ECON 4002 Health Economics

Insurance Coverage and Health Capital: Evidence from the Affordable Care Act Dependent Coverage Expansion

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December 17, 2021

Abstract

To solve the problem of low rate of insurance coverage in young adults, the dependent coverage expansion (DCE), a component of the Affordable Care Act, granted young adults to stay in their parents' health plans up to age 26 from January 2014. In this paper, we examine the policy impact of ACA-DCE on healthcare expenditure, healthcare utilization, and health outcomes using the data from the Medical Expenditure Panel Survey (MEPS) 2016 and utilizing a regression discontinuity design (RDD) method. We find that the provision increases health care utilization and improves mental and physical health of young adults in some aspects. However, health expenditures are found to change little after the implementation of ACA-DCE policy.

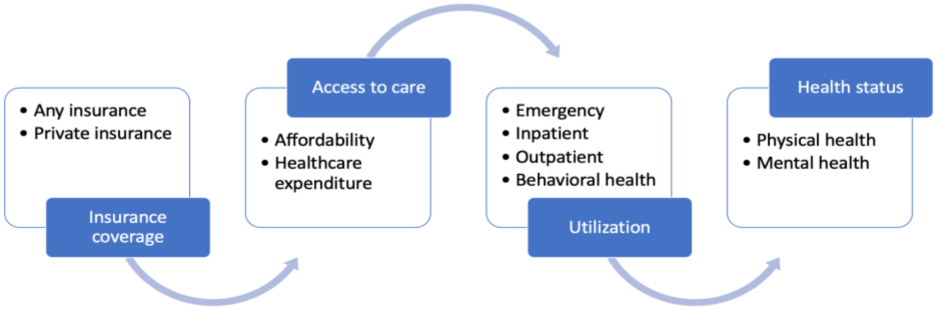
1. Introduction

Young adults' health insurance coverage has always been a concern because they are the most likely group to be uninsured. In the survey conducted in 2010 from National Center for Health Statistics, the percentage of uninsured people between age 18 and 24 was 32%, while the uninsured rate in other age groups did not exceed 30%. The high uninsured rate among young adults is because they are too old to be insured in children's programs, such as the Children's Health Insurance Program, and they are too young to be covered in employer-subsidized insurance (Collins and Nicholson 2010). Lacking health insurance will cause severe problems. Because of high out-of-pocket expenditure, young adults without coverage will postpone healthcare utilization and miss the best treatment time, resulting in severe problems and higher medical expenditure in later life (Kessler et al. 2005).

To solve the problem of low insurance rates and avoid further health problems among young adults, the Obama government has enacted dependent coverage expansion as part of the Affordable Care Act (ACA) in 2010, which started enforcing insurance providers to offer coverage for insurance holder's children under 26. The dependent coverage plan was limited to adults without employer-sponsored coverage from 2010 to 2014, but the limit was eliminated on January 1st, 2014, when young adults under 26 were covered without specific requirements (Cantor et al. 2012).

The dependent coverage policy is expected to have positive impacts directly and indirectly, as is summarized in figure 1 by Collins and Nicholson (2010). The most direct impact is on insurance coverage. With lower out-of-pocket expenditure insurance coverage, they can have access to health care and increase their health care utilization. More health care utilization would ultimately increase the health status of young adults.

Figure 1. Summary of DCE's impacts



Previous research estimated the ACA-DCE's impacts on one or several steps on this chain of causation, and they are divided into four groups based on the steps of causation they analyzed. The first group of research all found positive effects on insurance coverage by DCE (Akosa Antwi et al. 2013; O'Hara and Brault 2013). The second group of researchers mainly analyzed DCE's impact on out-of-pocket expenditure and did not find significant changes (Chen et al. 2015).

The researchers who are interested in health care utilization measured the impact of insurance coverage on emergency, in-patient, outpatient, and preventative healthcare services. They did not find significant impacts of DCE on emergency room visits (Chua and Sommers 2014; Chen et al. 2015) or inpatient care utilization (Chua and Sommers 2014; Chen et al. 2015). When examining the possible impacts on preventative health care, they did not find effects on physical exams (Barbaresco et al. 2015; Wallace and Sommers 2015). However, regarding influences on out-patient health care utilization of DCE, the research found more health care utilization and specifically suggested an increase in dental visits (Chen et al. 2019). The last group of researchers studied the impact on general mental and health conditions and found a significant increase in both (Chua and Sommers 2014; Sommers et al. 2015). All but one of these papers were conducted based on the difference-in-difference (DID) method, measuring the difference of outcomes pre- and post-DCE reform.

Based on the background of ACA-DCE enactment and following the steps of previous research, we conduct comprehensive research on the effects of DCE on outcomes observed in 2016 from the Medical Expenditure Panel Survey (MEPS) using RDD method. The outcomes of balancing tests of predetermined characteristics support the idea that individuals did not manipulate their birth timing to enjoy the insurance coverage brought by DCE, which is the key identifying assumption of RDD design. We found that DCE-eligible adults have higher health care utilization in dental visits. The mental and physical health of DCE-eligible adults are not significantly different from those of the ineligible ones in general. However, in more detailed aspects, DCE-eligible adults reported to have lower mental distress and lower possibilities of getting high blood pressure. We didn't find any significant impacts on health expenditure and preventative care. The results of our research passed a battery of robustness checks.

There are some features that distinguish our study from existing research. The first is our regression method. Previous research mainly applied the DID method by dividing sample aging from 19 to 34 into two groups, using 26 years old as a cut-off. The former mainly consist of students while the latter mainly consist of workers. Therefore, the predetermined characteristics are hard to control because students and workers are quite different in their incomes, habits, and other factors potentially affecting healthcare outcomes. To avoid such problems, our study employs the RDD method, only measuring people around the cut-off point, that is, 26 years old. Therefore, the predetermined characteristics are quite similar around the threshold. Second, as previous research only studied the impact of DCE on general mental and physical health conditions, our research adds detailed health indicators apart from the rough measurements. For mental health, we use an indexed variable combining several health indicators, which accurately manifests the mental condition of young adults compared to previous research. For physical health, we add high blood pressure as a measurement. The reason for adding high blood pressure as an outcome variable is that young adults are most vulnerable to this, according to the Institute of Medicine and National Research Council (2013).

The remainder of the paper is organized as follows. Section 2 briefly describes the ACA-DCE policy and the current condition of young adults and outlines the estimation strategy. Section 3 describes the data. Section 4 reports the main findings, possible interpretations, and conducts several robustness checks. Section 6 concludes.

2. Empirical Strategy

2.1 Estimation Framework

Since eligibility is based on the age of young adults, we take the sample of MSPE 2016 and divide them into two groups, by whether reaching 26 years old in January 2014. Since the survey was conducted randomly, people who are around the age threshold should have exhibited similar health status, with the only difference of ACA-DCE eligibility. Specifically, we use the regression discontinuity (RD) framework, which is an ideal model for observational data analysis in a quasi-experimental design. (e.g., Lee and Lemieux 2010).

Let Y_{i0} be the outcome of the illegible ACA dependent and denote D_i as the dependents' eligibility status, i.e., 1 if individual i is eligible and 0 otherwise.

The ACA dependent coverage expansion introduced in January 2014 implies that the probability of being eligible for DCE is discontinuous at a cutoff point c_0 of the birth cohort (c_i), i.e., $E[D_i|c_i = c] \neq E[D_i|c_i = c]$. Assuming $E[Y_{i0}|c_i = c]$ is continuous in c at c_0. Hahn et al. (2001) show that γ can be identified as

RDD estimator (coefficient of interest)

$$\gamma = \frac{E[Y_i|c_i = c] - E[Y_i|c_i = c]}{E[D_i|c_i = c] - E[D_i|c_i = c]} = \frac{\hat{\beta}_{reduced}}{\hat{\alpha}_{first}} = \hat{\gamma}_{RD}$$

The assignment variable in our RD estimation, birth cohort (c), which defines respondents who just reached 26 years old in January 2014 (the effective time of ACA Dependent Coverage Expansion). Therefore, in constructing our assignment variable, we define the birth cohort as 1988 and we accordingly set the cutoff point as c_0= 1988.

Lemieux (2010) showed that the RD estimator is essentially an instrumental variable estimator. Specifically, the first stage of the instrumental variable estimation has the following specification

$$D_i = \alpha I[c_i \geq c_0] + g(c_i) + \mu_i$$

and the reduced form is

$$Y_i = \beta I[c_i \geq c_0] + f(c_i) + \varepsilon_i$$

where I [.] is an indicator function that takes a value of 1 if the inequality in the bracket is true and 0 otherwise; $g(c_i)$ and $f(c_i)$ are flexible functions of c_i, controlling for the direct effect of birth cohort on outcome variables. Therefore, the RD estimator is $\hat{\gamma}_{RD} = \frac{\hat{\beta}_{reduced}}{\hat{\alpha}_{first}}$.

2.2 Empirical model

In order to estimate the parameters, we compare young adults who have reached 26 years old and young adults who have not reached 26 years old in January 2014. Our parametric approach equation specification is

$$Y_i = \theta_0 + \theta_1 X_i + \rho D_i + \gamma_1 D_i X_i + \eta_i$$

Where Y_i is the healthcare utilization, hospital expenditure, and health outcome for young adult individual i. The indicator D_i is a dummy variable and takes the value of 1 for eligible ACA dependent coverage. X_i is the individual's age distance towards the cut-off point of 26 years old, while X_0 is the cut-off point of being 26 years old in January 2014. $D_i = 1\ [X_i \geq 0]$ is a fuzzy RDD since the probability of treatment jumps at the cut-off. ρ captures the treatment effect on cutoff point X_0. To obtain a more precise estimation, we cluster at the cohort (people born in the same year and same month) level.

3. Data and Variables

Our primary data source is the Medical Expenditure Panel Survey (MEPS) conducted by the U.S. Agency for Healthcare Research. The MEPS provides nationally representative estimates of health care use, expenditures, sources of payment, and health insurance coverage for the U.S. civilian noninstitutionalized population.

Affordable Care Act Dependent coverage expansion became effective in January 2014 in all states that have adopted the Medicaid expansion except for the states with * signs in Table 1. We restrict our sample to ACA expansion states on January 1, 2014 and the final sample includes 14,994 respondents in MEPS 2016. Considering the delay effect on the health outcomes, we choose consolidated data in 2016 as ACA and dependent coverage expansion were implemented in 2014. Specifically, once covered by insurance, one might have more health care services utilizations. It takes time to have an expected medical treatment outcome.

Table 1. ACA expansion state and non-expansion state

Label	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont
Midwest	Indiana, Illinois, Iowa, Kansas*, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota*, and Wisconsin*
South	Alabama*, Arkansas, Delaware, District of Columbia, Florida*, Georgia*, Kentucky, Louisiana, Maryland, Mississippi*, North Carolina*, Oklahoma, South Carolina*, Tennessee*, Texas*, Virginia, and West Virginia
West	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming*

(Medicaid expansion became effective January 1, 2014 in all states except for the following: Florida*, Georgia*, Kansas*, Mississippi*, North Carolina*, South Carolina*, South Dakota*, Wisconsin*, Wyoming*.)

Table 2 represents summary statistics for our main variables: respondents' healthcare utilization, related expenditure, health status and basic demographics. We measure comprehensive healthcare services expenditure by total expenditure, in-patient expenditure (any health care service not required in-hospital stay), and out-of-pocket expenditure (those health care services that are paid individually and not covered by any insurance).

Healthcare utilization is measured by routine physical checkup, and dental check frequency which is the total number of dental care visits. Measures of perceived health status are obtained from both mental and physical health status. Respondents are asked to rate each person in the family according to the following categories: excellent, very good, good, fair, and poor. We also add psychological distress variables, using an aggregation method to get a weighted average health outcome with nervous, hopeless, restless, sad, difficult, and worthless (all 6 variables are reported frequency of each feeling in one week from respondents). The reason behind adding this aggregation index is the perceived mental status is a self-generated rating value, while the psychological distress variable is an aggregated index from six dimensions of perceived negative feelings. Except for respondents' perceived health status, we use one more variable about whether respondents had ever been diagnosed with high blood pressure to measure the physical health outcome. Choosing high blood pressure as a physical health outcome is also due to the fact that young adults are reporting increasing cases of blood pressure (Medicine and National Research Council, 2013).

The MEPS Household Component (HC) contains rich information on respondents' demographic and socioeconomic characteristics, such as gender, date of birth (month and year), ethnicity, marital status, educational attainment, employment status, etc. We use these predetermined characteristics of gender, race (non-Hispanic white only), BMI, income, education, risk tolerance, and marital status to conduct a validity test of RDD, and further include them in our regression as further controls.

Table 2. Descriptive Statistics

Variable	Eligible ACA-DCE			Ineligible ACA-DCE		
	#Obs	Mean	Std. Dev.	#Obs	Mean	Std. Dev.
Healthcare Expenditures						
Total expense	5876	4104.447	26753.355	9068	13211.556	49606.118
In-patient expense	5876	1582.579	24246.816	9068	5550.921	33421.048
Out-patient expense	5876	322.893	3152.369	9068	1663.135	15277.569
ER expense	5876	424.092	2072.995	9068	909.591	4211.467
Out-of-pocket expense	5876	.154	.481	9068	.201	.639
Healthcare Utilization						
Routine check	1835	1.913	1.425	8462	1.64	1.277
Dental check	5564	1.788	.995	8632	2.123	1.1
Health Status						
Perceived mental health	5816	1.753	.918	8809	2.16	1.043
Distress	1452	2.483	3.643	7273	2.932	4.185
Perceived health status	5818	1.786	.911	8810	2.458	1.075
High blood pressure	2017	.042	.2	9014	.363	.481
Diabetes	2018	.006	.08	9020	.124	.33
	5876	.507	.5	9068	.466	.499
Other Variables						
Gender	5876	.243	.429	9068	.4	.49
Non-Hispanic Whites	1914	25.877	5.848	8554	28.135	6.162
BMI	5876	5524.226	17021.3	9068	39486.589	43062.477
Income	4605	7.873	5.022	8918	13.145	4.087
Education	1449	2.428	1.283	7308	2.122	1.254

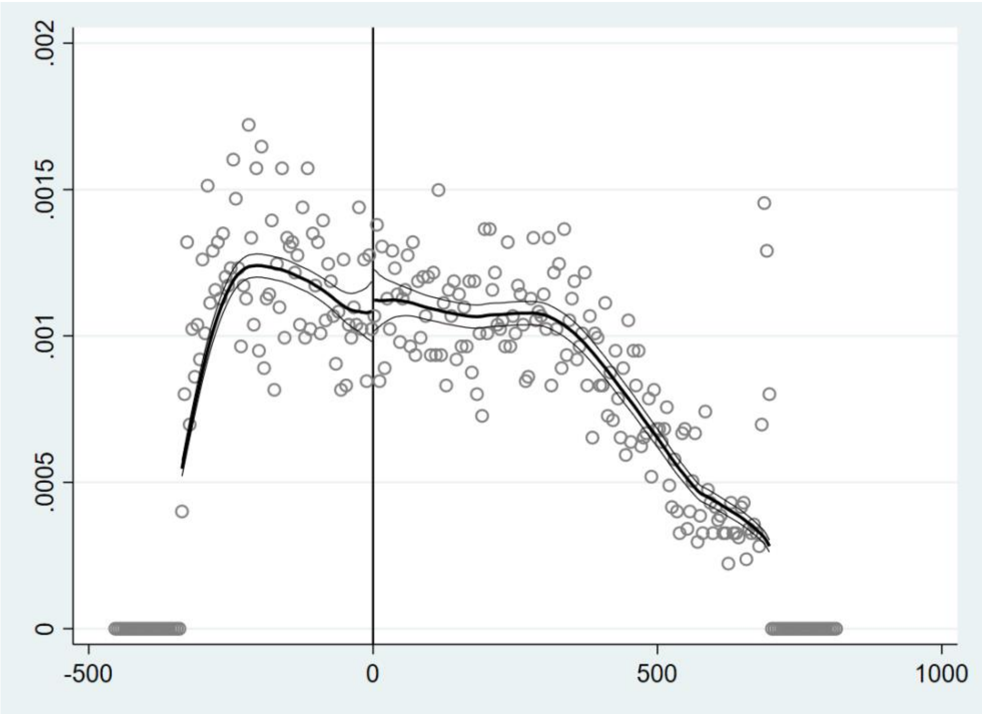
4. Empirical Result

4.1 Potential Manipulation

The key identifying assumption of our RD-DD estimations is that $E[Y_{i0}|c_i = c]$is continuous in c at c_0, which is equivalent to the case that no one can fully manipulate the assignment variable.

To support our identifying assumption, we conduct two sets of quantitative tests suggested by Lemieux (2010). Firstly, we test the continuity in the density of the birth cohort at the cutoff point (cohort 1988, aged 26 at 2014). Figure 1 shows the distribution of the birth cohort. It is obvious to see that there is no discontinuity at the cutoff point in the sample.

Figure 1. Density of birth cohort



Secondly, we check whether individuals' predetermined demographic and socioeconomic characteristics are smooth at the cutoff point. Specifically, we examine gender, personal income, BMI, employment, risk tolerance, and marital status. Figure 2 plots the differences in these socioeconomic variables between treatment (eligible young adults have not reached 26 years old in Jan. 2014) and control group (ineligible young adults reached 26 years old in Jan. 2014), as well as the 95% confidence intervals against different window lengths. As shown in these figures, we fail to reject the null hypothesis that the mean differences for these socioeconomic characteristics between treatment and control groups are zero at the 95% confidence interval.

Figure 2. Graphical evidence of smoothness

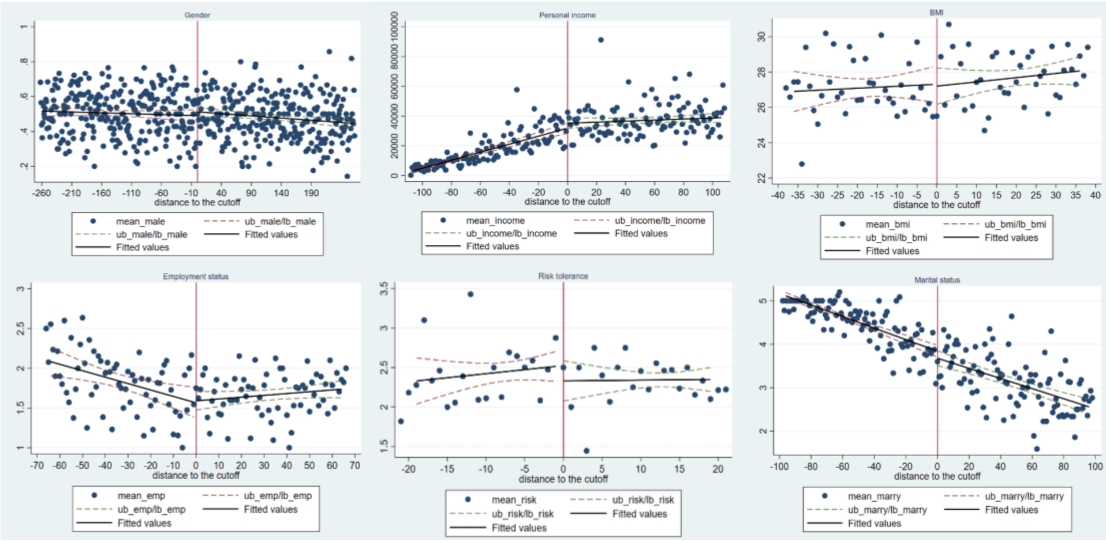


Table 3 shows the regression results of the predetermined characteristics. All the coefficients of interest are insignificant at 5% significance level. These regression results are consistent with the graphical evidence discussed in figure 2. The RDD is a local randomization with no significant impact in terms of predetermined characteristics.

Table 3. Regression results of smoothness

Variables	(1) Gender	(2) Income	(3) BMI	(4) Employment	(5) Risk tolerance	(6) Marital status
D	0.022	3,334.611	0.049	0.029	-0.022	-0.082
	(0.022)	(2,510.722)	(0.365)	(0.112)	(0.076)	(0.123)
X	-0.000	268.876***	0.027***	-0.009***	-0.001	-0.014***
	(0.000)	(20.922)	(0.004)	(0.002)	(0.001)	(0.001)
DX	-0.000	-234.229***	-0.022***	0.011***	-0.000	0.001
	(0.000)	(34.828)	(0.004)	(0.003)	(0.001)	(0.003)
Constant	0.490***	31,898.983***	27.526***	1.554***	2.390***	3.804***
	(0.017)	(1,718.813)	(0.280)	(0.096)	(0.055)	(0.076)
Observations	8,884	3,547	4,547	2,179	3,106	2,609
R-squared	0.001	0.103	0.036	0.013	0.003	0.129

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 Extension policy and birth cohorts (first stage results)

We first test the relation between actual ACA dependent coverage rate and DCE-eligibility (young adults who have not reached 26 years old in Jan. 2014) by using different cohort groups. As shown in table 4, for young adults who are eligible for DCE, there is an increase in the probability of being covered by their parents' insurance. This strong first stage result proves the relevance restriction of using DCE-eligibility as an instrument variable, supporting the validity of our RDD estimation.

Table 4. Extension policy and birth cohorts

VARIABLES	(1)	(2)	(3)
	ACA-DCE	ACA-DCE	ACA-DCE
D	0.329**	0.287***	0.264***
	(0.143)	(0.099)	(0.060)
X	-0.003	-0.001	-0.000
	(0.005)	(0.002)	(0.000)
DX	0.003	0.001	0.000
	(0.005)	(0.002)	(0.000)
Constant	0.671***	0.713***	0.736***
	(0.143)	(0.099)	(0.060)
Cohort	1985-1993	1981-1998	1969-2009
Observations	1,599	3,190	8,148
R-squared	0.161	0.152	0.140

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.3 Results

The ACA dependent coverage provision impacts on young adults' healthcare services expenditure, utilization and health outcome are reported in Table 6. The first three columns in Table 6 contain the healthcare services expenditure with three categories of *total expense, in-patient expense,* and *out-patient expense*. The column 4 and column 5 contain the results for healthcare utilization of *routine check* and *dental visit frequency*. The column 6-10 include both *mental* and *physical perceived health status* and whether diagnosed with *high blood pressure*.

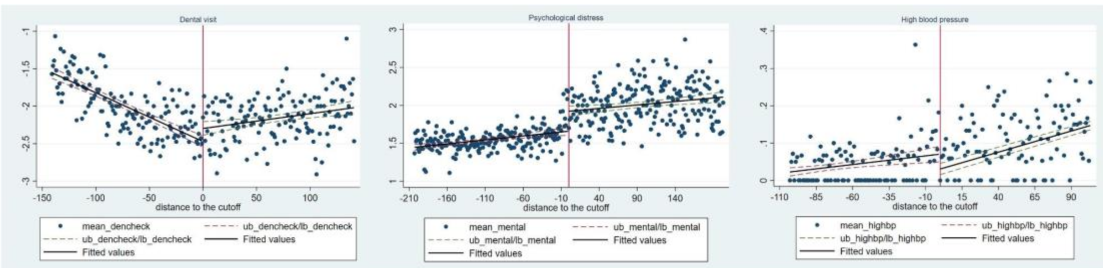
Table 6. Regression Results: non-parametric

Variables	Expenditure			Preventative care	
	(1)	(2)	(3)	(4)	(5)
	Total expenditure	*OOP*	*Inpatient expenditure*	*Dental visit*	*Routine checkup*
D	-761.717	0.027	40.729	0.174***	-0.179*
	(1,133.228)	(0.023)	(902.469)	(0.060)	(0.101)
X	8.219**	0.000	9.515**	-0.007***	0.005***
	(3.721)	(0.000)	(4.517)	(0.000)	(0.001)
DX	16.629*	-0.000	-10.135*	0.008***	-0.005***
	(8.689)	(0.000)	(6.083)	(0.001)	(0.001)
Constant	4,984.616***	0.139***	2,619.552***	-2.471***	2.212***
	(778.322)	(0.016)	(788.804)	(0.038)	(0.077)
Observations	9,622	7,288	6,890	4,560	3,772
	0.006	0.001	0.001	0.044	0.007
	-761.717	0.027	40.729	0.174***	-0.179*
R-squared	(1,133.228)	(0.023)	(902.469)	(0.060)	(0.101)

Variables	Mental Health		Physical Health	
	(6)	(7)	(8)	(9)
	Physical distress	*Mental health*	*Physical health*	*High blood pressure*
D	0.263***	0.202	-0.011	-0.040***
	(0.043)	(0.235)	(0.043)	(0.013)
X	0.001***	0.001	0.002***	0.000***
	(0.000)	(0.003)	(0.000)	(0.000)
DX	-0.000	-0.000	0.000	0.001***
	(0.000)	(0.004)	(0.000)	(0.000)
Constant	1.660***	2.551***	2.050***	0.070***
	(0.027)	(0.158)	(0.032)	(0.011)
Observations	6,764	3,193	7,233	11,031
R-squared	0.084	0.002	0.047	0.246
Observations	0.263***	0.202	-0.011	-0.040***
R-squared	(0.043)	(0.235)	(0.043)	(0.013)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 3. Graphical evidence of ACA-DCE's impacts



We mainly discuss the estimated coefficients ρ which capture the impact of ACA dependent coverage provision, namely, the coefficient of dummy D_i of the treatment group (eligible young adults who have reached 26 years old in Jan. 2014). Our results showed that ACA Dependent Coverage Expansion has no significant effect on *total expenditure*, *out-of-pocket expenditure*, and *in-hospital expenditure* for young adults who are insured, relative to the uninsured. However, since there is no statistically significant impact of ACA-DCE on young adults' out-of-pocket expenditure on health services, we can also imply that ACA-DCE could provide broader coverage of healthcare services for those young adults, therefore charging them with less or little out-of-pocket expenditure. A possible explanation for the insignificant impact on out-of-pocket expenditure is the limited insurance coverage for some young adults. To prevent moral hazards, private insurance companies provide limited insurance plans, such as coinsurance and copayment. The two plans provision in either a fixed percentage or a fixed amount of each medical bill, and let the insurer cover the remaining part, having a restricted impact on young adults' out-of-pocket expenditure.

In terms of *Routine checkup*, our results suggest that ACA-DCE affects young adults' hospital utilization of regular physical check-ups at a 10% significance level. To be fair, *Routine checkup* contains lower significant power and shows no significant effect in our latter robustness checked in second polynomial regression. One possible explanation is that young adults in the U.S. have little attention to preventive healthcare services such as physical routine checkups, vaccination, and screening (McRee & Gower & Reiter, 2018). Therefore, the difference between the two groups is insignificant. However, being eligible for ACA-DCE results in a higher rate of *dental check* for young adults who had not reached 26 years old in Jan. 2014. Therefore, the estimates of dental check frequency are consistent with our anticipation since general dental visits for eligible young adults increased by 0.174 times compared with their illegible peers. Our finding of an increase in dental visits suggests that better access to dental care may be an additional benefit of the ACA-DCE. This increase may be explained by ACA dependent coverage benefits may also include dental insurance, linking expansion of medical insurance to expansion of dental insurance.

Regarding the perceived mental health of respondents, those ACA-DCE eligible young adults report a significantly positive outcome. Specifically, the psychological distress of eligible young adults is 26.3% lower. However, mental health has a positive outcome while containing less significant power. As we mentioned earlier, psychological distress is an aggregated index of six perceived negative feelings, while mental health is only self-rated outcomes ranging from 1-5 for respondents. Results indicate that ACA-DCE eligible young adults tend to have a better mental health outcome, suggesting an impact of the DCE on overall utilization of mental health care for young adults.

From the perspective of physical health, results point to a significant decrease in the possibility of 4% of being diagnosed with high blood pressure for those ACA-DCE eligible young adults. At the same time, the perceived health status is not showing a significant difference between the two groups. The outcome is consistent with Lau and Adams (2014), suggesting that ACA-DCE implementation was associated with increased office visits and the use of certain preventive services, including blood pressure.

4.4 Robustness check

4.4.1 Second polynomial regression

For robustness check, we first use a second polynomial function to control for the direct effect of ACA-DCE eligible status.

$$Y_i = \theta_0 + \theta_1 X_i + \theta_2 X_i^2 + \rho D_i + \gamma_1 D_i X_i + \gamma_2 D_i X_i^2 + \eta_i$$

Table 7. presents the outcome of second-polynomial regression. By using a second-polynomial regression, we find that the overall outcome of ACA-DCE impacts is consistent with the outcome of the estimation equation shown in Table 6.

Table 7. Regression: Polynomial order (2nd order)

Variables	Expenditure		Preventative care		
	(1)	(2)	(3)	(4)	(5)
	Total expenditure	*OOP*	*Inpatient expenditure*	*Dental visit*	*Routine checkup*
D	-1,160.831	0.031	-1,530.576	0.541***	0.018
	(1,330.117)	(0.025)	(1,143.233)	(0.069)	(0.117)
X	36.571**	0.001**	44.057***	-0.017***	-0.000
	(16.899)	(0.000)	(15.748)	(0.001)	(0.004)
X2	0.112*	0.000***	0.134**	-0.000***	-0.000
	(0.060)	(0.000)	(0.057)	(0.000)	(0.000)
DX	-24.220	-0.001***	-44.560***	0.018***	-0.002
	(19.158)	(0.000)	(17.013)	(0.001)	(0.004)
DX2	-0.074	-0.000*	-0.108*	0.000***	0.000
	(0.062)	(0.000)	(0.058)	(0.000)	(0.000)
Constant	6,088.966***	0.162***	4,013.857***	-2.817***	2.118***
	(1,057.000)	(0.020)	(976.573)	(0.062)	(0.110)
Observations	14,944	14,944	14,944	14,196	10,297
R-squared	0.028	0.011	0.012	0.076	0.048

Variables	Mental Health		Physical health	
	(1)	(2)	(3)	(4)
	Physical distress	*Mental health*	*Physical health*	*High blood pressure*
D	-0.280***	0.371	-0.043	-0.069***
	(0.045)	(0.258)	(0.047)	(0.019)
X	0.001***	-0.007	0.002***	0.002***
	(0.000)	(0.009)	(0.001)	(0.000)
X2	0.000	-0.000	0.000**	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
DX	-0.001	0.007	-0.000	-0.001
	(0.000)	(0.009)	(0.001)	(0.001)
DX2	-0.000	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	1.672***	2.392***	2.088***	0.096***
	(0.034)	(0.224)	(0.039)	(0.016)
Observations	14,625	8,725	14,628	11,031
R-squared	0.141	0.003	0.124	0.246

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In summary, the overall impact outcomes are consistent with our main results, the exact numbers of estimators vary slightly based on our choice of polynomial control function.

4.4.2 Heterogeneous effect

We further investigate whether the effect of being eligible for ACA-DCE on healthcare expenditure, utilization, and health outcomes differs across individuals with different characteristics, and specifically, across Hispanic and different regions in MEPS 2016.

Ethnicity difference

To check whether there exist heterogeneous effects across different ethnicity groups, we estimate the treatment effect on Hispanic group and the result is reported in Table 8. The coefficients of interest are similar to what we get in the whole sample, suggesting no significant heterogeneous effects across different ethnicity groups in terms of healthcare expenditure, utilization, and health outcomes.

Table 8 Heterogeneous effects test (Hispanic)

Variables	Expenditure			Preventative care	
	(1)	(2)	(3)	(4)	(5)
	Total expenditure	*OOP*	*Inpatient expenditure*	*Dental visit*	*Routine checkup*
D	588.300	0.016	-209.202	0.192***	-0.168*
	(1,105.824)	(0.027)	(947.071)	(0.056)	(0.099)
X	0.726	0.000	7.124	-0.006***	0.005***
	(7.288)	(0.000)	(5.880)	(0.000)	(0.001)
DX	15.711	0.000	-1.066	0.008***	-0.005***
	(14.791)	(0.000)	(9.531)	(0.001)	(0.001)
Constant	4,518.829***	0.138***	2,485.375***	-2.471***	2.218***
	(814.592)	(0.019)	(790.524)	(0.036)	(0.076)
Observations	4,755	4,993	5,496	5,141	3,887
R-squared	0.001	0.001	0.001	0.058	0.008

Variables	Mental Health		Physical Health	
	(1)	(2)	(3)	(4)
	Mental status	*Distress*	*Health status*	*High blood pressure*
D	0.343	0.160***	0.005	-0.038**
	(0.227)	(0.051)	(0.041)	(0.018)
X	0.001	0.002***	0.002***	0.000**
	(0.003)	(0.000)	(0.000)	(0.000)
DX	-0.003	0.000	0.000	0.001***
	(0.003)	(0.001)	(0.000)	(0.000)
Constant	2.551***	1.708***	2.050***	0.065***
	(0.158)	(0.034)	(0.030)	(0.015)
Observations	3,541	4,543	8,131	4,006
R-squared	0.001	0.073	0.055	0.237

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Region difference

The outcomes in Table 9 & 10 are differences in regression results between samples of Northeast U.S. (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont) and the West U.S (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Washington). We find that the effects are larger for the Northeast sample than the West sample on physical and mental health outcomes, and also on dental visit checks. These results suggest that the regional disparity exists in our setting.

Table 9 Heterogeneous effect test (Northeast)

Variables	Expenditure		Preventative care		
	(1)	(2)	(3)	(4)	(5)
	Total expenditure	*OOP*	*Inpatient expenditure*	*Dental visit*	*Routine checkup*
D	484.139	0.036	-82.031	0.196***	-0.134
	(1,076.449)	(0.022)	(904.042)	(0.055)	(0.094)
X	5.948	-0.000	10.615**	-0.007***	0.005***
	(5.276)	(0.000)	(4.156)	(0.000)	(0.001)
DX	7.150	0.000	-10.506*	0.008***	-0.006***
	(8.846)	(0.000)	(6.015)	(0.001)	(0.001)
Constant	4,788.547***	0.130***	2,699.596***	-2.473***	2.218***
	(864.972)	(0.015)	(777.157)	(0.035)	(0.076)
Observations	7,176	8,148	7,406	5,184	4,448
R-squared	0.003	0.001	0.001	0.060	0.007

Variables	Mental Health		Physical Health	
	(1)	(2)	(3)	(4)
	Mental status	*Distress*	*Health status*	*High blood pressure*
D	0.411	0.266***	0.010	-0.045**
	(0.258)	(0.039)	(0.040)	(0.021)
X	-0.001	0.001***	0.002***	0.001***
	(0.003)	(0.000)	(0.000)	(0.000)
DX	-0.000	-0.000	0.000	0.000**
	(0.005)	(0.000)	(0.000)	(0.000)
Constant	2.453***	1.655***	2.048***	0.084***
	(0.171)	(0.024)	(0.030)	(0.017)
Observations	2,759	7,841	8,286	4,110
R-squared	0.001	0.094	0.056	0.253

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10 Heterogeneous effect (West)

Variables	Expenditure		Preventative care		
	(1)	(2)	(3)	(4)	(5)
	Total expenditure	*OOP*	*Inpatient expenditure*	*Dental visit*	*Routine checkup*
D	484.139	0.018	-29.521	0.168***	-0.177*
	(1,076.449)	(0.025)	(910.832)	(0.058)	(0.100)
X	5.948	0.000	10.417**	-0.006***	0.005***
	(5.276)	(0.000)	(4.820)	(0.000)	(0.001)
DX	7.150	0.000	-10.882	0.008***	-0.005***
	(8.846)	(0.000)	(6.807)	(0.001)	(0.001)
Constant	4,788.547***	0.137***	2,679.985***	-2.465***	2.213***
	(864.972)	(0.017)	(793.213)	(0.037)	(0.077)
Observations	7,176	6,218	6,318	4,753	3,817
R-squared	0.003	0.001	0.001	0.047	0.007

Variables	Mental Health		Physical Health	
	(1)	(2)	(3)	(4)
	Mental status	*Distress*	*Health status*	*High blood pressure*
D	0.361	0.206***	-0.007	-0.039**
	(0.226)	(0.047)	(0.043)	(0.016)
X	0.001	0.001***	0.002***	0.000**
	(0.003)	(0.000)	(0.000)	(0.000)
DX	-0.003	0.000	0.000	0.001***
	(0.003)	(0.000)	(0.000)	(0.000)
Constant	2.551***	1.680***	2.056***	0.064***
	(0.158)	(0.030)	(0.032)	(0.014)
Observations	3,587	5,639	7,086	6,714
R-squared	0.001	0.081	0.045	0.235

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

The dependent coverage expansion (DCE) policy was conducted with the aim of improving the insurance coverage condition of young adults. To measure the effectiveness of the policy, this paper estimates the effect on individuals' healthcare-related outcomes of the DCE policy and found that it positively influenced DCE-eligible individuals' healthcare utilization and health status. The results are consistent with previous research and remain robust under alternative tests.

Our study has some shortcomings. First, we only employ one year of data to conduct the study, and the results may differ from other years after the implementation. For example, if we conduct the study based on data from 2014, the impacts may be more significant because it’s the time when ACA-DCE policy started to have large-scale impacts on young adults. Second, we cannot exhaust all potential impacts on healthcare utilization and the health status of DCE due to data limitations. For example, DCE may affect healthcare utilization by increasing the vaccination rates, or health status by decreasing the possibility of getting other chronic diseases. We suggest future studies to expand the time horizon of the analysis and provide a possible expansion to future studies on more detailed and diversified healthcare measurements.

Though limitations exist, our research has some contributions and sheds light on the importance of a flexible insurance system. As the impacts of DCE are insignificant to some aspects of healthcare utilization and health status, the insurance system can be targeted to areas where DCE is influential.

References

Akosa Antwi, Yaa, Asako S. Moriya, and Kosali Simon. "Effects of Federal Policy to Insure Young Adults: Evidence from the 2010 Affordable Care Act's Dependent-

Coverage Mandate." *American Economic Journal: Economic Policy,* 5(4), 2013, 1-28.

Barbaresco, Silvia, Charles J. Courtemanche, and Yanling Qi. "Impacts of the Affordable Care Act Dependent Coverage Provision on Health-Related Outcomes of Young Adults." *Journal of Health Economics,* 40, 2015, 54-68.

Busch, Susan H., Ezra Golberstein and Ellen Meara. "ACA Dependent Coverage Provision Reduced High Out-Of-Pocket Health Care Spending For Young Adults." *Health Affairs*, 33(8), 2014,1361-1366.

Chen, J., Bustamante, A. V., & Tom, S. E. (2015). Health care spending and utilization by race/ethnicity under the Affordable Care Act's dependent coverage expansion. *American journal of public health*, *105*(S3), S499-S507.

Chen, R., Fang, D., & Hartarska, V. (2019). The Affordable Care Act: Does the ACA Dependent Coverage Mandate Mean Less Out-of-pocket Health Care Expenditure and Health Care Utilization?.

Cantor, Joel C., Alan C. Monheit, Derek DeLia, and Kristen Lloyd (2012). "Early Impact of the Affordable Care Act on Health Insurance Coverage of Young Adults." *Health Services Research*, 47(5), 1773–1790.

Collins, S. R., & Nicholson, J. L. (2010). Rite of passage: Young adults and the Affordable Care Act of 2010.

Institute of Medicine and National Research Council. 2013. Improving the Health, Safety, and Well-Being of Young Adults: Workshop Summary. Washington, DC: The National Academies Press.https://doi.org/10.17226/18340.

Kao-Ping Chua, and Benjamin D. Sommers. "Changes in Health and Medical Spending Among Young Adults Under Health Reform." *JAMA* 311(23), 2014, 2437-2439.

Kessler, R. C., Demler, O., Frank, R. G., Olfson, M., Pincus, H. A., Walters, E. E., . . . Zaslavsky, A. M. (2005). Prevalence and treatment of mental disorders, 1990 to 2003. New England Journal of Medicine, 352, 2515-2523.

Sommers, B. D., Gunja, M. Z., Finegold, K., & Musco, T. (2015). Changes in self-reported insurance coverage, access to care, and health under the Affordable Care Act. *Jama*, *314*(4), 366-374.

Lee, D. S., & Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of economic literature*, *48*(2), 281-355.

Wallace, J., & Sommers, B. D. (2015). Effect of dependent coverage expansion of the Affordable Care Act on health and access to care for young adults. *JAMA pediatrics*, *169*(5), 495-497.