Evaluating Medicaid Expansion Benefits for Patients with Cancer: National Cancer Database Analysis and Systematic Review

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Abstract

Background: Insurance status modifies healthcare access and inequities. The Affordable Care Act expanded Medicaid coverage for people with low incomes in the United States. This study assessed the consequences of this policy change for cancer care after expansion in 2014.

Methods: National Cancer Database (NCDB) public benchmark reports were queried for each malignancy in 2013 and 2016. Furthermore, a systematic search [PubMed, Embase, Scopus and Cochrane] was performed. Data on insurance status, access to cancer screening and treatment, and socioeconomic disparities in these metrics was collected.

Results: Two-tailed analysis of the NCDB revealed that 14 out of 18 eligible states had a statistically significant increase in Medicaid-insured patients with cancer after expansion. The average percentage increase was 51% (13.2–204%). From the systematic review, 229 studies were identified, 26 met inclusion. All 21 relevant articles reported lower uninsured rates. The average increase of Medicaid-insured patients was 77% (9.5–230%) and the average decrease of uninsured rates was 55% (13.4–73%). 15 out of 21 articles reported increased access to care. 16 out of 17 articles reported reductions in inequities.

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Disclaimer: 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 for the conclusions drawn from these data by the investigator. It is the policy of the National Cancer Database (NCDB) that facility-specific survival data obtained from NCDB cannot be published.

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Conclusion: Medicaid expansion in 2014 increased the number of insured patients with cancer. Expansion also improved access to screening and treatment in most oncologic care, and reduced socioeconomic disparities. Further studies evaluating correlative survival outcomes are needed.

Policy Summary: This study informs debates on expansion of Medicaid in state governments and electorates in the United States, and on health insurance reform broadly, by providing insight into how health insurance can benefit people with cancer while revealing how less insurance coverage could harm patients with cancer before and after their diagnosis. This study also contributes to discussions of health insurance mandates, subsidized coverage for people with low incomes, and covered healthcare services determinations by public and private health insurance providers in other countries.

Graphical Abstract
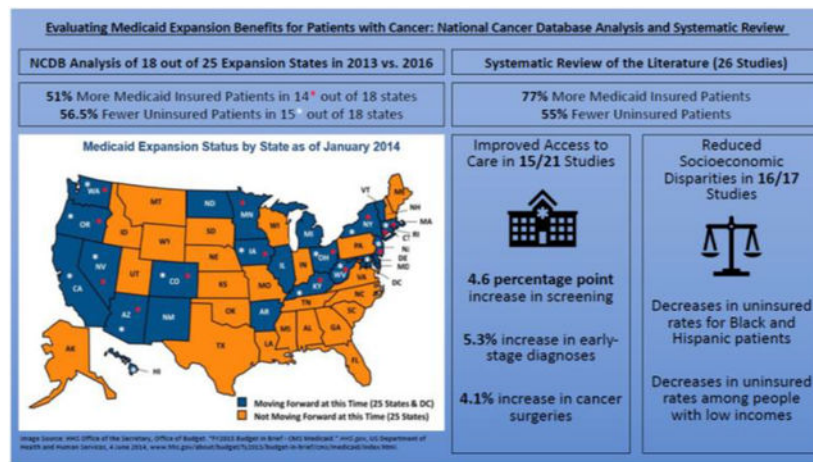
Keywords

Patient Protection and Affordable Care Act; Health Insurance; Early Detection of Cancer; Health Services Accessibility; Healthcare Disparities

Introduction

Cancer is a leading cause of mortality in the United States with an estimated 1,806,590 cases and 606,520 deaths in 2020 [1]. The all cancer five-year survival rate is 67.4% resulting in an estimated 15.5 million cancer survivors in America [1, 2]. Insurance status mediates access to care with relatively worse access for those without insurance [3–6]. As timely access to care influences cancer survival, insurance status impacts survival [7]. The percentage of uninsured cancer survivors decreased from 12.4% in 2012 to 7.7% in 2015 [8].

The Affordable Care Act (ACA) was largely implemented in 2014. The ACA provided federal funding for the expansion of Medicaid eligibility above previous state-set federal poverty level (FPL) limits to 138% FPL for nearly all adults, including childless nonelderly adults for the first time [9]. Due to the Supreme Court ruling *National Federation of Independent Business v. Sebelius*, states choose to expand [9]. As of November 2, 2020, 38 states and the District of Columbia have expanded Medicaid [9, 10]. Non-expansion states

have income limits at or below 100% FPL, as low as 17% FPL, and an average cutoff of 46.2% FPL [11]. While few states variously expanded Medicaid soon after the ACA was passed, most expansion states implemented the expansion on January 1, 2014, per ACA regulations (Figure 1).

Expansion led to more people being insured via Medicaid and fewer people being uninsured [12–14]. However, people living in non-expansion states are more likely to be uninsured, especially if their income places them in a coverage gap [15, 16]. A major limitation of existing literature is the tendency to juxtapose expansion states against heterogenous non-expansion states as groups, rather than contrasting pre-expansion and post-expansion data for each singular specific expansion state. A recent article reviewed the outcomes of Medicaid expansion in patients with cancer after passage of the ACA [17]. However, the authors included studies featuring data from states that expanded Medicaid prior to 2014, at different FPL eligibility criteria, thereby limiting the generalizability of the study [17].

We used NCDB public benchmark reports to compare the insurance status distributions of patients diagnosed with common cancers in 2013 versus 2016 for each specific state that changed its FPL eligibility to 138% per the ACA on January 1, 2014. Then we performed a systematic review that only included data on the 2014 expansion to investigate the impact of Medicaid expansion on patients with cancer in terms of insurance status, access to care, and socioeconomic disparities. The hypothesis was that more people would be insured via Medicaid in 2016 with improved access to care and decreased socioeconomic disparities. Understanding the impact of Medicaid expansion on patients with cancer can help guide further policy development in promoting Medicaid expansion and universal coverage.

Materials and Methods

Analysis of the National Cancer Database

The National Cancer Database (NCDB) is a hospital-based registry featuring data from over 1,500 Commission on Cancer-accredited facilities with about 70% of newly diagnosed cases of cancer across all states in America [18, 19]. As 25 states (Figure 1) implemented the ACA-standardized Medicaid expansion on January 1, 2014, the NCDB public benchmark reports were queried for these states with 2013 representing pre-expansion counts and 2016 representing the most recent post-expansion counts for each state [20]. Adopters of expansion after January 1, 2014 were excluded due to different follow-up time. The variable of insurance status generated distributions of the type of insurance people had when initially diagnosed with, and/or initially treated for, a particular cancer in a particular state in a particular year. All diagnosis types and all hospital types were included. This process was done for every cancer in all of the 25 expansion states, and data for a cancer or a state was excluded if no one in that state with that cancer in that year was uninsured or Medicaid insured. The 12 eligible cancers were brain, breast, colon, corpus uteri, kidney and renal pelvis, lung or bronchus non-small cell carcinoma, lung or bronchus small cell carcinoma, melanoma of the skin, nodal non-Hodgkin's lymphoma, pancreatic, thyroid, and urinary bladder cancers. Counts for each specific eligible malignancy were combined into an "all cancer" count, which was compared across insurance status between 2013 and 2016 for each eligible state. Percent change and averages were calculated. Chi square tests were performed

to assess changes in the insurance status distributions. The number of Medicaid insured people with cancer diagnosed in 2013 was compared against the number of Medicaid insured cancer patients diagnosed in 2016 for a specific state via two-sided Fisher's exact tests. Analysis was conducted using SAS 9.4 (Cary, North Carolina). Significance levels were denoted with a p<0.05.

Systematic Review

Framework followed Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines (Supplement 1, 2) [21]. Search strategy was last utilized on 5/1/2020 to search PubMed, Embase, Cochrane Registry of Trials, and Scopus databases. Search terms were: (Medicaid expansion [Title/Abstract]) AND (cancer [Title/Abstract]) AND (Affordable Care Act [Text]). Filters used were: Humans, English, from 2014 – 2020. Included studies were peer-reviewed, quasi-experimental articles employing population-based sources such as large databases, registries, and national surveys. Selected articles presented quantitative results related to the 2014 Medicaid expansion and its impact on patients with a type(s) of cancer. Studies assessing pre-2014 Medicaid expansion and forms of Medicaid expansion outside of the domain of the ACA were excluded as Medicaid eligibility criteria differed. Surveillance reports, theoretical projections, and single institution studies were excluded. To limit heterogeneity, any study combining states that expanded Medicaid at different times was excluded. The Risk of Bias in Non-Randomized Studies of Interventions (ROBINS-I) standard was applied [22]. To evaluate quality, the National Institutes of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies was employed [23]. Data extracted included outcome measures of insurance status, access to care in terms of screening and/or treatment and survival, if available, and inequities in these metrics influenced by race or income. Weighted averages of percent change in uninsured and Medicaid-insured rates were calculated.

Results

NCDB

18 out of 25 states were eligible for inclusion (Table 1). Pre-expansion insurance status distribution counts of 353,009 patients in 2013 were juxtaposed against post-expansion insurance status distribution counts of 370,810 patients in 2016. Fisher's exact tests determined that 14 of 18 eligible states had a statistically significant increase in the number of Medicaid insured patients with cancer post-expansion (Table 1). The average percentage increase was 51% (13.2–204%). Chi square analysis revealed that 15 of 18 states also reported statistically significant changes in insurance distribution with an average percentage decrease in uninsured patients of 56.5% (14.6–83.8%) (Table 1).

Systematic Review Study Characteristics

229 articles were screened, of which 26 were included (Figure 2). All had "moderate" bias [22] based on ROBINS-I scores and 23 had "good" National Institutes of Health Study Quality Assessment [23] scores with 3 articles having "fair" scores [24–26]. 17 studies utilized national or multi-state databases [26–42] (Table 2). 24 studies compared expansion states against non-expansion states, whereas two articles studied Kentucky alone.

Summary of Literature Search

Insurance Status—21 articles studied insurance status of people with cancer after Medicaid expansion, and all reported increases in the number of Medicaid insured and/or decreases in the number of uninsured patients with cancer in expansion states compared to non-expansion states [26–34, 36–47] (Table 2). Among the articles that report a relative percentage decrease in uninsured patients, the weighted average decrease was 55% (13.4–73%) after expansion [26–31, 33, 34, 36–38, 40–43, 45]. For studies that report a relative percentage increase in the number of patients with Medicaid, the weighted average increase was 77% (9.5–230%) [30, 32, 39, 41–44, 46, 47].

Access to Care—21 articles evaluated access to care in terms of screening, stage at diagnosis, and treatment rates (Table 2). One study evaluated survival [47]. 15 of these 21 articles reported a result indicating a statistically significant increase in one or more metric in expansion states compared to non-expansion states [24, 25, 31–35, 37, 40–43, 45, 47, 48]. 11 of these 15 articles specifically reported relatively higher screening rates and/or earlier stage of cancer at diagnosis in expansion states [24, 25, 33–35, 40–43, 47, 48]. The average increase in screening rates was 4.6 percentage points (1.5–11.4ppt) across three articles [24, 25, 48]. The percent increase in neoplasms diagnosed at an earlier stage following Medicaid expansion averaged to be 5.3% (2.3–12.8%) between seven studies [33–35, 40–43]. Heterogenous reporting precluded further quantitative analysis. Six studies described increased access to care as improved affordability of care and medications, reduced time to treatment, increases in non-discretionary cancer surgeries, greater utilization, and better survival in Medicaid expansion states [31, 32, 37, 41, 45, 47]. The six articles that did not find improved access to care reported varying observations, including earlier stage diagnosis for all cancers, later stage of diagnosis for cervical, uterine, or ovarian cancers, and no changes in screening [28, 29, 39, 44, 46, 49].

Socioeconomic Disparities—16 of the 17 studies that characterized changes in socioeconomic inequities along the continuum of care of patients with cancer reported reductions in disparities after expansion [24, 26–29, 32–34, 36–40, 48] (Table 2). The specific differences partially relieved included uninsured rates, and lower screening and surgery rates. Alleviation of differences based on race was observed in eight of 16 articles [26, 27, 29, 32–34, 36, 39], and narrowing of gaps based on income was reported in 10 of 16 studies [24, 26, 27, 29, 32, 33, 37, 38, 40, 48]. Depending on the study, the decrease in uninsured rates among Black patients ranged from 3.4–90.5% [26, 27, 29, 36]. The reduction in the proportion of uninsured people from low-income, high poverty, and/or rural backgrounds averaged to be 47% (4.8–77.7%) [26–29, 36, 47]. Five studies [26, 27, 29, 32, 33] reported simultaneous benefits for both minority (Black and/or Hispanic) and low-income populations, whereas three articles [37, 38, 40] reported that disparities in income but not race were reduced following expansion.

Discussion

We conducted a descriptive analysis of the NCDB and performed a systematic literature review to evaluate the influence Medicaid expansion in 2014 had on the insurance status of

people with cancer. This was previously unclear, as no prior study evaluated pre-expansion and post-expansion data for each specific state that changed its Medicaid eligibility to 138% FPL at the same time on January 1, 2014. For patients with one of twelve common malignancies, expansion led to statistically significant increases in the number of Medicaid-insured patients, and decreases in the number of uninsured patients. Systematic review of existing literature supported these observations. This shift in insurance status is critically important for people with cancer as insurance status impacts access to care throughout the continuum of care, influencing outcomes [3, 4, 47].

NCDB Analysis

Evaluation of NCDB data reveals the insurance status of patients with cancer at their point of care. The increase in Medicaid enrollment for patients with cancer after expansion among these 14 states averages to be 51% (13.2–204%), outpacing the gain in Medicaid signups throughout the country between 2013 and 2016 of 13% for the general population [50]. Furthermore, the decrease in the number of uninsured patients with cancer after expansion in the 15 states with significant changes in insurance distribution averaged to be 56.5% (14.6–83.8%). For these 15 states the average percent decrease in the number of uninsured people among the general population between 2013 and 2016 was 6.3% [50]. Therefore, cancer patients in these Medicaid expansion states had greater gains in Medicaid insurance and lower rates of being uninsured compared to the general population since Medicaid expansion in 2014.

Systematic Review

The trend from the NCDB correlated with the systematic review, as all relevant articles reported increased Medicaid coverage and decreased uninsured rates after expansion in 2014. These sequelae are important to confirm as insurance status modifies cancer patient outcomes [51]. People who are uninsured when newly diagnosed with a malignancy tend to be diagnosed at a later stage compared to people with insurance and are less likely to receive timely and appropriate treatment, contributing to worse survival for uninsured people with cancer [51, 52]. Moreover, Medicaid patients report having a usual source of care, having a healthcare visit in the last year, and not forgoing care or medications due to cost at greater rates than uninsured patients [51].

Therefore, the next domain we evaluated was access to care. The most common improvements after expansion were higher screening rates and/or earlier stage of cancer at diagnosis in expansion states relative to non-expansion states. Importantly, this increase in detecting neoplasms early was observed for malignancies for which screening is routinized via guidelines such as breast and colorectal cancers, and for all cancers in general. However, six articles report no relative shift in stage of diagnosis or change in screening rates for both frequently-screened and general malignancies, with one study even describing a decrease in Papanicolaou tests. Lyu *et al.* [25] observed that ACA-mediated Medicaid expansions were associated with increased cancer screening for breast, cervical, and colorectal cancers only in states with a high supply of primary care providers to meet the demand of more patients with Medicaid. In states with limited supply of primary providers, such limited cancer screening may be more pronounced with increased competition for appointments

among a larger insured population following ACA implementation. Clinics may have also rejected newly enrolled Medicaid patients as Medicaid pays less than other insurance [53]. Indeed, a study found greater availability of appointments for Medicaid enrollees between 2012 and 2014, when the ACA increased Medicaid reimbursement rates to Medicare levels [54]. These findings reveal a role for policy to increase the availability of primary care providers. Loan forgiveness and increased reimbursement rates for primary care providers may help achieve the goals of health insurance reform and expansion.

Diagnosing malignancies earlier and starting treatment earlier are main reasons why more people are surviving cancer [51, 55]. Indeed, three studies specifically noticed statistically significant increases in cancer surgery rates after expansion while others noted better affordability of care and medications. Thus, the increase in screening and earlier detection of neoplasms in people residing in states that expanded Medicaid could facilitate improved survival. This finding was made by Gan *et al.* [47] who saw that Medicaid expansion in Kentucky led to greater diagnosis of colorectal cancer, more early-stage diagnoses, and better survival.

We also noted reductions in socioeconomic disparities after Medicaid expansion in 2014. Income and race were the determinants of health most consistently evaluated in selected studies. Eligibility for Medicaid is based on a low modified adjusted gross income; thus, it is intuitive that increasing the income limit to 138% FPL will increase eligibility. Nonetheless, it is important to demonstrate that the income gap in insurance status did narrow following Medicaid expansion since this can influence cancer survival. O'Connor *et al.* [56] found that the mean cancer death rate was 185.9 per 100,000 person-years in high-income counties, compared with 204.9 and 229.7 per 100,000 person-years in medium- and low-income counties, respectively.

In addition, multiple studies reported gains in insurance and increases in screening for racial minorities, particularly African-Americans after Medicaid expansion. However, in one study the only minority group to not see a decrease in uninsured rates was American Indians/Alaska Natives [34], and in another study Asians and Pacific Islanders were the one group to not experience a decrease in uninsured rates [36]. Moreover, while Zerhouni *et al.* [49] reported an 8.1% increase in colorectal cancer screening for African-Americans after Medicaid expansion, they also observed that Latinx people experienced no increase in colorectal cancer screening. Despite these shortcomings, the progress in reducing disparities for the African-American population is certainly noteworthy, especially as increased screening may lead to earlier detection, which may translate to a reduction in the health disparity of differential colorectal cancer survival by race [47, 57]. Prior to Medicaid expansion, African-Americans were 4.9% less likely to receive timely cancer therapy relative to Whites, the greatest delay in time to treatment for cancer for any minority group [57]. After expansion, Adamson *et al.* [57] no longer observed this inequity. Eguia *et al.* [32] also noted a narrowed gap in odds to undergo surgery for Medicaid-insured Black and Hispanic patients after expansion. Therefore, these gains in Medicaid insurance enrollment, screening, odds to undergo surgery for cancer, and timely cancer treatment rates collectively indicate reductions in socioeconomic disparities for people with cancer.

The current systematic review features data from Surveillance, Epidemiology, and End Results (SEER) reports [36], Behavioral Risk Factor Surveillance System (BRFSS) surveys [44], and other sources, and was corroborated with the NCDB. Even though including data from different sources invites heterogeneity, using multiple sizable and diverse population-based methods makes the results more generalizable [58]. Increasing the broad relevance of findings from this analysis, six of the 26 studies included all cancers in their samples rather than limiting selected malignancies to neoplasms that are more detectable by screening or too uncommon. Moreover, the total sample size of 10,928,809 people for these 26 studies surpasses many datasets.

While differing in study design and included studies, our findings are similar to a recent review by Moss *et al.* [17]. They included studies on Medicaid expansions that occurred before 2014, which can be problematic since only a few states participated in Medicaid expansion between 2010 and 2014 [17, 59] at drastically different income eligibility limits ranging from 23%−200% FPL (Figure 1). The current study was restricted to states that expanded Medicaid in January 2014 at the same 138% FPL eligibility. Thereby, the results would be a more accurate representation of the effects of Medicaid expansion in its current form as regulated by the ACA.

Limitations

There are important limitations to acknowledge regarding use of the NCDB. As the NCDB is a hospital-based registry, it is not representative of the United States population, limiting the external validity. Therefore, the results were also corroborated across multiple data sources via systematic review. The NCDB is also susceptible to selection bias, as only patients with access to care are diagnosed with cancer, and those with greater access to care tend to be insured. This may underrepresent uninsured patients, and overrepresent insured patients compared to the general population. However, our analysis did not focus on the general population, but instead evaluated trends in insurance status of patients when first diagnosed and/or treated for cancer. The simultaneous downward trends in population uninsured rates and uninsured rates for newly diagnosed cancer patients are nevertheless reassuring. Ultimately, the NCDB was chosen since it has data from all states whereas other datasets such as SEER only have data from a few states [60].

Though the systematic review utilizes various sources, relying on select databases such as SEER for eight out of 26 articles can limit the generalizability of the data, and surveys are susceptible to response bias [61]. Incomplete retrieval of identified research and reporting bias are also potential limitations. In our analysis, we also merged multiple measured outcomes into three domains, inviting conflation and mixed findings. For example, it can be debated if findings in one study of alleviation of inequities by income but not race demonstrate that Medicaid expansion facilitates decreases in socioeconomic inequities. Moreover, the paucity of alternative variables to characterize social determinants of health reflects a limitation of the literature. Only three studies looked at rural location, and only Mesquita-Neto *et al.* [40] created a nuanced socioeconomic standing metric that added area unemployment rate and education level to income measures. Thus, insight into the effect of Medicaid expansion on health disparities is primarily restricted to the roles of race and

income along the continuum of care. This review may not capture changes in survival given the recency of Medicaid expansion implementation in 2014. Therefore, we cannot characterize the impact of Medicaid expansion on health disparities, but rather on inequities in factors that can influence health such as insurance status and access to care. This short time window also limited the number of studies overall.

Conclusions

Through a descriptive analysis of the National Cancer Database and a systematic review of the literature, we found that people with cancer experienced lower uninsured rates, increased Medicaid insurance rates, increased access to care in terms of screening and surgery, and alleviation of socioeconomic disparities in these metrics following Medicaid expansion in 2014. These findings serve as comprehensive evidence of the sustained consequences of Medicaid expansion throughout the continuum of care for patients with cancer. Moreover, this review and analysis highlight areas for future in-depth studies to track these results and further evaluate the impact on health disparities and survival. These studies can ultimately inform government action to increase insurance coverage.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements:

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Highlights:

- Medicaid expansion in 2014 reduced the number of uninsured patients with cancer

- Expansion increased the number of Medicaid-insured patients with cancer

- Expansion increased screening, earlier detection, and treatment of cancer

- Expansion decreased socioeconomic disparities in cancer care

3/23/2010: ACA signed into law

4/1/2010 CT: up to 56% FPL

7/1/2010 DC: up to 200% FPL

1/1/2014: All states up to 138% FPL

AZ, AR, CA, CO, CT, DE, DC, HI, IL, IA, KY, MA, MD, MN, NV, NJ, NM, NY, ND, OH, OR, RI, VT, WA, WV

2010   2011   2014

1/3/2011 WA: up to 133% FPL

3/1/2011 MN: up to 75% FPL

4/14/2011 NJ: up to 23% FPL
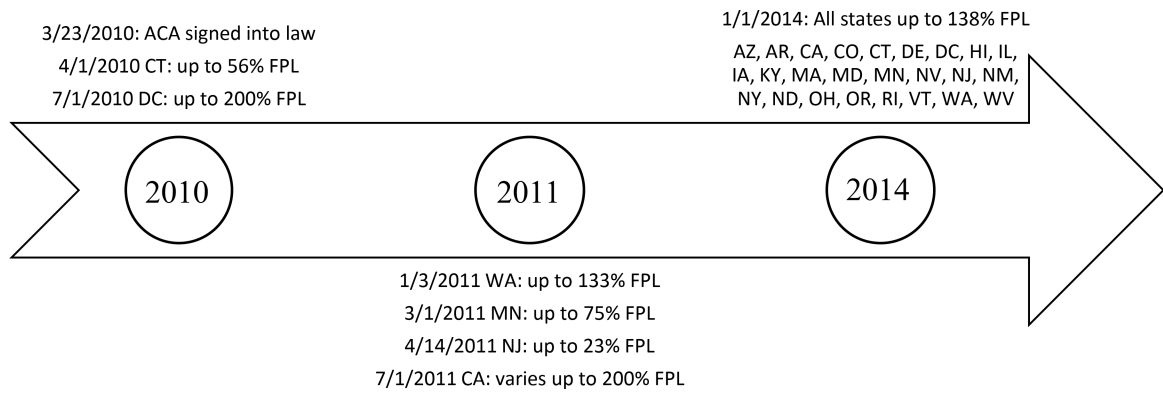
7/1/2011 CA: varies up to 200% FPL

Figure 1.
Timeline of when states implemented Medicaid expansions at particular Federal Poverty Level (FPL) eligibility cutoffs.
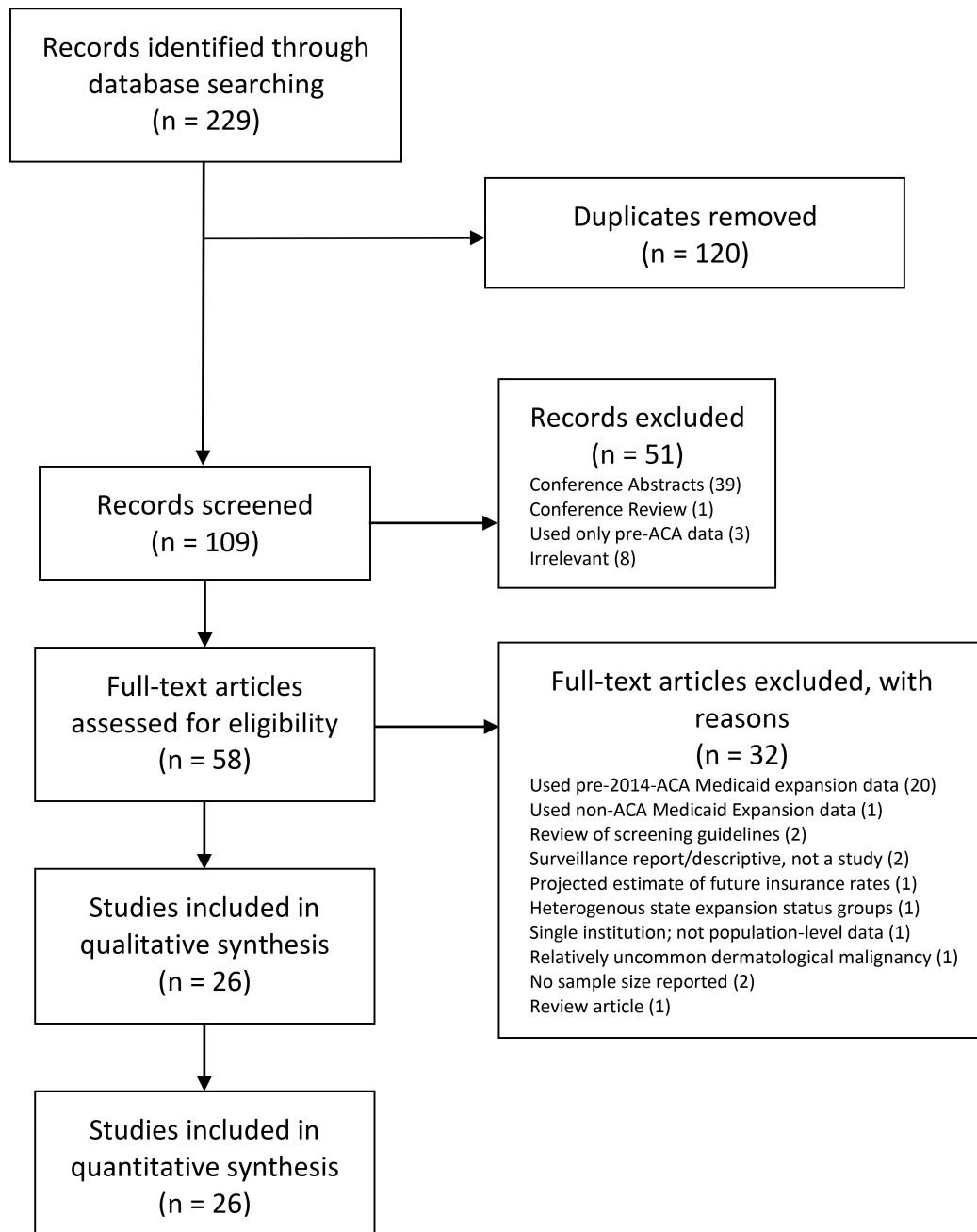
Figure 2.
Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram for systematic literature review.

Table 1.

NCDB results for 2013 and 2016 for selected Medicaid expansion states for all 12 eligible cancers (N = 723,819).

State	Insurance Type	2013	2016	Percent Change (%)	Adjusted p-value for only Total Change	p-value for only Medicaid Change
Arizona	Uninsured	89	76	−14.61		
	Private/Managed	2237	2795	+24.94		
	Medicaid	126	383	+204.0		<0.0001
	Medicare	2624	3502	+33.46		
	Total	5076	6756	+33.10	<0.0001	
California	Uninsured	1097	671	−38.83		
	Private/Managed	27522	33468	+21.60		
	Medicaid	5320	6195	+16.45		0.12
	Medicare	23437	25870	+10.38		
	Total	57376	66204	+15.39	<0.0 001	
Colorado	Uninsured	437	156	−64.30		
	Private/Managed	6606	5875	−11.07		
	Medicaid	748	1154	+54.28		<0.0001
	Medicare	7057	6906	−2.14		
	Total	14848	14091	−5.10	<0.0001	
Connecticut	Uninsured	137	145	+5.84		
	Private/Managed	6189	5880	−4.99		
	Medicaid	1102	1285	+16.61		<0.0001
	Medicare	7282	7390	+1.48		
	Total	14710	14700	−0.07	0.0002	
Delaware	Uninsured	35	37	+5.71		
	Private/Managed	1327	1315	−0.09		
	Medicaid	143	159	+11.19		0.52
	Medicare	1779	1789	0.56		
	Total	3284	3300	+0.49	0.91	
Hawaii	Uninsured	37	6	−83.78		
	Private/Managed	1602	1634	+2.00		
	Medicaid	241	277	+14.94		0.11
	Medicare	1508	1723	+14.26		
	Total	3388	3640	+7.44	0.0001	
Iowa	Uninsured	200	42	−79.00		
	Private/Managed	2674	2981	+11.48		
	Medicaid	300	376	+25.33		0.04
	Medicare	3356	3693	+10.04		
	Total	6530	7092	+8.61	<0.0001	

State	Insurance Type	2013	2016	Percent Change (%)	Adjusted p-value for only Total Change	p-value for only Medicaid Change
Kentucky	Uninsured	552	131	−76.27		
	Private/Managed	5796	5656	−2.42		
	Medicaid	1104	1827	+65.49		<0.0001
	Medicare	8400	9312	+10.86		
	Total	15852	16926	+6.78	<0.0001	
Massachusetts	Uninsured	199	148	−25.63		
	Private/Managed	13320	13821	+3.76		
	Medicaid	1566	1952	+24.65		<0.0001
	Medicare	12264	13702	+11.73		
	Total	27349	29623	+8.31	<0.0001	
Maryland	Uninsured	390	177	−54.62		
	Private/Managed	7875	6595	−16.25		
	Medicaid	709	624	−11.99		0.53
	Medicare	8073	7123	−11.77		
	Total	17047	14519	−14.83	<0.0001	
Minnesota	Uninsured	132	129	−2.27		
	Private/Managed	13061	13647	+4.49		
	Medicaid	973	1101	+13.16		0.03
	Medicare	8538	9107	+6.70		
	Total	22704	23984	+5.64	0.1251	
Nevada	Uninsured	195	57	−70.77		
	Private/Managed	1256	1245	−0.88		
	Medicaid	152	232	+52.63		<0.0001
	Medicare	1284	1458	+13.55		
	Total	2887	2992	+3.64	<0.0001	
New Jersey	Uninsured	1216	545	−55.18		
	Private/Managed	11023	10991	−0.29		
	Medicaid	830	1301	+56.75		<0.0001
	Medicare	13445	13352	−0.69		
	Total	26514	26189	−1.23	<0.0001	
New York	Uninsured	591	463	−21.66		
	Private/Managed	24281	23421	−3.54		
	Medicaid	5210	6123	+17.52		<0.0001
	Medicare	25192	25963	+3.06		
	Total	55274	55970	+1.26	<0.0001	
Ohio	Uninsured	1698	590	−65.25		
	Private/Managed	17023	16723	−1.76		
	Medicaid	2606	4140	+58.86		<0.0001
	Medicare	21896	24260	+10.80		

State	Insurance Type	2013	2016	Percent Change (%)	Adjusted p-value for only Total Change	p-value for only Medicaid Change
	Total	43223	45713	+5.76	<0.0001	
Oregon	Uninsured	314	115	−63.38		
	Private/Managed	4587	4360	−4.95		
	Medicaid	676	1117	+65.24		<0.0001
	Medicare	5593	6034	+7.88		
	Total	11170	11626	+4.08	<0.0001	
Washington	Uninsured	428	157	−63.32		
	Private/Managed	8585	9157	+6.70		
	Medicaid	1381	1987	+43.88		<0.0001
	Medicare	10678	11536	+8.04		
	Total	21072	22837	+8.38	<0.0001	
West Virginia	Uninsured	127	37	−70.87		
	Private/Managed	1557	1534	−1.48		
	Medicaid	501	579	+15.57		0.008
	Medicare	2520	2498	−0.87		
	Total	4705	4648	−1.21	<0.0001	

Statistical analyses generated p-values only for the total change in insurance status distribution and change in the number of people with cancer insured by Medicaid. The 12 eligible cancers were brain, breast, colon, corpus uteri, kidney and renal pelvis, lung or bronchus non-small cell carcinoma, lung or bronchus small cell carcinoma, melanoma of the skin, nodal non-Hodgkin's lymphoma, pancreatic, thyroid, and urinary bladder cancers.

Table 2.

Summary of literature search results evaluating effects of Medicaid expansion for the three key domains of changes in insurance rates, cancer screening and access to care, and socioeconomic disparities.

Citation, Author, Year	Sample	Cancer Type	Sample Size	More Insurance Coverage	More Screening & Treatment	Reduced Socioeconomic Disparities
24. Okoro et al. 2017	BRFSS. 18–64 years old. 2014.	Breast, cervical, colorectal	277,734	Not studied for cancer patients	Yes, greater breast (3ppt), cervical (1.5ppt), and colorectal (2.5ppt) cancer screening	Yes, reduced income gap in breast cancer screening, but not for cervical and colorectal cancer screening
25. Lyu et al. 2019	BRFSS. Low-income adults (<138% FPL). 18–64 years old. 2012 vs. 2016.	Breast, cervical, colorectal	31,890	Not studied.	Yes, greater breast (11.4ppt), cervical (6.9ppt), and colorectal (8.3ppt) cancer screening	Not studied.
26. Mahal et al. 2020	SEER. 18–64 years old. 2010–2014.	Breast, lung, and prostate	108,864	Yes, 71% fewer uninsured in Medicaid expansion states.	Not studied.	Yes, elimination of uninsured gap between Blacks (90.5% decrease) and Whites and between low-income (<138% FPL, 7% decrease) and high income people.
27. Chino et al. 2017	SEER. Radiation recipients. 18–64 years old. 2011–2014.	All Cancer	197,290	Yes, 53% fewer uninsured	Not studied.	Yes, greatest gains among Blacks (50%), high poverty areas (60% fewer uninsured)
28. Jemal et al. 2017	NCDB. 18–64 years old. 2011–2014.	All Cancer	1,718,864	Yes, 54.7% fewer uninsured	No, similar shift to earlier stage	Yes, reduced income gap in uninsured rate (62.5% fewer uninsured at <138%FPL)
29. Moss et al. 2017	SEER. Women. <65 years old. 2008–2014.	Cervical, uterine or ovarian	90,192	Yes, 50% fewer uninsured	No, shift toward later stage	Yes, reduced Black (by 50%) and low-income uninsured rate (by 72%)
30. Cannon et al. 2018	SEER. 19–64 years old. 2007–2014.	Head and Neck Squamous Cell Carcinoma	89,038	Yes, 52% fewer uninsured, 9.5% more via Medicaid	Not studied.	Not studied.
31. Crocker et al. 2018	HCUP-SID (Florida, Kentucky, Maryland, New Jersey, North Carolina). Cancer surgery patients. 18–64 years old. 2012–2015.	Colorectal, esophagogastric, hepatobiliary, lung, and urologic	78,915	Yes, 13.4% fewer uninsured	Yes, 4.1% increase in non-discretionary cancer surgeries (5.3% decrease in non-expansion states)	Not studied.
32. Eguia et al. 2018	HCUP-SID (Florida, Iowa, Maryland, New York). 18–64 years old. 2010–2014.	Pancreas, esophagus, prostate, bladder, colorectal, lung, and gastric	317,858	Yes, Medicaid insured increased: 12% for pancreatic, 14% for breast, 11% for colorectal, 34% for prostate, and	Yes, cancer surgery rates up 30% for lung cancer, 25% for breast cancer, 25% for colorectal cancer in Medicaid Expansion states compared to non-expansion states	Yes, disparities in odds to undergo surgery between Medicaid and privately insured cancer patients of Black race and Hispanic race decreased after Medicaid expansion

Citation, Author, Year	Sample	Cancer Type	Sample Size	More Insurance Coverage	More Screening & Treatment	Reduced Socioeconomic Disparities
				23% for gastric cancers (Expansion vs. non-expansion states)		and increased in non-expansion states
33. Han et al. 2018	NAACCR (40 states). First primary malignant cancer. 18–64 years old. 2010–2014.	All Cancer	2,471,154	Yes, 50% fewer uninsured	Yes, 2.3% greater early-stage diagnosis: all cancers combined	Yes, reduced insurance disparities based on race (for Blacks and Hispanics), income, and rural residence
34. Moss et al. 2018	SEER. 0–64 years old. 2008–2014.	Breast, lung, and colon	414,085	Yes, fewer uninsured, more Medicaid insured: Colon (−50%,+38%) lung (−57%, +24%) breast (−33%,+14%) cancer	Yes, increase in early-stage diagnoses by 1.2% for breast, 6.4% for colon, but no change for lung cancer	Yes, uninsured rates decreased for all races except: American Indians/ Alaskan Natives for lung & colon cancer, and except Blacks and American Indians/ Alaskan Natives for breast cancer
35. Soni et al. 2018	SEER. First time cancer diagnosis. 19–64 years old. 2010–2014.	All Cancer	3,055	Not studied.	Yes, 6.4% increase in early-stage diagnoses	Not studied.
36. Agarwal et al. 2019	SEER. 0–64 years old. 2011–2015. Compared expansion states against non-expansion states.	All Cancer	716,364	Yes, 3% greater decrease in uninsured in expansion vs. non-expansion states	Not studied.	Yes, greatest decreases in uninsured among rural (−4.8%) & minorities except Asians and Pacific Islanders: Black (−3.4%), Hispanic (−3.9%)
37. Crocker et al. 2019	HCUP-SID (Florida, Kentucky, Maryland, New Jersey, North Carolina). Inpatient cancer surgery patients. 18–64 years old. 2012–2015	Colorectal, esophagogastric, hepatobiliary, pancreatic, lung, urologic	81,628	Yes, 82.6% more insured via Medicaid in expansion states; 10.1% fewer Medicaid-insured in non-expansion states	Yes, 10.8% greater utilization by Medicaid & uninsured patients; 9.5% less in non-expansion states	Mixed Results. Expansion narrowed the income gap but not the race gap (Whites relative to Blacks and Hispanics) in cancer surgery utilization
38. Spiegel et al. 2019	SEER. New diagnosis. 19–64 years old. 2011–2014.	Breast, cervical, uterine, or prostate with brachytherapy	15,497	Yes, 38% fewer uninsured	Not studied.	Mixed Results. Expansion narrowed insurance income gap but not the race gap (Whites relative to Blacks and Hispanics)
39. Huguet et al. 2019	ADVANCE clinical data. Age-based screening cohorts from 21–64 years old. 2012–2015.	Cervical and colorectal	329,126	Yes, Medicaid visit rate up 56%, uninsured visit rate decreased 52% after Medicaid expansion	No, similar screening rates since increased in both states	Yes, narrowed race gap (Whites relative to Blacks and Hispanics) for cervical and colorectal cancer screening
40. Mesquita-Neto et al. 2019	SEER. All patients. 2007–2009 vs. 2014–2015.	Breast, colorectal, ovarian, lung, uterine, pancreatic, prostate, and liver	293,028	Yes, 50% fewer uninsured in Medicaid	Yes, 12.8% increase in early-stage diagnoses	Yes, 54.5% fewer uninsured & 3.8% greater access to surgery for people of

Citation, Author, Year	Sample	Cancer Type	Sample Size	More Insurance Coverage	More Screening & Treatment	Reduced Socioeconomic Disparities
				expansion states		low socioeconomic standing
41. Sineshaw et al. 2020	NCDB. 18–64 years old. 2010–2016.	Head and Neck Squamous Cell Carcinoma	90,789	Yes, 63% decrease in uninsured, 18% increase in Medicaid insured in Medicaid expansion states	Yes, 3.8% increase in early-stage diagnoses. Time to treatment initiation down 5.5 days for nonoropharyngeal head & neck squamous cell carcinoma, no difference for overall head & neck squamous cell carcinoma	Not studied.
42. Takvorian et al. 2020	NCDB. 40-64 years old. 2011–2016	Breast, colon, non-small cell lung	848,329	Yes, 24% more Medicaid-insured and 55% fewer uninsured in Medicaid expansion states	Yes, 4.4% increase in early-stage diagnoses, 2.2% fewer late-stage diagnoses in expansion states. No time to treatment initiation difference between expansion and non-expansion states	Not studied.
43. Ajkay et al. 2018	Kentucky Cancer Registry. Women. 20-64 years old. 2011–2016.	Breast	1,315,965	Yes, 73% fewer uninsured, 54% more via Medicaid	Yes, earlier stage (up 3.4%; 2.2ppt), earlier treatment (5.1% sooner)	Not studied.
44. Cawley et al. 2018	BRFSS. Low-income childless adults. 19–64 years old. 2010–2016	Breast and cervical	80,200	Yes, 16.7% more insured	No screening change, but better access to care overall	Not studied.
45. Nikpay et al. 2018	BRFSS. All-Cancer survivors. 18–64 years old. 2011–2015	All Cancer	17,381	Yes, 52.6% fewer uninsured	Yes, care (9ppt) & meds (14ppt) both more affordable	Not studied.
46. Alharbi et al. 2019	MEPS. Women. Low-income. <65 years old. 2012–2016.	Breast and cervical	13,078	Yes, 100% more insured via Medicaid	No, mammograms at the same rate and Papanicolaou tests at a lower rate	Not studied.
47. Gan et al. 2019	Kentucky Cancer Registry and Kentucky Hospital Discharge Database. 20+ years old. 2011–2016	Colorectal	930,176	Yes, 230% increase in screened Medicaid insured	Yes, more diagnosed, earlier stage, better survival (Hazard Ratio = 0.73)	Yes, patients from Appalachian parts of Kentucky (rural) saw 199% increase in Medicaid and 77.7% decrease in uninsured. Early stage diagnosis increased 9.3% for Appalachians post-expansion
48. Hendryx et al. 2018	BRFSS. Low-income childless adults. 18–64 years old. 2012 vs. 2016.	Breast, cervical, and colorectal	56,959	Not studied.	Yes, greater screening rates: cervical (2ppt) and colorectal (3.2ppt) (Expansion vs. Non-expansion states)	Yes, helped reduced gap in screening between low and high income folks.
49. Zerhouni et al. 2019	BRFSS. White, Black, and Hispanic respondents with complete demographic answers. Age 50–	Colorectal	341,350	Not studied.	No, 8% more likely to get colorectal cancer screening in expansion states than non-expansion states, but no increase after 2014 Medicaid expansion	No, no statistically significant changes in disparities after 2014 Medicaid expansion. Statistically significant changes in race (Whites relative to Blacks

Citation, Author, Year	Sample	Cancer Type	Sample Size	More Insurance Coverage	More Screening & Treatment	Reduced Socioeconomic Disparities
	64 years old. 2012–2016					and Hispanics) and income disparity reduction only seen in states that expanded Medicaid prior to 2014.
Summary	17 from national/ multi-state databases, 7 from national surveys, 2 from Kentucky databases	All Cancer (6), Breast (11), Gastrointestinal (11), Gynecologic (9), Lung (7), Squamous Cell Carcinoma (2), Urologic (6)	10,928,809	21 out of 21 articles	15 out of 21 articles	16 out of 17 articles

Abbreviations: ADVANCE (Accelerating Data Value Across a National Community Health Center Network), BRFSS (Behavioral Risk Factor Surveillance System), HCUP-SID (Healthcare Cost and Utilization Project - State Inpatient Databases), MEPS (Medical Expenditure Panel Survey), NAACR (North American Association of Cancer Registries), NCDB (National Cancer Database), SEER (Surveillance, Epidemiology, and End Results Program); ppt (Percentage Point); FPL (Federal Poverty Level).