HEALTH INSURANCE FOR YOUNG ADULTS: AN OBSERVATIONAL STUDY OF HEALTH CAPITAL AND AGING OUT

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ABSTRACT

Background

In 2010, the dependent health insurance coverage expansion (DCE) allowed adults younger than 26 years of age to take up insurance under a parent's employer-sponsored private plan. To study the effects of exposure to improved access to insurance we examined shifts in utilization rates overall and by payer as cohorts of young adults aged into and out of DCE eligibility compared with rates in cohorts never eligible for the DCE. We also examined evidence for health capital effects of improved access to insurance after age-out of DCE eligibility.

Methods

We used 2008–2014 data from the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID) and State Emergency Department Databases (SEDD). We examined the impact of the DCE on nonmaternal hospital use by comparing utilization patterns of cohorts of patients under age 26 years when the DCE went into effect against a comparison group of cohorts that were never eligible for the DCE. We examined the payer mix of utilization during and after DCE eligibility. To test health capital effects, we examined the rates of selected ambulatory-sensitive conditions as well as rates of mental health and substance abuse discharges and visits after age-out of DCE eligibility. We examined effects before and after the 2014 state insurance expansions.

Results

Based on the analysis, rates of uninsured discharges and emergency department visits dropped between 6% and 16% during DCE eligibility. After age-out of DCE eligibility, uninsured visits remained lower than pre-DCE rates. After DCE eligibility ended, rates of ambulatory-sensitive hospitalizations and emergency department (ED) visits, as well as rates of mental health and substance abuse discharges and ED visits, largely declined.

Conclusions

Rates of uninsured discharges and ED visits dropped for young adults exposed to improved access to insurance during DCE eligibility and after age-out of DCE eligibility. All-payer results showed modest support for the health capital effect of improved access to insurance.

BACKGROUND

Historically, young adults in the United States have had high rates of uninsurance. Prior to passage of the Affordable Care Act (ACA) in 2010, young adults had the highest uninsurance rates of any age group [1] and typically had low rates of access to job-based insurance [2]. In 2010, the ACA implemented a Dependent Coverage Expansion (DCE) mandate to help improve insurance coverage for young adults by requiring an extension of coverage eligibility to children younger than 26 years whose parents are privately insured. The DCE was effective for plan years starting after September 23, 2010, but many employers offered coverage shortly after the legislation was passed [3].

Much evidence has been produced about the impact of the DCE while young adults are eligible for the DCE [4,5]. These studies have focused on impacts such as shifts in coverage patterns [6-10] and the effects on outcomes or use [11-18]. Notably, studies have shown strong support for improved access to insurance and declines in uninsurance during DCE eligibility [4,19,20].

It is less clear whether increased access to care resulting from the DCE has had any persistent impact on the health care utilization of young adults after they turn 26 years and become ineligible for dependent coverage. Several recent studies on the long-term effects of child Medicaid eligibility have found that greater insurance eligibility during childhood improves health status and reduces hospitalization rates in adulthood [21-23]. These findings are consistent with the key assumption of the Grossman model of health capital, namely, that health can be modeled as a stock of human capital that (1) can be augmented or repaired by using medical services and (2) declines with illness and age [24]. However, there is no evidence on whether health care received by young adults can lead to health capital accumulation that is substantial enough to affect future health care utilization.

In this study, we followed cohorts of young adults aging into and out of DCE eligibility to examine the payer mix of utilization. We also examined whether there is a persistent effect of exposure to improved access to insurance through health capital accumulation. To test whether the DCE led to such health capital effects, we compared health care utilization at ages above 26 years between cohorts exposed to the DCE and older cohorts who turned 26 years before the DCE was implemented. In addition to controlling for cohort fixed effects and a common age profile in hospital utilization, we controlled for the implementation of other ACA coverage expansions. Focusing on utilization above age 26 years allowed us to compare utilization among the DCE-exposed cohorts with utilization by older cohorts facing a similar health policy environment, so that differences in all-payer utilization did not reflect differences across cohorts in the menu of health insurance options available. We examined whether the DCE-exposed cohort had lower rates of utilization associated with better health and health outcomes (e.g., lower rates of preventable admissions).

Conceptual Framework

Previous research has shown that compared with insured individuals, uninsured and underinsured individuals receive less medical care, have worse health outcomes (especially certain subgroups such as the chronically ill) [25], and receive a disproportionate amount of care for nonurgent conditions in the emergency department (ED) setting [26-28]. Health insurance has been largely associated with improved well-being and self-reported health, and health outcomes including depression outcomes that were either the same or improved [29].

Health insurance reduces the price of care and can improve access to care [28]. There are two primary mechanisms through which an expansion in health insurance coverage is expected to

affect contemporaneous health care utilization. First, health insurance lowers a consumer's out-of-pocket price for ED and inpatient discharges, and we expected that this lower price would increase ED and inpatient utilization (own-price effect) [30]. Second, health insurance lowers the out-of-pocket price of primary care for consumers and may result in the substitution of services received in the primary care setting for ED and inpatient care (cross-price effect). Previous research has found that for some subset of the uninsured population, ED use is a substitute for primary or more routine (preventive) care; therefore, insuring these individuals should result in a reduction in ED and inpatient use [31]. The overall contemporaneous effect of a health insurance expansion on ED and inpatient utilization depends on which of these two mechanisms dominates.

Study Contribution

We analyzed inpatient utilization using 2008–2014 Healthcare Cost and Utilization Project (HCUP) inpatient discharge data from 29 states and ED utilization data from 14 states. On the basis of the experience of age cohorts (i.e., following the experiences of birth cohorts of individuals over time), we examined, first, patterns of utilization by expected payer. Notably, we anticipated that private pay utilization would rise with better access to private insurance and uninsured utilization would fall during the period of DCE eligibility. Second, we analyzed patterns of utilization after age-out of DCE eligibility, focusing on changes in the rates of private, Medicaid, and uninsured utilization. Third, we analyzed whether there are lasting effects of improved exposure to insurance after age-out of eligibility for the DCE, by determining whether we detected declines in preventable admissions and preventable ED visits as well as mental health and substance abuse discharges and ED visits after DCE eligibility ends.

A few previous studies have investigated the impact of age-out. Prior to the ACA, Anderson et al. [32] investigated the impact on ED visits of reaching the age threshold when dependent insurance usually expired. Although Dahlen [33] investigated insurance choice and labor market outcomes upon aging out of the DCE using the National Health Interview Survey, to our knowledge no studies have assessed the impacts on health and health care utilization after aging out of eligibility for the DCE.

METHODS

We used the 2008–2014 all-payer HCUP State Inpatient Databases (SID) and State Emergency Department Databases (SEDD) from 2008 as our primary data source. Our sample of hospital inpatient discharge and ED records included 2008–2014 SID data from 29 states (12 expansion states and 17 nonexpansion states) and 2008–2014 SEDD data from 14 states (5 expansion states and 9 nonexpansion states). It also included discharges and visits for community, nonrehabilitation hospitals as defined in the American Hospital Association Annual Survey. The analytic database in this study was constructed in a manner similar to the database used in a related article by many of the same authors on a different research topic [34].

The HCUP databases are consistent with the definition of limited data sets under the Health Insurance Portability and Accountability Act Privacy Rule. The AHRQ Institutional Review Board considers research using HCUP data to have exempt status.

Throughout the study period, we counted ED and inpatient nonpregnancy (nonmaternal) discharges and visits by state, calendar quarter, primary payer, sex, and age. For each quarter, we applied population counts from the U.S. Census Bureau by state, year, sex, and age to construct ED and inpatient visit rates per 100,000 population. We used Clinical Classifications Software to define discharges and visits requiring hospitalization in young adults. We also used

several AHRQ Prevention Quality Indicators (PQIs) [35] to define indicators for several ambulatory-sensitive conditions that occur frequently in a younger population. These PQIs suggest that for asthma for inpatient discharges and ED visits and bacterial pneumonia for inpatient discharges, the ambulatory setting may not have been conducive to delivery of high-quality care.

We used the 1-year U.S. Census Bureau American Community Survey Integrated Public Use Microdata Samples (IPUMS) to obtain population characteristics for each state by payer for all individuals at the state, age, sex, and year levels. Race, ethnicity, marital status, education, household income, and employment status were the population characteristics included [36]. From the IPUMS, we also calculated percentage of the population that was employed full time and the percentage that was living with parents [37].

Estimation of Impact

To examine patterns in persistence over time and after age-out, we used an age-cohort approach in which we followed the experiences of birth cohorts on the basis of their age at the introduction of the DCE (Equation 1). For age cohorts eligible for the DCE (aged 20–25 years in third quarter [3Q] 2010), we estimated changes in utilization rates relative to rates in age cohorts never eligible for the DCE (aged 27–30 years in 3Q2010). We did not include the 19-year-old cohort in 3Q2010 because of the potential for part-year eligibility.

The cohort approach also allowed us to examine the pattern of effects over time as each cohort aged and to examine any changes that occurred as DCE eligibility ended for an age cohort. For example, those aged 24 years in 3Q2010 were eligible until they reached the age 26 threshold in 2012 when they no longer were eligible for private health insurance coverage under the DCE.

We used generalized linear models with the following specification for the conditional mean of the utilization rate to estimate the change in rates of each ED visit or inpatient discharge per population:

$$\mathbf{E}[y_{cst}|\cdot] = \exp\left(\begin{array}{c} \alpha + \mu_c + \theta_s + X_{cst}\beta + \ln(pop_{cst}) \\ +\gamma_1 \cdot DCE_t + \gamma_2 \cdot HIX\_ONLY_{st} + \gamma_3 \cdot HIX\_ME_{st} \\ +\delta_1 \cdot DCEELIG_{ct} \cdot DCE_t \\ +\delta_2 \cdot DCEELIG_{ct} \cdot HIX\_ONLY_{st} + \delta_3 \cdot DCEELIG_{ct} \cdot HIX\_ME_{st} \\ +\tau_1 \cdot AGED\_OUT_{ct} \cdot DCE_t \\ +\tau_2 \cdot AGED\_OUT_{ct} \cdot HIX\_ONLY_{st} + \tau_3 \cdot AGED\_OUT_{ct} \cdot HIX\_ME_{st} \end{array}\right). \quad (1)$$

In Equation 1, *c* indexes cohort, *s* indexes state, and *t* indexes time (year and quarter). y_{cst} is the outcome numerator, with corresponding population pop_{cst} of which the logarithm is specified as an offset term. Although not explicitly represented in the notation, this model formulation was implemented by sex and for all payers as well as separately for the various payer groups.

α is the common intercept, and μ_c and θ_s denote cohort and state fixed effects and their corresponding coefficients. X_{cst} contains age and sex as well as covariates for average population composition variables within each group for marital status, household income, living with parents, education, and race. The term DCE_t is an indicator for the DCE implementation period prior to 2014 (calendar 3Q2010 through 2013) (see Table 1 for an illustration of age, calendar time, and estimates).

Table 1. Example Age Cohort (Age 24 years in 3Q2010)

Description	Term	3Q2010	2011	2012	2013	2014
Age (y.)	Age	24	25	26	27	28
DCE eligibility status						
DCE eligible	$DCEELIG_{ct}$	Y	Y	N	N	N
Aged out of DCE eligibility	$AGED\_OUT_{ct}$	N	N	Y	Y	Y
DCE in effect	DCE_t	Y	Y	Y	Y	N
Expansion or Nonexpansion state in 2014						
Expansion state in 2014	HIX_ME_{st}	N	N	N	N	N
Nonexpansion state in 2014	HIX_ONLY_{st}	N	N	N	N	Y
Effect estimates	Coefficients	□1	□1	□1	□1	□2

c: cohort; DCE: Dependent Coverage Expansion; Q: quarter; s: state; t: time.

Time is quarterly in modeling.

We included two terms for calendar year 2014. HIX_ONLY_{st} is an indicator for the period after implementation of the health insurance exchanges (calendar year 2014) in a state that did not expand Medicaid. HIX_ME_{st} is an indicator for the period after implementation of the health insurance exchanges and Medicaid expansion (calendar year 2014) in a state that expanded Medicaid in 2014. $DCEELIG_{ct}$ is an indicator for being in a cohort that is eligible for the DCE in the current time period. $AGED\_OUT_{ct}$ is an indicator for being in a cohort that previously was eligible for the DCE but since has aged out of eligibility.

The coefficients of primary interest are denoted by δ and τ, which estimate the impacts of the DCE policy for cohorts that are currently eligible for the DCE and cohorts that previously were eligible for the DCE. For each cohort, we allowed the effect of current DCE eligibility (δ) and previous DCE eligibility (τ) to vary freely with the health policy environment. For example, the 2014 insurance expansions may modify the impact of the DCE if, for example, insurance exchanges make it easier for adults to obtain private insurance without being eligible for the DCE, thereby reducing the impact of the DCE on insurance status as alternatives improve. Of note, to focus on the impact of the DCE after the state expansions were implemented in 2014, we specified the model to ensure that trends of cohorts in expansion states were compared with cohorts in expansion states and trends of cohorts in nonexpansion states were compared with cohorts in nonexpansion states.

The counterfactuals on which the DCE impact estimates rely are based on the outcome trajectories for the cohorts that were never eligible for the DCE, observed over the same time frames, and with separate 2014 shocks permitted for the older cohorts in states that did and did not expand Medicaid (see the Appendix for additional detail).

A key assumption for estimation is that, for all cohorts, the age profile (trajectory) of utilization in the absence of the coverage expansions (*DCE, ME, HIX*) can be captured by a common age profile (trajectory) with cohort-specific intercepts plus state fixed effects and other demographic controls. We addressed this identification assumption by imposing a functional form on age effects. After testing various nonlinear transformations of age (e.g., age squared, age cubed, ln(age)), we included ln(age) in the covariates to capture a nonlinear age profile of utilization (see the Appendix for additional detail).

RESULTS

Inpatient data came from 29 states participating in the SID from 2008 through 2014. Our sample included 16.5 million young adults annually in the cohort eligible for the DCE and 10.5 million young adults aged 26–30 years in the comparison group cohort (see Table 2). ED data came from 14 states participating in both the SID and the SEDD. Our sample included 8.8 million young adults under age 26 years annually and 5.5 million over age 26 years. Demographic characteristics (e.g., percentage female, racial and ethnic composition) prior to the DCE of the young adult population eligible for the dependent insurance coverage expansion and those in the comparison group were similar. As expected, socioeconomic characteristics such as college graduation rates (10.6% for those under age 26 and 32% for those older than 26) and living with parents (43.5% for those under age 26 and 14.4% for those older than 26) differed between these cohorts and the comparison group.

Inpatient discharge rates were 729 per 100,000 population per quarter in the under age 26 years group and 960 per 100,000 population for the group over age 26 years. ED visit rates were 10,757 per 100,000 population per quarter in the under 26 years age group and 11,752 per 100,000 population for those older than age 26 years. The payer mix of discharges and visits was similar in the DCE-eligible cohort and the comparison cohort (payer rates are per 100,000 in the total population and the denominator population is not payer specific).

All Payer (Nonpregnancy)

Overall, in the period between the DCE mandate and insurance exchanges (3Q2010 through 2013), all-payer inpatient discharges decreased 2.2% and ED visits decreased 2.3% during DCE eligibility (Table 3, δ in Equation 1). In 2014 inpatient discharges and ED visits dropped (4.8% and 3.6%, respectively) in nonexpansion states but were unchanged in expansion states. After age-out of DCE eligibility, all-payer inpatient discharges and ED visits decreased between 3% and 5% before 2014 and after 2014 (Tables 3 and Figure 1, τ in Equation 1).

Primary Payer

During DCE eligibility, privately insured inpatient discharges increased 6.4% prior to 2014 and 11.3% in Medicaid expansion states in 2014 relative to the comparison group. ED visits followed a similar pattern and increased 4.7% prior to 2014 and 8.5% in expansion states after 2014. In nonexpansion states, in 2014 privately insured inpatient discharge rates and ED visit rates were unchanged relative to the comparison group. For the most part, Medicaid discharge rates and ED visit rates decreased during the period of time when the cohort was eligible for the DCE. Rates of uninsured discharges and ED visits dropped between 6% and 16% during DCE eligibility prior to and after 2014.

Upon age-out of DCE eligibility (Table 3 and Figure 1), privately insured inpatient discharge rates shifted direction and dropped 11.1% in the period between the DCE mandate and insurance exchanges (3Q2010 through 2013), dropped 12.9% in nonexpansion states in 2014, and dropped 13.6% in expansion states in 2014 relative to the comparison group. Privately insured ED visits also dropped between 9% and 12%. Rates of Medicaid inpatient discharges increased 7.9% in expansion states in 2014 and were unchanged prior to 2014 and in nonexpansion states in 2014. Rates of Medicaid ED visits increased upon age-out. Of note, uninsured inpatient discharge and ED visit rates remained 4% to 11% lower than pre-DCE rates for those aging out of DCE eligibility both before and after 2014.

Condition-Specific Results

We examined all-payer discharge and ED visit rates by condition after age-out of DCE eligibility (Table 4, τ in Equation 1). Discharge and ED visit rates for mental health, substance abuse, and all selected ambulatory-sensitive conditions except asthma were lower than for the comparison group in the period between the DCE mandate and insurance exchanges (3Q2010 through 2013). In nonexpansion states in 2014, mental health discharges and ED visits, substance abuse discharges and ED visits, and asthma ED visit rates also were lower. However, inpatient asthma and bacterial pneumonia discharge rates were no different from pre-DCE rates. In expansion states in 2014, trends followed a different pattern. Mental health ED visit rates and substance abuse discharge and ED visit rates were lower. However, mental health discharge, asthma discharge, bacterial pneumonia discharge, and ED asthma rates were unchanged.

Table 2. Characteristics of DCE-Eligible and Non-DCE-Eligible Groups

Variable	Inpatient Discharge Data (29 States)				Emergency Department Data (14 States)			
	DCE Eligible (n = 16,482,432)		Not DCE Eligible (n = 10,519,832)		DCE Eligible (n = 8,802,594)		Not DCE Eligible (n = 5,500,721)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
% female	48.8	0.500	49.8	0.500	48.9	0.500	50.0	0.500
% married	11.0	0.085	46.1	0.096	10.0	0.077	37.2	0.092
Household income (%)								
<$35,000	34.1	0.072	25.5	0.063	34.7	0.074	29.7	0.061
$35,000–$75,000	29.8	0.054	35.8	0.049	29.7	0.054	38.1	0.045
>$75,000	26.4	0.064	36.4	0.094	25.4	0.065	29.5	0.078
% lives with parents	43.5	0.107	14.4	0.056	44.1	0.110	18.4	0.061
Education (%)								
<High school graduate	12.7	0.043	13.3	0.043	12.7	0.041	12.4	0.035
High school graduate (includes equivalency)	29.3	0.059	23.8	0.054	28.8	0.062	25.2	0.059
Some college or associate’s degree	47.4	0.101	30.9	0.046	47.5	0.103	32.1	0.043
Bachelor's degree or higher	10.6	0.119	32.0	0.071	11.0	0.122	30.4	0.077
Labor force (%)								
Employed	64.7	0.155	89.8	0.044	63.1	0.159	89.4	0.039
Unemployed	12.1	0.031	9.2	0.022	12.9	0.031	9.7	0.025
In armed forces	1.5	0.024	0.8	0.011	1.4	0.021	1.1	0.015
Not in labor force	29.3	0.095	17.4	0.060	29.6	0.100	17.7	0.050
Race (%)								
White	73.4	0.093	70.8	0.103	72.5	0.102	73.6	0.103
Black or African American	17.2	0.086	14.3	0.078	19.6	0.084	17.6	0.078
Other	9.4	0.061	14.9	0.108	8.0	0.056	8.8	0.059
Ethnicity (%)								
Hispanic	18.0	0.129	21.4	0.141	13.8	0.083	14.4	0.082

Variable	Inpatient Discharge Data (29 States)				Emergency Department Data (14 States)			
	DCE Eligible (n = 16,482,432)		Not DCE Eligible (n = 10,519,832)		DCE Eligible (n = 8,802,594)		Not DCE Eligible (n = 5,500,721)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Discharge and visit rates per 100,000 population								
Total	729.30	166.24	959.94	217.62	10,756.78	3,363.78	11,752.21	3,142.36
Condition								
Mental health	395.40	148.29	586.79	190.82	1,972.56	1,135.94	2,764.14	,425.84
Substance abuse	152.18	67.06	233.32	9.44	298.92	100.03	389.71	126.15
Asthma	9.32	7.56	11.16	7.88	162.69	60.04	149.54	54.00
Bacterial pneumonia	9.68	6.25	12.10	6.03	N/A	N/A	N/A	N/A
Perforated appendix	14.57	15.62	16.00	13.70	N/A	N/A	N/A	N/A
Diabetes short-term complications	20.94	11.41	17.76	8.44	N/A	N/A	N/A	N/A
Primary Payer								
Uninsured	143.35	77.84	211.91	87.40	3,839.68	1,783.51	4,471.89	1,692.12
Private insurance	296.69	81.07	314.89	85.87	3,475.89	1,131.43	3,241.64	1,032.71
Medicaid	224.52	112.38	287.14	155.62	2,723.06	2,058.39	3,006.43	2,182.99

DCE: Dependent Coverage Expansion; N/A: not applicable.

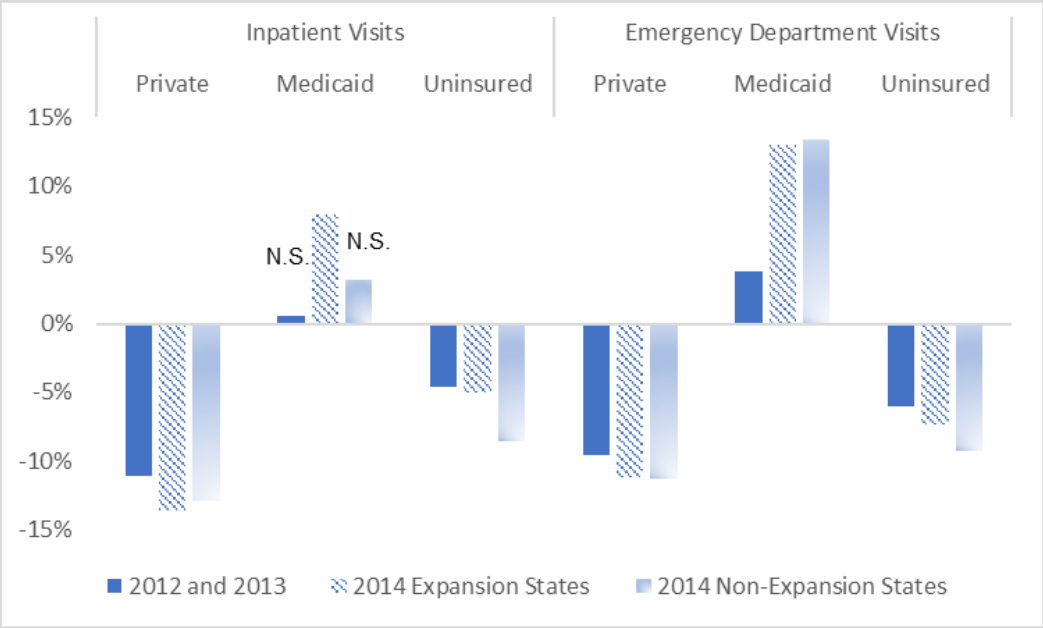
Table 3. Percent Changes in Discharge and Visit Rates by Primary Payer, Compared With Pre-DCE

Variable	DCE Eligible in 2Q2010–2013			DCE Eligible in 2014					
				Nonexpansion States			Expansion States		
	Percent Change	P	95% CI	Percent Change	P	95% CI	Percent Change	P	95% CI
While Eligible for the Dependent Coverage Expansion (δ in Equation 1)									
Inpatient discharges	–0.022	***	(–0.033, –0.011)	–0.048	***	(–0.069, –0.026)	–0.005		(–0.03, 0.021)
Private	0.064	***	(0.047, 0.081)	0.017		(–0.015, 0.049)	0.113	***	(0.074, 0.154)
Medicaid	–0.066	***	(–0.089, –0.043)	–0.058	**	(–0.106, –0.008)	–0.042	*	(–0.09, 0.008)
Uninsured	–0.099	***	(–0.054, –0.011)	–0.155	***	(–0.192, –0.117)	–0.082	***	(–0.14, –0.021)
ED visits	–0.023	***	(–0.033, –0.013)	–0.036	***	(–0.056, –0.015)	–0.011		(–0.033, 0.012)
Private	0.047	***	(0.031, 0.063)	0.023		(–0.009, 0.055)	0.085	***	(0.049, 0.122)
Medicaid	–0.013		(–0.04, 0.016)	0.033		(–0.025, 0.094)	0.081	***	(0.022, 0.143)
Uninsured	–0.079	***	(–0.094, –0.064)	–0.132	***	(–0.16, –0.102)	–0.063	***	(–0.102, –0.023)
After Age-Out of Eligibility for the Dependent Coverage Expansion (τ in Equation 1)									
	Age-Out in 2Q2010–2013			Age-Out in 2014					
				Nonexpansion States			Expansion States		
Inpatient discharges	–0.043	***	(–0.056, –0.03)	–0.053	***	(–0.071, –0.034)	–0.032	***	(–0.054, –0.011)
Private	–0.111	***	(–0.129, –0.093)	–0.129	***	(–0.153, –0.105)	–0.136	***	(–0.165, –0.107)
Medicaid	0.006		(–0.024, 0.036)	0.032		(–0.012, 0.078)	0.079	***	(0.035, 0.126)
Uninsured	–0.046	***	(–0.07, –0.020)	–0.086	***	(–0.119, –0.052)	–0.050	*	(–0.103, 0.007)
ED visits	–0.046	***	(–0.057, –0.034)	–0.037	***	(–0.054, –0.019)	–0.047	***	(–0.066, –0.028)
Private	–0.096	***	(–0.113, –0.079)	–0.098	***	(–0.123, –0.073)	–0.111	***	(–0.137, –0.083)
Medicaid	0.042	**	(0.007, 0.078)	0.138	***	(0.083, 0.195)	0.122	***	(0.070, 0.176)
Uninsured	–0.072	***	(–0.09, –0.054)	–0.107	***	(–0.132, –0.081)	–0.070	***	(–0.105, –0.034)

CI: confidence interval; DCE: Dependent Coverage Expansion; ED: emergency department; Q: quarter.

*** $P<.01$; ** $P<.05$; * $P<.10$..

Figure 1. Percent Change in Discharge and Visit Rates After Aging Out of DCE Eligibility, Compared With Pre-DCE by Primary Payer



DCE: Dependent Coverage Expansion; N.S.: not significant.

Table 4. Percent Change in Discharge and Visit Rates After Age-Out of DCE Eligibility Compared With Pre-DCE

After Age-Out of Eligibility for the Dependent Coverage Expansion (τ in Equation 1)									
Variable	Age-Out in 2Q2010–2013			Age-Out in 2014					
				Nonexpansion States			Expansion States		
	Percent Change	*P*	95% CI	Percent Change	*P*	95% CI	Percent Change	*P*	95% CI
Total inpatient	–0.043	***	(–0.056, –0.03)	–0.053	***	(–0.071, –0.034)	–0.005		(–0.030, 0.021)
Mental health	–0.052	***	(–0.068, –0.037)	–0.062	***	(–0.083, –0.041)	–0.024		(–0.053, 0.005)
Substance abuse	–0.058	***	(–0.079, –0.036)	–0.091	***	(–0.119, –0.063)	–0.041	**	(–0.078, –0.002)
Asthma	0.083	**	(0.013, 0.159)	0.011		(–0.082, 0.113)	0.038		(–0.083, 0.175)
Bacterial pneumonia	–0.080	***	(–0.137, –0.019)	–0.040		(–0.122, 0.050)	–0.091		(–0.196, 0.028)
Total emergency department	–0.046	***	(–0.057, –0.034)	–0.037	***	(–0.054, –0.019)	–0.011		(–0.033, 0.012)
Mental health	–0.056	***	(–0.071, –0.041)	–0.059	***	(–0.080, –0.038)	–0.030	**	(–0.057, –0.003)
Substance abuse	–0.076	***	(–0.095, –0.057)	–0.095	***	(–0.121, –0.068)	–0.046	***	(–0.079, –0.012)
Asthma	–0.029	**	(–0.054, –0.003)	–0.053	***	(–0.09, –0.015)	–0.019		(–0.064, 0.028)

CI: confidence interval; DCE: Dependent Coverage Expansion; Q: quarter.
***, *P*<.01; **, *P*<.05; *, *P*<.10.

DISCUSSION

Our results reflect earlier studies that showed improvements in insurance status for young adults [4,19,20] as signaled by lower rates of uninsured discharges and visits after the implementation of the DCE. Prior to 2014, we found a 9.9% drop in uninsured discharge rates. In 2014, we found a drop in the uninsured discharge rate of 8.2% in expansion states and 15.5% in nonexpansion states compared with baseline rates and relative to trends in the comparison group. Similarly, prior to 2014, we found a 7.9% drop in uninsured ED visit rates. In 2014, we found a drop in uninsured ED visit rates of 6.3% in expansion states and 13.2% in nonexpansion states compared with baseline rates and relative to trends in the comparison group.

Immediately after DCE eligibility expired (age-out), privately insured discharge rates and ED visit rates declined. However, in trends consistent with enrollment changes reported by Dahlen [33], the declines in uninsured discharges and ED visit rates that occurred during DCE eligibility also persisted after age-out of the DCE. These changes could arise from either selection into coverage (i.e., compositional effect) or utilization effects of coverage. We were unable to separate these effects in this study, and further research should examine the role of selection versus utilization in the DCE period.

We found some indication of improvements in health after age-out of eligibility for the DCE prior to 2014, as evidenced by lower nonmaternal inpatient discharge rates for mental health conditions, substance abuse, asthma, and bacterial pneumonia. Nonmaternal ED visit rates, as well as ED visit rates for mental health conditions, substance abuse, and asthma, also were lower.

If the effects on health take time to accumulate, then the reductions in discharge and visit rates and in ambulatory-sensitive conditions may be attributable to improvements in the stock of health. However, other explanations are possible. Increased insurance coverage at younger ages may have changed young adults' preferences for health insurance in the future—that is, health insurance demand may exhibit habit formation [33]. Alternatively, reduced job lock at younger ages might have promoted career development for DCE-exposed young adults, allowing them to find jobs where they were more productive and thus had higher compensation and greater health insurance coverage.

Health capital effects were less clear in expansion states in 2014, where access to Medicaid was improved by increasing income limits for eligibility. This affected both the group that aged out of the DCE and the comparison group, so the differences are less stark. In nonexpansion states, where access to insurance improved less dramatically through implementation of state health insurance exchanges, the DCE health effects appear to largely persist.

Our study has several limitations. First, although our study population was extremely large, we did not follow individuals over time through DCE and age-out. We examined the impact on population cohorts. Second, we used an older comparison group that was well matched on characteristics such as age, sex, and payer mix and, as expected, differed in other characteristics. Our identifying assumption rests on the ability to correctly characterize the age trajectory of utilization, which we characterized by including a nonlinear transformation of age that fit all age cohorts included in the study. Third, because the maximum amount of time that we could follow a cohort before age-out was 3 to 4 years, improved insurance exposure was relatively short term. Fourth, HCUP data include the anticipated payer, which can underestimate uninsured utilization and overestimate the existence of an anticipated payer [38]. Although this is more of an issue when one is estimating levels of effects, our study focused on changes in

utilization by payer category. If payer coding remains relatively consistent over time, then our study estimates capture relative changes in use by payer. Finally, although we found modest support for health capital effects, we were unable to trace the path through which health capital accumulates. Future research should investigate these mechanisms.

CONCLUSIONS

We followed birth cohorts of young adults through DCE eligibility and improved exposure to insurance, and after DCE eligibility ended. We found that although rates of privately insured discharges and ED visits dropped after age-out, lower rates of uninsured discharges and ED visits persisted after age-out, suggesting that the cohorts continued to have better exposure to insurance. We also found lower inpatient discharge rates, ED visit rates, and ambulatory care sensitive conditions after age-out, which could be attributable to improvements in health capital and better access to insurance.

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APPENDIX: IDENTIFICATION AND COUNTERFACTUAL

Testing Functional Form of Age

To select an appropriate functional form of age, we fitted different transformations of age (including polynomials and other transformations) to the cohorts in our sample using the two years of pre-Dependent Coverage Expansion (DCE) data available to us (first quarter [1Q] 2008 to 1Q2010). We then extrapolated our estimated age profiles to older ages (30–33 years) in the same time period and compared the out-of-sample fit across models. After testing various nonlinear transformations of age, we included ln(age) in the covariates to capture a nonlinear age profile of utilization.

Estimation

$$\mathbf{E}[y_{cst}|\cdot] = \exp\left(\begin{array}{c} \alpha + \mu_c + \theta_s + X_{cst}\beta + \ln(pop_{cst}) \\ + \gamma_1 \cdot DCE_t + \gamma_2 \cdot HIX\_ONLY_{st} + \gamma_3 \cdot HIX\_ME_{st} \\ + \delta_1 \cdot DCEELIG_{ct} \cdot DCE_t \\ +\delta_2 \cdot DCEELIG_{ct} \cdot HIX\_ONLY_{st} + \delta_3 \cdot DCEELIG_{ct} \cdot HIX\_ME_{st} \\ + \tau_1 \cdot AGED\_OUT_{ct} \cdot DCE_t \\ +\tau_2 \cdot AGED\_OUT_{ct} \cdot HIX\_ONLY_{st} + \tau_3 \cdot AGED\_OUT_{ct} \cdot HIX\_ME_{st} \end{array}\right). \quad (1)$$

In Equation 1 above and in the Methods section, *c* indexes cohort, s indexes state, and *t* indexes time (year and quarter). Y_{cst} is the outcome numerator, with corresponding population pop_{cst}, of which the logarithm is specified as an offset term. Although not explicitly represented in the notation, this model formulation was implemented by sex and for all payers, as well as separately for the various payer groups.

α is the common intercept, and μ_c and θ_s denote cohort and state fixed effects and their corresponding coefficients. X_{cst} contains age and sex as well as covariates for average population composition variables within each group for marital status, household income, living with parents, education, and race. The term DCE_t is an indicator for the DCE implementation period prior to 2014 (calendar 3Q2010 through 2013) (see Table A.1 for an illustration of age, time, and estimates).

Table A.1. Age Cohort: Age 24 in 3Q2010

Description	Term	3Q2010	2011	2012	2013	2014
Age (y.)	Age	24	25	26	27	28
DCE eligible	$DCEELIG_{ct}$	Y	Y	N	N	N
Aged out of DCE eligibility	$AGED\_OUT_{ct}$	N	N	Y	Y	Y
DCE in effect	DCE_t	Y	Y	Y	Y	N
Expansion state in 2014	HIX_ME_{st}	N	N	N	N	Y
Nonexpansion state in 2014	HIX_ONLY_{st}					
Effect estimate		□1	□1	□1	□1	□2/□3

c: cohort; DCE: Dependent Coverage Expansion; Q, quarter; s: state; t: time.

Time is annual for illustration, quarterly in modeling.

We included two terms for calendar year 2014. HIX_ONLY_{st} is an indicator for the period after implementation of the health insurance exchanges (calendar year 2014) in a state that did not expand Medicaid. HIX_ME_{st} is an indicator for the period after implementation of the health insurance exchanges and Medicaid expansion (calendar year 2014) in a state that expanded

Medicaid in 2014. $DCEELIG_{ct}$ is an indicator for being in a cohort that is eligible for the DCE in the current time period. $AGED\_OUT_{ct}$ is an indicator for being in a cohort that was previously eligible for the DCE but since has aged out of eligibility.

Counterfactuals

The counterfactuals on which the DCE impact estimates rely are based on the outcome trajectories for the cohorts that were never eligible for the DCE, observed over the same time frames, and with separate 2014 shocks permitted for the older cohorts in states that did and did not expand Medicaid. For example, the coefficient τ_1 captures the difference in utilization rates at ages 26+ years between cohorts that aged into and then out of the DCE prior to 2014 (i.e., those aged 23–25 years in 2010) and older cohorts that never were eligible for the DCE (i.e., those aged 26–30 years in 2010), controlling for age, state fixed effects, demographics, and cohort fixed effects. By controlling for age, the model effectively compares utilization by, for example, 27-year-olds in 2013 (who experienced approximately 2 years of DCE eligibility) with utilization by 27-year-olds in 2011 and earlier years (who were never DCE eligible). The cohort-specific intercepts are identified by differences in the levels of the age profiles prior to DCE implementation (from 1Q2008 to 1Q2010), and the DCE implementation time effect is identified by within-cohort changes in utilization among older cohorts that deviate from the common age profile.

While Eligible for the Dependent Coverage Expansion; 2Q2010–2013

δ_1. Counterfactual is never-eligible cohorts (aged 27–30 years at implementation) in the same state/demographic cell during the pre-HIX-ME period, assuming the age profile + cohort fixed effects (FE) fully control for cohort/age differences.

DCE time effect (γ_1) identified from average deviation of never-eligible cohorts from levels predicted on the basis of age profile, state effects, and demographics.

While Eligible for the Dependent Coverage Expansion; 2014: Nonexpansion States

δ_2. Counterfactual is never-eligible cohorts in the nonexpansion states in 2014, assuming the age profile + cohort FE fully control for cohort/age differences.

While Eligible for the Dependent Coverage Expansion; 2014: Expansion States

δ_3. Counterfactual is never-eligible cohorts in the expansion states in 2014, assuming the age profile + cohort FE fully control for cohort/age differences.

HIX_ONLY time effect is identified from average deviation of never-eligible cohorts from levels predicted on the basis of age profile, state effects, and demographics

HIX_ME time effect is identified from average deviation of never-eligible cohorts from levels predicted on the basis of age profile, state effects, and demographics

After Age-Out of Eligibility for the Dependent Coverage Expansion; 2Q2010–2013

τ_1. Counterfactual is never-eligible cohorts in the same state/demographic cell during the pre-*HIX-ME* period

After Age-Out of Eligibility for the Dependent Coverage Expansion; 2014: Nonexpansion States

τ_2. Counterfactual is never-eligible cohorts in the nonexpansion states in 2014, assuming the age profile + cohort FE fully control for cohort/age differences.

After Age-Out of Eligibility for the Dependent Coverage Expansion; 2014: Expansion States

τ_3. Counterfactual is never-eligible cohorts in the expansion states in 2014, assuming the age profile + cohort FE fully control for cohort/age differences.