

# **Cervical Cancer Screening Among Female Medicaid Beneficiaries With and Without Schizophrenia**

## **SHORT TITLE: Cervical Cancer Screening Among Women With Schizophrenia**

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### **ABSTRACT**

**Background and Hypothesis:** In the United States, women with schizophrenia face challenges in receiving gynecologic care, but little is known about how cervical cancer screening rates vary across time or states in a publicly insured population. We hypothesized that women Medicaid beneficiaries with schizophrenia would be less likely to receive cervical cancer screening across the U.S. compared with a control population, and that women with schizophrenia and other markers of vulnerability would be least likely to receive screening.

**Study Design:** This retrospective cohort study used U.S. Medicaid administrative data from across 44 states between 2002 and 2012 and examined differences in cervical cancer screening test rates among 283,950 female Medicaid beneficiaries with schizophrenia and a frequency-matched control group without serious mental illness, matched on age and race/ethnicity. Among women with schizophrenia, multivariable logistic regression estimated the odds of receiving cervical cancer screening using individual sociodemographics, comorbid conditions, and health care service utilization.

**Study Results:** Compared to the control group, women with schizophrenia were less likely to receive cervical cancer screening (OR=0.76; 95% CI 0.75-0.77). Among women with schizophrenia, non-White populations, younger women, urban dwellers, those with substance use

disorders, anxiety, and depression and those connected to primary care were more likely to complete screening.

**Conclusions:** Cervical cancer screening rates among U.S. women Medicaid beneficiaries with schizophrenia were suboptimal. To address cervical cancer care disparities for this population, interventions are needed to prioritize women with schizophrenia who are less engaged with the health care system or who reside in rural areas.

Key words: preventive care, women's health, gynecologic care, Papanicolaou test, health care disparities, health equity

## **BACKGROUND**

Since the 1950s, cervical cancer incidence and mortality in the United States have substantially decreased due to widespread screening with cervical cytology (the Papanicolaou, or Pap test).<sup>1</sup> However, disparities persist for vulnerable groups, including by socioeconomic status, race, ethnicity, and insurance type.<sup>2</sup> Women with serious mental illness (SMI), such as schizophrenia, experience high rates of homelessness and poverty and are more likely to be non-White.<sup>3-5</sup> Social risk factors, such as housing instability, poverty, and lack of transportation may pose additional challenges accessing timely and appropriate gynecologic care such as cervical cancer screening.<sup>6</sup> Altogether, these delays in timely cancer screening may contribute to the downstream higher mortality from cancers seen in populations with SMI.<sup>7</sup> These delays in preventive care contribute to premature mortality and shortened lifespan of 10-20 years among persons with schizophrenia.<sup>8</sup>

Within the United States, an estimated 87% of people with schizophrenia are enrolled in Medicaid, a joint federal and state insurance program for low-income adults, children, and people with disabilities, and administered by individual states.<sup>9</sup> Understanding patterns in access to reproductive and gynecologic care among this large population of publicly insured women with schizophrenia is important. Across the U.S. and world, studies (including a meta-analysis), have reported that women with schizophrenia have lower rates of cervical cancer screening and have a higher risk of developing cervical cancer than women without schizophrenia. Yet international studies have been mostly focused within countries with a single national healthcare system or insurance plan.<sup>10-13</sup> Within the U.S., cancer screening studies have used private or commercially insured populations; studies using publicly insured populations with Medicaid data have been limited to single health systems or single states.<sup>14-17</sup> As Medicaid insurance eligibility

and benefits vary across U.S. states, little is known about variation in screening across regions or high-risk subpopulations, and whether screening has improved over time.

This study aimed to compare cervical cancer screening rates for women with schizophrenia to those without SMI in a nationwide cohort of Medicaid beneficiaries over a 10-year period. We explored associations of cervical cancer screening with key sociodemographic variables, medical and psychiatric comorbidities, and health care utilization. We hypothesized that women Medicaid beneficiaries with schizophrenia would be less likely to receive cervical cancer screening across the U.S. compared with a control population, and that women with schizophrenia and other markers of vulnerability would be least likely to receive screening.

## **METHODS**

This retrospective cohort study compared cervical cancer screening among women with schizophrenia to a frequency-matched 1:1 cohort without SMI, matched by age and race/ethnicity upon first entry into the cohort. Data were from a parent study using Centers for Medicare and Medicaid Services Medicaid Analytic Extract (MAX) files, which provide a nationally representative sample of Medicaid beneficiaries.<sup>18</sup> Data availability restricted the parent sample to Medicaid beneficiaries enrolled between January 1, 2002 and December 31, 2012.

For the parent study, the cohort was restricted to Medicaid beneficiaries who were: 1) non-dually eligible for Medicare, 2) living in one of the participating 44 states, 3) having at least 11 months of eligibility during the calendar year. Cases included those with (a) one or more inpatient claims for schizophrenia (ICD-9 295.x) or (b) two or more outpatient claims for schizophrenia within a six-month period (24). The control cohort was defined as those without a

serious and persistent mental illness diagnosis, defined as no schizophrenia claims and no diagnoses of bipolar disorder (ICD-9 296.0x, 296.4x-296.7x, 296.80, 301.13), psychosis (ICD-9 298.x), delusional disorders (ICD-9 297.x), or pervasive developmental disorder (ICD-9 299.x) during the entire study period. In sensitivity analyses, we examined a control cohort that excluded individuals with major depressive disorder as well (ICD-9 296.20-296.26, 296.30-296.36). Individuals remained in their respective cohorts in each year of the 2002-2012 study period in which they continued to meet eligibility criteria. Differences in size between the two cohorts were possible due to not matching on dual eligible status. University of California, San Francisco Institutional Review Board approval was waived given use of deidentified data. Individual informed consent was waived as this study utilized archived data. The STROBE reporting guideline was followed.

The analytic dataset included in this substudy was restricted to 2003 to 2012 for women ages 21-64 years eligible for cervical cancer screening, per United States Preventive Services Task Force (USPSTF) guidelines and defined below.<sup>19-20</sup> Participants who received a hysterectomy (ICD-9 68.4x, 68.6x, 68.7x) during the study period were excluded.

### **Outcome assessment**

The primary outcome was receipt of at least one cervical cytology test (CPT P3000, P3001, G0123, G0124, G0141, G0143, G0144, G0145, G0147, G0148, Q0091, G0101, 88141, 88142, 88143, 88144, 88145, 88147, 88148, 88150, 88152, 88153, 88154, 88155, 88164, 88165, 88166, 88167, 88174, 88175, ICD-9 91.46), assessed dichotomously in every year of the study period, following previously validated methods.<sup>15-16</sup> In 2003, the USPSTF recommended cervical cancer screening with cytology every 3 years for women ages 21-64 years.<sup>19</sup> In March 2012, the

guidelines were updated to include the option of cytology and HPV co-testing among women ages 30 years and older and to expand the screening frequency to 5 years but continued to recommend screening every three years with cytology as a screening option.<sup>20</sup> As clinical care quality measures focus on the proportion of women up to date with cervical cancer screening, we report predicted triennial rates using the formula,  $p_3 = 1 - (1 - p_1)^3$  where  $p_1$  is the annual rate and  $p_3$  is the predicted triennial rate.<sup>15</sup> This formula calculates the probability of the screening event happening at least once within three years as the complement of the proportion who remain unscreened; it assumes the annual screening rate is constant and does not depend on whether an individual was screened in the prior year.

### **Covariates**

Covariates were coded categorically. Nominally assessed covariates included age, race/ethnicity (Non-Hispanic white, Non-Hispanic Black, American Indian/Alaskan Native, Asian, Hispanic or Latino, Native Hawaiian or other Pacific Islander, Multiracial, Unknown), urbancity (8 levels based on population density), substance use disorder (alcohol, opioid, cocaine, stimulant, cannabis, other), tobacco use disorder, other psychiatric disorders (anxiety, depression), sexually transmitted infections, number of mental health visits, and number of medical (non-mental health) visits.

### **Statistical Analysis**

Characteristics were summarized using frequencies to compare individuals with schizophrenia versus control cohorts using chi-square tests of homogeneity. Annual cervical cancer screening rates were calculated for each cohort. To account for clustering within stratum, all models

adjusted for matching factors, including age and race/ethnicity. Poisson models adjusted for confounders identified by using a directed acyclic graph. Within the schizophrenia cohort and control cohort, multivariable logistic regression was used to estimate associations between patient characteristics (demographics, comorbidities, health care utilization) and the odds of receiving annual cervical cancer screening, with robust standard errors to account for women being repeatedly followed over time. STATA Version 17 (College Station, TX) was used to perform statistical analyses.

## RESULTS

Our study population included 399,005 individuals in 2003 and 569,928 individuals in 2012 (**Table 1**). Women with schizophrenia had higher rates of co-occurring substance use disorders, anxiety, depression, and diagnosis of a sexually transmitted infection (STI) compared to the control cohort in 2003 and 2012. In addition, women with schizophrenia were more likely to have had medical and mental health outpatient visits in the calendar year compared to the control cohort.

In unadjusted analyses in 2003, 15.8% of women with schizophrenia received cervical cancer screening rate compared with 17.8% of women in the control cohort ( $p < .001$ ) (**Figure 1**), with predicted triennial screening rates of 40.3% versus 44.5% respectively. In 2012, 13.6% of women with schizophrenia received screening compared with 16.8% in the control cohort ( $p < .001$ ), with predicted triennial screening rates of 35.5% versus 42.4%, respectively. Yearly screening rates declined over time in both groups, with decreases of 2.2% and 1.1%, respectively, for the schizophrenia and control cohorts and the largest absolute rate difference



was 3.2 percentage points in 2012, with a higher rate in the control cohort. For populations predicted to be up-to-date on cervical cancer screening, the absolute difference in predicted triennial screening rates between women with schizophrenia and the control cohort increased, from 4.2% in 2003 to 6.9% in 2012.

In 2012, women with schizophrenia were 24% less likely to have received cervical cancer screening than women without SMI (OR=0.76, 95% CI 0.75-0.77), after adjusting for age, race/ethnicity, and urbanicity. Using a control cohort without major depression in a sensitivity analysis, differences in cervical cancer screening rates were attenuated but remained significant (13.6% schizophrenia vs. 16.4% control,  $p < .001$ ).

Among women with schizophrenia, we observed differences in cervical cancer screening rates by demographics, comorbidity, urbanicity, and healthcare utilization (**Table 2**). Similar associations and strengths of associations were observed among the control cohort for women without SMI (**Appendix A1**). Women identified as non-Hispanic Black (OR=1.34, 95% CI=1.31-1.38), Asian (OR=1.12, 95% CI=1.03-1.22), multiracial (OR=1.50, 95% CI=1.26-1.80), or Hispanic or Latino (OR=1.39, 95% CI=1.34-1.45) had higher odds of receiving cervical cancer screening compared to non-Hispanic White women. Compared to women ages 21-29 years, women in all other age groups had lower odds of receiving cervical cancer screening. Women ages 60-64 years had the lowest likelihood of screening (compared to youngest group, OR=0.26, 95% CI=0.25-0.27). Presence of any substance use disorder (OR=1.17, 95% CI=1.13-1.20), tobacco use disorder (OR=1.34, 95% CI 1.30-1.38), STI (OR=2.99, 95% CI=2.82-3.17), anxiety (OR=1.32, 95% CI=1.28-1.36), or depression (OR=1.38, 95% CI=1.34-1.41) diagnosis was associated with higher odds of screening.

In addition, women with schizophrenia living in more rural areas were less likely to receive cervical cancer screening compared to women in the most urban region (level 8 urbanicity compared to level 1 urbanicity (OR=0.41, 95% CI=0.32-0.53). Finally, a higher number of health care visits was associated with greater odds of receiving cervical cancer screening among women with schizophrenia. Women with schizophrenia who had at least two medical visits in the year had over seven times higher odds of receiving cervical cancer screening than women with schizophrenia without a medical visit (OR=7.27 95% CI=7.02-7.52). Women with schizophrenia who had at least one mental health visit in the year had 74% higher odds of receiving cervical cancer screening compared to women with schizophrenia without any mental health visits that year (OR=1.74 95% CI=1.70-1.78). Similar associations with urbanicity and utilization were observed in the control cohort (see **Appendix Table A1**).

**Figure 2** shows the geographic distribution of screening rates by state in 2012, the most recent year of data among women with schizophrenia. States located in the Northeast and Upper Midwest regions had higher screening rates, while more states located in the West and with large rural tracts had lower screening rates. Adjusted cervical cancer screening rates among women with schizophrenia ranged from 5-7% in South Dakota, Alaska, and Colorado to 17-20% in Michigan, Minnesota, and New Jersey. (See **Appendix Table A2** for details of unadjusted and adjusted individual state rates.)

## **DISCUSSION**

### **Key Findings**

Among a cohort of over 400,000 Medicaid beneficiaries across the United States., the rate of cervical cancer screening was modestly lower among women Medicaid beneficiaries with schizophrenia compared to those without SMI. Among women with schizophrenia, non-Hispanic white women were less likely to receive screening than women identified as non-Hispanic Black, Asian, Multiracial, and Hispanic or Latino. Older age women with schizophrenia were also less likely to receive screening, a pattern that has also been observed in the general population.<sup>21</sup> Declining rates of cervical cancer screening were observed among the schizophrenia and control cohorts, consistent with national trends.<sup>22</sup>

Our work extends our understanding of the care quality for cervical cancer screening that women with schizophrenia and public insurance received, from prior single state analyses to now a national picture in United States, and are consistent with prior work that women with schizophrenia are less likely to receive cancer screening.<sup>15,17</sup> The absolute difference in the proportion of women with schizophrenia and a control cohort who received cervical cancer screening in a given year was small (ranging from 2.0-3.2%). This may reflect efforts of healthcare personnel to deliver screening to all women, irrespective of mental illness status. However, over time annual cervical cancer screening rates declined more for women with schizophrenia compared with a control cohort. As guideline-concordant cervical cancer screening reflects the cumulative proportion of women who received screening across a three-year period, our predicted triennial rates suggests that disparities may be widening between women with schizophrenia and the general population.

While our findings of differences in cervical cancer screening by race are surprising given other documented racialized inequities in cancer screening,<sup>21</sup> our results are similar to other studies.<sup>15-16,23</sup> Prior work has identified uncontrolled psychiatric symptoms, stigmatizing attitudes

from clinicians, poor coordination/communication with healthcare staff, limited transportation, and fragmentation of mental health and cancer care delivery as major barriers that women with SMI encounter when accessing cancer screening.<sup>6,24</sup> Facilitators to accessing cancer screening included social support from friends, family, and healthcare providers.<sup>6</sup> Our findings that women with schizophrenia living in rural areas and those who are less engaged with health care services are the least likely to complete breast cancer screening complements these other studies. These results emphasize the need for transportation to mammography facilities or mammography units to bring care to where women with schizophrenia are living or already being seen for care.

We observed state-by-state variation in cervical cancer screening for women with schizophrenia. This may reflect differences in practice patterns, availability of medical resources, or differential access between rural and urban areas.<sup>25</sup> Our findings on rurality and its association with decreased cancer screening rates extend prior work from a Maryland Medicaid population with schizophrenia.<sup>17</sup> In our study, higher cervical cancer screening rates achieved by states (Vermont, New York, New Jersey, Minnesota) that were “bright spots” may represent proof of concept that higher screening rates can be attained despite the socioeconomic complexities of delivering preventive care to SMI populations. Further work also is needed to identify promising state-based initiatives and programs that can be scaled up nationally or adapted for local contexts, with greater attention paid to areas outside of metropolitan areas.

Our data provide a foundation from which to measure whether these trends persist, particularly in light of important policy and temporal changes in the United States. After passage of the Affordable Care Act in 2010, some states expanded Medicaid (public) insurance eligibility to cover more low-income Americans. This insurance expansion has been associated with improved cervical cancer screening rates in some studies<sup>26-28</sup> but not others,<sup>29-30</sup> with screening

rate increases differing by state, income, and race.<sup>30-31</sup> Similarly, the COVID-19 pandemic that began in 2020, with differing U.S. state responses, is associated with lower rates of cervical cancer screening, with rates disproportionately lower and for longer periods of time among racially and ethnically diverse populations.<sup>32</sup> Future work is needed to examine these policy changes and events for women with schizophrenia.

Notably, more women with schizophrenia had at least two medical visits in a calendar year than those without SMI, but they were still less likely to receive cervical cancer screening. Similar findings were observed in another study using private insurance administrative claims data in the U.S.<sup>16</sup> There, authors suggested that disparities in cervical cancer screening between women with and without SMI extend beyond having a general medical visit. Our study adds additional nuance by finding a strong positive association between the number of medical visits and receipt of screening when examining the cohort of women with schizophrenia. Due to the study's observational design, it is not possible to know whether this finding reflects women who were more likely to seek out health care overall or whether these women have a greater burden of disease that drives greater medical attention. For example, having a diagnosis of a STI had a robust association with Pap test receipt. It may be that this subgroup a) presented with symptoms and sought out gynecologic care; b) were treated for an STI and returned for additional gynecologic care; or c) sought out general medical care, received a Pap test and STI testing, and were found to have an STI. Similarly, positive associations between presence of other comorbidities (e.g., substance use disorder, tobacco use disorder, anxiety, depression) and receipt of cervical cancer screening may reflect a population who engages with health care services for management of other conditions and therefore is more likely to receive recommended cancer screening. Finally, other studies suggest that women with schizophrenia seek out care for urgent

medical problems but avoid preventive care<sup>33</sup>—indicating a need for better ways for clinicians to communicate the role of screening in health maintenance.

### **Clinical Implications**

Overall, our findings support the need to increase access to primary care providers through collaborative and integrated care models so that women with schizophrenia can receive timely reproductive and gynecologic services, including cancer prevention care. Integrated care initiatives have focused on metabolic screening for populations with SMI.<sup>34-35</sup> Routine cancer screening should also be included when thinking about incorporating medical care into specialty mental health settings including inpatient settings<sup>17,36</sup> and, when guideline-appropriate, should be initiated for young people with early psychosis. In addition, cancer prevention strategies, such as the human papillomavirus (HPV) vaccine, should be emphasized among women with SMI, as HPV is responsible for more than 95% of cervical cancer cases.<sup>37</sup> Finally, new tools for patient education and shared decision-making will be important in helping clinicians and women with schizophrenia communicate about risks and benefits of cancer screening procedures.

### **Study Limitations**

This study has several limitations. Despite use of a frequency-matched group, residual confounding likely remains. Medicaid and Medicare administrative claims race/ethnicity codes combine Hispanic ethnicity with race categories and may have limited accuracy for individuals of multiracial identity.<sup>38</sup> In addition, we were unable to measure housing status, health literacy, and prior cervical cancer screening receipt, which may be related to likelihood of screening. The methods for selecting the schizophrenia cohort may miss those who primarily receive crisis care

or do not engage with health care services. This study also excluded Medicaid and Medicare dual eligible beneficiaries, who represent a vulnerable population with high levels of complex care needs. The study sample also does not reflect uninsured, privately insured, or incarcerated populations. We also were unable to identify if women had a hysterectomy prior to the study period and subsequently did not need screening for cervical cancer. As claims data are limited by the quality of submitted claims and variability may exist across states, we are unable to determine if our findings reflect data quality or true changes within statewide screening. Furthermore, due to processing time for data availability, this study used data from 2003 to 2012. These claims precede Medicaid expansion under the Affordable Care Act (ACA) starting in 2014, which broadened access to health care services as well as established models that focus on integrating physical and behavioral health services, such as health homes models and Accountable Care Organizations.<sup>39</sup> Furthermore, it precedes the coronavirus pandemic, which may have affected preventive care delivery for this population. Evaluating the outcomes of these policy changes, initiatives, and service disruptions will be critical next steps. However, gaps in cancer screening continue to be a critical issue for vulnerable populations and women with schizophrenia still do not receive sufficient preventive care compared to the general population,<sup>40</sup> so this study's findings address relevant health inequities today.

Study strengths include the large, frequency-matched sample with longitudinal outcomes data, which capture important trends affecting Medicaid-insured women in the United States across ten years. This study provides a baseline for comparison for future studies to examine the effects of Medicaid expansion on cervical cancer screening for women with schizophrenia, and provides a basis for comparison across states, by urbanicity, and by health care utilization.

Additional studies should also examine differences between Medicaid-only beneficiaries and

dually eligible beneficiaries since dual eligible recipients are more likely to have multiple chronic conditions, which may affect their access to preventive care.<sup>41</sup> Though dual eligible beneficiaries tend to have lower incomes than Medicaid-only recipients, the higher reimbursement for health services through Medicare could increase their uptake of cervical cancer screening.<sup>42</sup> Finally, Pap tests are only the first step in cervical cancer care continuum. Future work will need to examine follow up care after abnormal Pap test results for women with schizophrenia. While out of the scope of this study, future work among women with schizophrenia and Medicaid beneficiaries should examine incidence of new cervical cancer diagnoses, as higher incidence of cervical cancer and poor prognosis for advanced cervical cancer has been observed in other studies among women with schizophrenia.<sup>10,43</sup>

## **CONCLUSION**

Among a national cohort of over 400,000 non-dually eligible Medicaid beneficiaries, women with schizophrenia were less likely to receive cervical cancer screening than women without SMI. Among those with schizophrenia, older women, non-Hispanic White women, and those residing in rural regions were less likely to have cervical cancer screening. Presence of comorbidity, STIs, and outpatient health care utilization (primary care or mental health) was associated with increased odds of cervical cancer screening. Given the variation observed across states, future outreach programs to improve cervical cancer outcomes in this priority population may learn from “high performing” states. State approaches to the integration of psychiatric and primary medical care for persons with SMI vary widely but offer a starting point to advance gynecologic and preventive cancer care.





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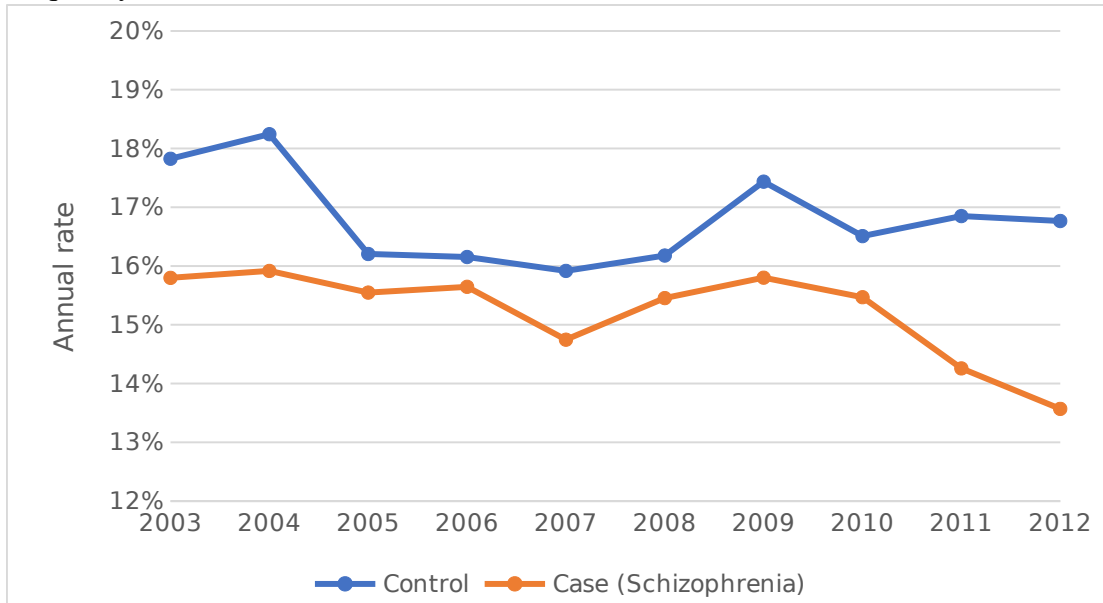
**Table 1.** Characteristics of Medicaid beneficiaries (N=968,933) enrolled in 2003 and 2012 and stratified by schizophrenia diagnosis.

	2003 (N=399,005)				P-value	2012 (N=569,928)				P-value
	Schizophrenia a (N = 196,571)		Control (N= 202,434)			Schizophrenia (N=283,950)		Control (N=285,978)		
<b>Demographics</b>										
<i>Age (mean ± SD)</i>	46.3 (10.4)		46.6 (10.8)			47.2 (11.2)		47.4 (11.8)		
<i>Age</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>		<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	
21-29	15,672	8.0	16,003	7.9	<.001	28,375	10.0	30,884	10.8	<.001
30-39	36,651	18.7	36,590	18.1		46,877	16.5	46,077	16.1	
40-49	68,360	34.7	66,821	33.0		73,621	25.9	67,755	23.7	
50-59	56,165	28.6	60,158	29.7		99,437	35.0	98,544	34.5	
60-64	19,723	10.0	22,862	11.3		35,640	12.6	42,718	14.9	
<i>Race</i>										
Non-Hispanic White	100,505	51.1	108,321	53.5	<.001	132,611	46.7	135,783	47.5	<.001
Non-Hispanic Black	57,429	29.2	60,962	30.1		92,496	32.6	96,684	33.8	
American Indian/Alaskan Native	1,295	0.7	1,350	0.7		2,158	0.8	2,316	0.8	
Asian	2,810	1.4	3,439	1.7		4,808	1.7	5,096	1.8	
Multiracial	332	0.2	164	0.1		861	0.3	788	0.3	
Hispanic or Latino	14,079	7.2	14,438	7.1		23,960	8.4	23,924	8.5	
Native Hawaiian/Pacific Islander	2,359	1.2	1,816	0.9		3,295	1.2	2,201	0.8	
Unknown	17,762	9.0	11,944	5.9		23,761	8.4	19,186	6.7	
<b>Urbanicity</b>										
1= 1M+	5,700	3.0	3,903	2.0	<.001	7,844	2.8	6,996	2.5	<.001
2= 250k-1M	3,387	1.8	2,236	1.1		4,682	1.7	4,223	1.5	
3= <250K (metro)	71,452	37.1	67,625	34.2		92,490	33.2	94,938	34.0	

4= 20K+ (adjacent to metro)	50,066	26.0	64,616	32.6		75,925	27.3	83,237	29.8	
5= 20K+ (not adjacent to metro)	40,440	21.0	38,901	19.7		66,477	23.9	60,998	21.8	
6= 2.5K+ (adjacent to metro)	16,693	8.7	17,586	8.9		24,754	8.9	25,087	9.0	
7= 2.5K+ (not adjacent to metro)	4,035	2.1	2,612	1.3		5,519	2.0	3,388	1.2	
8 <2.5K+ (adjacent to metro)	636	0.3	530	0.3		981	0.4	690	0.3	
<b>Comorbidities</b>										
Alcohol or other substance use disorder <sup>1</sup>	22,292	11.3	6,190	3.1	<.001	42,557	15.0	10,343	3.6	<.001
Tobacco use disorder	16,197	8.2	7,566	3.7	<.001	45,167	15.9	20,686	7.2	<.001
Anxiety	19,037	9.7	12,015	5.9	<.001	46,660	16.4	23,218	8.1	<.001
Depression	54,669	27.8	25,633	12.7	<.001	80,766	28.4	34,430	12.0	<.001
Sexually transmitted infections	2,668	1.4	1,970	1.0	<.001	5,214	1.8	3,667	1.3	<.001
<b>Health care utilization</b>										
Medical visits, at least 2 in year	103,857	52.8	99,507	49.2	<.001	167,101	58.9	143,224	50.1	<.001
Mental health visits, at least 1 in year	80,902	41.2	10,071	5.0	<.001	143,121	50.4	18,832	6.0	<.001

<sup>1</sup>“Any substance use disorder” includes alcohol and other substance use disorders, and excludes tobacco use disorder.

**Figure 1:** Annual cervical cancer screening rates for women with schizophrenia and frequency-matched controls, 2003-2012<sup>a</sup>



<sup>a</sup>Unadjusted annual cervical cancer screening rate defined by at least one claim for cervical cytology in given year per non-dual eligible beneficiary over number of non-dual eligible beneficiaries

**Table 2:** Cervical cancer screening among women with schizophrenia by demographics, comorbidities, and utilization, 2012<sup>a</sup>

<b>Demographics</b>	<b>Schizophrenia Cohort, (n=283,950)</b>	
	<b>OR</b>	<b>95% CI</b>
<i>Race/ethnicity<sup>1</sup></i>		
Non-Hispanic White	REF	---
Non-Hispanic Black	1.34	1.31-1.38
American Indian or Alaskan Native	1.00	0.87-1.14
Asian	1.12	1.03-1.22
Multiracial	1.50	1.26-1.80
Hispanic or Latino	1.39	1.34-1.45
Native Hawaiian or Pacific Islander	0.95	0.85-1.07
Unknown	1.10	1.06-1.15
<i>Age, years<sup>1</sup></i>		
21-29	REF	
30-39	0.65	0.63-0.68
40-49	0.50	0.48-0.51
50-59	0.37	0.36-0.38
60-64	0.26	0.25-0.27
<i>Urbanicity<sup>1</sup></i>		
1= 1M+	REF	
2= 250k-1M	0.59	0.53-0.66
3= <250K (metro)	0.65	0.61-0.69
4= 20K+ (adjacent to metro)	0.67	0.63-0.71
5= 20K+ (not adjacent to metro)	0.79	0.74-0.84
6= 2.5K+ (adjacent to metro)	0.66	0.61-0.70
7= 2.5K+ (not adjacent to metro)	0.49	0.44-0.54
8 <2.5K+ (adjacent to metro)	0.41	0.32-0.53
<b>Comorbidities</b>		
<i>Substance Use Disorders<sup>2</sup></i>		
Alcohol or other substance use disorder	1.17	1.13-1.20
Tobacco use disorder	1.34	1.30-1.38
<i>Sexually transmitted infection (any)<sup>1</sup></i>	2.99	2.82-3.17
<i>Psychiatric<sup>3</sup></i>		
Anxiety	1.32	1.28-1.36
Depression	1.38	1.34-1.41
<b>Health care utilization<sup>4</sup></b>		
>=2 medical visit in the year	7.27	7.02-7.52
>=1 mental health visit in the year	1.74	1.70-1.78

<sup>1</sup> Adjusted for demographics (race/ethnicity, age, urbanicity) unless variable is predictor of interest

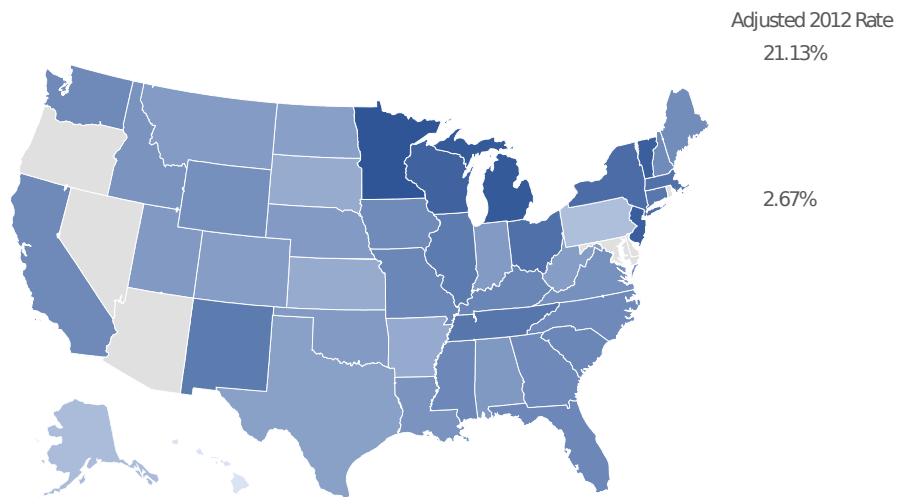
<sup>2</sup> Adjusted for demographics (race/ethnicity, age, urbanicity), axis I diagnosis

<sup>3</sup> Adjusted for demographics (race/ethnicity, age, urbanicity), history of substance use disorder



<sup>4</sup> Adjusted for demographics (race/ethnicity, age, urbanicity), axis I diagnosis, history of substance use disorder

**Figure 2:** Cervical cancer screening rates in 2012 across the United States for women with schizophrenia, adjusted for age and race/ethnicity.



Shading indicates percentage of non-dual eligible women with schizophrenia who received at least 1 cervical cytology test in 2012. Gray indicates states where data were not available.