

# Healthcare Utilization After a Children's Health Insurance Program Expansion in Oregon

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**Abstract** *Objective* The future of the Children's Health Insurance Program (CHIP) is uncertain after 2017. Survey-based research shows positive associations between CHIP expansions and children's healthcare utilization. To build on this prior work, we used electronic health record (EHR) data to assess temporal patterns of healthcare utilization after Oregon's 2009–2010 CHIP expansion. We hypothesized increased post-expansion utilization among children who gained public insurance. *Methods* Using EHR data from 154 Oregon community health centers, we conducted a retrospective cohort study of pediatric patients (2–18 years old) who gained public insurance coverage during the Oregon expansion (n = 3054), compared to those who were continuously publicly insured (n = 10,946) or continuously uninsured (n = 10,307) during the 2-year study period. We compared pre-post rates of primary care visits, well-child visits, and dental visits within- and between-groups. We also conducted longitudinal analysis of monthly visit rates, comparing the three insurance groups. *Results* After Oregon's 2009–2010 CHIP expansions, newly insured patients' utilization rates were more than double their pre-expansion rates

[adjusted rate ratios (95 % confidence intervals); increases ranged from 2.10 (1.94–2.26) for primary care visits to 2.77 (2.56–2.99) for dental visits]. Utilization among the newly insured spiked shortly after coverage began, then leveled off, but remained higher than the uninsured group. *Conclusions* This study used EHR data to confirm that CHIP expansions are associated with increased utilization of essential pediatric primary and preventive care. These findings are timely to pending policy decisions that could impact children's access to public health insurance in the United States.

**Keywords** Health insurance · Children · Utilization · Electronic health records · Medicaid · CHIP

## Significance

Survey-based research shows positive associations between CHIP expansions and children's healthcare utilization. To build on this previous work, we used electronic health record (EHR) data to assess temporal patterns of healthcare utilization after Oregon's 2009–2010 CHIP expansion. Using this novel data source, this study contributes to the body of evidence suggesting that insurance coverage facilitates children's access to primary and preventive care. These findings are timely as the United States makes important policy decisions that could impact children's access to public health insurance.

## Introduction

The Children's Health Insurance Program (CHIP) was informed by evidence that uninsured children have significant unmet healthcare needs [1–3]. CHIP was partially

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responsible for the uninsured rate among children in the United States (US) dropping from 14 % in 1997, when CHIP began, to 7 % in 2012 [4]. CHIP provides public insurance for children otherwise not eligible for Medicaid; CHIP expansions have also been associated with increased enrollment in Medicaid via awareness of public coverage options [5]. Survey data suggest that newly insured children experience improved access to pediatric primary and dental care services [6–14], but this self-reported data can be subject to certain biases (e.g., recall error, response fatigue) [4, 15, 16]. EHR databases have the potential to overcome such biases. We know of just one prior study using electronic data to examine the association between CHIP expansions and care utilization [17]. That study assessed pre- and post-coverage utilization among children gaining CHIP coverage, and found higher rates of pediatric care visits in the post-period; however, this study did not include continuously uninsured or those already insured as comparators.

Funding for CHIP has been extended through 2017 [18]. If CHIP is not reauthorized or similar funding is not available after that date, some children could face barriers to coverage [4, 19]. Given the uncertainty of CHIP's future, the unknown and indirect effect of the Affordable Care Act on children's insurance coverage, and the need for more evidence on potential impacts of these public insurance programs, we used EHR data to confirm and quantify the relationship between gaining public insurance coverage and children's healthcare utilization. Using a retrospective cohort design, we identified 3 groups of established community health center (CHC) pediatric study participants: (1) patients who gained public insurance coverage during Oregon's 2009–2010 CHIP expansion, (2) patients who were either continuously insured, or (3) continuously uninsured throughout the study period. Oregon expanded its CHIP program in 2009–2010 to offer coverage to children in families with incomes  $\leq 200\%$  of the federal poverty level (FPL); the eligibility limit in the pre-expansion period was  $\leq 185\%$  FPL. This expansion, referred to as "Healthy Kids," was coupled with a large media campaign across Oregon and resulted in  $>100,000$  newly insured children via Medicaid or CHIP [20], and ultimately reduced the child uninsurance rate in the state by 50 % [21].

Our study aim was to utilize EHR data to compare pre- and post-coverage rates of primary care and dental services utilization within and between these groups. We also longitudinally assessed the timing of post-coverage utilization at monthly intervals to identify temporal patterns. This study is unique in that it compares changes in healthcare utilization rates of newly insured patients to those of both continuously insured and continuously uninsured patients; it is the first to use EHR data to compare children's

temporal patterns with insurance group as the independent variable.

## Methods

### Data Sources

We used EHR data from Oregon CHCs in the OCHIN community health information network with an EHR in place for practice management by 2008 ( $n = 154$  CHCs) (OCHIN was originally the Oregon Community Health Information Network but shortened to "OCHIN, Inc" when membership expanded beyond Oregon). We used Medicaid and CHIP identification numbers to link individual-level EHR data with state administrative data to confirm public insurance coverage periods. All other patient-level data was extracted from the EHR.

### Study Setting and Population

We identified 31,796 OCHIN patients who met the following criteria throughout the study period: aged 2–18; no record of insurance other than Medicaid/CHIP; and not pregnant, which independently impacts coverage and utilization. Medicaid/CHIP enrollment was restricted to eligibility based on poverty status (i.e., 'categorically eligible' children were excluded). Analyses were limited to Oregon patients with  $\geq 1$  billed encounter at an OCHIN CHC at any point before their 'start date' (defined below), plus  $\geq 1$  visit after their 'start date,' to establish a minimum of care continuity at OCHIN clinics. These encounters did not need to occur within the study period and encounters outside of the study period were not included in analyses.

### Insurance Coverage Groups

The newly insured group included children continuously uninsured for  $\geq 1$  year prior to gaining public coverage during the Healthy Kids expansion period (09/01/09–12/31/10) (pre-period), then continuously insured by Medicaid or CHIP for  $\geq 1$  year after the coverage start date (post-period). Comparison groups were children who had continuous public coverage, or who were continuously uninsured, in an analogous period. To estimate these analogous periods, each comparison group child was randomly assigned a 'start date' based on the distribution of Medicaid/CHIP coverage start dates among newly insured children (e.g., if 2 % of children in the group who gained insurance had an actual coverage start date of January 1, 2010, that start date was randomly assigned to 2 % of those in each comparison group). We included children who gained either CHIP or Medicaid during this time period, as

insurance expansions in one public program (i.e., CHIP) often increase awareness of other available public programs (i.e., Medicaid). Given the complexity and sporadic nature of insurance coverage among children with discontinuous insurance over the study period, children with public insurance for only part of the pre- or post-period were excluded from analyses ( $n = 7489$ ).

### Utilization Outcomes

We examined the following visit outcomes: (1) primary care; (2) well-child; (3) acute care; (4) total dental; and (5) preventive dental. Primary care visits were defined as visits in the primary care setting (clinic types designated as primary care, public health, or early childhood in the EHR system) and included well-child visits. Well-child, acute care, and dental visits were identified via Current Procedural Terminology (CPT) codes, Healthcare Common Procedure Coding System (HCPCS) codes, and/or International Classification of Diseases, Ninth Revision (ICD-9) codes (see footnotes in Table 2 for specific codes). We assessed utilization rates 1 year prior to each individual's 'start date' (pre-period) and 1 year after the 'start date' (post-period).

### Analyses

We used Fisher's exact, Chi-square and  $t$  tests to compare demographic characteristics of the study groups. Missing demographic data were coded as a separate category, thus no patients were dropped from the models due to missing data.

To obtain pre-post utilization rate ratios and assess changes within and between groups, we fitted generalized Poisson mixed models with random effects to account for households nested within primary CHC (assuming a compound symmetry covariance structure) [22]. Confidence intervals of rate ratios were used to assess significance in pre versus post utilization rates within groups, and an interaction term between group and period was included to

determine whether the pre-post rate ratios differed between groups [23]. To compare longitudinal patterns of primary care (well-child visits and acute care visits separately) and dental utilization across the 2 years, we computed monthly encounter rates using generalized estimating equations with a robust sandwich estimator [24] to account for within-patient temporal correlation [25]. All models were adjusted for potential confounders: child age on 'start date', gender, race/ethnicity, household income as percent of FPL, and urban/rural classifications based on the 2004 Rural–Urban Commuting Area Zip Code file for the US. All statistical tests were two-sided and statistical significance was defined as a  $p$  value  $<0.05$ . Statistical analyses were performed using SAS Enterprise Guide v.6.1. This study was approved by the Oregon Health & Science University's Institutional Review Board and the data was collected under a waiver of authorization.

## Results

### Study Population

We identified 24,307 patients meeting all study inclusion criteria. The newly insured group differed significantly from comparison groups on most demographic characteristics. Compared to the continuously insured, they were older, more commonly non-Hispanic white and less commonly Hispanic, less likely to have a household income under the FPL, and more commonly from a non-urban area. The only non-significant differences were gender and urban/rural classifications between the newly insured and the continuously uninsured group (Table 1).

### Utilization by Insurance Group

Among the newly insured group, post-period utilization rates were more than two times higher than in the pre-period for all outcomes (Table 2). Newly insured pre-post primary care visits increased from 0.54 to 1.28 per patient

**Table 1** Patient demographic characteristics by insurance group

	Newly insured <sup>a</sup> N = 3054	Continuously insured <sup>b</sup> N = 10,946	Continuously uninsured <sup>c</sup> N = 10,307
Gender, no. (column %)			
Female	1566 (51.3)	5399 (49.3)	5300 (51.4)
Male	1487 (48.7)	5547 (50.7)	5004 (48.6)
Unknown	1 (0.03)	0	3 (0.03)
$p$ value versus newly insured <sup>d</sup>		0.02	0.96
Race/ethnicity, no. (column %)			
Hispanic	1519 (49.7)	6937 (63.4)	4345 (42.2)
Non-hispanic white	1111 (36.4)	2634 (24.1)	3957 (38.4)

**Table 1** continued

	Newly insured <sup>a</sup> N = 3054	Continuously insured <sup>b</sup> N = 10,946	Continuously uninsured <sup>c</sup> N = 10,307
Non-hispanic other	297 (9.7)	1073 (9.8)	1148 (11.1)
Missing/unknown	127 (4.2)	302 (2.8)	857 (8.3)
<i>p</i> value versus newly insured <sup>c</sup>		<.001	<.001
Age on start date, years, no. (column %)			
2–6	852 (27.9)	3831 (35.0)	2111 (20.5)
7–11	1171 (38.3)	4175 (38.1)	4028 (39.1)
12–18	1031 (33.8)	2940 (26.9)	4168 (40.4)
<i>p</i> value versus newly insured <sup>c</sup>		<.001	<.001
Mean (SD)	9.5 (4.0)	8.8 (4.0)	10.3 (4.0)
<i>p</i> value versus newly insured <sup>f</sup>		<.001	<.001
Household income <sup>g</sup> , no. (column %)			
<100 % FPL	1923 (63.0)	7678 (70.1)	5807 (56.3)
100 %–200 % FPL	658 (21.5)	2200 (20.1)	1284 (12.5)
>200 % FPL	226 (7.4)	599 (5.5)	868 (8.4)
Missing/unknown	247 (8.1)	469 (4.3)	2348 (22.8)
<i>p</i> value versus newly insured <sup>c</sup>		<.001	<.001
Number of OCHIN children in household, no. (column %)			
1	1640 (53.7)	3846 (35.1)	8250 (80.0)
2	970 (31.8)	3907 (35.7)	1611 (15.7)
3+	444 (14.5)	3193 (29.2)	446 (4.3)
<i>p</i> value versus newly insured <sup>c</sup>		<.001	<.001
Urban/rural, based on patient zip code <sup>h</sup> no. (column %)			
Urbanized area	2559 (83.8)	9951 (90.9)	8503 (82.5)
Urban cluster	230 (7.5)	620 (5.7)	859 (8.3)
Small town	179 (5.9)	186 (1.7)	634 (6.2)
Rural	63 (2.1)	90 (0.8)	259 (2.5)
Missing/unknown	23 (0.8)	99 (0.9)	52 (0.5)
<i>p</i> value versus newly insured <sup>c</sup>		<.001	0.12

*SD* standard deviation, *FPL* federal poverty level

<sup>a</sup> Newly insured group included children continuously uninsured for ≥1 year prior to gaining public coverage during the Healthy Kids expansion (09/01/09–12/31/10) (pre-period), then continuously publicly insured for ≥1 year after the coverage start date (post-coverage)

<sup>b</sup> Continuously insured group included children who had continuous public coverage during the study period

<sup>c</sup> Continuously uninsured group included children who were continuously uninsured during the study period

<sup>d</sup> Fisher’s exact test

<sup>e</sup> Chi-square test

<sup>f</sup> Two-sample *t* test

<sup>g</sup> Household income was averaged for each patient across the study; for patients with no FPL data assessed in study period, we used available FPL data from encounters occurring after the study period; values ≥1000 % were considered erroneous and set to missing

<sup>h</sup> 2004 Rural–Urban Commuting Area (RUCA) Zip Code file for the US, based on 2000 Census. Urbanized area = Census-designated Urban Area with ≥50,000 population; Urban cluster = Census-defined Urban Area with 10,000–49,999 population; Small town = Census-defined Urban Area with 2500–9999 population; Rural = outside of a Census-defined Urban Area; missing/unknown indicates zip code was missing, invalid, or did not exist at time of 2000 Census

per year [*adjusted rate ratio (aRR)* = 2.10, 95 % *confidence interval (95 % CI)* = 1.95–2.26], well-child visits from 0.14 to 0.31 per patient per year (*aRR* = 2.26, 95 % *CI* = 2.04–2.50), acute care visits from 0.18 to 0.55 per patient per year (*aRR* = 3.12, 95 % *CI* = 2.80–3.47), total dental encounters from 0.35 to 0.98 per patient per year (*aRR* = 2.77, 95 % *CI* = 2.56–2.99), and preventive dental encounters from 0.24 to 0.63 per patient per year (*aRR* = 2.56, 95 % *CI* = 2.38–2.75). Comparison groups showed some significant pre-post utilization changes, though not of the same magnitude, direction, or consistency as observed in the newly insured. Between-group pre-post differences in rate ratios for all outcomes revealed that changes in utilization for the newly insured were

significantly different from those of the continuously insured and continuously uninsured groups ( $p < 0.001$ ).

### Temporal Patterns of Utilization

Well-child visit rates were higher among the newly insured compared to continuously insured immediately post-coverage with utilization rates leveling off over time. Primary care acute care visits also increased significantly in the post-period compared to pre-period for the newly insured group, but the rates for these visits were slightly lower than the continuously insured rates throughout the post-period. Utilization among the newly insured for both types of visits remained significantly higher than among the continuously

**Table 2** Within and between group comparisons of pre-post coverage<sup>a</sup> CHC visit rates by insurance group

	Newly insured <sup>b</sup> N = 3054		Continuously insured <sup>c</sup> N = 10,946		Continuously uninsured <sup>d</sup> N = 10,307	
	Total visits	Mean visits (SD) per patient/year	Total visits	Mean visits (SD) per patient/year	Total visits	Mean visits (SD) per patient/year
<b>Visits in primary care setting<sup>e</sup></b>						
Pre-period	1641	0.54 (1.19)	16,382	1.50 (2.03)	5026	0.49 (1.33)
Post-period	3444	1.28 (1.76)	14,655	1.34 (1.84)	4582	0.44 (1.30)
Adjusted <sup>f</sup> rate ratio (95 % CI), post versus pre		2.10 (1.95, 2.26)		0.89 (0.87, 0.92)		0.91 (0.87, 0.96)
<i>p</i> value, adjusted rate ratio versus newly insured <sup>g</sup>				<.001		<.001
<b>Well child visits<sup>h</sup></b>						
Pre-period	426	0.14 (0.36)	3484	0.32 (0.51)	1160	0.11 (0.34)
Post-period	962	0.31 (0.51)	3405	0.31 (0.50)	1107	0.11 (0.32)
Adjusted <sup>f</sup> rate ratio (95 % CI), post versus pre		2.26 (2.04, 2.50)		0.98 (0.94, 1.02)		0.95 (0.89, 1.03)
<i>p</i> value, adjusted rate ratio versus newly insured <sup>g</sup>				<.001		<.001
<b>Acute care visits<sup>i</sup></b>						
Pre-period	537	0.18 (0.66)	7174	0.66 (1.33)	1491	0.14 (0.61)
Post-period	1673	0.55 (1.26)	7800	0.71 (1.34)	1764	0.17 (0.63)
Adjusted <sup>f</sup> rate ratio (95 % CI), post vs. pre		3.12 (2.80, 3.47)		1.09 (1.05, 1.12)		1.18 (1.10, 1.27)
<i>p</i> value, adjusted rate ratio versus newly insured <sup>g</sup>				<.001		<.001
<b>Dental visits, total<sup>j</sup></b>						
Pre-period	1081	0.35 (0.85)	15,073	1.38 (1.87)	3864	0.37 (0.85)
Post-period	2990	0.98 (1.79)	15,061	1.38 (1.81)	4250	0.41 (0.85)
Adjusted <sup>f</sup> rate ratio (95 % CI), post versus pre		2.77 (2.56, 2.99)		1.00 (0.98, 1.02)		1.10 (1.05, 1.15)
<i>p</i> value, adjusted rate ratio versus newly insured <sup>g</sup>				<.001		<.001
<b>Dental visits: preventive<sup>k</sup></b>						
Pre-period	746	0.24 (0.60)	10,514	0.96 (1.26)	3068	0.30 (0.67)
Post-period	1911	0.63 (1.07)	10,632	0.97 (1.24)	3289	0.32 (0.70)
Adjusted <sup>f</sup> rate ratio (95 % CI), post versus pre		2.56 (2.38, 2.75)		1.01 (0.99, 1.03)		1.07 (1.03, 1.12)

**Table 2** continued

	Newly insured <sup>b</sup> N = 3054		Continuously insured <sup>c</sup> N = 10,946		Continuously uninsured <sup>d</sup> N = 10,307	
	Total visits	Mean visits (SD) per patient/year	Total visits	Mean visits (SD) per patient/year	Total visits	Mean visits (SD) per patient/year
<i>p</i> value, adjusted rate ratio versus newly insured <sup>e</sup>			<.001		<.001	

*CHC* community health center, *SD* standard deviation, *CI* confidence interval

<sup>a</sup> Children in continuously insured and continuously uninsured groups were randomly assigned a pre-post coverage ‘start date’ based on the distribution of Medicaid/CHIP coverage start dates among newly insured children

<sup>b</sup> Newly insured group included children continuously uninsured for ≥1 year prior to gaining public coverage during the Healthy Kids expansion (09/01/09–12/31/10) (pre-period), then continuously publically insured for ≥1 year after the coverage start date (post-coverage)

<sup>c</sup> Continuously insured group included children who had continuous public coverage during the study period

<sup>d</sup> Continuously uninsured group included children who were continuously uninsured during the study period

<sup>e</sup> Defined by clinic type (primary care, public health, early childhood). Primary care visits that were not coded as well child or acute care included those for immunizations or labs only, chronic conditions, family planning, and mental/behavioral health

<sup>f</sup> Poisson mixed models adjusted for fixed effects of age, race/ethnicity, FPL, patient urban/rural status, and random effects of household nested in primary health center

<sup>g</sup> Tested by contrast from parameter estimates of group \* period interaction term in Poisson mixed model

<sup>h</sup> CPT codes 99323–99385, 99392–99395; HCPCS codes G0438, G0439; ICD9 codes V20.2, V70.0, V70.3, V70.5, V70.6, V70.8, V70.9

<sup>i</sup> CPT codes 99201–99205, 99211–99215, excluding visits where primary ICD9 code = V\*

<sup>j</sup> CPT codes D1000–D1999 and/or D2000–D9999

<sup>k</sup> CPT codes D1000–D1999

uninsured (Fig. 1). Adjusted monthly total dental visit rates showed a similar pattern as that of the well child visit rates, but spiked a few months later in the post-coverage period (Fig. 2).

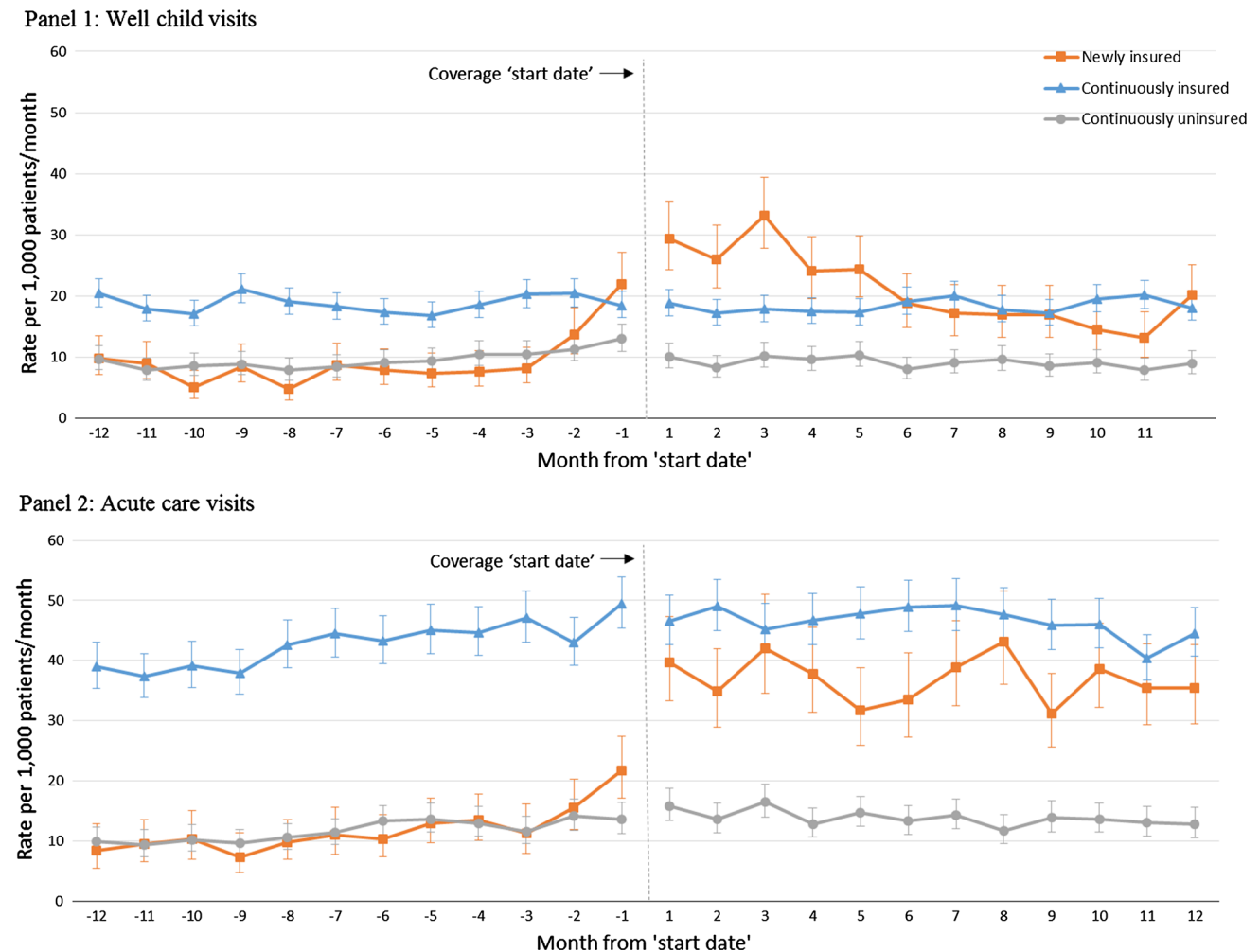
## Discussion

Our study uses EHR data to confirm findings from survey-based studies: children who gain public insurance coverage have increased utilization of important healthcare and dental services in the 12 months after gaining coverage. Among those who gained insurance, primary care visit rates doubled from an annual rate of 54 visits per 100 patients in the pre-period to an annual rate of 128 per 100 patients in the post-period; dental visit rates also doubled for this newly insured group. Our study adds substantially to the existing literature: we used EHR data to capture pediatric utilization rates during both insured and uninsured periods, and assessed monthly temporal patterns of utilization pre- and post-insurance coverage, including dental services.

This study builds on prior evidence suggesting that children utilize services differently when uninsured versus when insured, and that expansions in children’s public insurance coverage facilitates access to care for vulnerable children. Now, with CHIP’s future unclear, some experts warn that low- and middle-income children’s access to

health insurance may be uncertain due to what has become known as the ‘family glitch’ [4, 26]. If CHIP is not reauthorized or similar funding is unavailable, families with children who previously qualified for public health insurance would likely be eligible for federal subsidies through the ACA’s Insurance Exchange. However, if an employer offers affordable individual coverage for an employee based on his/her wages, the employee and his/her family are no longer eligible for subsidized insurance through the Exchange program. Thus, an employee might be able to afford individual insurance coverage but unable to afford it for the entire family. According to the Government Accountability Office, this ‘family glitch’ affects insurance coverage of almost half a million children [27].

The comparison of monthly temporal patterns of utilization among the three groups has important implications. First, it demonstrates that ‘pent up demand’ for healthcare services observed among adults who gain coverage [28, 29] may also hold true for newly insured children. This finding has important workforce implications; specifically, whenever a group of children gain insurance coverage through expansions in a state or national program, the pediatric workforce should prepare for a ‘spike’ in utilization, to ensure capacity to meet this demand. Second, the increase in pre-post utilization among newly insured children suggests that insurance helped address unmet needs, which have been reported by parents of uninsured children [30, 31]. Similarly, the lower utilization rates among



**Fig. 1** Adjusted<sup>1</sup> monthly well child visit and acute care visit rates<sup>2</sup> by insurance group, 1 year pre- through one year post- coverage 'start date'<sup>3</sup>. Note. Newly insured group included children continuously uninsured for  $\geq 1$  year prior to gaining public coverage during the Healthy Kids expansion (09/01/09–12/31/10) (pre-period), then continuously publicly insured for  $\geq 1$  year after the coverage start date (post-period); Continuously insured group included children who had continuous Medicaid/CHIP coverage during the study period; Continuously uninsured group included children who were

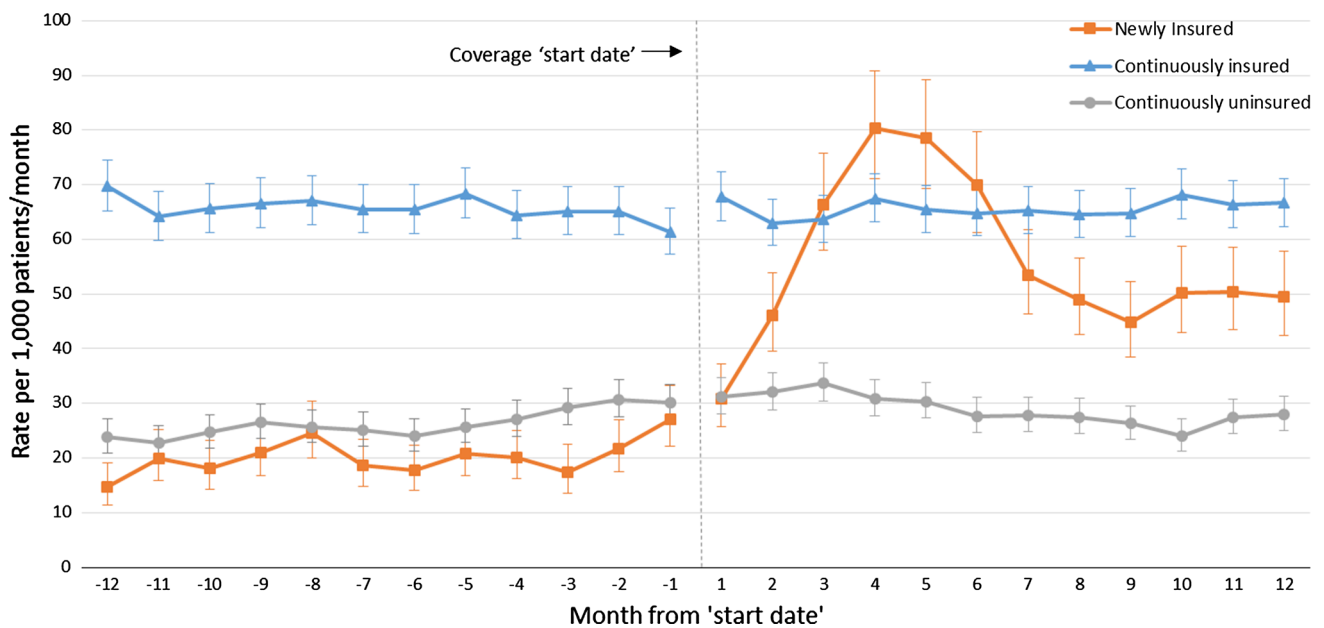
continuously uninsured during the study period. <sup>1</sup>Generalized estimating equation analysis adjusted for age, race/ethnicity, FPL, and patient urban/rural status. Error bars represent 95 % confidence intervals for the monthly rates. <sup>2</sup>Rates are averaged over each one-month interval. <sup>3</sup>Children in continuously insured and continuously uninsured groups were randomly assigned a coverage 'start date' based on the distribution of actual Medicaid/CHIP coverage start dates among newly insured children

continuously uninsured children in this study, compared to newly insured or continuously insured children, might imply that these uninsured children continued to have significant unmet needs. Finally, after the initial increase, utilization rates of newly insured children fell below those of continuously insured children for both the well-child visits and dental visits. Rates of primary care acute visits for the newly insured did not surpass those for the continuously insured at any point in the post-period. Explanations for these interest findings include the possibility that families who are newly insured have different utilization patterns and/or less sustained need for services than those with more consistent coverage. These findings

warrant further study as they could also be due to other unobserved differences between these groups.

### Limitations

We did not include patients who were partially insured in the pre- or post-period because of the complex and sporadic nature of insurance coverage for this subgroup over the study period. Given our finding that gaining and maintaining insurance is, in fact, associated with increased utilization, future research is warranted to determine the graded effects of insurance coverage on utilization over time. We also excluded patients whose first visit was after



**Fig. 2** Adjusted<sup>1</sup> dental visit rates<sup>2</sup> by insurance group, 1 year pre-through 1 year post- coverage ‘start date’<sup>3</sup>. Note. Newly insured group included children continuously uninsured for  $\geq 1$  year prior to gaining public coverage during the Healthy Kids expansion (09/01/09–12/31/10) (pre-period), then continuously publically insured for  $\geq 1$  year after the coverage start date (post-coverage); Continuously insured group included children who had continuous public coverage during the study period; Continuously uninsured group included

children who were continuously uninsured during the study period. <sup>1</sup>Generalized estimating equation analysis adjusted for age, race/ethnicity, FPL, and patient urban/rural status. Error bars represent 95 % confidence intervals for the monthly rates. <sup>2</sup>Rates are averaged over each one-month interval. <sup>3</sup>Children in continuously insured and continuously uninsured groups were randomly assigned a coverage ‘start date’ based on the distribution of actual Medicaid/CHIP coverage start dates among newly insured children

the coverage start date, as we would not be able to assess pre- and post-utilization rates for these patients; thus, this paper only looked at established patients. EHR data was from patients at CHCs in Oregon; given differences across states in public insurance coverage eligibility standards and differences between CHCs and other primary care settings, results might not generalize to other healthcare settings. Our observational design prevents the ability to draw causal inferences; however, our finding that the temporal patterns of utilization among the comparison groups was relatively stable compared with utilization among the newly insured suggests that the post-period increase among those that gained insurance was not attributable to secular trends or other concurrent health policy initiatives. There were significant differences between the groups in measured covariates; while we controlled for available demographic variables, the groups may also have differed on unmeasured confounders. The monthly temporal correlation complicated the modeling approaches used. We were able to include households and clinics as nested random effects in the estimation of pre- and post-period rate ratios. However, the temporal modeling required random effects for individuals to account for within-patient correlation over time, and these models would not accommodate random effect for clinics and households. Finally, although

access to, and appropriate utilization of, health care services are associated with improved health outcomes [32, 33], and insurance coverage is shown to act interdependently with access to care to accomplish these outcomes [34, 35], we did not examine the association between insurance and biomarker/health outcomes. Future studies are warranted to assess this relationship.

**Conclusions**

This study used EHR data to confirm previous evidence suggesting that public insurance coverage facilitates children’s access to primary and preventive care. It also suggests that healthcare utilization may spike in the immediate period after a child gains insurance, which has important pediatric workforce implications. These findings inform changes in the US health insurance landscape and how these changes might affect children’s access to primary care and dental care. If CHIP, Medicaid, or similar public funding becomes less available, unmet healthcare needs may again increase among low- and middle-income children in the US.

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### Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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