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Dental safety net capacity: An innovative use of existing data to measure dentists' clinical engagement in state Medicaid programs

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Abstract

Background: The demand for dentists available for state Medicaid populations has long outpaced the supply of such providers. To help understand the workforce dynamics, this study sought to develop a novel approach to measuring dentists' relative contribution to the dental safety net and, using this new measurement, identify demographic and practice characteristics predictive of dentists' willingness to participate in Indiana's Medicaid program.
Methods: We examined Medicaid claims data for 1,023 Indiana dentists. We fit generalized ordered logistic regression models to measure dentists' level of clinical engagement with Medicaid. Using a partial proportional odds specification model, we estimated proportional adjusted odds ratios for covariates and separate estimates for each contrast of nonproportional covariates.
Results: Though 75% of Medicaid-enrolled dentists were active providers, only 27% of them had 800 or more claims during fiscal year 2015. As has been shown in previous studies, our findings from the proportional odds model reinforced certain demographic and practice characteristics to be predictive of dentists' participation in state Medicaid programs.
Conclusions: In addition to confirming predictive factors for Medicaid enrollment, this study validated the clinical engagement measure as a reliable method to assess the level of Medicaid participation. Prior studies have been limited by self-reported data and variations in Medicaid claims reporting.
Practical implications: Our findings have implications for state Medicaid policymakers by enabling access to data regarding dental providers' level of participation in Medicaid in addition to identifying factors predictive of such participation. This information will inform Medicaid program plans and provider recruitment efforts.

Introduction

Cost and availability are major barriers to accessing dental care among low-income Americans and those residing in dental health professional shortage areas (DHPSA). Many Americans rely on the dental safety net to obtain preventive dental care and treatment. This safety net is composed of programs, organizations, and dental professionals all focused on reducing barriers to dental care access for underserved Americans (1).

State Medicaid programs are an important component of the dental safety net. These social insurance programs for low-income children and adults enable access to care by removing cost as a barrier. However, simply providing a form of public dental insurance does not ensure access. In order

for patients to actually access care, dental professionals must be available in the community, enrolled in state Medicaid programs, and willing to provide care to Medicaid recipients on an equitable basis as private pay patients.

Many states face a shortage of dental providers willing to enroll in their Medicaid programs (2-5). Previous studies have found that dentists are more likely to participate in Medicaid if they are from a racial or ethnic minority group and/or practice in pediatric dentistry (6-8). However, much of the existing literature examines dentists' self-reported participation or anticipated participation in Medicaid which may or may not reflect their *actual* participation. Additionally, dentists' participation in Medicaid is generally studied as a dichotomous variable, as in whether a dentist does or does not participate in Medicaid as opposed to the level of participation or the proportional contribution of a dentist's time to the provision of care for Medicaid recipients. Since a dentist may technically be considered a Medicaid provider without actually serving Medicaid patients, it is important to consider the level of participation to accurately assess Medicaid beneficiaries' access to dental care.

A 2017 article published in the *Journal of the American Dental Association* sought to develop more "nuanced metrics of dentists' participation in state Medicaid programs" by examining publicly available state-level data sources (9). Although the study identified a robust source of information on Medicaid program *enrollment* among dentists, it reinforced the lack of a comparable, consistent measure of dentists' actual participation or "clinical engagement" with Medicaid beneficiaries (9). Specifically, the Warder et al. study revealed several challenges to the validity and reliability of existing data on dentists' Medicaid participation, noting "insufficient state infrastructure, reliance on third-party contractors, high turnover in administrative positions, and inadequate resources allotted to Medicaid-related administration" (9). Additional challenges include variation in states' methods of counting claims data, inconsistent billing practices among group practices, and confounding issues related to Medicaid managed care and capitation arrangements, in addition to inherent challenges related to self-reporting.

The objectives of our study were to (a) develop a new method of measuring dentist participation in a state Medicaid program and (b) examine the association between various characteristics of dentists and level of participation in state Medicaid programs. We hypothesized that certain demographic and practice characteristics of Medicaid-enrolled dentists are predictive of their actual clinical engagement with Medicaid beneficiaries. Our study provides a viable solution to the "complicated endeavor" (9) of evaluating levels of dentists' participation in Medicaid and addresses the salient issue of accurately measuring dental safety net capacity. Our innovative approach used administrative data (enrollment and claims filed) from a state office of Medicaid and followed best practice guidelines for the management of federal health workforce shortage designation to quantify dentists' level of Medicaid participation. Our study fills an important gap in the literature by overcoming potential biases associated with self-reported participation in Medicaid programs and contributes to the understanding of proportional contribution of dentists to the dental safety net.

Methods

Study population and data sources

We retrieved 2016 dentist licensure data from the Indiana Professional Licensing Agency. These licensure data were supplemented with dentists' self-reported demographic and practice information through a survey administered in conjunction with biennial license renewals (10). The licensure survey was modeled after tools maintained by the federal government and the American Dental Association (11-13). Using license number as a unique identifier, we merged these data with Medicaid enrollment and claims count data for fiscal year 2015 (FY15). These data were obtained from the Indiana State Office of Medicaid Planning and Policy.

In 2016, there were 3,862 licensed dentists in the State of Indiana. Our analyses excluded individuals who did not have a valid Indiana dental license, self-reported not actively practicing within the state, and/or were not enrolled in Indiana Medicaid during the study period (FY15). Six dentists were removed from the sample as statistical outliers in total Medicaid claims for FY15 (Figure 1). Our final study sample included 1,023 dentists enrolled as Medicaid providers of whom 759 had at least one Medicaid claim (active) and 264 had no Medicaid claims (inactive) in FY15.

Outcome measure

Our primary outcome measure was "clinical engagement," which was defined as the level of participation in the state Medicaid program based on the number of unique claims. Indiana Medicaid offers health insurance coverage for aged, blind, disabled, and low-income adults (up to 138% of federal poverty level) and children (up to 250% of federal poverty level) (14). With few exceptions, dental services are a covered benefit for adults and children enrolled in Indiana Medicaid (14). In 2016, 52% of Medicaid recipients were adults and 48% of Medicaid recipients were children. Dental claims from all Indiana Medicaid programs and State Children's Health Insurance Program were included in study analyses (14-16). Medicaid claims were converted to time-based contributions using criteria defined by the US Health Resources and Services Administration (HRSA) for the identification of DHPSA. As part of the assessment process for

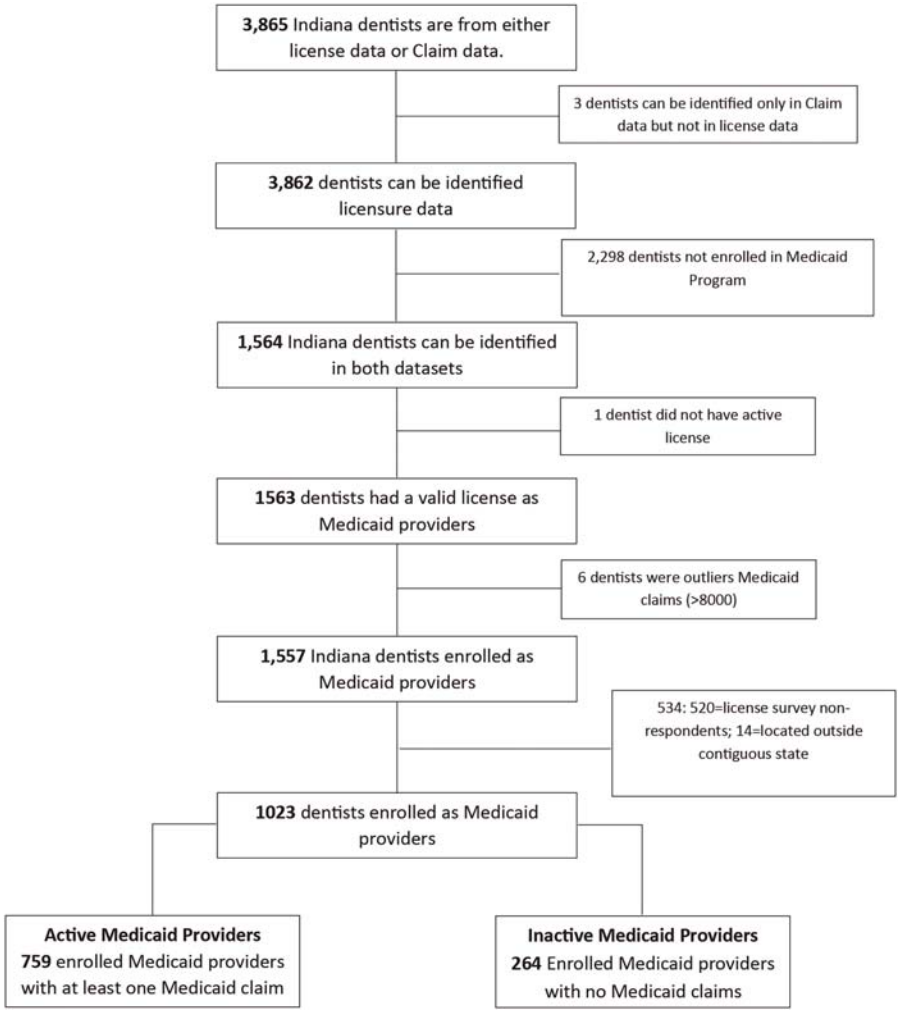

Figure 1 Study sample selection criteria.

DHPSAs, HRSA equates 4,000 Medicaid claims to one full-time equivalent (FTE) of a Medicaid provider (17). Therefore, we converted Medicaid claims to an estimated weekly time contribution by dividing "total Medicaid claims" by 4,000 (17). Our clinical engagement measure represents the estimated weekly time contribution and was evaluated as a seven-level categorical variable with "1" representing an "inactive Medicaid provider" (meaning 0 hours per week as a Medicaid provider) and a value of "7" representing "8 hours or more per week as a Medicaid provider" (Table 1). These categories were selected for the primary analyses through identification of clusters in the distribution of claims counts. Additionally, these categories are also consistent with meaningful time-based clinical contributions as 30-minute increments are consistent with the average times for preventive dental visits within the dental safety net (18).

Table 1 Categorization and Conversion of Medicaid Claims

Medicaid claim category	Number of claims	Estimated hours per week providing dental care to Medicaid recipients*	Total dentists
1	0	0 hours (inactive)	264
2	1–49	<0.5 hours	133
3	50–99	0.5–1 hours	67
4	100–199	1–2 hours	96
5	200–399	2–4 hours	105
6	400–799	4–8 hours	147
7	≥800 claims	8+ hours	211

*Conversion based on criteria defined by the Health Resources and Services Administration.

Table 2 Independent Covariate Definitions

Variable	Description	Value
Age category	Age group assignment based on a dentist's age, which was calculated from the date or survey completion and a dentists' date of birth	1 = less than 35 2 = 35 – 54 3 = 55 and older
Race	Indicator of whether a dentist was white or another race, based on their survey response	1 = white 2 = other race
Job status	Indicator of whether a dentist works full time or part time, based on whether they reported spending 32 hours or more per week in direct patient care	1 = full time (32 hours or more per week) 2 = part time (less than 32 hours per week)
Sex	Dentists' gender, based on survey response	1 = male 2 = female
Dental practice setting	Dentists' reported primary practice setting, derived from a 17-category variable Settings included in other category: Hospital/clinic Federal government hospital FQHC, long-term care facility Home health setting Local health department Public health/community health setting School health service Mobile unit Correctional facility Indian health service Head start Staffing organization Other setting	1 = office/clinic: solo practice 2 = office/clinic: partnership 3 = office/clinic: group practice 4 = other setting
Urban/rural	Rurality designation of primary practice county location, based on the 2013 rurality classification defined by the Office of Management and Budget	1 = rural 2 = urban
Self-reported Medicaid status	Indicator of whether a dentist reported serving Medicaid patients at their primary practice	1 = reported being an active Medicaid provider 2 = reported not being an active Medicaid provider
Dental specialty	Dentist's self-reported practice type and/or self-reported completion of dental residency	1 = general practice 2 = dental public health 3 = pediatric dentistry 4 = oral and maxillofacial surgery 5 = other (includes the following: endodontics, periodontics, prosthodontics, oral and maxillofacial pathology, oral and maxillofacial radiology, and other)

The clinical engagement measure is described in more detail in the Technical Appendix.

Independent variables

A number of self-reported demographic and practice characteristics are potential predictors of a dentist being an active provider and their clinical engagement in the Medicaid program. Characteristics of interest to this study include age, race, job status, gender, practice setting, practice location, and dental specialty.

To understand how these independent factors are associated with clinical engagement in Medicaid, we included them as covariates in our analyses. These predictors of Medicaid participation are largely consistent with previous research that has demonstrated their relationship with dental Medicaid enrollment (7-9). More detailed definitions of the independent variables are available in the Table 2.

Statistical analysis

We reported descriptive summary statistics for all independent variables and the outcome measure to describe the study sample. We performed cross-tabulations and chi-squared statistics to identify differences in clinical engagement by dentists' demographic and practice characteristics.

We used the SAS LOGISTIC procedure with the "unequal slopes" option to estimate generalized ordered logistic regressions (also called proportional odds models) to determine the effects of dentists' characteristics on the level of clinical engagement in Medicaid. By specifying the "unequal slopes" option, we were able to test for proportionality in each of the model effects as well as overall. Proportionality is the assumption that, when determining the likelihood of being in a specific level or higher compared to the lower levels of an ordinal dependent variable, the odds of being in the higher level are the same at all levels, thus indicating an equal effect by the independent covariate. We estimated one adjusted odds ratio (AOR) for variables in which proportionality was confirmed; these AORs indicated the likelihood of dentists having an overall greater clinical engagement in Medicaid. Where the proportionality assumption was violated, or the effect varied across the different levels of Medicaid participation, we estimated separate AORs for each comparison, as in "0" versus ">0", . . . , "<8.0 versus 8.0+" hours per week as a Medicaid provider. We selected a partial proportional odds specification model to account for proportional AORs for all covariates except for age, which showed nonproportionality at $P < 0.05$.

We conducted multiple sensitivity analyses to assess the robustness of our findings with respect to the clinical engagement measure. We considered several alternative approaches to the categorization of claims counts, such as binary classification and a four-level categorical variable (see the Technical Appendix for results from these alternative approaches). We conducted all statistical analyses using SAS Statistical Software 9.4©. Statistical significance was determined at *P*-value < 0.05. This study was approved by the Indiana University Institutional Review Board (Protocol #1701057378).

Results

First, we found that of the 1,023 dentists enrolled in Indiana Medicaid in FY15, 759 (74%) were active Medicaid providers (having one or more claims) while the remaining 264 (26%) were considered inactive Medicaid providers. However, of those who were active only 27% had Medicaid claims that were equivalent to a contribution of 8 hours or more. Table 3

Table 3 Demographic and Practice Characteristics of Indiana Dentists by Medicaid Participation Status

	Active		Not active		
	N	%	*N*	%	*P*-value
All	759	74.19	264	25.81	
Age category					0.008
less than 35	132	65.67	69	34.33	
≤35–54	373	76.75	113	23.25	
Greater or equal to 55	254	75.6	82	24.4	
Race					0.335
White	652	73.67	233	26.33	
Other race	107	77.54	31	22.46	
Job status					0.267
Full time (32 hours or more per week)	517	75.25	170	24.75	
Part time (less than 32 hours per week)	242	72.02	94	27.98	
Gender					0.133
Female	224	71.11	91	28.89	
Male	535	75.56	173	24.44	
Dental practice setting					<0.0001
Solo practice	409	78.35	113	21.65	
Partnership	110	76.39	34	23.61	
Other setting	55	64.71	30	35.29	
Group practice	185	68.01	87	31.99	
Practice location					0.351
Rural	134	77.01	40	22.99	
Urban	625	73.62	224	26.38	
Dental specialty					<0.0001
General practice	613	74.76	207	25.24	
Dental public health	18	85.71	3	14.29	
Pediatric	74	84.09	14	15.91	
Other type	3	17.65	14	82.35	
Oral and maxillofacial surgery	51	66.23	26	33.77	

Source: Authors' analysis of state Medicaid claims counts, 2015.

Note: Active and nonactive Medicaid participation status was determined by the presence of at least on Medicaid claim within the study period.

Table 4 Adjusted Odds Ratios and 95% CI from Generalized Ordered Logistic Regression Models of Clinical Engagement in Medicaid (Hours/Week) by Dentists' Demographic and Practice Characteristics

	AOR and 95% CI Clinical engagement in Medicaid (hours/week)[a] If the odds ratio is proportional, a single AOR is shown in the center column If the odds are nonproportional three AORs are shown, one for each of the three contrasts					
Variables	0 versus > 0	<0.5 versus 0.5+	<1 versus .1+	<2 versus 2+	<4 versus 4+	<8 versus 8+
Practice setting (other settings)						
Solo practice	1.40 (0.90, 2.17)					
Partnership practice	1.14 (0.70, 1.87)					
Group practice	1.13 (0.71, 1.79)					
Dental specialty (other specialties)						
Dental public health	29.77 (7.46, 118.81) ***					
General practice	13.42 (4.24, 42.44)***					
Oral surgery	9.62 (2.90, 31.92)***					
Pediatric	55.32 (16.52, 185.30)***					
Gender (female)	1.24 (0.98, 1.57)					
Race (nonwhite)	0.69 (0.51, 0.94)**					
Full-time job status (part time)	1.38 (1.11, 1.72)**					
Age category (≥55 years old)						
35–54 years old	1.1 (0.80, 1.51)*	1.37 (1.03, 1.82)**	1.58 (1.20, 2.09)***	2.00 (1.50, 2.64)***	1.93 (1.44, 2.6)***	2.03 (1.43, 2.88)***
Less than 35 years old	0.61 (0.42, 0.89)*	0.87 (0.55, 1.10)	0.96 (0.67, 1.35)	1.33 (0.93, 1.89)	1.83 (1.27, 2.64)**	1.66 (1.67, 2.57)*

Source: Authors' analysis of state Medicaid claims count data, 2015.
Reference category in parentheses.
AOR, adjusted odds ratio; CI, confidence interval.
***$P < 0.001$; **$P < 0.01$; *$P < 0.05$.
[a]If proportionality assumption was violated (rejected at an alpha level of 0.05) for any covariate, separate AORs were estimated for each contrast for the seven levels of the clinical engagement outcome (see Technical Appendix for additional details).

provides a summary of the demographic and practice characteristics for all 1,023 dentists. Though the largest portion of active dentists were between the ages of 35 and 54, nearly a third of active dentists were 55 years or older. Over half of active Medicaid providers reported working in a solo practice and the majority reported their dental specialty as a general dentistry.

Clinical engagement in Medicaid

The partial proportional odds model that examined the level of Medicaid participation as compared to simply Medicaid provider status identified several significant predictors for our measure of clinical engagement. In regard to dental specialty, dentists self-reporting general practice, pediatric dentistry, and public health had greater odds of being more clinically engaged in the state Medicaid program as compared to dentists self-reporting other specialties. Most notably, pediatric dentists were over 55 times more likely to have greater clinical engagement than "other" practice types (AOR = 55.32; 95% CI, 16.52, 185.30; $P = < 0.0001$). Caution must be taken when interpreting results associated with dental specialty. Dental specialty is derived from self-reported data obtained during the biennial relicensure survey; therefore, respondents practicing in public health settings may identify as a public health dentist regardless of having completed formal training in dental public health. In addition to dental specialty, the generalized ordered logistic regression analyses also identified race and job status to be significant predictors of providers' clinical engagement in Medicaid. Full results for the multivariable regression are summarized in Table 4.

Age was also a significant predictor of clinical engagement in Medicaid. However, age did not pass the tests for proportionality and therefore was evaluated using a partial proportional odds specification. Results of tests for proportionality for age categories as well as additional details regarding the partial proportional odds model are provided in the Technical Appendix.

Figure 2 illustrates the percentage of dentists in each level of clinical engagement within each age group. These descriptive trends suggest that dentists between the ages of 35 and 54 represent an increasing and greater proportion of Medicaid-enrolled dentists in categories of higher clinical engagement. AORs for each contrast of the age effect in the partial proportional odds model are provided in Table 3. When comparing the youngest age category (<35 years old)

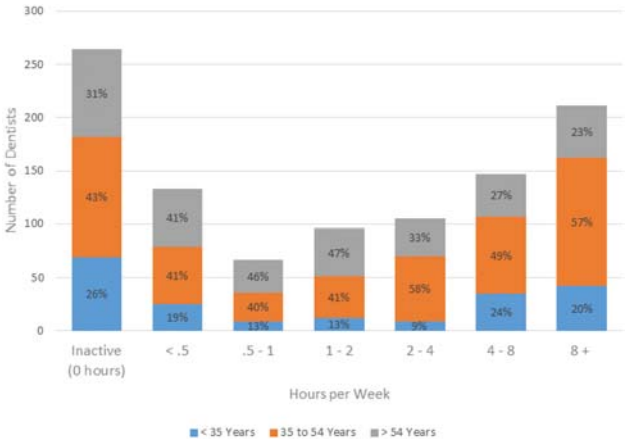

Figure 2 Distribution of dentists' Medicaid participation by age category. [Color figure can be viewed at wileyonlinelibrary.com]

to the oldest age category (55 years or older), younger dentists were less likely to be clinically engaged (i.e., contributing greater than 0 hours per week) (AOR = 0.61; 95% CI 0.42, 0.89; $P = 0.012$); however, when comparing contrasts for 4 hours or more per week or greater, younger dentists had a greater likelihood of contributing as compared to those dentists in the oldest age category. Furthermore, when comparing the 35 to 54-year-old category to the age 55+ category, the odds of making a greater clinical contribution increased consistently for each contrast above "0 hours versus >0 hours" for the age effect in the partial proportional odds model.

Discussion

This study sought to develop and test a new method of measuring dentists' relative contribution to the dental safety net. Using administrative data from a state office of Medicaid and applying federal criterion for measuring the actual supply of dental Medicaid providers, we found that more than 25% of Medicaid-enrolled dentists did not actively participate in the program. Dental specialty, age, race, and job status were all identified as factors significantly associated with likelihood of participating in Medicaid. These findings demonstrate inherent weaknesses and strengths of administrative data for dental safety net workforce assessments.

To our knowledge, this study is the first to use administrative data to measure the relative contribution of dentists to the dental safety net and assess predictors of clinical engagement in state Medicaid programs. Our use of Medicaid claims data enabled us to create a more accurate measure of clinical engagement in state Medicaid programs and ultimately tell a more meaningful story in regard to dental safety net supply as compared with prior studies which focused on Medicaid enrollment and used self-reported data (9,19,20). Reliance on self-reported Medicaid participation and Medicaid enrollment data has been cited in the literature as a limitation to this area of study as it may lead to misrepresentation of dental safety net supply (9). Our findings confirm this assertion by demonstrating that approximately 25% of dentists enrolled in Indiana Medicaid are inactive providers (i.e., they did not submit a claim within FY15). As such, using Medicaid enrollment data for policy and planning may lead to overestimates of capacity. On the other hand, by using administrative data to assess clinical engagement, our study was not subject to the inherent bias of self-reported data and provides an innovative way to measure actual supply of state Medicaid programs that may inform policy and planning initiatives.

State Dental Directors and State Medicaid Directors should seek out partnerships and opportunities to leverage administrative and workforce data maintained by licensing agencies and/or dental boards, State Offices of Medicaid, and State Offices of Primary Care. These data offer valuable information on provider supply and characteristics that can be used to inform policy and programing, particularly related to recruiting dental providers into Medicaid programs (21). Availability of administrative and workforce data varies by state (22). State-level information on the availability of workforce survey data can be found in the 2016 data collection report by University at Albany - State University of New York Center for Health Workforce Studies (22).

This study also assessed whether certain characteristics of Medicaid-enrolled dentists were associated with their level of participation in state Medicaid programs. Findings revealed that significant predictors of the level of clinical engagement are consistent with previous literature examining factors influencing Medicaid enrollment (20,23-26). These consistencies provide some external validity to this new method of measuring levels of Medicaid participation. Furthermore, sensitivity analyses demonstrated consistent results and identified the same predictors of clinical engagement as our main analyses, which provides additional support for the robustness of our findings.

Of note were the variations in clinical engagement we observed by dental specialty. Additional research is needed to understand the relationship between dental specialty and clinical engagement in Medicaid. We expect that, to some extent, variations observed by specialty reflect differences in Medicaid programs, including covered services and reimbursement rates, for adults and children. This study analyzed total dental claims counts for all Indiana Medicaid programs (15). Dental claims counts by Medicaid subprogram were not available for this study. Future studies could examine clinical engagement by program to better understand the contribution of certain dental specialties to Medicaid populations.

This study builds on previous literature attempting to measure the supply of the dental safety net. There are relatively simple methods to calculate the supply of Medicaid-enrolled providers based on state licensure data, but simply calculating the number of enrolled providers does not adequately capture unmet need within the dental safety net. Understanding dentists' level of participation (i.e., clinical engagement) in state Medicaid programs is needed to more accurately assess supply and identify shortages to inform policy and planning efforts. Future studies could incorporate demand side factors, including utilization rates, socioeconomic and demographic characteristics of the Medicaid-enrolled population, to further explore the relationship between Medicaid provider supply and demand.

While there are myriad strategies to strengthen providers' engagement in the safety net, such as Long et al.'s (2013) suggestions of "lowering the costs of participating in Medicaid by simplifying administrative processes, speeding up reimbursement, and reducing the costs associated with caring for those patients" (27), such strategies are difficult to measure without an accurate indicator of clinical engagement in state Medicaid programs. Our method of measuring clinical engagement provides a mechanism for measuring such outcomes, enabling robust research and high quality data which policy makers could use to develop evidence-based policies to improve dental safety net capacity and provider recruitment needs.

The underlying principle for this new method of measuring dentists' level of Medicaid participation is the conversion claims counts to a categorical value corresponding to the provider's Medicaid FTE using criteria defined by HRSA originally developed for the identification of DHPSAs (17). However, no studies have validated HRSA's conversion criteria for dentists, physicians, or psychiatrists, which poses an interesting area of future research to further validate this method of measuring providers' clinical engagement in state Medicaid programs.

This study could also be replicated with larger datasets to inform other state Medicaid programs. For example, the US Centers for Medicare and Medicaid Services' federal level claims information could be used to create a representative sample of dentists throughout the United States to validate this study on a larger scale. Similar studies could be performed for all Medicaid provider types that bill Medicaid. However, additional research must evaluate the unique reporting structure of Medicaid claims at the state level to determine the feasibility of this method in states that have different administrative structures as compared to Indiana Medicaid.

Limitations

The findings from this research should be discussed in the context of certain limitations. First, the study only examines a sample of Indiana dentists. Also, the sample only includes those for whom demographic and practice characteristics were available from the licensure survey administered in 2016. Although, we excluded Medicaid providers with missing demographic and practice characteristics, the purpose of this research was to assess the validity of a new measure of Medicaid participation and not to determine Indiana's current dental safety net capacity. Also, since the study sample was limited to dentists in Indiana, results may not be generalizable to other states. However, the underlying principles used to measure Medicaid participation can be applied to all 50 states and the District of Columbia since they are all required to report Medicaid claims data.

Finally, since certain demographic and practice characteristics used in this study rely on self-reported information, there is a possibility of response bias in this study. To mitigate this potential limitation, we followed best practices of evaluating health workforce supply by collecting demographic and practice characteristics in conjunction with state licensure renewal data.

Conclusion

Our findings validate several demographic and practice characteristics of dentists [i.e., job status, self-reported Medicaid participation, age, race, dental practice type (20,23-25)] as predictors of their participation in state Medicaid programs. Just as importantly, our study provides a novel method of measuring the relative contribution (clinical engagement) of dentists in state Medicaid programs by examining Medicaid claims counts and DHPSA designation resources in addition to state-based licensure data. This cost-effective method presents a viable solution to the complicated challenge of measuring low-income individuals' access to dental care and the capacity of the dental safety net. This solution is particularly relevant for state Medicaid offices as they have historically struggled with Medicaid provider recruitment.

These salient findings are timely as the US health-care landscape continues to evolve. With ongoing policy efforts related to Medicaid reform, it has become increasingly important to accurately measure state Medicaid capacity for all health professions that serve Medicaid beneficiaries. While

several studies have attempted this, it remains a "complicated endeavor" (9).

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

