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# The Effect of Medicaid on Dental Care of Poor Adults: Evidence from the Oregon Health Insurance Experiment

*Katherine Baicker* , *Heidi L. Allen*, *Bill J. Wright*,  
*Sarah L. Taubman*, and *Amy N. Finkelstein*

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**Objective.** To evaluate the effect of Medicaid coverage on dental care outcomes, a major health concern for low-income populations.

**Data Sources.** Primary and secondary data on health care use and outcomes for participants in Oregon's 2008 Medicaid lottery.

**Study Design.** We used the lottery's random selection to gauge the causal effects of Medicaid on dental care needs, medication, and emergency department visits for dental care.

**Data Collection.** Data were collected for lottery participants over 2 years, including mail surveys ( $N = 23,777$ ) and in-person questionnaires ( $N = 12,229$ ). Emergency department (ED) records were matched to lottery participants in Portland ( $N = 24,646$ ).

**Principal Findings.** Medicaid coverage significantly reduced the share of respondents who reported needing dental care ( $-9.8$  percentage points,  $p < .001$ ) or having unmet dental care needs ( $-13.5$  percentage points,  $p < 0.001$ ). Medicaid doubled the share visiting the ED for dental care ( $+2.6$  percentage points,  $p = .003$ ) and the use of anti-infective medications often prescribed for dental care, but it had no detectable effect on uncovered dental care or out-of-pocket spending.

**Conclusions.** Expansion of Medicaid covering emergency dental care substantially reduced unmet need for dental care, increasing ED dental visits and medication use, while not changing patient use of uncovered dental services.

**Key Words.** Medicaid, dental health

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Dental care is an important component of health spending and of overall health and well-being. The United States spent an estimated \$117.5 billion on dental services in 2015, with a substantial share of that care delivered in emergency departments (Seu, Hall, and Moy 2012; Kim and Bush 2013; Wall and Nasseh 2013; National Center for Health Statistics 2015; Okunseri 2015; Wall and Vujcic 2016). Oral health also has important implications for overall

health. Although the biological mechanisms are not fully understood, oral health has been associated with outcomes for conditions including cardiovascular disease, diabetes, cancer, obesity, and preterm birth (Michaud et al. 2008; Azarpazhooch and Tenenbaum 2012; Hwang et al. 2012; Lockhart et al. 2012; Torres et al. 2013). There remains substantial unmet need for dental care, particularly among low-income populations where between a quarter and a half of individuals report untreated dental caries; additionally, poor adults are much less likely to see a dentist than those with higher income (Wall, Vujicic, and Nasseh 2012; National Center for Health Statistics 2014).

While federal rules require states to provide comprehensive dental coverage to children on Medicaid, adult dental coverage is left to the discretion of the states. In 2007, 16 state Medicaid programs (including DC) provided coverage for all dental services, 13 states had limited coverage that lacked coverage for one or more dental services, 16 states (including Oregon) provided coverage only for “emergency dental care” (such as extractions or treatment of abscesses, whether provided in the emergency department [ED] or an office setting), and 6 provided no dental coverage except for care in the ED (which is covered in all states) (McGinn-Shapiro 2008; Wall, Nasseh, and Vujicic 2013). The uninsured can still, of course, access dental care in the ED or elsewhere, but they are responsible for paying the bills for that care. Between 2002 and 2013, 11 states and the District of Columbia increased their Medicaid dental benefits, while 15 states decreased their benefits (Wall, Nasseh, and Vujicic 2013).

Insurance coverage of adult dental benefits may play an important role in observed care patterns, as financial barriers are a persistent obstacle to receiving care (Vujicic and Nasseh 2014; Wall, Nasseh, and Vujicic 2014a,b; Vujicic, Buchmueller, and Klein 2016). The majority of dental ED visits are nonurgent and could likely be handled more effectively and at a lower cost in dental offices (Nasseh, Vujicic, and Romaine 2014; Buchmueller, Miller, and Vujicic 2016).

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Some research suggests that reducing Medicaid's adult dental coverage results in more people seeking dental care in hospitals and EDs, while additional coverage leads to dental care market growth and dentists seeing more Medicaid patients (Cohen, Manski, and Hooper 1996; Cohen et al. 2003; Choi 2011; Wallace et al. 2011; Nasseh and Vujicic 2013, 2017; Neely et al. 2014; Yarbrough, Vujicic, and Nasseh 2014; Singhal et al. 2015; Sun et al. 2015; Buchmueller, Miller, and Vujicic 2016; Chalmers, Grover, and Compton 2016). However, the effect of Medicaid coverage itself on health care use, particularly across settings, and outcomes is difficult to isolate from confounding factors. Individual characteristics such as income or health needs may affect both insurance coverage and care use, biasing observational estimates.

In 2008, Oregon held a lottery to allocate a limited number of Medicaid slots to low-income uninsured adults on a waiting list. This lottery provided researchers with the opportunity to evaluate the causal effect of Medicaid coverage on a range of outcomes. We use the lottery to evaluate the effect of that Medicaid program on the use of dental care.

## METHODS

### *The Oregon Health Insurance Experiment*

In 2008, Oregon allocated 10,000 available slots in its Medicaid program for low-income adults, Oregon Health Plan (OHP) Standard, by drawing names from a waiting list of approximately 90,000 people. We use the random selection in the lottery to study the effects of coverage, as described in greater detail elsewhere (Finkelstein et al. 2012; Baicker et al. 2013; Allen, Wright, and Baicker 2014; Taubman et al. 2014). Previous analyses using the lottery found that Medicaid coverage increased health care use (including primary, hospital, prescription, and emergency department care); improved financial security (although had no significant effect on employment or earnings); and improved self-reported health and mental health, but had no detectable effects on several measures of physical health (Finkelstein et al. 2012; Baicker et al. 2013; Allen, Wright, and Baicker 2014; Baicker et al. 2014; Taubman et al. 2014).

Oregon Health Plan Standard covered dental care only in the case of dental emergencies (not routine office visits, although it covered emergency extractions in offices or other settings). The lottery provides an opportunity to gauge the causal effects of Medicaid coverage on health outcomes and health care utilization patterns, including the substitution of covered care in one setting for uncovered care in other settings. The expected effects of emergency-

only dental coverage are uncertain because of both the limited coverage and the potential interaction between dental care and use of other (covered) health care services.

### *Data Sources and Study Population*

We collected information on both those randomly selected in the lottery and those not selected from several primary and secondary data sources. The analyses presented here use administrative emergency department (ED) data and mail and in-person survey responses. The data sets are described in more detail elsewhere, including collection protocols and coverage (Finkelstein et al. 2012; Baicker et al. 2013; Taubman et al. 2014). Here we give only brief descriptions, focusing on the new outcome variables. More details on the sample are shown in Figure S1 in Appendix SA2.

*Mail and In-Person Survey Responses.* Mail surveys (mailed statewide 1–2 months after the lottery and again approximately 12 months after the lottery) and an in-person survey (fielded in the greater Portland metro area approximately 2 years after the lottery) were administered to investigate individuals' self-reported health care needs, utilization, and costs. There were 26,423 respondents to the initial mail survey, 23,777 respondents to the 12-month mail survey and 12,229 to the in-person survey. The mail surveys asked: "In the last 6 months, have you needed any dental care?" and, "If you needed dental care in the last 6 months, did you get all the care you needed?" The in-person survey asked individuals whether they had received dental care in the last 12 months, and, if so, to estimate their out-of-pocket spending on that care. The distribution of out-of-pocket costs is described in Table S1 in Appendix SA2. Among those with positive spending on dental care in the control group, the median of out-of-pocket costs of dental care was \$250, and those in the top 10 percent of spenders had more than \$1,200 in out-of-pocket costs.

*Emergency Department Discharge Records.* We analyze ED discharge data obtained from 12 emergency departments in the Portland area from January 2007 through September 2009 (approximately 18 months after the lottery), probabilistically matched to lottery list members (Taubman et al. 2014). There were 24,646 lottery list members covered by the ED data collection. As detailed in Tables S2 and S3 in Appendix SA2, we consider ED visits where the primary diagnosis was a dental condition. This category is the fourth most

prevalent category, accounting for 4.6 percent of the control group's ED visits. Nearly a third of these admissions were for dental caries (or cavities), which can largely be prevented with regular dental care (Institute of Medicine 2011).

*Medication Catalog.* In conjunction with the in-person survey, we cataloged the medications currently in the possession of all study participants. Details of the data construction and classification can be found in Appendix SA2. We focus here on two categories of drugs most likely to be used for dental care: analgesics and anti-infectives (Phero and Becker 2002; Baumgartner and Xia 2003; Becker and Phero 2005; Heard et al. 2008; Becker 2010; Okunseri et al. 2012). We examined these medications overall as well as a subset of them that are most frequently prescribed for dental care (see Table S4 in Appendix SA2). It is important to note that we do not, however, know whether these medications were prescribed specifically in connection with dental care needs, and that they are often used for nondental health care. We also do not have information on the history of use or adherence; rather, we have a snapshot of medications in study participants' possession at the time of the in-person interview.

Table 1 summarizes the demographic characteristics for these three sample groups, including the treatment group selected in the lottery and the control group not selected. There were no statistically significant differences in these characteristics between the treatment and control groups, as would be expected with random assignment.

### *Statistical Approach*

Our analysis relies on the lottery's random assignment to generate estimates of the causal effect of Medicaid on outcomes that are not contaminated by confounding factors. Not all adults selected in the lottery successfully enrolled in Medicaid (with some of those selected not completing the application and some of those applying ultimately deemed ineligible). As shown in Table S5 in Appendix SA2, lottery selection increased the probability of being covered by Medicaid at any point during the study period by about 25 percentage points.

The subgroup of those selected in the lottery who went on to be enrolled is not comparable to the overall group not selected in the lottery, so simple comparisons of those actually enrolled to the control group would not provide valid causal estimates of the effects of Medicaid. Rather, we used standard instrumental variables approach to gauge the effect of gaining Medicaid coverage through the lottery on subsequent health care use (Angrist, Imbens, and

Table 1: Sample Characteristics

	Twelve-Month Mail Survey Sample			In-Person Survey Sample			Emergency Department Sample			Initial Mail Survey Sample <sup>†</sup>		
	Controls (4)	Lottery Winners (5)	p-Value (6)	Controls (7)	Lottery Winners (8)	p-Value (9)	Controls (1)	Lottery Winners (2)	p-Value (3)	Controls (10)	Lottery Winners (11)	p-Value (12)
N	11,966	11,811		5,842	6,387		15,020	9,626		13,152	13,271	
Age (years)	41.5	41.5	.79	39.1	39.3	.37	39.4	39.3	.59	41.9	41.5	.02
Female (%)	59.1	58.7	.58	56.9	56.4	.60	55.4	54.4	.09	59.9	59.0	.12
White (%)	82.0	81.7	.58	68.8	69.2	.68	32.0	32.5	.47	82.9	82.0	.10
Any prelottery ED visits (%)												
F-Statistic for above variables	0.236			0.416			1.074			3.296		
p-Value	.87			.74			.36			.02		

Notes. Table shows characteristics of different samples analyzed. For each sample, the first column shows the weighted mean value for control individuals who entered the lottery but were not selected, the second column reports the regression-adjusted weighted mean value for those randomly selected by the lottery to be able to apply for Medicaid coverage, and the third column shows the p-value of difference between the means. Information on age and gender was measured at the time of lottery sign-up; data on race was collected in the initial and 12-month mail surveys and the in-person survey. Survey samples are all weighted with corresponding survey weights. The final rows report the pooled F statistics and p-values from testing treatment-control balance on the above variables jointly.

<sup>†</sup> Analysis of the initial survey was not included in the prespecified analysis plan (available at <http://www.nber.org/oregon>).

Rubin 1996; Finkelstein et al. 2012; Baicker et al. 2013, 2014; Taubman et al. 2014). These local average treatment effects thus indicate the causal effect of Medicaid coverage for the population that gained coverage through the lottery but who would not have enrolled if they had not won the lottery (given that the main avenue through which the lottery affects outcomes is Medicaid enrollment, as discussed in the in Appendix SA2). This is a population margin that may be of particular interest to policy makers. Table S6 in Appendix SA2 also shows the reduced form effect of lottery selection itself (intent-to-treat estimates). Table S7 in Appendix SA2 shows robustness of the main results to alternative functional forms.

For a full description of the analytic specifications used as well as alternative specifications and additional tables, see Appendix SA2. The methods used here follow those of our prior quantitative analyses very closely; however, the outcome measures are new. Analyses were prespecified and publicly archived in advance of completing any outcomes analyses (with exceptions noted below; see <http://www.nber.org/oregon/documents/analysis-plan/analysis-plan-dental-2014-11-17.pdf> for archived analysis plan).

## RESULTS

### *Self-Reported Dental Care Need and Utilization*

Table 2 reports the effect of Medicaid coverage on needing dental care, receiving needed dental care, and out-of-pocket costs. Of the control group, 73.9 percent reported needing dental care in the 12-month mail survey. This was 9.8 percentage points lower for those gaining Medicaid coverage through the lottery ( $p < .001$ ). We observe a similar lower level of 13.5 percentage points ( $p < .001$ ) in the share reporting that they had unmet dental needs.

Among those surveyed in-person roughly 2 years after the lottery, 31.7 percent of the control group reported receiving any dental care. This was a statistically insignificant 4.2 percentage points higher for those with Medicaid coverage ( $p = .27$ ). The average out-of-pocket dental spending reported by the control group was \$120, which was an insignificant \$19 higher for those with Medicaid coverage ( $p = .66$ ).

Between one-third and one-half of the reduction in dental care need was observed at the time of the initial survey, conducted shortly after the lottery, with Medicaid decreasing the share reporting they experienced a need for dental care by 4.4 percentage points and the share reporting an unmet dental

Table 2: Survey Data

	<i>Mean Value in Control Group (1)</i>	<i>Effect of Medicaid Coverage (2)</i>	<i>p-Value (3)</i>
Twelve-month mail survey sample (roughly 1 year after lottery)			
Needed dental care (past 6 months)	73.9 (43.9)	−9.8 (2.4)	<.001
Had unmet dental needs (past 6 months)	60.6 (48.9)	−13.5 (2.7)	<.001
In-person survey sample (roughly 2 years after lottery)			
Received dental care (past 12 months)	31.7 (46.5)	4.2 (3.8)	.27
Out-of-pocket costs of dental care (past 12 months)	120.1 (550.7)	19.3 (43.8)	.66
Initial mail survey sample (roughly at time of lottery) <sup>†</sup>			
Needed dental care (past 6 months)	76.8 (42.2)	−4.4 (1.8)	.02
Had unmet dental needs (past 6 months)	66.4 (47.2)	−4.9 (2.0)	.02

*Notes.* Data sources are responses to mail or in-person surveys. All regressions include indicators for the number of household members on the lottery list and cluster standard errors (shown in parentheses in column (2)) by household. Analyses of the initial and 12-month mail surveys also contain indicator variables for survey wave and for the interaction between survey wave and number of household members on the lottery list. The 12-month mail survey and in-person survey analyses include sampling weights. Sample sizes are  $N = 26,423$  for the initial mail survey,  $N = 23,777$  for the 12-month mail survey, and  $N = 12,229$  for the in-person survey.

<sup>†</sup>Analysis of the initial mail survey was not included in the prespecified analysis plan (available at [www.nber.org/oregon](http://www.nber.org/oregon)).

need by 4.9 percentage points ( $p = .02$ ). As noted in the table, unlike the other analyses presented, analysis of this initial survey was not prespecified in our analysis plan.

### *Emergency Department Utilization*

Table 3 reports the effect of Medicaid coverage on ED visits for teeth and jaw disorders. Of the control group, 2.7 percent had at least one dental ED visit in this 18-month period (the intensive margin), with an average of 0.05 dental ED visits over the 18 months (the total margin, including those who had 0). These numbers were substantially higher for those gaining Medicaid coverage. The share with at least one ED visit doubled relative to the control group, increasing by 2.7 percentage points ( $p = .003$ ), and the average number of visits more than doubled, increasing by .067 ( $p = .005$ ).

### *Medications*

Table 4 reports the effect of Medicaid on use of analgesic and anti-infective medications. Medicaid did not result in any statistically significant

Table 3: Emergency Department Data

	Percent with Any Visits			Number of Visits		
	Mean Value in Control Group (1)	Effect of Medicaid Coverage (2)	<i>p</i> -value (3)	Mean Value in Control Group (4)	Effect of Medicaid Coverage (5)	<i>p</i> -value (6)
	ED visit for disorders of teeth and jaw (in 18 months after lottery)	2.72 (16.28)	2.68 (0.89)	.003	0.049 (0.437)	0.067 (0.024)

*Notes.* Data source is emergency department records for the greater Portland metro area matched to lottery list population. All regressions include indicators for the number of household members on the lottery list, control for preperiod versions of the outcomes (1 January 2007 – March 9, 2008), and and cluster standard errors (shown in parentheses in columns (2) and (5)) by household. Sample size  $N = 24,646$  individuals.

changes in the use of analgesics, but increased the use of anti-infectives. Medicaid nearly doubled the share using any anti-infectives, which was 3.7 percentage points higher (vs. a base of 4 percent in the control group;  $p = .02$ ), and the number of anti-infectives in their possession, which was .04 higher (vs. a base of .05 in the control group;  $p = .047$ ). These increases were disproportionately but not exclusively seen in the types of anti-infectives more commonly used for dental care. Results for prescription medications only are quite similar and are shown in Table S6 in Appendix SA2.

*Comparison to Nondental Care*

Table 5 compares the new results on dental care from this analysis to previous findings on medical care. The increase in dental emergency department visits represents a substantial share of the overall increase in emergency department visits for this population. Medicaid coverage increased the total number of ED visits relative to the control group by 0.41 visits, so the observed increase of .067 in dental ED visits represents 16 percent of the total increase. Similarly, Medicaid increased the share of the sample with any ED visits for any cause by 7.0 percentage points, so the increase of 2.7 percentage points seen here represents 38 percent of the increase in utilizers. Prescription medications, which also increased, were covered by insurance as well.

Table 4: Analgesic and Anti-Infective Medications

	Analgesics			Anti-Infectives		
	Mean Value in Control Group (1)	Effect of Medicaid Coverage (2)	p-Value (3)	Mean Value in Control Group (4)	Effect of Medicaid Coverage (5)	p-Value (6)
Any medications	39.07 (48.79)	-1.36 (4.07)	.74	4.00 (19.60)	3.73 (1.65)	.02
Number of medications	0.52 (0.76)	-0.04 (0.06)	.55	0.05 (0.26)	0.04 (0.02)	.047
Any medication commonly used for dental care	34.50 (47.54)	-0.13 (3.97)	.97	1.29 (11.30)	1.65 (1.04)	.11
Number of prescription medications commonly used for dental care	0.43 (0.67)	-0.04 (0.05)	.46	0.01 (0.11)	0.02 (0.01)	.06

*Notes.* Data source is medication catalog from the in-person survey sample. All regressions include indicators for the number of household members on the lottery list and weights that account for the probability of being sampled in the new lottery. Standard errors (shown in parentheses in columns (2) and (5)) are clustered by household. Categorization of the subsets of analgesic and anti-infective medications mostly commonly used for dental care were determined in consultation with a dental care expert. Sample size is  $N = 12,039$ . Analysis of medications was not originally included in dental analysis plan, but it was prespecified in a separate analysis plan that included both overall and dental medication possession in advance of analysis of the medication data (both available at [www.nber.org/oregon](http://www.nber.org/oregon)).

Table 5: Comparison of Effects on Dental and Medical Care

	Mean Value in Control Group (1)	Effect of Medicaid Coverage (LATE) (2)	p-Value (3)
Emergency department sample (for 18 months after lottery)			
Any ED visits for disorders of teeth and jaw	2.7 (16.3)	2.7 (0.9)	.003
Any ED visits <sup>†</sup>	34.5 (47.5)	7.0 (2.4)	.003
Number of ED visits for disorders of teeth and jaw	0.049 (0.437)	0.067 (0.024)	.005
Number of ED visits <sup>†</sup>	1.022 (2.632)	0.402 (0.117)	<.001
Twelve-month mail survey sample (roughly 1 year after lottery)			
Needed dental care (past 6 months)	73.9 (43.9)	-9.8 (2.4)	<.001
Needed medical care (past 6 months) <sup>†</sup>	74.9 (43.4)	0.5 (2.3)	.81
Had unmet dental needs (past 6 months)	60.6 (48.9)	-13.5 (2.7)	<.001
Had unmet medical needs (past 6 months) <sup>†</sup>	31.6 (46.5)	-24.2 (2.2)	<.001
In-person survey sample (roughly 2 years after lottery)			
Received dental care (past 12 months)	31.7 (46.5)	4.2 (3.8)	.27
Received medical care (past 12 months) <sup>†</sup>	78.4 (41.1)	12.9 (3.3)	<.001
Out-of-pocket costs of dental care (past 12 months)	120.1 (550.7)	19.3 (43.8)	.66
Out-of-pocket medical costs (past 12 months) <sup>†</sup>	552.8 (1219.5)	-215.3 (98.7)	.03

Notes. All regressions include indicators for the number of household members on the lottery list and cluster standard errors (shown in parentheses in column (2)) by household. Analyses of the initial and 12-month mail surveys also contain indicator variables for survey wave and for the interaction between survey wave and number of household members on the lottery list. Analyses of the emergency department data also control for preperiod versions of the outcomes (January 1, 2007 – March 9, 2008). The 12-month mail survey and in-person survey analyses include weights that account for the probability of being sampled in the new lottery. Sample sizes are  $N = 26,423$  for the initial mail survey,  $N = 23,777$  for the 12-month mail survey,  $N = 12,229$  for the in-person survey, and  $N = 24,646$  for the emergency department data.

<sup>†</sup>Medical care results previously reported elsewhere; they are included here for comparison to dental results.

## DISCUSSION

There is substantial unmet dental care need among low-income adult populations; indeed, two-thirds of our control group reported having unmet dental care needs. Like many Medicaid programs, the Oregon program studied here covers emergency dental services but not routine care. Using a randomized controlled design enabled by Oregon’s lottery for Medicaid coverage, we found that coverage substantially reduced the unmet need for dental care. It doubled the use of the emergency department for dental visits and anti-infectives often prescribed for dental care, but it had no effect on self-reports of dental care or out-of-pocket spending.

These results highlight the value of Medicaid in addressing a substantial unmet need for care in low-income adults. The mechanism through which

these outcomes were changed may hinge on the way in which the Medicaid program changed the cost to enrollees of obtaining care. In prior work, we found that Medicaid increased use of primary care, prescriptions, hospital care, and ED visits overall, consistent with this care being difficult to afford for many of the uninsured and free in most circumstances for those with Medicaid (Finkelstein et al. 2012; Baicker et al. 2013; Taubman et al. 2014). This study of dental care provides an interesting case in which emergency dental care (which in practice may translate to dental care delivered in the emergency department) was covered but routine care was not. As shown in Table 5, the increase in dental emergency department visits represents a substantial share of the overall increase in emergency department visits for this population.

The expected effect of Medicaid on use of uncovered care and out-of-pocket spending is ambiguous a priori, given the multiple channels that might be at work. Medicaid might increase the use of uncovered outpatient dental care by increasing enrollees' financial resources or by increasing access to providers who detect the need for care (which could increase both care and reporting of unmet need). These mechanisms could increase out-of-pocket spending, although coverage of ED visits and medication could reduce what uninsured individuals would otherwise have spent. Obtaining newly covered dental care at the ED could reduce subsequent need for dental care (both in and out of the ED).

Respondents did not report any significant increase in out-of-pocket spending or use of dental care (referring to use across settings). Indeed, the increase in the share of respondents with ED visits for dental care (2.7 percentage points) explains the majority of the (statistically insignificant) increase in the share reporting receiving any dental care (4.2 percentage points; additional results for overlap sample shown in Appendix SA2). Along with the increase in use of anti-infective medications, this is consistent with a pattern of increased use of covered (but not uncovered) services, highlighting the importance that the form of coverage may play in the mix of services delivered, and raising the possibility that care could be delivered earlier and in lower-cost settings with more comprehensive coverage.

Although the substantial drop in unmet need thus seems consistent with the increase in use of covered services, interpretation is not entirely straightforward. Much of the 13.5 percentage point drop in having unmet dental care needs is accounted for by the 9.8 percentage point drop in having any need for dental care at all — suggesting that it is not that people's ongoing needs are being met regularly through increased access to care, but that they have fewer dental needs altogether. The drop in need is only partly accounted for by early

dental visits to the ED, but it may also be attributable in part to the increase in the use of anti-infectives. Another factor at work could be that, despite the specificity of the question about the need for dental care, responses may also have been capturing the more general effects of insurance coverage. The drop in the share reporting that they needed dental care at all that was observed almost immediately after the lottery (of 1/3 or more the size seen 1 year later) suggests that these self-reports may also be capturing general feelings of improved access to care and well-being. Medicaid coverage substantially increased overall self-reported health and well-being, and those changes may be conflated with reports about improved dental health (Finkelstein et al. 2012). One respondent reported that without Medicaid his life “would be miserable. It’d be really miserable mostly because of the dental. I mean I wouldn’t be able to eat.” Respondents also highlighted the connection between their oral health and other aspects of their health. One diabetic respondent noted, “When you’re diabetic, you have to be very careful with your gums . . . The Oregon Health Plan helps with emergency dental, but nothing like [the] issue I have.” A second important way in which Medicaid coverage improved enrollees’ well-being was through the financial protection it provided. As previously reported, Medicaid dramatically reduced enrollees’ need to borrow, exposure to catastrophic out-of-pocket spending, and chances of having bills sent to collection (Finkelstein et al. 2012; Baicker et al. 2013).

This analysis presents estimates of the causal effects of Medicaid coverage on several aspects of dental care. Respondents reported substantially lower unmet need for dental services. Medicaid coverage of emergency-only dental services led to a doubling of emergency department visits for dental care and use of anti-infective medications, which were covered by the insurance, while not detectably changing self-reported use of other dental services (such as routine cleanings) or out-of-pocket spending. Insurance coverage thus has important implications not just for addressing a large unmet health need of low-income populations, but on the type and site of care delivered and its effectiveness in improving dental health.

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## REFERENCES

- Allen, H., B. J. Wright, and K. Baicker. 2014. "New Medicaid Enrollees in Oregon Report Health Care Successes and Challenges." *Health Affairs (Millwood)* 33 (2): 292–9.
- Angrist, J. D., G. W. Imbens, and D. B. Rubin. 1996. "Identification of Causal Effects Using Instrumental Variables." *Journal of the American Statistical Association* 91 (434): 444–55.
- Azarpazhooh, A., and H. C. Tenenbaum. 2012. "Separating Fact from Fiction: Use of High-Level Evidence from Research Syntheses to Identify Diseases and Disorders Associated with Periodontal Disease." *Journal/Canadian Dental Association* 78: c25.
- Baicker, K., S. L. Taubman, H. L. Allen, M. Bernsterin, J. H. Gruber, J. P. Newhouse, E. C. Schneider, B. J. Wright, A. M. Zaslavsky, A. N. Finkelstein, and O. H. S. Group. 2013. "The Oregon Experiment - Effects of Medicaid on Clinical Outcomes." *New England Journal of Medicine* 368 (18): 1713–22.

- Baicker, K., A. Finkelstein, J. Song, and S. Taubman. 2014. "The Impact of Medicaid on Labor Market Activity and Program Participation: Evidence from the Oregon Health Insurance Experiment." *American Economic Review: Papers and Proceedings* 104 (5): 322–8.
- Baumgartner, J. C., and T. Xia. 2003. "Antibiotic Susceptibility of Bacteria Associated with Endodontic Abscesses." *Journal of Endodontia* 29 (1): 44–7.
- Becker, D. E. 2010. "Pain Management: Part 1: Managing Acute and Postoperative Dental Pain." *Anesthesia Progress* 57 (2): 67–79.
- Becker, D. E., and J. C. Phero. 2005. "Drug Therapy in Dental Practice: Nonopioid and Opioid Analgesics." *Anesthesia Progress* 52 (4): 140–9.
- Buchmueller, T., S. Miller, and M. Vujicic. 2016. "How Do Providers Respond to Changes in Public Health Insurance Coverage? Evidence from Adult Medicaid Dental Benefits." *American Economic Journal: Economic Policy* 8 (4): 70–102.
- Chalmers, N., J. Grover, and R. Compton. 2016. "After Medicaid Expansion in Kentucky, Use of Hospital Emergency Departments for Dental Conditions Increased." *Health Affairs* 35 (12): 2268–76.
- Choi, M. K. 2011. "The Impact of Medicaid Insurance Coverage on Dental Service Use." *Journal of Health Economics* 30 (5): 1020–31.
- Cohen, L. A., R. J. Manski, and F. J. Hooper. 1996. "Does the Elimination of Medicaid Reimbursement Affect the Frequency of Emergency Department Dental Visits?" *Journal of the American Dental Association* 127 (5): 605–9.
- Cohen, L. A., R. J. Manski, L. S. Magder, and C. D. Mullins. 2003. "A Medicaid Population's Use of Physician Offices for Dental Problems." *American Journal of Public Health* 93 (8): 1297–301.
- Finkelstein, A., S. Taubman, B. Wright, M. Bernstein, J. Gruber, J. Newhouse, H. Allen, K. Baicker, and Oregon Health Study Group. 2012. "The Oregon Health Insurance Experiment: Evidence from the First Year." *Quarterly Journal of Economics* 127 (3): 1057–106.
- Heard, K. J., N. L. Ries, R. C. Dart, G. M. Bogdan, R. D. Zallen, and F. Daly. 2008. "Overuse of Non-Prescription Analgesics by Dental Clinic Patients." *BMC Oral Health* 8: 33.
- Hwang, S. S., V. C. Smith, M. C. McCormick, and W. D. Barfield. 2012. "The Association between Maternal Oral Health Experiences and Risk of Preterm Birth in 10 States, Pregnancy Risk Assessment Monitoring System, 2004–2006." *Maternal and Child Health Journal* 16 (8): 1688–95.
- Institute of Medicine. 2011. *Advancing Oral Health in America*. Washington, DC: The National Academies Press.
- Kim, J., and M. A. Bush. 2013. "QuickStats: Percentage of Emergency Department (ED) Visits That Were Dental-Related among Persons Aged <65 Years, by Age Group." *Morbidity and Mortality Weekly Report* 62 (38): 803.
- Lockhart, P. B., A. F. Bolger, P. N. Papapanou, O. Osinbowale, M. Trevisan, M. E. Levison, K. A. Taubert, J. W. Newburger, H. L. Gornik, M. H. Gewitz, W. R. Wilson, S. C. Smith Jr., L. M. Baddour, American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Disease in the Young, Council on Epidemiology and Prevention,

- Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. 2012. "Periodontal Disease and Atherosclerotic Vascular Disease: Does the Evidence Support an Independent Association?: A Scientific Statement from the American Heart Association." *Circulation* 125 (20): 2520–44.
- McGinn-Shapiro, M. 2008. "Medicaid Coverage of Adult Dental Services." *State Health Policy Monitor*. Washington, DC: National Academy for State Health Policy.
- Michaud, D. S., Y. Liu, M. Meyer, E. Giovannucci, and K. Joshipura. 2008. "Periodontal Disease, Tooth Loss, and Cancer Risk in Male Health Professionals: A Prospective Cohort Study." *Lancet. Oncology* 9 (6): 550–8.
- Nasseh, K., and M. Vujicic. 2013. "Health Reform in Massachusetts Increased Adult Dental Care Use, Particularly among the Poor." *Health Affairs (Millwood)* 32 (9): 1639–45.
- . 2017. "Early Impact of the Affordable Care Act's Medicaid Expansion on Dental Care Use." *Health Services Research* 52 (6): 2256–68. <https://doi.org/10.1111/1475-6773.12606>
- Nasseh, K., M. Vujicic, and D. Romaine. 2014. "Diverting Emergency Department Dental Visits Could Save Maryland's Medicaid Program \$4 Million Per Year." In *Health Policy Institute Research Brief*. Chicago: American Dental Association.
- National Center for Health Statistics. 2014. *Health, United States, 2013: With Special Feature on Prescription Drugs*. Hyattsville, MD: National Center for Health Statistics.
- National Center for Health Statistics. 2015. *Health, United States, 2014: With Special Feature on Adults Aged 55-64*. Hyattsville, MD: National Center for Health Statistics.
- Neely, M., J. A. Jones, S. Rick, and L. Gutierrez. 2014. "Effects of Cuts in Medicaid on Dental-Related Visits and Costs at a Safety-Net Hospital." *American Journal of Public Health* 104 (6): e13–e16.
- Okunseri, C. 2015. "There Are More Than 1.3 Million Emergency Department Visits and Charges of \$1 Billion Annually Due to Nontraumatic Dental Conditions in the United States." *Journal of Evidence Based Dental Practice* 15 (1): 33–4.
- Okunseri, C., E. Okunseri, J. M. Thorpe, Q. Xiang, and A. Szabo. 2012. "Medications Prescribed in Emergency Departments for Nontraumatic Dental Condition Visits in the United States." *Medical Care* 50 (6): 508–12.
- Phero, J., and D. Becker. 2002. "Rational Use of Analgesic Combinations." *Dental Clinics of North America* 46 (4): 691–705.
- Seu, K., K. K. Hall, and E. Moy. 2012. "Emergency Department Visits for Dental-Related Conditions, 2009." Healthcare Cost and Utilization Project.
- Singhal, A., D. J. Caplan, M. P. Jones, E. T. Momany, R. A. Kuthy, C. T. Buresh, R. Isman, and P. C. Damiano. 2015. "Eliminating Medicaid Adult Dental Coverage in California Led to Increased Dental Emergency Visits and Associated Costs." *Health Affairs (Millwood)* 34 (5): 749–56.
- Sun, B. C., D. L. Chi, E. Schwarz, P. Milgrom, A. Yagapen, S. Malveau, Z. Chen, B. Chan, S. Danner, E. Owen, V. Morton, and R. A. Lowe. 2015. "Emergency

- Department Visits for Nontraumatic Dental Problems: A Mixed-Methods Study." *American Journal of Public Health* 105 (5): 947–55.
- Taubman, S. L., H. L. Allen, B. J. Wright, K. Baicker, and A. N. Finkelstein. 2014. "Medicaid Increases Emergency-Department Use: Evidence from Oregon's Health Insurance Experiment." *Science* 343 (6168): 263–8.
- Torres, L. H., D. D. da Silva, A. L. Neri, J. B. Hilgert, F. N. Hugo, and M. L. Sousa. 2013. "Association between Underweight and Overweight/Obesity with Oral Health among Independently Living Brazilian Elderly." *Nutrition* 29 (1): 152–7.
- Vujicic, M., T. Buchmueller, and R. Klein. 2016. "Dental Care Presents the Highest Level of Financial Barriers, Compared to Other Types of Health Care Services." *Health Affairs* 35 (12): 2176–82.
- Vujicic, M., and K. Nasseh. 2014. "A decade in Dental Care Utilization among Adults And Children (2001-2010)." *Health Services Research* 49 (2): 460–80.
- Wall, T., and K. Nasseh. 2013. "Dental-Related Emergency Department Visits on the Increase in the United States." *Health Policy Institute Research Brief*. Chicago: American Dental Association.
- Wall, T., K. Nasseh, and M. Vujicic. 2013. "Financial Barriers to Dental Care Declining after a Decade of Steady Increase." *Health Policy Resources Center Research Brief*. Chicago: American Dental Association.
- . 2014a. "Fewer Americans Forgoing Dental Care Due to Cost." *Health Policy Institute Research Brief*. Chicago: American Dental Association.
- . 2014b. "Most Important Barriers to Dental Care Are Financial, Not Supply Related." *Health Policy Institute Research Brief*. Chicago: American Dental Association.
- Wall, T., and M. Vujicic. 2016. "U.S. Dental Spending Up in 2015." *Health Policy Institute Research Brief*. Chicago: American Dental Association.
- Wall, T. P., M. Vujicic, and K. Nasseh. 2012. "Recent Trends in the Utilization of Dental Care in the United States." *Journal of Dental Education* 76 (8): 1020–7.
- Wallace, N. T., M. J. Carlson, D. M. Mosen, J. J. Snyder, and B. J. Wright. 2011. "The Individual and Program Impacts of Eliminating Medicaid Dental Benefits in the Oregon Health Plan." *American Journal of Public Health* 101 (11): 2144–50.
- Yarbrough, C., M. Vujicic, and K. Nasseh. 2014. "Medicaid Market for Dental Care Poised for Major Growth in Many States." *Health Policy Institute Research Brief*. Chicago: American Dental Association.

## SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix

Appendix SA2: Supplementary Methods Appendix.

Table S1: Distribution of Out-of-Pocket Costs of Dental Care (Control Group).

Table S2: ED Visits Primary Diagnosis (Control Group).

Table S3: ED Admissions for “Disorders of Teeth and Jaw” (Control Group).

Table S4: Analgesic and Anti-infective Medications Commonly Used for Dental Care.

Table S5: Effect of Lottery on Insurance Coverage (First-Stage Estimates).

Table S6: Intent-to-Treat Effect of Lottery and Local Average Treatment Effect of Medicaid.

Table S7: Robustness Analysis.

Table S8: Analysis of Samples Overlapping across Data Sources.

Figure S1: Study Sample.