Association of the Affordable Care Act's Medicaid expansion with the diagnosis and treatment of clinically localized melanoma: A National Cancer Database study

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Background: The Affordable Care Act's Medicaid expansion is associated with earlier diagnosis and improved care among lower socioeconomic status populations with cancer, but its impact on melanoma is undefined.

Objective: To determine the association of Medicaid expansion with stage of diagnosis and use of sentinel lymph node biopsy in nonelderly adult patients with newly diagnosed clinically localized melanoma.

Methods: Quasi-experimental, difference-in-differences retrospective cohort analysis using data from the National Cancer Database from 2010 to 2017. Patients from expansion versus nonexpansion states and diagnosed before (2010-2013) versus after (2014-2017) expansion were identified.

Results: Of 83,322 patients, 46.6% were female, and the median age was 55 years (interquartile range, 49-60). After risk adjustment, Medicaid expansion was associated with a decrease in the diagnosis of T1b stage or higher melanoma (odds ratio [OR], 0.93; 95% confidence interval [CI], 0.88-0.98; $P = .011$) and decrease in uninsured status (OR, 0.61; 95% CI, 0.52-0.72; $P < .001$) but was not associated with a difference in sentinel lymph node biopsy performance when indicated (OR, 1.06; 95% CI, 0.95-1.20; $P = .29$).

Limitations: Retrospective study using a national database.

Conclusion: In this study of patients with clinically localized melanoma, Medicaid expansion was associated with a decrease in the diagnosis of later T-stage tumors. (J Am Acad Dermatol 2021;84:1628-35.)

Key words: Affordable Care Act; health care disparities; health policy; Medicaid; Medicaid expansion; melanoma; sentinel node.

Enacted in 2014, the Affordable Care Act's (ACA's) provision to expand Medicaid eligibility gives each state the option to provide Medicaid coverage to nonelderly adults earning up to 138% of the federal poverty level. Since its implementation, 39 states (including the District of Columbia) have opted in, improving access to care and increasing use of health care services for millions of previously uninsured, low-income Americans.[1-3] These participants are more likely to receive preventive care, including screening examinations for cancer.[4-13] Cancer outcomes are associated with

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insurance status, and studies suggest that after the expansion, low-income patients residing in expansion states are diagnosed with various cancers at earlier stages, are more likely to undergo surgery for their cancer, and may even have improved survival compared to low-income individuals living in nonexpansion states.[4,14-19]

Melanoma is the fifth leading cancer diagnosis in the United States, and its incidence is rising both in the United States and worldwide, particularly among lower socioeconomic status populations.[20-23] For patients with clinically localized melanoma, wide excision of the primary lesion is standard, and sentinel lymph node biopsy (SLNB) is recommended for patients at increased risk of having occult nodal metastases, namely those with T1b or higher stage disease.[24] Since passage of the ACA, access to dermatologic care among low-income individuals has significantly increased, but the effect of Medicaid expansion on the care of patients diagnosed with melanoma is not well defined.[25] The primary objective of this study was to determine the association of Medicaid expansion with stage of diagnosis and use of SLNB in nonelderly adults with newly diagnosed clinically localized melanoma. The primary outcome was diagnosis of T1a or higher stage (≥T1b) disease. Secondary outcomes were the performance of SLNB when indicated and patients' insurance status.

CAPSULE SUMMARY

- Patients with lower socioeconomic status are at increased risk for delayed melanoma diagnosis and worse outcomes.
- Public health policies such as Medicaid that improve insurance coverage among lower socioeconomic status populations may lead to earlier melanoma diagnoses, potentially improving outcomes among these disproportionately affected communities.

METHODS

Study design and patient selection

Patients diagnosed with clinically localized malignant melanoma from 2010 to 2017 were identified from the National Cancer Database (NCDB), a collaborative effort between the American Cancer Society and the American College of Surgeons. The NCDB includes more than 1500 Commission on Cancer—accredited facilities nationally and captures more than 70% of new cancer diagnoses.[26,27] All deidentified data are compliant with the Health Insurance Portability and Accountability Act, and the study was exempt from institutional review board approval.

Using a quasi-experimental, difference-in-differences (DID) design, patients were grouped by residence in expansion (exposure) and nonexpansion (control) states and diagnosis in pre-expansion (2010-2013) and postexpansion (2014-2017) periods (Supplemental Table I; available via Mendeley at https://doi.org/10.17632/tr37nngmt5.1).[28,29] Although early expansion states began to increase coverage for low-income adults in 2010, these early increases were limited compared to the coverage expansions that started on January 1, 2014.[30] Therefore, the early and 2014 expansion states were grouped together. Late expansion states that adopted ACA's Medicaid expansion after January 1, 2014, were not included because 2014 to 2017 did not represent a postexpansion period in those states. Because the NCDB suppresses information on Medicaid expansion for patients aged 40 years or younger and the ACA's 2014 Medicaid expansion did not affect patients age 65 years or older who were eligible for Medicare, only those aged 40 through 64 years and not insured through Medicare were included in the study (Supplemental Fig 1; available via Mendeley at https://doi.org/10.17632/tr37nngmt5.1).[31] Patients who had clinically apparent in-transit, regional nodal, or distant metastatic disease or who received palliative treatment were excluded.

Outcomes and variables

The study outcomes were uninsured status, T stage, and performance of SLNB, which were modeled as dichotomous variables. To make results most applicable with current practice guidelines, T stage was defined according to the American Joint Committee on Cancer (AJCC), Eighth Edition staging system for melanoma.[32] Specifically, the outcome of interest was diagnosis of T1b-stage or higher melanoma, for which SLNB may be recommended according to current clinical practice guidelines.[33,34] The performance of SLNB was evaluated among the subset of patients with T1b stage disease or higher.

Multivariable analyses adjusted for demographic variables, including age, sex, race, Hispanic ethnicity, Charlson-Deyo score for comorbidities,[35,36] county of residence, and education and income level for the patient's zip code. Education, or the proportion of adults aged 25 years or older without a high school diploma, and median income, adjusted for 2016 inflation, were derived from the 2012 to 2016 American Community Survey data.[37,38]

Abbreviations used:

ACA:	Affordable Care Act
AJCC:	American Joint Committee on Cancer
CI:	confidence interval
DID:	difference-in-differences
NCDB:	National Cancer Database
OR:	odds ratio
SLNB:	sentinel lymph node biopsy

Adjusted analysis of T stage also included insurance type, academic status of the hospital, region (Northeast, South, Midwest, and West), and primary tumor location. Because T stage may influence the decision to perform SLNB, primary tumor thickness and ulceration were also included in the multivariable analysis for the performance of SLNB. Missing values for each variable were categorized as *unknown* for analyses.

Statistics

The DID approach assumes parallel trends between the exposure and control groups in the period before the policy change.[28] The parallel trends for unadjusted outcomes are illustrated graphically in Fig 1. Parallel trends after risk adjustment were confirmed by regressing the interaction between expansion status and diagnosis year on each outcome using pre-expansion data (Supplemental Table II; available via Mendeley at https://doi.org/10.17632/tr37nngmt5.1). A nonsignificant interaction term suggests that the pre-expansion trends between expansion and nonexpansion states did not differ significantly.

The association between Medicaid expansion and each outcome was evaluated by using the following logistic regression framework, which includes an interaction between expansion status and pre-expansion versus post-expansion period:[28]

$$\text{Outcome}_i = \beta_0 + \beta_1(\text{Expansion}_i) + \beta_2(\text{Period}_i) + \beta_3(\text{Expansion}_i \times \text{Period}_i) + \beta_4(\text{Covariates}_i)$$

β represents the coefficient for each term. The DID estimator is derived from the coefficient of the interaction between expansion status and period, or β_3. All tests were 2 sided. Because 3 comparisons were included in the analysis, a significance threshold of $P < .017$ was set for outcomes to account for Bonferroni correction for multiple testing. Data were analyzed between September 20 and October 10, 2020, using R, version 3.5.3.[39]

RESULTS

Patient characteristics

Of 83,322 patients diagnosed with melanoma and meeting inclusion criteria, 23,011 (27.6%) in 2010 to 2013 and 27,000 (32.4%) in 2014 to 2017 resided in expansion states, and 15,639 (18.8%) in 2010 to 2013 and 17,672 (21.2%) in 2014 to 2017 resided in nonexpansion states. The median age at diagnosis was 55 years (interquartile range, 49-60), and 46.6% of patients were female. As shown in Table I, patients from expansion and nonexpansion states differed significantly in several demographic and clinicopathologic characteristics.

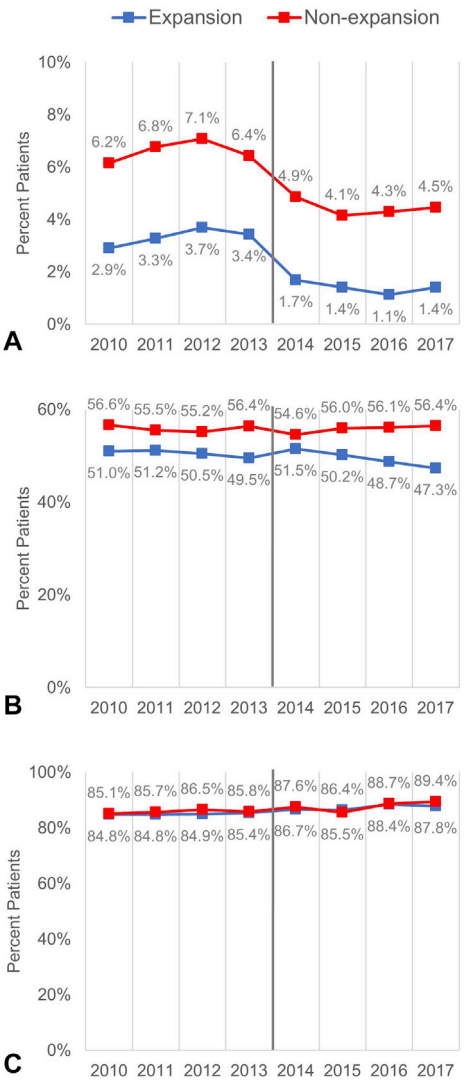

Fig 1. Unadjusted trends in insurance status, T stage, and sentinel lymph node biopsy. Percentage of patients from expansion and nonexpansion states who (**A**) were uninsured, (**B**) had stage T1b disease or higher, and (**C**) underwent sentinel lymph node biopsy if T1b or higher. The gray vertical line divides the period before and after Medicaid expansion.

Insurance status

In Medicaid expansion states, the uninsured rate decreased from 3.3% in 2010 to 2013 to 1.4% in 2014

Table I. Patient characteristics

Characteristics	Before expansion (2010-2013)			After expansion (2014-2017)		
	Expansion states (n = 23,011)	Nonexpansion states (n = 15,639)	*P* value	Expansion states (n = 27,000)	Nonexpansion states (n = 17,672)	*P* value
Age, y, median (interquartile range)	54 (49-59)	54 (48-60)	.94	55 (49-60)	55 (49-60)	.001
Female, n (%)	10,808 (47.0)	7095 (45.4)	.002	12,811 (47.4)	8090 (45.8)	<.001
Race, n (%)			<.001			<.001
White	22,484 (97.7)	15,336 (98.1)		26,289 (97.4)	17,303 (97.9)	
Black	72 (0.3)	71 (0.5)		115 (0.4)	107 (0.6)	
Other	197 (0.9)	101 (0.6)		287 (1.1)	119 (0.7)	
Not reported	258 (1.1)	131 (0.8)		309 (1.1)	143 (0.8)	
Ethnicity, n (%)			<.001			.54
Non-Hispanic	21,924 (95.3)	14,991 (95.6)		26,007 (96.3)	17,057 (96.5)	
Hispanic	321 (1.4)	258 (1.6)		484 (1.8)	297 (1.7)	
Not reported	766 (3.3)	390 (2.5)		509 (1.9)	318 (1.8)	
Charlson-Deyo score, n (%)			<.001			<.001
0	20,889 (90.8)	13,930 (89.1)		24,138 (89.4)	15,567 (88.1)	
1	1869 (8.1)	1466 (9.4)		2379 (8.8)	1733 (9.8)	
2	186 (0.8)	189 (1.2)		325 (1.2)	264 (1.5)	
≥3	67 (0.3)	54 (0.3)		158 (0.6)	108 (0.6)	
Percentage of adults without high school diploma in zip code, n (%)			<.001			<.001
≥17.6	1740 (7.6)	2348 (15.0)		2026 (7.5)	2375 (13.4)	
10.9-17.6	3746 (16.3)	3521 (22.5)		4287 (15.9)	3867 (21.9)	
6.3-10.8	6604 (28.7)	3878 (24.8)		7691 (28.5)	4305 (24.4)	
<6.3	8863 (38.5)	4107 (26.3)		9969 (36.9)	4579 (25.9)	
Not reported	2058 (8.9)	1785 (11.4)		3027 (11.2)	2546 (14.4)	
Median household income in zip code, n (%)			<.001			<.001
<$40,227	1213 (5.3)	2168 (13.9)		1330 (4.9)	2274 (12.9)	
$40,227-$50,353	2622 (11.4)	3315 (21.2)		3063 (11.3)	3543 (20.0)	
$50,354 -$63,332	4374 (19.0)	3411 (21.8)		4974 (18.4)	3781 (21.4)	
≥$63,333	12,710 (55.2)	4944 (31.6)		14,573 (54.0)	5503 (31.1)	
Not reported	2092 (9.1)	1801 (11.5)		3060 (11.3)	2571 (14.5)	
County of residence, n (%)			<.001			<.001
Metropolitan	19,575 (85.1)	12,699 (81.2)		23,117 (85.6)	14,487 (82.0)	
Urban	2466 (10.7)	2178 (13.9)		2910 (10.8)	2383 (13.5)	
Rural	239 (1.0)	332 (2.1)		256 (0.9)	327 (1.9)	
Not reported	731 (3.2)	430 (2.7)		717 (2.7)	475 (2.7)	
Academic hospital, n (%)	13,217 (57.4)	6912 (44.2)	<.001	15,501 (57.4)	8277 (46.8)	<.001
Region, n (%)			<.001			<.001
Northeast	7017 (30.5)	331 (2.1)		7725 (28.6)	380 (2.2)	
South	2534 (11.0)	11,356 (72.6)		2718 (10.1)	12,774 (72.3)	
Midwest	6919 (30.1)	2931 (18.7)		7761 (28.7)	3375 (19.1)	
West	6541 (28.4)	1021 (6.5)		8796 (32.6)	1143 (6.5)	
Primary tumor location, n (%)			<.001			<.001
Head/neck	3546 (15.4)	2645 (16.9)		4067 (15.1)	2928 (16.6)	
Trunk	8401 (36.5)	5572 (35.6)		9854 (36.5)	6376 (36.1)	
Extremity	10,943 (47.6)	7293 (46.6)		12,945 (47.9)	8271 (46.8)	
Not reported	121 (0.5)	129 (0.8)		134 (0.5)	97 (0.5)	
Primary tumor thickness, mm, n (%)			<.001			<.001
<0.8	12,153 (52.8)	7521 (48.1)		14,177 (52.5)	8208 (46.4)	
0.8-1.0	2417 (10.5)	1685 (10.8)		2703 (10.0)	1900 (10.8)	
>1.0-2.0	4543 (19.7)	3486 (22.3)		5493 (20.3)	4124 (23.3)	
>2.0-4.0	2278 (9.9)	1672 (10.7)		2607 (9.7)	1931 (10.9)	
>4.0	1620 (7.0)	1275 (8.2)		2020 (7.5)	1509 (8.5)	
Primary tumor ulceration, n (%)			<.001			<.001
Absent	19,408 (84.3)	12,746 (81.5)		23,161 (85.8)	14,723 (83.3)	
Present	3054 (13.3)	2318 (14.8)		3572 (13.2)	2725 (15.4)	
Not reported	549 (2.4)	575 (3.7)		267 (1.0)	224 (1.3)	

to 2017 ($P < .001$), with a concurrent increase in Medicaid coverage among these patients (3.2% vs 6.9%; $P < .001$) (Fig 1, *A*). The uninsured rate in nonexpansion states also decreased across the same timeframe (6.6% vs 4.4%; $P < .001$) but was primarily due to an increase in private policies (90.7% vs 92.8%; $P < .001$) with no change in the proportion of patients covered by Medicaid (2.6% vs 2.8%; $P = .46$). After adjustment for demographic differences, Medicaid expansion was independently associated with a significant decrease in uninsured status (odds ratio [OR], 0.61; 95% confidence interval [CI], 0.52-0.72; $P < .001$) (Fig 2 and Supplemental Table III; available via Mendeley at https://doi.org/10.17632/tr37nngmt5.1).

Diagnosis of T1b or higher melanoma

In Medicaid expansion states, the percentage of patients presenting with T1b or higher melanoma decreased from 50.5% in 2010 to 2013 to 49.4% in 2014 to 2017 ($P = .014$), whereas the percentage of patients with T1b or higher melanoma in nonexpansion states remained stable across this timeframe (55.9% vs 55.8%; $P = .83$) (Fig 1, *B*). After adjustment for demographic and clinicopathologic differences, Medicaid expansion was independently associated with a significant decrease in diagnoses of T1b melanoma or higher (OR, 0.93; 95% CI, 0.88-0.98; $P = .011$) (Fig 2 and Supplemental Table IV; available via Mendeley at https://doi.org/10.17632/tr37nngmt5.1). In addition, patients covered by any insurance, either Medicaid (OR, 0.90; 95% CI, 0.81-1.00; $P = .042$) or private (OR, 0.58; 95% CI, 0.53-0.62; $P < .001$), were significantly less likely to be diagnosed with T1b or higher melanoma than were uninsured patients.

Performance of SLNB

For those for whom SLNB was indicated, 8210 (74.6%) of patients with T1b disease, 16,271 (92.2%) of those with T2, 7855 (92.5%) of those with T3, and 5350 (83.3%) of those with T4 underwent the procedure. Among all patients with T1b or greater melanoma, the rate of SLNB performance increased from 2010 to 2013 versus 2014 to 2017 similarly for patients residing in Medicaid expansion states (85.0% vs 87.3%; $P < .001$) and in nonexpansion states (85.8% vs 87.8%; $P < .001$) (Fig 1, *C*). After adjustment for demographic and clinicopathologic differences, Medicaid expansion was not associated with a change in the rate of SLNB performance for patients in whom the procedure was indicated (OR, 1.06; 95% CI, 0.95-1.20; $P = .29$) (Fig 2 and Supplemental Table V; available via Mendeley at https://doi.org/10.17632/tr37nngmt5.1). Patients with private insurance (OR, 1.61; 95% CI, 1.42-1.83; $P < .001$), but not Medicaid (OR, 1.14; 95% CI, 0.96-1.35; $P = .14$), were significantly more likely to undergo SLNB when it was indicated than were uninsured patients.

DISCUSSION

Although studies have evaluated the effect of the ACA's Medicaid expansion on various types of cancer, the impact of expansion on the stage of diagnosis and treatment of melanoma has not been characterized. In the present study, among nonelderly adults diagnosed with clinically localized melanoma, Medicaid expansion was associated with a significant decrease in both the proportion of patients diagnosed with T1b stage disease or higher, as well as the proportion of patients who were uninsured. However, the expansion was not associated with a significant change in performance of SLNB when it was indicated.

The lower proportion of more advanced-stage diagnoses after Medicaid expansion has been similarly witnessed with other types of cancer and is likely related to improved access to care.[4-7] Although the US Preventive Services Task Force offers no official skin cancer screening recommendations, melanoma exemplifies the type of cancer in which screening has the potential to improve care.[40-42] Additionally, the American Academy of Dermatology recommends regular self-skin examinations and discussion with a dermatologist about any abnormal findings, and multiple studies support an association between more frequent physician-led skin examinations and earlier melanoma diagnosis.[42-46] The common denominator among all these publications is access to care. Insurance improves accessibility to health care providers, which in turn may lead to more frequent examinations and melanoma diagnoses. It is likely the increases in insurance coverage provided by Medicaid allow for improved access to health care and the associated decreased rates of later-stage melanoma diagnoses.

The majority of patients (>70%) in the study population across T stages underwent SLNB when indicated in accordance with recommended guidelines, and Medicaid expansion was not shown to have an impact on performance of the procedure when indicated. Patients with private insurance, but not Medicaid coverage, were significantly more likely to undergo SLNB when indicated compared to uninsured patients, and like Medicaid, private insurance policies were also associated with earlier melanoma diagnosis. However, despite the beneficial associations seen for patients with coverage by either private

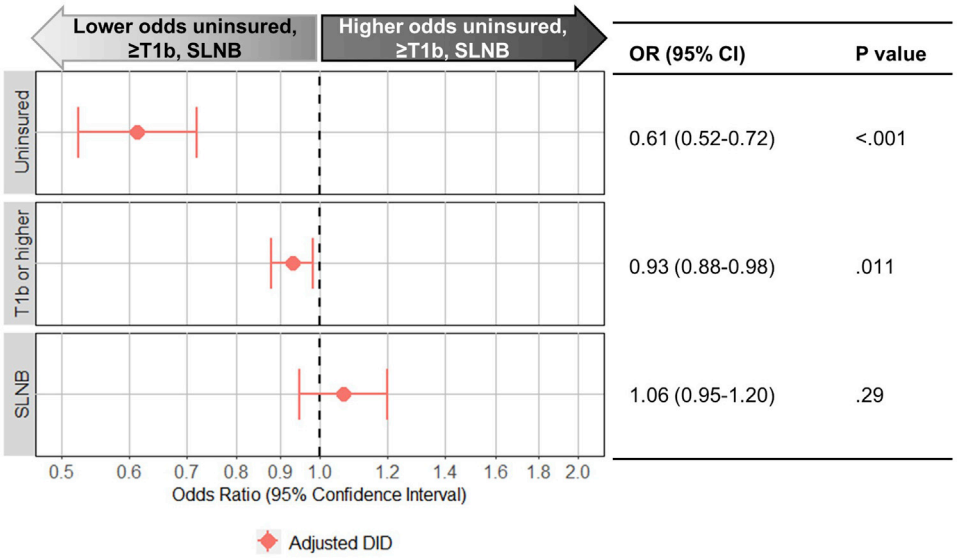

Fig 2. Changes in insurance status, T stage, and sentinel lymph node biopsy associated with Medicaid expansion. Risk-adjusted difference-in-differences (DID) estimator for the association of Medicaid expansion with uninsured status, diagnosis with T1b or higher melanoma, and performance of sentinel lymph node biopsy (SLNB) if T1b or higher. *CI*, Confidence interval; *OR*, odds ratio.

insurance or Medicaid, expanded Medicaid coverage primarily benefits populations of lower socioeconomic status. Marginalized communities are also known to be disproportionately affected by melanoma, giving these vulnerable populations the most to gain from earlier diagnosis and better melanoma care.[47-49] Patients in nonexpansion states were more likely to display lower socioeconomic status characteristics and were also more likely to present with thicker and ulcerated tumors. Moreover, after expansion, patients in expansion states were more often diagnosed with lesions without ulceration, suggesting that Medicaid beneficiaries after expansion were more likely to have melanomas identified before the development of worrisome characteristics. Earlier diagnosis allows for more curative treatment options and is intimately associated with improved prognosis for all cancers, including early-stage melanoma.[32,50] By facilitating earlier diagnosis, Medicaid expansion has the potential to improve outcomes for populations of lower socioeconomic status with clinically localized melanoma.

It is important to consider other health care policies that were passed in addition to Medicaid expansion that could have also played a role in improving melanoma-related care in expansion states. The ACA created health insurance marketplaces in both expansion and nonexpansion states to assist individuals in purchasing private health policies, which have been associated with providing coverage and improving access to care for a substantial number of Americans.[51,52] Additionally, policies were also been passed mandating that private insurance carriers in all states cover routine screening and preventive services at no additional cost to the patient.[53] Finally, individual state-specific policies could have affected health insurance and access to care, leading to earlier melanoma presentation. Although these policies were unable to be controlled for, which must be acknowledged as a main limitation of the present study, it is unlikely that they are completely responsible for the earlier T-stage melanoma diagnoses seen in expansion states and, thus, should not deter from this study's major findings.

Several additional limitations should be considered. Melanoma lesions were reclassified to the eighth edition of the AJCC staging system to make the results more applicable to current practice. Although this may have had some influence on the derived results, the impact is likely very small, given that the changes between the seventh and eighth editions would essentially affect the classification of only a subset of T1b lesions.[32] Moreover, even among this subgroup, recommendations for consideration of SLNB during the seventh edition already had incorporated tumor thickness (≥0.76 mm) as in the current eighth edition, despite thickness not being formally integrated into the subclassification of T1 status.[54] Furthermore, a large proportion of mitosis data (which was part of staging of T1 patients in AJCC seventh edition but not AJCC eighth edition)

is missing within the NCDB and, thus, would require exclusion of a large number of patients for accurate staging. Therefore, all patients were ultimately staged using AJCC eighth edition criteria. Although the adoption of Medicaid expansion by some states and not others allows for a quasi-experimental study design, this was a retrospective observational study, and thus, some variations between the expansion and nonexpansion cohorts may not have been captured and could have affected the results in undefined ways. Additionally, although confounders were adjusted for in the DID model, the patient populations and health care resources in expansion and nonexpansion states are inherently different, and not all differences could be completely controlled for. Specifically, differences in access to care among expansion versus nonexpansion states was not able to be directly accounted for; however, demographic and clinical factors that could have affected access to care were controlled for in an attempt to mitigate any unidentified confounding variables that may have led to differences in care access. Also, the patients included within the NCDB consist of only those who have received some element of their care at an accredited Commission on Cancer facility, and thus, these results and their implications for melanoma care may not be generalizable on a national level. Finally, Medicaid expansion remains a relatively recent legislation, and its long-term impact on the care of patients with melanoma should be evaluated with future studies.

CONCLUSION

In this study of a nationally representative cohort of patients with clinically localized melanoma, the ACA's expansion of Medicaid eligibility was independently associated with a decrease in the proportion of patients without health insurance and with lower rates of later T-stage diagnoses, but it did not affect the performance of SLNB when indicated. These findings suggest that public health policies that provide better insurance coverage and access to care for populations with lower socioeconomic status may lead to earlier melanoma diagnoses, potentially improving outcomes among these disproportionately affected communities. As the melanoma burden continues to rise both in the United States and worldwide, it is of critical importance that public health measures consider coverage expansion to include marginalized patient populations who suffer most.

Conflicts of interest

None disclosed.

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