ORIGINAL REPORT: HEALTH SERVICES RESEARCH

Dentists' Adoption of Silver Diamine Fluoride among 1- to 5-Year-Old Children in North Carolina

B.D. Meyer[1], E.R. Kelly[2], and P. McDaniel[2]

Abstract: ***Background:*** *A natural experiment was conducted to observe the adoption of silver diamine fluoride (SDF) by Medicaid-enrolled dentists in North Carolina (NC). The purpose of this study was to describe the sociocontextual and community health characteristics where dentists adopted SDF, determine the association between SDF use and general anesthesia (GA) use, and examine the changes in GA utilization following implementing SDF reimbursement.*

Methods: *NC Medicaid initiated SDF reimbursement in 2016 for children ages 1 to 5 y. This cross-sectional time series study used aggregate NC Medicaid claims, including geographic data, from 2014 to 2018. All dentists who provided GA and/or SDF to children ages 1 to 5 y were included. County health ranking data described social and community health indicators. Descriptive statistics, spatial data techniques, and multivariable methods were used.*

Results: *From 2016 to 2018, the number of dentists using SDF increased from 35 to 258, or 637%, whereas the number of dentists using GA increased from 179 to 211, or 17%. SDF utilization spread outward from areas of good social and health indicators to areas of poorer indicators. SDF utilization increased from 0.35 to 0.65 per 1,000 children, whereas GA utilization decreased from 2.57 to 2.47 per 1,000 children. GA utilization was positively associated with SDF utilization and poorer county health ranking but did not change before and after SDF implementation.*

Conclusion: *Early adopters of SDF in NC practiced in areas with positive social and community health indicators. Over time, SDF was adopted in resource-poor communities. It remains too early to determine the public health impacts of SDF treatment on GA utilization.*

Knowledge Transfer Statement: *Policy makers and clinicians can use the results of this study to develop geographically targeted interventions that could lead to clinically and cost-effective public health programs.*

Keywords: access to care, health services research, pediatric dentistry, public health, prevention, spatial analysis

Introduction

Early childhood caries (ECC) represents a significant public health burden and causes financial stress on many families in the United States (Bruen et al. 2016; Dye et al. 2017). The dental profession has traditionally provided surgical and rehabilitative treatment for ECC. For many young children unable to cooperate with conventional behavior management or dentists uncomfortable treating an uncooperative young child, moderate sedation or general anesthesia (GA) is often required to complete restorative treatment (Crystal, Marghalani, et al. 2017). This method of care is expensive, and many children treated in this manner have recurrent problems requiring retreatment (Berkowitz et al. 2011; Meyer et al. 2017). Significant adverse events following dental treatment under GA (Lee et al. 2017) and the growing emphasis of patient safety in health care (American Academy of

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A supplemental appendix to this article is available online.

Pediatric Dentistry 2017) have challenged clinicians and policy makers to consider alternative caries management strategies.

Silver diamine fluoride (SDF) emerged as one such alternative to traditional caries management. New to the US market in 2015, its use was quickly touted as an acceptable alternative for managing ECC as part of individualized, patient-specific caries management (Crystal, Marghalani, et al. 2017). One of the side effects of SDF is the black staining of caries lesions to which it is applied (Crystal, Janal, et al. 2017). Uptake of this new alternative was initially slow, perhaps due to parents declining treatment and, subsequently, dentists opting not to adopt it in their practices. A 2016 survey of pediatric dental residency program directors found only 25% used SDF as a caries control agent, with reimbursement being a perceived barrier to practice implementation among 73% of respondents (Nelson et al. 2016).

North Carolina's dental Medicaid program initiated SDF reimbursement in 2016, and an opportunity arose to observe provider adoption trends. North Carolina has one of the highest utilization rates of dental treatment under GA in the United States (Bruen et al. 2016), and for certain ages, treatment in this venue can consume nearly 40% of expenditures (Meyer et al. 2017). SDF is often evaluated within the context of reducing or delaying GA utilization in young children (Johhnson et al. 2019). In North Carolina, children ages 1 to 5 y are the most frequent users of GA for dental treatment (Meyer et al. 2017). For these reasons, North Carolina policy makers selected SDF to control expenditures and perhaps delay or avoid the need for GA to complete dental treatment by limiting the policy to children ages 1 to 5 y, inclusive.

As a relatively new technique to the United States, scant data describe how, when, and where dentists are using SDF. Implementation science helps researchers and clinicians identify and disseminate processes or clinical protocols to larger scales or settings in a way that improves outcomes (Stetler et al. 2006). In our case, the outcome could be SDF utilization delaying or avoiding dental GA. Implementation occurs at multiple levels—individual provider, practice, or system/policy (Ferlie and Shortell 2001)—and can be evaluated according to the intervention, the external environment to the subject, the internal environment to the subject, the characteristics of the personnel, and the overall process of implementing a new procedure (Damschroder et al. 2009). The premise of this study was to report observations of a natural experiment regarding the adoption of a new technique (Craig et al. 2012). Implementation science frameworks would consider this an evaluation of the external environment where a policy changed initiating reimbursement for SDF treatment.

Our primary objective was to describe SDF adoption trends by Medicaid-enrolled dentists who treat children ages 1 to 5 y. First, we described the geographic and sociocontextual community health characteristics where providers adopted SDF treatment. Geographic and social determinants of health have been shown to influence ECC (Watt 2012; Iida and Rozier 2013; Watt et al. 2018), but it remains unknown how this relates to adoption of new techniques and technologies into daily clinical practice. Second, we compared changes in provider GA utilization against provider SDF utilization, as well as GA utilization changes before and after implementing SDF reimbursement.

Methods

We employed cross-sectional, time-series descriptive methods. The University of North Carolina at Chapel Hill Institutional Review Board reviewed the application and determined it to be non–human subjects research (IRB 18-2203). This study conforms to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies. For the purposes of this study, we assumed that any child treated with SDF and/or GA had ECC.

Data Sources

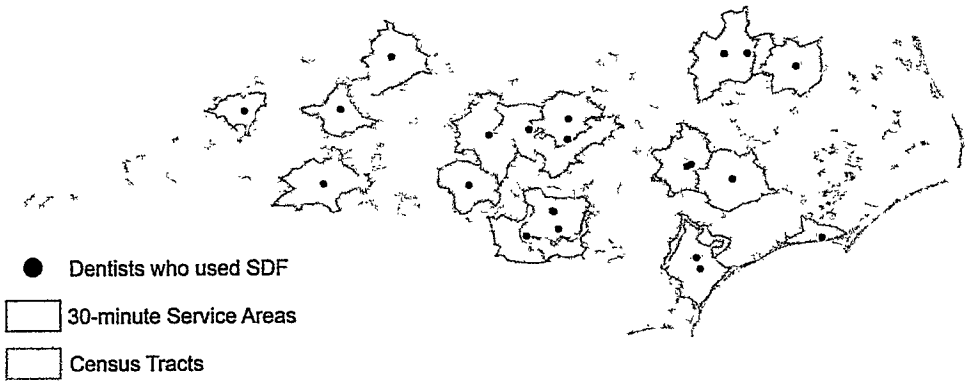
We requested data from the North Carolina Medicaid Dental Division to use public provider information to answer our study questions. First, we limited our data request for claims from January 1, 2014, to December 31, 2018. SDF became reimbursable by Current Dental Terminology (CDT) code D1354 effective January 1, 2016 (American Dental Association 2017), and North Carolina Medicaid initiated reimbursement beginning in calendar year 2016, retroactive to January 1, 2016. Accordingly, the primary focus of our observation included calendar years 2016 to 2018. However, claims from calendar years 2014 to 2015 were used to compare dental GA utilization (CDT code 9420) pre- and post-SDF implementation. Next, we requested a list of dentists with paid claims for SDF and GA in children ages 1 to 5 y because the SDF reimbursement policy in North Carolina Medicaid imposes the same age limits. Although individuals with special health care needs are a group indicated to receive SDF (Crystal, Marghalani, et al. 2017), we did not include dentists with paid claims for individuals outside the 1- to 5-y age range.

We received and merged 2 files (1 for dentists who provided SDF and 1 for dentists who used GA) from the claims that included the following information aggregated by year for each dentist:

- Practice address including ZIP code for geocoding
- Provider specialty (general versus pediatric)
- Number of children treated by the provider with the procedure

In North Carolina, there are approximately 5,500 licensed dentists, and 29% (around 1,600) are enrolled in the Medicaid program (American Dental Association 2018). More than 1,100 dentists had a claim for an oral health service provided to a child 1 to 5 y old. During the study period, 136 dentists only provided SDF, 139 only provided GA, and

Figure 1. Example map showing 30-min service areas created to determine the denominator of the utilization ratio calculations. Providers were geolocated and superimposed over census tracts. Service areas were created to determine 30-min travel times to providers from all directions. All census tracts completely within or touching the service area were included in the denominator of the utilization ratio calculations. SDF, silver diamine fluoride.



142 provided both SDF and GA (total n = 417). Even though increased periodicity and frequency of SDF application improves its effectiveness (Fung et al. 2018), we did not differentiate between 1 and 2 SDF applications since our primary interest was the general adoption of SDF among Medicaid-enrolled dentists in North Carolina. In addition, we limited our analysis to dentists and not dental hygienists since all claims are billed through the supervising dentist for North Carolina Medicaid.

Finally, we used additional data sources to provide context and create variables for descriptive analysis. To aid visual display and spatial analysis, we used 2018 North Carolina county health ranking data (2018) as a best approximation to generically describe geographic and community health characteristics where dentists adopted SDF treatment. The county health rankings combine county-level data from multiple sources of social and health indicators into thematic categories. These categories are weighted for ranking and include health outcomes, health behaviors, access to clinical care, social and economic environment, and physical environment. The data are weighted and converted to z scores so that each county is ranked in relation to the others, and we used these scores to create quintiles for analyses. Counties in the highest quintile had the lowest z scores (most negative). These counties had higher levels of educational attainment, higher incomes, lower unemployment rates, better access to food, more social support, less violent communities, and better access to quality air, water, and housing. These counties also demonstrated better health and health access with fewer uninsured individuals, better access to health care providers, lower health care costs, lower tobacco and alcohol use, lower rates of sexually transmitted infections and teen births, less obesity, more access to physical activities, and better overall health. We defined counties in this highest quintile as resource-rich counties.

Outcomes and Other Variables

The primary outcome of interest was SDF adoption by dentists. For descriptive analysis, we standardized comparisons among dentists by calculating a service utilization ratio per 1,000 children. We accounted for providers near county boundaries who may treat patients from adjacent counties by using census tract-level population estimates from the 2012 to 2016 five-year estimates of the American Community Survey. Using roadmap data, we created 30-min service areas around each provider (example shown in Fig. 1). The SDF utilization ratio numerator equaled the number of children a dentist treated with SDF, and the denominator equaled the estimated population 5 y old and younger in any census tract within or touching the 30-min service area:

$$\frac{\text{number of children treated by a dentist}}{\text{population 5 y and younger within 30-min service area}} = \frac{x(\text{normalized})}{1{,}000}.$$

Since SDF can be used to prevent or avoid dental GA, we calculated a similar GA utilization ratio for descriptive analysis.

For our secondary research questions, we assessed the early effects of SDF utilization on GA utilization. Here, we used the number of children treated, rather than utilization ratio, as the unit of observation. A more detailed explanation can be found in the online Appendix.

Statistical Analysis

Sociocontextual and Community Health Characteristics of SDF Utilization

Descriptive statistics were used to describe changes in the number of SDF providers and their SDF utilization ratios over time. Annual SDF utilization ratios were divided into terciles for visualization. The lowest tercile included providers with zero utilization, the middle tercile included providers with utilization ratios below the median, and

the highest tercile included providers with utilization ratios above the median.

For spatial data analysis, data at the street address level maintained the widest array of analysis options. Providers were geolocated using the billing address in the Medicaid claims. However, to protect individual privacy, precise locations were aggregated to coarser units of geography for presentation, for which we used tessellated hexagons. Tessellations are regular, repeating geometric patterns, and their use allows the display of geographic data while concealing privacy of subjects. All spatial analysis maps were generated using ArcGIS software, version 10.5 (Environmental Systems Research Institute). North Carolina has 100 counties, and we mapped each county according to its county health score using a color gradient and then superimposed SDF utilization against these quintiles.

Association between SDF and GA Utilization Ratios among Providers

Descriptive statistics were used to describe changes in the number of GA providers and their GA utilization ratios over time. For spatial data analysis, we used graduated color maps to compare annual provider SDF utilization ratios against provider GA utilization ratios according to terciles represented by tessellated hexagons.

Dentists could have provided only SDF, only GA, or both, which could have varied in different years of the study window. To account for this variation and different levels of data, we used a zero-inflated negative binomial model to evaluate whether GA utilization was associated with SDF utilization, provider specialty, the county health score of the provider's county, or the amount of time since SDF became reimbursable. A more detailed description of the statistical methodology is provided in the online Appendix.

GA Utilization before and after Implementing SDF Reimbursement

The GA utilization ratios in years before (2014–2015) and after (2017–2018) SDF became available were compared to detect changes. We omitted 2016 since it was the year the code was introduced and to allow for provider education and office protocol development (Burgette et al. 2019; Weintraub et al. 2019). The data skewed toward zero, so for each provider, we calculated a GA utilization ratio as follows:

$$\text{GA utilization ratio} = -\log\left(\frac{\text{number of GA cases at end of period}}{\text{number of GA cases at start of period}}\right).$$

The number of positive and negative values for each of the providers in the data set was compared using the Wilcoxon signed-rank test. This test compares the distributions of the GA utilization ratio before and after SDF implementation. If the sign favored positive responses, then the changes indicated an increase over the period. If the sign favored zero, then the changes were considered nonsignificant. All analyses were run using STATA software (v15.1; STATA Corp., LLC).

Results

Sociocontextual and Community Health Characteristics of SDF Utilization

Table 1 presents summary statistics. From 2016 to 2018, the number of Medicaid-enrolled dentists who used SDF increased from 35 to 258, or 637%. The SDF utilization ratio for each dentist increased from 0.35 to 0.65 per 1,000 children. Among pediatric dentists, the SDF utilization ratio increased (0.14 to 0.78 per 1,000 children, or a 457% increase). Among general dentists, the SDF utilization ratio decreased (0.64 to 0.57 per 1,000 children, or an 11% decrease). In other words, pediatric dentists used SDF in more children per 1,000, and general dentists used SDF in fewer children per 1,000 in 2018 compared to 2016.

SDF utilization spread outward from urban centers (Raleigh-Durham and Charlotte) across the study period. One trend noticed across all years was a utilization gap for the counties at the state's perimeter, especially along the eastern shoreline and the western mountains. Figure 2 shows areas with above-average SDF utilization and no GA utilization against counties classified into county health score quintiles. Above-average SDF utilization presented in all 5 county health quintiles over the study period. However, SDF was slightly more common in areas that fall into the lowest resource quintiles. These counties had the poorest social and community health indicators, including poor access to dental care.

Association between SDF and GA Utilization Ratios among Providers

From 2016 to 2018, the number of Medicaid-enrolled dentists who used GA to treat children ages 1 to 5 y increased from 179 to 211, or 17%. The average GA utilization ratio for each provider decreased from 2.57 to 2.47 per 1,000 children. Pediatric dentists increased their GA utilization ratios (from 2.29 to 2.39 cases per 1,000 children) while general dentists decreased their GA utilization ratio (from 3.21 to 2.75 cases per 1,000 children).

Figure 3 compares the provider SDF utilization terciles to provider GA utilization terciles from 2016 to June 2018 on a graduated color map. The blank bottom left square in the legend indicates anywhere without a hexagon had zero providers of SDF or GA, analogous to a transparent hexagon. The areas of interest for this study were those areas that had above-average SDF utilization and no GA utilization. From 2016 to 2018, the graduated color maps become more purple, indicating that SDF utilization had become more widespread across the state.

The zero-inflated negative binomial analysis revealed a significant, positive relationship between GA utilization at the provider level with SDF utilization ($P = 0.001$), provider specialty ($P = 0.002$), and county health score ($P < 0.001$). Table 2 presents the full regression results. Providers using SDF are also likely to use GA—for every 1-child increase in SDF utilization, GA utilization increased 1%. The zero-inflated model confirms the decrease in GA

Table 1.
Data Summary Describing Silver Diamine Fluoride and General Anesthesia According to Utilization, Provider Specialty, and County Health Ranking for Each Year of Observation.

Variable	2014	2015	2016	2017	2018
Silver diamine fluoride (SDF)					
Dentists with an SDF claim	—	—	35	131	258
Utilization per dentist					
Ratio per 1,000 children within 30-min service area, mean (95% CI)	—	—	0.35 (0.05–0.65)	.45 (.23–.66)	.65 (.44–.86)
Children treated per dentist, mean (95% CI)	—	—	6.8 (1.58–12.07)	9.7 (5.72–13.69)	14.8 (11.22–18.46)
Provider specialty					
Number (%) of pediatric dentists	—	—	20 (57.1)	66 (50.4)	105 (40.7)
Number (%) of general dentists	—	—	15 (42.9)	65 (49.6)	153 (59.3)
County health ranking					
SDF dentists practicing in resource-poor areas <50th percentile, *n* (%)	—	—	4 (11.4)	24 (18.3)	56 (21.7)
SDF dentists practicing in resource-rich areas >50th percentile, *n* (%)	—	—	31 (88.6)	107 (81.7)	202 (78.3)
General anesthesia (GA)					
Dentists with a GA claim	177	178	179	192	211
Utilization per provider					
Ratio per 1,000 children within 30-min service area, mean (95% CI)	2.34 (1.71–2.98)	2.53 (1.81–3.25)	2.57 (1.84–3.30)	2.39 (1.76–3.02)	2.47 (1.78–3.17)
Children treated per dentist, mean (95% CI)	48.83 (40.02–57.64)	51.24 (42.25–60.22)	53.11 (44.25–61.97)	50.67 (42.87–58.46)	50.26 (42.73–57.79)
Provider specialty					
Number (%) of pediatric dentists	93 (52.5)	99 (55.6)	108 (60.3)	117 (60.9)	131 (62.1)
Number (%) of general dentists	84 (47.5)	79 (44.4)	71 (39.7)	75 (39.1)	80 (37.9)
County health ranking					
GA dentists practicing in resource-poor areas <50th percentile, *n* (%)	30 (16.9)	30 (16.9)	34 (19.0)	42 (21.9)	40 (19.0)
GA dentists practicing in resource-rich areas >50th percentile, *n* (%)	147 (83.1)	148 (83.1)	145 (81.0)	150 (78.1)	171 (81.0)

—, SDF not reimbursable.

utilization among providers between 2016 and 2018 is gradual but not statistically significant. The model also conveys the probability of being a certain zero. For every 1 additional child treated with SDF, the probability of being a certain zero decreases 2%. Likewise, pediatric dentists have a 79% reduced likelihood of being a certain zero, confirming the descriptive statistics, which suggest that pediatric dentists were more likely than general dentists to use SDF.

GA Utilization before and after Implementing SDF Reimbursement

The 2-y time periods before (2014–2015) and after (2017–2018) SDF implementation compared changes in provider GA utilization ratios. The

Figure 2. Superimposition of dentists with high silver diamine fluoride (SDF) utilization ratios over social/health indices measured by the North Carolina county health score quintiles.

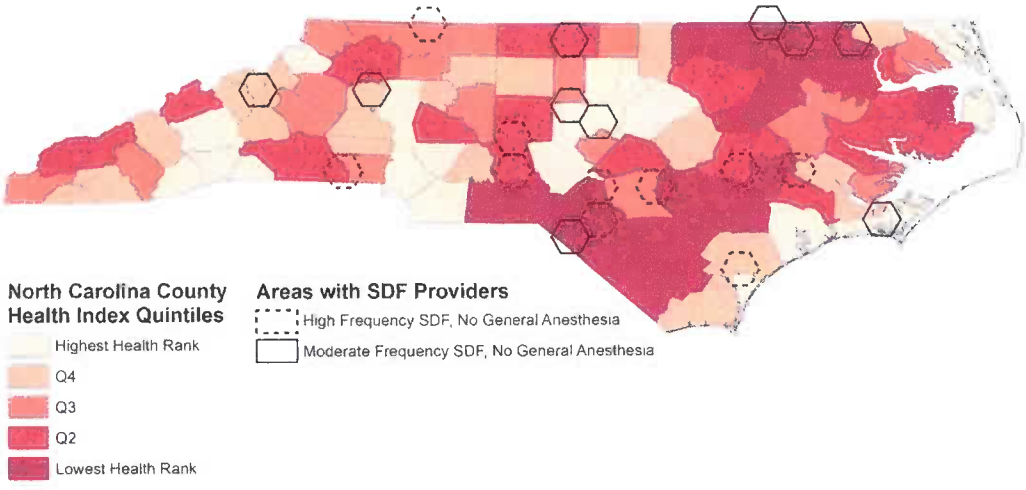
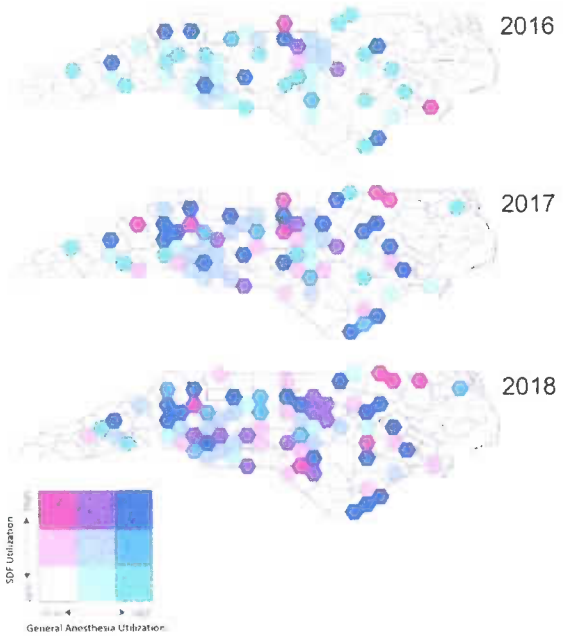


Figure 3. Graduated color maps comparing silver diamine fluoride (SDF) utilization and general anesthesia utilization from 2016 to 2018.



preponderance of the differences favored zero (n = 227), although there were slightly more positive (n = 104) than negative (n = 86) changes. However, the signed-rank test revealed no significant difference between the 2 periods (test statistic = .922; P = 0.4).

Discussion

Early adopters of SDF were located in resource-rich, primarily urban areas. These areas had the best access to health care, the best health outcomes, and the strongest social supports. After 2 subsequent years, SDF utilization became more widespread and reached many resource-challenged, more rural areas. A major provision gap still exists among the counties with the poorest access to care, worst health outcomes, and weakest social supports. Among the major findings is how quickly SDF was adopted by both general and pediatric dentists. This is remarkable relative to other types of dental procedures used to manage ECC. For example, general dentists still underuse stainless steel crowns compared to pediatric dentists (Shelton et al. 2019). That SDF utilization increased so quickly among different providers and in different geographies should be encouraging for public health programs and third-party payers. Continuing education and public health programs may be solutions to help implement SDF protocols into even more dental practices (Burgette et al. 2019; Weintraub et al. 2019).

Provider SDF utilization ratios nearly doubled over the study period. The increase in 2018 is especially impressive considering that emerging techniques typically take decades to enter routine clinical practice (Morris et al. 2011). North Carolina Medicaid was among the first states to initiate reimbursement for SDF, which likely played a role in

Table 2.
Results of a Zero-Inflated Negative Binomial Regression Modeling the Number of General Anesthesia (GA) Cases against the Number of Children Treated with Silver Diamine Fluoride (SDF), Time since SDF Reimbursement, and County Health Score.

GA Predictors	IRR	SE	*z* Score	*P* Value	95% CI
Children treated with SDF (per provider)	1.01	.003	3.20	<0.0001	1.00–1.02
Year (reference: 2016)					
2017	.91	.124	−0.66	0.512	.70–1.19
2018	.84	.115	−1.28	0.202	.64–1.10
Provider specialty (reference: general dentists)					
Pediatric dentists	.70	.079	−3.12	0.002	.56–.88
County health score	1.57	.156	4.53	<0.0001	1.29–1.90
Probability of Being a Certain Zero	**OR**	**SE**	***z* Score**	***P* Value**	**95% CI**
Children treated with SDF (per provider)	.98	.008	−2.71	0.007	.97–.99
Taxonomy (reference: general dentists)					
Pediatric dentists	.214	.144	−10.67	<0.0001	.16–.28

IRR, incidence rate ratio; OR, odds ratio; SE, standard error.

the rapid adoption by dentists. The conditional recommendation for SDF to manage ECC by the American Academy of Pediatric Dentistry in 2017, as well as other professional organization recommendations endorsing nonsurgical caries management, an umbrella covering SDF, also may have played a role (Crystal, Marghalani, et al. 2017; Slayton et al. 2018).

When compared with other emerging and innovative dental techniques for managing dental caries, the breadth and depth of SDF adoption in North Carolina appear impressive. For example, barriers to the adoption of dental sealants to prevent pit and fissure caries were reported as early as 1982 (Horowitz and Frazier 1982), with poor reimbursement being a major barrier over the decades (Horowitz and Frazier 1982; Chapko 1991; Fiset and Grembowski 1997; O'Donnell et al. 2013). Still today, sealants remain underused in children ages 6 to 9 y (Office of Disease Prevention and Health Promotion 2020), in part because sealants are not a routine part of many dental practices (O'Donnell et al. 2013).

Provider GA utilization ratios appear stable, but no meaningful conclusions can be drawn over such a short time period about its relationship to SDF utilization. A recent simulation suggested that SDF can result in major cost savings to Medicaid by averting expensive treatment options, such as general anesthesia (Johhnson et al. 2019). Our results suggest the changes in GA utilization following SDF implementation may be more gradual or less dramatic. Several sources of bias influence GA utilization ratios in North Carolina. Namely, we could not account for the impact of 4 dental-specific ambulatory surgical centers opening across the state. These dental centers opened to provide sedation and general anesthesia services for individuals with Medicaid. In addition, the dental sedation rules and regulations in North Carolina changed considerably over the study period, and the regulatory and compliance costs may drive providers to use hospital general anesthesia rather than moderate sedation to manage moderate ECC cases. These ambulatory surgical centers may increase GA utilization ratios. In the absence of individual patient data, a direct link between SDF and GA utilization is difficult to make over our limited study period.

Our study applied spatial analysis techniques to oral health services data in a primarily descriptive manner. These techniques are becoming more meaningful in oral health services research (Saman et al. 2010; Kruger et al. 2011; Isringhausen et al. 2014; Emami et al. 2016). Our results paint an important picture for public health and school-based program planning. When considering the primary preventive effects of SDF when compared with placebo or fluoride varnish (Oliveira et al. 2019), these results suggest a place for SDF utilization in school-based prevention programs targeted toward provision gaps (Ruff and Niederman 2018).

Limitations

Among several limitations, endogeneity is chief among them (Duncan et al. 2004). In natural experiments, it is nearly impossible to control for individual-level variables. In our case, we could

not control for parental treatment preferences (Crystal, Janal, et al. 2017), provider knowledge and preferences (Nelson et al. 2016; Crystal, Marghalani, et al. 2017; Ngoc et al. 2018), and implementation practices (Burgette et al. 2019; Weintraub et al. 2019), all of which affect clinical decision making that leads to SDF utilization. The study design prevented direct interaction with the dentists or caregivers with decision-making power for their children's dental care. Questions remain about the use of SDF as definitive or interim treatment prior to GA. Published guidelines suggest it is suitable to use in either fashion (Crystal, Marghalani, et al. 2017), and how providers decide to use it may vary within a practice according to patient needs. In addition, the county health rankings were used as a proxy to describe geographic and community health characteristics. While these data provided generic descriptions, we did not directly measure health disparities or access to SDF treatment by patient and provider race/ethnicity or rurality.

Conclusions

SDF adoption among Medicaid providers in North Carolina began in resource-rich, primarily urban areas. After 3 y, SDF adoption spread to practices in communities with fewer resources and less access to health care. Providers relatively rapidly adopted SDF treatment to manage ECC. Despite GA utilization remaining unchanged after SDF implementation, it remains too early to determine the public health effects of SDF utilization on GA utilization. Well-designed intervention studies are needed to clarify SDF protocols and their relationship to delayed or avoided GA visits.

Author Contributions

B.D. Meyer, contributed to conception, design, data acquisition, analysis, and interpretation, drafted and critically revised the manuscript; E.R. Kelly, P. McDaniel, contributed to design, data analysis, and interpretation, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

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