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RESEARCH BRIEF

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# Does preventive dental care reduce nonpreventive dental visits and expenditures among Medicaid-enrolled adults?

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## Abstract

**Objective:** To determine whether preventive dental visits are associated with fewer subsequent nonpreventive dental visits and lower dental expenditures.

**Data Sources:** Indiana Medicaid enrollment and claims data (2015–2018) and the Area Health Resource File.

**Study Design:** A repeated measures design with individual and year fixed effects examining the relationship between preventive dental visits (PDVs) and non-preventive dental visits (NPVs) and dental expenditures.

**Data Collection/Extraction Methods:** Not applicable.

**Principal Findings:** Of 28,152 adults (108,349 observation-years) meeting inclusion criteria, 36.0% had a dental visit, 27.8% a PDV, and 22.1% a NPV. Compared to no PDV in the prior year, at least one was associated with fewer NPVs ($\beta = -0.13$; 95% CI −0.12, −0.11), lower NPV expenditures ($\beta = -\$29.12.53$; 95% CI −28.07, −21.05), and lower total dental expenditures (−$70.12; 95% −74.92, −65.31), as well as fewer PDVs ($\beta = -0.24$; 95% CI −0.26, −0.23).

**Conclusions:** Our findings suggest that prior year PDVs are associated with fewer subsequent NPVs and lower dental expenditures among Medicaid-enrolled adults. Thus, from a public insurance program standpoint, supporting preventive dental care use may translate into improved population oral health outcomes and lower dental costs among certain low-income adult populations, but barriers to consistent utilization of PDV prohibit definitive findings.

KEYWORDS
administrative data use, dentistry/dental care, health care costs, Medicaid, state health policies

### What is known on this topic

- To maintain optimal oral health and avoid poor oral health outcomes, dental providers recommend routine preventive dental care.

- Previous evidence of the effectiveness of adult preventive dental care is limited and subject to bias from unobserved characteristics that may confound the relationship between preventive dental care and future adverse oral health outcomes.
- Studies on the effectiveness of certain dental procedures among Medicaid populations are needed to inform state administrators and decision makers who are trying to determine the optimal balance of covered services with limited budgetary resources.

**What this study adds**

- Previous year preventive dental visits are associated with fewer subsequent nonpreventive visits and lower dental expenditures among Medicaid-enrolled adults.
- From a Medicaid insurance program standpoint, supporting preventive dental care use may improve population oral health outcomes by reducing the number of nonpreventive visits and associated costs.
- Despite common recommendations for adults to have regular dental care, the number of Medicaid adult enrollees having at least one yearly dental visit was low and irregular.

## 1 | INTRODUCTION

Poor oral health remains a significant public health challenge in the United States, particularly for low-income adults.[1–3] Adverse outcomes such as caries,[4] periodontal disease (advanced gum disease),[5] and tooth loss[6] are associated with pain,[4,7] decreased chewing function,[8] negative social perceptions,[9] and reduced quality of life.[10–14] To maintain optimal oral health and avoid these poor outcomes, dental providers recommend routine preventive dental care.[15–18] The recommended frequency of preventive dental care is based on a dental provider's assessment of the individual's risk of (and from) oral disease.[19] Typically, most adults are recommended to receive routine preventive dental care 1–3 times annually.[20]

Routine dental care allows for early identification of oral diseases, preventive care, and/or tailored delivery of oral hygiene education, all of which may prevent more serious or extensive disease(s) and treatment(s).[15,21,22] However, evidence as to whether routine preventive dental care reduces nonpreventive dental services and expenditures among adults is limited.[19,23] Some insurance payors have reported lower total dental expenditures and fewer dental emergencies among adult enrollees who receive preventive dental care than those who do not.[16,24,25] One study of a sample of Medicaid-enrolled adults with chronic diseases found preventive dental care was associated with an increased likelihood of future nonpreventive dental visits yet lower total dental expenditures.[26] However, previous evidence has been subject to bias from unobserved characteristics such as individual oral health behaviors, habits, and beliefs, which may confound the relationship between preventive dental care and future adverse oral health outcomes.

Given the high prevalence of poor oral health and unmet dental needs among low-income adults,[2,27] it is important to determine whether preventive dental care is effective against adverse oral health outcomes among this population, especially from a public insurance program perspective. States are not mandated to provide dental benefits for Medicaid-enrolled adults, and as a result, coverage varies greatly across states ranging from no dental benefits whatsoever to "extensive" or comprehensive dental benefits.[28] Some states ($n = 16$) provide "limited" Medicaid dental benefits to eligible low-income adults and cover diagnostic, preventive, and some minor restorative services, but overall cover less than one-sixth of all dental procedures.[28] Ultimately, little is understood about the effectiveness of preventive dental, and how various state Medicaid dental benefit programs are related to oral health outcomes and expenditures.

This study examined whether and to what extent preventive dental visits are associated with nonpreventive dental visits, nonpreventive expenditures, and overall dental expenditures among a population of low-income adults enrolled in a state Medicaid program. Specifically, we examine the Healthy Indiana Plan (HIP) Plus program, a "limited dental benefit program," during the first 4 years of its implementation following Medicaid expansion in February 2015. Our study design takes advantage of an econometric technique that controls for unobserved time-invariant characteristics that may confound the relationship between preventive dental care and nonpreventive dental care and expenditures, including individuals' intrinsic care-seeking attitudes and their level of health consciousness. Findings from this study may inform state administrators and decision makers who are trying to determine the optimal balance of covered services with limited budgetary resources. In addition, this study also contributes to evidence on the effectiveness of preventive dental care, which has thus far been very limited.

## 2 | METHODS

This study used a repeated measures design with individual fixed effects at the person-year level to estimate the relationship between preventive dental visits (PDV) and nonpreventive dental visits (NPV) and dental expenditures among Medicaid-enrolled adults with dental coverage.

### 2.1 | Population and data

Our primary data were administrative enrollment and claims data from Indiana's Family and Social Services Administration Office of Medicaid

Policy and Planning. Our inclusion criteria required adults to be continuously enrolled for 36 months in the HIP Plus program with no gap in coverage greater than 1 month between February 1, 2015, and December 31, 2018. Under the HIP Plus program, enrollees contribute a fixed monthly payment to a special savings account (referred to as a POWER account), which enrollees can use to help pay for their health care.[29] Monthly payments range from $1 to $20, depending on the enrollee's income.[29] As part of their coverage benefits, enrollees are able to receive two dental cleanings a year, up to four minor restorative services (e.g., fillings) every year, and one major restorative service (e.g., crown).[30,31] Our primary data was also supplemented with data from the Area Health Resources File that tracks whether a county is a dental health professional shortage area.[32,33] Given our data were deidentified, our study received an exemption from review by the BLINDED Institutional Review Board.

## 2.2 | Dependent variables

For each 12-month period of enrollment, we computed the following three outcomes: (1) number of NPVs, (2) annual expenditures for NPVs, and (3) total annual expenditures for all dental visits. We defined a NPV as a dental claim with Common Dental Procedure (CDT) codes for restorative (D2000-D2999), endodontic (D3000-D3999), periodontic (D4000-D4999), prosthodontic (D5000-D5999, D6200-D6999), oral and maxillofacial surgery (D7000-D7999) and/or all other non-preventive (D6000-D6199, D8000-D9999) dental procedures. All dental services rendered by providers were counted, regardless of whether they were reimbursed or denied by Medicaid. Dental expenditures were calculated as the total amount paid by Medicaid for dental services over an annual enrollment period, adjusted for inflation using the 2019 Consumer Price Index.[34]

## 2.3 | Main explanatory variable

Our main explanatory variable was a categorical variable indicating the total number of preventive dental visits in the prior year (0, 1, 2, 3, or more). We defined a preventive dental visit as the presence of a dental claim with CDT codes D0120 (periodic oral evaluation), D0150 (comprehensive oral evaluation), D1110 (adult prophylaxis), D1206 (topical application of fluoride varnish), D1208 (topical application of fluoride excluding varnish), D1351 (tooth sealant), and D1330 (oral hygiene instructions), and the absence of CDT codes D2000-D9999 on the same claim.[35]

## 2.4 | Analysis

We characterized the adults included in the study and calculated summary statistics for expenditures and preventive, nonpreventive, and total dental visits conditional on having a dental visit within a 12-month enrollment period. Next, we analyzed two models at the person-year

**TABLE 1** Characteristics of study population[a] ($N = 108,349$ adult observation-years)

| Characteristic | N(%) |
|---|---|
| Sex | |
| Male | 44,833 (41.4) |
| Female | 63,516 (58.6) |
| Marital status | |
| Married | 33,941 (31.3) |
| Single | 48,747 (45.0) |
| Widowed/Unknown | 6327 (5.8) |
| Divorced | 19,334 (17.9) |
| Mean age (Standard Deviation) | 45.1 (12.0) |
| Race/ethnicity | |
| Non-Hispanic white | 82,295 (75.9) |
| Black | 10,790 (10.0) |
| Hispanic | 5670 (5.2) |
| Asian or Pacific Islander/Native American | 9594 (8.9) |
| Year | |
| 2015 | 21,532 (19.9) |
| 2016 | 27,170 (25.1) |
| 2017 | 28,152 (26.0) |
| 2018 | 31,495 (29.0) |
| Dental Health Professional Shortage Area designation[b] | |
| Not shortage area | 39,523 (36.2) |
| Full or partial shortage area | 69,096 (63.8) |
| Months enrolled, mean (Standard Deviation) | 42.8 (4.08) |
| Family size | |
| 1 | 51,844 (47.9) |
| 2 | 24,762 (22.9) |
| 3 | 12,479 (11.5) |
| 4 | 9124 (8.4) |
| 5 or more | 9602 (8.9) |
| Unknown | 538 (0.5) |
| Any dental visit | 39,013 (36.0) |
| Any preventive dental visit[c] | 30,148 (27.8) |
| Any non-preventive dental visit[d] | 23,892 (22.1) |
| Number of enrollees who have at least one dental visit each year of enrollment | 13,893 (12.8%) |
| Number of enrollees who had at least one preventive dental visit each year of enrollment | 9817 (9.1%) |

[a]Specific to Healthy Indiana Program Plus enrollees with at least 36 months continuous enrollment between Feb. 1, 2015 and Dec. 31, 2018.
[b]Dental health professional shortage area as defined within Area Health Resource File from the U.S. Health Resources and Services Administration.
[c]Dental Claim that contains any of the following CDT codes (D0120, D1050, D1110, D1206, D1208, D1351, D1330) and the absence of CDT codes (D2000-D9999).
[d]Dental Claim that contains any of the following CDT codes (D2000-D9999).

**TABLE 2** Summary statistics of dental visits and expenditures by year of enrollment among Medicaid enrollees[a] with any dental care use

| | Overall, N = 39,013 Mean (SD) | Year 1, (Enrolled 12 months), N = 11,030 Mean (SD) | Year 2, (Enrolled 24 months), N = 10,869 Mean (SD) | Year 3, (Enrolled 36 months), N = 10,370 Mean (SD) | Year 4, (Enrolled 37–47 months), N = 6744 Mean (SD) |
|---|---|---|---|---|---|
| Visits | | | | | |
| Average number of dental visits | 2.35 (1.42) | 2.49 (1.52) | 2.44 (1.48) | 2.34 (1.35) | 1.95 (1.15) |
| Average number of visits diagnostic[b] only visits | 0.32 (0.61) | 0.28 (0.57) | 0.34 (0.64) | 0.36 (0.63) | 0.28 (0.56) |
| Average number of preventive[c] only visits | 1.09 (0.78) | 1.08 (0.77) | 1.12 (0.83) | 1.13 (0.78) | 0.98 (0.69) |
| Average number of nonreventive[d] only visits | 0.68 (0.93) | 0.80 (1.04) | 0.73 (0.96) | 0.63 (0.86) | 0.50 (0.74) |
| Average number of visits with a combination of diagnostic, preventive, and/or nonpreventive services | 0.26 (0.51) | 0.33 (0.57) | 0.25 (0.51) | 0.22 (0.47) | 0.20 (0.44) |
| | **Median (IQR)** | **Median (IQR)** | **Median (IQR)** | **Median (IQR)** | **Median (IQR)** |
| Expenditures per enrollee | | | | | |
| Median diagnostic[b] dental expenditures | $65.43 (41.81–101.08) | $93.63 (60.50–141.33) | $68.05 (42.82–110.10) | $47.55 (34.32–97.13) | $46.63 (13.26–90.73) |
| Median preventive[c] dental expenditures | $93.26 (47.07–136.00) | $97.84 (49.96–142.69) | $95.10 (40.17–144.20) | $93.60 (47.07–136.65) | $93.26 (47.07–93.26) |
| Median nonpreventive[d] dental expenditures | $97.59 (0–298.89) | $135.44 (0–388.8) | $98.36 (0–288.54) | $78.78 (0–239.31) | $0 (0–205.18) |
| Median total dental expenditures | $263.99 (148.35–497.22) | $364.76 (197.19–623.00) | $271.98 (149.88–485.84) | $237.72 (142.64–424.81) | $206.20 (127.93–368.64) |

[a]Specific to Healthy Indiana Program Plus enrollees with at least 36 months continuous enrollment between Feb. 1, 2015 and Dec. 31, 2018.
[b]Diagnostic services, specifically CDT codes (D0001-D0999, excluding D0120 & D0150).
[c]Preventive services, specifically defined as CDT codes (D0120, D1050, D1110, D1206, D1208, D1351, D1330).
[d]Nonpreventive services encompasses procedures with CDT codes D2000-D9999 and includes restorative, periodontic, endodontic, prosthodontic, and surgical care.

**TABLE 3** Fixed effects ordinary least squares regression models predicting the total number of nonpreventive visits (NPVs), NPV expenditures, and total dental expenditures among Indiana Medicaid-enrolled adults[a] following preventive dental visits in the prior year ($N = 28{,}152$)

| No prior PDV | Total number of NPVs Coefficient (95% Confidence interval) Reference | Total NPV expenditures Coefficient (95% Confidence interval) Reference | Total dental expenditures Coefficient (95% Confidence interval) Reference |
|---|---|---|---|
| 1 prior PDV | −0.13*** (−0.12, −0.11) | −29.12*** (−32.74, −25.50) | −70.12*** (−74.92, −65.31) |
| 2 prior PDVs | −0.21*** (−0.20, −0.18) | −40.95*** (−46.03, −35.87) | −110.52*** (−117.27, −103.77) |
| 3+ prior PDVs | −0.14*** (−0.20, −0.09) | −47.27*** (−58.61, −35.93) | −114.07*** (−129.13, −99.01) |
| Constant | 10.16*** (9.15, 11.17) | 1916.58*** (1692.94, 2140.23) | 3626.38*** (3329.27, 3923.48) |

*Note*: All models are adjusted for observed time-varying characteristics, namely age, dental health professional shortage area designation, and year (See Table S6 for full model). *$p < 0.05$, **$p < 0.01$, ***$p \leq 0.001$.

Abbreviation: PDV, Preventive dental visit; NPV, nonpreventive dental visit.

[a]Specific to Healthy Indiana Program Plus enrollees with at least 36 months continuous enrollment between Feb. 1, 2015 and Dec. 31, 2018.

level for each of our outcomes of interest (i.e., number of NPVs, NPV expenditures, and total dental expenditures) using two-way fixed effects (individual and year) linear regressions. We examined whether and to what extent the previous year's PDVs are associated with each outcome of interest. Individual fixed effects treat each adult as their own control, thus reducing bias from time-invariant individual characteristics, even if unobserved. We also include controls for observable time-varying characteristics in our population, namely age, whether the enrollee resided in a county designated as a dental health professional shortage area, and year. Results can be understood as the average change in the outcome attributed to each level of preventive visits (i.e., 1, 2, 3, or more) versus none. We used SAS 9.2[36] for data management and Stata SE version 17[37] for all analyses.

We conducted multiple sensitivity analyses. First, we examined the relationship between prior year PDVs and current year PDVs to assess overall utilization over time (Table S1). Since our dependent variables were nonnegative, we estimated fixed effects Poisson estimators in Table S2. We evaluated a more restrictive exclusion criterion for those without NPVs in the first 6 months of enrollment (Table S3) to account for the possibility that these enrollees may have pent-up and previously unmet dental needs. We analyzed cost outcomes using the modal value paid by Medicaid for each procedure, rather than the paid amount as it appeared in the claims (Table S4) to assess any effect of Medicaid's benefit limits, such as a maximum of four minor restorative visits per enrollment year are covered. Finally, to capture longer duration outcomes, we examined the total number of PDVs in the previous 2 years associated with each outcome of interest (Table S5).

## 3 | RESULTS

A total of 28,152 adults (constituting 108,349 observation years) met the study inclusion criteria. Population characteristics are presented in Table 1. Approximately 59% of the population were female, 76% were non-Hispanic whites, and 45% were never married. On average, included individuals were enrolled continuously for approximately 43 months. Overall, 36.0% had a dental visit, 27.8% had a preventive dental visit, and 22.1% had a nonpreventive dental visit. Approximately 13% had at least one dental visit, and 9% had a PDV each year of their enrollment.

Table 2 presents summary statistics for enrollees' overall annual number of dental services and expenditures, and the number of dental services and expenditures by year of enrollment, conditional on any dental care use. On average, among adults who had dental care, enrollees had 2.35 dental visits (SD = 1.42) per enrollment period. This included 1.09 (SD = 0.78) preventive-only visits and 0.68 (SD = 0.93) nonpreventive only visits. The median total cost for all dental visits in a 12-month enrollment period among adults with any dental visit was $263.99 (IQR = 148.35–497.22) per enrollee, $93.26 (IQR = 47.07–136.00) for preventive visits, and $97.59 (IQR = 0–298.89) for nonpreventive visits.

Results from fixed-effects linear regression models predicting the total number of NPVs, total NPV expenditures, and total dental expenditures following PDVs in the prior year are shown in Table 3. Compared to having no PDVs in the prior year, having at least one PDV was associated with fewer NPVs ($\beta = -0.13$; 95% CI −0.12, −0.11), lower NPV expenditures ($\beta = -\$29.12$; 95% CI −32.74, −25.50), and lower total dental expenditures (−$70.12; 95% −74.92, −65.31). Additional PDVs in the prior year were associated with fewer NPVs, lower NPV expenditures, and lower total dental expenditures relative to no PDVs. Full model output and sensitivity analyses, which were consistent with our main analysis, can be found in Tables S1–S6.

## 4 | DISCUSSION

We examined the relationship between PDVs and NPVs and dental expenditures among Medicaid-enrolled adults with dental coverage. When accounting for within-person characteristics, we observed having any PDVs in the previous year (or in the previous 2 years) was associated with subsequently fewer NPVs, lower nonpreventive dental care expenditures, and lower overall dental expenditures. Our findings suggest preventive dental care may improve oral health by reducing the need for costly restorative care, or it may reduce the

perceived need for services. We examined the first 4 years of expanded Medicaid dental benefits within a previously uninsured population. Thus we cannot exclude the possibility of pent-up demand for dental care use, especially since dental care utilization was inconsistent and all services, including PDVs, declined per person over time. Future research should examine perceptions of need and patterns of dental care utilization among adult Medicaid enrollees, including potential barriers to access and adverse selection.

Our findings are similar to Pourat et al.,[26] who observed preventive dental care was associated with lower overall dental expenditures among a sample of Medicaid-enrolled adults. Although Pourat et al.[26] did not observe preventive dental care associated with fewer nonpreventive dental care services, their findings support the notion that more frequent preventive services reduce the need for extensive and costly nonpreventive care. Our study, which accounted for time-invariant individual characteristics, provides evidence that preventive dental care may reduce both nonpreventive dental care use and associated expenditures. Optimal management of oral health relies on the early treatment of minor problems to prevent more invasive and more costly nonpreventive treatments.[38] Thus, from a public insurance program standpoint, coverage of preventive dental care may translate to downstream improved population oral health outcomes among low-income adults. This is a particularly salient point for states considering whether to add dental benefits to their Medicaid programs, and states with existing adult Medicaid dental coverage, as these benefits are optional and reduced or eliminated with state budgets that are often constrained.

Importantly, Pourat et al.[26] examined a sample of Medicaid-enrolled adults in California, a state with comprehensive or "extensive" dental benefits for its enrollees, whereas we examined a state that offers "limited" dental benefits for adults enrolled in the HIP Plus program. Similar to 15 other states, this level of generosity in dental benefits covers fewer than 100 of 600 dental procedures and generally focuses on the prevention or emergency care but limits the options for restorative care (e.g., root canals are not covered).[39] Given these benefit limits, public dental insurance programs may not be structured to incentivize optimal oral health across one's lifespan.[40] Thus, beyond oral health outcomes, future research should also consider how the quality of life is affected by the design of a state's dental insurance program.

Despite common recommendations for adults to have regular dental care, few enrollees had a dental visit each year of enrollment or at least one PDV each year of enrollment. Although utilization may decline within an individual over time as oral health status improves, particularly when they may not have had dental coverage previously, it is unlikely that only 9% of the population was advised to have at least 1 PDV annually. This contrasts with other populations studied, particularly children in public insurance programs, wherein PDV utilization is much more frequent.[41–43] Other barriers to regular care beyond coverage may exist. For example, lack of time to visit the dentist and inability to easily travel to see a dentist are consistent reasons reported by Medicaid-enrolled adults as to why they forgo visiting a dentist annually.[27,44] Regardless, additional research using robust mixed methods approaches is needed to determine the reasons why there is irregular use and the long-term consequences of such inconsistent care.

As a strength, this study employed a two-way fixed effects study design that allowed us to reduce bias from unobserved time-invariant confounders. Furthermore, we provided insights into the dental services covered in a state Medicaid program that provides "limited" dental benefits, which have not been explored. Still, some limitations are worth noting. First, our study design does not permit control for unobserved time-varying factors that may confound the relationship between preventive dental visits and nonpreventive dental visits and expenditures, such as health literacy campaigns or consumer incentives from managed care organizations. We cannot rule out the possibility of reverse causality, wherein NPV leads to PDV. We assumed individual characteristics remained constant (i.e., health consciousness, oral behaviors, and hygiene habits) but acknowledge some behaviors may have changed. However, if these behavioral changes were motivated by dental professionals during a preventive dental visit, this would be appropriately captured in the effect estimates of our analyses. Ultimately, since we lack relevant oral health diagnoses, we are unable to account for certain care-seeking behaviors and selection of treatment options. Additionally, we are unable to account for changes in an individual's diet, which may alter caries risk. Given the short study time period, we are unable to rigorously analyze cumulative, repetitive preventive dental care. Finally, our findings may not generalize to adults who disenroll prior to 36 months of coverage or to low-income adults who have coverage in a state Medicaid program with a different level of generosity in dental benefits.

## 5 | CONCLUSION

Our findings suggest that prior year PDVs are associated with fewer subsequent NPVs and lower dental expenditures among Medicaid-enrolled adults, but also subsequent PDVs. Thus, from a public insurance program standpoint, supporting preventive dental care use may translate into improved population oral health outcomes and lower dental costs among certain low-income adult populations, but barriers to consistent utilization of PDV prohibit definitive findings.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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