Original investigation

Tobacco Cessation in Affordable Care Act Medicaid Expansion States Versus Non-expansion States

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Abstract

Introduction: Community health centers (CHCs) care for vulnerable patients who use tobacco at higher than national rates. States that expanded Medicaid eligibility under the Affordable Care Act (ACA) provided insurance coverage to tobacco users not previously Medicaid-eligible, thereby potentially increasing their odds of receiving cessation assistance. We examined if tobacco users in Medicaid expansion states had increased quit rates, cessation medications ordered, and greater health care utilization compared to patients in non-expansion states.

Methods: Using electronic health record (EHR) data from 219 CHCs in 10 states that expanded Medicaid as of January 1, 2014, we identified patients aged 19–64 with tobacco use status documented in the EHR within 6 months prior to ACA Medicaid expansion and ≥ 1 visit with tobacco use status assessed within 24 months post-expansion (January 1, 2014 to December 31, 2015). We propensity score matched these patients to tobacco users from 108 CHCs in six non-expansion states ($n = 27\,670$ matched pairs; 55 340 patients). Using a retrospective observational cohort study design, we compared odds of having a quit status, cessation medication ordered, and ≥ 6 visits within the post-expansion period among patients in expansion versus non-expansion states.

Results: Patients in expansion states had increased adjusted odds of quitting (adjusted odds ratio [aOR] = 1.35, 95% confidence interval [CI]: 1.28–1.43), having a medication ordered (aOR = 1.53, 95% CI: 1.44–1.62), and having ≥ 6 follow-up visits (aOR = 1.34, 95% CI: 1.28–1.41) compared to patients from non-expansion states.

Conclusions: Increased access to insurance via the ACA Medicaid expansion likely led to increased quit rates within this vulnerable population.

Implications: CHCs care for vulnerable patients at higher risk of tobacco use than the general population. Medicaid expansion via the ACA provided insurance coverage to a large number of tobacco users not previously Medicaid-eligible. We found that expanded insurance coverage was associated with increased cessation assistance and higher odds of tobacco cessation. Continued provision of insurance coverage could lead to increased quit rates among high-risk populations, resulting in improvements in population health outcomes and reduced total health care costs.

Introduction

Reducing tobacco-related disparities remains a public health challenge in the United States.^{1,2} Vulnerable populations, including those of lower socioeconomic status and the uninsured, have significantly higher rates of tobacco use than the general population.³ Individuals without health insurance coverage for cessation services also have a lower likelihood of receiving cessation assistance and fewer quit attempts compared to insured individuals.⁴⁻⁶ Recent national policies aimed to address these inequalities,^{1,2,7} including the passage of the Patient Protection and Affordable Care Act (ACA) in 2010.

The ACA supported states in expanding Medicaid eligibility to adults with incomes $\leq 138\%$ of the federal poverty level (FPL). Further, the ACA mandated that tobacco cessation assistance be covered without cost-sharing for new ACA-eligible Medicaid enrollees; however, this was not mandated for beneficiaries with traditional, pre-expansion Medicaid coverage.⁸ As of January 2014, 25 states opted to expand Medicaid via the ACA,⁹ which produced a natural policy experiment in which some states expanded Medicaid and others did not; over time, additional states decided to expand their Medicaid programs as well. As of December 2015, the ACA expansion made tobacco cessation coverage available to approximately 2.3 million adult smokers not eligible for Medicaid pre-expansion.¹⁰

Several cross-sectional studies using national survey data have shown that insurance coverage is associated with increased tobacco cessation assistance and higher quit rates.^{4,5,11} This retrospective observational cohort study sought to confirm these relationships using longitudinal electronic health record (EHR) data from a multi-state network of community health center (CHC) clinics. These settings are important to study given that the majority of patients are uninsured or Medicaid recipients with higher rates of tobacco use than the general population. We tested the hypothesis that after ACA Medicaid expansions, tobacco users residing in Medicaid expansion states would have higher odds of tobacco cessation and a cessation medication ordered, and increased primary care utilization, compared with tobacco users in non-expansion states.

Methods

Data Sources

We used EHR data from the Accelerating Data Value Across a National Community Health Center Network (ADVANCE) Clinical Data Research Network (CDRN).^{12,13} The ADVANCE CDRN's data warehouse integrates outpatient EHR data from several data networks.¹⁴ This study used CHC data from the OCHIN network and the Health Choice Network (HCN).

Study Setting and Population

We included primary care CHCs "live" on their EHR as of January 1, 2013 ($n = 219$ CHCs) in 10 states that had expanded Medicaid eligibility to $\leq 138\%$ of the federal poverty level for all adults including those without dependent children as of January 1, 2014 (California, Hawaii, Maryland, Minnesota, New Mexico, Ohio, Oregon, Rhode Island, Washington, and Wisconsin) and 108 CHCs in six non-expansion states (Florida, Kansas, Missouri, North Carolina, Texas, and Montana). We included Wisconsin as an expansion state because, although they did not expand Medicaid to 138% FPL, they opened enrollment to adults with eligibility criteria of 100% FPL and therefore behaved more like an expansion than a non-expansion state.^{15,16} We included Montana as a non-expansion state because

they did not expand Medicaid until after the end of our study period (expanded January 1, 2016). Our designation of states as expansion versus non-expansion are similar to other studies that examined Medicaid coverage expansions and tobacco cessation.^{17,18}

Patient Population

We identified all patients aged 19–64 in Medicaid expansion states who had ≥ 1 visit to a study CHC in the 24 months prior to Medicaid expansion (January 1, 2014), whose most current tobacco status during this time period was "tobacco user" (pre-period), and who had ≥ 1 visit in the 24 months post-ACA with ≥ 1 documented tobacco status assessment (post-period: January 1, 2014 to January 1, 2015). We excluded patients without post-expansion tobacco assessments ($n = 37\,374$) or documented sex ($n = 563$). We excluded pregnant women ($n = 93\,030$) as rates of care utilization and cessation treatment recommendations differ for this subgroup. After exclusions, 41% of remaining patients ($n = 295\,220$) had a tobacco assessment in the 24-month pre-expansion period and of those 32% ($n = 94\,045$) were current tobacco users in their final pre-expansion assessment. We propensity score matched these patients to tobacco users with the same inclusion criteria from non-expansion states.

Variables

Outcomes

The EHR presents a discrete data field for tobacco use status at each primary care encounter, which can be confirmed, updated, or not reviewed. If confirmed or updated, the date is saved. Our primary outcome was tobacco cessation ("quit") during the post-period, coded as a binary yes/no variable. Using methods similar to prior EHR-based studies,^{11,19–22} a person was identified as "quit" if the last recorded tobacco-use status during the pre-period indicated that the patient was a current user, and if there was at least one subsequent measurement documented in the post-period that indicated the patient's status was a "nonuser" (eg, former user, not a current user). We extracted the following tobacco cessation medications from EHR medication orders: bupropion, varenicline, and all nicotine replacement products; as a proxy for utilization of care, we extracted data on the number of post-period office visits per patient (≥ 6 vs. < 6 visits) based on previous studies.^{11,23}

Independent Variable

Our independent variable was Medicaid expansion status: patients from CHCs in states that expanded versus not.

Patient Characteristics

EHR data from the *pre-period* were used to extract the following patient characteristics: sex, age, race/ethnicity, household income as percent of FPL, location of patient's primary clinic (urban/rural), insurance status at the majority of visits, cessation medication order (y/n), and the following medical comorbidities associated with tobacco use (including total number): diabetes, coronary artery disease, hyperlipidemia, chronic obstructive pulmonary disease or asthma, hypertension, substance use disorder (excluding tobacco use disorder), and diagnosis of any of the following psychiatric disorders: anxiety disorders and post-traumatic stress disorder, schizophrenia, and other psychosis disorders, depressive disorders, and bipolar disorder. Comorbidities were ascertained using International Classification of Diseases (ICD)-9/10 codes classified using the Chronic Condition Data Warehouse classification algorithm (<https://www.ccwdata.org/web/guest/condition-categories>).

Analysis

We considered an observational cohort propensity score matched study instead of a patient-level difference-in-difference approach for two reasons: 1) given the time-varying nature of quit attempts among smokers, a patient-level difference-in-difference analysis would have to manage a changing at-risk population over time which is not easily interpretable; 2) given that the ACA was not a randomized experiment, by selecting current smokers around ACA implementation and matching them across expansion status, we are emulating a target trial that would have tested the impact of Medicaid expansion on quit attempts.²⁴

PS Matching

Propensity Score (PS) matching was used to balance confounders between expansion groups and reduce bias,²⁵ as expansion and non-expansion patients differed on multiple characteristics. To perform the propensity score matching we used the procedure from the “matchit” package in R. We first fit a logistic regression model for expansion state residence controlling for all patient characteristics listed above. We did not include data network (OCHIN vs. HCN) as a covariate. While this would have allowed matching to take place within and between data networks to achieve the most balanced patient-level covariate distributions, each network tended to be centered in expansion or non-expansion states and forcing a match within the network would greatly reduce the matched sample. We utilized this model to estimate the probability of being in the expansion state group for each patient. To match expansion to non-expansion patients, we used the “nearest neighbor method” with a 0.1 SD caliper where each treatment unit (expansion state resident) is matched to one control unit (non-expansion state resident) at random within the number of standard deviations of the propensity score designated by the caliper going in descending order of the PS of the expansion state residents.²⁶ Two central assumptions when using PS is covariate balance and the existence of common support (overlapping distributions of PS between expansion and non-expansion groups). To assess covariate balance before and after matching, we computed standardized differences as they are not unduly influenced by large sample sizes.²⁷ We considered covariates with absolute standardized difference ≥ 0.1 in the PS-matched sample to have residual imbalance and controlled for these by including them in the regression models.^{28,29} To assess common support, we produced a box plot and density plots portraying the PS distributions for expansion and non-expansion group and found it to have good overlap (Supplementary Appendix Figures 1 and 2). We restricted the analysis to the range of common support and thus the final study sample included 27 670 matched pairs (55 340 patients). To evaluate the robustness of study findings to the PS-matched approach, a sensitivity analysis was performed replacing PS-matched analyses with an inverse probability of treatment weighting (IPTW) analysis which is a similar statistical approach where patients are weighted by the inverse of the probability of being sampled from the treatment (ie, expansion) group. This modeling strategy estimates the average treatment effect, at the population level, of moving from the non-expansion group to the expansion group.

Logistic Generalized Estimating Equation Regression

Using the PS-matched sample, we computed adjusted odds ratios (aOR) of quitting tobacco use, having a cessation medication ordered, and having ≥ 6 follow-up visits using logistic

generalized estimating equation (GEE) regression models to control for imbalanced covariates and to account for the clustering of patients within CHCs. GEE models included variables with absolute standardized difference ≥ 0.1 ²⁷ and we controlled for data network (OCHIN vs. HCN) to address potential confounding due to differences in outcome prevalences across networks and to account for the higher-level clustering of CHCs within network.

Heterogeneity of ACA Effects

To assess heterogeneity of ACA effects on quit rates by primary care utilization, interactions between ACA expansion status and post-period utilization were added to the model. A similar approach was used for medication order status, percent of FPL at baseline, and insurance status at baseline. All GEE models assumed a compound symmetry correlation structure and applied a robust sandwich variance estimator to account for possible misspecification.³⁰ Analyses were conducted using R v.3.3.3. The study was approved by the Oregon Health and Science University Institutional Review Board.

Results

Table 1 displays the characteristics of the patients who reported being tobacco users at baseline, by the original sample and the PS-matched sample. Overall, patients in the PS-matched sample were predominantly female, in households earning $\leq 138\%$ of the FPL, and received care in urban CHCs. Almost half of the sample was non-Hispanic white and more than half had ≥ 1 comorbidity. Overall, among the PS-matched sample, rates of transitioning from a tobacco user in the pre-period to quit in the post-period were 25% for those in expansion states versus 19% in non-expansion states (Supplementary Appendix Table 1).

Table 2 presents aORs for quit status, tobacco cessation medication orders, and primary care utilization over 24 months by expansion status. Patients in expansion states had 35% increased odds of quitting compared to patients from non-expansion states (aOR = 1.35, confidence interval [CI] = 1.28–1.43). The odds of having a medication ordered were 53% higher for patients in expansion states compared to the non-expansion sample (aOR = 1.53, 95% CI = 1.44–1.62), and expansion state patients had 34% higher odds of having ≥ 6 follow-up visits than the non-expansion state patients (aOR = 1.34, 95% CI = 1.28–1.41).

Figure 1 presents heterogeneity of the relationship between expansion group and quit status by post-period primary care utilization, cessation medication ordered in the post-period, percent of FPL at baseline and insurance status at baseline. Among patients with a cessation medication ordered, those from expansion states had 65% higher odds of quitting compared to those from non-expansion states (aOR = 1.65, 95% CI = 1.48–1.84); the odds of quitting among those without a cessation medication ordered were 29% higher for patients in expansion versus non-expansion states. For patients in Medicaid expansion states, the odds of quitting were higher regardless of follow-up visit numbers or percent of FPL at baseline, compared to those in non-expansion states. Among patients who were uninsured at baseline, those in expansion states had 51% higher odds of quitting than those from states that did not expand (aOR = 1.51, 95% CI = 1.39–1.64); the odds of quitting among those that were insured at baseline were also higher for patients in expansion versus non-expansion states, although of lesser magnitude (aOR = 1.29, 95% CI = 1.21–1.37).

Table 1. Characteristics of Study Sample of CHC Patients Who Reported Being Current Tobacco Users at Baseline

	Original sample			Propensity score matched comparison sample		
	Expansion (N = 62 164) n (%)	Non-expansion (N = 31 881) n (%)	ASMD	Expansion (N = 27 670) n (%)	Non-expansion (N = 27 670) n (%)	ASMD
Sex: male	29 439 (47.4)	13 764 (43.2)	0.084	12 986 (46.9)	12 239 (44.2)	0.054
Age (baseline date)			0.129			0.055
19–39	24 483 (39.4)	10 776 (33.8)		7480 (27.0)	7329 (26.5)	
40–49	16 366 (26.3)	8422 (26.4)		11 086 (40.1)	10 530 (38.1)	
50–62	21 315 (34.3)	12 683 (39.8)		9104 (32.9)	9811 (35.5)	
Race/ethnicity			0.470			0.115
Non-Hispanic white	40 387 (65.0)	14 531 (45.6)		12 682 (45.8)	13 810 (49.9)	
Hispanic ^a	8529 (13.7)	6749 (21.2)		5796 (20.9)	5445 (19.7)	
Non-Hispanic black	8987 (14.5)	9102 (28.5)		7218 (26.1)	7038 (25.4)	
Non-Hispanic other	2206 (3.5)	469 (1.5)		795 (2.9)	464 (1.7)	
Missing/unknown	2055 (3.3)	1030 (3.2)		1179 (4.3)	913 (3.3)	
Household income (% of FPL)			0.157			0.145
≤138%	45 295 (72.9)	25 257 (79.2)		19 606 (70.9)	21 345 (77.1)	
>138%	7416 (11.9)	3251 (10.2)		3675 (13.3)	3007 (10.9)	
Missing/unknown	9453 (15.2)	3373 (10.6)		4389 (15.9)	3318 (12.0)	
Urban	37 740 (60.7)	25 179 (79.0)	0.406	20 075 (72.6)	21 065 (76.1)	0.082
Insured at Baseline	51 102 (82.2)	19 885 (62.4)	0.454	18 345 (66.3)	18 893 (68.3)	0.042
Diabetes	8597 (13.8)	4211 (13.2)	0.018	4724 (17.1)	3814 (13.8)	0.091
Hypertension	21 034 (33.8)	8641 (27.1)	0.147	9909 (35.8)	8128 (29.4)	0.138
CAD	2348 (3.8)	1013 (3.2)	0.033	1301 (4.7)	953 (3.4)	0.064
Hyperlipidemia	17 661 (28.4)	7286 (22.9)	0.128	8010 (28.9)	6785 (24.5)	0.100
Asthma/COPD	15 162 (24.4)	5502 (17.3)	0.176	6111 (22.1)	5257 (19.0)	0.076
No. of Medical Comorbidities			0.189			0.178
0	26 150 (42.1)	16 277 (51.1)		10 866 (39.3)	13 273 (48.0)	
1–2	28 275 (45.5)	12 721 (39.9)		13 331 (48.2)	11 626 (42.0)	
3–5	7739 (12.4)	2883 (9.0)		3473 (12.6)	2771 (10.0)	
Psychiatric diagnosis	47 480 (76.4)	18 991 (59.6)	0.366	18 286 (66.1)	17 910 (64.7)	0.029
Substance use disorder	14 843 (23.9)	3573 (11.2)	0.338	4557 (16.5)	3535 (12.8)	0.105

CHC = Community health center; ASMD = Absolute Standardized Mean Difference; FPL = Federal Poverty Level; CAD = Coronary Artery Disease; COPD = Chronic Obstructive Pulmonary Disease. Bold denotes imbalance between expansion groups as defined by an absolute standardized difference ≥ 0.1 . These variables were included in outcome models to address residual imbalance. Propensity scores were estimated using logistic regression and included the following variables: sex, age at baseline, insurance status at baseline, racial/ethnic group, percent $\leq 138\%$ of FPL, community health center (CHC) location, number of comorbidities, and diagnosis of: diabetes, coronary artery disease, hypertension, lipid disorder, COPD/asthma, psychiatric disorder (anxiety disorders and post-traumatic stress disorder, schizophrenia and other psychosis disorders, depressive disorders, and bipolar disorder), and substance use disorder excluding tobacco use disorder.

^aIncludes Spanish language speakers regardless of recorded ethnicity.

Table 2. Adjusted Odds Ratios for Tobacco Cessation Assistance, Primary Care Utilization, and Quit Status Over 24 Months Comparing Patients in Medicaid Expansion vs. Non-expansion States

Outcome	Expansion group	Odds ratio	95% CI	p-value
Quit attempt	Non-expansion	Ref		
	Expansion	1.35	1.28–1.43	<.001
Tobacco cessation medication ordered	Non-expansion	Ref		
	Expansion	1.53	1.44–1.62	<.001
Had ≥ 6 follow-up visits	Non-expansion	Ref		
	Expansion	1.34	1.28–1.41	<.001

CI = confidence interval. Using the PS-matched sample, we computed adjusted odds ratios (aOR) of quitting tobacco use, having a cessation medication ordered, and having ≥ 6 follow-up visits using logistic generalized estimating equation (GEE) regression models to control for imbalanced covariates and to account for the clustering of patients within community health centers (CHCs). Covariates included in the matching procedure included: sex, age at baseline, insurance status at baseline, race/ethnicity, federal poverty level (FPL) % (indicator for being above or below 138%), urbanicity of residence, diabetes diagnosis, CHD diagnosis, hypertension diagnosis, lipid disorder diagnosis, COPD/asthma diagnosis, number of conditions, psychiatric disorders, and substance abuse disorders.

Figure 1. Heterogeneity of ACA effects: adjusted odds ratios for quit status over 24 months comparing Medicaid expansion vs. non-expansion states (reference group) stratified by medication ordered, follow-up visits, percent of federal poverty level, and insurance status at baseline. *Note:* ACA= Affordable Care Act, LCL = lower confidence limit of the 95% confidence interval, UCL = upper confidence limit of the 95% confidence interval, CI = confidence interval. Odds ratios were estimated using GEE models accounting for clustering of patients at the clinic level and performed on propensity score matched sample. To assess heterogeneity of ACA effects on quit rates by clinic utilization, interactions between ACA expansion status and post-period utilization were added to the model. A similar approach was used for medication order status, federal poverty level at baseline and insurance at baseline. All models included a fixed-effect indicator for network site (OCHIN vs. HCN) to account for the higher-level clustering of CHC within network.

The sensitivity analyses using IPTW logistic regression in lieu of PS-matched logistic regression showed qualitatively similar relationships between expansion status and the outcomes of quit status, medications ordered, and primary care utilization ([Supplementary Appendix Table 2](#)).

Discussion

This is the first study to use EHR data from CHCs to evaluate the impact of ACA Medicaid expansion on tobacco cessation and assistance. In the 24-month follow-up period, patients from Medicaid expansion states had higher odds of having a cessation medication ordered, more follow-up visits, and higher odds of quitting compared with those in non-expansion states.

The ACA expansion resulted in insurance coverage for millions of US adults not previously Medicaid-eligible.¹⁰ Access to this new insurance coverage option for tobacco users in ACA Medicaid expansion states, compared to non-expansion states,^{15,31,32} likely led to both increased access to cessation medications and primary care services which, in turn, resulted in improved quit rates

among these patients. Although we were unable to ascertain cessation counseling or referrals from the data, we hypothesize that part of the reason for the increased quit rates was improved opportunities for tobacco cessation counseling services offered during visits.

Our findings are similar to two recent studies that used pooled, cross-sectional survey data to examine changes in smoking rates among low-income adults in expansion and non-expansion states. These studies reported an increase in cessation among persons without dependent children who were current or former smokers in expansion states compared to those in non-expansion states^{17,18}; however, analyses that examined changes in smoking rates overall (not limited to childless adults) did not find significant differences in cessation rates.^{18,33} This is not surprising given that low-income adults without dependent children are the population most likely to benefit from the Medicaid expansion. We were unable to determine if our patients were parents of dependent children. Yet, these previous studies suggest that limiting our sample to patients without children would have resulted in even greater differences between the expansion and non-expansion states.

This study indicates that access to Medicaid, along with improved coverage for tobacco treatment among newly eligible patients, increased primary care utilization, and access to tobacco cessation assistance. These findings are consistent with those from a recent study among a cohort of patients newly enrolled in healthcare after ACA implementation that found patients with Medicaid who smoke had greater odds of tobacco treatment than patients with commercial insurance.³⁴ Given the longstanding impacts of tobacco use on mortality and morbidity, increased quit rates among high-risk populations could have major benefits on population health outcomes and reduce total health care costs.³⁵

Limitations

We only had follow-up tobacco status for patients who had a return clinic visit, and therefore, we cannot determine the quit status of non-returning patients. We also were unable to ascertain the duration of tobacco cessation. We observed larger quit rates in one data network compared to the other (data not shown) for both expansion and non-expansion states; however, we adjusted for this in our models to account for the difference. Although we used PS-matching to balance a range of baseline factors, there could be residual confounding due to unmeasured variables accounting for the observed differences. We might not have captured the use of nicotine replacement therapy that does not require a prescription. We also were unable to assess if bupropion was prescribed for tobacco cessation or depression; however, all patients in the study sample were current tobacco users and our models controlled for depressive disorders. We did observe a small to moderate amount of missing data on race/ethnicity and FPL, though enough to include these patients by creating missing data categories in our modeling. Another limitation is the lack of consensus on the best propensity score matching approach, which could impact the results. Our sensitivity analysis using IPTW showed qualitatively similar results mitigating concerns about the results being driven by methodology alone. Future research could replicate these findings using alternative methods, including difference-in-differences methodologies. Lastly, we were unable to examine different types of tobacco use; however, we assume that, as with the general population, the majority were cigarette smokers.³⁶

Conclusions

Patients seen in CHCs from ACA Medicaid expansion states had increased odds of tobacco cessation over 24 months of follow-up than those from non-expansion states. These findings suggest that increasing Medicaid access can lead to a substantial decrease in tobacco use rates among vulnerable populations, thus reducing tobacco-related disparities.

Supplementary Material

Supplementary data are available at *Nicotine and Tobacco Research* online.

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Declaration of Interests

None declared.

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