Original Article

Impact of Medicaid expansion under the Patient Protection and Affordable Care Act on lung cancer care in the US

Aitua Charles Salami[1]^, Daohai Yu[2], Xiaoning Lu[2], Jeremiah Martin[3], Cherie P. Erkmen[4], Charles T. Bakhos[4,5]

[1]Department of Cardiovascular and Thoracic Surgery, University of Texas Southwestern Medical Center, Dallas, TX, USA; [2]Department of Biomedical Education and Data Science, Center for Biostatistics and Epidemiology, Temple University, Philadelphia, PA, USA; [3]Department of Surgery, Southern Ohio Medical Center, Portsmouth, OH, USA; [4]Department of Thoracic Medicine and Surgery, Lewis Katz School of Medicine, Philadelphia, PA, USA; [5]Department of Surgical Oncology, Fox Chase Cancer Center, Philadelphia, PA, USA

Contributions: (I) Conception and design: AC Salami, D Yu, J Martin, CP Erkmen, CT Bakhos; (II) Administrative support: AC Salami, CT Bakhos; (III) Provision of study materials or patients: None; (IV) Collection or assembly of data: None; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Charles T. Bakhos, MD, MBA, MS, FACS. Department of Thoracic Medicine and Surgery, Lewis Katz School of Medicine, Philadelphia, PA, USA; Department of Surgical Oncology, Fox Chase Cancer Center, 3401 North Broad Street, C501, Parkinson Pavilion, Philadelphia, PA 19140, USA. Email: charles.bakhos@tuhs.temple.edu.

Background: Healthcare disparities significantly affect access to care and outcomes in lung cancer patients. The Patient Protection and Affordable Care Act (ACA) Medicaid expansion (ME) was enacted with the aim of improving access to quality and affordable healthcare. This study aims to determine the impact of ME on access to care and outcomes for patients with lung cancer.

Methods: We conducted a retrospective analysis of adults (ages 40–64 years) diagnosed with non-small cell lung cancer (NSCLC) in the National Cancer Database between 2009–2019. The study population was divided into a pre-expansion era (A: 2009–2013) and a post-expansion era (B: 2015–2019). The exposure of interest was residence in a state that expanded Medicaid in 2014 (ME) *vs.* non-expansion (NE). Outcomes were insurance coverage, clinical stage at diagnosis, treatment facility, and survival. Propensity score analysis was used to determine the association between ME and survival.

Results: A total of 202,003 patients were included (era B, 51.6%). The median age was 58 years, the majority of patients were male (53.0%), White (79.7%), had no comorbidities (62.0%) and adenocarcinoma (57.4%). From era A to B, insurance coverage increased to 96.7% (+6.6%), stage I disease to 25.3% (+6.5%), and treatment at an academic facility to 43.9% (+3.5%) in the ME group. For the NE group, the increases were up to 88.3% (+4.3%), 21.6% (+4.0%), and 28.6% (+0.2%), respectively. The increase in stage I cancer diagnosis was most noticeable in females. Following risk adjustment, era B was associated with an improvement in survival outcomes irrespective of ME status.

Conclusions: Disparities in lung cancer care seem to have improved after ME. Ongoing monitoring is still necessary to confirm the program's long-term impact on lung cancer survival.

Keywords: Medicaid expansion (ME); lung cancer; disparities; access; outcomes

Submitted May 13, 2024. Accepted for publication Jul 19, 2024. Published online Sep 12, 2024.
doi: 10.21037/jtd-24-786
View this article at: https://dx.doi.org/10.21037/jtd-24-786

^ ORCID: 0000-0003-1224-2173.

Introduction

Lung cancer is the second most common malignancy and the leading cause of cancer-related deaths in the United States (1). The 5-year survival rate is estimated at 19%, largely because most cases are diagnosed at advanced stages (1). There are significant opportunities for improvement in the screening and treatment of lung cancer (2). Healthcare disparities have emerged as an important barrier to the delivery of standard of care therapy for lung cancer (3-5). This is apparent in the socially marginalized and uninsured, as a recent study demonstrated a lower rate of surgical therapy and survival for individuals with early-stage tumors in these subgroups (4).

The Patient Protection and Affordable Care Act (ACA) was enacted in 2010, with the aim of improving access to quality and affordable healthcare. A central component of the ACA is the expansion of Medicaid eligibility which provides insurance coverage to non-elderly adults earning less than 138% of the federal poverty level (6). Since the expansion of Medicaid eligibility in 2014, studies evaluating its impact have reported an increase in insurance coverage, timely cancer diagnosis, and improved access to surgical care in heterogeneous cancer populations (7-10). However, others have failed to demonstrate any improvement in clinical outcomes (11). Some evidence suggest Medicaid may be suboptimal for the management of complex cancers (12), and Medicaid expansion (ME) could increase racial disparities in access to quality surgical care (13). Population-level data that examine the impact of ME on survival for patients with non-small cell lung cancer (NSCLC) are scarce. Two recent studies reported a 2-year survival increase with ME but were limited by a relatively short-term follow-up (10,14). Therefore, the effect of ME on long-term survival for patients with NSCLC remains unknown.

The aim of this study is to evaluate the impact of ME on access to care and outcomes for patients with lung cancer. Specifically, we sought to determine the impact of ME on insurance coverage, stage of diagnosis, treatment characteristics, and survival outcomes of patients with NSCLC. We also sought to examine the impact of ME on gender and racial disparities in lung cancer care. The authors hypothesize that ME led to improvements in lung cancer care by improving insurance coverage, facilitating timely diagnosis and decreasing access disparities for minorities with NSCLC. We present this article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-786/rc).

Highlight box

Key findings

- Medicaid expansion (ME) improves the insurance enrollment rate, timeliness of diagnoses, and treatment at academic institutions for patients with lung cancer.

What is known and what is new?

- ME is associated with a 2-year survival improvement for lung cancer patients.
- ME does not seem to impact long-term (5-year) survival.

What is the implication, and what should change now?

- Need for ongoing monitoring to confirm the program's long-term impact on access to care and survival for patients with non-small cell lung cancer.

Methods

Data source

The National Cancer Database (NCDB), a joint program of the American College of Surgeons and the American Cancer Society, is a nationwide oncology outcome database for more than 1,500 commission-accredited cancer programs in the United States and Puerto Rico. It collects information on approximately 70% of all new cancer diagnoses in the United States each year, and captures relevant data on patient demographics, clinical characteristics, tumor characteristics, treatment, postoperative outcomes, and survival (15). The 2019 participant-use file of the NCDB was chosen as the data source for the study. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was deemed institutional review board-exempt based on the use of deidentified data.

Study population and selection criteria

The NCDB was used to identify all patients with a diagnosis of NSCLC as a first primary malignant neoplasm based on histology and/or cytology between the years 2009 and 2019. The ME variable in the NCDB codes the status of states of residence for patients aged 40 years and older. Patients <40 years were excluded as their ME status was unavailable. Those >64 years were excluded because they were not eligible for the ACA ME. Patients diagnosed in

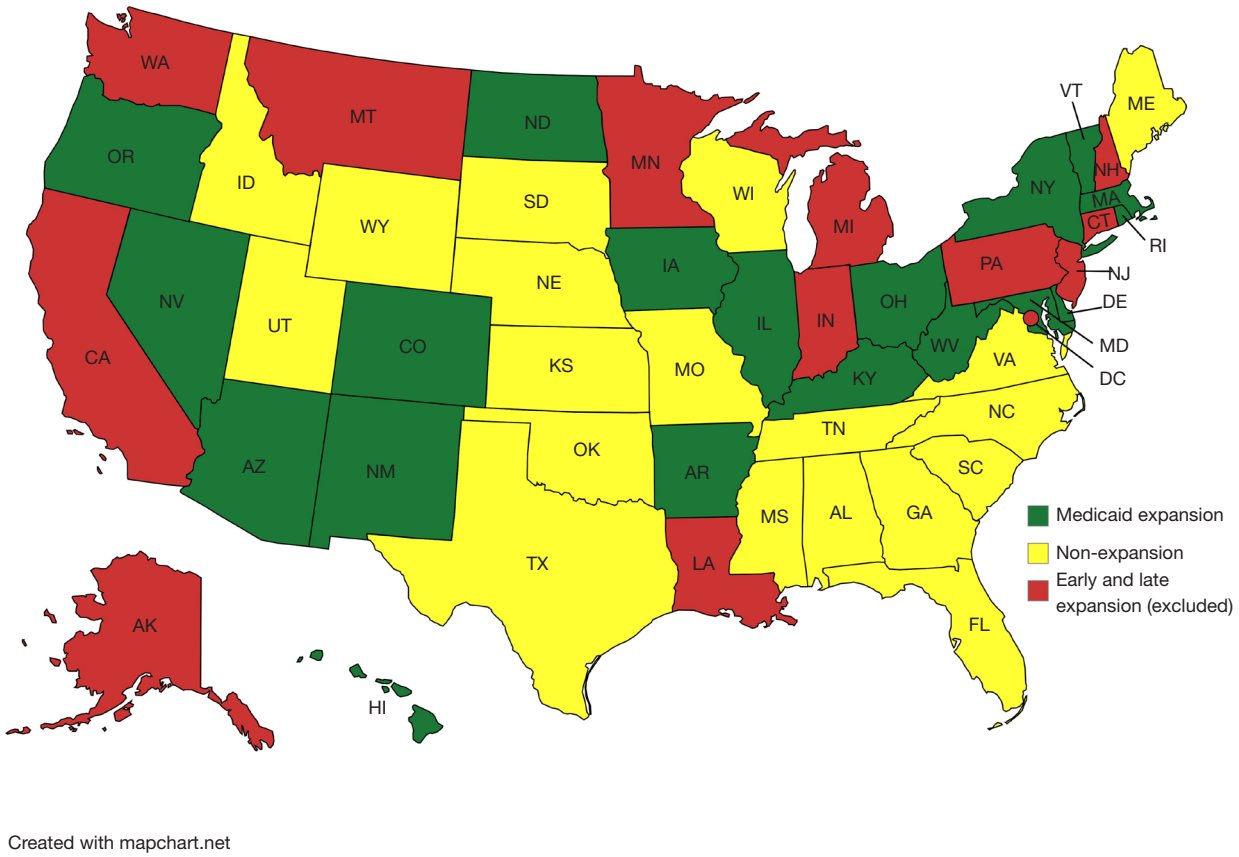

Figure 1 Distribution of states according to Medicaid expansion status.

2014 were excluded to allow for washout related to the implementation of the ME program.

Coverage under the ACA ME became effective on January 1, 2014. This was used as the timepoint to classify states into ME and non-expansion (NE) states. Patients diagnosed in early expansion states (WA, CA, NJ, MN, CT, and DC) were excluded as these states expanded Medicaid between 2010 and 2013. Similarly, late expansion states (NH, IN, MI, PA, AK, MT, and LA) that expanded Medicaid after January 2014 were excluded to minimize bias. Patients in the ME group were from KY, NV, CO, OR, NM, WV, AR, RI, AZ, MD, MA, ND, OH, IA, IL, VT, HI, NY and DE. Those in the NE group were from TN, NC, ID, GA, FL, MO, AL, MS, KS, TX, WI, UT, SC, SD, VA, OK, NE, WY, and ME (*Figure 1*) (16).

The final study population was divided into a pre-expansion (era A: 2009–2013) and a post-expansion cohort (era B: 2015–2019). To determine outcome trends, comparisons were made pre- *vs.* post-expansion (era A *vs.* era B) based on ME status. The outcomes of interest were: (I) insurance coverage; (II) clinical stage at diagnosis; (III) treatment facility; and (IV) overall survival (OS).

Statistical analysis

Descriptive statistics were performed. Categorical variables were compared using the Pearson's χ^2 test and expressed as counts and percentages. Continuous variables were compared using the Wilcoxon rank sum test and expressed as medians and interquartile ranges (IQRs).

OS was defined as the number of years between the date of diagnosis and the date of last contact (if alive) or date of death. Of note, the NCDB 2019 participant-use file does not capture survival data for patients diagnosed in 2019 due to limited follow up. Hence, survival analysis was limited to patients diagnosed prior to 2019. Survival estimates were calculated using the Kaplan-Meier product limit method and OS curves were compared using the log-rank test for survival differences between the ME and NE groups. To determine the association between eras and OS and at the

same time to account for potential patients' population shift or heterogeneity over time, propensity score-weighted multivariable Cox regression analysis was performed. A propensity score was calculated as the probability of patients being diagnosed in era A or B. The Cox regression modeling was performed with the inverse propensity score (of treatment/era) weighting methodology (IPTW) for each observation before inclusion in model building. Variables used in calculating the propensity score were age at diagnosis, gender, race, insurance status, income level, educational level, Charlson-Deyo comorbidities, American Joint Committee on Cancer (AJCC) clinical staging (8th edition), tumor histology, and type of treatment facility. Variables included in building the multivariable models were related patient demographic and disease characteristics but only those covariates that had a P value <0.05 with OS were kept in the final regression models.

Subgroup analysis was performed on the subset of patients that underwent definitive resections and did not receive immunotherapy. This model was further adjusted for pathological stage, surgical approach (minimally invasive *vs.* open), resection margin, perioperative radiation and chemotherapy. All statistical tests were two-sided and a P value <0.05 was deemed statistically significant. Statistical analysis was conducted using SAS software, version 9.4 (SAS Institute, Cary, USA).

Results

Study population

A total of 202,003 NSCLC cases met inclusion criteria. Of these, 104,211 (51.6%) were diagnosed in era B. The median age of the entire study population was 58.0 (IQR, 54.0–61.0) years and the majority of patients were male (53.0%), white (79.7%), had no comorbidities (62.0%), and adenocarcinoma as underlying histology (57.4%). The distribution of clinical characteristics between eras A and B were as follows: age (median: 57.0 *vs.* 59.0 years; P<0.001), male gender (54.2% *vs.* 51.9%; P=0.55), white race (80.1% *vs.* 79.4%; P=0.20), no comorbidities (61.3% *vs.* 62.6%; P=0.006) and adenocarcinoma histology (54.1% *vs.* 60.5%; P<0.001), respectively.

There was no statistically significant age difference between patients in the ME and NE groups in eras A and B (P>0.05 for both). The baseline demographic, clinical and tumor characteristics for patients in eras A and B are presented in *Table 1*.

Insurance coverage

Patients in the ME group were significantly more likely than those in the NE group to be insured in both eras A and B (A: 90.1% *vs.* 84.0%; B: 96.7% *vs.* 88.3%). Between eras A and B, insurance coverage increased more significantly in the ME group as compared to the NE group (+6.6% *vs.* +4.3%; P<0.001 for both). The highest increase in insurance coverage was observed in the non-white population in ME states (+9.2%).

Clinical stage I disease

Compared to the NE group, patients in the ME group were significantly more likely to be diagnosed with stage I NSCLC in both eras A and B (A: 18.8% *vs.* 17.6%; B: 25.3% *vs.* 21.6%). Between eras A and B, the proportion of patients diagnosed with stage I NSCLC increased in ME states by +6.5% *vs.* +4.0% in NE states (P<0.001 for both). The highest increase in stage I lung cancer diagnosis was observed in females in ME states (+7.3%).

Treatment facility

Patients in the ME group were significantly more likely than those in the NE group to receive treatment at an academic facility in both eras A and B (A: 40.4% *vs.* 28.4%; B: 43.9% *vs.* 28.6%). The proportion of patients treated at an academic facility increased by +3.5% (P<0.001) in ME states *vs.* +0.2% (P=0.45) in NE states between eras A and B.

Table 2 summarizes the trends in insurance coverage, clinical stage I disease, and treatment facility between eras A and B, stratified by gender and race.

OS

The median OS of patients in eras A and B were 1.25 (IQR, 0.41–5.57) and 2.15 (IQR, 0.51–6.45) years, respectively. In the ME group, median OS improved from 1.35 (IQR, 1.33–1.38) to 2.52 (IQR, 2.45–2.60) years between eras A and B (variation: +1.17 years; P<0.001). For the NE group, the trend was from 1.18 (IQR, 1.16–1.20) to 1.90 (IQR, 1.85–1.96) years (variation: +0.72 years; P<0.001) (*Figures 2,3*). This trend of greater survival gains in the ME group was observed in all demographic subgroups (*Table 3*).

In the propensity score weight adjusted model analyses, being diagnosed in era B when compared to era A was independently associated with improved survival outcomes

Table 1 Demographic and clinical characteristics of the study population stratified by era (n=202,003)

Variables	Era A (n=97,792)	Era B (n=104,211)	P value
Expansion status			0.005
Medicaid expansion	42,527 (43.5)	45,960 (44.1)	
Non-expansion	55,265 (56.5)	58,251 (55.9)	
Age (years)	57.0 (53.0–61.0)	59.0 (55.0–62.0)	<0.001
Sex			0.55
Male	52,976 (54.2)	54,041 (51.9)	
Female	44,816 (45.8)	50,170 (48.1)	
Race			0.20
White	78,301 (80.1)	82,714 (79.4)	
Non-White	19,491 (19.9)	21,497 (20.6)	
Insurance status			<0.001
Not insured	10,285 (10.5)	6,862 (6.6)	
Medicaid	15,024 (15.4)	19,806 (19.0)	
Medicare	15,683 (16.0)	19,778 (19.0)	
Other government	2,647 (2.7)	2,665 (2.6)	
Private	51,408 (52.6)	53,620 (51.5)	
Unknown	2,745 (2.8)	1,480 (1.4)	
Income ($)			<0.001
<40,227	22,883 (23.4)	24,479 (23.5)	
40,227–50,353	24,273 (24.8)	23,739 (22.8)	
50,354–63,332	22,197 (22.7)	19,934 (19.1)	
≥63,333	20,089 (20.5)	21,990 (21.1)	
Unknown	8,350 (8.5)	14,069 (13.5)	
Education[†]			<0.001
≥17.6	20,799 (21.3)	24,324 (23.3)	
10.9–17.5	28,160 (28.8)	28,321 (27.2)	
6.3–10.8	26,196 (26.8)	22,979 (22.1)	
<6.3	14,355 (14.7)	14,726 (14.1)	
Unknown	8,282 (8.5)	13,861 (13.3)	
Charlson-Deyo comorbidities			0.006
0	59,993 (61.3)	65,252 (62.6)	
1	26,828 (27.4)	24,711 (23.7)	
2	7,848 (8.0)	8,811 (8.5)	
≥3	3,123 (3.2)	5,437 (5.2)	

Table 1 (*continued*)

Table 1 (*continued*)

Variables	Era A (n=97,792)	Era B (n=104,211)	P value
Facility of treatment			<0.001
Academic program	32,853 (33.6)	36,828 (35.3)	
CCCP	38,033 (38.9)	39,857 (38.2)	
CCP	7,385 (7.6)	7,645 (7.3)	
Integrated network	19,521 (20.0)	19,881 (19.1)	
AJCC clinical staging 8th edition			<0.001
Stage I	17,756 (18.2)	24,225 (23.2)	
Stage II	6,469 (6.6)	6,962 (6.7)	
Stage III	20,000 (20.5)	18,664 (17.9)	
Stage IV	46,194 (47.2)	46,800 (44.9)	
Unknown	7,373 (7.5)	7,560 (7.3)	
Histology			<0.001
Adenocarcinoma	52,930 (54.1)	63,065 (60.5)	
Squamous cell	24,015 (24.6)	25,632 (24.6)	
Large cell	2,206 (2.3)	1,115 (1.1)	
Other	18,641 (19.1)	14,399 (13.8)	

Data are expressed as n (%) or median (IQR). †, percentage with no high school degree. IQR, interquartile range; CCCP, comprehensive community cancer program; CCP, community cancer program; AJCC, American Joint Committee on Cancer.

both in the ME [hazard ratio (HR): 0.75, 95% confidence interval (CI): 0.74–0.77; P<0.001] and NE groups (HR: 0.77, 95% CI: 0.76–0.78; P<0.001). Among patients who underwent definitive surgery without perioperative immunotherapy (n=42,955), those diagnosed in era B demonstrated superior survival outcomes than era A, independent of ME status. Following the propensity score adjustment, being diagnosed in era B was independently associated with an improvement in survival outcomes for both the ME (HR: 0.72, 95% CI: 0.68–0.76; P<0.001) and NE groups (HR: 0.72, 95% CI: 0.69–0.76; P<0.001). In the ME group, the median time to definitive surgery increased from 30 to 37 days between eras A and B (variation: +7 median days; P<0.001). For the NE group, the trend was from 28 to 35 days (variation: +7 median days; P<0.001).

Discussion

In this study, we used the NCDB to evaluate the impact of the ACA ME on lung cancer care in the US. We assessed the impact of ME by comparing ME to NE states pre- and post-expansion of Medicaid eligibility. Based on our analysis, being in a ME state was associated with a higher likelihood of insurance coverage, early cancer diagnosis, and treatment at an academic facility. However, the ME program did not seem to be associated with an improvement in survival outcomes after risk adjustment. This study intentionally focused on patients with NSCLC as it is a leading cause of cancer-related morbidity and mortality in the US (1), and is subject to population-based screening. Furthermore, patients with lung cancer often require complex oncologic procedures and have been shown to suffer disparities in access to care in several studies (3,4,17). The results of this study are of importance to health economists and healthcare policy makers in view of the existing skepticism towards Medicaid's ability to provide high-quality cancer care (12,18,19), the ongoing debate on the cost-benefit profile of the ACA's ME program, and the persistent search for equitable healthcare access.

Similar to prior studies, patients in the ME group were more likely to have health insurance (7-10,20). This observation is partially due to the disproportionate increase

Table 2 Trends in insurance enrolment, clinical stage I disease and treatment characteristics for patients with NSCLC stratified by gender and race (n=202,003)

Variable	Expansion status	Era A (%)	Era B (%)	% variation	P value
Males					
Insurance coverage	ME	89.4	96.4	+7.0	<0.001
	NE	83.0	87.0	+4.0	<0.001
Clinical stage I disease	ME	15.2	20.6	+5.4	<0.001
	NE	14.5	17.1	+2.6	<0.001
Treatment at an academic facility	ME	39.7	43.3	+3.6	<0.001
	NE	28.4	28.3	−0.1	0.81
Females					
Insurance coverage	ME	90.9	97.1	+6.2	<0.001
	NE	85.3	89.7	+4.4	<0.001
Clinical stage I disease	ME	22.9	30.2	+7.3	<0.001
	NE	21.5	26.6	+5.1	<0.001
Treatment at an academic facility	ME	41.1	44.6	+3.5	<0.001
	NE	28.3	28.9	+0.6	0.18
Whites					
Insurance coverage	ME	90.9	96.8	+5.9	<0.001
	NE	85.1	89.0	+3.9	<0.001
Clinical stage I disease	ME	19.4	25.8	+6.4	<0.001
	NE	18.5	22.7	+4.2	<0.001
Treatment at an academic facility	ME	36.9	40.3	+3.4	<0.001
	NE	26.3	26.7	+0.4	0.23
Non-Whites					
Insurance coverage	ME	87.0	96.2	+9.2	<0.001
	NE	80.0	85.5	+5.5	<0.001
Clinical stage I disease	ME	16.5	23.2	+6.7	<0.001
	NE	14.2	17.6	+3.4	<0.001
Treatment at an academic facility	ME	55.8	59.5	+3.7	<0.001
	NE	36.0	35.2	−0.8	0.21

NSCLC, non-small cell lung cancer; ME, Medicaid expansion; NE, non-expansion.

in the percentage of patients with Medicaid in ME as compared to NE states following the implementation of the ACA (% variation between eras B and A in ME and NE states were +6.6% and +4.3%, respectively). Congruent with a study that described a decrease in socioeconomic and racial disparities following the implementation of ME (21), we also noted a greater increase in the proportion of minorities with insurance in ME as compared to NE states post-expansion (*Table 2*).

Several studies suggested an association between ME and the early diagnosis and treatment of patients with lung, colorectal, and breast cancer (7,22,23). This is thought to be

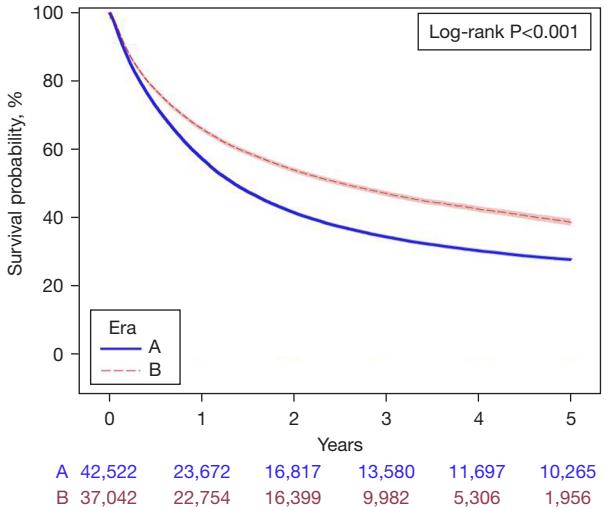

Figure 2 Kaplan-Meier survival estimates in the Medicaid expansion group stratified by era (n=79,564).

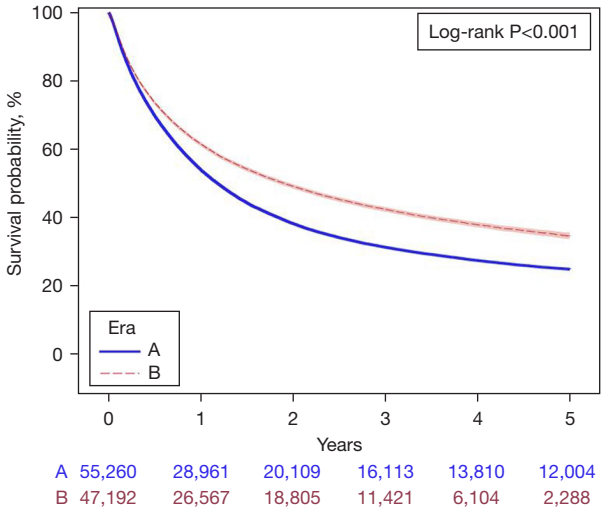

Figure 3 Kaplan-Meier survival estimates in the non-expansion group stratified by era (n=102,452).

Table 3 Trends in overall survival for patients with NSCLC stratified by gender and race (n=202,003)

Variables	Expansion status	Median overall survival (years)			P value
		Era A	Era B	Era B – era A	
Males	ME	1.07	1.72	+0.65	<0.001
	NE	0.97	1.33	+0.36	<0.001
Females	ME	1.86	3.99	+2.13	<0.001
	NE	1.58	2.98	+1.40	<0.001
Whites	ME	1.33	2.42	+1.09	<0.001
	NE	1.21	1.98	+0.77	<0.001
Non-Whites	ME	1.49	3.00	+1.51	<0.001
	NE	1.11	1.65	+0.54	<0.001

NSCLC, non-small cell lung cancer; ME, Medicaid expansion; NE, non-expansion.

related to the increased adoption of screening and preventive health services in ME states. For instance, Goold *et al.* previously reported the increased utilization of primary care services following ME in Michigan State (24). In their study, enrollment in the ME program was associated with a 26.6% increase in the proportion of patients that utilized a doctor's office for care (65.1% to 91.7%), and a corresponding 14.5% decrease in emergency room visits (16.2% to 1.7%) (24). In our analysis, we found an improvement in the number of patients diagnosed with stage I disease in both ME and NE states. Although the increase appears slightly higher in the ME cases, it is hard to attribute this to Medicare expansion alone. In era A, the number of patients with early disease was already higher in ME states than in NE states. Of note that the US Preventive Services Task Force's (USPSTF) lung cancer screening recommendations were issued in 2013 based on data from the NLST trial (25,26). However, despite the availability of level 1 data in support of lung cancer screening, there are several patient- and provider-level barriers to its universal adoption (27). These barriers disproportionally affect patients of minority background and low socioeconomic status. In this analysis, minorities in ME states were more likely than those in NE states to be diagnosed with stage I NSCLC (*Table 2*).

We found that patients diagnosed with NSCLC in ME states were more likely to receive treatment at academic centers when compared to those diagnosed in NE states in era B. This benefit was also extended to patients of minority background who reside in ME states in a greater magnitude (*Table 2*). Previous studies have described superior outcomes for patients undergoing complex oncologic procedures at tertiary, academic and high-volume hospitals (28,29). In fact, our results corroborate those reported by Diaz *et al.* in their analysis of the California Office of Statewide Health Planning Database (11). The authors found an association between ME and an increase in access to care at high volume hospitals among patients with lung, esophageal, pancreatic and rectal cancers (11). However, while we noted a trend towards the higher utilization of academic treatment facilities among minorities in ME as compared to NE states, other reports suggest ME may increase inequalities in access to high quality surgical care (13,30). This is thought to be due to racial disparities in regionalization, with black patients being less likely to accept surgical treatment recommendations from specialists when compared to Caucasians, and minority patients being more likely to reside in areas close to hospitals with significant variation in quality (13). Furthermore, the discordance in our findings may be related to differences in the study population. While our analysis is based on the NCDB in the ACA era, the other studies were conducted using the New York State inpatient database pre-enactment of the ACA. We noted a 7-day increase in the median time to definitive surgery in the post-expansion era in both ME and NE states, despite a corresponding increase in the proportion of patients with stage I lung cancer. The exact reason for this trend is unclear and beyond the scope of our analysis, but it is certainly an important area for further investigation.

Few studies reported any association between ME and survival for cancer patients. Lam *et al.* found the implementation of ME to be associated with improved survival outcomes for patients with lung, breast and colorectal cancer (20). Notably, adjustment for cancer stage led to a loss of the survival advantage in their analysis, indicating that the survival benefit with ME may be closely related to the promotion of early diagnosis and treatment (20). While ME has been shown to improve access to primary care and preventive health services, some evidence suggest Medicaid may be suboptimal for the management of complex cancers (12). This is thought to be related to the lower reimbursement rates, and the limited ability of Medicaid coverage to facilitate access to specialized outpatient services (31). In our analysis, we noted an improvement in survival outcomes in era B irrespective of ME status with the degree of improvement being similar in the risk-adjusted model. This finding is possibly due to better screening, improved surgical technique, the increased use of immunotherapy and targeted therapies, and decreased smoking in both ME and NE states in era B (32,33). Our results are discordant from two recent population-based studies that noted a 2-year survival benefit with ME among patients with NSCLC (10,14). The dissimilarities in our findings may be related to differences in the study population and the length of follow up. While we used the NCDB for this analysis, the other studies analyzed Surveillance Epidemiology, and End Results (SEER) and North American Association of Central Cancer Registries (NAACCR) data.

The results of our analysis must be interpreted within the context of its limitations. By virtue of its retrospective design, the study may be liable to selection bias. Despite employing methods to minimize selection bias, there remains the risk of residual confounding. The NCDB collects data from hospital registries covering approximately 70% of all newly diagnosed cancer cases in the USA. Therefore, the results of this study may not be generalizable to every patient with NSCLC. We also performed the analysis using socioeconomic data obtained at the time of diagnosis. These variables are prone to change over time; a possibility that was not accounted for in the analysis. The above correlations do not establish causality as the adoption and timeframe for ME may be a surrogate for complex issues within each state and region. We did not have access to granular data on patterns of screening, smoking, use of targeted therapy, and population migration during the study period. Additionally, it is quite possible that ME states have more academic institutions than NE states, which could have influenced the results. Regarding the days to definitive procedure analysis, it was impossible to determine the extent of the resection performed (i.e., wedge versus anatomic resection) as that level of procedural detail is not available in the NCDB. Lastly, we were only able to study trends for 5 years post-ME and so are unable to comment on the long-term sustainability of our findings. Despite the above limitations, this study offers a valuable assessment of the early impact of the ACA ME on lung cancer care and treatment patterns.

Conclusions

Higher insurance enrollment rates, earlier lung cancer

diagnoses, and more frequent treatment at academic institutions are observed in the US, particularly among patients of minority background. These changes in care patterns seem to be more pronounced in states that implemented ME compared to those who did not. Similar over-time improvements in survival outcomes were observed regardless of ME. Ongoing monitoring is necessary to confirm the program's long-term impact on access to care and survival for NSCLC, and to potentially elucidate additional insight to our findings.

Acknowledgments

The authors acknowledge the contributions of Sakib Adnan, MD for the NCDB file acquisition, and Emanuela Taioli, PhD for the conceptualization and design of this study. The abstract was presented at the AATS 2023 Annual Meeting in Los Angeles, USA.
Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-786/rc

Peer Review File: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-786/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-786/coif). C.P.E. reports health disparities grants from Pfizer and Merck for research that is unrelated to this work. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

References

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. CA Cancer J Clin 2020;70:7-30.
2. Cancer Statistics Review, 1975-2017 - SEER Statistics. Available online: https://seer.cancer.gov/csr/1975_2017/
3. Sineshaw HM, Sahar L, Osarogiagbon RU, et al. County-Level Variations in Receipt of Surgery for Early-Stage Non-small Cell Lung Cancer in the United States. Chest 2020;157:212-22.
4. Ebner PJ, Ding L, Kim AW, et al. The Effect of Socioeconomic Status on Treatment and Mortality in Non-Small Cell Lung Cancer Patients. Ann Thorac Surg 2020;109:225-32.
5. Wolf A, Alpert N, Tran BV, et al. Persistence of racial disparities in early-stage lung cancer treatment. J Thorac Cardiovasc Surg 2019;157:1670-1679.e4.
6. Frean M, Gruber J, Sommers BD. Disentangling the ACA's Coverage Effects - Lessons for Policymakers. N Engl J Med 2016;375:1605-8.
7. Takvorian SU, Oganisian A, Mamtani R, et al. Association of Medicaid Expansion Under the Affordable Care Act With Insurance Status, Cancer Stage, and Timely Treatment Among Patients With Breast, Colon, and Lung Cancer. JAMA Netw Open 2020;3:e1921653.
8. Eguia E, Cobb AN, Kothari AN, et al. Impact of the Affordable Care Act (ACA) Medicaid Expansion on Cancer Admissions and Surgeries. Ann Surg 2018;268:584-90.
9. Jemal A, Lin CC, Davidoff AJ, et al. Changes in Insurance Coverage and Stage at Diagnosis Among Nonelderly Patients With Cancer After the Affordable Care Act. J Clin Oncol 2017;35:3906-15.
10. Liu Y, Colditz GA, Kozower BD, et al. Association of Medicaid Expansion Under the Patient Protection and Affordable Care Act With Non-Small Cell Lung Cancer Survival. JAMA Oncol 2020;6:1289-90.
11. Diaz A, Chavarin D, Paredes AZ, et al. Utilization of High-Volume Hospitals for High-Risk Cancer Surgery in California Following Medicaid Expansion. J Gastrointest Surg 2021;25:1875-84.
12. Pezzi TA, Schwartz DL, Pisters KMW, et al. Association of Medicaid Insurance With Survival Among Patients With Small Cell Lung Cancer. JAMA Netw Open

2020;3:e203277.
13. Xiao D, Zheng C, Jindal M, et al. Medicaid Expansion and Disparity Reduction in Surgical Cancer Care at High-Quality Hospitals. J Am Coll Surg 2018;226:22-9.
14. Han X, Zhao J, Yabroff KR, et al. Association Between Medicaid Expansion Under the Affordable Care Act and Survival Among Newly Diagnosed Cancer Patients. J Natl Cancer Inst 2022;114:1176-85.
15. About the National Cancer Database. Accessed February 25, 2018. Available online: https://www.facs.org/quality-programs/cancer/ncdb/about
16. Status of State Medicaid Expansion Decisions: Interactive Map | KFF. Accessed September 22, 2021. Available online: https://www.kff.org/medicaid/issue-brief/status-of-state-medicaid-expansion-decisions-interactive-map/
17. Bach PB, Cramer LD, Warren JL, et al. Racial differences in the treatment of early-stage lung cancer. N Engl J Med 1999;341:1198-205.
18. Liu JH, Zingmond DS, McGory ML, et al. Disparities in the utilization of high-volume hospitals for complex surgery. JAMA 2006;296:1973-80.
19. Al-Refaie WB, Muluneh B, Zhong W, et al. Who receives their complex cancer surgery at low-volume hospitals? J Am Coll Surg 2012;214:81-7.
20. Lam MB, Phelan J, Orav EJ, et al. Medicaid Expansion and Mortality Among Patients With Breast, Lung, and Colorectal Cancer. JAMA Netw Open 2020;3:e2024366.
21. Mahal AR, Chavez J, Yang DD, et al. Early Impact of the Affordable Care Act and Medicaid Expansion on Racial and Socioeconomic Disparities in Cancer Care. Am J Clin Oncol 2020;43:163-7.
22. Le Blanc JM, Heller DR, Friedrich A, et al. Association of Medicaid Expansion Under the Affordable Care Act With Breast Cancer Stage at Diagnosis. JAMA Surg 2020;155:752-8.
23. Gan T, Sinner HF, Walling SC, et al. Impact of the Affordable Care Act on Colorectal Cancer Screening, Incidence, and Survival in Kentucky. J Am Coll Surg 2019;228:342-353.e1.
24. Goold SD, Tipirneni R, Chang T, et al. Primary Care, Health Promotion, and Disease Prevention with Michigan Medicaid Expansion. J Gen Intern Med 2020;35:800-7.
25. National Lung Screening Trial Research Team, Aberle DR, Adams AM, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. N Engl J Med 2011;365:395-409.
26. US Preventive Services Task Force, Krist AH, Davidson KW, et al. Screening for Lung Cancer: US Preventive Services Task Force Recommendation Statement. JAMA 2021;325:962-70.
27. Sosa E, D'Souza G, Akhtar A, et al. Racial and socioeconomic disparities in lung cancer screening in the United States: A systematic review. CA Cancer J Clin 2021;71:299-314.
28. Birkmeyer JD, Siewers AE, Finlayson EV, et al. Hospital volume and surgical mortality in the United States. N Engl J Med 2002;346:1128-37.
29. Merritt RE, Abdel-Rasoul M, Fitzgerald M, et al. The Academic Facility Type Is Associated With Improved Overall Survival for Early-Stage Lung Cancer. Ann Thorac Surg 2021;111:261-8.
30. Al-Refaie WB, Zheng C, Jindal M, et al. Did Pre-Affordable Care Act Medicaid Expansion Increase Access to Surgical Cancer Care? J Am Coll Surg 2017;224:662-9.
31. Asplin BR, Rhodes KV, Levy H, et al. Insurance status and access to urgent ambulatory care follow-up appointments. JAMA 2005;294:1248-54.
32. Current Cigarette Smoking Among Adults in the United States | CDC. [Accessed May 21, 2023]. Available online: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm
33. State of Lung Cancer | American Lung Association. [Accessed May 21, 2023]. Available online: https://www.lung.org/research/state-of-lung-cancer

Cite this article as: Salami AC, Yu D, Lu X, Martin J, Erkmen CP, Bakhos CT. Impact of Medicaid expansion under the Patient Protection and Affordable Care Act on lung cancer care in the US. J Thorac Dis 2024;16(9):5604-5614. doi: 10.21037/jtd-24-786