Original Article

The Impact of the Patient Protection and Affordable Care Act on Insurance Coverage and Cancer-Directed Treatment in HIV-Infected Patients With Cancer in the United States

Kelsey L. Corrigan, MPH [1]; Leticia Nogueira, MPH, PhD [2]; K. Robin Yabroff, PhD[2]; Chun Chieh Lin, MBA, PhD[2,3]; Xuesong Han, PhD[2]; Junzo P. Chino, MD [1,4]; Anna E. Coghill, MPH, PhD [5]; Meredith Shiels, PhD [6]; Ahmedin Jemal, DVM, PhD [2]; and Gita Suneja, MD, MSHP[1,4,7]

BACKGROUND: To the authors' knowledge, little is known regarding the impact of the Patient Protection and Affordable Care Act (ACA) on people living with HIV and cancer (PLWHC), who have lower cancer treatment rates and worse cancer outcomes. To investigate this research gap, the authors examined the effects of the ACA on insurance coverage and receipt of cancer treatment among PLWHC in the United States. **METHODS:** HIV-infected individuals aged 18 to 64 years old with cancer diagnosed between 2011 and 2015 were identified in the National Cancer Data Base. Health insurance coverage and cancer treatment receipt were compared before and after implementation of the ACA in non–Medicaid expansion and Medicaid expansion states using difference-in-differences analysis. **RESULTS:** Of the 4794 PLWHC analyzed, approximately 49% resided in nonexpansion states and were more often uninsured (16.7% vs 4.2%), nonwhite (65.2% vs 60.2%), and of low income (36.3% vs 26.9%) compared with those in Medicaid expansion states. After 2014, the percentage of uninsured individuals decreased in expansion states (from 4.9% to 3%; $P = .01$) and nonexpansion states (from 17.6% to 14.6%; $P = .06$), possibly due to increased Medicaid coverage in expansion states (from 36.9% to 39.2%) and increased private insurance coverage in nonexpansion states (from 29.5% to 34.7%). There was no significant difference in cancer treatment receipt noted between Medicaid expansion and nonexpansion states. However, the percentage of PLWHC treated at academic facilities increased significantly only in expansion states (from 40.2% to 46.7% [$P < .0001$]; difference-in-differences analysis: 7.2 percentage points [$P = .02$]). **CONCLUSIONS:** The implementation of the ACA was associated with improved insurance coverage among PLWHC. Lack of insurance still is common in non–Medicaid expansion states. Patients with minority or low socioeconomic status more often resided in nonexpansion states, thereby highlighting the need for further insurance expansion. ***Cancer* 2020;126:559-566**. © *2019 American Cancer Society*.

KEYWORDS: health care disparities, HIV, insurance coverage, neoplasms, Patient Protection and Affordable Care Act.

INTRODUCTION

The Patient Protection and Affordable Care Act (ACA) has been associated with a substantial reduction in the number of uninsured adults throughout the United States.[1] Specifically, the ACA improved health insurance coverage options by allowing dependents to remain on their parents' private health insurance plans, facilitating the purchase of individual policies through the Marketplace, and expanding Medicaid in some states.[2-4] It also eliminated cost-sharing for evidence-based preventive services, including cancer screening. Prior research has demonstrated that Medicaid expansions are associated with improved access to cancer screening and therapies.[5-7] Medicaid expansions also are associated with shifts toward the diagnosis of cancer at an early stage[3,4,8] and decreased patient out-of-pocket costs.[9] Together, these effects could translate into better cancer care.

The ACA has improved care maintenance for individuals with HIV by eliminating preexisting condition exclusions[10] and has improved care receipt through the reduction of premiums and out-of-pocket expenses for a population disproportionally comprised of lower income and uninsured/underinsured patients.[11] This has led to increased insurance

Corresponding author: Gita Suneja, MD, MSHP, Department of Radiation Oncology, Duke University Medical Center, Box 3085, Durham, NC 27710; gita.suneja@icloud.com

[1]Duke University School of Medicine, Durham, North Carolina; [2]Surveillance and Health Services Research Program, American Cancer Society, Atlanta, Georgia; [3]Department of Neurology, University of Michigan Medical School, Ann Arbor, Michigan; [4]Department of Radiation Oncology, Duke Cancer Institute, Durham, North Carolina; [5]Cancer Epidemiology Program, H. Lee Moffitt Cancer Center and Research Institute, Tampa, Florida; [6]Division of Cancer Epidemiology and Genetics, Infections and Immunoepidemiology Branch, National Cancer Institute, Rockville, Maryland; [7]Department of Radiation Oncology and Global Health, Duke Global Health Institute, Durham, North Carolina

The data used in the study were derived from a limited data set of the National Cancer Data Base. We acknowledge the efforts of the American College of Surgeons, the Commission on Cancer, and the American Cancer Society in the creation of the National Cancer Data Base. The American College of Surgeons and the Commission on Cancer have not verified and are not responsible for the analytic or statistical methodology used, or the conclusions drawn from these data by the authors.

Additional supporting information may be found in the online version of this article.

DOI: 10.1002/cncr.32563, **Received:** April 26, 2019; **Revised:** July 19, 2019; **Accepted:** August 28, 2019, **Published online** November 11, 2019 in Wiley Online Library (wileyonlinelibrary.com)

availability and Medicaid coverage among HIV-infected patients in states with Medicaid expansion.[12] This growth of insurance coverage has resulted in better control of HIV and increased accessibility to primary care services,[13] which may lead to improved downstream health outcomes in this population.

Although the reported effects of the ACA on patients with cancer[2,9,14,15] and patients with HIV[12,13] have been established separately, to our knowledge little is known regarding the specific impact of the ACA on people living with HIV and cancer (PLWHC). Prior studies have demonstrated that PLWHC are at risk of not receiving cancer treatment, despite greater longevity due to improvements in HIV control.[16] In addition, PLWHC have worse cancer-specific survival compared with patients without HIV, partly due to disparities in cancer treatment.[17-20] Because insurance status and access to health care influence cancer treatment rates and outcomes, investigating the impact of the ACA on the receipt of cancer treatment is especially relevant as the public health burden of cancer in the aging HIV population continues to grow.[21,22]

The purpose of the current study was to assess the impact of the ACA on health insurance coverage and cancer treatment among PLWHC in Medicaid expansion and non–Medicaid expansion states in the United States.

MATERIALS AND METHODS

Patient Population

We used the National Cancer Data Base (NCDB), a hospital-based cancer registry jointly sponsored by the American College of Surgeons and the American Cancer Society that captures approximately 70% of all US cancer cases,[23] to analyze data from HIV-infected patients aged 18 to 64 years old who were diagnosed with cancers of the head and neck (oral cavity, pharynx, and larynx), upper gastrointestinal tract, colorectum, anus, lung, female breast, cervix, and prostate; Hodgkin lymphoma; and diffuse large B-cell lymphoma between January 2011 and December 2015. New cancer diagnosis and the date of diagnosis were determined using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes 140 to 209 and 230 to 239 and ICD-10-CM codes C00 to D49 and the initial recorded diagnosis date.[24] HIV status was determined from reported comorbidities using the ICD-9-CM diagnosis codes 042.00 to 044.90 and ICD-10-CM codes B20 to B22 and B24. Although certain comorbidities are underreported in the NCDB, prior studies have demonstrated high concordance between HIV/AIDS reporting in the NCDB and claims data in the Surveillance, Epidemiology, and End Results–Medicare database.[25] Patients with ICD codes for both cancer and HIV in their medical record were used for the current study. Patients aged ≥65 years were excluded due to age eligibility for Medicare coverage. Patients with stage 0 (according to the traditional American Joint Committee on Cancer staging system), occult, not any, or unknown cancer stage (1951 patients) and those with missing data regarding insurance status (54 patients) also were excluded.

We extracted clinical and demographic data, including age at diagnosis, sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other), health insurance coverage, zip code–level median income quintile (<$36,000,$36,000-$43,999,$44,000-$52,999,$53,000-$68,999, and ≥$69,000), year of cancer diagnosis, cancer type, reporting facility type, and receipt of cancer treatment. Insurance status was determined according to coding for the primary payer at the time of diagnosis and was categorized as private, Medicaid, Medicare, uninsured, or other. Facility type was categorized as community cancer program, comprehensive community cancer program, teaching/academic research program, National Cancer Institute program/network, and other. Receipt of cancer treatment was defined as receiving any surgery, radiotherapy, and/or systemic therapy in inpatient and outpatient settings for the first course of treatment.

Insurance Coverage and Cancer Care

The primary outcomes of the current study were insurance coverage, receipt of cancer treatment, and facility type before (pre-ACA) and after (post-ACA) implementation of the ACA and in Medicaid expansion versus non–Medicaid expansion states among PLWHC. The pre-ACA era was defined as January 2011 to December 2013. The post-ACA era was defined as January 2014 to December 2015 because a majority of states expanded Medicaid in 2014. Other time periods (before ACA, early ACA, and late ACA) also were evaluated (see Supporting Table 1), with findings similar to the comparison between the pre-ACA and post-ACA time periods.

Medicaid expansion states were defined as "expansion states" if they chose to exercise the expansion option through the ACA by developing a new state plan or using a Section 1115 waiver in 2010 to 2013, or if they chose to expand Medicaid to 138% of the Federal Poverty Level beginning in 2014. "Expansion states" were time varying, and were considered to be "nonexpansion states" until the time of Medicaid expansion. A total of 25 states expanded Medicaid eligibility. All states that did not fully

expand Medicaid by the end of 2015 were defined as nonexpansion states. Cancers diagnosed in 2015 in Arkansas, Indiana, and Pennsylvania (64 cancers) were excluded from the analysis because these states expanded Medicaid eligibility in 2015, the last year of the study period for the current study.

Statistical Analysis

Wald chi-square analysis was used for comparisons of proportions. Changes in the percentage of health insurance types at the time of cancer diagnosis, the rate of receipt of cancer treatment, and the percentage of PLWHC who received cancer treatment at each facility type throughout the 2 ACA periods were calculated for expansion and nonexpansion states. Paired comparisons of the changes between insurance coverage, treatment receipt, and facility type at which treatment was received between the 2 ACA periods were calculated. Difference-in-differences (DD) analyses were used to assess the association between Medicaid expansion states and changes in health insurance coverage, receipt of cancer treatment, and the facility type. Patients in Medicaid expansion states were considered to be the intervention group and patients in nonexpansion states were the control group. To calculate DD estimates, we fitted crude and multivariable linear probability models adjusting for age, sex, race/ethnicity, year of diagnosis, and zip code–level median income quintile. All statistical analyses were performed using SAS statistical software (version 9.4; SAS Institute Inc).

The current study was granted exemption from full review by the Morehouse School of Medicine institutional review board.

RESULTS

Of the 4794 PLWHC diagnosed with cancer between 2011 and 2015, a total of 2331 (48.6%) lived in nonexpansion states and 2448 (51.1%) lived in Medicaid expansion states. Across the entire PLWHC population analyzed herein, the median age at the time of cancer diagnosis was 50 years (interquartile range, 44-57 years) and the majority of patients were male (75%) and nonwhite (13.5% were Hispanic and 49.3% were black). The 2 most common malignancies diagnosed in PLWHC were diffuse large B-cell lymphoma (22.9%) and lung cancer (17.9%). PLWHC most commonly received cancer treatment in health facilities characterized as teaching/academic research programs (40.8%). All patient demographic and clinical characteristics for the Medicaid expansion cohorts are shown in Table 1.

In non–Medicaid expansion states, PLWHC more often were uninsured (16.7% vs 4.2%; $P < .0001$), treated at comprehensive community cancer programs (26.9% vs 18.6%; $P < .0001$), identified as being of black race (54.2% vs 44.7%; $P < .0001$), and resided in areas with lower median incomes (36.3% vs 26.9% in areas with a median income <$36,000; $P < .0001$) compared with PLWHC residing in expansion states. PLWHC in Medicaid expansion states were more likely to be white (37.7% vs 33.8%) and to be treated at a teaching/academic research program (44.3% vs 37.3%) compared with those in nonexpansion states (all $P < .0001$).

Insurance Coverage

Across all states, the percentage uninsured among PLWHC decreased from 11.5% pre-ACA to 8.5% post-ACA. The number of uninsured PLWHC was significantly higher in nonexpansion states compared with expansion states (Fig. 1 Top). Table 2 shows DD estimates of the changes in the percentage of PLWHC with Medicaid, private insurance, or no insurance. As expected, after adjustment for sociodemographic factors, there was increased Medicaid coverage noted in expansion states compared with nonexpansion states (DD, 5.8 percentage points [pp]; $P = .02$) in the post-ACA era (Fig. 1 Middle). In contrast, there was a significant increase in privately insured PLWHC observed in non–Medicaid expansion states compared with expansion states (DD, −5.6 pp; $P = .03$) (Fig. 1 Bottom). As a result, the percentage of uninsured patients decreased in both Medicaid expansion and nonexpansion states (DD, 1.0 pp; $P = .6$).

Receipt of Cancer Treatment

Table 3 shows DD estimates of the changes in the percentage of PLWHC who received cancer treatment and the facilities at which these patients received their treatment. Although there was no change noted in the percentage of patients who received cancer treatment post-ACA, there was a significant increase observed with regard to the percentage of PLWHC who received treatment at teaching/academic research programs in expansion states (from 40.2% pre-ACA to 46.7% post-ACA; $P = .003$), but not in non–Medicaid expansion states (DD, 7.2 pp; $P = .02$). Overall, PLWHC with private insurance were more likely to receive treatment (87.2%) compared with those with Medicaid coverage (80.8%) or those who were uninsured (79.7%) (Table 4).

TABLE 1. Demographic and Clinical Characteristics Among HIV-Infected Patients With Cancer in Medicaid Expansion Versus Non–Medicaid Expansion States

Characteristic	Non–Medicaid Expansion States[a] (No. [%])	Medicaid Expansion States[b] (No. [%])	*P*
Total	2331 (100.0)	2448 (100.0)	
Time Period			
Pre-ACA	1457 (62.5)	1426 (58.3)	
Post-ACA	874 (37.5)	1022 (41.7)	.0027
Median age at diagnosis (SD), y	49.0 (9.2)	50.6 (8.9)	<.0001
Sex			
Male	1734 (74.4)	1849 (75.5)	
Female	597 (25.6)	599 (24.5)	.3621
Race/ethnicity			
White	784 (33.8)	915 (37.7)	
Black	1257 (54.2)	1085 (44.7)	
Hispanic	255 (11.0)	376 (15.5)	
Other	25 (1.1)	51 (2.1)	<.0001
Insurance			
Private	743 (31.9)	808 (33.0)	
Medicare	526 (22.6)	592 (24.2)	
Medicaid	642 (27.5)	935 (38.2)	
Uninsured	390 (16.7)	102 (4.2)	
Other	30 (1.3)	11 (0.4)	<.0001
Facility type			
NCI designated	287 (12.6)	456 (19.3)	
Comprehensive	612 (26.9)	441 (18.6)	
Teaching	849 (37.3)	1050 (44.3)	
Community	105 (4.6)	185 (7.8)	
Other	426 (18.7)	236 (10.0)	<.0001
Median income quintile			
<$36,000	842 (36.3)	656 (26.9)	
$36,000-$43,999	492 (21.2)	432 (17.7)	
$44,000-$52,999	454 (19.6)	405 (16.6)	
$53,000-$68,999	358 (15.4)	498 (20.4)	
≥$69,000	174 (7.5)	447 (18.3)	<.0001
Cancer site			
DLBCL	559 (24.0)	538 (22.0)	
HL	227 (9.7)	230 (9.4)	
Head and neck	178 (7.6)	225 (9.2)	
Cervix	86 (3.7)	64 (2.6)	
Lung	436 (18.7)	422 (17.2)	
Colorectal	149 (6.4)	161 (6.6)	
Esophagus	24 (1.0)	38 (1.6)	
Stomach	39 (1.7)	34 (1.4)	
Pancreas	56 (2.4)	62 (2.5)	
Breast	126 (5.4)	124 (5.1)	
Anal	283 (12.1)	307 (12.5)	
Prostate	168 (7.2)	243 (9.9)	.0001

Abbreviations: ACA, Patient Protection and Affordable Care Act; DLBCL, diffuse large B-cell lymphoma; HL, Hodgkin lymphoma; NCI, National Cancer Institute; y, years.
[a]Non–Medicaid expansion states include Alaska, Alabama, Florida, Georgia, Idaho, Indiana, Kansas, Louisiana, Maine, Missouri, Mississippi, Montana, Nebraska, North Carolina, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Wisconsin, and Wyoming.
[b]Medicaid expansion states include Arizona, Arkansas, California, Colorado, Connecticut, District of Columbia, Delaware, Hawaii, Illinois, Iowa, Kentucky, Massachusetts, Maryland, Minnesota, New Jersey, New Mexico, Nevada, New York, North Dakota, Ohio, Oregon, Rhode Island, Vermont, Washington, and West Virginia.

DISCUSSION

In this national study of individuals living with HIV and newly diagnosed with cancer, we found that insurance coverage improved in both Medicaid expansion and non–Medicaid expansion states after implementation of the ACA. The improved insurance coverage in nonexpansion states was driven by increases in private insurance compared with the increased Medicaid coverage that occurred primarily in expansion states. However, even post-ACA, the percentage of uninsured individuals was 5 times higher in nonexpansion states compared with expansion states. Nearly one-half of the US population of individuals infected with HIV live in non–Medicaid expansion states, and PLWHC in these states are more likely to be of lower income. Thus, the most vulnerable PLWHC live in geographic locations associated with poor accessibility to insurance coverage.

In the general cancer population, certain demographic risk factors, such as nonwhite race and low income, are associated with decreased receipt of cancer

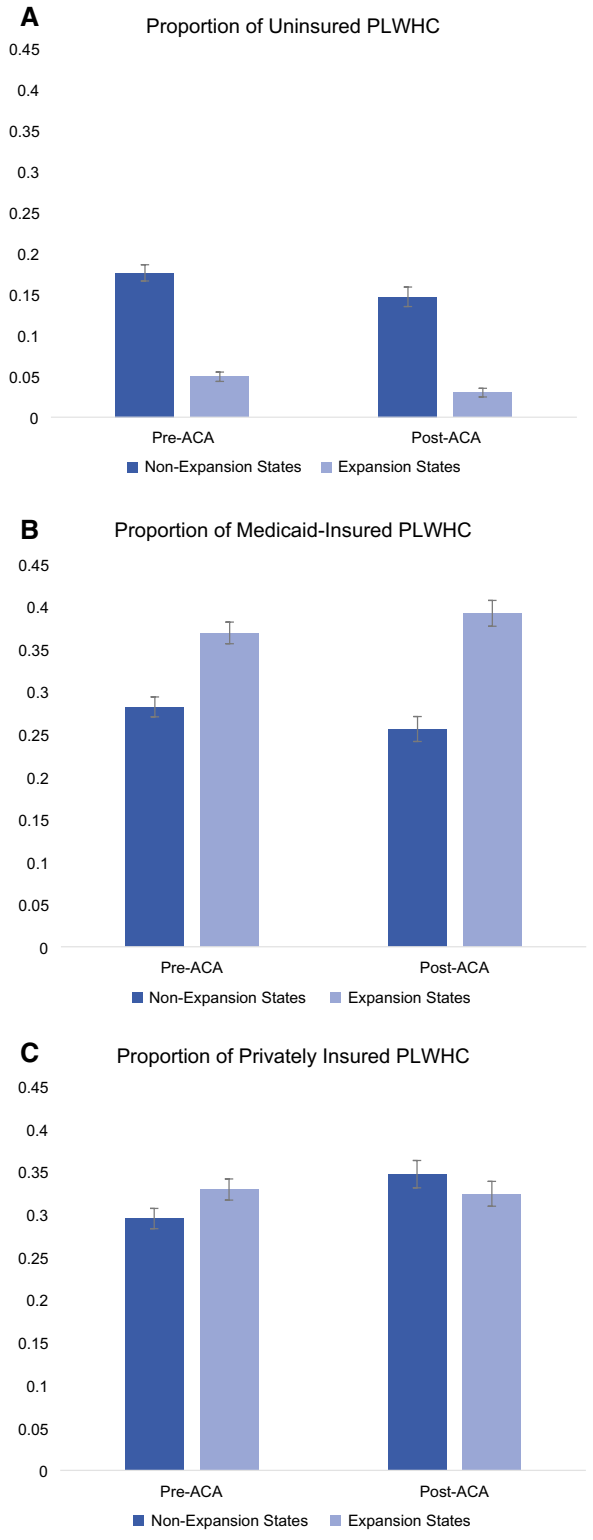

Figure 1. Percentage of (*Top*) uninsured, (*Middle*) Medicaid-insured, and (*Bottom*) privately insured HIV-infected patients with cancer in non–Medicaid expansion states and Medicaid expansion states. ACA indicates Patient Protection and Affordable Care Act; PLWHC, people living with HIV and cancer.

TABLE 2. Difference-in-Differences Analysis for Insurance Coverage in Non–Medicaid Expansion States Versus Medicaid Expansion States

	Non–Medicaid Expansion States				Medicaid Expansion States				Unadjusted		Adjusted[a]	
	Pre-ACA	Post-ACA	Difference	*P*	Pre-ACA	Post-ACA	Difference	*P*	DD (95% CI)	*P*	DD (95% CI)	*P*
Uninsured	17.6%	14.7%	−2.9 (−6.0 to 0.1)	.0605	4.94%	3%	−1.9 (−3.5 to −0.4)	.0129	1.0 (−2.4 to 4.4)	.5761	1.0 (−2.9 to 4.9)	.6045
Medicaid insurance	28.2%	25.6%	−2.6 (−6.3 to 1.1)	.163	36.9%	39.2%	2.3 (−1.6 to 6.2)	.2432	4.9 (−0.4 to 10.3)	.0708	5.8 (0.8 to 10.9)	.0236
Private Insurance	29.5%	34.7%	5.2 (1.3 to 9.1)	.0092	32.9%	32.4%	−0.5 (−4.2 to 3.3)	.7959	−5.7 (−11.1 to −0.3)	.0396	−5.6 (−10.8 to −0.5)	.0333

Abbreviations: ACA, Patient Protection and Affordable Care Act; DD, difference-in-differences analysis.
[a]Adjusted for age, sex, race/ethnicity, year of diagnosis, and zip code–level median income quintile.

TABLE 3. Difference-in-Differences Analysis for Cancer Treatment Receipt With Cancer Treatment Facility Type in Non-Medicaid Expansion States Versus Medicaid Expansion States

	Non–Medicaid Expansion States				Medicaid Expansion States				Unadjusted		Adjusted[a]	
	Pre-ACA	Post-ACA	Difference	*P*	Pre-ACA	Post-ACA	Difference	*P*	DD (95% CI)	*P*	DD (95% CI)	*P*
Received cancer treatment	82.2%	85.2%	3.1 (−0.9 to 7.0)	.1316	83.7%	85.1%	1.4 (−2.5 to 5.3)	.4872	−1.7 (−7.2 to 3.9)	.5555	−1.1 (−6.5 to 4.3)	.6921
NCI-designated	13.6%	13.2%	−0.4 (−3.5 to 2.7)	.7955	20%	19.6%	−0.4 (−3.8 to 3.1)	.8201	0.0 (−4.6 to 4.6)	.9969	−0.5 (−5.1 to 4.2)	.8477
Comprehensive	22.9%	27.4%	4.5 (0.6 to 8.5)	.0253	17.4%	19.7%	2.3 (−1.1 to 5.7)	.1856	−2.3 (−7.5 to 3.0)	.397	−3.1 (−8.1 to 2.0)	.2368
Teaching	37.1%	37%	−0.1 (−4.4 to 4.3)	.9821	40.2%	46.7%	6.5 (2.2 to 10.8)	.0029	6.6 (0.4 to 12.7)	.0363	7.2 (1.1 to 13.3)	.0217
Community	3.79%	5.59%	1.8 (−0.2 to 3.8)	.0718	8.2%	5.06%	−3.1 (−5.3 to −1.0)	.0036	−4.9 (−7.8 to −2.1)	.0008	−4.6 (−7.5 to −1.8)	.0015
Other facility	19.3%	16%	−3.3 (−6.7 to 0.1)	.0599	9.6%	8.88%	−0.7 (−3.2 to 1.8)	.5692	2.6 (−1.7 to 6.8)	.2356	2.8 (−1.5 to 7.0)	.1984

Abbreviations: ACA, Patient Protection and Affordable Care Act; DD, difference-in-differences analysis; NCI, National Cancer Institute.
[a]Adjusted for age, sex, race/ethnicity, year of diagnosis, and zip code–level median income quintile.

TABLE 4. Receipt of Cancer Treatment Among PLWHC From 2011 Through 2015 Stratified by Insurance Type

Insurance Type	Cancer Treatment Receipt Rate[a]
Private	87.20%
Medicare	86.05%
Medicaid	80.77%
Uninsured	79.70%
Other[b]	83.88%

Abbreviation: PLWHC, people living with HIV and cancer.
[a]Adjusted for age, sex, race/ethnicity, year of diagnosis, and zip code–level median income quintile.
[b]Other includes non-Medicare and non–Medicaid government-funded insurance.

treatment.[26-28] Although there was no difference noted with regard to the receipt of cancer treatment between nonexpansion and expansion states in the current study, PLWHC in non–Medicaid expansion states were more likely to be of nonwhite race and to reside in low-income areas, thereby suggesting that they may be at higher risk of receiving suboptimal cancer treatment and subsequently have poor outcomes due to sociodemographic factors. After implementation of the ACA, PLWHC residing in expansion states were more likely to be treated at teaching and academic research programs, at which they may receive more specialized or integrated cancer and HIV care with greater access to clinical trials.[29,30] This could be due to Medicaid expansion or to other factors. However, further insurance coverage options are needed to ensure access to appropriate cancer services, including prevention, screening, diagnosis, management, and surveillance, for uninsured PLWHC living in non–Medicaid expansion states.

Other studies of the general cancer population have demonstrated that access to cancer control services is enhanced by the ACA. Individuals living in Medicaid expansion states are more likely to be up to date with cancer screening compared with those living in nonexpansion states.[6,31] Medicaid expansion also has been found to be associated with an earlier stage of disease at the time of diagnosis among patients newly diagnosed with cancer[3,4] and who receive radiotherapy as part of their cancer treatment regimen.[2] Furthermore, cancer survivors living in Medicaid expansion states have greater access to cancer surveillance and routine follow-up care.[32] Finally, individuals living in expansion states are more likely to be tested and treated for HIV.[13,33] Although the results of the current study demonstrated similar benefits from the ACA among those living in expansion and nonexpansion states, we found that a large percentage of the nonwhite and

low-income population of PLWHC lived in nonexpansion states. Therefore, the results of the current study highlight the need for additional Medicaid expansion, particularly to those populations at risk of receiving less or suboptimal cancer care.

We did not find significant differences with regard to the receipt of cancer treatment among PLWHC, potentially due to the relatively short follow-up period after the full implementation of Medicaid expansion, the introduction of private insurance coverage options through Marketplace, and other ACA policy changes in 2014. Healthcare access is complex and multifactorial, and although insurance status is an important contributor, there are other factors leading to cancer care disparities and poor cancer outcomes.[34,35] Our prior work demonstrated that even after controlling for insurance status, HIV was associated with a lack of receipt of cancer treatment.[17] Nonetheless, insurance coverage for basic cancer services is an important first step toward mitigating disparities among PLWHC.

The current study has several strengths, including the use of a nationwide comprehensive database, which to our knowledge makes it among the largest published studies of PLWHC to date. The current study also has several limitations. First, these data were not population based because the NCDB data comes only from hospitals that have cancer programs accredited through the Commission on Cancer of the American College of Surgeons. However, the NCDB covers approximately 72% of newly diagnosed cancer patients in the United States,[36] and prior studies of the effects of the ACA on insurance coverage and stage of disease at diagnosis based on the NCDB[4] were remarkably similar to those based on population-based cancer registries.[3] Second, health insurance coverage is collected only once in the NCDB. Therefore, we were not able to distinguish those patients who were uninsured before their diagnosis and gained Medicaid coverage due to their cancer diagnosis from those who were continuously insured by Medicaid. We also were not able to include patients with liver cancer herein due to the wide range of therapy options (eg, transarterial chemoembolization and transplantation) that are not captured in detail in the NCDB. Finally, due to the delay between healthcare policy implementation and causative survival benefit, currently available data are insufficient to fully evaluate the association between insurance expansion and cancer outcomes. The period after full implementation of the ACA in 2014 was somewhat limited, particularly for those states that expanded in 2015. Accordingly, the small effect size noted in the current study was anticipated given the limited follow-up in the post-ACA period. Ongoing evaluation of the potential benefits of the ACA on cancer survival for PLWHC will be important for future research.

To the best of our knowledge, the current study is the first to measure the benefits of the ACA on insurance coverage and receipt of cancer treatment in PLWHC. The findings have highlighted that a significant percentage of PLWHC in the United States are at risk of uninsurance, which may exacerbate already existing disparities in cancer treatment receipt and outcomes. There is an urgent need for further insurance expansion to improve access to care and cancer outcomes for PLWHC living in all states.

FUNDING SUPPORT

Supported by American Cancer Society Intramural Research Funding and the intramural program of the National Cancer Institute.

CONFLICT OF INTEREST DISCLOSURES

At the time this work was completed, Leticia Nogueira, K. Robin Yabroff, Chun Chieh Lin, Xuesong Han, and Ahmedin Jemal were employed by the American Cancer Society, which receives grants from private and corporate foundations, including foundations associated with companies in the health sector, for research outside the submitted work. They were not funded by or key personnel for any of these grants, and their salaries were solely funded through American Cancer Society funds. Gita Suneja was supported by grants K08CA228631 and P30AI064518 from the US National Institutes of Health for work performed as part of the current study. The other authors made no disclosures.

AUTHOR CONTRIBUTIONS

Kelsey L. Corrigan: Data curation, formal analysis, investigation, methodology, validation, visualization, and writing–original draft. **Leticia Nogueira:** Data curation, formal analysis, funding acquisition, investigation, methodology, resources, software, validation, visualization, and writing–review and editing. **K. Robin Yabroff:** Conceptualization, data curation, funding acquisition, investigation, project administration, resources, supervision, and writing–review and editing. **Chun Chieh Lin:** Data curation, funding acquisition, methodology, resources, and writing–review and editing. **Xuesong Han:** Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, supervision, and writing–review and editing. **Junzo P. Chino:** Formal analysis, methodology, resources, software, and writing–review and editing. **Anna E. Coghill:** Data curation, formal analysis, investigation, methodology, resources, visualization, and writing–review and editing. **Meredith Shiels:** Data curation, formal analysis, funding acquisition, investigation, methodology, resources, and writing–review and editing. **Ahmedin Jemal:** Conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, and writing–review and editing. **Gita Suneja:** Conceptualization, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, and writing–review and editing.

REFERENCES

1. Obama B. United States health care reform: progress to date and next steps. *JAMA*. 2016;316:525-532.
2. Chino F, Suneja G, Moss H, Zafar SY, Havrilesky L, Chino J. Health care disparities in cancer patients receiving radiation: changes in insurance status after Medicaid expansion under the Affordable Care Act. *Int J Radiat Oncol Biol Phys*. 2018;101:9-20.

3. Han X, Yabroff KR, Ward E, Brawley OW, Jemal A. Comparison of insurance status and diagnosis stage among patients with newly diagnosed cancer before vs after implementation of the Patient Protection and Affordable Care Act. *JAMA Oncol*. 2018;4:1713-1720.
4. Jemal A, Lin CC, Davidoff AJ, Han X. Changes in insurance coverage and stage at diagnosis among nonelderly patients with cancer after the Affordable Care Act. *J Clin Oncol*. 2017;35:3906-3915.
5. Brooks GA, Hoverman JR, Colla CH. The Affordable Care Act and cancer care delivery. *Cancer J*. 2017;23:163-167.
6. Sabik LM, Tarazi WW, Bradley CJ. State Medicaid expansion decisions and disparities in women's cancer screening. *Am J Prev Med*. 2015;48:98-103.
7. Wharam JF, Zhang F, Landon BE, LeCates R, Soumerai S, Ross-Degnan D. Colorectal cancer screening in a nationwide high-deductible health plan before and after the Affordable Care Act. *Med Care*. 2016;54:466-473.
8. Soni A, Simon K, Cawley J, Sabik L. Effect of Medicaid expansions of 2014 on overall and early-stage cancer diagnoses. *Am J Public Health*. 2018;108:216-218.
9. Dixon MS, Cole AL, Dusetzina SB. Out-of-pocket spending under the Affordable Care Act for patients with cancer. *Cancer J*. 2017; 23:175-180.
10. Kaiser Family Foundation. Obamacare and You: If You Have a Pre-Existing Condition. Kaiser Family Foundation; 2013.
11. Brennan C. ACA and HIV: opportunities and challenges. *HIV Clin*. 2014;26:1, 4-6.
12. Hood JE, Buskin SE, Anderson BJ, et al. A cross-jurisdictional evaluation of insurance coverage among HIV care patients following the Affordable Care Act. *AIDS Care*. 2017;29:511-515.
13. Satre DD, Altschuler A, Parthasarathy S, Silverberg MJ, Volberding P, Campbell CI. Implementation and operational research: Affordable Care Act implementation in a California health care system leads to growth in HIV-positive patient enrollment and changes in patient characteristics. *J Acquir Immune Defic Syndr*. 2016;73:e76-e82.
14. Silva A, Molina Y, Hunt B, Markossian T, Saiyed N. Potential impact of the Affordable Care Act's preventive services provision on breast cancer stage: a preliminary assessment. *Cancer Epidemiol*. 2017;49:108-111.
15. Robbins AS, Han X, Ward EM, Simard EP, Zheng Z, Jemal A. Association between the Affordable Care Act dependent coverage expansion and cervical cancer stage and treatment in young women. *JAMA*. 2015;314:2189-2191.
16. Smith CJ, Ryom L, Weber R, et al;D:A:D Study Group. Trends in underlying causes of death in people with HIV from 1999 to 2011 (D:A:D): a multicohort collaboration. *Lancet*. 2014;384:241-248.
17. Suneja G, Lin CC, Simard EP, Han X, Engels EA, Jemal A. Disparities in cancer treatment among patients infected with the human immunodeficiency virus. *Cancer*. 2016;122:2399-2407.
18. Han X, Jemal A, Hulland E, et al. HIV infection and survival of lymphoma patients in the era of highly active antiretroviral therapy. *Cancer Epidemiol Biomarkers Prev*. 2017;26:303-311.
19. Suneja G, Coghill A. Cancer care disparities in people with HIV in the United States. *Curr Opin HIV AIDS*. 2017;12:63-68.
20. Coghill AE, Shiels MS, Suneja G, Engels EA. Elevated cancer-specific mortality among HIV-infected patients in the United States. *J Clin Oncol*. 2015;33:2376-2383.
21. Shiels MS, Pfeiffer RM, Gail MH, et al. Cancer burden in the HIV-infected population in the United States. *J Natl Cancer Inst*. 2011;103:753-762.
22. Seaberg EC, Wiley D, Martinez-Maza O, et al;Multicenter AIDS Cohort Study (MACS). Cancer incidence in the multicenter AIDS Cohort Study before and during the HAART era: 1984 to 2007. *Cancer*. 2010;116:5507-5516.
23. Lerro CC, Robbins AS, Phillips JL, Stewart AK. Comparison of cases captured in the National Cancer Data Base with those in population-based central cancer registries. *Ann Surg Oncol*. 2013;20: 1759-1765.
24. American College of Surgeons Commission on Cancer. Data Items and Record Layout for Submissions to NCDB Made During 2015 Using NAACCR Layout 12.0 Specifications (CS version 2.05). American College of Surgeons; 2014.
25. Lin CC, Virgo KS, Robbins AS, Jemal A, Ward EM. Comparison of comorbid medical conditions in the National Cancer Database and the SEER-Medicare Database. *Ann Surg Oncol*. 2016;23:4139-4148.
26. Shavers VL, Brown ML. Racial and ethnic disparities in the receipt of cancer treatment. *J Natl Cancer Inst*. 2002;94:334-357.
27. Gross CP, Smith BD, Wolf E, Andersen M. Racial disparities in cancer therapy: did the gap narrow between 1992 and 2002? *Cancer*. 2008;112:900-908.
28. Du XL, Lin CC, Johnson NJ, Altekruse S. Effects of individual-level socioeconomic factors on racial disparities in cancer treatment and survival: findings from the National Longitudinal Mortality Study, 1979-2003. *Cancer*. 2011;117:3242-3251.
29. Meguid RA, Brooke BS, Chang DC, Sherwood JT, Brock MV, Yang SC. Are surgical outcomes for lung cancer resections improved at teaching hospitals? *Ann Thorac Surg*. 2008;85:1015-1024; discussion 1024-1025.
30. David JM, Ho AS, Luu M, et al. Treatment at high-volume facilities and academic centers is independently associated with improved survival in patients with locally advanced head and neck cancer. *Cancer*. 2017;123:3933-3942.
31. Choi SK, Adams SA, Eberth JM, et al. Medicaid coverage expansion and implications for cancer disparities. *Am J Public Health*. 2015;105(suppl 5):S706-S712.
32. Tarazi WW, Bradley CJ, Harless DW, Bear HD, Sabik LM. Medicaid expansion and access to care among cancer survivors: a baseline overview. *J Cancer Surviv*. 2016;10:583-592.
33. Wagner Z, Wu Y, Sood N. The Affordable Care Act may increase the number of people getting tested for HIV by nearly 500,000 by 2017. *Health Aff (Millwood)*. 2014;33:378-385.
34. Pan HY, Walker GV, Grant SR, et al. Insurance status and racial disparities in cancer-specific mortality in the United States: a population-based analysis. *Cancer Epidemiol Biomarkers Prev*. 2017;26:869-875.
35. Walker GV, Grant SR, Guadagnolo BA, et al. Disparities in stage at diagnosis, treatment, and survival in nonelderly adult patients with cancer according to insurance status. *J Clin Oncol*. 2014;32: 3118-3125.
36. Mallin K, Browner A, Palis B, et al. Incident cases captured in the National Cancer Database compared with those in U.S. population based central cancer registries in 2012-2014. *Ann Surg Oncol*. 2019;26:1604-1612.