Changes in dental visits and expenditures in veterans, older adults, and foreign-born after Affordable Care Act repeal efforts: A quasi-experimental difference-in-differences study

SUPPLEMENTARY FILE

SECTION 1

Caption: Dependent Variables

Source/Notes: Authors' analysis of data from the Medical Expenditure Panel Survey, 2016-2018

SECTION 2

Caption: Independent Variable

Source/Notes: Authors' analysis of data from the Medical Expenditure Panel Survey, 2016-2018. At the time of this analysis in January 2021, 38 states had adopted Medicaid expansion, and 12 states had not.[5]

SECTION 3

Caption: Covariates

Source/Notes: Authors' analysis of data from the Medical Expenditure Panel Survey, 2016-2018.

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Source/Notes: Authors' analysis of data from the Medical Expenditure Panel Survey, 2016-2018.

SECTION 1: Dependent Variables

Measure	Description
*Dental visits	
No	Persons without a dental visit.
Yes	Persons with a dental visit.
Dental expenditure	Total expenditure in U.S. dollars on dental services – the sum of "out-of-pocket, private, Medicaid, and Medicare" expenditures.

Note. *Continuous data in MEPS, recoded into a binary or dichotomous variable for this analysis.

SECTION 2: Independent Variable

Measure	Description
*Medicaid expansion	
No	Medicaid expansion not adopted (*untreated*).
Yes	Medicaid expansion adopted (*treated*).

Note. *At the time of this analysis in January 2021, 38 states had adopted Medicaid expansion, and 12 states had not.[1]

SECTION 3: Covariates

Measures	Criteria
Sex	Male
	Female
Age	18–64
	>64
Race and ethnicity	Hispanic
	White (non-Hispanic)
	Black (non-Hispanic)
	Asian (non-Hispanic)
Educational level	Less than high school
	High school/GED
	More than high school
Poverty level	Poor
	Near-poor
	Nonpoor
Region of residency	Northeast
	Midwest
	South
	West
Marital status	Married
	Unmarried
	Never Married
Veteran status	Nonveteran
	Veteran
Nativity status	US-born
	Foreign-born
Dentate status	Non-dentate
	Dentate
Dental insurance status	Has dental insurance
	No dental insurance

SECTION 4: **Statistical Analysis**

The relationships between Medicaid expansion, the main outcome variables (dental visits and expenditures), and covariates were assessed using regression models. Dental visit is modeled as follows:

$$Y_{ist} = \beta_0 + \beta_1 x_1 + \beta_2 x_{st} + \gamma W + \varepsilon_{ist}$$

- *Yist*: Outcome (dental visit) for individual *i* living in state *s* at time *t* (expressed as year).
- β_0: State-specific fixed effects (intercept).
- β_1: Regression coefficient for main predictor, Medicaid expansion status indicator for x_1.
- β_2: Regression coefficient for interaction term between Medicaid expansion status indicator and the postreform time period for x_{st}. Indicators equal to 1 if the individual lived in an expansion state in reform years for the state *s* where the individual lived.
- γ: Vector of regression coefficients for covariates W (adjustment variables, such as sex, age, race/ethnicity, educational level, poverty status, region of residency, marital, veteran, nativity, dentate, and dental insurance status).
- ε_{ist}: Error term

- $Log\ of\ Odds\ of\ Dental\ Visits_{it} = \beta_0 + \beta_1 MedExp + \beta_2 MedExp_i \times Post_i + \gamma W$ (Equation 1)

Dental expenditure is modeled as follows:

$$Y_{ist} = \beta_0 + \beta_1 x_1 + \beta_2 T_{st} + \gamma W + \varepsilon_{ist}$$

- *Yist*: Outcome for individual *i* living in state *s* at time *t* (expressed as year).

- *β0*: State-specific fixed effects (intercept).
- *β1*: Regression coefficient for the main predictor, Medicaid expansion status indicator (*x1*).
- *β2Tst*: Regression coefficient for the interaction term between Medicaid expansion status indicator and the postreform time period (*Tst*). Indicators equal to 1 if the individual lived in an expansion state in reform years for the state *s* where the individual lived.
- *γ*: Vector of regression coefficients for covariates W (adjustment variables, such as sex, age, race/ethnicity, educational level, poverty status, region of residency, marital, veteran, nativity, dentate, and dental insurance status).
- ε_{ist}: Error term

- $Dental\ Expenditures_{ist} = \beta_0 + \beta_1 MedExp + \beta_2 MedExp_i \times Post_i + \gamma W + \varepsilon_{ist}$ (Equation 2)

Both equations were estimated separately for veterans, older adults ≥ 65 years, and the foreign-born by reform time periods defined as pre-repeal (2016), and repeal time periods (2017–2018). Frequencies and percentages were calculated to present a descriptive analysis. Bivariate analyses for comparison of demographic characteristics in the sample were performed using Chi-square tests for the key independent variable (Medicaid expansion), covariates, and the dependent variable (dental visits). The Medicaid expansion variable and covariates were observed for statistical significance and association with dental visits (dependent variable). Cross-tabulations were used to describe the relationship between Medicaid expansion, covariates, and dental visits.

Simple logistic regressions (unadjusted) were performed because the dependent variable (primary outcome), dental visits, was dichotomous. Simple logistic regressions were conducted by reform time periods defined as pre-repeal (2016), and repeal time periods (2017–2018), and by veteran status, age group, and foreign-born status, resulting in odds ratios (ORs) and 95% confidence intervals (CIs). Multiple regression, also known as adjusted logistic regression, were performed using the same variables; by pre-repeal (2016), and repeal time periods (2017–2018); and by veteran status, age group, and foreign-born status, resulting in ORs and 95% CIs. For both simple and multiple regressions, dummy interaction variables were included in the model as follows: an interaction of Medicaid expansion and dentate status (Medicaid expansion × dentate status), an interaction of Medicaid expansion and dental insurance status (Medicaid expansion × dental insurance), and an interaction of dentate status and dental insurance (dentate status × dental insurance).

For adjusted logistic regressions, a difference-in-differences (DiD) analysis, an analytic method to assess effect of policy changes, was conducted.[2, 3] The DiD analysis provided summary estimates of the policy change effect across all postexpansion years. These DiD summary estimates were estimated using the same equations for the simple logistic regressions by including a dummy variable denoting the interaction between a Medicaid expansion state during the postperiod ($post_i \times MedExp_i$; see Equation 1). This indicator turned on starting in the year of expansion for each state. For the DiD, the treatment group was defined as the states that expanded Medicaid, whereas the control group were the states that did not expand Medicaid by the time of this analysis in January 2021. Officially, ACA expansion was implemented by January 2014 in most of the states;

however, some states that expanded before January 2014 (Michigan expanded in April 2014, New Hampshire in August 2014, Pennsylvania in January 2015, Indiana in February 2015, and Alaska in September 2015) were also classified together with the expanded states, following the procedure described by Simon et al.[4] Therefore, the DiD estimator compared the 38 Medicaid expansion states with the 12 nonexpansion states, and we estimated separate equations for veterans, those ≥ 65 years old, and the foreign-born to answer the study's research question. DiD is based on a parallel trend assumption prior to implementation of the intervention.[3]

Rather than an ordinary least square (OLS) or linear regression for the continuous, dependent variable (dental expenditures), a two-part econometric regression model (2pm) was fit. Healthcare expenditures are challenging to model because these dependent variables typically have distributions that are skewed with a large mass at zero (a "spike" of zero values) and skewness (a heavy right-hand tail), meaning most expenditures are seen in only a small proportion of the population.[5-9] These properties make OLS estimation biased and inefficient. Popular alternatives to OLS include two-part models (Manning et al., 1981; Duan et al., 1983, 1984), which model the probability of nonzero costs separately from their level conditional on nonzero costs.[5-7]

The initial 2pm analysis was done by states (reform states vs. nonreform states), by veteran status, age group, and foreign-born status, and by reform time periods as simple regressions. This analysis was followed by a progressively adjusted 2pm estimated using all variables, by states (reform states vs. nonreform states), by veteran status, age group, foreign-born status, and by reform periods. Reform periods were defined as pre-repeal (2016), and repeal time periods (2017–2018) in the 2pm.

The first part of the 2pm comprised of a probabilistic regression model (probit), which provided an estimate of the probability of zero versus positive expenditures. Dependent upon having a positive healthcare expenditure, a generalized linear model (GLM) with gamma distribution and a logarithmic-link function estimates the average expenditure per capita or marginal expenditure in the second part. The "margins" command was used after the 2pm to retrieve this estimate.

Using the estimated average expenditure per capita for each independent variable, we used simple subtractions to calculate changes in dental care expenditures as the difference in predicted expenditures in pre-repeal and repeal time periods for reform (Medicaid expansion) and nonreform (no Medicaid expansion) states separately. Next, DiD summary estimates were calculated in U.S. dollars using average marginal effects. This DiD summary estimate was the difference in predicted outcomes of the interaction terms for each observation in each of the subpopulations (veterans, those ≥ 65 years, and the foreign-born), comparing those living in a reform (Medicaid expansion) state to those living in a nonreform (no Medicaid expansion) state, with the results averaged over the national sample.

SECTION 5: **Total and Predicted Per Capita Spending on Dental Services (USD), MEPS 2016-2018**

Variables	Total expenditures	Unadjusted expenditures per capita	Adjusted expenditures per capita
Veteran status			
Non-veteran	-	-	-
Veteran	7.46 B	341.80	341.71
Age			
18-64 years	-	-	-
≥ 65 years	5.84 B	311.88	311.92
Nativity status			
US-born	-	-	-
Foreign-born	7.13 B	365.18	365.21

SECTION 6: **Descriptive Statistics, MEPS 2016–2018 (N=66,639)**

	Total	No dental visits	Dental visits
Study sample	n = 66,639	n = 41,433	n = 25,206
Study population	n = 236,408,797		
Was Medicaid expansion adopted?			
Not adopted	3.2% (21,078)	32.7% (14,414)	26.9% (6,664)
Adopted	69.8% (45,561)	67.3% (27,019)	73.1% (18,542)
Sex			
Male	48.2% (30,875)	51.5% (20,230)	43.8% (10,645)
Female	51.8% (35,764)	48.5% (21,203)	56.2% (14,561)
Age (categories based on 65)			
Age 18–64	79.2% (52,619)	82% (33,884)	75.5% (18,735)
≥ 65 years	2.8% (14,020)	18% (7,549)	24.5% (6,471)
Race and ethnicity			
Hispanic	16.5% (17,367)	2.7% (13,040)	11% (4,327)
White (non-Hispanic)	65.1% (33,476)	57.6% (17,347)	75% (16,129)
Black (non-Hispanic)	12.2% (11,343)	15.3% (8,376)	8.08% (2,967)
Asian (non-Hispanic)	6.16% (4,453)	6.4% (2,670)	5.85% (1,783)
Educational level			
Less than H/S	12.2% (12,133)	16% (9,469)	7.28% (2,664)
High School/GED	45.8% (31,025)	51.5% (21,013)	38.3% (10,012)
More than H/S	41.9% (23,481)	32.5% (10,951)	54.4% (12,530)
Family income as % of poverty line			
Poor (100% <)	1.4% (10,657)	13.6% (8,267)	6.25% (2,390)
Near poor (100–199%)	15.7% (13,269)	2.1% (9,927)	9.94% (3,342)
Nonpoor (>200%)	73.8% (42,713)	66.3% (23,239)	83.8% (19,474)
Region of residency			
Northeast	17.9% (10,783)	16.8% (6,206)	19.3% (4,577)
Midwest	2.9% (13,375)	19.4% (7,602)	22.8% (5,773)
South	37.8% (25,573)	41.6% (17,582)	32.7% (7,991)
West	23.5% (16,908)	22.2% (10,043)	25.1% (6,865)

	Total	No dental visits	Dental visits
Marital status			
Married	52.3% (32,998)	47.8% (18,772)	58.2% (14,226)
Unmarried (separated, widowed, divorced)	19.6% (14,196)	2.5% (9,169)	18.4% (5,027)
Never married	28.1% (19,445)	31.7% (13,492)	23.4% (5,953)
Honorably discharged from military			
Nonveteran	92.4% (61,874)	92.7% (38,773)	91.9% (23,101)
Veteran	7.64% (4,765)	7.27% (2,660)	8.13% (2,105)
Nativity Status			
U.S.-born	82.5% (50,700)	79.6% (30,048)	86.4% (20,652)
Foreign-born	17.5% (15,939)	2.4% (11,385)	13.6% (4,554)
Dentate status			
Nondentate	6.36% (4,687)	9.09% (3,866)	2.77% (821)
Dentate	93.6% (61,952)	9.9% (37,567)	97.2% (24,385)
Dental insurance status			
Has dental insurance	45.6% (25,984)	39.2% (13,396)	54.2% (12,588)
No dental insurance	54.4% (40,655)	6.8% (28,037)	45.8% (12,618)

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