Community Health Center Use After Oregon's Randomized Medicaid Experiment

Jennifer E. DeVoe, MD, DPhil[1,2]
Miguel Marino, PhD[1,3]
Rachel Gold, PhD, MPH[2,4]
Megan J. Hoopes, MPH[2]
Stuart Cowburn, MPH[2]
Jean P. O'Malley, MPH[3]
John Heintzman, MD[1]
Charles Gallia, PhD[5]
K. John McConnell, PhD[6]
Christine A. Nelson, PhD, RN[2]
Nathalie Huguet, PhD[1]
Steffani R. Bailey, PhD[1]

[1]Oregon Health & Science University, Department of Family Medicine, Portland, Oregon

[2]OCHIN, Inc, Portland, Oregon

[3]Department of Public Health and Preventive Medicine, Division of Biostatistics, Oregon Health & Science University, Portland, Oregon

[4]Kaiser Permanente Northwest Center for Health Research, Portland, Oregon

[5]Office of Health Analytics, Oregon Health Authority, Portland, Oregon

[6]Center for Health System Effectiveness, Department of Emergency Medicine, Oregon Health & Science University, Portland, Oregon

MORE ONLINE
www.annfammed.org

Conflicts of interest: authors report none.

CORRESPONDING AUTHOR

Steffani R. Bailey, PhD
Department of Family Medicine
Oregon Health and Science University
3181 SW Sam Jackson Park Rd
Mailcode: FM
Portland, OR 97239
bailstef@ohsu.edu

ABSTRACT

PURPOSE There is debate about whether community health centers (CHCs) will experience increased demand from patients gaining coverage through Affordable Care Act Medicaid expansions. To better understand the effect of new Medicaid coverage on CHC use over time, we studied Oregon's 2008 randomized Medicaid expansion (the "Oregon Experiment").

METHODS We probabilistically matched demographic data from adults (aged 19-64 years) participating in the Oregon Experiment to electronic health record data from 108 Oregon CHCs within the OCHIN community health information network (originally the Oregon Community Health Information Network) (N = 34,849). We performed intent-to-treat analyses using zero-inflated Poisson regression models to compare 36-month (2008-2011) usage rates among those selected to apply for Medicaid vs not selected, and instrumental variable analyses to estimate the effect of gaining Medicaid coverage on use. Use outcomes included primary care visits, behavioral/mental health visits, laboratory tests, referrals, immunizations, and imaging.

RESULTS The intent-to-treat analyses revealed statistically significant differences in rates of behavioral/mental health visits, referrals, and imaging between patients randomly selected to apply for Medicaid vs those not selected. In instrumental variable analyses, gaining Medicaid coverage significantly increased the rate of primary care visits, laboratory tests, referrals, and imaging; rate ratios ranged from 1.27 (95% CI, 1.05-1.55) for laboratory tests to 1.58 (95% CI, 1.10-2.28) for referrals.

CONCLUSIONS Our results suggest that use of many different types of CHC services will increase as patients gain Medicaid through Affordable Care Act expansions. To maximize access to critical health services, it will be important to ensure that the health care system can support increasing demands by providing more resources to CHCs and other primary care settings.

Ann Fam Med 2015;13:312-320. doi: 10.1370/afm.1812.

INTRODUCTION

The Patient Protection and Affordable Care Act (ACA) created health insurance coverage options for millions of people in the United States.[1-3] It is predicted that ACA insurance expansions will lead to increased demand for primary care services by those gaining coverage.[4-6] Community health centers (CHCs) currently provide primary care and other critical services to many uninsured patients likely to be affected by the ACA. For example, in 2012, CHCs provided care to an estimated 21 million patients; 36% of these patients were uninsured and 40% were covered by Medicaid.[7] It is unknown whether ACA expansions will affect use of CHCs. Some postulate that individuals who gain Medicaid will increase their use of CHCs, contrary to other assumptions that the newly insured will go elsewhere.[8-13]

Predictions of individuals' increased health care demand after gaining insurance are based on studies showing an association between coverage and better access to health care.[14] Most of these previous studies examined coverage gains that occurred as a result of major life changes (eg, aging, dis-

ability, new job).[15-17] Other studies attempted to isolate the effect of gaining insurance by assessing "natural policy experiments" in which individuals gained coverage because of a policy change, rather than a potentially confounding life event.[9,18-22] For example, studies of Massachusetts' 2006 expansions found that patients who gained coverage used ambulatory care services at higher rates postcoverage.[9,19-21] This body of quasiexperimental research is based on the assumption that the observed changes in outcomes are caused by a change in insurance status and not due to unmeasured confounding variables.[23] Assessing persons randomly assigned to an intervention leading to insurance coverage (or no coverage) would yield stronger data for establishing causality, but it is nearly impossible to design such a study.[24-26]

The "Oregon Experiment" provides a rare opportunity to assess causality within an insurance intervention.[26-30] In 2008, the Oregon Health Plan (OHP) reopened enrollment for its expansion Medicaid program (OHP Standard), seeking to enroll 10,000 noncategorically eligible adults (ie, persons not meeting federally mandated eligibility criteria). OHP Standard had been closed to new enrollment since 2004, so it was anticipated that demand for enrollment would exceed the allocated budget. Uninsured, low-income adults were encouraged to put their names on a "reservation list." From this list, there were 8 random drawings; individuals selected in these drawings were invited to apply for OHP coverage. The reservation list included more than 90,000 names; approximately 30,000 people were randomly selected to apply, and approximately 10,000 were enrolled.[30] Detailed information about the Oregon Experiment is available elsewhere.[26-28,30]

Early studies of the Oregon Experiment found increased demand for primary care services among patients who gained coverage based on respondents' self-reported use and receipt of care.[26,28] To confirm these findings and specifically quantify the effect of gaining Medicaid coverage on use of CHCs, we analyzed electronic health record (EHR) data from 108 CHCs to examine CHC use among more than 30,000 patients during the initial 36 months after the Oregon Experiment. These data allow us to retrospectively capture postintervention data directly from a patient's medical record without risk of biases inherent in self-report (eg, recall bias, nonresponse bias).[31-35] This is the first study to directly examine CHC use among Oregon Experiment participants.

METHODS

Data Sources

OCHIN (originally the Oregon Community Health Information Network, but shortened to OCHIN when membership expanded beyond Oregon) supports more than 300 CHC sites in 20 states by providing a centrally hosted EHR.[36,37] We used EHR data from the 108 CHC sites in Oregon that were part of the OCHIN practice-based research network in 2007-2011. State administrative data were used to identify OCHIN CHC patients on the reservation list; Oregon's Medicaid enrollment data were used to determine periods of Medicaid coverage.

Study Population

We used Link Plus software (Centers for Disease Control and Prevention)[38] and demographic variables common to both data sets to probabilistically match 100,407 individuals on the reservation list to all 515,575 patients in the OCHIN database (Figure 1). Two research staff (S.R.B. and another staff member) independently validated matches and performed case-by-case review of uncertain matches. We identified 35,411 matched individuals, 13,422 of whom were selected to apply for coverage, and 21,989 of whom were not selected. To preserve randomization, individuals were not required to have a visit during the study period and we applied minimal exclusions: we excluded patients aged younger than 19 years (26 patients) and older than 64 years (404 patients), patients not alive at the end of the postselection period (130 patients), and those with unknown sex (2 patients). Our final study population consisted of 34,849 patients: 13,219 selected to apply for coverage and 21,630 not selected.

Analytic Approach

Random selection to apply for Medicaid coverage occurred through drawings held between March 2008 and October 2008. Individuals on the reservation list were not screened for eligibility before the randomization. If selected, an individual was invited to complete an application that was used to determine eligibility; thus, some selected individuals were deemed ineligible to receive coverage via the Experiment or did not return the application after randomization.[30] Among selected individuals, coverage "start dates" were retroactively assigned as the date of selection notification (the selection date). Persons not selected to apply for coverage were randomly assigned a 2008 selection date based on the distribution of selection dates among those selected to apply.

To preserve the randomization, we first conducted an intent-to-treat (ITT) analysis comparing use between patients randomly selected to apply for Medicaid coverage vs those not selected. This analysis included all patients regardless of whether those selected to receive the "treatment" (ie, insurance coverage) actually received it. The ITT analysis maintains covariate bal-

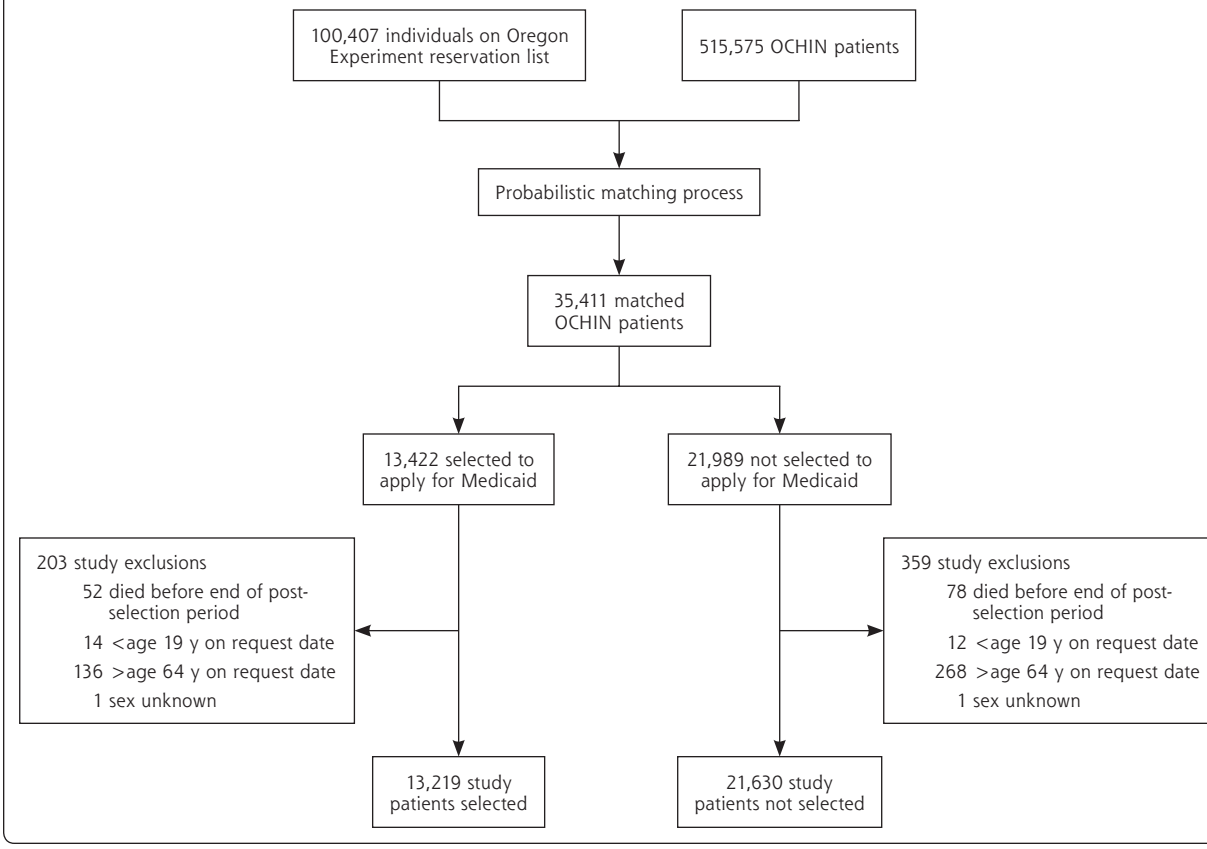
ance generated from the random selection and limits inferences based on arbitrary subgroups of patients in the trial.[39] A substantial number of individuals randomly selected in the Oregon Experiment did not actually gain Medicaid coverage, however. Because our primary interest was to estimate the effect of actually gaining Medicaid on health care use, we considered 2 analytic techniques: an effect of treatment on the treated (ETOT) approach and an instrumental variable (IV) approach. The ETOT approach is conducted in many randomized trials but has limitations because of bias introduced when treated and nontreated groups differ. The IV approach was developed as a more valid way to address some of those limitations and is preferred when appropriate "instrument(s)" can be identified. The IV approach is designed to provide unbiased, consistent estimates when unobservable factors are present and correlated with the treatment and outcome variable. The benefit of the IV approach is that, if its assumptions hold, it provides a causal estimate of gaining Medicaid on use, as opposed to a measure of association.[40]

Fortunately, we were able to identify 2 valuable instruments for conducting an IV analysis in this study: random selection to apply for Medicaid and having any Medicaid coverage in the 12 months before selection. The treatment variable was having at least 6 months of continuous Medicaid coverage in the postselection period starting from the selection date. Because the IV analysis is a stronger methodologic approach than the ETOT analysis, we include the methods and results of the IV analysis here. (ETOT findings are given in Supplemental Appendix Tables 1 and 2, available at http://www.annfammed.org/content/13/4/312/suppl/DC1.)

Use Outcomes

We measured rates of use of CHC services in the 36 months after the selection date (the postselection period). The use outcomes were primary care office visits, behavioral/mental health visits, laboratory tests, referrals, immunizations, and imaging. Laboratory tests, referrals, immunizations, and imaging were identified using standard procedure codes (eg, Current Procedural Terminology) and groupers that categorize data and inform quality performance assessments in the OCHIN EHR.[10,41] Not all clinics had the EHR capability to designate behavioral/mental health visits; therefore, these analyses were limited to the subset of 33 clinics with the behavioral/mental health indicator.

Figure 1. Study population flow diagram.



Covariates

We used EHR data to obtain patient age, sex, race/ethnicity, household income, and baseline health status. Patients' household income was collected at visits as percent of federal poverty level; we created a composite federal poverty level based on the average from visits wherein this information was collected. To measure baseline health status, we assessed diagnosis of 5 chronic conditions—asthma, coronary artery disease, diabetes, dyslipidemia, and hypertension—before each patient's selection date using standard code sets as part of EHR Meaningful Use criteria[42] or the Healthcare Effectiveness Data and Information Set (HEDIS).[43] A patient was considered to have a given condition if a qualifying diagnosis code appeared on the problem list or in at least 2 encounters before the selection date.

Statistical Methods

ITT Analyses

We first described and assessed differences between those randomly selected and not selected, using χ^2 tests for categorical variables and 2-sample *t* tests for continuous variables. Next, we conducted ITT analyses, comparing use in the 36-month postselection period between the selected and nonselected groups. To better model the distribution of the use count data, we considered several regression models. The Vuong test[44] suggested that the zero-inflated Poisson (ZIP) models[45] provide a better fit to the data than standard Poisson regression, owing to the number of zeroes and data dispersion. These ZIP models were adjusted for baseline covariates that differed significantly between selection groups. We calculated rate ratios between the groups and monthly outcome rates per 1,000 patients. Robust clustered sandwich estimators of the variance[46,47] were used to estimate rate ratio confidence intervals to correct for clustering of patients within CHCs.

IV Analyses

Many people randomly selected to apply did not submit an application. Further, as eligibility for Medicaid was not determined until after an individual had been selected and submitted a full application, some people on the reservation list did not meet income requirements or already had Medicaid coverage, making them ineligible to obtain coverage via the Oregon Experiment. To address these potential issues, we used IV analyses to estimate the causal effect of gaining Medicaid coverage on CHC use during the 36-month period after random selection. To be considered valid instruments,[48] variables must be associated with Medicaid coverage, but must not be associated with the use outcome *except* through its effect on Medicaid coverage. Under these criteria, we used 2 IVs that met the standards for valid instruments: (1) selection status in the Oregon Experiment (randomly selected to apply, or not) and (2) Medicaid coverage status in the 12 months before selection (any or none). Both of these variables were strongly associated with postselection period coverage, but neither would be expected to be directly associated with postselection period use except through their association with postselection period coverage. For consistency and because the Vuong test suggested a ZIP model to be a better fit for the use outcomes, we used 2-stage residual inclusion IV models[49] instead of 2-stage ordinary least-squares IV models as the former have shown to be more consistent and less biased for complex models such as the ZIP model.[50] The 2-stage residual inclusion models controlled for age and race/ethnicity. The validity of the instruments was tested using an overidentification test.[51] We used bootstrapping with 2,000 repetitions clustered by CHC[52] to obtain confidence intervals for the rate ratio estimates accounting for clustering of patients within CHC. All statistical tests were 2-sided, and statistical significance was defined as a *P* value less than .05. Statistical analyses were performed using SAS version 9.3 (SAS Institute Inc) and Stata version 12.1 (StataCorp). This study was approved by the institutional review board at Oregon Health & Science University.

RESULTS

Demographics

The majority of study patients were female (57.8%), were non-Hispanic white (65.3%), and had a household income of less than 100% of the federal poverty level (62.2%) (Table 1). The selected and nonselected groups differed significantly with respect to race/ethnicity and categorical age; however, the percentage differences were relatively small.

Ultimately, 39.8% of the selected group gained Medicaid coverage, compared with 10.1% of the nonselected group.

ITT Analyses

In adjusted ITT analyses, compared with nonselected patients, patients selected to apply had significantly lower rates of behavioral/mental health visits (adjusted rate ratio [aRR] = 0.89; 95% CI, 0.81-0.99) and higher rates of referral (aRR = 1.18; 95% CI, 1.02-1.35) and imaging (aRR = 1.08; 95% CI, 1.01-1.16) in the 36-month postselection period (Table 2). The 2 groups did not differ significantly with respect to primary care office visits, laboratory tests, and immunizations.

IV Analyses

Table 3 displays the causal effects of gaining Medicaid coverage on CHC use in the 36-month postselection period, estimated by the IV approach. The 2-stage residual inclusion model estimates indicated that participants who received Medicaid coverage had significantly more primary care office visits compared with those who did not, with 81 additional visits per 1,000 Medicaid-covered patients per month (aRR = 1.39; 95% CI, 1.16-1.66). The number of primary care office visits per month was 282 per 1,000 Medicaid-covered patients, compared with 201 for patients without such coverage. Medicaid coverage led to a 58% higher rate of referrals (aRR = 1.58; 95% CI, 1.10-2.28), with gastrointestinal and orthopedic referrals being the most common for both groups. Receipt of Medicaid coverage also resulted in a 27% higher rate of orders for laboratory tests (aRR = 1.27; 95% CI, 1.05-1.55) and a 33% higher imaging rate (aRR = 1.33; 95% CI, 1.07-1.64) in the 36-month postselection period. We found no significant effect of Medicaid coverage on behavioral/mental health visit rates and immunization rates.

Table 1. Demographic Characteristics of Study Sample by Selection Status (N = 34,849)

Characteristic	Selected, No. (%) (n = 13,219)	Not Selected, No. (%) (n = 21,630)	*P* Value[a]
Sex			.56
Female	7,639 (57.8)	12,431 (57.5)	
Male	5,580 (42.2)	9,199 (42.5)	
Age-group, y[b]			<.001
19-29	3,529 (26.7)	5,877 (27.2)	
30-39	3,212 (24.3)	4,831 (22.3)	
40-49	3,300 (25.0)	5,720 (26.4)	
50-59	2,574 (19.5)	4,209 (19.5)	
60-64	604 (4.6)	993 (4.6)	
Race/ethnicity			.004
Hispanic, any race	1,750 (13.2)	2,579 (11.9)	
Non-Hispanic, white	8,635 (65.3)	14,295 (66.1)	
Non-Hispanic, other	1,495 (11.3)	2,519 (11.7)	
Unknown	1,339 (10.1)	2,237 (10.3)	
Average federal poverty level[c]			.36
<100%	8,215 (62.2)	13,564 (62.7)	
≥100%	3,598 (27.2)	5,736 (26.5)	
Missing/unknown	1,406 (10.6)	2,330 (10.8)	
Number of chronic conditions[d]			.25
Missing/unknown	4,240 (32.1)	6,758 (31.2)	
0	7,075 (53.5)	11,547 (53.4)	
1	1,128 (8.5)	1,989 (9.2)	
2	509 (3.9)	859 (4.0)	
3	221 (1.7)	402 (1.9)	
4	43 (0.3)	69 (0.3)	
5	3 (0.02)	6 (0.03)	

Note: Oregon OCHIN patients selected to apply for health insurance coverage via Oregon Experiment compared with those patients not selected to apply.

[a] *P* values for χ^2 test.

[b] Mean (SD) age was 39.3 (12.1) years for selected patients vs 39.4 (12.2) years for nonselected patients; 2-sided Wilcoxon rank sum test *P* = .50.

[c] Values ≥1,000% of the federal poverty level (seen in less than 1% of patients) were set to missing.

[d] Diagnosed before selection date; among asthma, coronary artery disease, diabetes, dyslipidemia, and hypertension. Missing/unknown indicates that patient had no preselection date encounters from which to assess chronic condition diagnoses.

DISCUSSION

To better predict how use of CHC services might change after ACA Medicaid expansions, we studied primary care use over a 36-month period among a population of low-income adult CHC patients who gained coverage after Oregon expanded its Medicaid program in 2008. Consistent with previous studies of self-reported data from Oregon Experiment participants in general primary care settings,[26,53] our results suggest that use of primary care services in CHCs will increase when patients gain Medicaid through ACA insurance expansions. The fact that we found an increase in specialty services (referrals, imaging, laboratory tests) in CHCs among those who gained Medicaid insurance is promising because it suggests that as CHC patients gain insurance via the ACA, they will be able to access services that have been difficult to obtain while uninsured.[54,55]

Our findings have important implications. Accessible and appropriate primary care services are associated with improved health outcomes.[56-58] Insurance coverage acts interdependently with access to primary care to accomplish these outcomes.[59-61] Our analyses—and others—suggest that insurance expansions could lead to increased demand for services from CHCs and other primary care settings. To ensure these crucial services are available, CHCs and other primary care settings need more resources. One study projected the need for an estimated 52,000 additional primary care physicians by 2025, with 8,000 of those necessary just to meet the needs of patients newly covered under the ACA by 2020.[62] As in Massachusetts, if primary care services are not expanded to meet this need, patients who gain insurance coverage may seek emergency department care for primary

care–treatable conditions.[63] Primary care workforce shortages and other access barriers might help to explain the higher emergency department visit rates observed among those who gained Medicaid coverage in a prior Oregon Experiment study, compared with those who remained uninsured.[29]

Our findings strengthen observational evidence of positive associations between insurance coverage and increased access to primary care services.[10,14,64-66] Our use of EHR data enabled direct capture of care received, allowing us to overcome potential biases that can result when asking patients to recall services received.[34,35] The EHR data also provided information about services used during periods without health insurance, thus overcoming past limitations of analyzing insurance claims (billing) data, which only report use when a patient has insurance coverage.[67-69] The randomization component of Oregon's 2008 Medicaid expansion enabled us to examine both the effects of being selected to apply for Medicaid coverage (through the randomization process and ITT analyses) and the isolated effect of actually gaining Medicaid coverage (through the IV techniques).

Table 2. Intent-to-Treat Outcome Rates by Selection Group (Selected n = 13,219; Not Selected n = 21,630)

Outcome in Postselection Period	Unadjusted			Adjusted Rate Ratio (95% CI)
	Rate per 1,000 Patients/ Month (SE)	Absolute Difference in Rate	Rate Ratio (95% CI)	
Total primary care office visits[a]				
Selected[b]	235 (12)	–1	1.00 (0.93-1.08)	1.01 (0.94-1.09)
Not selected (ref)	236 (17)	–	1.00	1.00
Total behavioral/mental health visits[c]				
Selected	201 (28)	–31[d]	0.87 (0.79-0.94)[d]	0.89 (0.81-0.99)[d]
Not selected (ref)	232 (29)	–	1.00	1.00
Total laboratory tests[e]				
Selected	342 (28)	–13	0.96 (0.88-1.05)	0.97 (0.89-1.05)
Not selected (ref)	355 (39)	–	1.00	1.00
Total referrals[f]				
Selected	45 (9)	+5	1.14 (0.95-1.37)	1.18 (1.02-1.35)[d]
Not selected (ref)	40 (6)	–	1.00	1.00
Total immunizations[g]				
Selected	57 (4)	–2	0.97 (0.93-1.01)	0.98 (0.94-1.03)
Not selected (ref)	59 (4)	–	1.00	1.00
Total imaging studies[h]				
Selected	43 (3)	+2	1.06 (0.99-1.13)	1.08 (1.01-1.16)[d]
Not selected (ref)	41 (2)	–	1.00	1.00

CHC = community health center; CPT = Current Procedural Terminology; EHR = electronic health record; HCPCS = Healthcare Common Procedure Coding System; ref = reference group; SE = standard error.

Notes: (1) Rates are zero-inflated Poisson regression estimates. Adjusted estimates controlled for categorical age and race/ethnicity as these variables differed significantly between the selection groups at baseline. (2) All models accounted for clustering of patients by primary CHC through a robust sandwich variance estimator. (3) Postselection period was the 36 months after an applicant was notified of selection to apply for insurance coverage (the selection date) through the Oregon Experiment or, for those not selected, a randomly assigned selection date based on the distribution of selection dates for the selected group. (4) SE denotes robust standard error estimate of the use rate that accounts for clustering of patients within primary CHC.

[a] Face-to-face office visits in a primary care setting and/or with a primary care clinician.

[b] Oregon OCHIN patients selected to apply for health insurance coverage via the Oregon Experiment vs not selected.

[c] Face-to-face encounters designated as behavioral or mental health in the EHR; limited to 11,571 patients seen at 1 or more of the 33 clinics with the behavioral/mental health visit indicator.

[d] Statistically significant difference compared with reference group.

[e] CPT and HCPCS codes grouped as laboratory tests in the EHR.

[f] CPT and HCPCS codes grouped as referrals in the EHR.

[g] CPT and HCPCS codes grouped as immunizations in the EHR.

[h] CPT and HCPCS codes grouped as imaging studies in the EHR.

Limitations

We found that patients continue to seek health care services from CHCs and increased their use of many different types of CHC services after obtaining insurance; however, we were unable to assess the extent to which study participants sought care at non-study CHC settings. Research suggests that federally qualified health centers are more likely to see patients newly insured via Medicaid compared with other providers[70]; however, future studies are needed to determine what percent of patients seek care elsewhere after receiving insurance to more accurately assess the net impact on demand patterns in these settings.

Although individuals in this study were similar to those gaining Medicaid through ACA-supported expansions, participation in the Oregon Experiment was voluntary, and ACA policies include a coverage mandate. Further, this study was conducted in a single state and may not be generalizable to others.

In IV analyses, we used 2 instruments: random selection to apply for OHP and preexisting Medicaid coverage. Such models assume that the instruments are not correlated with the outcomes, except indirectly through the

Table 3. Estimated Effect of Gaining Medicaid Coverage on Use Outcomes Among Oregon OCHIN Patients Who Participated in the Oregon Experiment (N = 34,849)

Outcome in Postselection Period	Rate per 1,000 Patients/ Month (SE)	Absolute Difference in Rate	Rate Ratio (95% CI)
Total primary care office visits[a]			
Medicaid coverage	282 (21)	+81[b]	1.39 (1.16-1.66)[b]
No Medicaid coverage (ref)	201 (15)	–	1.00
Total behavioral/mental health visits[c]			
Medicaid coverage	183 (37)	–13	0.93 (0.66-1.32)
No Medicaid coverage (ref)	196 (28)	–	1.00
Total laboratory tests[d]			
Medicaid coverage	436 (43)	+94[b]	1.27 (1.05-1.55)[b]
No Medicaid coverage (ref)	342 (38)	–	1.00
Total referrals[e]			
Medicaid coverage	45 (14)	+17[b]	1.58 (1.10-2.28)[b]
No Medicaid coverage (ref)	28 (5)	–	1.00
Total immunizations[f]			
Medicaid coverage	57 (6)	+1	1.03 (0.87-1.21)
No Medicaid coverage (ref)	56 (4)	–	1.00
Total imaging studies[g]			
Medicaid coverage	45 (5)	+11[b]	1.33 (1.07-1.64)[b]
No Medicaid coverage (ref)	34 (2)	–	1.00

Acronyms are as shown in Table 2 footnote.

Notes: (1) Rates calculated using the 2-stage residual inclusion instrumental variable approach. Models adjusted for categorical age and race/ethnicity as these variables differed significantly between selection groups at baseline. (2) SEs were estimated with 2,000 bootstrap replicates clustered by primary CHC. (3) Postselection period was the 36 months after an applicant was notified of selection to apply for health insurance coverage (the selection date) via the Oregon Experiment or, for those not selected, a randomly assigned selection date based on the distribution of selection dates for the selected group.

[a] Face-to-face office visits in a primary care setting and/or with a primary care clinician.

[b] Statistically significant difference compared with reference group.

[c] Face-to-face encounters designated as behavioral or mental health in the EHR; limited to 11,571 patients seen at 1 or more of the 33 clinics with the behavioral/mental health visit indicator.

[d] CPT and HCPCS codes grouped as laboratory tests in the EHR.

[e] CPT and HCPCS codes grouped as referrals in the EHR.

[f] CPT and HCPCS codes grouped as immunizations in the EHR.

[g] CPT and HCPCS codes grouped as imaging in the EHR.

treatment variable (Medicaid coverage). It is possible that preexisting Medicaid coverage correlated with establishing care at a CHC, but it is unlikely that coverage in the past would directly affect future use of CHC services independent of postselection period coverage, particularly in CHCs that provide services to uninsured patients. The ETOT findings (Supplemental Appendix Table 2) were consistent with what was observed in the IV approach, increasing our confidence in the results of this study. Additionally, tests of overidentifying restrictions for the inclusion of 2 IVs provide support for the set of study instruments (results not shown).

Finally, although we did not find an increase in use of mental/behavioral health services, we assessed only services provided in the primary care setting. We were not able to assess use of services for more severe mental health conditions that likely prompted referral for specialty care. Research suggests that recent policy changes (parity law) are associated with increased use of services for a subset of patients with more severe mental illness.[71,72]

Conclusions

Results from this randomized insurance experiment suggest that use of primary care services in CHCs will increase when patients gain Medicaid through ACA insurance expansions. If the US health care system adequately expands resources in CHCs and other primary care settings to fully meet this demand, it could lead to better access to health care for previously uninsured patients. If the US health care system is not able to adequately provide primary care services, potential gains in population health may not be realized, and health care costs will increase unnecessarily if patients must seek hospital care for primary care–treatable conditions.

To read or post commentaries in response to this article, see it online at http://www.annfammed.org/content/13/4/312.

Key words: community health centers; primary care utilization; Medicaid; Patient Protection and Affordable Care Act; ACA; Oregon Experiment; health policy; practice-based research; vulnerable populations

Submitted February 12, 2015; submitted, revised, May 15, 2015; accepted May 26, 2015.

This study has been registered as an observational study at clinicaltrials.gov (NCT02355132).

Funding support: This study was supported by grant R01HL107647 from the National Heart, Lung, and Blood Institute, and grant K08HS021522 from the Agency for Healthcare Research and Quality.

Disclaimer: The funding agencies had no involvement in the design and conduct of the study; analysis and interpretation of the data; and preparation, review, or approval of the manuscript.

Previous presentations: How Did the Oregon Medicaid Experiment Affect Utilization of Health Care Services Among Patients of Federally-Qualified Health Centers? Oral presentation at the 2014 North American Primary Care Research Group Annual Meeting; November 21-25, 2014; New York City, New York.

Acknowledgments: The authors gratefully acknowledge the OCHIN network and the OCHIN PBRN.

Supplementary materials: Available at http://www.AnnFamMed.org/content/13/4/312/suppl/DC1/.

References

1. Kaiser Family Foundation. Medicaid moving forward. http://kff.org/health-reform/issue-brief/medicaid-moving-forward/. Published Mar 9, 2015. Accessed Jun 22, 2015.
2. Kaiser Family Foundation. How is the ACA impacting Medicaid enrollment? http://kff.org/medicaid/issue-brief/how-is-the-aca-impacting-medicaid-enrollment/. Published May 5, 2014. Accessed Jan 15, 2015.
3. Crowley RA, Golden W. Health policy basics: Medicaid expansion. *Ann Intern Med*. 2014;160(6):423-425.
4. Abraham JM. How might the Affordable Care Act's coverage expansion provisions influence demand for medical care? *Milbank Q*. 2014;92(1):63-87.
5. Ku L, Jones K, Shin P, Bruen B, Hayes K. The states' next challenge—securing primary care for expanded Medicaid populations. *N Engl J Med*. 2011;364(6):493-495.
6. Schoen C, Hayes SL, Radley DC, Collins SR. Access to primary and preventive health care across states prior to the coverage expansions of the Affordable Care Act. *Commonwealth Fund*. 2014;17(Issue Brief).
7. Kaiser Commission on Medicaid and the Uninsured, Kaiser Family Foundation. Community health centers: a 2012 profile and spotlight on implications of state Medicaid expansion decisions. http://kaiserfamilyfoundation.files.wordpress.com/2014/09/8624-community-health-centers-a-2012-profile-and-implications-of-state-medicaid-expansion-decisions.pdf. Published Sep 2014. Accessed Jan 11, 2015.
8. Angier H, Hoopes M, Gold R, et al. An early look at rates of uninsured safety net clinic visits after the Affordable Care Act. *Ann Fam Med*. 2015;13(1):10-16.
9. Ku L, Jones E, Shin P, Byrne FR, Long SK. Safety-net providers after health care reform: lessons from Massachusetts. *Arch Intern Med*. 2011;171(15):1379-1384.
10. Gold R, Bailey SR, O'Malley JP, et al. Estimating demand for care after a Medicaid expansion: lessons from Oregon. *J Ambul Care Manage*. 2014;37(4):282-292.
11. Kulesher RR. Health reform's impact on federally qualified community health centers: the unintended consequence of increased Medicaid enrollment on the primary care medical home. *Health Care Manag (Frederick)*. 2013;32(2):99-106.
12. Hawkins D, Groves D. The future role of community health centers in a changing health care landscape. *J Ambul Care Manage*. 2011;34(1):90-99.
13. Taylor J. Changes in latitudes, changes in attitudes: FQHCs and community clinics in a reformed health care market. *Issue Brief Natl Health Policy Forum*. 2012;(848):1-22.
14. Freeman JD, Kadiyala S, Bell JF, Martin DP. The causal effect of health insurance on utilization and outcomes in adults: a systematic review of US studies. *Med Care*. 2008;46(10):1023-1032.
15. McWilliams JM, Zaslavsky AM, Meara E, Ayanian JZ. Impact of Medicare coverage on basic clinical services for previously uninsured adults. *JAMA*. 2003;290(6):757-764.
16. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Differences in control of cardiovascular disease and diabetes by race, ethnicity, and education: U.S. trends from 1999 to 2006 and effects of Medicare coverage. *Ann Intern Med*. 2009;150(8):505-515.
17. Card D, Dobkin C, Maestas N. The impact of nearly universal insurance coverage on health care utilization: evidence from Medicare. *Am Econ Rev*. 2008;98(5):2242-2258.
18. DeLeire T, Dague L, Leininger L, Voskuil K, Friedsam D. Wisconsin experience indicates that expanding public insurance to low-income childless adults has health care impacts. *Health Aff (Millwood)*. 2013;32(6):1037-1045.
19. Kolstad JT, Kowalski AE. The impact of health care reform on hospital and preventive care: evidence from Massachusetts. *J Public Econ*. 2012;96(11-12):909-929.
20. Long SK, Masi PB. Access and affordability: an update on health reform in Massachusetts, fall 2008. *Health Aff (Millwood)*. 2009;28(4):w578-w587.
21. Long SK, Stockley K. The impacts of state health reform initiatives on adults in New York and Massachusetts. *Health Serv Res*. 2011;46(1p2):365-387.
22. Burns ME, Dague L, DeLeire T, et al. The effects of expanding public insurance to rural low-income childless adults. *Health Serv Res*. 2014;49(Suppl 2):2173-2187.
23. Harris AD, McGregor JC, Perencevich EN, et al. The use and interpretation of quasi-experimental studies in medical informatics. *J Am Med Inform Assoc*. 2006;13(1):16-23.
24. RAND Health. *The Health Insurance Experiment: A Classic RAND Study Speaks to the Current Health Care Reform Debate*. RAND Research Brief. http://www.rand.org/pubs/research_briefs/2006/RAND_RB9174.pdf. Published 2006. Accessed Feb 11, 2015.
25. Aron-Dine A, Einav L, Finkelstein A. The RAND Health Insurance Experiment, three decades later. *J Econ Perspect*. 2013;27(1):197-222.
26. Finkelstein A, Taubman S, Wright B, et al; Oregon Health Study Group. The Oregon Health Insurance Experiment: evidence from the First Year. *Q J Econ*. 2012;127(3):1057-1106.
27. Allen H, Baicker K, Finkelstein A, Taubman S, Wright BJ; Oregon Health Study Group. What the Oregon health study can tell us about expanding Medicaid. *Health Aff (Millwood)*. 2010;29(8):1498-1506.
28. Baicker K, Taubman SL, Allen HL, et al; Oregon Health Study Group. The Oregon experiment—effects of Medicaid on clinical outcomes. *N Engl J Med*. 2013;368(18):1713-1722.
29. Taubman SL, Allen HL, Wright BJ, Baicker K, Finkelstein AN. Medicaid increases emergency-department use: evidence from Oregon's Health Insurance Experiment. *Science*. 2014;343(6168):263-268.
30. Oregon Division of Medical Assistance Programs. OHP Standard Reservation List Final Report. March Through October 2008. http://www.oregon.gov/oha/healthplan/DataReportsDocs/OHP%20Standard%20Reservation%20List%20Final%20Report.pdf. Published 2008. Accessed May 14, 2015.
31. Gorin A, Stone A. Recall biases and cognitive errors in retrospective self-reports: a call for momentary assessments. In: *Handbook of Health Psychology*. Mahwah, NJ: Erlbaum; 2001.
32. Choi BC, Pak AW. A catalog of biases in questionnaires. *Prev Chronic Dis*. 2005;2(1):A13.
33. Bowling A. Mode of questionnaire administration can have serious effects on data quality. *J Public Health (Oxf)*. 2005;27(3):281-291.
34. Tisnado DM, Adams JL, Liu H, et al. What is the concordance between the medical record and patient self-report as data sources for ambulatory care? *Med Care*. 2006;44(2):132-140.
35. Bhandari A, Wagner T. Self-reported utilization of health care services: improving measurement and accuracy. *Med Care Res Rev*. 2006;63(2):217-235.
36. Devoe JE, Sears A. The OCHIN community information network: bringing together community health centers, information technology, and data to support a patient-centered medical village. *J Am Board Fam Med*. 2013;26(3):271-278.
37. Devoe JE, Gold R, Spofford M, et al. Developing a network of community health centers with a common electronic health record: description of the Safety Net West Practice-based Research Network (SNW-PBRN). *J Am Board Fam Med*. 2011;24(5):597-604.
38. US Department of Health & Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. Registry Plus™ Link Plus. http://www.cdc.gov/cancer/npcr/tools/registryplus/lp.htm. Published 2015. Accessed Jun 22, 2015.
39. Gupta SK. Intention-to-treat concept: a review. *Perspect Clin Res*. 2011;2(3):109-112.

40. Angrist JD, Imbens GW, Rubin DB. Identification of causal effects using instrumental variables. *J Am Stat Assoc.* 1996;91:444-455.

41. Heintzman J, Bailey SR, Hoopes MJ, et al. Agreement of Medicaid claims and electronic health records for assessing preventive care quality among adults. *J Am Med Inform Assoc.* 2014;21(4):720-724.

42. Centers for Medicaid and Medicare Services. 2011-2013 Eligible Professional Clinical Quality Measures (CQMs). http://ushik.ahrq.gov/QualityMeasuresListing?system=mu&sortField=500&sortDirection=ascending&filter520=Eligible%20Professionals&stage=Stage%201&enableAsynchronousLoading=true. Accessed Jun 22,2015.

43. National Committee for Quality Assurance (NCQA). *HEDIS 2013: Technical Specifications for Physician Measurement.* Washington, DC: NCQA; 2013.

44. Voung QH. Likelihood ratio tests for model selection and non-nested hypotheses. *Econometrica.* 1989;57(2):307-333.

45. Du J, Park YT, Theera-Ampornpunt N, McCullough JS, Speedie SM. The use of count data models in biomedical informatics evaluation research. *J Am Med Inform Assoc.* 2012;19(1):39-44.

46. Huber PJ. The behavior of maximum likelihood estimates under nonstandard conditions. *Vol 1 of Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability.* Berkeley, CA: University of California Press; 1967;221-233.

47. Rogers W. Regression standard errors in clustered samples. *Stata Tech Bull.* 1993;13:19-23.

48. Baiocchi M, Cheng J, Small DS. Instrumental variable methods for causal inference. *Stat Med.* 2014;33(13):2297-2340.

49. Woolridge J. *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press; 2010.

50. Terza JV, Basu A, Rathouz PJ. Two-stage residual inclusion estimation: addressing endogeneity in health econometric modeling. *J Health Econ.* 2008;27(3):531-543.

51. Windmeijer FAG, Santos Silva JMC. Endogeneity in count data models: an application to demand for health care. *J Appl Econ.* 1997;12(3):281-294.

52. Mooney C. *Bootstrapping: A Nonparametric Approach to Statistical Inference.* Newbury Park, CA: Sage Publications; 1993.

53. Baicker K, Taubman SL, Allen HL, et al; Oregon Health Study Group. The Oregon experiment—effects of Medicaid on clinical outcomes. *N Engl J Med.* 2013;368(18):1713-1722.

54. Cook NL, Hicks LS, O'Malley AJ, Keegan T, Guadagnoli E, Landon BE. Access to specialty care and medical services in community health centers. *Health Aff (Millwood).* 2007;26(5):1459-1468.

55. Felt-Lisk S, McHugh M, Howell E. Monitoring local safety-net providers: do they have adequate capacity? *Health Aff (Millwood).* 2002;21(5):277-283.

56. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q.* 2005;83(3):457-502.

57. Shi L. The impact of primary care: a focused review. *Scientifica (Cairo).* 2012;2012:432892.

58. Macinko J, Starfield B, Shi L. Quantifying the health benefits of primary care physician supply in the United States. *Int J Health Serv.* 2007;37(1):111-126.

59. DeVoe JE, Fryer GE, Phillips R, Green L. Receipt of preventive care among adults: insurance status and usual source of care. *Am J Public Health.* 2003;93(5):786-791.

60. DeVoe JE, Tillotson CJ, Lesko SE, Wallace LS, Angier H. The case for synergy between a usual source of care and health insurance coverage. *J Gen Intern Med.* 2011;26(9):1059-1066.

61. Sommers BD, Long SK, Baicker K. Changes in mortality after Massachusetts health care reform: a quasi-experimental study. *Ann Intern Med.* 2014;160(9):585-593.

62. Petterson SM, Liaw WR, Phillips RL Jr, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010-2025. *Ann Fam Med.* 2012;10(6):503-509.

63. Smulowitz PB, O'Malley J, Yang X, Landon BE. Increased use of the emergency department after health care reform in Massachusetts. *Ann Emerg Med.* 2014;64(2):107-115, e1-e3.

64. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Use of health services by previously uninsured Medicare beneficiaries. *N Engl J Med.* 2007;357(2):143-153.

65. Gold R, DeVoe JE, McIntire PJ, Puro JE, Chauvie SL, Shah AR. Receipt of diabetes preventive care among safety net patients associated with differing levels of insurance coverage. *J Am Board Fam Med.* 2012;25(1):42-49.

66. Bailey SR, O'Malley JP, Gold R, Heintzman J, Marino M, DeVoe JE. Receipt of diabetes preventive services differs by insurance status at visit. *Am J Prev Med.* 2015;48(2):229-233.

67. Tang PC, Ralston M, Arrigotti MF, Qureshi L, Graham J. Comparison of methodologies for calculating quality measures based on administrative data versus clinical data from an electronic health record system: implications for performance measures. *J Am Med Inform Assoc.* 2007;14(1):10-15.

68. Riley GF. Administrative and claims records as sources of health care cost data. *Med Care.* 2009;47(7)(Suppl 1):S51-S55.

69. Naessens JM, Ruud KL, Tulledge-Scheitel SM, Stroebel RJ, Cabanela RL. Comparison of provider claims data versus medical records review for assessing provision of adult preventive services. *J Ambul Care Manage.* 2008;31(2):178-186.

70. Saloner B, Kenney GM, Polsky D, Rhodes K, Wissoker DA, Zuckerman S. The availability of new patient appointments for primary care at federally qualified health centers: findings from an audit study. *Urban Institute.* http://www.urban.org/research/publication/availability-new-patient-appointments-primary-care-federally-qualified-health-centers-findings-audit-study. Published Apr 7, 2014. Accessed May 14, 2015.

71. McConnell KJ. The effect of parity on expenditures for individuals with severe mental illness. *Health Serv Res.* 2013;48(5):1634-1652.

72. McConnell KJ, Gast SH, Ridgely MS, et al. Behavioral health insurance parity: does Oregon's experience presage the national experience with the Mental Health Parity and Addiction Equity Act? *Am J Psychiatry.* 2012;169(1):31-38.