Use of self-reported data, however, should have only minor impact on the validity of our results. Most studies show that self-reported data are reasonably accurate although not precise [*20,21*]. In a recent study of validity of self-reported mammography use, most inaccuracies were due to telescoping, i.e., reporting screening to have occurred more recently than it actually did [*35*]. In our study, telescoping was a nonissue for self-reported lifetime use and was likely to be minimized by using the last semi-annual visit as a reference point. However, more recent publications have shown some differences in self-reported mammography use in comparisons made across ethnic groups [*36,37*]. Validity of self-reported data has not been examined in our population.

As a disadvantaged population, HIV-positive women are at risk of not having appropriate breast cancer screening. Since they are dealing with a life-threatening medical condition, they and their health care providers may view mammography screening as a lesser priority. Conversely, as frequent users of health care services in general due to their HIV status, they may have greater opportunities to be advised about the need for breast cancer screening and other recommended prevention and early detection procedures, when compared to other disadvantaged women. We observed evidence of this among WIHS participants, in that HIV-positive women generally received more

screening than HIV-negative women. Nonetheless, screening in WIHS HIV-positive women was lower than reported in the overall population. Further, WIHS participants may be more likely to use the health care system than the general HIV-positive population, as evidenced by their motivation for study participation. Also, since they receive breast examinations at every semi-annual visit, these women may have received more frequent physician recommendations for mammography than would ordinarily have occurred in a population of HIV-positive women. Thus, screening among HIV-positive women in general may be lower than what we have shown.

The fact that WIHS study participants are not getting adequate breast cancer screening represents "missed opportunities" to explain the benefits of mammography as has been noted by other authors [*32*]. Breast cancer incidence will almost certainly increase among HIV-positive women as a consequence of improved survival due to efficacious antiretroviral therapies. Primary care physicians and other health care providers, such as nurses and physicians assistants, need to be educated about the importance of mammography for HIV-positive women. Stereotypes die slowly, and many health care providers may not realize how long women are living with HIV infection. Targeted counseling of providers who treat HIV-positive women could focus on the appropriateness of various chronic disease screening tests and on ways of communicating the importance of screening to HIV-positive patients. But the general mammography literature suggests that educating health professionals will be necessary but not sufficient to increase screening and that efforts will also need to reach women directly. Since many HIV-positive women are in contact with the health care system, "in-reach" strategies that provide education and referrals to patients at the point of health care service may be particularly promising [*34*]. Such strategies must be culturally and ethnically appropriate and must address the specific barriers that may characterize HIV-positive women.

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