

Research Article

Insurance Trends in Patients Diagnosed with Melanoma Before and After the Affordable Care Act: A National Database Study

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Abstract

Background: The Affordable Care Act (ACA) was intended, in part, to reduce the uninsured population. It underwent full implementation in 2014 with optional state Medicaid expansion and health insurance marketplaces. Prior to the ACA, studies show that insurance status affects cancer care, including prevention, diagnosis, stage at diagnosis, and management. ACA impact on malignant melanoma is unknown. In this study, the primary objective is to examine the impact of the ACA on insurance rates among patients diagnosed with malignant melanoma. Survival by insurance type was also assessed.

Methods: A retrospective analysis of the Surveillance, Epidemiology and End Results (SEER) cancer registry was performed for malignant melanoma between 2007 (first year of insurance data in SEER) and 2015. Standardized mean differences were used for 2007-2013 and 2014-2015 (after full ACA implementation) for the primary objective. Sub-analysis was performed for Medicaid expansion and non-expansion states. The impact of insurance type (uninsured, Medicaid, non-Medicaid) on all-cause and cause-specific mortality was assessed via adjusted cox regression models.

Results: Nationally, the ACA decreased percentage of uninsured patients (-1.12% to -2.26%, $P < 0.05$) and increased percentage of Medicaid enrollees (+1.53% to +4.02%, $P < 0.005$) diagnosed with malignant melanoma. Expansion states showed decreased percentage of uninsured patients (-1.43% to -2.24%, $P < 0.05$) and increased percentage of Medicaid enrollees (+1.66% to +4.84%, $P < 0.05$). Non-expansion states showed no change in percentages of uninsured patients and Medicaid enrollees. All-cause and cause-specific mortality were decreased in uninsured and Medicaid patients diagnosed with malignant melanoma compared to non-Medicaid insured patients (reference group).

Discussion: The ACA decreased the rate of patients diagnosed with malignant melanoma with uninsured status, but this was only significant in Medicaid expansion states. Although diagnosis of melanoma is associated with High Socioeconomic Status (SES), Medicaid expansion seems to have increased access to dermatologic care. Increasing the number of states expanding Medicaid may be beneficial. However, Medicaid patient have worse all-cause and cause-specific mortality compared to non-Medicaid insured patients. Addressing these disparities through policy is important to ensure insurance coverage translates to better outcomes.

Keywords: Melanoma; Insurance; Medicaid; Survival; SEER; Database; Outcomes; Private Insurance

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Introduction

The Patient Protection and Affordable Care Act (ACA), signed into law on March 23, 2010, is a federal initiative to reduce the uninsured population in the United States and improve access to medical care [1]. Although enacted in 2010, the ACA was fully implemented on January 1, 2014. With full implementation, the ACA hoped to increase insurance accessibility by means of the nationwide health insurance marketplace and optional state Medicaid expansion [2]. Nevertheless, since its inception in 2010, the ACA decreased the uninsured population from 49 million individuals to 29 million by 2015 [3].

One aspect of healthcare access the ACA sought to address was the barrier to cancer care. Insurance status affects multiple aspects of cancer care including prevention, diagnosis, stage at diagnosis, and management [4-6]. This has been shown for a wide range of malignancies such as breast, head and neck, cervix, and prostate cancers [7-10]. Melanoma is the deadliest cutaneous malignancy and is responsible for \$3.3 billion USD in annual healthcare expenditures [11]. It is a major public health issue accounting for the fifth and sixth most common cancer diagnoses in males and females, respectively [12]. Cancer patients living in Medicaid expansion states have better access to cancer care than their counterparts in non-expansion states [13]. Since its enactment, the ACA has increased insurance coverage in patients diagnosed with gynecologic, colon, lung, breast, and head and neck cancers [14-16]. These findings are especially true in expansion states [14-16]. However, the impact of the ACA on insurance status for patients diagnosed with malignant melanoma is unknown.

Since its inception in 1973, the Surveillance, Epidemiology and End Results (SEER) United States cancer database has collected and curated statistics on patient demographics, tumor characteristics, treatments, and survival of cancer cases from 18 registries comprising 34.6% of the nation's population [17]. In this study, our primary objective was to evaluate pre- and post-ACA insurance rates (uninsured, Medicaid, non-Medicaid) in patients diagnosed with malignant melanoma using SEER. An ancillary outcome assessed was all-cause and cause-specific survival by insurance type.

Methods

Cohort

In SEER, the International Classification of Diseases for Oncology-3/World Health Organization 2008 (ICD-O-3/WHO 2008) code for "Melanoma of skin", which includes all skin melanoma types across all ICD-O-3 skin topographical codes (C44.0-44.9), was used for case extraction. Behavior code "Malignant" was used to exclude cases of melanoma *in-situ*. Age was restricted to 18-64, excluding patients 65 years or older eligible for Medicare. The decision to exclude was based off the lack of Medicare insurance data in SEER; insurance analysis including patients of Medicare-eligible age is not recommended [18]. Data was extracted from 2007 to 2015. 2007 was the first year SEER recorded insurance data. 2015 was the last year of data in the database. 23,017 cases with unknown insurance status were excluded. Institutional board review was not needed; SEER is a publicly-accessible national cancer database maintained by the National Cancer Institute.

Insurance Analysis

Insurance categories included in analysis were: "Uninsured", "Any Medicaid", "Insured", and "Insured, no specifics". The variable "Insured, no specifics" was defined as being either "Medicare/Medicare, NOS" or "Insurance, NOS". Since patients 65 and above were excluded, the category "Insured, no specifics" likely comprises mostly privately insured patients and was therefore combined with "Insured" under the nomenclature "non-Medicaid Insured" [18].

The primary outcomes were to: (1) compare the rate of insurance type ("Uninsured", "Any Medicaid", "non-Medicaid insurance") in patients diagnosed with malignant melanoma before and after the ACA nationally; (2) compare the rate of insurance type in patients diagnosed with malignant melanoma before and after the ACA in expansion states only (expanded by January 1, 2014); and (3) compare the rate of insurance type in patients diagnosed with malignant melanoma before and after the ACA in non-expansion states only (did not expand by January 1, 2014). States which expanded between January 1, 2014 and December 31, 2015 (Alaska and Michigan) were excluded from analysis because exact date of diagnosis is unknown in SEER, which confounds study of the association with Medicaid expansion in these states. Cases were grouped into those diagnosed before (2007-2013) and after (2014-2015) full ACA implementation. Standardized mean differences and 95% Confidence Interval (CI) were used to compare insurance rates between the two groups. P-values were 2-sided, and $P < 0.05$ was used for statistical significance.

Descriptive Analysis and Survival Analysis

Descriptive statistics for patient and tumor characteristic variables were calculated based on pre-ACA or post-ACA diagnosis time.

Another outcome assessed was survival by insurance type. In addition to the selection criteria noted above, patients with unknown cause-specific death or unspecified survival months were excluded from survival analysis. Adjusted Cox regression models were used to compare all-cause and cause-specific survival by insurance status. Numerous variables were extracted and adjusted for as covariates (Appendix A). These included: demographics, tumor characteristics, treatment variables, socioeconomic status (county-attributed median family income), year of diagnosis grouping (2007-2013, 2014-2015) and outcome variables. The non-Medicaid group served as the reference group. 5-year survival plots were generated for all-cause and cause-specific survival. Statistical analyses were conducted using IBM Statistical Package for the Social Sciences for Macintosh version 25: IBM Corporation, Armonk, New York.

Results

72,602 patients met the inclusion criteria. 72,599 of these patients had received follow-up with a mean time of 46.12 months (SD 31.621). Mean age was 33.07 (SD 10.837). Descriptive statistics for the cohort based off time of diagnosis are displayed in Table 1.

Insurance Analysis

Nationally, comparison of the rate of insurance type in patients diagnosed with malignant melanoma before and after the ACA demonstrated: (1) statistically significant decrease in patients diagnosed with malignant melanoma with uninsured status (3.92% before versus 2.21% after; -1.71% difference; 95% CI -1.12% to -2.26%, $P < 0.05$); (2) statistically significant increase in patients diagnosed with malignant melanoma with Any Medicaid status (4.48% before versus 7.26% after; +2.78% difference, 95% CI +1.53% to +4.02%, $P < 0.05$); and (3) no significant difference in patients diagnosed with malignant melanoma with non-Medicaid status (91.59% before versus 90.53% after; -1.07% difference, 95% CI -2.53% to 0.40%, $P = 0.322$) (Fig. 1).

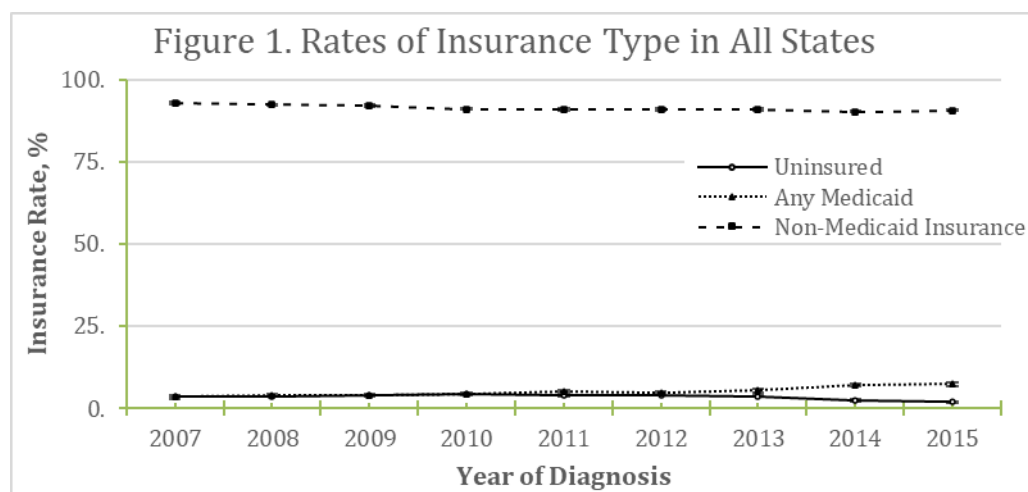


Figure 1: Rate of insurance types in patients diagnosed with malignant melanoma between 2007 and 2015 nationally.

In expansion states, comparison of the rate of insurance type in patients diagnosed with malignant melanoma before and after the ACA demonstrated: (1) statistically significant decrease in patients diagnosed with malignant melanoma with uninsured status (3.35% before versus 1.57% after; -1.78% difference, 95% CI -1.39% to -2.16%, $P < 0.05$); (2) statistically significant increase in patients diagnosed with malignant melanoma with Any Medicaid status (4.76% before versus 7.96% after; +3.20% difference, 95% CI +1.53% to +4.86%, $P < 0.05$); and (3) no statistically significant change in patients diagnosed with malignant melanoma with non-Medicaid status (91.89% before versus 90.47% after; -1.42% difference, 95% CI -3.01% to +0.16%, $P = 0.07$) (Fig. 2).

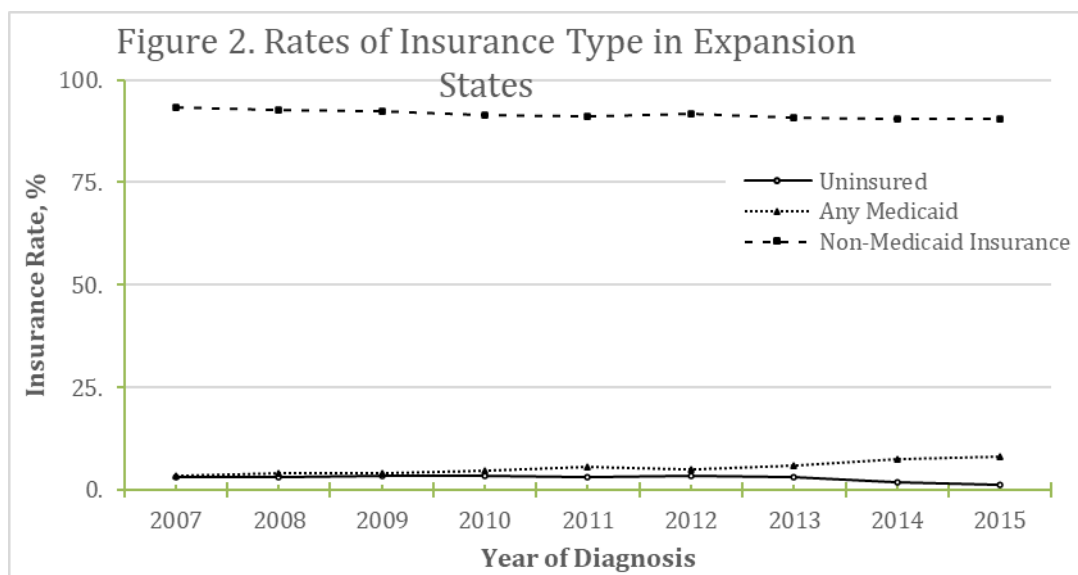


Figure 2: Rate of insurance types in patients diagnosed with malignant melanoma between 2007 and 2015 in states that expanded Medicaid on January 1, 2014.

In non-expansion states, comparison of the rate of insurance type in patients diagnosed with malignant melanoma before and after the ACA demonstrated: (1) no statistically significant difference in patients diagnosed with malignant melanoma with uninsured status (6.54% before versus 5.09% after; -1.45% difference, 95% CI -2.91% to +0.01%, $P=0.051$); (2) no statistically significant difference in patients diagnosed with malignant melanoma with Any Medicaid status (3.88% before versus 4.26% after; +0.38% difference, 95% CI -0.71% to +1.46%, $P=0.44$); and (3) no statistically significant difference in patients diagnosed with malignant melanoma with non-Medicaid status (89.58% before versus 90.65% after; +1.07% difference, 95% CI -0.76% to 2.90%, $P=0.21$) (Fig. 3).

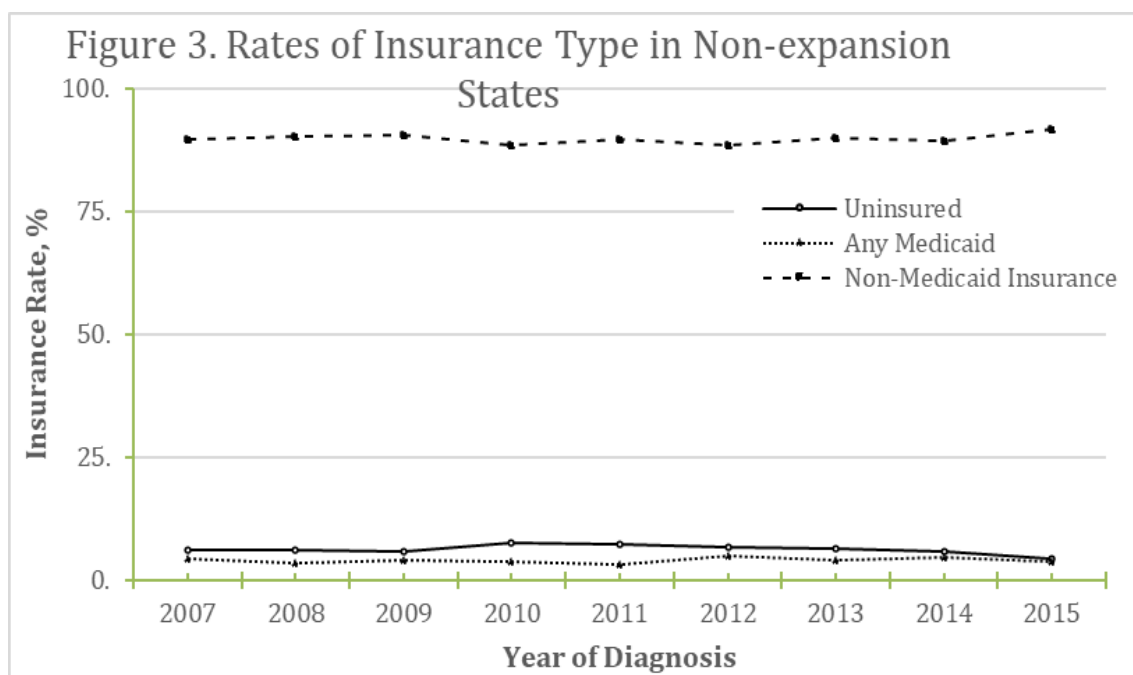


Figure 3: Rate of insurance types in patients diagnosed with malignant melanoma between 2007 and 2015 in states that did not expand Medicaid by January 1, 2014.

Survival Analysis

In adjusted analysis (Appendix A), the uninsured subgroup demonstrated increased cause-specific (HR 1.495; 95% CI 1.343 to 1.664; $P < 0.001$) and all-cause mortality risk (HR 1.520; 95% CI 1.377 to 1.677; $P < 0.001$) compared to the reference group, non-Medicaid individuals. Similarly, the Any Medicaid subgroup displayed increased cause-specific (HR 1.818; 95% CI 1.663 to 1.986; $P < 0.001$) and all-cause mortality risk (HR 1.966; 95% CI 1.813 to 2.130; $P < 0.001$) compared to the reference group. 5-year survival plots are displayed in Fig. 4,5.

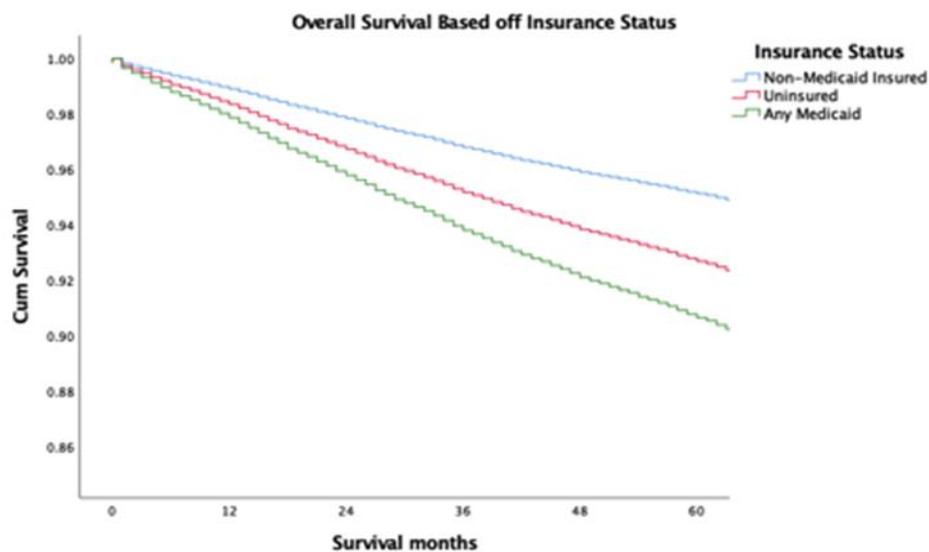


Figure 4: Cumulative 5-year overall survival plot based off insurance status.

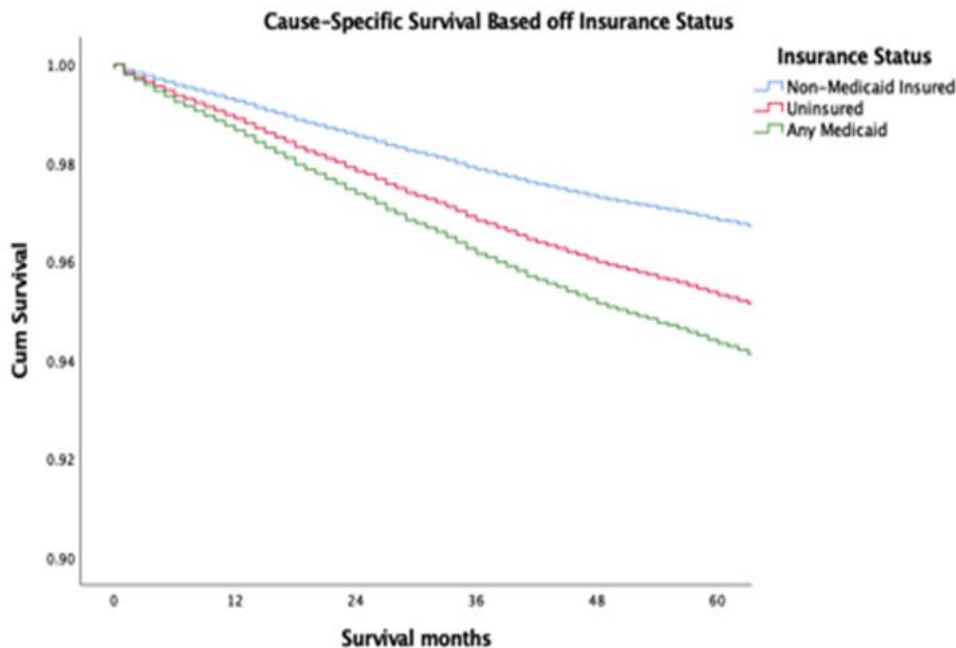


Figure 5: Cumulative 5-year cause-specific survival plot based off insurance status.

Discussion

Increasing the insured population helps decrease some healthcare access barriers, including those related to screening, prevention, and treatment. This is particularly true in cancer patients who are disproportionately uninsured [19]. After the first ACA enrollment period, the per-centage of uninsured persons ages 19-64 dropped from 20% to 15% nationally (~9.5 million

individuals) [20]. Our study demonstrates a larger decrease in similarly aged patients (18-64), albeit for a specific subset of cancer patients. Of patients diagnosed with malignant melanoma, a decreased rate of uninsured status was observed (-43.62% nationally and -53.33% in expansion states). Likewise, of patients diagnosed with malignant melanoma, an increased rate of Medicaid status was noted (+62.05% nationally and +69.00% in expanded states). These trends were not seen in non-expansion states.

Even though the ACA became law in 2010, the largest reduction in patients diagnosed with malignant melanoma with uninsured status occurred after January 1, 2014 (Fig. 1). This coincides with the installation of several features of the ACA such as the ban on denial of cover-age based on pre-existing conditions, implementation of health insurance exchanges, and provision of subsidies to purchase insurance. In our study, the largest impact is likely due to expansion of Medicaid. This is supported by the fact that non-expansion states lack statistically significant reduction in patients diagnosed with malignant melanoma with uninsured status. Other studies of gynecologic and head and neck malignancies mirror these findings [14,16]. There are more expansion states in SEER than non-expanded, which may account for the overall national trends paralleling those of expansion states (Fig. 1,2). However, unlike the prior cited studies, our investigation additionally shows that there was no statistically significant difference in rate of patients diagnosed with malignant melanoma with non-Medicaid insurance status both before and after the ACA. This more definitively points to Medicaid expansion as the driver of decreasing uninsured rates because healthcare exchanges would have increased non-Medicaid insurance rates (Fig. 2,3).

Ninety-one percent of uninsured individuals have incomes at or below 400% of the Federal Poverty Level (FPL). The majority these patients (52%) are below 138% of the FPL and eligible for Medicaid in expansion states [21]. Melanoma, unlike other malignancies, is more frequently diagnosed in individuals of higher Socioeconomic Status (SES) [22]. Our study has higher rates of patients diagnosed with malignant melanoma with non-Medicaid insurance status (>90%) than other studies (~80%) [14,16]. This is important because by expanding Medicaid, there has been increased access to healthcare for those of lower SES, likely spurring the increased rate of diagnosis of malignant melanoma in patients with Medicaid status seen in our study. The reason why we did not observe changes in other forms of insurance (non-Medicaid insured patients) is unknown, but is a finding unique to malignant melanoma [14,16]. This may have to do with the complexities of obtaining insurance through the healthcare insurance exchanges (income 139-400% of the FPL) and other unknown factors [21]. Future research may provide additional insight in less theoretical ways as to what the reasons behind these observed trends may be.

Our survival analysis shows that uninsured patients have increased all-cause and cause-specific mortality compared to non-Medicaid insured patients, the reference group. Prior literature has shown an association between lack of insurance and cancer morbidity and mortality [4,8,20]. Uninsured patients may have misconceptions on risk, lower utilization of healthcare services, lack of access to dermatologic services, higher grade/stage cancer on initial presentation, and lower rates of receiving guideline-based care among other risk factors [4,23-28]. These factors may portend poor clinical outcomes. Using study designs outside of SEER, it would be prudent to probe other risk factors contributing to worse mortality in uninsured patients and identify ways to address them.

Our study showed national and expansion state-specific decreases in patients diagnosed with malignant melanoma with uninsured status. While this is favorable, prior research has shown that survival outcomes may be worse in Medicaid patients compared to non-Medicaid patients [29-31]. Medicaid is a surrogate for SES. Universal health care is unable to account for SES factors which contribute to poor survival [32,33]. In our study, under multivariable analysis, Medicaid patients diagnosed with malignant melanoma demonstrated increased all-cause and cause-specific mortality compared to non-Medicaid insured patients. Although our study design included data acquisition for median family income (a county-attributed variable) as a marker of SES, we recognize how capturing an array of other related SES factors would benefit our analyses. Such documented factors affecting Medicaid patients include: lack of providers in underserved regions; majority of Medicaid-insured patients losing coverage within 1 year; increased difficulty to access dermatology clinics compared to private insured patients and high cost of care in meta-static disease, which leads to cause-specific mortality [34-38]. Other factors are likely at play and require further investigation.

This study has several limitations. It is observational in design and retrospective in nature. As such, randomization was not

possible. Patient selection biases may be present. Miscoded data and insurance changes during the study period may also be present. SES variables are not all-encompassing in SEER to account for all confounding factors. However, using SEER allowed for the largest study of this kind for malignant melanoma. Furthermore, since SEER only began including insurance information in 2007, survival data analysis was limited as long-term data was not available. Survival benefits for a malignancy like melanoma, which is more often in older individuals, may not be as readily apparent as survival outcomes for younger patients. The exclusion criteria for unknown insurance status resulted in removal of approximately 20,000 patients from this cohort study, effectively creating a large data void. The study is also an incidence-based study and cannot assess prevalence. However, the design was appropriate for the objective of this study to assess the trends in insurance type of patients diagnosed with malignant melanoma before and after the ACA. It is important to note that in the U.S., most patients between the age of 18-64 are commercially insured (i.e., private insurance). A large percentage of patients in the U.S. 65 years and above are insured by Medicare, which is not an insurance status tracked in SEER. SEER itself recommends stratifying data by cohorts above and below 65 years of age to avoid this confounding effect, as we have done. However, this results in a disproportionate number of patients privately insured in our cohort, which is similar to prior studies in this area [14,15].

With the future of the ACA hanging in the balance, such an investigation is both relevant and prudent. Increasing access to care through more widely available insurance is beneficial, especially in dermatology, a field in which SES seems to play a large role in obtaining care. Increasing Medicaid expansion to more states may be beneficial. However, studies are needed to further elucidate factors contributing to worse survival in our Medicaid and uninsured populations diagnosed with malignant melanoma. Introducing policy, initiatives, and incentives to mitigate them in order to raise all-cause and cause-specific mortality is crucial. Other malignancies, including other dermatologic cancers, could be studied in this way to further assess the impact of the ACA.

		Diagnosis Time			
		Pre-ACA		Post-ACA	
		N	Valid N %	N	Valid N %
Age	18-29 Years Old	3492	6.3%	877	5.0%
	30-49 Years Old	19227	34.8%	5485	31.5%
	50-59 Years Old	20487	37.1%	6832	39.3%
	60-64 Years Old	11992	21.7%	4210	24.2%
Sex	Male	29423	53.3%	9101	52.3%
	Female	25775	46.7%	8303	47.7%
Race	White	52781	95.6%	16671	95.8%
	Unknown	1607	2.9%	424	2.4%
	Other (American Indian/AK Native, Asian/Pacific Islander)	533	1.0%	217	1.2%
	Black	277	0.5%	92	0.5%
Ethnicity	Not Hispanic	53047	96.1%	16626	95.5%
	Hispanic	2151	3.9%	778	4.5%

Insurance Status	Non-Medicaid Insured	50552	91.6%	15755	90.5%
	Uninsured	2166	3.9%	386	2.2%
	Any Medicaid	2480	4.5%	1263	7.3%
County Attributed Median Family Income	\$25,650-\$63,030	18644	33.8%	5650	32.5%
	\$63,031-\$79,140	17832	32.3%	5686	32.7%
	\$79,140+	18714	33.9%	6068	34.9%
	Unknown	8	0.0%	0	0.0%
Grade	Grade I	89	0.2%	27	0.2%
	Grade II	131	0.2%	32	0.2%
	Grade III	258	0.5%	49	0.3%
	Grade IV	91	0.2%	22	0.1%
	Unknown	54629	99.0%	17274	99.3%
SEER Summary Stage	L	45467	82.4%	14292	82.1%
	RE	920	1.7%	294	1.7%
	RN	3725	6.7%	1143	6.6%
	RE+RN	450	0.8%	117	0.7%
	R, Unspecified	445	0.8%	144	0.8%
	D	2525	4.6%	903	5.2%
	U	1666	3.0%	511	2.9%
Breslow Depth	1.00 mm or less	35576	64.5%	11332	65.1%
	1.01-2.00 mm	8660	15.7%	2764	15.9%
	2.01 mm or more	7108	12.9%	2325	13.4%
	Unknown	3854	7.0%	983	5.6%
Ulceration	Not Ulcerated	44817	81.2%	14317	82.3%
	Ulcerated	6144	11.1%	1965	11.3%
	Unknown	4237	7.7%	1122	6.4%

Table 1: Characteristics of patients diagnosed with malignant melanoma based off Pre-ACA or Post-ACA time of diagnosis.

Appendix A

Survival Analysis Variables

Demographics (age, race, sex, ethnicity, marital status at diagnosis), tumor characteristics (primary site, grade, sequence, SEER summary stage, presence of ulceration, Breslow depth), treatment variables (radiation administration and chemotherapy

administration), socioeconomic status variable (county-attributed median family income), and outcome variables. The outcome variables were: vital status (“alive” or “dead”), cause-specific death classification (“alive or dead of other cause” or “dead attributable to cancer diagnosis”), survival months, and year of diagnosis groupings (2007-2013, 2014-2015). Non-Medicaid insured group served as the reference group.

Conflict of Interest

The authors have no conflict of interest to declare.

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