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HIV Testing in Women: Missed Opportunities

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Abstract

Objective: To investigate opportunities for early human immunodeficiency virus (HIV) testing of women.

Methods: A retrospective cohort study design linked case reports from HIV surveillance to several statewide health-care databases. Medical encounters occurring before the first positive HIV test (missed opportunities) were categorized by diagnosis/procedure codes to distinguish visits that were likely to have prompted an HIV test. Women were categorized as late testers (AIDS diagnosis <12 months from first HIV test date), non-late testers (no AIDS diagnosis during study period or diagnosis of AIDS >12 months of HIV diagnosis), of reproductive age (13–44 years old), and not of reproductive age (>44 years old). Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were used to estimate risk and its statistical significance.

Results: Of 3303 HIV-infected women diagnosed during the study period, 2408 (73%) had missed opportunity visits. Late testers (39%) were more likely to be black than white (aOR 1.48, 95% CI 1.12–1.95), be older (>44 years old; aOR 7.85, 95% CI 4.49–13.7), and have >10 missed opportunity visits (aOR 2.17, 95% CI 1.62–2.91). Fifty-four percent of women >44 years old were also late testers. Women >44 years old had lower median initial CD4 counts ($p < 0.001$). The top two procedures were the same for all groups of women but mammography was ranked fourth for women >44 years old and Papanicolaou smear was ranked fourth for late testers.

Conclusions: Feasibility and acceptability of routine HIV testing in nontraditional health-care settings, such as mammography and Papanicolaou screenings, should be explored to identify late testers and older (not of reproductive age) HIV-infected women.

Introduction

A PREVIOUS REPORT DEMONSTRATED THAT human immunodeficiency virus (HIV) testing practices in South Carolina have failed to diagnose HIV infection in many cases despite documented prior encounters with the medical system (missed opportunities).¹ It was found that 73.4% of individuals testing HIV positive had visited a South Carolina health-care facility prior to the date of their first positive HIV test and 43.4% of those testing HIV-positive developed AIDS within 1 year of first testing. However, it remains to be demonstrated if HIV-infected women have visited health-care venues often viewed as nontraditional HIV testing sites prior to their diagnosis. Implementation of HIV testing in both traditional and nontraditional venues would offer the most complete coverage of diagnostic services and allow for reali-

zation of the goals of the Centers for Disease Control and Prevention (CDC) revised recommendations for HIV testing in health-care settings.²

Disease stage at diagnosis is important because early diagnosis (HIV-only) and prompt linkage to care allows for access to antiretroviral medications that may decrease transmission and improve morbidity and mortality when compared with a late diagnosis (AIDS).³ Women in South Carolina were more likely than men to be diagnosed as HIV-only.¹ The widespread implementation of routine screening during prenatal years may explain why women are diagnosed earlier than men. However, this implies that there may be a gap in routine screening if a woman is not having children and hence not accessing obstetrical services. Also, it has not yet been proven if late HIV diagnosis of women not of reproductive age results from either delayed presentation for care or missed opportunities for early testing.

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Further investigation of the association of gender, age, and race with HIV testing is important because epidemiologic data from the South Carolina Department of Health and Environmental Control (SCDHEC) HIV/AIDS Reporting System (eHARS) show that many older African American women were diagnosed late.⁴ This finding suggests that providers and women, especially black women, may not perceive themselves to be at risk for HIV infection but may be at risk through their partners' practices.^{5,6}

Missed opportunities among older adults were associated with a late diagnosis.⁷ This suggests dangerously prolonged periods of unidentified infection in older adults who also may not be perceived by themselves or health-care workers to be at risk for HIV infection because of their age.⁸ In 2005, the CDC estimated that individuals ≥ 50 years old accounted for 15% of new HIV/AIDS diagnoses and 24% of persons living with HIV/AIDS. Of HIV-infected persons who have died, a reported 35% were more than 50 years old.⁹ Demographically, the rates of HIV/AIDS among persons 50 years and older were 12 times higher among blacks (51.7/100,000) and five times higher among Hispanics (21.4/100,000) compared with whites (4.2/100,000). These rates are troubling and suggest an emerging public health epidemic among a vulnerable population.

To explore the possibility of additional opportunities for earlier HIV diagnosis in women of and not of reproductive age and women who tested early and those who tested late, a population-based retrospective cohort study was devised that linked HIV case surveillance data to several health-care databases: the centralized health department patient encounter database, a federally subsidized breast and cervical cancer screening program medical encounter database, and the statewide hospital health-care database. Linkage of these four databases allowed the investigators to (1) to assess if HIV screening at nontraditional venues outside of obstetrical care or an emergency department could identify HIV-infected older women, and (2) determine whether specific diagnostic/procedure codes at earlier health-care visits were associated with a subsequent positive HIV test.

Methods

The SCDHEC and the Office of Research and Statistics (ORS) of the State Budget and Control Board provided the data used in this analysis. Both the SCDHEC Institutional Review Board and ORS Data Oversight Committee approved this study.

SCDHEC data

SCDHEC provided data sets from three sources: the HIV/AIDS Reporting System (eHARS), Best Chance Network (BCN),¹⁰ and the health department clinics' Patient Automated Tracking System (PATS) database.

SCDHEC has had a confidential name-based reporting system for HIV since 1986 and this information is maintained in eHARS. The data quality of eHARS is high for both timeliness of reporting (93% of cases reported within 6 months) and completeness of reporting (97% of cases reported based on a comparison with other data sources).¹¹ State law requires all licensed laboratories to report all CD4⁺ T-cell counts and HIV viral load measurements to SCDHEC, and these data are recorded in eHARS.

The study cohort of HIV-infected women was extracted from eHARS and linked to the other data sets described in following text, to explore for potential missed opportunity health-care visits. Variables requested from eHARS include date of first positive HIV test, date of AIDS diagnosis (if applicable), route of transmission (heterosexual, intravenous drug use, no identified risk, no risk reported), source of positive HIV test report (county health department, hospital, private/group practice, other including Department of Corrections and Mental Health), race/ethnicity (non-Hispanic white, non-Hispanic black), and age at initial HIV diagnosis. eHARS data were limited to women diagnosed with HIV infection from January 1, 1996, to December 31, 2007, who were South Carolina residents and at least 13 years of age at HIV diagnosis. Women were followed until December 31, 2008, for determination of disease stage at diagnosis.

The BCN¹⁰ is a federal program that provides free breast and cervical cancer screenings for medically underserved women in South Carolina who have limited or no health insurance, are age 40–64 years old, and meet certain income guidelines (<200% federal poverty level). The goal of the BCN program is to reduce mortality from breast and cervical cancers among medically underserved women in South Carolina. Funding has been provided by the CDC since 1991. Variables requested from the BCN data set include dates of service and results of procedures performed (Papanicolaou smears and mammograms).

PATS data are collected by SCDHEC staff during medical encounters in the 46 county health department clinics, including sexually transmitted disease (STD)/family planning, immunization, and tuberculosis (TB) clinics. Variables requested from the PATS data set include date of visit, reason for visit, diagnosis (both clinical and laboratory-based), and treatment provided. Both positive and negative test results for syphilis, gonorrhea, and chlamydia reported from the SCDHEC state laboratory are also included with the PATS data set.

ORS data

ORS receives uniform billing data on medical encounters that have occurred at 101 hospitals (inpatient, outpatient, imaging, and emergency departments), 77 ambulatory surgery centers, and 22 free clinics in South Carolina (ORS, unpublished data). Variables requested from the hospital discharge (HD) data set include admission dates, payer of services (commercial insurance, Medicaid, Medicare, indigent/self-pay), *International Statistical Classification of Diseases and Related Health Problems* (ICD-9) diagnostic and procedure codes, and facility type.

Data linkage

The eHARS data set was linked to other health-care data sets (PATS, BCN, HD) to determine visits that occurred before the first positive HIV test date. The linkage variables included patient name, birth date, gender, race/ethnicity, social security number, and county of residence. Linkage took place in a secure location and was completed by individuals trained in ORS confidentiality procedures as well as the Health Insurance Portability and Accountability Act. All protected personal identifiers (name, social security number, address) were removed by ORS staff before data were returned to study investigators.

Categorizations of women and visits

Women were categorized by both disease stage at diagnosis (late testers, AIDS diagnosis ≤ 12 months after the first positive HIV test date; non-late testers, no diagnosis with AIDS during the study period or diagnosed with AIDS > 12 months from first positive HIV test date) and reproductive age (13–44 years old, of reproductive age; > 44 years old, not of reproductive age). Women for which disease stage or age could not be determined were excluded from the analysis.

The missed opportunity period was delineated using initial median CD4⁺ T-cell counts obtained at diagnosis and calculating the length of time to reach that value from a normal count following HIV infection.¹² Accordingly, visits were categorized as missed opportunities if they occurred within 3 years of the first positive HIV test for non-late testers and within 10 years of first positive HIV test for late testers. Visits not within the study period, duplicate visits, or those without an associated date in each data set were excluded from the analysis. Also, any visits related to HIV prevention and treatment (HIV testing, counseling, partner notification) were also deleted because these visits would not be classified as missed opportunities.

Missed opportunity visits were further categorized by the diagnosis and procedure codes assigned at the medical encounter and reported to the BCN, PATS, or HD data sets. The diagnostic codes were categorized either as those likely to prompt an HIV test (AIDS-defining illnesses [e.g., toxoplasmosis, thrush], sexually transmitted infections, lymphadenopathy, pregnancy, gynecologically related diagnoses [e.g., abnormal Papanicolaou smear, cervical cancer], drug or alcohol dependence) or as those not likely to prompt an HIV test (e.g., hypertension, diabetes). Diagnoses likely to prompt an HIV test were further investigated by categorizing into six groups: (1) sexually transmitted infections, (2) AIDS-defining illnesses and other symptoms, (3) abnormal Pap smear and cervical cancer, (4) pregnancy and childbirth, (5) drug or alcohol dependence, and (6) hepatitis. The top 10 procedural codes reported at medical encounters were determined for all women, late testers, non-late testers, and women 13–44 years old and women > 44 years old. More than one procedure or diagnosis code could be attributed to the same visit and were counted separately.

Statistical analysis

The number of visits and the number of women with missed opportunity visits were assessed for each data set separately and the overall combined data sets. Chi-square test for categorical variables and Kruskal–Wallis test for continuous variables were used to measure the univariate difference among the groups. A multiple logistic regression model was created to evaluate the differences among late testers as compared with non-late testers, after controlling for race/ethnicity, transmission category, source of HIV report, and age group at the time of HIV diagnosis. Another multiple logistic regression model was created to assess the differences between women not of reproductive age (> 44 years old) at the time of diagnosis compared with women of reproductive age (13–44 years old), after controlling for race/ethnicity, transmission category, source of HIV report, and disease stage at the time of diagnosis (AIDS/HIV-only). Measure of association is reported in terms of adjusted odds ratio (aOR)

and 95% confidence interval (CI). Furthermore, frequencies were determined for diagnoses categorized as likely and not likely to prompt an HIV test, as well as for missed opportunity visits at which these diagnoses were coded. The diagnostic codes assigned at missed opportunity visits were assessed by univariate logistic regression analysis. In this case, missed opportunity visits associated with illnesses/symptoms not likely to prompt HIV testing (e.g., diabetes, hypertension) were used as reference category. All statistical analyses were performed with SAS version 9.1 (SAS Institute Inc.) using two-sided tests and $\alpha < 0.05$ for statistical significance.

Results

Of the 3303 women diagnosed with HIV from January 1, 1996, to December 31, 2007, and reported to eHARS, 2408 (73%) had missed opportunity visits for early testing at the health-care settings examined in this study (Fig. 1). The median age at HIV diagnosis for the women was 35 years old. Thirty-nine percent of women were identified as late testers and, of these late testers, 79% were diagnosed with AIDS within 1 month of their HIV diagnosis. The majority of women (76%) were 13–44 years old, while 54% of women who were > 44 years old were also late testers.

There were 16,983 missed opportunity visits identified in the combined data sets and most of these visits were to hospital settings ($\sim 15,000$ visits; range, 1–185; median, 4) with the majority (74%) of hospital visits to emergency departments (Fig. 1). Of all missed opportunity visits for HIV diagnosis, 51% occurred among late testers, 27% among women > 44 years old, and 19% among late-testing women who were > 44 years old. For missed opportunity hospital visits, the most common payer of services were Medicaid (38%) and self-pay/indigent (35%). Medicaid was 35% of the payer source for late testers and 29% of the payer source for women > 44 years old.

Missed opportunities for early HIV testing represented 21% (16,983/81,993) of all visits to health-care settings by women in the combined data sets and, separately, 27% of the BCN visits, 21% of HD visits, and 20% of the PATS visits. Women had the least number of missed opportunity visits to the BCN (range, 1–7; median, 1). Approximately 21% of all missed opportunity visits occurred within 6 months of HIV diagnosis.

The differences among women by disease stage at diagnosis and by reproductive age are shown in Table 1. Late-testing women were more likely than non-late testers to be black than white (aOR 1.48, 95% CI 1.12–1.95), have more than 10 missed opportunity visits (aOR 2.17, 95% CI 1.62–2.91), be diagnosed with HIV infection in hospitals (aOR 2.62, 95% CI 2.08–3.29), and be older. There was a significant increasing linear trend of age for late-testing versus non-late-testing women ($p < 0.001$ for trend). Median first CD4 counts were 101 cells/mm³ for late testers and 464 cells/mm³ for non-late testers ($p < 0.001$).

Women > 44 years old were more likely than women 13–44 years old to have no identified risk behavior (aOR 1.48, 95% CI 1.14–1.91) or to have no risk factor reported (aOR 1.71, 95% CI 1.29–2.28) as their HIV transmission category, be diagnosed with HIV infection in hospitals (aOR 1.68, 95% CI 1.30–2.17), and be late testers (aOR 2.21, 95% CI 1.80–2.70; Table 1). Median first CD4 counts were 288 cells/mm³ for women 13–44 years old and 197 cells/mm³ for women > 44 years old ($p < 0.001$).

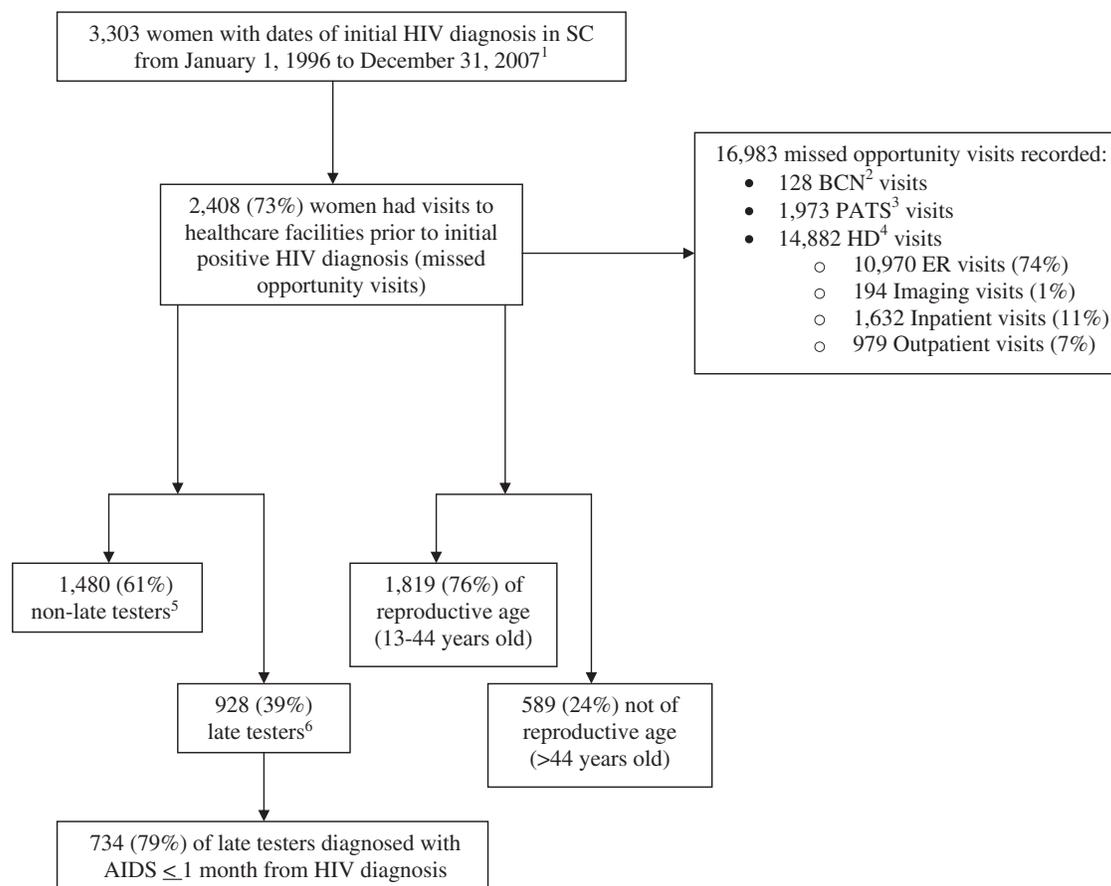


FIG. 1. Women with missed opportunities for early human immunodeficiency virus (HIV) testing in South Carolina. ¹Obtained from the South Carolina HIV/AIDS Reporting System (eHARS) surveillance database; eligible individuals were women who were South Carolina residents and ≥ 13 years of age. ²Best Chance Network (BCN) is a federally funded program that provides cervical and breast cancer screening for women ages 40–64 years old and below 200% federal poverty level. ³Patient Automated Tracking System (PATS) is database of medical encounters from health department adult health clinics, including sexually transmitted disease (STD), family planning, and tuberculosis (TB) clinics. ⁴Hospital discharge (HD) records from emergency rooms (ER) and inpatient and outpatient facilities in South Carolina. ⁵Women diagnosed with HIV disease stage only or with AIDS more than 1 year after HIV diagnosis during the study time period. ⁶Women diagnosed with AIDS within 12 months of HIV diagnosis.

Of the 16,983 missed opportunity visits, 19% overall were likely to prompt an HIV test; specifically, 11% for late testers and 4% for women > 44 years old. All PATS visits were likely to prompt an HIV test, with the majority of BCN (55%) and only 7% of HD visits likely to prompt an HIV test. The diagnostic codes assigned at missed opportunity visits were associated with significant odds of receiving a late diagnosis (Table 2).

The top two procedures by frequency (brief interview/evaluation and injection/infusion of prophylaxis) were the same for all women in the study cohort (Table 3). However, Papanicolaou smears were ranked number 4 for late testing women and not in the top 10 procedure for non-late-testing women. Manually assisted delivery was ranked number 4 for women 13–44 years old, while mammograms were ranked number 4 for women > 44 years old. Colonoscopy was ranked number 10 for women > 44 years old.

Discussion

This study investigates opportunities for early HIV testing of women in different types of health-care settings. Of the 3303 South Carolina women with dates of HIV diag-

nosis from January 1, 1996, to December 31, 2007, 2408 (73%) had previously visited a health-care facility during a period when it is assumed that they were already HIV-positive, but they did not receive a diagnostic HIV test. Approximately half of these women with missed opportunity visits were late testers and of these, 79% were diagnosed with AIDS within 1 month of their HIV diagnosis. Only one quarter of the women (24%) with missed opportunity visits for testing were not of reproductive age (> 44 years old) but represented half (54%) of late-testing women. Routine HIV screening in obstetrical settings is a proven strategy to identify some HIV-infected women, but the findings of this analysis suggest that women not of reproductive age may not benefit from routine HIV screening in this setting. Similarly, although the majority of visits were to emergency departments, not all women at risk for HIV infection may visit this health-care venue and potentially could be identified elsewhere in the system.

The proportion of late-testing women who were not of reproductive age suggests that a woman's age may be a factor in deciding whether an HIV test is accepted or offered. Older individuals are more likely to refuse testing^{13–15} and this

TABLE 1. MULTIPLE LOGISTIC REGRESSION ANALYSIS OF MISSED OPPORTUNITIES FOR EARLY HIV DIAGNOSIS IN WOMEN^a CATEGORIZED BY DISEASE STAGE AND REPRODUCTIVE AGE, SOUTH CAROLINA, JANUARY 1996 TO DECEMBER 2007

Characteristic	Disease stage ^a				Reproductive age (years) ^b			
	Late tester	Non-late tester	Late vs. non-late tester ^c		13-44	>44	13-44 vs. >44	
	n (%)	n (%)	aOR	95% CI	n (%)	n (%)	aOR	95% CI
Race/ethnicity ^d								
White, not Hispanic	97 (10)	225 (15)	1.00	—	249 (14)	73 (12)	1.00	—
Black, not Hispanic	810 (87)	1229 (83)	1.48	1.12-1.95	1534 (84)	505 (86)	0.98	0.73-1.32
Transmission category ^e								
Heterosexual	555 (60)	987 (67)	1.00	—	1218 (67)	324 (55)	1.00	—
Intravenous drug use	61 (7)	102 (7)	0.86	0.60-1.24	126 (7)	37 (6)	1.03	0.69-1.55
No identified risk	183 (20)	212 (14)	1.17	0.91-1.50	271 (15)	124 (21)	1.48	1.14-1.91
No risk reported	125 (13)	174 (12)	0.90	0.68-1.20	198 (11)	101 (17)	1.71	1.29-2.28
Missed opportunity visits								
1 visit	161 (17)	306 (21)	1.00	—	367 (20)	100 (17)	1.00	—
2-5 visits	335 (36)	649 (44)	0.99	0.77-1.28	740 (41)	244 (41)	1.27	0.96-1.67
6-10 visits	191 (21)	309 (21)	1.20	0.90-1.61	375 (21)	125 (21)	1.21	0.88-1.66
>10 visits	241 (26)	216 (14)	2.17	1.62-2.91	337 (19)	120 (20)	1.09	0.79-1.51
Source of report								
County health department	215 (23)	562 (38)	1.00	—	642 (35)	135 (23)	1.00	—
Hospital	441 (48)	339 (23)	2.62	2.08-3.29	529 (29)	251 (43)	1.68	1.30-2.17
Private/group practice	207 (22)	370 (25)	1.27	0.99-1.63	212 (12)	62 (11)	1.39	1.06-1.83
Other ^f	65 (7)	209 (14)	0.68	0.48-0.95	436 (24)	141 (24)	1.32	0.93-1.88
Age (years)								
<20	16 (2)	126 (9)	1.00	—	142 (8)	NA ^g	NA	NA
20-24	57 (6)	244 (16)	1.61	0.88-2.96	301 (17)	NA	NA	NA
25-29	90 (10)	231 (16)	2.65	1.47-4.79	321 (18)	NA	NA	NA
30-39	295 (32)	445 (30)	4.65	2.68-8.09	740 (41)	NA	NA	NA
40-44	145 (16)	166 (11)	6.26	3.50-11.2	315 (17)	NA	NA	NA
>44	321 (35)	268 (18)	7.85	4.49-13.7	NA	589 (100)	NA	NA
HIV disease stage								
Non-late tester	NA	NA	NA	NA	1212 (67)	268 (46)	1.00	—
Late tester	NA	NA	NA	NA	607 (33)	321 (54)	2.21	1.80-2.70
Payer of services ^h								
Commercial	1285 (17)	1123 (15)	1.00	—	1494 (14)	914 (21)	1.00	—
Medicaid	2652 (35)	2956 (40)	0.78	0.70-0.87	4342 (41)	2166 (29)	0.49	0.44-0.55
Medicare	464 (6)	452 (6)	0.54	0.46-0.64	400 (4)	516 (12)	2.15	1.82-2.55
Self-pay	2572 (34)	2354 (32)	1.03	0.92-1.15	3612 (34)	1314 (30)	0.57	0.51-0.63
Other ⁱ	522 (7)	502 (7)	0.89	0.76-1.05	629 (6)	395 (9)	1.04	0.88-1.22

^aWomen diagnosed with HIV-only disease stage, or diagnosed with AIDS more than 1 year after HIV diagnosis during the study period; non-late tester, $n=1480$. Women diagnosed with disease stage of AIDS within 12 months of HIV diagnosis; late tester, $n=928$.

^bWomen of reproductive age defined as age 13-44 years old; $n=1819$. Women not of reproductive age defined as age >44 years old; $n=589$.

^caOR, adjusted odds ratio; CI, 95% confidence interval.

^dWomen of other races (Hispanic, Asian, etc.) were not included in the analysis.

^eWomen with other transmission categories (blood transfusion, prenatal, etc.) were not included in the analysis.

^fOther source of report category includes South Carolina residents who were reported from other states, from blood banks/businesses, federal facilities, laboratories, and from unknown sources.

^gNA, not applicable.

^hPayer of services—derived from the Hospital Discharge dataset at last visit for individuals who had an inpatient, emergency department or outpatient/ambulatory medical encounter before the date of the first positive HIV test.

ⁱIncludes workers compensation, indigent, charitable organizations, and no report.

Obtained from the South Carolina HIV/AIDS Reporting System (eHARS) surveillance database; eligible individuals were women who were South Carolina residents and ≥ 13 years of age.

population presents new challenges for testing, prevention, and education because they are not often targeted or perceived to be at high risk.⁷ In this analysis, women not of reproductive age were more likely to have no identified risk or no risk factor reported to the SCDHEC eHARS surveillance database as the route of HIV transmission (Table 1). Thus, the data presented do not support the practice of targeted testing of risk groups as a viable HIV-screening strategy to identify

older women who are likely HIV infected because this group does not generally have traditionally perceived risk factors.

In recognition of the increasing numbers of older HIV-infected individuals, on December 8, 2009, the Centers for Medicare and Medicaid Services announced the decision to reimburse for HIV screening. This screening provision includes individuals who are at increased risk for infection, women who are pregnant, and Medicare recipients of any age

TABLE 2. NUMBER AND PERCENTAGE OF HEALTH-CARE VISITS AND CATEGORIES OF DIAGNOSIS BY DISEASE STAGE AND REPRODUCTIVE AGE OF WOMEN WHO HAD VISITED A HEALTH-CARE FACILITY BEFORE DATE OF HIV DIAGNOSIS, SOUTH CAROLINA, 1996–2007

Type of visits before HIV diagnosis	Disease stage ^a				Reproductive age (years) ^b				
	Late tester	Non-late tester	Late tester vs. non-late tester		13-44	>44	13-44 vs. >44		
			n (%)	n (%)			OR	95% CI	n (%)
Visits with diagnoses likely to prompt an HIV test									
Sexually transmitted diseases and related diagnoses	1,346	491 (36)	855 (64)	0.58	0.51–0.65	1,216 (90)	160 (10)	2.96	2.50–3.50
AIDS-defining illness/symptom ^c	482	330 (68)	152 (32)	2.18	1.79–2.64	268 (56)	214 (44)	0.49	0.40–0.59
Abnormal pap/cervical cancer	138	68 (49)	70 (51)	0.97	0.69–1.36	88 (64)	50 (36)	0.69	0.48–0.97
Pregnancy and childbirth ^d	90	34 (38)	56 (62)	0.61	0.40–0.93	89 (99)	1 (1)	—	—
Drug/alcohol dependence	280	136 (49)	144 (51)	0.95	0.75–1.20	175 (63)	105 (37)	0.65	0.51–0.83
Visits with diagnoses not likely to prompt a HIV test ^e	13,813	6898 (50)	6915 (50)	1.00	Ref.	9945 (72)	3868 (28)	1.00	Ref.
Total visits	16,983	8734 (51)	8249 (49)			12,374 (73)	4609 (27)		

^aLate testers defined as women diagnosed with disease stage of AIDS within 12 months of HIV diagnosis; $n=928$. Women diagnosed with HIV-only disease stage or diagnosed with AIDS more than 1 year after HIV diagnosis during the study period; non-late tester, $n=1480$.

^bWomen of reproductive age defined as age 13–44 years old; $n=1819$. Women not of reproductive age defined as age >44 years old; $n=589$.

^cAIDS-defining illness/symptom including pulmonary tuberculosis, thrush, recurrent pneumonia, toxoplasmosis, lymphadenopathy, and unexplained weight loss.

^dNot included in the calculation of odds ratios for reproductive age category due to smaller numbers.

^eIncluding diabetes, hypertension, and stroke.

Bolded numbers represent values that were statistically significant.

Obtained from the South Carolina HIV/AIDS Reporting System (eHARS) surveillance database; eligible individuals were women who were South Carolina residents and ≥ 13 years of age.

who voluntarily request the service. This new policy is significant; it will facilitate the early detection of HIV infection for older individuals by removing the barrier to HIV testing caused by the cost for screening. In this population of HIV-infected women in South Carolina, Medicaid was 35% of the payer source for late testers and 29% of the payer source for women not of reproductive age, and so women not yet diagnosed may benefit greatly from this revised policy if routine testing is widely implemented. The proposed Medicaid expansion as part of health-care reform offers an opportunity to identify these women and ultimately reduce the cost associated with delayed diagnosis.^{16–18}

There were 16,983 overall missed opportunity visits for early HIV diagnosis, of which 51% of visits occurred among late testers and 27% of visits were for women not of reproductive age. The majority of visits were to hospital emergency departments (74%), which underscores the observation that this venue remains important in diagnosing women who are unaware of their HIV status.¹ However, the findings of this analysis, which includes data reported from health-care facilities, such as radiologic imaging centers and those dedicated to gynecological procedures, such as Papanicolaou screening, demonstrates that the acceptability and feasibility of routine HIV screening in nontraditional venues should be investigated. Women who are not having children and those not of reproductive age may receive United States Preventive Services Task Force^{19,20} recommended routine health screenings throughout their life, and rapid HIV test technology makes testing more realistic in settings outside of emergency departments. In South Carolina, expanded routine opt-out HIV screening in nontraditional health-care settings (e.g., radiologic imaging centers)

may further reduce the number of older women who are unaware of their HIV-infected status.

We considered all of the health departments PATS database visits, after excluding HIV-related visits, as missed opportunities for HIV testing. Ideally, all women visiting these STD, TB, and family planning clinics, regardless of eventual diagnosis, should be offered an HIV test. In this study, only 11% of the missed opportunity health-care visits for late testers and 4% of the visits for women not of reproductive age were likely to prompt HIV testing in a nonroutine testing environment. For diagnoses likely to prompt an HIV test by the provider, STD-related diagnoses were the most common. AIDS-defining illness/symptom diagnoses were much more common for late testers than non-late-testing women. These diagnoses should have prompted HIV tests. Liddicoat et al.²¹ found 50% of missed opportunity visits to a hospital documented an HIV trigger (i.e., men who have sex with men [MSM]), but HIV testing was recommended in only 27% of visits with triggers. Women not of reproductive age accounted for ~50% of AIDS-defining illness/symptom diagnoses (Table 2) while only accounting for 24% of the South Carolina study population. Again, it appears that these older women are not being offered testing even though they have physical symptoms; other studies have shown that older individuals infected with HIV are not tested because of misdiagnosed opportunistic infections.^{9,22}

The top procedures were not different for women of different disease stage and age (Table 3); however, women not of reproductive age are receiving more mammograms (ranked fourth) than women of reproductive age. Similarly,

TABLE 3. PROCEDURES PERFORMED AT HEALTH-CARE VISITS BY DISEASE STAGE AND REPRODUCTIVE AGE OF WOMEN WHO HAD VISITED A HEALTH-CARE FACILITY BEFORE DATE OF HIV DIAGNOSIS RANKED BY FREQUENCY, SOUTH CAROLINA, 1997–2007

Rank	<i>Late testers^a</i>		<i>Non-late testers^b</i>	
	<i>Top 10 procedures^c</i>	<i>Frequency of visits</i>	<i>Top 10 procedures</i>	<i>Frequency of visits</i>
1	Brief interview/evaluation (HD)	361	Brief interview/evaluation (HD)	720
2	Injection/infusion of prophylaxis (HD)	158	Injection/infusion of prophylaxis (HD)	210
3	Other x-ray of thorax (HD)	86	Microscopic exam of specimen from bladder, urine (NOS) (HD)	175
4	Pap smear (HD+BCN)	86	Other x-ray of thorax (HD)	144
5	EGD with closed biopsy (HD)	82	Other manually assisted delivery (HD)	86
6	Microscopic exam of specimen from bladder, urine (NOS) (HD)	79	Electrocardiogram (HD)	82
7	Transfusion of packed cells (HD)	64	Microscopic exam of blood, toxicology (HD)	80
8	Venous catheterization, not elsewhere classified (HD)	62	Other puncture of vein (HD)	74
9	Other puncture of vein (HD)	60	Closure of skin and other subcutaneous tissue (HD)	63
10	Closure of skin and other subcutaneous tissue (HD)	57	Gynecological examination (HD)	62

Rank	<i>Of reproductive age^d</i>		<i>Not of reproductive age^e</i>	
	<i>Top 10 procedures</i>	<i>Frequency of visits</i>	<i>Top 10 procedures</i>	<i>Frequency of visits</i>
1	Brief interview/evaluation (HD)	707	Brief interview/evaluation (HD)	374
2	Injection/infusion of prophylaxis (HD)	242	Injection/infusion of prophylaxis (HD)	126
3	Microscopic exam of specimen from bladder, urine (NOS) (HD)	172	Other x-ray of thorax (HD)	108
4	Other manually assisted delivery (HD)	134	Mammogram (HD+BCN)	94
5	Other x-ray of thorax (HD)	122	EGD with closed biopsy (HD)	80
6	Gynecological exam (HD)	105	Other puncture of vein (HD)	78
7	Closure of skin and other subcutaneous tissue (HD)	97	Pap smear (HD+BCN)	77
8	Other incision with drainage of skin and other subcutaneous tissue (HD)	88	Electrocardiogram (HD)	66
9	Other fetal monitoring (HD)	78	Venous catheterization, not elsewhere classified (HD)	61
10	Insertion of indwelling urinary catheter (HD)	69	Colonoscopy (HD)	43

^aLate testers defined as women diagnosed with disease stage of AIDS within 12 months of HIV diagnosis; *n*=928

^bNon-late testers defined as women diagnosed with HIV disease stage only or with AIDS more than 1 year after HIV diagnosis during the study time period; *n*=1480.

^cHD, Hospital Discharge statewide database maintained by the South Carolina Office of Research and Statistics. BCN, Best Chance Network; federally subsidized program that offers assistance to low-income women to obtain breast and cervical cancer screening; EGD, esophagogastroduodenoscopy; NOS, not otherwise specified.

^dWomen of reproductive age defined as age 13–44 years old; *n*=1819.

^eWomen not of reproductive age defined as age >44 years old; *n*=589.

Obtained from the South Carolina HIV/AIDS Reporting System (eHARS) surveillance database; eligible individuals were women who were South Carolina residents and ≥13 years of age.

late testing women received more Papanicolaou screening (ranked fourth) than non-late testers. Although procedures (e.g., mammograms) conducted in nontraditional settings may have initially been ordered by the woman's primary care provider, the key objective of CDC Program Collaboration and Service Integration²³ is to encourage service providers to offer various interrelated services to persons wherever they access health service and thereby promote continuity of care. The advent of rapid HIV testing technology with test results in 20 minutes makes routine screening in these environments (mammography, Papanicolaou screening) practical. Strong consideration should be given to study the

acceptability and feasibility of routine screening in these non-traditional settings especially in locations with high prevalence of HIV infection. Both providers and patients will need education to improve their understanding and acceptance of HIV testing in these nontraditional environments.

The findings in this report are subject to at least six limitations. First, although eHARS and ORS data are considered comprehensive, certain HIV/AIDS diagnoses and health-care visits may not have been reported. Second, women thought not to have missed opportunity visits may have in fact had medical encounters that were reported to databases not accessible for linkage in the current study. Third, although several variables

were available for linking records between the two datasets, matching might not have been successful in all cases. However, these three limitations would likely only result in an underestimation of the number of missed opportunities for testing. Fourth, HIV testing might have been recommended but rejected by certain patients during earlier visits. Fifth, referral for HIV testing might have occurred during some of the health-care encounters before HIV was diagnosed, making these visits not truly missed opportunities. The incidence of the latter two issues cannot be addressed with the current dataset, but given the multitude of visits that were documented for many patients these occurrences are unlikely to have had a substantial impact. Finally, certain non-late and late testers might not have been HIV infected at the time of the previous health-care encounters, some of which occurred several years before AIDS was diagnosed; therefore, those visits might not have represented true missed opportunities for HIV diagnosis. However, given the long average latent period of approximately 10 years after HIV infection before the onset of AIDS and our restriction of visits to 3 years before diagnosis for non-late testers,²⁴ the majority of individuals were most likely HIV-infected at the time of the included medical encounters.

In summary, our previous publication identified several missed opportunities in the general population for early HIV testing in emergency departments. However, the present analysis of only women, strongly suggests that the feasibility and acceptability of implementing a routine HIV testing program in nontraditional health-care settings should be investigated. Nontraditional settings located in high prevalence areas, such as radiologic imaging centers and at the time of Papanicolaou screening, may yet identify HIV-infected women who are not of reproductive age or are not having children. Other settings initially not thought of as ideal venues for routine HIV screening (e.g., jails, dental clinics, during labor and delivery),²⁵⁻²⁸ have all been shown to be suitable after investigative studies were conducted. This wider implementation of the CDC recommendations is likely to increase the yield of HIV-infected women who can be linked to care and provided with access to life-saving antiretroviral therapy. The realization of the full goals of routine screening will necessitate a revised approach to places where health-care providers think patients can and should be HIV tested.

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