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RESEARCH ARTICLE

Impacts of the Affordable Care Act Dependent Coverage Provision on Young Adults With Cancer

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Introduction: Evidence through 2012 suggests that the 2010 Affordable Care Act Dependent Coverage Provision, extending dependent insurance coverage eligibility to age 26 years, increased young adult insurance coverage and decreased cancer diagnosis stage in young adult cancer patients. This study examines Dependent Coverage Provision–associated changes in insurance coverage and diagnosis stage through 2014 in young adult cancer patients.

Methods: Using a quasi-experimental study design, analyses were conducted in 2017–2018 using 2007 to 2014 data from the Surveillance, Epidemiology, and End Results (SEER) 18 and the National Cancer Database (NCDB). Using difference-in-differences analyses applied to linear probability models, changes in the percentage of policy-eligible individuals aged 19–25 years versus ineligible individuals aged 27–29 years who were insured (excluding Medicaid) and diagnosed at early (Stages 0 and 1) or late (Stage 4) stages following Dependent Coverage Provision enactment were estimated.

Results: A total of 36,901 and 92,358 young adults were included from SEER and NCDB. Consistent increases in the percentage insured (SEER: 3.45 percentage points, 95% CI=2.04, 4.87; NCDB: 3.72 percentage points, 95% CI=2.80, 4.64); variable increases in early-stage diagnoses (2.25 percentage points, 95% CI=0.40, 4.10; 0.69 percentage points, 95% CI= −0.65, 2.02); and decreases in late-stage diagnoses (−1.74 percentage points, 95% CI= −3.10, −0.38; −0.58 percentage points, 95% CI= −1.46, 0.30) were observed in young adults aged 19–25 versus 27–29 years.

Conclusions: These results provide clear evidence for a Dependent Coverage Provision–associated impact on insurance coverage in young adult cancer patients; however, clear impacts on diagnosis stage are less evident.

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INTRODUCTION

Cancer is diagnosed annually in approximately 21,000 U.S. young adults aged 20 to 29 years,[1] with more than 2,300 deaths annually.[2] Young adult cancer survival improvement in recent decades has lagged behind other age groups.[3] For example, from 2000 to 2007, individuals aged 20–29 years were the only age group without decreased cancer mortality,[4] and more recently lower survival gains were reported compared with other age groups.[3] A lower percentage of young adults with insurance coverage may contribute to these patterns.[5–7]

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The Affordable Care Act (ACA) increased health insurance access in young adults through the September 23, 2010 Dependent Care Provision (DCP) enactment mandating dependent care coverage up to age 26 years. The DCP has been attributed to decreasing the percentage of uninsured young adults from approximately 34% in 2010 to about 20% in 2014,[8] with early data suggesting positive effects on healthcare access, healthcare utilization,[9,10] self-assessed health and BMI,[11] and mental health.[12] The DCP has also been associated with decreasing the percentage uninsured among newly diagnosed young adult cancer cases[13,14] and enabling earlier cancer diagnosis.[13,15]

This study's objective is to extend early results on DCP impacts in young adult cancer patients with two additional years of data from two U.S. young adult cancer patient samples. In addition to its expected positive impact on insurance coverage, evidence for a DCP impact on cancer diagnosis stage is evaluated. This could occur if increased access results in early diagnosis. Further, exploratory analyses are conducted to assess DCP impacts on survival in DCP-eligible young adults.

METHODS

Study Populations

Using a quasi-experimental design, DCP impacts on insurance coverage, diagnosis stage, and survival in DCP-eligible individuals aged 19–25 years versus DCP-ineligible individuals aged 27–29 years at diagnosis were evaluated. Population-based cancer diagnoses data for 28% of the U.S. population were obtained from Surveillance, Epidemiology, and End Results (SEER) 18.[16] Cancer diagnoses data for ≅70% of the U.S. population[17] were obtained from the National Cancer Database (NCDB) 2015 Participant User Files. Individuals diagnosed with first malignant primary cancers during 2007–2009 (pre-DCP) and 2011–2014 (post-DCP) at ages 19–25 and 27–29 years were included. Exclusions included individuals diagnosed at age 26 years because of potential partial year eligibility and those diagnosed in 2010 to consider a washout and phase-in period except in the insurance coverage and stage at diagnosis trend analyses. For NCDB, facilities not reporting cases in all years (2007–2009 and 2011–2014) were also excluded. Cases with leukemia, central nervous system, and other intracranial and intraspinal neoplasms, or other cancer diagnoses classified as having inapplicable staging using the SEER American Joint Committee on Cancer (AJCC) 6th Edition Group Stage variable or the NCDB Analytic Stage Group variable were excluded for diagnosis stage analyses. Finally, cases with Stage 0 tumors (except bladder[18]) were excluded (Appendix Methods and Results). Both SEER and NCDB data are considered non-human subjects research, and therefore IRB approval was not required.

Measures

For SEER and NCDB, the Derived AJCC Stage Group, 6th edition (2004+) and the Analytic Stage Group variables were used, respectively. Stages 0 (bladder cancer) and 1 were considered early stage, and Stage 4 was considered late stage. The SEER Insurance Recode (2007) and NCDB Primary Payer variables were used to define insurance status as insured, Medicaid, and uninsured. The Adolescents and Young Adults Site Recode (AYA site recode/WHO 2008) variable was used to derive cancer types as previously described[13] (Appendix Methods and Results provide additional variable details).

Statistical Analysis

All statistical analyses were conducted in 2017–2018 using R, version 3.3.2. Chi-square tests were used to compare study population demographics and across time. Multiple imputation[19] was used to estimate missing values, with results across imputed data sets combined following Rubin's rules[20] (Appendix Methods and Results). Kaplan–Meier plots were used to compare survival between age groups pre- and post-ACA.

Difference-in-differences (DID) analyses[21] applied to linear probability models were used to evaluate the DCP impact on the percentage point change from the pre- to the post-DCP period in insured and diagnosis stage in DCP eligible individuals aged 19–25 years versus ineligible individuals aged 27–29 years. The policy ineligible group was assumed to be undergoing the same trends as the policy eligible group except for those that occurred in response to the policy.[21] In general, the linear probability model was specified as

$$P(Y=1) = \alpha + \beta_1 \text{age group} + \beta_2 \text{period} + \beta_3(\text{age group} \times \text{period}) + \beta_4 \text{covariates} + \varepsilon$$

where Y is the binary dependent variable indicating whether the individual was reported as insured, or diagnosed at an early or late stage for respective analyses. Age group and period represent binary indicator variables for age groups 19–25 and 27–29 years and periods 2007–2009 and 2011–2014, respectively. β_3, estimating the DID, is equivalent to the difference between individuals aged 19–25 and 27–29 years in the adjusted percentage point difference for each group in the outcome variable from 2007–2009 to 2011–2014. The covariates are a vector of potential confounding variables including sex; race/ethnicity; urban/rural residence; marital status (SEER only); county/ZIP code education level; county/ZIP code income level; and cancer type (except insurance analyses). For the DID to be valid, "parallel trends" in the outcome variable in the pre-policy period for the policy eligible and ineligible groups are required. The parallel trends assumption was evaluated by restricting analyses to 2007 and 2009 diagnoses and treating 2009 as the post-policy period.[21] Unless noted, all presented analyses met this assumption ($p>0.05$).

To assess evidence for a DCP impact on the percentage of insured young adults aged 19–25 years following 2010 implementation, the authors conducted analyses excluding and including individuals with Medicaid, with the latter grouping those with Medicaid with the uninsured (i.e., Y=1 if insured and Y=0 if reported as having Medicaid or uninsured).

Exploratory survival analyses were conducted using Cox proportional hazards regression models to estimate the DCP impact on cancer (SEER) and overall (both SEER and NCDB) survival. Analyses were stratified by age group to estimate the hazard of death in the post- versus pre-DCP periods. Heteroscedasticity robust SEs were used in all regression models, and all p-values are

Table 1. Summary of SEER and NCDB Patient Populations

	SEER				NCDB			
	DCP eligible: 19–25 years		DCP ineligible: 27–29 years		DCP eligible: 19–25 years		DCP ineligible: 27–29 years	
Variable	Pre-ACA (*n*=8,858)	Post-ACA (*n*=12,547)	Pre-ACA (*n*=6,464)	Post-ACA (*n*=9,032)	Pre-ACA (*n*=22,053)	Post-ACA (*n*=31,298)	Pre-ACA (*n*=16,196)	Post-ACA (*n*=22,811)
Insurance								
Insured	5,896 (66.6)	8,656 (69)	4,496 (69.6)	5,983 (66.2)	15,128 (68.6)	22,051 (70.5)	11,869 (73.3)	15,881 (69.6)
Medicaid	1,602 (18.1)	2,320 (18.5)	1,025 (15.9)	1,814 (20.1)	3,760 (17)	5,472 (17.5)	2,363 (14.6)	4,100 (18)
Uninsured	836 (9.4)	863 (6.9)	482 (7.5)	660 (7.3)	2,459 (11.2)	2,873 (9.2)	1,452 (9)	2,212 (9.7)
Missing	524 (5.9)	708 (5.6)	461 (7.1)	575 (6.4)	706 (3.2)	902 (2.9)	512 (3.2)	618 (2.7)
Stage at diagnosis								
I (early stage)	3,689 (51.6)	5,445 (54)	3,113 (57.5)	4,301 (56.1)	8,089 (45.3)	12,944 (51)	6,929 (50.1)	10,565 (53.7)
II	1,209 (16.9)	1,698 (16.8)	785 (14.5)	1,152 (15)	3,173 (17.8)	4,599 (18.1)	2,234 (16.1)	3,357 (17.1)
III	888 (12.4)	1,192 (11.8)	626 (11.6)	932 (12.2)	2,217 (12.4)	3,250 (12.8)	1,730 (12.5)	2,528 (12.9)
IV (late stage)	774 (10.8)	1,005 (10)	476 (8.8)	760 (9.9)	1,806 (10.1)	2,724 (10.7)	1,223 (8.8)	1,916 (9.7)
Missing	587 (8.2)	742 (7.4)	414 (7.6)	520 (6.8)	2,554 (14.3)	1,880 (7.4)	1,728 (12.5)	1,296 (6.6)
Not included in stage analyses	1,711	2,465	1,050	1,367	4,214	5,901	2,352	3,149
Deaths (at end of study period)								
Death from cancer[a]	1,292 (14.6)	899 (7.2)	894 (13.8)	678 (7.5)	3,890 (17.6)	3,532 (11.3)	2,773 (17.1)	2,504 (11)
Alive, or death from other cause	7,563 (85.4)	11,624 (92.6)	5,555 (85.9)	8,340 (92.3)	18,163 (82.4)	27,766 (88.7)	13,423 (82.9)	20,307 (89)
Missing	3 (0)	24 (0.2)	15 (0.2)	14 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)
Sex								
Male	4,321 (48.8)	6,143 (49)	2,773 (42.9)	3,768 (41.7)	10,654 (48.3)	14,952 (47.8)	6,573 (40.6)	9,252 (40.6)
Female	4,537 (51.2)	6,404 (51)	3,691 (57.1)	5,264 (58.3)	11,399 (51.7)	16,346 (52.2)	9,623 (59.4)	13,559 (59.4)
Marital status								
Unmarried	6,838 (77.2)	9,964 (79.4)	3,255 (50.4)	4,971 (55)				
Married	1,410 (15.9)	1,518 (12.1)	2,675 (41.4)	3,212 (35.6)				
Missing	610 (6.9)	1,065 (8.5)	534 (8.3)	849 (9.4)				
Race/ethnicity by groups								
Non-Hispanic white	5,196 (58.7)	7,079 (56.4)	3,833 (59.3)	5,159 (57.1)	14,358 (65.1)	20,948 (66.9)	10,475 (64.7)	15,373 (67.4)
Non-Hispanic black	814 (9.2)	1,094 (8.7)	608 (9.4)	894 (9.9)	2,159 (9.8)	3,317 (10.6)	1,633 (10.1)	2,473 (10.8)
Non-Hispanic other	677 (7.6)	1,057 (8.4)	534 (8.3)	796 (8.8)	956 (4.3)	1,621 (5.2)	727 (4.5)	1,298 (5.7)
Hispanic	1,997 (22.5)	3,044 (24.3)	1,364 (21.1)	1,980 (21.9)	2,862 (13)	4,328 (13.8)	2,074 (12.8)	2,886 (12.7)
Missing	174 (2)	273 (2.2)	125 (1.9)	203 (2.2)	1,718 (7.8)	1,084 (3.5)	1,287 (7.9)	781 (3.4)

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Table 1. Summary of SEER and NCDB Patient Populations (*continued*)

	SEER				NCDB			
	DCP eligible: 19–25 years		DCP ineligible: 27–29 years		DCP eligible: 19–25 years		DCP ineligible: 27–29 years	
Variable	Pre-ACA (*n*=8,858)	Post-ACA (*n*=12,547)	Pre-ACA (*n*=6,464)	Post-ACA (*n*=9,032)	Pre-ACA (*n*=22,053)	Post-ACA (*n*=31,298)	Pre-ACA (*n*=16,196)	Post-ACA (*n*=22,811)
Education								
Low	2,172 (24.5)	3,073 (24.5)	1,608 (24.9)	2,188 (24.2)	5,336 (24.2)	7,979 (25.5)	3,825 (23.6)	5,544 (24.3)
Mid-low	2,153 (24.3)	3,097 (24.7)	1,621 (25.1)	2,341 (25.9)	6,897 (31.3)	9,640 (30.8)	5,121 (31.6)	7,151 (31.3)
Mid-high	2,198 (24.8)	3,039 (24.2)	1,600 (24.8)	2,185 (24.2)	5,396 (24.5)	7,461 (23.8)	4,100 (25.3)	5,721 (25.1)
High	2,335 (26.4)	3,337 (26.6)	1,634 (25.3)	2,317 (25.7)	4,091 (18.6)	6,102 (19.5)	2,959 (18.3)	4,315 (18.9)
Missing	0 (0)	1 (0)	1 (0)	1 (0)	333 (1.5)	116 (0.4)	191 (1.2)	80 (0.4)
Income								
Low	2,130 (24)	2,996 (23.9)	1,601 (24.8)	2,191 (24.3)	3,773 (17.1)	5,481 (17.5)	2,694 (16.6)	3,896 (17.1)
Mid-low	2,320 (26.2)	3,254 (25.9)	1,644 (25.4)	2,320 (25.7)	5,095 (23.1)	7,099 (22.7)	3,767 (23.3)	5,181 (22.7)
Mid-high	2,203 (24.9)	3,078 (24.5)	1,641 (25.4)	2,295 (25.4)	5,861 (26.6)	8,286 (26.5)	4,426 (27.3)	6,229 (27.3)
High	2,205 (24.9)	3,218 (25.6)	1,577 (24.4)	2,225 (24.6)	6,959 (31.6)	10,289 (32.9)	5,104 (31.5)	7,418 (32.5)
Missing	0 (0)	1 (0)	1 (0)	1 (0)	365 (1.7)	143 (0.5)	205 (1.3)	87 (0.4)
Residence								
Non-metro	736 (8.3)	1,034 (8.2)	572 (8.8)	724 (8)	2,828 (12.8)	3,956 (12.6)	2,044 (12.6)	2,784 (12.2)
Metro	8,104 (91.5)	11,483 (91.5)	5,883 (91)	8,289 (91.8)	18,411 (83.5)	26,557 (84.9)	13,657 (84.3)	19,404 (85.1)
Missing	18 (0.2)	30 (0.2)	9 (0.1)	19 (0.2)	814 (3.7)	785 (2.5)	495 (3.1)	623 (2.7)
Cancer type								
Leukemias[b]	634 (7.2)	902 (7.2)	325 (5)	439 (4.9)	1,754 (8)	2,554 (8.2)	837 (5.2)	1,190 (5.2)
Non-Hodgkin lymphoma	616 (7)	877 (7)	389 (6)	504 (5.6)	1,594 (7.2)	2,174 (6.9)	938 (5.8)	1,210 (5.3)
Hodgkin lymphoma	1,110 (12.5)	1,435 (11.4)	448 (6.9)	562 (6.2)	2,864 (13)	3,772 (12.1)	1,183 (7.3)	1,567 (6.9)
CNS and other intracranial and intraspinal neoplasms[b]	527 (5.9)	771 (6.1)	300 (4.6)	405 (4.5)	1,690 (7.7)	2,259 (7.2)	1,006 (6.2)	1,292 (5.7)
Osseous and chondromatous neoplasms	250 (2.8)	307 (2.4)	82 (1.3)	118 (1.3)	741 (3.4)	985 (3.1)	230 (1.4)	333 (1.5)
Soft tissue sarcomas (excluding Kaposi sarcoma)	420 (4.7)	552 (4.4)	232 (3.6)	303 (3.4)	1,102 (5)	1,415 (4.5)	592 (3.7)	810 (3.6)
Germ cell and trophoblastic neoplasms of gonads	1,428 (16.1)	1,971 (15.7)	804 (12.4)	1,164 (12.9)	3,149 (14.3)	4,263 (13.6)	1,807 (11.2)	2,583 (11.3)
Melanoma	906 (10.2)	1,178 (9.4)	772 (11.9)	982 (10.9)	1,852 (8.4)	2,042 (6.5)	1,472 (9.1)	1,789 (7.8)
Thyroid carcinoma	1,310 (14.8)	2,125 (16.9)	1,061 (16.4)	1,618 (17.9)	3,355 (15.2)	5,824 (18.6)	2,873 (17.7)	4,381 (19.2)
Carcinoma of head and neck	162 (1.8)	241 (1.9)	126 (1.9)	162 (1.8)	440 (2)	596 (1.9)	317 (2)	452 (2)
Carcinoma of trachea, bronchus, and lung	65 (0.7)	98 (0.8)	72 (1.1)	87 (1)	194 (0.9)	274 (0.9)	195 (1.2)	273 (1.2)

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Table 1. Summary of SEER and NCDB Patient Populations (*continued*)

Variable	SEER				NCDB			
	DCP eligible: 19–25 years		DCP ineligible: 27–29 years		DCP eligible: 19–25 years		DCP ineligible: 27–29 years	
	Pre-ACA (*n*=8,858)	Post-ACA (*n*=12,547)	Pre-ACA (*n*=6,464)	Post-ACA (*n*=9,032)	Pre-ACA (*n*=22,053)	Post-ACA (*n*=31,298)	Pre-ACA (*n*=16,196)	Post-ACA (*n*=22,811)
Carcinoma of breast (in females)	221 (2.5)	299 (2.4)	499 (7.7)	793 (8.8)	522 (2.4)	743 (2.4)	1,424 (8.8)	2,109 (9.2)
Carcinoma of kidney	88 (1)	169 (1.3)	122 (1.9)	187 (2.1)	280 (1.3)	457 (1.5)	348 (2.1)	497 (2.2)
Carcinoma of gonads	91 (1)	128 (1)	70 (1.1)	110 (1.2)	236 (1.1)	362 (1.2)	199 (1.2)	296 (1.3)
Carcinoma of cervix	175 (2)	204 (1.6)	330 (5.1)	390 (4.3)	380 (1.7)	495 (1.6)	833 (5.1)	1,092 (4.8)
Carcinoma of colon and rectum	230 (2.6)	386 (3.1)	247 (3.8)	430 (4.8)	571 (2.6)	994 (3.2)	682 (4.2)	1,095 (4.8)
Carcinoma of stomach	51 (0.6)	62 (0.5)	41 (0.6)	73 (0.8)	96 (0.4)	158 (0.5)	115 (0.7)	157 (0.7)
Other	574 (6.5)	842 (6.7)	544 (8.4)	705 (7.8)	1,233 (5.6)	1,931 (6.2)	1,145 (7.1)	1,685 (7.4)

Note: Values are presented as *n* (%).
[a]Overall survival, not cancer survival, was used in NCDB.
[b]Cancer type not included in stage at diagnosis analyses.
ACA, Affordable Care Act; CNS, Central Nervous System; DCP, Dependent Coverage Provision; NCDB, National Cancer Database; SEER, Surveillance, Epidemiology, and End Results.

two-sided, with $p<0.05$ considered statistically significant. Statistical code can be accessed at: https://github.com/kijohnson/ACA-DCP-files.

RESULTS

A total of 36,901 (SEER) and 92,358 (NCDB) cases were included for the DCP insurance and survival analyses and 30,308 (SEER) and 76,742 (NCDB) cases were included for the stage analyses (Appendix Methods and Results provide exclusion details). Statistically significant differences ($p<0.05$) in the characteristics of the age groups were observed across time for marital status (SEER); race/ethnicity (SEER and NCDB); cancer type (SEER and NCDB); ZIP code education level (NCDB); and ZIP code income level (NCDB; Table 1).

Trends in the percentage of insured individuals in SEER and NCDB are shown in Figure 1A (excluding Medicaid) and 1B (grouping Medicaid with uninsured). The adjusted DIDs were 3.45 (95% CI=2.04, 4.87, $p<0.001$) and 3.72 (95% CI=2.8, 4.64, $p<0.001$) percentage points for SEER and NCDB. Although varying in magnitude, the DIDs were positive for nearly all cancer types (Figure 2A and Appendix Table 1, available online). In analyses that also included those with Medicaid, the adjusted DIDs were 6.13 (95% CI=4.29, 7.97, $p<0.001$) and 5.86 (95% CI=4.74, 6.98, $p<0.001$) for SEER and NCDB, respectively (Appendix Table 1, available online).

Trends in the percentage of individuals with early-stage diagnoses are shown in Figure 1C. The adjusted DIDs were 2.25 (95% CI=0.4, 4.1, $p=0.017$) and 0.69 (95% CI= −0.65, 2.02, $p=0.31$) percentage points for SEER and NCDB. Most cancer types showed positive DIDs across both data sources of varying magnitudes (Figure 2B and Appendix Table 2, available online). For NCDB, there was a significant DCP-associated increase in early-stage diagnoses for carcinoma of the colon and rectum in individuals aged 19–25 vs 27–29 years (DID=14.87 percentage points, 95% CI=7.95, 21.78, $p<0.001$) that was positive but not significant in SEER (DID=2.76 percentage points, 95% CI= −6.78, 12.3, $p=0.57$; Figure 1D, Appendix Table 2, available online).

Trends in the percentage of individuals with late-stage diagnoses are shown in Figures 1E and 1F. The adjusted DIDs were −1.74 (SEER: 95% CI= −3.1, −0.38, $p=0.012$) and −0.58 (NCDB: 95% CI= −1.46, 0.30, $p=0.20$) percentage points. For NCDB, the DIDs were statistically significant for soft tissue sarcomas (−8.79 percentage points, 95% CI= −15.29, −2.29, $p=0.008$); and carcinomas of the thyroid (−0.83 percentage points, 95% CI= −1.51, −0.15, $p=0.016$); kidney (−8.64 percentage points, 95% CI= −15.07, −2.21, $p=0.008$); and colon and rectum (−7.42 percentage points,

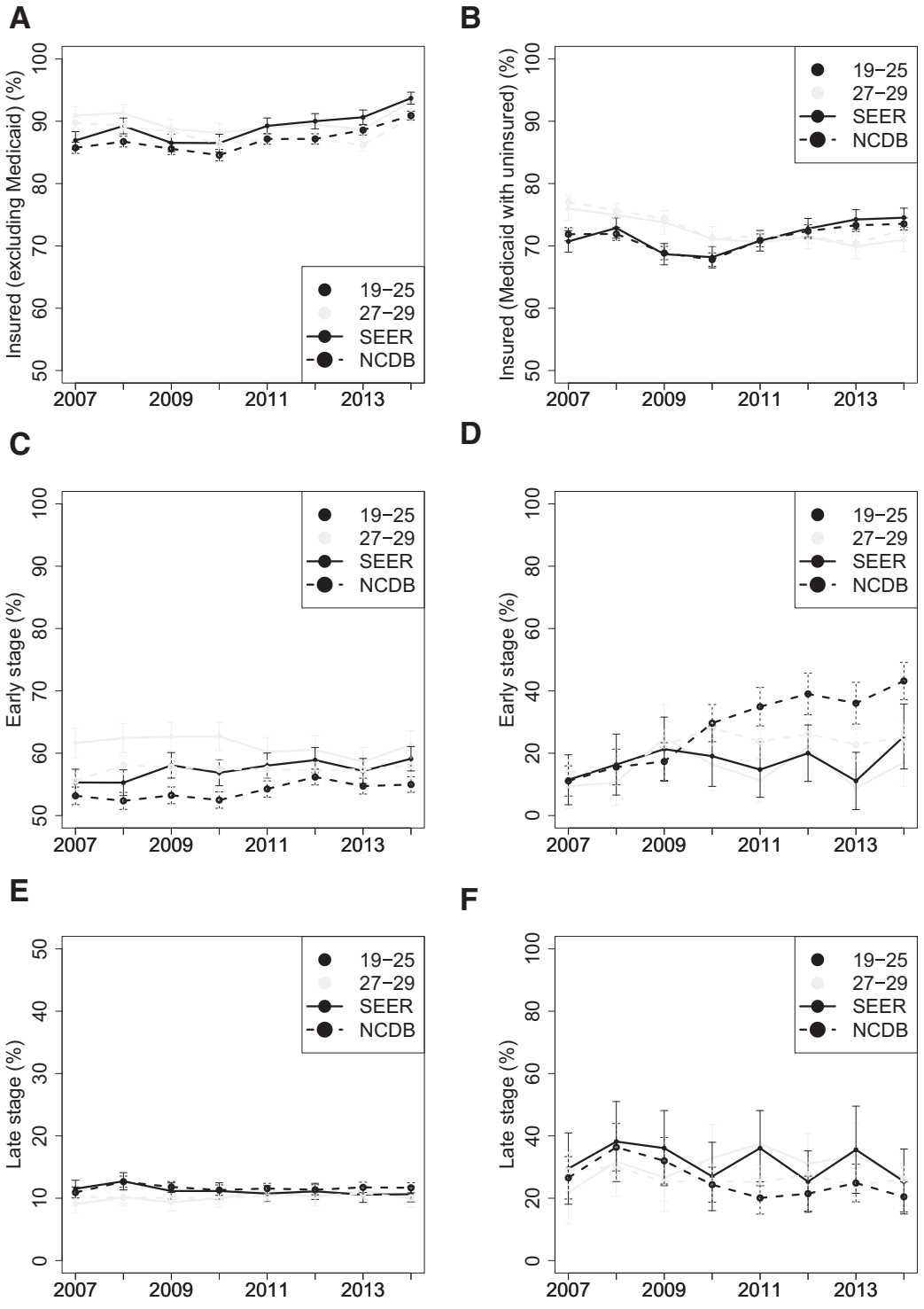

Figure 1. Percentage of individuals with private insurance coverage excluding Medicaid (A); and grouping Medicaid with uninsured (B); early-stage diagnoses (C); early-stage (stage I) diagnoses for colorectal cancer (D); late-stage diagnoses (E); and late-stage (Stage IV) diagnoses for colorectal cancer (F) for individuals aged 19–25 years and 27–29 years in SEER 18 and NCDB databases from 2007 to 2014.

NCDB, National Cancer Database; SEER, Surveillance, Epidemiology, and End Results.

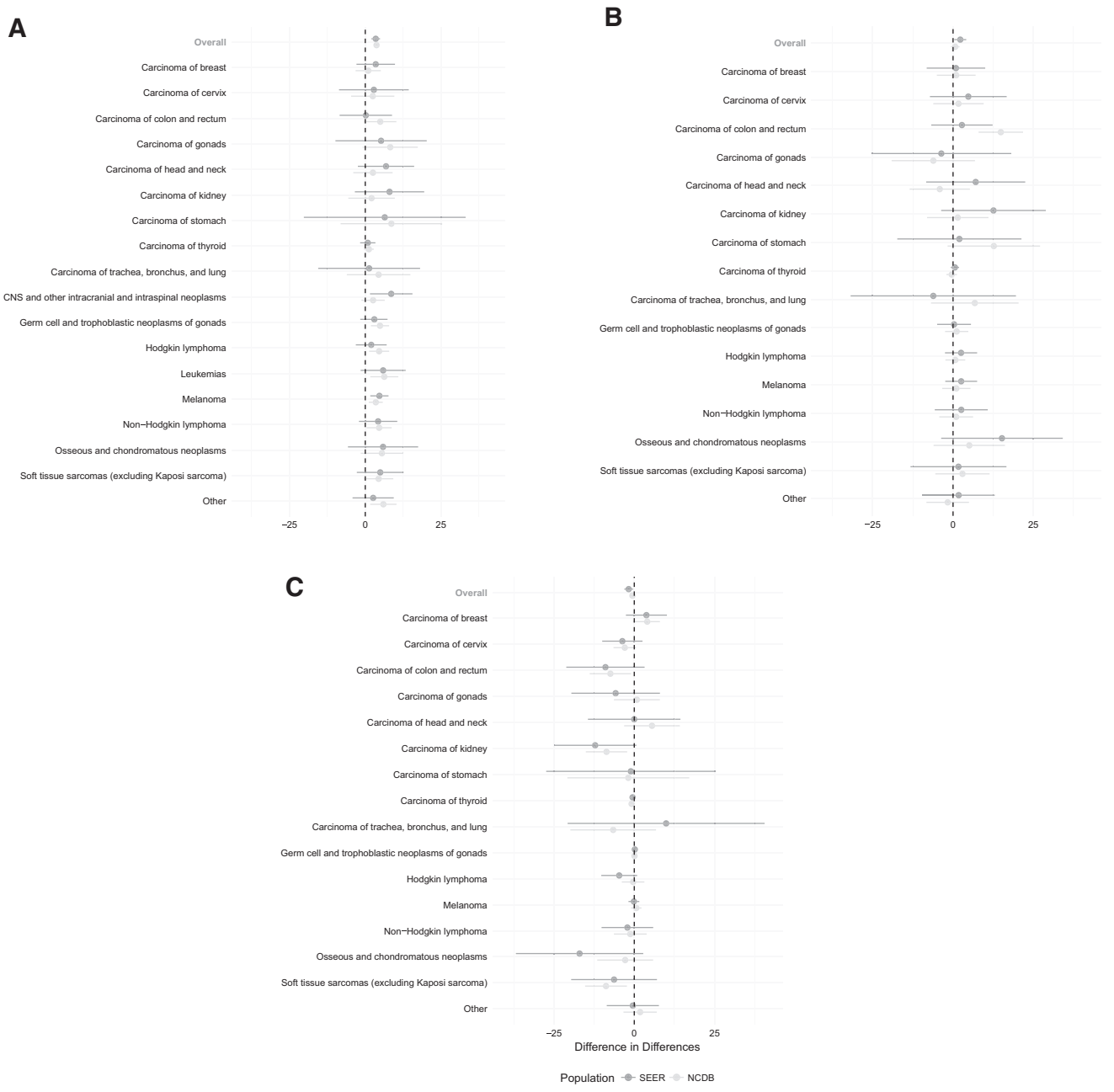

Figure 2. Difference-in-differences (DID) results for individuals aged 19–25 years versus those aged 27–29 years for insured (excluding Medicaid) (A); early-stage diagnoses (B); and late-stage diagnoses (C).

Note: The dots are the percentage point estimates for the DID and the lines are the 95% CIs. The DID estimates for the following cancer types did not meet the parallel trends assumptions: panel (A): carcinomas of the stomach and gonads (SEER) and Hodgkin lymphoma (NCDB); panel (B): carcinomas of the kidney (SEER and NCDB) and stomach (SEER); panel (C): carcinoma of the stomach (SEER).

SEER, Surveillance, Epidemiology, and End Results; NCDB, National Cancer Database.

95% CI= −13.86, −0.99, p=0.023) with nonsignificant negative DIDs for these cancer types in SEER (Figure 2C, Appendix Table 2, available online). In addition, significant positive DIDs were observed for women with breast carcinoma in NCDB (4.03 percentage points, 95% CI=0.09, 7.97, p=0.045) with a nonsignificant finding in SEER (3.78 percentage points, 95% CI= −2.6, 10.16, p=0.25; Figure 2C, Appendix Table 2, available online).

Kaplan–Meier curves comparing survival in individuals aged 19–25 and 27–29 years at diagnosis pre- and post-DCP for cancer and overall survival are shown in Figure 3A–B and survival in colorectal cancer patients

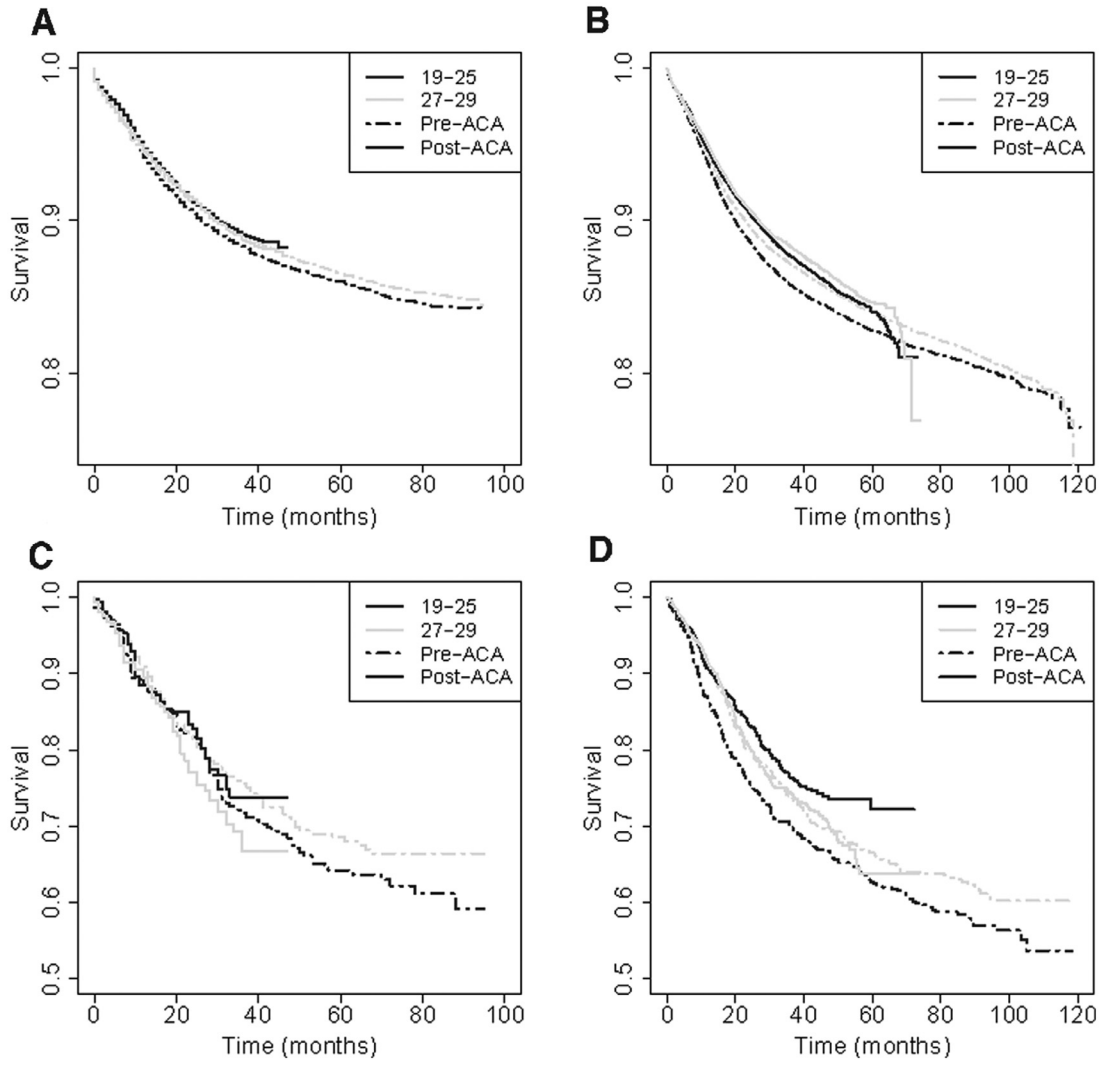

Figure 3. K-M survival curves for individuals aged 19–25 years and 27–29 years pre- and post-DCP. Cancer survival for SEER (A). Overall survival for NCDB (B). Colorectal cancer survival for SEER (C) and overall survival for colorectal cancer patients for NCDB (D). The median follow-up times overall (and for the censored cohort) were 71 (75) and 18 (20) months pre- and post-DCP, respectively, in SEER (equal times for both age groups); 76.1 (81.7) and 79.0 (83.7) months pre-DCP for the groups aged 19–25 years and 27–29 years, respectively, and 31.5 (33.8) and 32.3 (34.6) months post-DCP for the groups aged 19–25 years and 27–29 years, respectively in NCDB.

ACA, Affordable Care Act; DCP, Dependent Coverage Provision; NCDB, National Cancer Database; SEER, Surveillance, Epidemiology, and End Results.

are shown in Figure 3C and 3D. In SEER, a significant decreased hazard of cancer death following the DCP (hazard ratio [HR]=0.91, 95% CI=0.83, 0.99, p=0.032) in individuals aged 19–25 years versus no significant change in the individuals aged 27–29 (HR=1.02, 95% CI=0.91, 1.14, p=0.73) years was observed. In NCDB, a significant decreased hazard of death from any cause in both individuals aged 19–25 years (HR=0.88, 95% CI=0.84, 0.93, p<0.001) and 27–29 years (HR=0.93, 95% CI=0.88, 0.98, p=0.013) was observed. By cancer type, a significant decreased hazard of death for colorectal cancer in individuals aged 19–25 years (HR=0.72, 95% CI=0.59, 0.88, p=0.002) versus no change in individuals aged 27–29 years (HR=1.04, 95% CI=0.87, 1.26, p=0.65) was observed. Nonsignificant but similar trends in colorectal cancer were seen in SEER (Appendix Table 3, available online).

Additional analyses were conducted to assess the robustness of the results, including removing states that expanded Medicaid early (California, Connecticut, New Jersey, Washington, SEER only); states with pre-existing young adult coverage extensions (New Jersey, New Mexico, Utah, SEER only); and cases diagnosed in 2014, the year in which many states expanded Medicaid. Because state is suppressed in NCDB, analyses were conducted that removed facilities where increases in Medicaid were

observed following the DCP to evaluate the impact of early Medicaid expansion on the results. An analysis was also conducted using only complete data. Finally, analyses were performed that estimated changes in the percentage insured and diagnosed at the early or late stage in 2011−2014 versus 2007−2009 in each age group separately. Conclusions from these analyses were largely consistent with the main results (Appendix Methods and Results and Appendix Tables 4−11, available online).

DISCUSSION

As a whole, these results provide strong evidence for a DCP impact on insurance coverage in young adult cancer patients aged 19−25 years with weaker evidence for an impact on cancer diagnosis stage. For specific cancer types, the strongest evidence for a DCP impact was observed for carcinomas of the colon and rectum.

The finding of increased insurance coverage among individuals aged 19−25 years following the DCP is consistent with prior reports.[9,22−24] In young adult cancer patients specifically, a DCP impact on insurance coverage has also been reported.[14,25]

Two prior studies examined DCP-associated impacts on young adult cancer diagnosis stage,[13,15] using slightly different age groups (19−25 and 26−34[13] years; 21−25 and 26−34[15] years). The increase in early- and decrease in late-stage diagnoses overall for SEER is consistent with the results from the study by Han et al.,[13] including data through 2012.

Although not significant, in line with three earlier studies,[13,15,25] DCP-associated increases in early-stage diagnoses among cervical cancer cases were observed. In addition, when the policy ineligible group age range was expanded to 26−34 years,[13,15] a significant reduction in late-stage diagnoses was observed in both SEER (DID= −6.81 percentage points, 95% CI= −13.5, −0.15, p=0.046) and NCDB (DID= −3.80 percentage points, 95% CI= −7.01, −0.59, p=0.020; data not shown). However, restricting the age range of the policy ineligible group to be closer to the group aged 19−25 years should result in greater group comparability and increased validity of results.[26] The most likely mechanism underlying the earlier cervical cancer finding[13] would be increased uptake of Pap tests by the group aged 19−25 years as a result of insurance coverage. However, Han and colleagues[13] did not find evidence for an early DCP impact on Pap tests. Furthermore, Pap testing would likely increase the number of pre-malignant and Stage 0 lesions identified, which are not captured at all or on a limited basis in NCDB or SEER data.[27] Therefore, it is possible that there could be an impact on premalignant cervical lesions that could not be detected, which comprises an important area for further investigation.

With respect to cancers without screening recommendations in young adults, an impact on diagnosis stage would only be expected for malignancies found incidentally or because of symptoms. For example, Han et al.[13] reported positive DCP effects on early-stage diagnoses for osseous and chondromatous neoplasms suggesting that this may have resulted from increased detection through dental exams, where increased dental insurance coverage and utilization may have been spillover effects of the DCP.[28,29] In line with this finding, nonsignificant increases in early-stage diagnoses and decreases in late-stage diagnoses in individuals aged 19−25 versus 27−29 years in SEER were observed in the current study. However, given less marked findings in NCDB, it is uncertain whether increased insurance coverage explains changes in diagnosis stage for this cancer type.

One of the most consistent findings for a DCP impact in the current study was for colorectal carcinomas. Young adult colorectal cancer incidence has been increasing with this group more likely to have later-stage diagnoses (Stage 3/4).[30] Diagnosis delays in young adults may stem from lack of health insurance. Thus, one would expect that increased health insurance coverage may reduce diagnosis delays because of increased access and result in earlier-stage diagnoses and consequent improved survival. This pattern was present in the current study's results, particularly for NCDB. It is interesting to note that unlike in NCDB, the SEER DID insurance results showed no notable increase, which could explain the lower impact on diagnosis stage and survival relative to NCDB. The finding of improved survival in association with the DCP should continue to be evaluated given the relatively short follow-up period following the DCP.

Consistent findings across study populations of DCP-associated worsening of outcomes among women with breast cancer are noteworthy. Evidence for an increase from 1976 to 2009 in late-stage breast cancer diagnoses in young women aged 25−39 years at diagnosis with no commensurate increase in older women was reported.[31] Evidence for an increase in late-stage diagnoses in both SEER and NCDB for breast cancer cases in women aged 19−25 versus 27−29 years was observed in the current study, which is in line with the prior report. These data suggest that the increase in late stage diagnoses cannot be attributed to the DCP.

Inconsistencies between NCDB and SEER results may stem from study population differences. Despite its larger size, NCDB is not population-based in contrast to SEER. Both databases are similar with respect to variable definitions and ensuring data quality procedures.

However, NCDB requires that reporting hospitals be accredited through the Commission on Cancer, which may result in selection bias as these hospitals generally have more resources than non-accredited hospitals.[32]

Beyond young adults, other studies suggest that health policy increases insurance coverage in cancer patients with evidence for downstream impacts on cancer stage and outcomes. The ACA has been associated with decreasing the percentage of uninsured non-elderly cancer patients.[33–36] In DID analyses, increases in early-stage diagnoses in Medicaid expansion versus non-expansion states were observed using SEER[37] and North American Association of Central Cancer Registries[36] but not NCDB data.[34] In pre–post analyses, an improvement in early-stage diagnosis for several cancer types, particularly for those amenable to screening, was reported following the 2014 implementation of the ACA.[34,36,38] In the current study, evidence was less clear for an impact on early stage with variation between data sources in the DID analyses and marginal nonsignificant increases in early-stage diagnoses in the age-stratified analyses in both SEER and NCDB.

Study strengths include the use of two samples of young adult cancer patients and additional years of post-ACA data allowing for longer-term evaluation of DCP impacts. A comparison group was also included to help inform whether trends in the group aged 19–25 years were likely because of the DCP.

Limitations

The validity of DID analyses[39] depends on the comparison group adequacy, which is critical to avoid parallel trends and common shocks assumption violations that assume similar trends before and after the policy between the two groups with the exception of a policy-related change in trends.[21] Although almost all analyses met the parallel trends assumption, trend differences between the two groups in the pre-policy period may still have limited detection of DCP-associated impacts. With respect to the common shocks assumption, one concern raised by others is the impact of the 2008 economic recession on employer-sponsored insurance.[13] However, others note that employment rates in the likely parents (aged 46–54 years) of individuals aged 19–25 years were similar to those of individuals aged 26–34 years, suggesting equal impacts on both age groups. In analyses including those with Medicaid, there were greater increases in the percentage of individuals aged 27–29 versus 19–25 years with Medicaid in the post-DCP period, which explains the larger DIDs. This may be attributed in part to early Medicaid expansion in some states. However, in analyses addressing this concern, results were similar. Although multiple imputation was used to address missing data bias, bias may still exist if data were not missing at random.[40] Finally, the large number of analyses increases type I error risk. If a stricter threshold were adopted such as α=0.005,[41] the primary conclusions (with the exception of colorectal cancer) would be unchanged.

CONCLUSIONS

Evidence was observed for a DCP-associated increase in health insurance coverage in young adult cancer patients aged 19–25 years. A DCP-associated impact on diagnosis stage and survival overall is less clear. Improvements on a cancer-specific level were observed for colorectal cancer. Further research should continue to monitor the impact of insurance coverage on cancer diagnosis stage and survival in young adults with cancer.

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SUPPLEMENTAL MATERIAL

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