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Review

The Affordable Care Act's Medicaid Expansion and Impact Along the Cancer-Care Continuum: A Systematic Review

Haley A. Moss, MD, MBA [1,*], Jenny Wu, BS [2], Samantha J. Kaplan, PhD [2], S. Yousuf Zafar, MD, MHS, FASCO[3]

Affiliations of authors: [1]Duke Cancer Institute, Durham, NC, USA; [2]Duke University School of Medicine, Durham NC, USA; and and [3]Duke Cancer Institute, Duke-Margolis Center for Health Policy, Durham, NC, USA

[*]**Correspondence to:** Haley Moss, MD, MBA, Division of Gynecologic Oncology, DUMC 3079, Durham, NC 27710, USA (e-mail: haley.moss@duke.edu).

Abstract

Background: Health reform and the merits of Medicaid expansion remain at the top of the legislative agenda, with growing evidence suggesting an impact on cancer care and outcomes. A systematic review was undertaken to assess the association between Medicaid expansion and the goals of the Patient Protection and Affordable Care Act in the context of cancer care. The purpose of this article is to summarize the currently published literature and to determine the effects of Medicaid expansion on outcomes during points along the cancer care continuum. **Methods:** A systematic search for relevant studies was performed in the PubMed/MEDLINE, EMBASE, Scopus, and Cochrane databases. Three independent observers used an abstraction form to code outcomes and perform a quality and risk of bias assessment using predefined criteria. **Results:** A total of 48 studies were identified. The most common outcomes assessed were the impact of Medicaid expansion on insurance coverage (23.4% of studies), followed by evaluation of racial and/or socioeconomic disparities (17.4%) and access to screening (14.5%). Medicaid expansion was associated with increases in coverage for cancer patients and survivors as well as reduced racial- and income-related disparities. **Conclusions:** Medicaid expansion has led to improved access to insurance coverage among cancer patients and survivors, particularly among low-income and minority populations. This review highlights important gaps in the existing oncology literature, including a lack of studies evaluating changes in treatment and access to end-of-life care following implementation of expansion.

Since the Patient Protection and Affordable Care Act (ACA) was signed into law in 2010, health reform has been an important policy agenda item in a vigorous national debate (1, 2). Whereas opposition to the ACA focuses on several components of the multifaceted law, the dialogue surrounding the merits of Medicaid expansion has been more nuanced (3). In the original law, the ACA expanded the eligibility of Medicaid to adults with incomes up to 138% of the federal poverty level. In June 2012, the Supreme Court ruled that the federal government cannot mandate expansion and allowed states to opt out (4). As of January 2020, 37 states and the District of Columbia have opted to expand Medicaid eligibility (Figure 1). Five states and the District of Columbia received waivers to expand Medicaid enrollment early (5).

Multiple studies have shed light on the effects of Medicaid expansion on access to and cost of health care. There is strong evidence that expansion has been associated with better access to health services and improved quality of care as well as increases in patient perception of affordability (6). The impact of Medicaid expansion on cancer care is relevant because approximately 40% of men and women in the United States will be diagnosed with cancer at some point during their lifetime, and the number of new cases is expected to increase because of an aging population (7, 8). Access to cancer care is strongly associated with insurance, socioeconomic status, and race. Approximately one-third of cancer deaths in Americans between 25 and 74 years of age could be averted with the elimination of socioeconomic disparities (9). Increasing access to health coverage can address disparities facing racial and ethnic minorities and low-income patients (10). Medicaid expansion has the potential to address many disparities, as uninsured blacks disproportionally reside in states not implementing expansion (11).

Although many studies have evaluated the impact of expansion on cancer care, research designs have focused on different outcomes with various methodologies. The purpose of our study was to conduct a structured and systematic review of the research findings regarding the effects of Medicaid expansion on outcomes during points along the cancer-care continuum,

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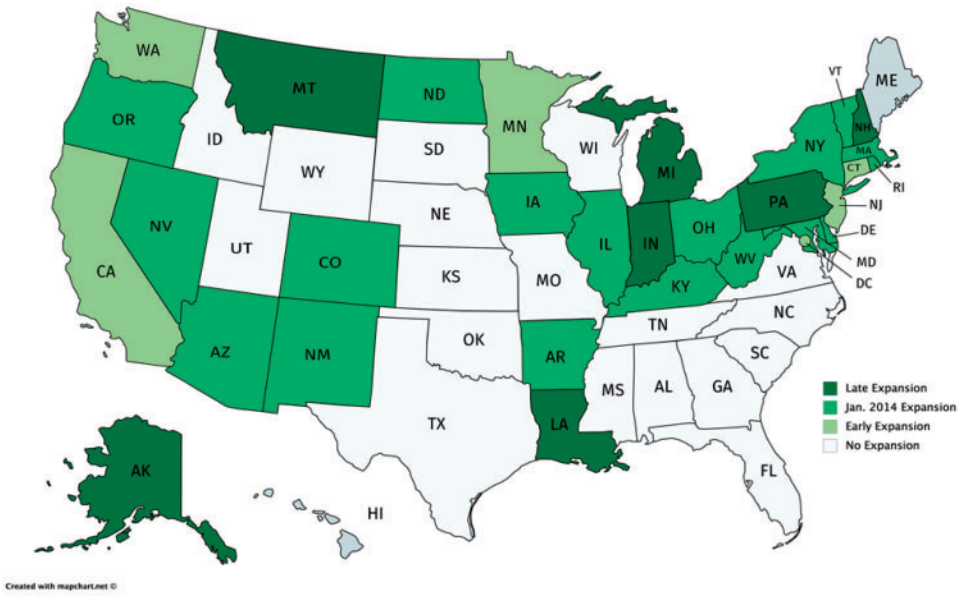

Figure 1. Status of state Medicaid expansion as of January 2020.

including prevention, screening, diagnosis, treatment, survivorship, and end-of-life care (12). Although the impact of expansion has been evaluated in the general population, to our knowledge this is the first systematic review of the impact on cancer patients. In addition to a summary and synthesis of the existing literature, we offer suggestions for future research. Our findings should be of interest to clinicians, policy makers, and the public as many states continue to debate the merits of Medicaid expansion.

REVIEW

Methods

Conceptual Framework

This systematic review adheres to the guidelines set by the Preferred Reporting Issues for Systematic Review and Meta-Analysis standards for systematic review of studies that evaluate health-care interventions and uses the Covidence platform (an online Cochrane primary screening and data extraction tool) to ensure a rigorous methodology and reporting (13, 14).

Search Strategy

A medical librarian (S. Kaplan) searched MEDLINE (via PubMed), Embase (via Elsevier), Scopus (via Elsevier), and the Cochrane Registry of Trials (via Wiley) using a combination of keywords and database-specific controlled vocabulary terms for the concepts: Medicaid Expansion and Cancer (available online) (Appendix 1). Because the review concerned changes resulting from the ACA—American legislation passed in 2010 but largely not in effect until 2014—results were restricted to publications published December 1, 2013, to January 29, 2020. To evaluate the impact of Medicaid expansion on changes in health behaviors that could potentially reduce the risk of cancer, such as smoking cessation, we conducted a manual search for relevant publications. Articles were further cross-referenced to identify additional articles. All citations were compiled into EndNote and then imported into Covidence.

Study Selection

We included original peer-reviewed research reporting quantitative, quasi-experimental, or mixed-methods results regarding the exposure of Medicaid expansion on outcomes along the cancer-care continuum (prevention, screening, diagnosis, treatment, survivorship, and end-of-life care) (Figure 2) (12). We defined Medicaid expansion as states that expanded Medicaid for patients with a household income 138% above the federal poverty level from 2010 and onward. We excluded studies that examined the effects of Medicaid expansion before or not part of the ACA, such as the Oregon Health Insurance Experiment. Review articles, published abstracts, conference proceedings, and forecast analyses were excluded. Finally, we excluded articles pertaining to legal, political, or ethical aspects of the ACA, including letters to the editor, policy briefs, and governmental reports.

Titles and abstracts were reviewed for eligibility independently by 2 investigators (H. Moss and J. Wu). Any disagreements were resolved by discussion with a third author (Y. Zafar). The full texts of the eligible articles were uploaded into Covidence, which were subsequently reviewed (HM and JW) to ensure the study met the predefined inclusion and exclusion criteria as noted above.

Data Extraction

A standardized data abstraction form was used to extract data on sample characteristics, study design, and relevant outcomes. Data extraction was performed by 2 investigators (HM and JW), and differences were resolved by discussion and consensus. Outcomes of interest included access to insurance coverage, timeliness of care, incidence/survival metrics, changes in care affordability, and impact on racial and socioeconomic disparities. Outcomes were not mutually exclusive and can occur across the cancer-care continuum.

Two independent investigators (HM and JW) applied the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool to assess bias (Appendices 2 and 3, available online) and

Figure 2. Cancer care continuum: number of studies included at each stage.

the National Institutes of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies to assess quality (Appendix 4, available online) for each study. ROBINS-I assesses bias across 7 domains (confounding, participant selection, intervention classification, departure from intended intervention, missing data, measurement of outcomes, and selection of reported results), and the risk of bias is then determined through a combination of all the domains (15). The NIH Quality Assessment Tool includes a 14-item checklist to evaluate nonrandomized studies by considering study objectives, timing between exposure and outcomes, and risk of confounders. Items 4, 10, and 12 were omitted because they were not applicable to these observational studies. Each study was rated as "good," "fair," and "poor" based on answers to the tool questions (16). Discrepancies were resolved by consensus. All studies meeting the inclusion criteria were included in the analysis regardless of rating.

Results

Eligible Studies

According to the search strategy, 187 records were identified excluding duplicates, of which 128 did not meet inclusion criteria. A total of 59 records were screened for eligibility by full text review. An additional 11 articles were excluded for not meeting the eligibility criteria. Nine additional articles were included after cross-reference to capture cancer risk–modifying behaviors that did not include "cancer" in the title or abstract. A total of 48 studies were included in this review. Figure 3 provides a Preferred Reporting Issues for Systematic Review and Meta-Analysis flowchart detailing study identification, screening, eligibility, and selection process. Study characteristics are summarized in Tables 1 and 2. Public and government surveys were the most common data source (47%), followed by cancer registries (33%). Approximately 43% of studies assessed data just 1-2 years after Medicaid expansion, 35% for 2-3 years, and 19% assessed 3 years or more. The majority (approximately 90%) of the studies evaluated more than 1 expansion state. In the 48 studies, 124 outcomes were evaluated, and the authors noted that these outcomes are not mutually exclusive and overlap can occur across the cancer-care continuum. The most common outcomes assessed were the impact of expansion on insurance coverage (23%), followed by evaluation of disparities (18%) and access to screening (15%). Other outcomes assessed include prevention (9%), stage at diagnosis (9%), incidence (4%), access to treatment (4%), time to treatment (2%), survival (3%), care affordability (6%), and other health and quality of care (8%).

Several methods used in the studies included evaluation of states pre- and post-ACA implementation, comparisons of expansion states with nonexpansion states, and focus on lower socioeconomic populations and racial and ethnic minorities. The most commonly used analytic method was a difference-in-differences analysis (n = 29). This approach allows researchers to evaluate the impact of a policy while accounting for trends that may exist in both the exposure and comparison groups (65). The included cancer diagnoses, data sources, and number of expansion vs nonexpansion states are further detailed in Table 1.

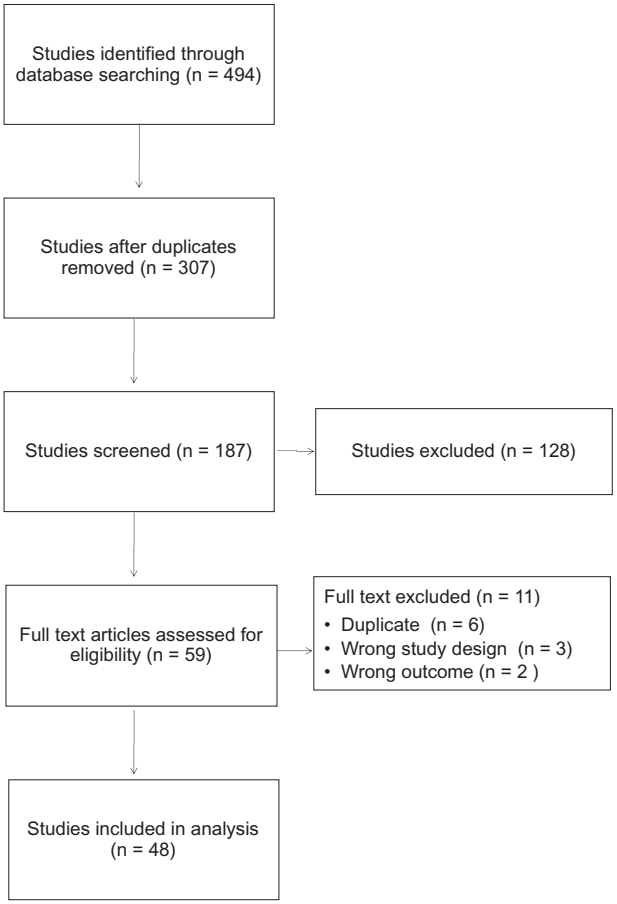

Figure 3. Study selection flowchart adapted from the Preferred Reporting Issues for Systematic Review and Meta-Analysis statement.

Study Participant Characteristics

Along the cancer-care continuum, 11 studies examined the impact of expansion during the prevention stage and 18 studies during screening. Nineteen studies focused on outcomes at the time of diagnosis, 6 evaluated patients at the time of treatment, and 6 evaluated outcomes during survivorship. No studies examined outcomes at the end of life (Figure 2). There was heterogeneity in the cancer types, data sources, methods, and number of expansion states analyzed in each stage of the cancer

Table 1. Description of the 48 studies on Medicaid expansion and cancer

Citation	Point on care continuum	Cancer type	Data source or methods	No. of states* ME	No. of states* NE	Outcome measured	Bias	NIH
Agarwal et al., 2019 (17)	Diagnosis	All	SEER (2011-2015); DD on insurance coverage	9	4	Insurance, Disparities	Moderate	Good
Ajkay et al., 2018 (18)	Screening, diagnosis, treatment	Breast	KCR, KHFS, and ACS (2011-2016); descriptive statistics and linear and logistic regression of quality of breast cancer care in Kentucky	1	0	Insurance, screening, stage, access to treatment, time to treatment	Moderate	Good
Alharbi et al., 2019 (19)	Screening	Breast, cervical	MEPS-HC (2012-2013 and 2015-2016); DD on mammography and Pap test use	26	14	Insurance, screening	Moderate	Good
Barnes et al., 2019 (20)	Diagnosis	All cancers treated with radiation	SEER (2007-2013); DD on changes in insurance coverage and stage of diagnosis	4	9	Insurance, stage, survival	Moderate	Fair
Cannon et al., 2018 (21)	Diagnosis	Head and neck	SEER (2007-2014); descriptive statistics, Kaplan-Meier methods, and multivariable survival analysis on insurance coverage	9	5	Insurance, survival	Moderate	Good
Cawley et al., 2018 (22)	Prevention, screening	Breast, cervical, cancers associated with tobacco use	BRFSS (2010-2016); DD on insurance coverage, preventative care, risky health behaviors, and self-assessed health	31	20	Insurance, prevention, screening, quality of care	Moderate	Good
Chino et al., 2018 (23)	Diagnosis	All cancers treated with radiation	SEER (2011-2014); DD on insurance coverage	8	5	Insurance, disparities	Moderate	Good
Cole et al., 2017 (24)	Screening	Cervical, colorectal	UDS (2011-2014); DD on insurance coverage, number of patients served, and quality of care	26	25	Insurance, screening	Moderate	Good
Corrigan et al., 2020 (25)	Diagnosis, treatment	All	NCDB (2011-2015); DD on insurance coverage and cancer treatment receipt in HIV-infected patients	25	24	Insurance, access to treatment	Moderate	Good
Cotti et al., 2019 (26)	Prevention	Cancers associated with tobacco use	NCP (2011-2015); fixed effects regression model on cigarette taxes and other adverse consumption goods	31	20	Prevention	Moderate	Fair
Crocker et al., 2019 (27)	Treatment	Colorectal, esophagus, hepatobiliary, lung, urologic	HCUP-SID, AHA, and AHRF (2012-2015); Poisson interrupted time series analysis on use of cancer surgery	2	2	Insurance, access to treatment, disparities	Moderate	Good
Davidoff et al., 2018 (28)	Survivorship	All	NHIS (2012-2015); descriptive statistics, linear probability modeling on insurance coverage	29	22	Insurance	Moderate	Good
DiGuillo et al., 2016 (29)	Prevention	Cancers associated with tobacco use	CMS-MBES, BRFSS, American Lung Association (2014-2016); descriptive statistics on tobacco cessation coverage in adult smokers	32	0	Prevention	Moderate	Good
Donahoe et al., 2019 (30)	Prevention	Cancers associated with tobacco use	TUS-CPS, ASEC (2010-2011 and 2014-2015); boosted logistic regression and propensity score weighting strategy on changes in smoking cessation for childless adults	21	22	Prevention	Moderate	Good

(continued)

Table 1. (continued)

Citation	Point on care continuum	Cancer type	Data source or methods	No. of states* ME	No. of states* NE	Outcome measured	Bias	NIH
Eberth et al., 2019 (31)	Diagnosis, survivorship	All	CDC-USCS (2011-2015); mortality-to-incidence ratios by congressional district and cancer type	37	14	Incidence, survival	Moderate	Good
Eguia et al., 2018 (32)	Treatment	Breast, bladder, colorectal, esophagus, gastric, lung, pancreatic, prostate	HCUP-SID (2010-2014); Poisson distribution, logistic regression, incidence rate ratios, DD on trends in cancer admissions and surgeries	3	1	Access to treatment, quality of care, disparities	Moderate	Good
Fedewa et al., 2019 (33)	Screening	Breast, colorectal	BRFSS (2012, 2014, and 2016); DD on screening	32	19	Screening, disparities	Moderate	Good
Gan et al., 2019 (34)	Screening, diagnosis, survivorship	Colorectal	KCR, KHFS (2011-2016); descriptive statistics and Cox regression analyses on CRC screening rates, incidence, and survival	1	0	Screening, stage, incidence, survival	Moderate	Good
Gibbs et al., 2020 (35)	Screening	Cervical	Medicaid enrollment and claims data (2011-2016); descriptive statistics and logistic regression on preventative reproductive services for women in Oregon	1	0	Screening, quality of care	Moderate	Fair
Goldman et al., 2020 (36)	Survivorship	All	MEPS-HC (2011-2016); DD, linear regression, and sensitivity analyses on annual rate of disruption in Medicaid coverage and loss of coverage in people with chronic conditions (including those diagnosed with cancer)	30	19	Insurance, quality of care, disparities	Moderate	Good
Goold et al., 2019 (37)	Prevention, screening	Breast, cervical, colorectal, cancers associated with tobacco use	Healthy Michigan Voices telephone survey (2016); logistic regression analyses on access to and receipt of primary care and preventative services in Michigan	1	0	Prevention, screening, quality of care, care affordability	Moderate	Good
Han et al., 2018 (38)	Diagnosis	All	NAACCR (2010-2014); DD on insurance coverage and early-stage cancer diagnoses	21†	19	Insurance, stage, disparities	Moderate	Good
Han et al., 2019 (39)	Survivorship	All	BRFSS (2011-2017); DD on insurance coverage and care unaffordability	32	19	Insurance, care affordability, disparities	Moderate	Good
Hendryx et al., 2018 (40)	Screening	Breast, cervical, colorectal	BRFSS (2012, 2016); DD and sensitivity analyses on screening with comparison with low-income Medicare and higher income populations	28	18	Screening	Moderate	Good
Huguet et al., 2019 (41)	Screening	Cervical, colorectal	ADVANCE (2012-2015); DD on prevalence and screening likelihood	9	4	Insurance, screening	Moderate	Good
Jemal et al., 2017 (42)	Diagnosis	All	NCDB (2011-2013, 2014); DD on insurance coverage and early-stage diagnosis	27	23	Insurance, stage, disparities	Moderate	Good
Kino et al., 2018 (43)	Screening	Breast, cervical, colorectal	BRFSS (2011-2016); DD on socioeconomic inequality in use of health-care services including cancer screening	31	20	Screening, quality of care, care affordability, disparities	Moderate	Good

(continued)

Table 1. (continued)

Citation	Point on care continuum	Cancer type	Data source or methods	No. of states* ME	No. of states* NE	Outcome measured	Bias	NIH
Koma et al., 2017 (44)	Prevention	Cancers associated with tobacco use	BRFSS (2011-2015); DD on probability of recent smoking cessation among current or former smokers	31	20	Insurance, prevention, care affordability, disparities	Moderate	Fair
Lyu et al., 2019 (45)	Screening	Breast, cervical, colorectal	BRFSS (2012, 2016); DD on pre-post changes in cancer screening use by primary care provider supply	22	24	Screening, disparities	Moderate	Fair
Maclean et al., 2019 (46)	Prevention	Cancers associated with tobacco use	Medicaid SDUD (2011-2017); descriptive statistics and DD on Medicaid-financed smoking cessation prescriptions	27	20	Prevention, quality of care, care affordability	Moderate	Good
Mahal et al., 2019 (47)	Diagnosis	Breast, lung, prostate	SEER (2010-2014); multivariable logistic regressions on insurance coverage by state approach to Medicaid expansion	3	2	Insurance, disparities	Moderate	Fair
Mesquita-Neto et al., 2019 (48)	Diagnosis, treatment	Breast, colorectal, liver, lung, ovarian, pancreatic, prostate, uterine	SEER (2007-2015); DD on access to cancer-specific surgical care	10	3	Insurance, access to treatment, stage, disparities	Moderate	Good
Moss et al., 2017 (49)	Diagnosis	Cervical, ovarian, uterine	SEER (2008-2014); DD on insurance coverage	9	5	Insurance, stage, disparities	Moderate	Good
Moss et al., 2018 (50)	Diagnosis	Breast, colorectal, lung	SEER (2008-2014); DD on insurance coverage	9	5	Insurance, stage, incidence, disparities	Moderate	Good
Nikpay et al., 2018 (51)	Survivorship	All	BRFSS (2011-2015); DD on insurance coverage and health-care access measures	29	22	Insurance, quality of care, care affordability	Moderate	Good
Nogueira et al., 2019 (52)	Diagnosis	All	NCDB (2003-2015); DD and interrupted time series on insurance coverage among young adult cancer patients stratified by dependent coverage expansion (DCE) eligibility	27	23	Insurance	Moderate	Good
Okoro et al., 2017 (53)	Screening	Breast, cervical, colorectal	BRFSS (2014); descriptive statistics on insurance coverage and other health-care measures	26	25	Insurance, screening, quality of care, care affordability	Moderate	Fair
Roberts et al., 2019 (54)	Prevention	Cervical	Publicly available data on state health policies, National Immunization Survey-Teen (2015); qualitative comparative analysis on combinations of various policies for high HPV vaccination among adolescents	32	19	Prevention	Moderate	Poor
Sammon et al., 2018 (55)	Screening	Prostate	BRFSS (2012, 2014); multivariable logistic regression models on screening	26	25	Screening, disparities	Moderate	Fair
Satyananda et al., 2019 (56)	Screening, diagnosis	Breast	Institutional retrospective review (2011-2012, 2015-2016); descriptive statistics and Cox regression modeling on access to breast cancer screening and diagnoses at a Los Angeles hospital	1	0	Insurance, screening, stage, incidence, disparities	Serious	Fair
Simon et al., 2017 (57)	Prevention, screening			31	20		Moderate	Fair

(continued)

Table 1. (continued)

Citation	Point on care continuum	Cancer type	Data source or methods	No. of states* ME	No. of states* NE	Outcome measured	Bias	NIH
		Breast, cervical, cancers associated with tobacco use	BRFSS (2010-2015); DD on preventative care, risky health behaviors, and self-assessed health			Prevention, insurance, screening, quality of care		
Sineshaw et al., 2020 (58)	Diagnosis, treatment	Head and neck	NCDB (2010-2016); DD on insurance coverage, stage at diagnosis and time to treatment initiation	32	19	Insurance, stage, time to treatment	Moderate	Good
Soni et al., 2018 (59)	Diagnosis	All	SEER (2010-2014); DD on overall and early-stage diagnosis	9	4	Incidence, stage	Moderate	Good
Spiegel et al., 2019 (60)	Diagnosis	Breast, cervical, prostate, uterine	SEER (2011-2014); DD on insurance coverage among patients treated with brachytherapy	8	5	Insurance, disparities	Moderate	Good
Valvi et al., 2019 (61)	Prevention	Cancers associated with tobacco use	BRFSS (2003-2009 and 2011-2015); multivariable logistic regression on current smoking and quit attempts	30	21	Prevention, disparities	Moderate	Fair
Valvi et al., 2019 (62)	Screening	Breast	BRFSS (2003-2015); multivariable logistic regression on screening stratified by Appalachian states	30	21	Screening, disparities	Moderate	Fair
Yip et al., 2019 (63)	Prevention	Cancers associated with tobacco use	Anonymous survey (2015-2016); descriptive statistics and logistic regression on receipt of smoking cessation services among substance use disorder treatment patients	8	6	Insurance, prevention	Moderate	Poor
Zerhouni et al., 2019 (64)	Screening	Colorectal	BRFSS (2012-2016); DD on screening	25	20	Screening, disparities	Moderate	Fair

*District of Columbia is also considered in the analysis. ACS = American Community Survey; ADVANCE = Accelerating Data Value Across a National Community Health Center Network (includes OCHIN and HCN); AHA = American Hospital Association Yearly Survey; AHRF = Area Health Resources Files; ASEC = Annual Social and Economics Supplement of the Current Population Survey; BRFSS = Behavioral Risk Factor Surveillance System; CMS-MBES = Centers for Medicare and Medicaid Services Medicaid Budget and Expenditure System; DD = differences-in-differences analysis; HCUP = Healthcare Cost and Utilization Project (includes State Inpatient Databases); KCR = Kentucky Cancer Registry; KHFS = Kentucky Cabinet for Health and Family Services; ME = Medicaid expansion; MEPS-HC = Medical Expenditure Panel Survey–Household Component; NAACCR = North American Association of Central Cancer Registries; NCDB = National Cancer Data Base; NCP = National Consumer Panel; NE = non-Medicaid expansion; NHIS = National Health Interview Survey; NIH = National Institutes of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies; SDUD = State Drug Utilization Database; SEER = Surveillance, Epidemiology, and End Results Program; TUS-CPS = Tobacco Use Supplement to the Current Population Survey; UDS = Uniform Data System.
This study included 40 states for overall insurance coverage analysis and limited the stage analysis to 34 states.

Table 2. Selected characteristics of the 48 studies on Medicaid expansion and cancer care

Characteristic	No. of studies (%)
Data source	
Cancer registry	17 (33.3)
Clinical data set	5 (9.8)
Public or government survey	24 (47.1)
Private survey	1 (2.0)
Other	5 (7.8)
Total	51*
Postexpansion years analyzed	
<1	1 (2.1)
1 < 2	23 (47.9)
2 < 3	16 (33.3)
3+	8 (16.7)
Total	48
Expansion states analyzed	
One	5 (10.4)
More than 1 but limited by dataset	24 (50.0)
National assessment	19 (39.6)
Total	48
Outcomes analyzed	
Insurance coverage	29 (23.4)
Prevention	11 (8.9)
Access to cancer screening	18 (14.5)
Stage at diagnosis	11 (8.9)
Incidence	5 (4.0)
Access to cancer treatment	5 (4.0)
Time to treatment	2 (1.6)
Survival	4 (3.2)
Care affordability	7 (5.7)
Other health and quality of care	10 (8.1)
Impact on disparities	22 (17.8)
Total	124

*Some studies use multiple data sources.

continuum. Most studies evaluated nonelderly adults between ages 18 and 64 years. Six studies included patients younger than 18 years (17, 21, 27, 28, 31, 35). For the prevention stage, 10 studies examined the impact of expansion on smoking cessation. For the screening stage, 10 studies used the Behavioral Risk Factor Surveillance System (BRFSS) database, with most studies examining a combination of breast, cervical, and colorectal cancer. For the diagnosis stage, 10 studies used the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER) database, 4 studies used the National Cancer Data Base, and 9 studies examined all types of cancer. For the treatment stage, 2 studies used the Healthcare and Utilization Project clinical dataset using various cancer types. For the survivorship stage, 5 studies examined all types of cancer diagnoses.

Quality and Bias Assessment

Using the NIH-tool measure, study quality was rated as "good" for 33 studies, "fair" for 13 studies, and "poor" for 2 studies. The majority of studies with higher scores used national cancer registries and followed up patients for multiple years following expansion. Studies with lower scores evaluated outcomes that required longitudinal assessment (such as stage shift or changes in treatment patterns) but evaluated the impact of only 1 year of expansion. The overall risk of bias was moderate for all studies based on the ROBINS-I tool (Table 1).

Prevention

Eleven studies focused on the impact of Medicaid expansion on cancer prevention (22, 26, 29, 30, 37, 44, 46, 54, 57, 61, 63). "Prevention" is defined as an action that lowers the chance of getting cancer. Ten studies (22, 26, 29, 30, 37, 44, 46, 57, 61, 63) evaluated smoking cessation, and 1 study (54) evaluated uptake of HPV vaccine. Actions to prevent cancer improved following expansion in 8 studies. All of these studies evaluated the prevention of cancers related to tobacco use. These studies revealed increased use of smoking cessation medications. Koma et al. (44) reported a 2.1% increase the probability of smoking cessation in expansion states compared with nonexpansion states. Maclean (46) found that expansion increased Medicaid-financed smoking cessation prescriptions by 34% and led to a 24% increase in new medication use. One study reported that expansion was not associated with increases in smoking quit attempts and smoking cessation after adjusting for state socioeconomic trends, welfare policies, and tobacco control policies (30).

Roberts et al. (54) evaluated trends in HPV vaccination associated with Medicaid expansion. This study concluded that Medicaid expansion as a policy alone was not sufficient to improve HPV vaccine uptake. Expansion in combination with other state policies, including classroom sex education mandates, school-entry requirements, and policies permitting HPV vaccination in pharmacies, could improve vaccine uptake.

Screening

Eighteen studies evaluated access to cancer screening. Most studies evaluated breast cancer screening (n = 12) (18, 19, 22, 33, 37, 40, 43, 45, 53, 56, 57, 62). This was followed by pap smears for cervical cancer (n = 11) (19, 22, 24, 35, 37, 40, 41, 43, 45, 53, 57) and colorectal cancer screening (n = 10) (24, 33, 34, 37, 40, 41, 43, 45, 53, 64). Prostate cancer screening was evaluated in 1 study (55) . Overall, screening increased in 8 studies, no change was reported in 4 studies, and mixed results were found in 6 studies depending on the screening method.

Most studies concluded that Medicaid expansion was not associated with increased access to mammograms (19, 22, 33, 40, 43, 56, 57). Lyu et al. (45) reported statistically significant increases in mammograms in expansion states but only in states with a high supply of primary care providers. Between 2012 and 2013, breast cancer screening among low-income women increased by 4.9% and 3.7% in early-expansion states and nonexpansion states, respectively, but this change was not statistically significant (33).

Seven studies concluded that more women received cervical cancer screening after 2014 (24, 37, 40, 41, 45, 53, 57). Huguet et al. (41) found that cervical cancer screening improved in both expansion and nonexpansion states, with the greatest increase among uninsured patients in expansion states and privately insured patients in nonexpansion states. Four studies reported decreased access to pap smears (19, 22, 35, 43). Alharbi et al. reported that the probability of receiving a pap test decreased statistically significantly among low-income women following Medicaid expansion (19). Two studies concluded there was no change in cervical cancer screening (22, 43).

Table 3. The impact of Medicaid expansion on cancer patients and survivors in states that extended Medicaid eligibility

Outcomes	Outcomes analyzed No. (%)	Increases No. (%)	Decreases No. (%)	Mixed No. (%)	No change No. (%)
Insurance coverage	29 (23.4)	28 (96.6)	0 (0.0)	1 (3.5)	0 (0.0)
Prevention	11 (8.9)	8 (72.8)	0 (0.0)	2 (18.2)	1 (9.1)
Access to screening	18 (14.5)	8 (44.4)	0 (0.0)	6 (33.3)	4 (22.2)
Stage at diagnosis	11 (8.9)	6 (54.6)	0 (0.0)	4 (36.4)	1 (9.1)
Incidence	5 (4.0)	2 (40.0)	0 (0.0)	2 (40.0)	1 (20.0)
Access to treatment	5 (4.0)	2 (40.0)	0 (0.0)	3 (60.0)	0 (0.0)
Time to treatment	2 (1.6)	0 (0.0)	0 (0.0)	2 (100.0)	0 (0.0)
Survival	4 (3.2)	1 (25.0)	0 (0.0)	2 (50.0)	1 (25.0)
Care affordability	7 (8.1)	0 (0.0)	7 (100.0)	0 (0.0)	0 (0.0)
Other quality of care	10 (5.7)	7 (70.0)	0 (0.0)	1 (10.0)	2 (20.0)
Impact on disparities	22 (17.7)	0 (0.0)	11 (50.0)	11 (50.0)	0 (0.0)

Eight studies concluded that colorectal screening increased following expansion (33, 34, 37, 40, 41, 45, 53, 64). Two studies found no statistically significant difference in colorectal screening rates (24, 43). In Kentucky, a state that expanded Medicaid in January 2014, screening increased by 27.7% following expansion. Medicaid patients experienced the greatest improvement in screening (292.5%) (34). Fedewa et al. (33) grouped patients into categories based on timing of state's expansion status: very early (6 states expanding March 2010 to April 2011), early (21 states expanding January 2014 to August 2014), late (5 states expanding January 2015 to July 2016), and not expanding (as of January 2017). Between 2012 and 2016, the proportion of low-income adults up to date with colorectal screening increased by 8.0% in very early states, 2.9% in early states, and 3.8% in nonexpansion states. Among low-income adults in late expansion states, there was no statistically significant change in screening.

Sammon et al. (55) found that although the prevalence of PSA screening decreased overall, low-income residents of early-expansion states experienced a 3% increase in screening. Importantly, the US Preventive Services Task Force supports individualized decision-making for men aged 55-69 years and recommends against screening men 70 years and older (88).

Access to Insurance at the Time of Diagnosis

The most commonly explored outcome was access to health insurance coverage. The majority of studies used a difference-in-differences analysis. Using this methodology, the percentage of uninsured patients may have decreased in both expansion and nonexpansion states, but an overall greater decrease in expansion states (65). Twenty-eight studies concluded that expansion resulted in increased access to insurance (17, 19–25, 27, 28, 36, 38, 39, 41, 42, 44, 47–53, 56–58, 60, 63). In expansion states, 17 studies concluded that Medicaid enrollment increased after passage of the ACA (17–21, 23–25, 27, 36, 41, 42, 49, 50, 52, 58, 60). In 7 studies, fewer patients were enrolled in private insurance (17, 20, 23, 25, 27, 41, 42), whereas 4 studies revealed increases in private-insurance enrollment (21, 24, 56, 58). In nonexpansion states, 4 studies concluded that Medicaid enrollment decreased following implementation of the ACA (17, 23, 42, 60). Access to private insurance increased in 8 studies in nonexpansion states (23, 25, 41, 42, 49, 50, 58, 65).

Before Medicaid expansion, 12.4% of cancer survivors were uninsured. The uninsured rate decreased to 7.7% following ACA implementation (28). Although most of the studies concluded that the percentage of uninsured patients decreased in all states, decreases were greater in expansion than nonexpansion states. Han et al. (38) showed that in the pre-post period, the percentage of uninsured patients declined from 5.2% to 2.6% in expansion states compared with 8.7% to 7.8% in nonexpansion states. Insurance gains in nonexpansion states were related to increased access to private insurance, likely related to other provisions of the ACA (17, 23, 41, 42, 49, 50). Unfortunately, patients with chronic illnesses, including cancer, continue to experience coverage disruptions and loss even in expansion states (36).

Stage at Diagnosis

Eleven studies evaluated whether Medicaid expansion affected the stage at diagnosis (18, 20, 34, 38, 42, 48–50, 56, 58, 59). In the largest study evaluating stage shift, Han et al. (38) reported that expansion was associated with a small but statistically significant increase in the percentage of all early-stage diagnosis for all cancers. Early-stage diagnoses were detected for colorectal, lung, and female breast cancer, and melanoma in both expansion and nonexpansion states. Non-Hodgkin lymphoma and pancreatic cancer were more likely to be diagnosed at an early stage in expansion states, whereas liver cancer was more likely to be diagnosed later (38). Soni et al. (59) found that early-stage diagnoses in Medicaid expansion states were largely driven by an increase in early diagnosis among those aged 35 to 54 years and by cancers amenable to screening (59). In studies evaluating breast cancer in a single expansion state, Ajkay et al. (18) found an increase in early-stage disease in Kentucky, whereas Satyananda et al. (56) reported no difference in diagnosis stage in California. In gynecological malignancies, there was a trend towards more advanced stage disease in uterine and cervical cancer in expansion states. Ovarian cancer staging was not affected by Medicaid expansion (49).

Cancer Incidence

Cancer incidence was evaluated in 5 studies (31, 34, 50, 56, 59). Soni et al. (59) reported that Medicaid expansion was associated with an increase in cancer incidence of 3.4%. The authors conclude that this was driven by an increase in early-stage diagnoses (59). In a similar study evaluating the SEER database, Moss et al. (50) reported an increase in breast and colorectal diagnoses but not lung cancer. In Kentucky, the incidence of colorectal cancer increased after Medicaid expansion in individuals with

Medicaid coverage (34). Eberth et al. (31) reported that the mortality-to-incidence ratio for all cancer types was lower in Medicaid expansion states compared with nonexpansion states.

Treatment

Five studies evaluated access to cancer-related treatment, and 1 study evaluated treatment access as a survivor (18, 25, 27, 32, 48, 58). In a study evaluating 81 000 patients who underwent cancer-directed surgery, Crocker et al. (27) found that Medicaid expansion was associated with increased rates of cancer-directed surgery for patients in low-income ZIP codes. There was no change in use in nonexpansion states (27). Similarly, Mesquita-Neto et al. (48) reported that adoption of expansion did not improve access to cancer-directed surgery in the overall cohort but did show improvement in a low-income population. Among people living with HIV and cancer, there was no statistically significant difference in cancer treatment noted between Medicaid expansion and nonexpansion states (25).

Two studies evaluated time to treatment (18, 58). Among women diagnosed with breast cancer in Kentucky, time from diagnosis to surgery increased ($P < .01$), time from surgery to chemotherapy remained unchanged ($P = .26$), and time from surgery to radiation decreased ($P < .01$). Sineshaw et al. (58) reported that time to treatment did not differ between expansion and nonexpansion states among a large cohort of patients with head and neck squamous cell carcinoma. However, among patients with nonoropharyngeal head and neck squamous cell carcinoma, there was a statistically significant improvement in time to treatment (58).

Survivorship

Six studies evaluated the impact of expansion on cancer survivors (28, 31, 34, 36, 39, 51). Among cancer survivors, the probability of having a primary physician increased in both nonexpansion and expansion states by 1.6% and 5.0%, respectively, although the relative change was not statistically significant (51).

Survival Outcomes

Survival outcomes were explored in 4 studies (20, 21, 31, 34). Gan et al. (34) reported that expansion in Kentucky statistically significantly improved colorectal cancer survival in Medicaid enrollees compared with patients pre-ACA implementation, particularly among the Appalachian population. Furthermore, the remaining uninsured patients who did not receive coverage had overall worse survival compared with pre-ACA (34). Barnes et al. (20) reported no change in survival among cancer patients receiving radiation. Two studies reported mixed results (21, 31). Eberth et al. (31) found a lower mortality-to-incidence ratio in Medicaid expansion states in all cancer except those of the esophagus and pancreas. In these more lethal malignancies, the mortality-to-incidence ratio was higher in Medicaid expansion states.

Care Affordability

The impact of Medicaid expansion on the affordability of health-care-related costs was evaluated in 7 studies (37, 39, 43, 44, 46, 51, 53). Six studies reported patient's perception of affordability and financial barriers to care (37, 43, 44, 51, 53, 66). All studies concluded that there was a decrease in patient-reported concerns related to costs in Medicaid expansion states compared with nonexpansion states.

Analyzing a population-based survey, Han et al. (39) found that adult cancer survivors reported decreased self-reported care unaffordability following implementation of the ACA, with the largest reductions in those residing in expansion states. Nikpay et al. (51) reported that the percentage of survivors who could not afford to see a physician within the last year because of cost fell by 9.1% in expansion states and did not change among nonexpansion states. The percentage of survivors in expansion states who could not afford their medicine also fell. Unpaid medical bills were common in both expansion and nonexpansion states and remained unchanged following changes in Medicaid eligibility. Two studies addressed improved access to smoking cessation and preventive services because of fewer cost-related barriers (44, 46).

Impact on Racial and Socioeconomic Disparities

Twenty-two studies addressed Medicaid expansion's impact on racial, ethnic, or socioeconomic disparities by comparing changes in access to insurance coverage, screening, and treatment by different demographics (17, 23, 27, 31–33, 36, 38, 39, 42, 43, 45, 47–50, 55, 56, 60–62, 64). Eleven studies concluded that disparities decreased in expansion states, whereas 11 studies found a mixed effect depending on the subgroup analyzed.

Seventeen studies evaluated the impact of expansion on racial or ethnic disparities (17, 23, 27, 32, 33, 36, 38, 39, 47–50, 55, 56, 60, 62, 64). Ten studies found a decrease in disparities (17, 23, 32, 33, 36, 38, 39, 47, 49, 50), 5 studies found a mixed effect (55, 56, 60, 62, 64), and 2 studies concluded no change (27, 48). Han et al. (38) reported that Medicaid expansion resulted in narrowing of disparities among non-Hispanic blacks, Hispanics, and other minority groups. Although there were reductions in the percentage of uninsured patients in nonexpansion states, the overall decrease was small and similar across demographic groups (38). Among surgical cancer patients, Crocker et al. (27) found no statistically significant effect of expansion on racial disparities. Income disparities were evaluated in 18 studies. Fifteen studies concluded that Medicaid expansion was associated with decreased income-related disparities (23, 24, 27, 38, 39, 42, 44, 47–49, 55, 59–61, 64). Three studies found a mixed effect (43, 45, 50). Jemal et al. (42) reported that the percentage of uninsured between low- and high-income groups narrowed substantially in expansion states. This finding is consistent across several other studies evaluating income disparities that concluded that expansion resulted in a narrowing of socioeconomic disparities within expansion states (23, 38, 50).

Discussion

In this systematic review of studies evaluating the impact of Medicaid expansion on cancer care, we found that this provision of the ACA has expanded insurance coverage among cancer patients and survivors, improved access to screening and preventative care, shifted diagnoses towards earlier stage, and reduced insurance-related disparities among low-income and minority populations. Further research is required to demonstrate the impact of expansion on access to cancer-directed treatment, health-care spending, and cancer-specific outcomes

such as survival. As nonexpansion states continue to debate the merits of changing Medicaid eligibility, it is important to note that expansion was not associated with any negative consequences to patients or the health system in any of the studies evaluated.

The major focus of included studies evaluated the changes in the rates of uninsured and Medicaid enrollment. Before implementation of the ACA, approximately 14.7% of cancer survivors younger than 65 years were uninsured (67). Among cancer patients, insurance coverage varied by demographics and cancer type. The results of this review are consistent with other studies that have found that expansion states have seen large reductions in uninsured rates, primarily due to increases in Medicaid enrollment. Furthermore, patients living in nonexpansion states have slightly increased access to private insurance through other provisions of health reform. Notably, racial and ethnic minorities and those living in higher poverty communities—those more likely to be uninsured—are also more likely to live in nonexpansion states and have remained without access to affordable coverage (6, 68, 69).

Insurance coverage at the time of diagnosis and early treatment is an important determinant of cancer-related outcomes. Uninsured patients are more likely to be diagnosed with late-stage disease, receive nonguideline adherent care, and have worse survival outcomes (70, 71). This review noted that screening-detectable cancers are more likely to be diagnosed at an early stage in expansion states despite unclear improvements in screening. There are several explanations for the mixed results regarding surveillance. Studies may not evaluate the appropriate length of time necessary to assess the screening modalities, particularly those not performed annually. Major guidelines differ in their recommendation for how often women of different ages should undergo mammography. For women 55 years and older, the American Cancer Society recommends a mammogram every 2 years and the American College of Obstetricians and Gynecologists recommends annual exams (72). For cervical cancer, the interval of screening differs based on method. If cytology alone is performed, women should undergo screening every 3 years. If an HPV test is administered with cytology, women extend screening to a 5-year interval (73). This limits the ability for studies to accurately evaluate the impact of expansion on cancer surveillance. Additionally, newly enrolled Medicaid beneficiaries may not be aware of preventive services under the ACA, and acute health concerns may take priority over cancer screening (19, 40, 74, 75). Furthermore, a proportion of breast and cervical cancer screening for uninsured and underinsured patients is covered by the Center for Disease Control National Breast and Cervical Cancer Early Detection Program (76). Despite unclear benefits to screening, Medicaid expansion was associated with a small but statistically significant shift towards earlier stage disease. It remains too early to assess whether early diagnosis translates to improved survival for these patients.

Few studies examined the impact of expansion on treatment. In the largest of the 4 studies evaluating expansion on cancer-directed surgery, Crocker et al. found that expansion was associated with greater use of cancer surgery by low-income patients. Better access to treatment was not appreciated in the published studies included in this systematic review. However, in a population-based analysis presented during the 2019 American Society of Clinical Oncology Annual Meeting Plenary Session, Adamson et al. (77) reported that African American cancer patients were 4.9% less likely to receive timely treatment before expansion. Regardless of race, Medicaid expansion trended towards an increase in receiving timely treatment, and prior racial disparities resolved following expansion (77). As with other studies, the impact of timely access to treatment on survival was not measured.

The extent to which care quality has improved and costs have decreased for cancer patients as a result of expansion cannot be wholly determined at this time. Health-care spending in cancer care remains an important issue, as cost is increasing faster in cancer than in other medical conditions, largely due to an aging population and the development of new treatment options (89). At this time, insufficient evidence is available to conclude that expansion has had a statistically significant effect on the costs and affordability of cancer care. However, in the general population, Jacobs et al. (90) found that newly eligible Medicaid enrollees spend less and use fewer services than previously eligible Medicaid enrollees. Additionally, Medicaid spending has declined since initial implementation of expansion. Similar findings may be seen in cancer care, as early diagnoses are associated with less costly treatment.

This review has certain limitations. First are the inherent limitations of a systematic review, including multiple and inconsistent outcomes measured in the individual studies, difficult to compare cohorts, and underlying study heterogeneity. Conference abstracts and unpublished work evaluating the impact of Medicaid expansion on more recent years were not included in our analysis. This exclusion limits the time frame of our study and the potential to fully evaluate certain outcomes such as access to treatment and cost. The majority of studies analyzed the first 1 to 2 years following expansion; this relatively short time frame might be insufficient. Last, the SEER and the Center for Disease Control and Prevention's BRFSS were the most common data sources among the studies included for analysis. During the study period, the SEER database contained only 13 states and covered only 28% of the United States, limiting the ability to draw conclusions on national trends (78). The BRFSS relies on information reported directly by the respondent, possibly introducing response bias.

This analysis identified several opportunities to further study the impact of Medicaid expansion on cancer care. Results from this systematic review highlight several gaps in the existing literature. The cancer care continuum is a useful framework to evaluate cancer-related interventions and to identify research-related gaps (12). The continuum includes risk assessment, primary prevention, screening, detection, diagnosis, treatment, survivorship, and end-of-life care. There are few rigorous studies demonstrating the impact of expansion on the treatment and survivorship phase. Relevant research topics would include evaluation of time to treatment from diagnosis (as addressed by Adamson et al. (77) in their yet-unpublished study), access to subspecialty care, use of guideline-adherent care, and cancer-specific survival outcomes. Additionally, a more robust analysis of health-care expenditures is needed to control for the impact of other ACA-related provisions and economic trends. The limitations of the individual studies and the reliance on simple descriptive statistics may affect the results. Most notably, there are no studies evaluating end-of-life care, including palliative care and hospice. Several prospective studies have demonstrated that integrating palliative care with cancer treatment improves quality of life and reduces costs without harming survival (79–82). Unfortunately, underinsured patients are less likely to receive adequate end-of-life care (83). Expansion in insurance coverage might be associated with increased access to hospice and concurrent palliative care for

patients with cancer, but this question has yet to be explored (91)

Future studies should examine additional postexpansion years to assess whether current trends persist over time and to better evaluate the impact on treatment decisions, outcomes, and health-care spending. Last, policy makers have introduced several changes to the Medicaid program, including implementing work requirements, charging premiums or monthly contributions, and the restructuring of Medicaid to block grants (84–86). These policy changes can potentially affect the benefit of expansion. For example, work requirements in Arkansas were associated with a statistically significant loss of coverage and increases in uninsured rates (84).

In conclusion, we found that Medicaid expansion has led to improved access to insurance coverage among cancer patients, particularly among low-income and minority populations. This review also serves to highlight important gaps in the existing literature in cancer care and serves as a resource for further research. The ACA has led to historic gains in health insurance coverage. Despite coverage gains, approximately 650 000 patients newly diagnosed with cancer and adults with a cancer history remain uninsured, predominantly in nonexpansion states (42, 67, 87). As health reform continues to be an issue at the top of the policy agenda, further policies are needed to expand coverage for all.

REVIEW

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