



# ARTICLE

## Changes in Noninsurance and Care Unaffordability Among Cancer Survivors Following the Affordable Care Act

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### Abstract

**Background:** Little is known about changes in socioeconomic disparities in noninsurance and care unaffordability among nonelderly cancer survivors following the Affordable Care Act (ACA).

**Methods:** Cancer survivors aged 18–64 years nationwide were identified from the Behavioral Risk Factor Surveillance System. Trend and difference-in-differences analyses were conducted to examine changes in percent uninsured and percent reporting care unaffordability pre–(2011 to 2013) and post–(2014 to 2017) ACA Medicaid expansion, by sociodemographic factors.

**Results:** A total of 118 631 cancer survivors were identified from Medicaid expansion ( $n = 72\,124$ ) and nonexpansion ( $n = 46\,507$ ) states. Following the ACA, percent uninsured and percent reporting care unaffordability decreased nationwide. Medicaid expansion was associated with a 1.8 (95% confidence interval [CI] = 0.1 to 3.5) percentage points (ppt) net decrease in noninsurance and a 2.9 (95% CI = 0.7 to 5.1) ppt net decrease in care unaffordability. In stratified analyses by sociodemographic factors, substantial decreases were observed in female survivors, those with low or medium household incomes, the unemployed, and survivors with multiple comorbidities. However, we observed slightly increased percentages in reporting noninsurance (ppt = 1.7; 95% CI = –1.2 to 4.5) and care unaffordability (ppt = 3.1, 95% CI = –0.4 to 6.5) in nonexpansion states between 2016 and 2017, translating to 67 163 and 124 160 survivors, respectively.

**Conclusion:** We observed reductions in disparities by sociodemographic factors in noninsurance and care unaffordability among nonelderly cancer survivors following the ACA, with largest decreases in women, those with low or medium income, multiple comorbid conditions, the unemployed, and those residing in Medicaid expansion states. However, the uptick of 82 750 uninsured survivors in 2017, mainly from nonexpansion states, is concerning. Ongoing monitoring of the effects of the ACA is warranted, especially in evaluating health outcomes.

Cancer survivors account for approximately 5% of the current US population, and the number of cancer survivors is expected to grow because of aging of the population and improved survival associated with advances in early detection and cancer treatment (1). Survivorship care requires surveillance for recurrence of primary cancer, as well as specialty care for increased risk of secondary cancers and other conditions from lasting effects of cancer treatments (2). As a result, survivors have a higher need for ongoing health care. They are also more prone to financial barriers to care than

individuals without a cancer history because cancer treatments and resulting employment disruptions may deplete savings and reduce earnings (3–5). Affordable and reliable health insurance coverage is a strong protective factor against medical financial hardship for cancer survivors and other frequent health-care users (3,6–8). Improvements in health insurance options may be particularly beneficial to survivor populations that have historically experienced disparities in health care and health outcomes, including the poor and unemployed (9,10).

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The Affordable Care Act (ACA) contained multiple provisions to increase health insurance coverage options, such as expanding Medicaid eligibility to individuals with income no more than 138% of the federal poverty level (FPL) regardless of parental status in states that opted in, providing tax credit premium subsidies for those with income 100%–400% of the FPL and cost-sharing subsidies to those with income 100%–250% of the FPL in marketplace for individual purchase of private insurance, and prohibiting coverage denials based on preexisting conditions (11,12). Since the implementation of these primary components of the ACA in 2014, the uninsured rate of Americans reached a historical low: 9.2% in the first 9 months of 2018 compared to 16.0% in 2010, when the ACA was signed into law (13). Recent studies report diminishing socioeconomic disparities in insurance coverage (14,15). This progress has been mainly reported in the general population of Americans. Less is known, however, about changes in socioeconomic disparities in noninsurance among cancer survivors following the ACA.

With rising prices for cancer care, financial hardship, partly manifested as care unaffordability (3,4,8), is an increasingly documented challenge among cancer survivors in the United States (8,16–18). Previous studies showed that financial hardship was more prevalent among those survivors who were younger, female, a racial and/or ethnic minority, with lower income and more comorbidities, and those who made employment changes because of cancer (3,8). Expansion of health insurance coverage to such survivor populations may reduce care unaffordability.

In this study, we examine changes in self-reported noninsurance and care unaffordability among cancer survivors aged 18–64 years following the implementation of the ACA's key components in 2014 by states' Medicaid expansion status and key sociodemographic factors, including age, sex, race and ethnicity, household income, education, employment status, marital status, and number of comorbid conditions.

## Methods

### Data and Sample

We used data from the 2011–2017 Behavioral Risk Factor Surveillance System (BRFSS), an annual health-related household telephone survey conducted by the Centers for Disease Control and Prevention of adult residents in all 50 states and the District of Columbia (19). The median response rates of states in BRFSS ranged from 45.2% to 49.7% in the years of 2011–2017 (19); sampling weights are used to help ensure representativeness of each state and reduce effects of nonresponse.

The BRFSS collects data regarding health-related risk behaviors, chronic conditions, health insurance coverage, and access to care. Cancer survivors were identified from the responses to a question about ever being told about any type of cancer diagnosis (except skin cancer) by a doctor, nurse, or other health professional. We limited our analytic sample to 118 631 survivors aged 18–64 years, with known sex, and from 1 of the 50 US states or DC, including 61 825 from 26 states and DC that expanded Medicaid eligibility under the ACA in 2014 or earlier, 10 299 from five states that expanded Medicaid in 2015–2016, and 46 507 from 19 states that had not expanded Medicaid eligibility by the end of 2017 (Supplementary Table 1, available online). Survivors aged 65 years and older were excluded because the near-universal Medicare insurance coverage for this age group.

## Measures

Our primary outcomes were noninsurance and care unaffordability. Insurance coverage was measured with a question about whether the person had any kind of health-care coverage, including private health insurance, prepaid plans such as health maintenance organizations, or government plans such as Medicare, or Indian Health Services. Care unaffordability was measured by a question about whether there was a time in the past 12 months that the person needed to see a doctor but could not because of cost.

Sociodemographic characteristics include sex, age (18–44 years, 45–54 years, 55–64 years), race and ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other, and unknown), educational attainment ( $\leq$  high school graduate, some college,  $\geq$  college graduate, unknown), employment status (employed, unemployed, not in labor force, unknown), and marital status (married or unmarried). Exact household income amount was not collected by the BRFSS (the income category choice is capped at  $\geq$ \$75 000) and household size was not acquired for cellular telephone respondents, so we categorized household income as low ( $<$ \$25 000), medium (\$25 000–\$74 999), high ( $\geq$ \$75 000), and unknown, attempting to align with the Medicaid eligibility of 138% of the FPL and premium subsidy threshold of 400% of the FPL (\$27 310 and \$79 160, respectively, for a household size of three in 2014). The definition for low-income has been used elsewhere (20). Chronic health conditions other than cancer were ascertained with a series of questions about whether a doctor, nurse, or other health professional ever told the person that he or she had any of the following conditions: heart attack, angina, stroke, asthma, chronic obstructive pulmonary disease, arthritis, depressive disorder, kidney disease (excluding kidney stones, bladder infection, or incontinence), and diabetes. These conditions were summed for each survivor and categorized as the total number of comorbid conditions (0, 1,  $\geq$ 2).

### Statistical Analyses

Descriptive statistics were calculated for survivors by state Medicaid expansion status. Percent uninsured and reporting care unaffordability were calculated by calendar year and Medicaid expansion status. The six states that expanded Medicaid earlier than 2014 and the 21 states that expanded Medicaid in 2014 were combined into one group because their trends were similar. Trends in percent uninsured and percent reporting care unaffordability were depicted by sociodemographic subgroups for Medicaid expansion states and nonexpansion states separately. To evaluate the effects of Medicaid expansion on insurance coverage and care affordability among survivors, we used a quasi-experimental study design and a difference-in-differences (DD) analytic approach, where survivors from nonexpansion states served as control individuals and survivors from expansion states as the intervention group in pre-ACA and post-ACA periods. The years 2011–2013 were defined as the pre-ACA period and the years 2014–2017 were defined as the post-ACA period, with some exceptions for states expanding after 2014 (see Supplementary Table 1, available online, for expansion dates and classification of post-ACA years). Changes in percent uninsured and percent reporting care unaffordability pre-ACA and post-ACA and the corresponding DD overall and in each sociodemographic group were calculated by fitting linear probability models with Taylor series variance estimation and accounted for survey weights (21), adjusting for age

group, sex, race and ethnicity, household income level, marital status, employment status, number of comorbidities, and state. Survivors in the first year post-ACA were excluded from the DD analyses for percent reporting care unaffordability because the measure has a time frame of the past 12 months.

The BRFSS sampling weights were used to estimate the numbers of survivors reporting noninsurance or care unaffordability. Analyses were conducted in 2018–2019 using SAS 9.4 and SAS-callable SUDAAN (SAS Institute Inc., Cary, NC). All analyses used sample weights to account for complex survey design and nonresponse. *P* values from Wald  $\chi^2$  tests and *t* tests were individually calculated without adjustment for multiple comparisons. All tests were two-sided, and a *P* value of less than .05 was considered statistically significant.

## Results

### Sample Characteristics

Of nonelderly cancer survivors, 41.0% had a high school education or less, 50.8% were employed, and 41.1% had at least two comorbidities. Compared to those in nonexpansion states, survivors in expansion states were more likely to have household income of \$75 000 or more (29.2% vs 23.1%), be college graduates (27.0% vs 22.6%), be employed (52.0% vs 48.8%), and were less likely to be non-Hispanic black (8.1% vs 12.1%) or have two or more comorbidities (39.6% vs 43.4%) (all *P* < .001; Table 1).

### Overall Trends

Between 2013 and 2014, percent uninsured dropped from 13.1% to 7.7% in Medicaid expansion states and from 17.8% to 16.2% in nonexpansion states, and it continued to decrease in 2015 to 5.5% and 12.1%, respectively (Figure 1). Between 2016 and 2017, however, percent uninsured increased slightly from 5.4% to 6.0% in expansion states (increase of 0.5 with 95% confidence interval [CI] = −0.9 to 2.0 percentage points [ppt]) and from 11.8% to 13.5% in nonexpansion states (increase of 1.7; 95% CI = −1.2 to 4.5 ppt). Nationwide, percent uninsured increased from 7.9% in 2016 to 8.9% in 2017 (increase of 1.0, 95% CI = −0.4 to 2.4 ppt), representing 82 750 more uninsured cancer survivors in 2017, the majority (67 163) from nonexpansion states.

Similarly, percent reporting care unaffordability decreased following the ACA in both expansion (from 21.5% to 14.8%) and non-expansion states (from 26.9% to 22.1%) between 2013 and 2016 (Figure 1). In nonexpansion states, it slightly increased to 25.1% in 2017, with the 3.1 (95% CI = −0.4, 6.5) ppt uptick translating to 124 160 more survivors reporting unaffordable care in 2017. No uptick in care unaffordability was seen in expansion states.

### Changes in Disparities by Expansion Status and Sociodemographic Factors

When trends were analyzed by expansion status and sociodemographic factors, overall improvements in insurance and care affordability varied, with reductions in disparities generally more prominent in expansion states than in nonexpansion states (Figures 2 and 3; Supplementary Figures 1 and 2, available online). For example, the disparities in percent uninsured and reporting care unaffordability by sex, age, income, education, employment status, and marital status diminished following the ACA to a larger extent in expansion states than in nonexpansion states. Percent uninsured and care unaffordability

decreased in all racial and ethnic groups, but the disparities between Hispanic and non-Hispanic white survivors persisted. The uptick in percent uninsured and reporting care unaffordability was observed in most sociodemographic segments of cancer survivors in nonexpansion states and in non-Hispanic black and unemployed survivors in expansion states.

The DD analyses (Table 2) showed that Medicaid expansion was associated with a net decrease of 1.8 (95% CI = 0.1 to 3.5) ppt in percent uninsured (*P* = .04) and a net decrease of 2.9 (95% CI = 0.7 to 5.1) ppt in percent reporting care unaffordability (*P* = .009). Reductions were most prominent in female, low- and middle-income, unemployed, unmarried survivors and those with two or more comorbidities (all *P* < .05), leading to a more pronounced narrowing of disparities in noninsurance and care unaffordability by these sociodemographic factors in expansion than in nonexpansion states.

## Discussion

Using population-based survey data for nonelderly adult cancer survivors from 50 states and DC during 2011 to 2017, we found that the percent uninsured and percent reporting care unaffordability decreased following the ACA, although they slightly increased between 2016 and 2017. Decreases were greater in Medicaid expansion states than in nonexpansion states, especially among socioeconomically disadvantaged groups of non-Hispanic black, low-income, low-educational attainment, and unemployed, as well as among those with two or more comorbidities. Ongoing evaluations of the long-term effects of Medicaid expansions and other aspects of the ACA on health-care affordability and health outcomes in cancer survivors are warranted.

The key components of the ACA were designed to increase health insurance coverage options among lower-income populations, offering the promise of reducing socioeconomic disparities in insurance coverage and subsequently in access to care and health outcomes. Since the implementation of the primary provisions of the ACA in 2014, studies using data from national surveys have identified progress in health insurance coverage and reductions in health-care disparities by race and ethnicity and income among the nonelderly general population (14,15,22–27). Reduction in disparities of coverage and/or access to care by age, sex, marital status, rurality (14), education, employment status, and home-ownership status (27) have also been reported. Along with a recent study reporting narrowed racial and ethnic disparity in health insurance coverage, health-care use and out-of-pocket prescription drug expenditures among breast cancer survivors (28), our study adds the evidence that the implementation of the ACA has helped reduce insurance and health-care affordability disparities among all cancer survivors, who tend to be older, female, with greater comorbidity burden and health-care needs and more potential difficulties in obtaining health insurance than the general population. We also report reductions in care unaffordability across a wide range of sociodemographic factors, including age, sex, race and ethnicity, income, education, marital status, employment status, and comorbidity for cancer survivors.

Compared to individuals without cancer history, cancer survivors are more likely to report medical financial hardship manifested in material (eg, problems paying medical bills), psychological (eg, financial distress and worry), and behavioral (eg, forgoing medical care because of cost or affordability)

**Table 1.** Sociodemographic characteristics of cancer survivors aged 18–64 years, BRFSS 2011–2017

Characteristic	Total N = 118 631 (100.0%)* No.(%)	Expansion N = 72 124 (61.6%)* No.(%)	Nonexpansion N = 46 507 (38.4%)* No.(%)	P†
Survey year				.39
2011	18 880 (14.0)	11 147 (13.9)	7733 (14.1)	
2012	16 812 (14.1)	10 774 (14.3)	6038 (13.8)	
2013	18 150 (14.4)	10 627 (14.5)	7523 (14.1)	
2014	16 399 (14.2)	10 189 (14.3)	6210 (14.0)	
2015	15 711 (14.4)	9270 (14.2)	6441 (14.8)	
2016	16 917 (14.4)	10 674 (14.5)	6243 (14.3)	
2017	15 762 (14.5)	9443 (14.2)	6319 (14.9)	
Sex				.05
Male	33 137 (31.4)	20 404 (31.8)	12 733 (30.7)	
Female	85 494 (68.6)	51 720 (68.2)	33 774 (69.3)	
Age, y				.001
18–44	19 822 (26.8)	11 510 (26.0)	8312 (28.1)	
45–54	30 779 (28.1)	18 910 (28.1)	11 869 (28.0)	
55–64	68 030 (45.1)	41 704 (45.9)	26 326 (44.0)	
Race and ethnicity				<.001
NH white	95 181 (72.5)	57 882 (73.1)	37 299 (71.4)	
NH black	8530 (9.7)	4411 (8.1)	4119 (12.1)	
Hispanic	5936 (9.9)	4002 (10.0)	1934 (9.6)	
Other and unknown	8984 (8.0)	5829 (8.7)	3155 (6.8)	
Household income				<.001
<\$25 000	33 649 (29.4)	19 333 (27.5)	14 316 (32.3)	
\$25 000–\$74 999	38 948 (31.1)	23 198 (31.0)	15 750 (31.2)	
≥\$75 000	31 182 (26.8)	20 411 (29.2)	10 771 (23.1)	
Unknown	14 852 (12.8)	9182 (12.3)	5670 (13.5)	
Education				<.001
≤High school graduate	40 645 (41.0)	23 776 (39.8)	16 869 (43.0)	
Some college	35 815 (33.3)	21 145 (32.8)	14 670 (34.0)	
≥College graduate	41 750 (25.3)	26 918 (27.0)	14 832 (22.6)	
Unknown	421 (0.4)	285 (0.5)	136 (0.3)	
Employment status‡				<.001
Employed	61 121 (50.8)	37 830 (52.0)	23 291 (48.8)	
Unemployed	7956 (8.1)	4948 (8.3)	3008 (7.8)	
Not in labor force	48 840 (40.4)	28 891 (39.0)	19 949 (42.6)	
Unknown	714 (0.7)	455 (0.7)	259 (0.8)	
Marital status§				.25
Married	64 459 (55.4)	38 598 (55.1)	25 861 (55.8)	
Unmarried	54 172 (44.6)	33 526 (44.9)	20 646 (44.2)	
No. of comorbid conditions				<.001
0	35 722 (31.1)	22 010 (32.2)	13 712 (29.5)	
1	33 081 (27.8)	20 324 (28.2)	12 757 (27.1)	
≥2	49 828 (41.1)	29 790 (39.6)	20 038 (43.4)	

\*Sample N and weighted % are presented. BRFSS = Behavioral Risk Factor Surveillance System; NH = non-Hispanic.

†P values were from two-sided Wald  $\chi^2$  tests.

‡Employed includes employed for wages and self-employed; unemployed includes out of work; not in labor force includes a homemaker, a student, retired, and unable to work; unknown includes refused and missing.

§Unmarried includes divorced, widowed, separated, never married, a member of an unmarried couple, refused, and missing.

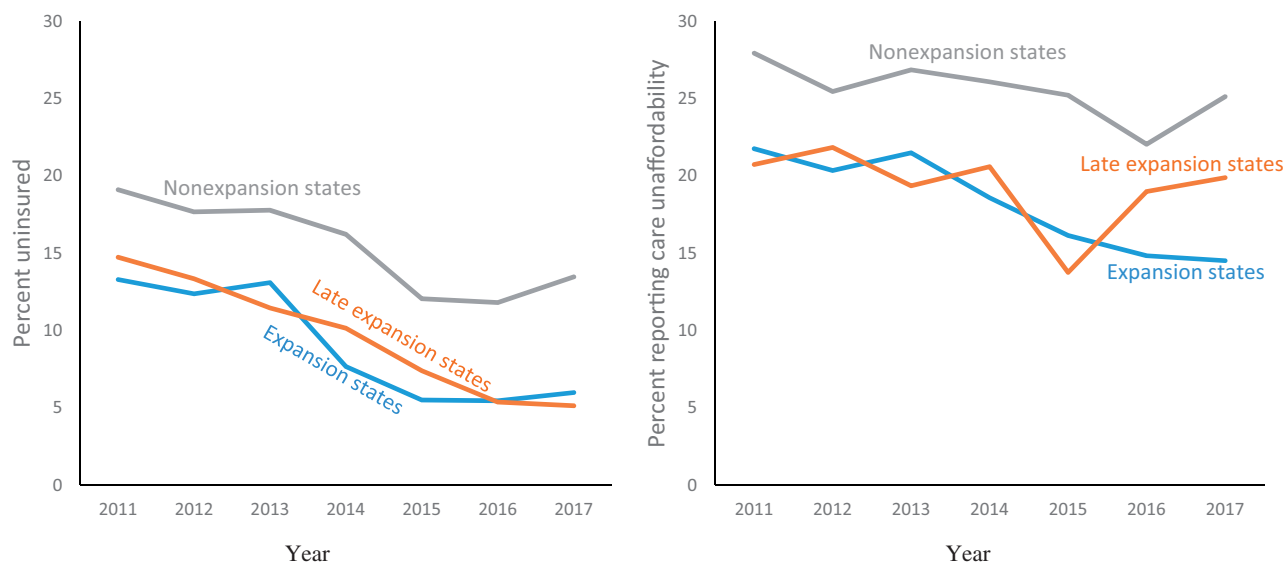
||Comorbid conditions include history of heart attack (ie, myocardial infarction), angina (ie, coronary heart disease), stroke, asthma, chronic obstructive pulmonary disease (COPD; emphysema or chronic bronchitis), arthritis, depression disorder, kidney disease, and diabetes.

domains (3,4,8). The care unaffordability question (needed to see a doctor but could not because of cost) in our study is a measure of the behavioral domain of financial hardship. Our study provides one of the first examinations of impacts of the ACA on financial hardship among cancer survivors, showing a reduction in financial hardship among cancer survivors, especially among those socioeconomically disadvantaged, and suggesting a narrowing in disparities. A recently published study comparing nonelderly cancer survivors in 2016 vs 2011 did not detect changes in self-reported financial burden (29); potential reasons

for inconsistencies with our findings include the small sample size in the other study and differences in measurement of financial hardship. The other study reported prevalence of ever having financial difficulties at any time since cancer diagnosis, whereas the BRFSS question used in our study referred specifically to financial hardship in the past year, making it potentially more sensitive for an evaluation of the effect of Medicaid expansion.

Medicaid expansions are associated with gains in health insurance coverage and/or access to care among various





**Figure 1.** Trends in percent uninsured and percent reporting care unaffordability by Medicaid expansion status among cancer survivors aged 18–64 years, Behavioral Risk Factor Surveillance System 2011–2017. Care unaffordability is measured by the question “Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?” Expansion states include 27 states that expanded Medicaid in 2014 or earlier; late expansion states include five states that expanded Medicaid in 2015–2016; nonexpansion states include 19 states that had not expanded Medicaid by the end of 2017.

populations (26,30–33), including newly diagnosed cancer patients (34,35) and low-income cancer survivors (36). This study extends previous research by identifying not only gains in insurance coverage and care affordability associated with Medicaid expansion but also diminished disparities by sociodemographic factors among cancer survivors. Moreover, unlike some of the previous studies, we also found diminished disparities in nonexpansion states, although to a lesser extent than in expansion states, suggesting other provisions of the ACA, such as establishment of the Marketplace and elimination of preexisting condition exclusion, also helped socioeconomically disadvantaged cancer survivors acquire insurance coverage and affordable health care. For example, prior to the ACA, most non-elderly adults with cancer obtained health insurance through their employer or spouses’ employer like other working-age individuals in the United States (37–39). Nongroup insurance coverage was less available for cancer survivors because they were often denied coverage or priced out of coverage because of their cancer history (39–44). On the one hand, cancer survivors are prone to limitations in ability to work thus loss of employment because of the lasting effects of cancer diagnosis and treatment (45–47); on the other hand, some cancer survivors experience “job lock” and are unable to leave a position because of fear of losing employer-sponsored health insurance (48–50). The establishment of the marketplace and the prohibition of denying or charging higher premiums based on preexisting conditions made it possible for unemployed cancer survivors to purchase affordable health insurance. Our findings of decreased percent uninsured and decreased percent reporting care unaffordability among unemployed cancer survivors in both Medicaid expansion states and nonexpansion states support the protective effects of such provisions.

In 2017, we observed a small increase in noninsurance and care unaffordability, mostly in nonexpansion states (1.7 ppt and 3.1 ppt increase, respectively). The ACA continues to be threatened (51) and has been undermined by destabilization of insurance markets, including terminating funding for cost-sharing reductions, cutting resources for enrollment outreach,

removing the individual mandate, and the emerging prevalence of non-ACA-compliant short-term health insurance plans (52–54). Such changes may partly explain the uptick in percent uninsured and percent reporting care unaffordability in 2017. Although not all these policy changes became effective before 2017, negative publicity about the ACA may have discouraged patient enrollment and uncertainty may have led insurers to exit from the marketplace. In fact, a recent county-based analysis showed that after 2 years of stable rates of insurer participation in marketplace, insurance choices declined sharply in 2017, especially in rural counties and states not expanding Medicaid (55).

Other policy changes to Medicaid programs occurred in late 2017 and early 2018. Revisions on Section 1115 Medicaid Waivers allow states more flexibility to modify programs (56), and as of April 2019, seven states have approved work requirements and another six states had work requirement waivers pending approval (57) despite the recent ruling blocking the implementation in Kentucky and continuation in Arkansas (58). Other states have approved or are considering other waivers to add cost-sharing or restrict health benefits (57). It will be important to monitor the effects of these changes on health disparities for cancer survivors and other vulnerable populations.

Strengths of our study include a large, national population-based dataset that allowed us to examine disparities by multiple sociodemographic factors in all states and DC, both Medicaid expansion and nonexpansion states, with recent data. Limitations include unavailability of detailed insurance type information and clinical information such as cancer type, stage, course of treatment, and time since diagnosis. Future studies with such clinical information are warranted to understand the effects of the ACA on specific survivor populations such as long-term vs recent and adult vs childhood cancer survivors. Cancer history, insurance coverage, and care unaffordability were self-reported and thus may be subject to recall errors and social desirability bias. Additionally, our income categories are not identical to ACA eligibility cutoffs because of insufficient

**Table 2.** Difference-in-differences analyses of association of Medicaid expansion status with percent uninsured and percent reporting care unaffordability among cancer survivors aged 18–64 years by sociodemographic factors, BRFS 2011–2017

Characteristic	Expansion states*			Nonexpansion states*			Crude model		Adjusted model†	
	Pre-ME	Post-ME	Difference (95% CI)	Pre-ME	Post-ME	Difference (95% CI)	DD (95% CI)	P‡	DD (95% CI)	P‡
<b>Percent uninsured</b>										
Total	12.8	6.0	–6.8 (–7.7 to –5.9)	18.2	13.4	–4.8 (–6.3 to –3.3)	–2.0 (–3.7 to –0.2)	.03	–1.8 (–3.5 to –0.1)	.04
<b>Age group, y</b>										
18–44	21.0	9.7	–11.3 (–13.7 to –8.9)	28.3	20.7	–7.7 (–11.3 to –4.0)	–3.6 (–8.0 to 0.8)	.11	–3.1 (–7.5 to 1.2)	.15
45–54	12.2	6.1	–6.1 (–7.7 to –4.5)	17.3	13.5	–3.8 (–6.7 to –1.0)	–2.3 (–5.5 to 1.0)	.17	–2.0 (–5.2 to 1.2)	.22
55–64	8.2	4.1	–4.2 (–5.2 to –3.1)	11.7	9.0	–2.7 (–4.4 to –1.0)	–1.4 (–3.4 to 0.6)	.16	–1.5 (–3.4 to 0.5)	.15
<b>Sex</b>										
Male	10.7	6.6	–4.1 (–5.8 to –2.4)	13.5	11.0	–2.5 (–5.2 to 0.2)	–1.6 (–4.8 to 1.5)	.31	–1.1 (–4.1 to 2.0)	.50
Female	13.8	5.8	–8.0 (–9.1 to –6.9)	20.3	14.4	–5.9 (–7.7 to –4.0)	–2.2 (–4.3 to –0.0)	.05	–2.2 (–4.3 to –0.1)	.04
<b>Race/ethnicity</b>										
NH white	11.5	4.8	–6.7 (–7.6 to –5.7)	16.5	11.8	–4.7 (–6.3 to –3.0)	–2.0 (–3.9 to –0.1)	.04	–1.8 (–3.7 to 0.0)	.05
NH black	15.3	6.2	–9.1 (–12.9 to –5.3)	19.3	12.4	–6.9 (–11.0 to –2.8)	–2.2 (–7.8 to 3.4)	.44	–2.1 (–7.6 to 3.4)	.46
Hispanic	21.2	12.9	–8.2 (–12.5 to –3.9)	31.0	26.6	–4.4 (–12.3 to 3.6)	–3.9 (–12.9 to 5.2)	.40	–2.6 (–11.3 to 6.2)	.57
<b>Household income</b>										
<\$25 000	24.8	11.3	–13.5 (–15.9 to –11.1)	33.0	25.1	–7.8 (–11.1 to –4.6)	–5.7 (–9.7 to –1.6)	.006	–5.6 (–9.6 to –1.6)	.006
\$25 000–\$74 999	10.5	5.7	–4.8 (–6.2 to –3.4)	12.1	8.6	–3.6 (–5.7 to –1.4)	–1.2 (–3.8 to 1.4)	.35	–1.2 (–3.8 to 1.4)	.37
≥\$75 000	2.3	1.6	–0.8 (–1.6 to 0.0)	3.4	3.2	–0.2 (–1.7 to 1.4)	–0.6 (–2.3 to 1.1)	.49	–0.6 (–2.3 to 1.1)	.50
<b>Education</b>										
≤High school graduate	17.8	9.1	–8.7 (–10.5 to –6.9)	25.3	19.5	–5.7 (–8.5 to –2.9)	–3.0 (–6.3 to 0.4)	.08	–2.6 (–5.9 to 0.6)	.11
Some college	12.3	5.6	–6.7 (–8.3 to –5.1)	15.7	11.3	–4.4 (–6.6 to –2.1)	–2.4 (–5.1 to 0.4)	.10	–2.3 (–5.0 to 0.5)	.11
≥College graduate	5.3	2.3	–3.0 (–3.9 to –2.2)	7.9	5.3	–2.6 (–4.2 to –0.9)	–0.5 (–2.3 to 1.4)	.63	–0.7 (–2.5 to 1.2)	.49
<b>Employment§</b>										
Employed	10.6	5.4	–5.2 (–6.3 to –4.1)	16.3	11.1	–5.1 (–7.2 to –3.1)	–0.0 (–2.4 to 2.3)	.98	–0.1 (–2.4 to 2.2)	.94
Unemployed	35.1	15.3	–19.8 (–25.2 to –14.4)	43.8	34.8	–9.1 (–15.7 to –2.4)	–10.7 (–19.3 to –2.1)	.01	–10.9 (–19.2 to –2.5)	.01
Not in labor force	10.2	5.0	–5.2 (–6.5 to –3.9)	14.8	12.3	–2.5 (–4.7 to –0.3)	–2.7 (–5.2 to –0.1)	.04	–2.4 (–4.9 to 0.2)	.07
<b>Marital status  </b>										
Married	8.3	4.1	–4.2 (–5.1 to –3.2)	13.5	8.5	–5.0 (–6.8 to –3.2)	0.8 (–1.2 to 2.8)	.44	0.7 (–1.3 to 2.7)	.47
Unmarried	18.3	8.5	–9.8 (–11.4 to –8.1)	24.3	19.4	–4.9 (–7.5 to –2.4)	–4.8 (–7.9 to –1.8)	.002	–4.8 (–7.8 to –1.7)	.002
<b>No. of comorbid conditions¶</b>										
0	11.0	6.1	–4.9 (–6.5 to –3.3)	15.5	10.8	–4.7 (–7.4 to –2.1)	–0.2 (–3.3 to 3.0)	.91	0.2 (–2.8 to 3.2)	.88
1	12.9	5.7	–7.3 (–9.0 to –5.6)	17.5	12.8	–4.6 (–7.5 to –1.8)	–2.7 (–6.0 to 0.7)	.12	–2.6 (–5.9 to 0.7)	.13
≥2	14.3	6.3	–8.0 (–9.5 to –6.5)	20.5	15.4	–5.1 (–7.5 to –2.7)	–2.9 (–5.7 to –0.1)	.04	–3.0 (–5.7 to –0.2)	.04
<b>Percent reporting care unaffordability#</b>										
Total	21.1	15.5	–5.6 (–6.9 to –4.4)	26.8	24.2	–2.6 (–4.5 to –0.7)	–3.0 (–5.3 to –0.7)	.01	–2.9 (–5.1 to –0.7)	.009
<b>Age group, y</b>										
18–44	31.7	21.4	–10.3 (–13.2 to –7.4)	39.7	33.7	–5.9 (–10.3 to –1.5)	–4.4 (–9.6 to 0.9)	.11	–4.5 (–9.6 to 0.7)	.09
45–54	22.5	17.0	–5.5 (–7.8 to –3.2)	27.1	26.0	–1.2 (–4.9 to 2.6)	–4.3 (–8.7 to 0.0)	.05	–4.2 (–8.3 to –0.1)	.04
55–64	13.7	11.5	–2.2 (–3.7 to –0.6)	17.5	17.4	–0.1 (–2.4 to 2.2)	–2.0 (–4.8 to 0.7)	.15	–2.0 (–4.7 to 0.7)	.15

(continued)

Table 2. (continued)

Characteristic	Expansion states*			Nonexpansion states*			Crude model		Adjusted model†	
	Pre-ME	Post-ME	Difference (95% CI)	Pre-ME	Post-ME	Difference (95% CI)	DD (95% CI)	P‡	DD (95% CI)	P‡
Sex										
Male	15.2	13.2	-2.0 (-4.3 to 0.3)	18.8	17.2	-1.5 (-4.6 to 1.5)	-0.4 (-4.3 to 3.4)	.83	0.3 (-3.3 to 4.0)	.86
Female	23.8	16.6	-7.2 (-8.7 to -5.8)	30.3	27.3	-3.0 (-5.4 to -0.6)	-4.4 (-7.1 to -1.5)	.003	-4.6 (-7.3 to -1.9)	<.001
Race/ethnicity										
NH white	19.4	13.9	-5.5 (-6.7 to -4.3)	23.7	22.3	-1.4 (-3.4 to 0.6)	-4.1 (-6.5 to -1.8)	<.001	-3.9 (-6.1 to -1.6)	<.001
NH black	25.1	12.3	-12.8 (-17.5 to -8.2)	30.0	23.3	-6.8 (-12.4 to -1.1)	-6.1 (-13.4 to 1.3)	.11	-5.6 (-12.6 to 1.4)	.12
Hispanic	29.3	24.5	-4.8 (-10.4 to 0.8)	41.5	32.5	-9.0 (-18.4 to 0.5)	4.2 (-6.8 to 15.1)	.46	4.1 (-6.5 to 14.8)	.45
Household income										
<\$25 000	38.3	26.6	-11.7 (-14.6 to -8.8)	47.2	38.7	-8.5 (-12.2 to -4.7)	-3.2 (-8.0 to 1.5)	.18	-3.4 (-8.0 to 1.3)	.16
\$25 000-\$74 999	19.2	16.1	-3.0 (-5.1 to -0.9)	19.8	20.9	1.2 (-2.1 to 4.4)	-4.2 (-8.1 to -0.3)	.03	-4.7 (-8.5 to -1.0)	.01
≥\$75 000	5.8	6.0	0.2 (-1.3 to 1.6)	6.8	7.8	1.0 (-1.5 to 3.5)	-0.9 (-3.8 to 2.1)	.57	-0.9 (-3.8 to 1.9)	.52
Education										
≤High school graduate	27.6	20.2	-7.4 (-9.7 to -5.1)	34.2	28.8	-5.4 (-8.8 to -2.1)	-2.0 (-6.0 to 2.1)	.34	-1.9 (-5.8 to 2.0)	.33
Some college	20.9	16.2	-4.7 (-6.9 to -2.6)	26.0	25.7	-0.3 (-3.6 to 3.0)	-4.4 (-8.3 to -0.5)	.03	-4.3 (-8.1 to -0.5)	.03
≥College graduate	10.6	8.4	-2.2 (-3.5 to -0.9)	12.9	14.0	1.1 (-1.4 to 3.6)	-3.3 (-6.1 to -0.5)	.02	-3.3 (-6.1 to -0.6)	.02
Employment§										
Employed	16.4	12.3	-4.1 (-5.6 to -2.6)	21.5	19.9	-1.6 (-4.2 to 1.1)	-2.6 (-5.6 to 0.4)	.09	-2.9 (-5.8 to 0.0)	.05
Unemployed	41.6	26.1	-15.6 (-21.2 to -9.9)	50.4	45.5	-5.0 (-12.4 to 2.5)	-10.6 (-2.0 to -1.2)	.03	-11.0 (-20.3 to -1.6)	.02
Not in labor force	22.4	17.8	-4.6 (-6.6 to -2.5)	27.8	25.5	-2.3 (-5.3 to 0.6)	-2.3 (-5.8 to 1.3)	.22	-1.8 (-5.2 to 1.7)	.32
Marital status										
Married	15.1	12.1	-3.0 (-4.5 to -1.5)	20.2	18.5	-1.6 (-4.1 to 0.8)	-1.3 (-4.2 to 1.5)	.36	-1.7 (-4.4 to 1.1)	.23
Unmarried	28.3	19.6	-8.6 (-10.6 to -6.6)	35.3	31.0	-4.3 (-7.4 to -1.2)	-4.3 (-8.0 to -0.7)	.02	-4.3 (-7.9 to -0.7)	.02
No. of comorbid conditions¶										
0	12.7	8.8	-3.9 (-5.8 to -2.1)	15.8	13.2	-2.6 (-5.5 to 0.4)	-1.4 (-4.8 to 2.1)	.44	-0.9 (-4.2 to 2.5)	.61
1	18.3	12.9	-5.4 (-7.5 to -3.3)	21.5	19.5	-2.0 (-5.4 to 1.3)	-3.4 (-7.4 to 0.6)	.09	-3.1 (-7.1 to 0.9)	.13
≥2	30.1	22.6	-7.6 (-9.7 to -5.4)	37.7	34.6	-3.2 (-6.3 to -0.0)	-4.4 (-8.2 to -0.6)	.02	-4.4 (-8.2 to -0.7)	.02

\*Pre-ME or post-ME cutoff is defined as 2014 for all states except 2015 for New Hampshire (expanded on 8/15/2014), Pennsylvania (1/1/2015), and Indiana (2/1/2015), 2016 for Alaska (9/1/2015) and Montana (1/1/2016), and 2017 for Louisiana (7/1/2016). BRFSS = Behavioral Risk Factor Surveillance System; CI = confidence interval; DD = difference-in-differences; ME = Medicaid expansion; NH = non-Hispanic.

†Models were adjusted for age group, sex, race and ethnicity, household income level, marital status, employment status, number of comorbidities, and state if applicable.

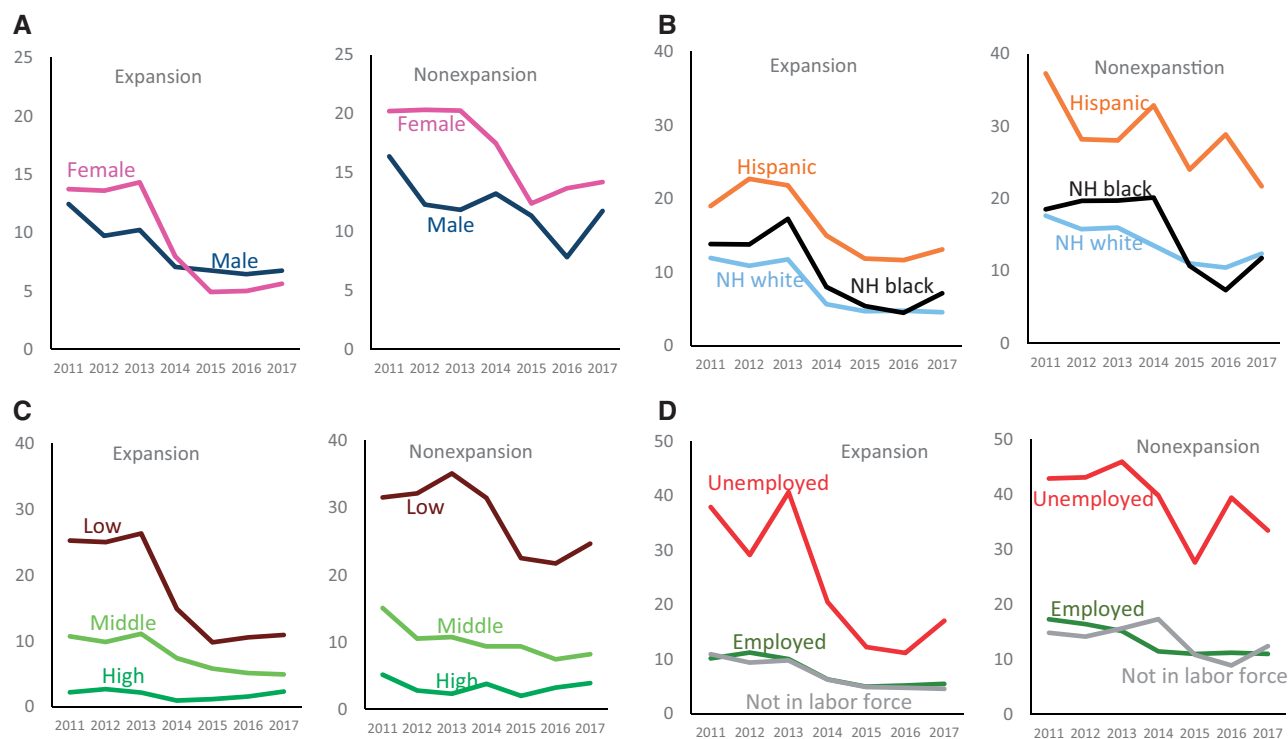
‡P values were from two-sided t tests.

§Employed includes employed for wages and self-employed; unemployed includes out of work; not in labor force includes a homemaker, a student, retired, and unable to work; unknown includes refused and missing.

||Unmarried includes divorced, widowed, separated, never married, a member of an unmarried couple, refused, and missing.

¶Comorbid conditions include history of heart attack (ie, myocardial infarction), angina (ie, coronary heart disease), stroke, asthma, chronic obstructive pulmonary disease (COPD; emphysema or chronic bronchitis), arthritis, depression disorder, kidney disease, and diabetes.

#Care affordability is measured by the question "Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?" Analyses for percent reporting care unaffordability excluded observations in the first year of expansion.



**Figure 2.** Trends in percent uninsured by Medicaid expansion status and sociodemographic factors among cancer survivors aged 18–64 years, Behavioral Risk Factor Surveillance System 2011–2017. **A)** Sex; **(B)** race and ethnicity; **(C)** household income; **(D)** employment status. Expansion states include 27 states that expanded Medicaid in 2014 or earlier; non-expansion states include 19 states that had not expanded Medicaid by the end of 2017. Trends for late expansion states are not shown for presentation clarity. NH = non-Hispanic.



**Figure 3.** Trends in percent reporting care unaffordability by Medicaid expansion status and sociodemographic factors among cancer survivors aged 18–64 years, Behavioral Risk Factor Surveillance System 2011–2017. Care unaffordability is measured by the question “Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?” **A)** Sex; **(B)** race and ethnicity; **(C)** household income; **(D)** employment status. Expansion states include 27 states that expanded Medicaid in 2014 or earlier; non-expansion states include 19 states that had not expanded Medicaid by the end of 2017. Trends for late expansion states are not shown for presentation clarity. NH = non-Hispanic.



information on exact income and household size in the BRFSS. Although some early ACA provisions were implemented in 2010, we did not examine the effects of those provisions in this study because trend analysis combining 2010 and earlier BRFSS data with 2011 and later BRFSS data are discouraged because of the addition of cellular telephone households and revised weighting methodology starting with the 2011 BRFSS (59). Moreover, we could not assess insurance coverage and care unaffordability changes following a cancer diagnosis because of the cross-sectional nature of the BRFSS data.

Using population-based survey data from all 50 states and DC, we conducted a comprehensive examination of the effects of Medicaid expansions on disparities in insurance coverage and care affordability among nonelderly adult cancer survivors and identified diminishing disparities by various sociodemographic factors nationwide, with stronger effects in Medicaid expansion states. However, the recent increase in uninsured rate and care unaffordability is concerning. Additional research is needed to examine other aspects of cancer survivorship such as quality of life, cost of care, and survival following the ACA and monitor progress in reducing cancer disparities with changes in policies.

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## Notes

Affiliation of authors: Surveillance and Health Services Research, American Cancer Society, Atlanta, GA (XH, AJ, ZZ, AGS, SF, KRY).

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The American Cancer Society had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

Xuesong Han from the American Cancer Society had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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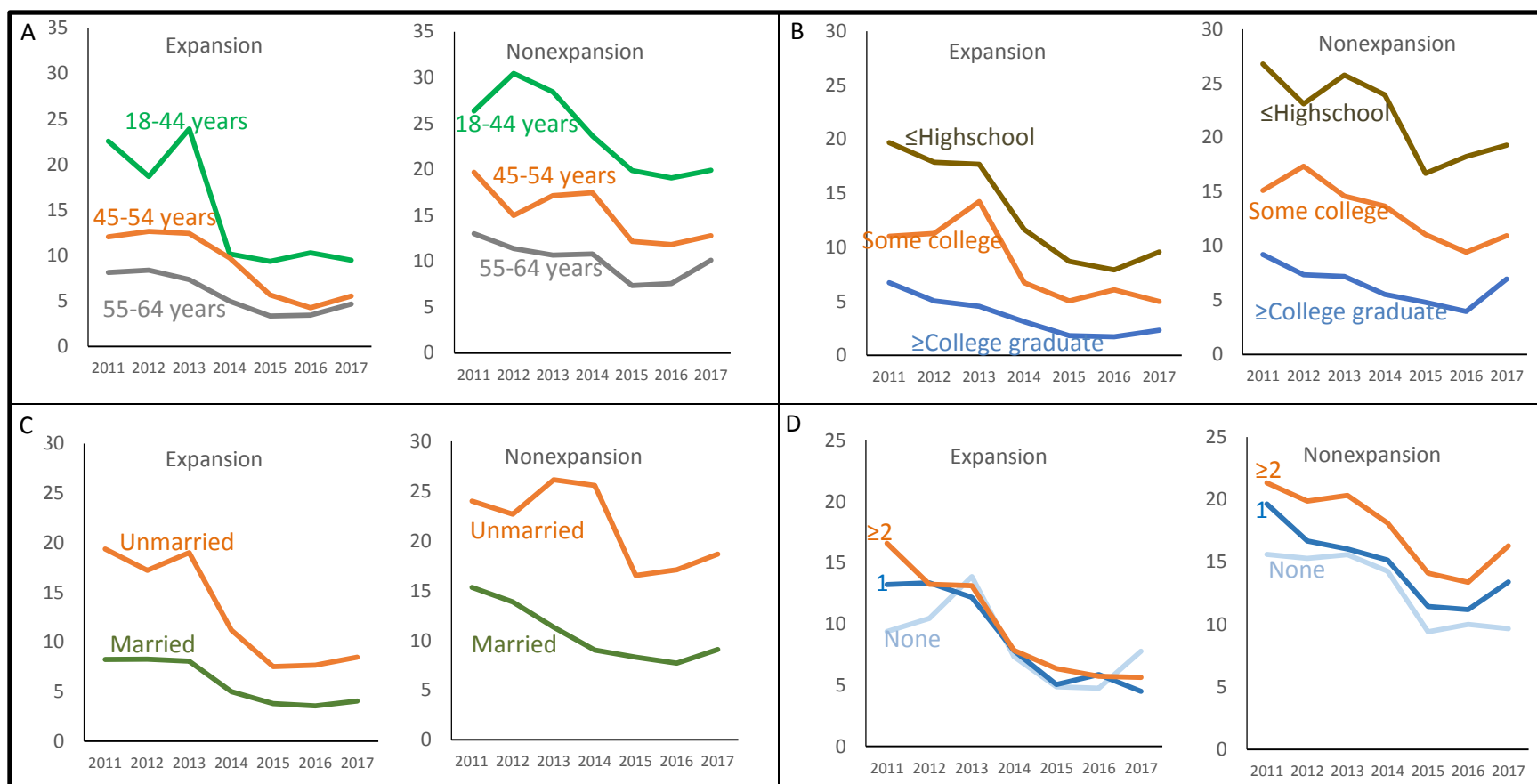
SUPPLEMENTARY MATERIALS

**Supplementary Table 1. Medicaid expansion status by December 31, 2017 and number of cancer survivors in Behavioral Risk Factor Surveillance System 2011-2017**

<b>State</b>	<b>Medicaid Expansion date</b>	<b>Post-Affordable Care Act years in analysis</b>	<b>Sample N</b>
2014 or earlier expansion states			61825
Early expansion states			
California	11/1/2010	2014-2017	2796
Connecticut	4/1/2010	2014-2017	2491
District of Columbia	7/1/2010	2014-2017	936
Minnesota	3/1/2010	2014-2017	3856
New Jersey	4/14/2011	2014-2017	2876
Washington	1/3/2011	2014-2017	3673
2014 expansion states			
Arizona	1/1/2014	2014-2017	2156
Arkansas	1/1/2014	2014-2017	1288
Colorado	1/1/2014	2014-2017	3173
Delaware	1/1/2014	2014-2017	1159
Hawaii	1/1/2014	2014-2017	1624
Illinois	1/1/2014	2014-2017	1187
Iowa	1/1/2014	2014-2017	1754
Kentucky	1/1/2014	2014-2017	3304
Maryland	1/1/2014	2014-2017	3355
Massachusetts	1/1/2014	2014-2017	3802
Michigan	4/1/2014	2014-2017	2909
Nevada	1/1/2014	2014-2017	1090
New Hampshire	8/15/2014	2015-2017	1854
New Mexico	1/1/2014	2014-2017	2042
New York	1/1/2014	2014-2017	3079
North Dakota	1/1/2014	2014-2017	1439
Ohio	1/1/2014	2014-2017	3059
Oregon	1/1/2014	2014-2017	1594
Rhode Island	1/1/2014	2014-2017	1763
Vermont	1/1/2014	2014-2017	1770
West Virginia	1/1/2014	2014-2017	1796
Late expansion states			10299
Alaska	9/1/2015	2016-2017	1059
Indiana	2/1/2015	2015-2017	2473
Louisiana	7/1/2016	2017	1842
Montana	1/1/2016	2016-2017	2162
Pennsylvania	1/1/2015	2015-2017	2763
Nonexpansion states			46507

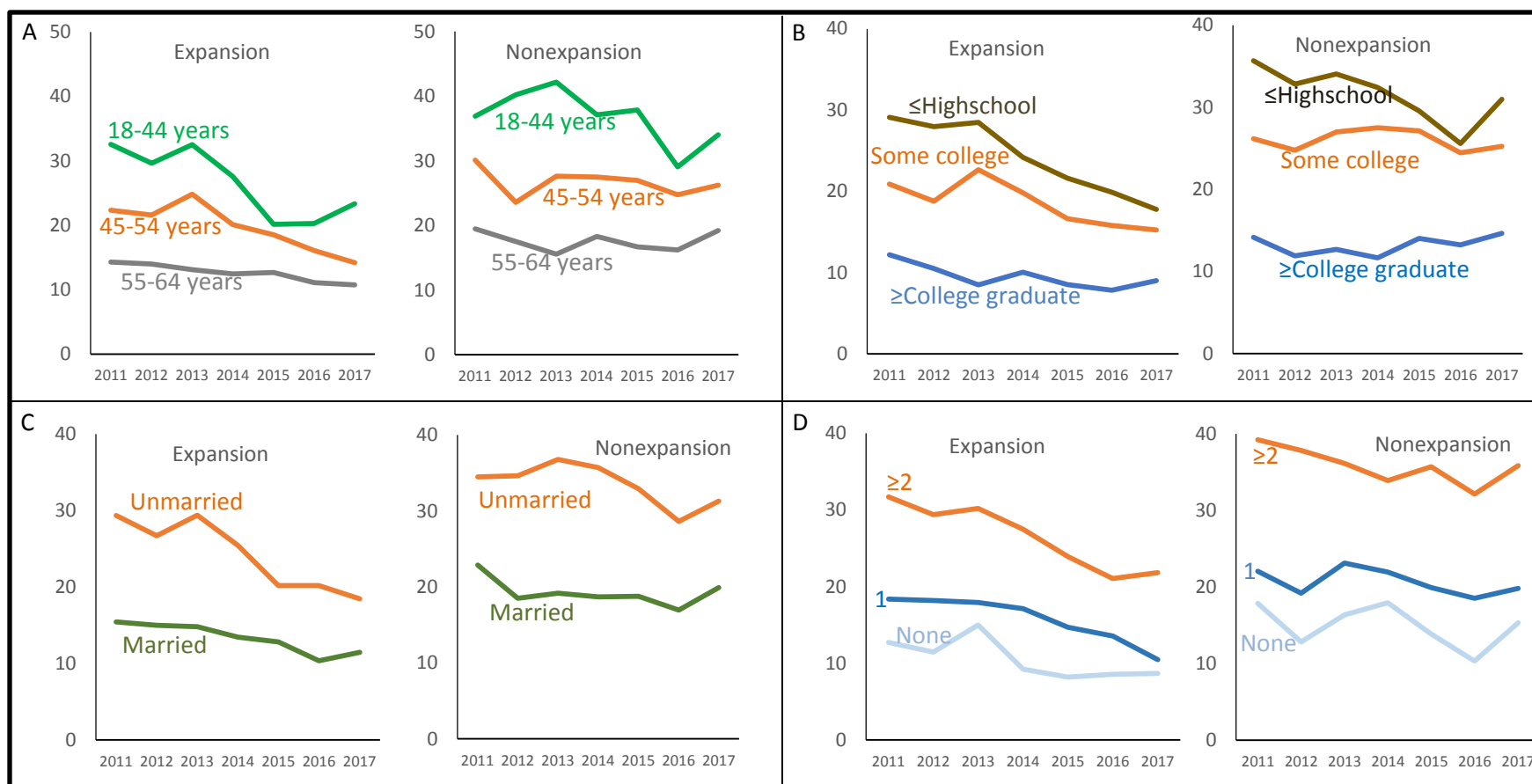
Alabama	--	2014-2017	2253
Florida	--	2014-2017	4738
Georgia	--	2014-2017	1648
Idaho	--	2014-2017	1383
Kansas	--	2014-2017	4632
Maine	--	2014-2017	2850
Mississippi	--	2014-2017	1587
Missouri	--	2014-2017	1875
Nebraska	--	2014-2017	4480
North Carolina	--	2014-2017	2014
Oklahoma	--	2014-2017	1891
South Carolina	--	2014-2017	2887
South Dakota	--	2014-2017	1739
Tennessee	--	2014-2017	1780
Texas	--	2014-2017	2847
Utah	--	2014-2017	2887
Virginia	--	2014-2017	2138
Wisconsin	--	2014-2017	1390
Wyoming	--	2014-2017	1488

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**Supplementary Figure 1. Trends in percent uninsured by Medicaid expansion status and sociodemographic factors among cancer survivors aged 18-64 years, Behavioral Risk Factor Surveillance System 2011-2017.** Panel A is for Age; panel B is for Education; panel C is for Marital status; panel D is for Number of comorbid conditions. NH is an abbreviation for Non-Hispanic. Expansion states include 27 states expanded Medicaid in 2014 or earlier; nonexpansion states include 19 states had not expanded Medicaid by the end of 2017. Trends for late expansion states are not shown for presentation clarity.





**Supplementary Figure 2. Trends in percent reporting care unaffordability by Medicaid expansion status and sociodemographic factors among cancer survivors aged 18-64 years, Behavioral Risk Factor Surveillance System 2011-2017.** Panel A is for Age; panel B is for Education; panel C is for Marital status; panel D is for Number of comorbid conditions. NH is an abbreviation for Non-Hispanic. Care unaffordability is measured by question “was there a time in the past 12 months when you needed to see a doctor but could not because of cost?” Expansion states include 27 states expanded Medicaid in 2014 or earlier; nonexpansion states include 19 states had not expanded Medicaid by the end of 2017. Trends for late expansion states are not shown for presentation clarity.