Rural Versus Urban Analysis of Dental Procedures Provided to Virginia Medicaid Recipients

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Abstract

Purpose: The purpose of this study was to report the distribution of procedures provided to Virginia Medicaid children by 3 types of dental providers in rural and urban areas.

Methods: Medicaid claims filed for dental patients less than 21 years old were obtained and analyzed for fiscal years 1994-1995. Dental providers were categorized according to their practice type: (1) general practice (GP); (2) pediatric (PD); and (3) public health (PH) dentists. Each type of practice was categorized as practicing in a metropolitan, urban, rural, or completely rural location and evaluated for percentages of preventive, diagnostic, and corrective services provided.

Results: Rural areas had a higher percentage of significant providers than did metropolitan or urban areas. General dentists performed more diagnostic and preventive but fewer corrective procedures than pediatric dentists. Pediatric dentists and general dentists in completely rural areas performed more corrective procedures than their counterparts in metropolitan or urban areas.

Conclusions: General, pediatric, and public health dentists in metropolitan and urban areas perform slightly more diagnostic services and fewer corrective services than practitioners in more rural areas. (*Pediatr Dent.* 2004;26:440-444)

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Significant disparities in oral health exist according to race, ethnicity, education, income, and geography. Low-income and minority children have more dental disease than other children. They also have reduced access to dental care, resulting in fewer opportunities for prevention and more unmet treatment needs.[1]

In Virginia, approximately 450,000 children are eligible to receive dental services through the state Medicaid program.[2] It has been shown in a previous study of Virginia Medicaid, that general practitioners (GP) performed a significantly greater percentage of diagnostic procedures for their Medicaid patients than did pediatric (PD) and public health dentists (PH).[3] The percentage of preventive procedures performed by PD and GP dentists was not significantly different, but was significantly lower than those performed by PH dentists.[3] Those numbers did not hold true when it came to the percentage of corrective procedures done. In this area, pediatric dentists provided significantly more procedures than GP or PH dentists.[3]

Several North Carolina studies of dental services in Medicaid have reported similar results. A study by Venezie et al found that general dentists provide proportionately more initial exams to their Medicaid child patients than do pediatric dentists.[4] This was confirmed by another study of NC Medicaid children, which showed that pediatric dentists tended to provide more complete care and less sporadic care for these children.[5] These studies generate the question "in areas where there are no pediatric dentists—for example, in the rural areas of the state—do GPs perform more corrective procedures than elsewhere in the state?"

The purpose of this study was to examine the distribution of dental procedures to Virginia Medicaid children provided by pediatric, general, and public health dentists by comparing metropolitan, urban, rural, or completely rural locations.

Methods

A database was compiled of all Medicaid dental claims paid for the fiscal years 1994-1995 (July 1994 to July 1996) from the Virginia Division of Medical Assistance Services (VDMAS), which oversees the program. Any reference to year is the fiscal year (FY: July to July) and not the calendar year. This is in accordance with the format in which Virginia Medicaid data are collected and reported. Fiscal years 1994-1995 were chosen because they were the last 2 years VDMAS administered the entire Medicaid program for dentistry. In 1996, HMO vendors were added in certain portions of the state. In the database, the number of procedures in each zip code area of Virginia was classified as to:

1. fiscal year (1994 or 1995);
2. provider (PD, GP, or PH);
3. whether the provider was a "significant provider;"
4. location of practice.

Each provider in each year was classified as a "significant provider" if the total number of procedures performed was at least 700. The number 700 was chosen because it had been used in previous research studies as defining significant providers.[6]

Location was originally coded into the 10 categories established by the Economic Research Service of the US Department of Agriculture (Table 1).[7] The number of providers was small in some categories, especially in the more rural areas. These 10 categories were then collapsed into 4 due to small cells size and the fact that there were no statistically significant differences in the distribution of services between subgroups of metropolitan (metro), urban, and rural across the state. Completely Rural had no subgroups and as such was left alone. Figure 1 shows the geographic relationship of providers by location. Medicaid patients for this study are patients less than 21 years of age. More than 1 million procedures completed by 747 dental providers were examined.

Procedures were classified into:

1. diagnostic services (DXS), which included radiographic and/or oral exams;
2. preventive services (PS), which included scaling, prophylaxis, fluoride treatments, and sealants;
3. corrective services (CS), which included all operative, endodontic, prosthodontic, and surgical procedures;
4. "other" procedures, which included any procedures billed to Medicaid by the providers but which did not directly fit into the other 4 categories.

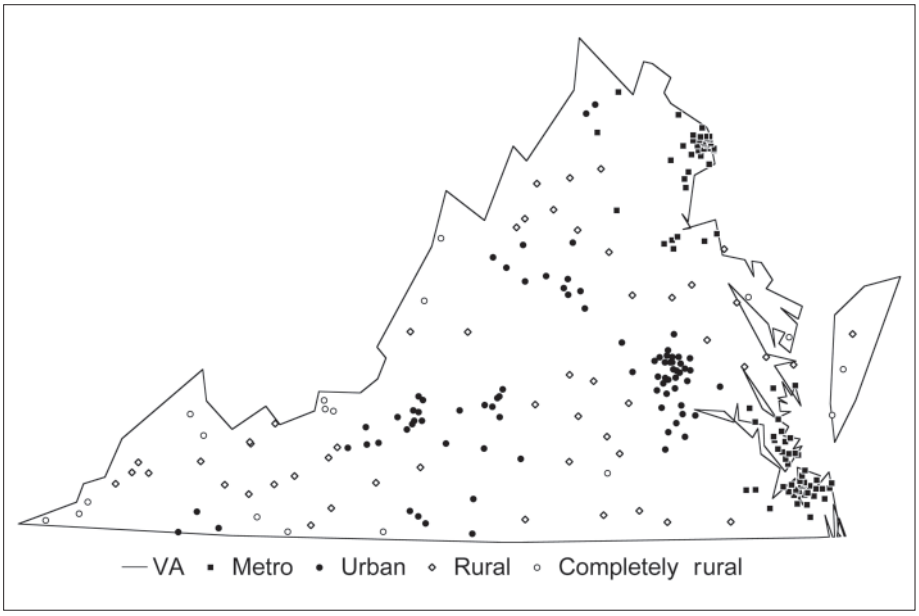

Figure 1. Geographic distribution of dental providers by location. The black squares are the metropolitan locations. The black circles are the urban areas, and the white diamonds are the rural areas. The completely rural areas are indicated by a white circle.

Table 1. Distribution of Dental Procedures According to Practice Setting Location

	No. of procedures		%	
Rurality grouping	**1994**	**1995**	**1994**	**1995**
Metropolitan			39	37
1. Central counties of metro areas ≥1 million	157,412	212,148		
2. Fringe counties of metro areas of ≥1 million	5,131	8,420		
Urban			42	40
1. Counties in metro areas of 250,000-1 million	112,796	147,262		
2. Counties in metro areas of <250,000	45,958	59,680		
3. Adjacent to a metro area ≥20,000	13,334	30,266		
Rural			11	13
1. Not adjacent to a metro area ≥20,000	5,186	11,851		
2. Adjacent to a metro area 2,500-19,999	19,418	26,747		
3. Not adjacent to a metro area 2,500-19,999	15,419	26,501		
4. Adjacent to metro area <2,500	4,984	14,243		
Completely rural			4	6
1. Not adjacent to metro area <2,500	16,801	34,609		
Unknown zip code	15,853	21,759	4	4

Table 2. Classification of Dental Procedure Types by Fiscal Year

	No. of procedures		%	
Procedure type	1994	1995	1994	1995
DXS	129,977	185,283	32	31
OPP	149,257	213,974	36	36
SL	22,130	35,561	5	6
OCP	92,672	129,115	22	22
EXT	17,322	25,192	4	4
Other	934	4,361	0	1
Total	412,292	593,486	99	100

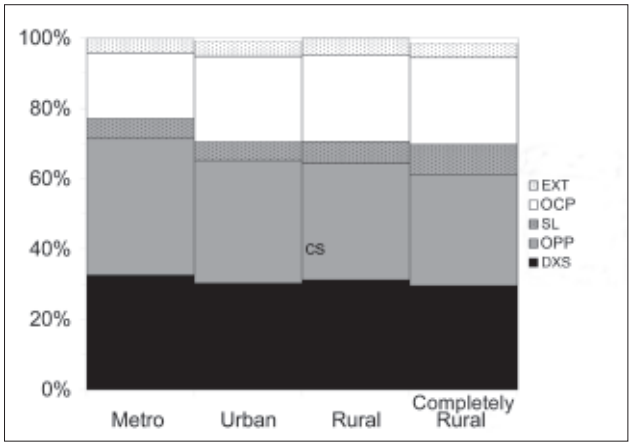

Figure 2. Distribution of procedure types by practice setting location.

Preventive procedures were then subdivided into sealants (SL) and other preventive procedures (OPP), and corrective procedures were subdivided into extractions (EXT) and other corrective procedures (OCP). The preventive and corrective categories were subdivided for descriptive analyses and to examine differences in the use of sealants and extractions by provider type (Tables 2, 3 and 4). For the purpose of multivariate analysis, the procedure groups were retained as the 3 main procedure groups and the "other" category was dropped from the analyses.

Using a repeated-measures log-linear model in SAS version 8.1 (SAS Institute, Cary, NC), the relationship was examined between the number of procedures performed and: (1) location (4 rurality subgroups); (2) procedure group; (3) practice type; (4) significant provider; and (5) year. Providers were identified as the independent subject in the generalized estimating equation (GEE) analysis. The frequency counts were assumed to be Poisson distributed, and score chi-square tests of effects were determined to be significant at the alpha=0.05 level.

Results

The mixture of the type of procedures performed depended upon the location (rurality) of the practice setting (Figure 2). Completely rural practitioners tended to provide more corrective and less diagnostic services, while metropolitan practitioners provided more diagnostic services. Other factors, however, were related to location of the practice setting and the mix of procedure type. For example, a larger percentage of completely rural dentists were "significant providers" (43% vs 26%) and a larger percentage of pediatric dentists were significant providers (65% PD, 46% PH, 23% GP).

There were differences in the type of procedures delivered between significant and nonsignificant providers. Significant providers had a practice mix consisting of fewer diagnostic (30% vs 35%) and more corrective procedures (23% vs 19%) than nonsignificant providers (Table 3). All these factors combined to predict the number of procedures that may be performed by a dentist, depending upon location, practice type, significant provider status, and year.

The GP provided a significantly greater percentage of diagnostic procedures for their Medicaid patients than did PD and PH dentists (chi-square=1,672, $P<.0001$). The percentage of preventive procedures performed by PDs and GPs was not significantly different, but was significantly lower than those performed by PH dentists (chi-square=914, $P<.0001$). Finally, pediatric dentists performed a significantly greater (chi-square=3,060, $P<.0001$) percentage of corrective procedures than both GP and PH dentists (Table 4).

Table 5 regression results show all of the factors that significantly predicted the number of procedures. The number of procedures differed by year ($P=.0054$), and significant provider status ($P<.001$). There was a significant interaction between practice setting location and procedure type

Table 3. Number and Percentage (%) of Procedure Types for Significant and Nonsignificant Providers

	No. of procedures			%		
	Significant provider			Significant provider		
Procedures	No	Yes	All	No	Yes	All
DXS	72,096	243,164	315,260	35	30	31
OPP	74,147	289,084	363,231	36	36	36
SL	11,757	45,934	57,691	6	6	6
OCP	39,989	181,798	221,787	19	23	22
EXT	8,701	33,813	42,514	4	4	4
Other	207	5,088	5,295	0	1	1
Total	206,897	798,881	1,005,778	100	100	100

Table 4. Number and Percentage of Procedure Types for Each Practice Type (GP, PD, PH)

	No. of procedures				%			
	Practice type				Practice type			
Procedures	GP	PD	PH	All	GP	PD	PH	All
DSX	208,036	87,598	19,550	315,184	33	29	29	31
OPP	229,772	104,966	28,396	363,134	36	35	41	36
SL	32,667	14,041	10,967	57,675	5	5	16	6
OCP	136,675	77,293	7,782	221,750	22	26	11	22
EXT	26,269	14,462	1,775	42,506	4	5	3	4
Other	1,000	4,294	1	5,295	0	1	0	1
Total	634,419	302,654	68,471	1,005,544	100	100	100	100

(*P*=.0044). This implies that the effect of practice type and location can only be interpreted by taking procedure type into account. Hence, the main questions of interest relate to the mixture of services (the procedure type effect in the model) and how the mixture of services varied with other characteristics (the interaction effects in the model). There were no significant 3- or 4-way interactions (*P*>.05). Consequently, the mixture of services can be illustrated by showing differences due to practice type and location.

According to the authors' regression results, there was an interaction between the mix of procedure type and practice location. As the providers moved from metro to completely rural, there was a gradual transformation in the practice composition (Table 6). For the GP, diagnostic procedures decreased (33% to 31%), preventive procedures decreased (39% to 30%), and corrective procedures increased (19% to 30%). For PDs, diagnostic procedures decreased (31% to 27%), preventive services decreased (39% to 21%), and corrective procedures increased (20% to 24%) as practice location changes from metro to completely rural. PH exhibited much less change than GPs or PDs. Diagnostic procedures slightly decreased (29% to 27%). There was almost no difference, however, between the preventive (43% to 43%) and corrective (6% to 6%) procedures as they moved from metro to completely rural.

Discussion

Completely rural practitioners provided fewer diagnostic, less preventive, and more corrective procedures than metropolitan practitioners. In addition, general practitioners performed significantly more diagnostic and more preventive procedures, but significantly fewer corrective procedures than pediatric dentists. Overall, though, there was no 3-way interaction between the type of practitioner, practice location, and procedure type (Table 5). Among all significant providers, the largest proportion was pediatric dentists, regardless of the geographic area.

When comparing significant to nonsignificant providers, it was observed that significant providers perform a higher percentage of corrective procedures (23% vs 19%) and a lower percentage of diagnostic procedures (30% vs 35%; Table 3). Overall, general practitioners performed significantly more diagnostic and more preventive procedures, but significantly fewer corrective procedures than pediatric dentists.

Lack of access to dental care is one of the reasons caries remains untreated in certain populations. Whether the problem is due to financial condition, geographic factors, or lack of education about the importance of good oral health, the fact is that many children who desperately need dental care are not receiving it.[1] The average GP in a metropolitan area performs 21% corrective procedures compared to 33% in a completely rural area. In rural areas, GPs are doing more corrective procedures than GPs in the more populated areas (Table 6).

When comparing metropolitan to completely rural, there was a decrease in the percentage of preventive procedures for PDs (43% to 33%) and GPs (45% to 36%). At the same time, there was an increase in the percentage of corrective procedures for PDs (27% to 40%) and GPs (21% to 33%; Table 6). This transition makes sense, since rural residents of all ages tend to have a greater prevalence of untreated caries than their nonrural counterparts.[6] This was different for PH dentists whose practice composition does not differ noticeably in metro vs completely rural communities (Table 6). The increase in percentage of corrective

Table 5. Regression Results for the Number of Dental Procedures Performed on Virginia Medicaid Patients

Source*	df	Chi-square	*P*
Year	1	7.73	.0054
Practice type	2	1.23	.5411
Location	3	1.49	.6839
Significant provider	1	60.63	<.0001
Year/significant provider†	1	5.76	.0164
Practice type/location†	6	7.59	.2694
Procedure type	2	13.57	.0011
Procedure type/practice type†	4	22.24	.0002
Procedure type/location†	6	18.86	.0044
Procedure type/significant provider†	2	42.34	<.0001

*Practice type=GP, PD, or PH; location=metropolitan through completely rural; significant provider=yes or no; procedure type=DXS, PS, CS.
†Interaction indicates that the effect of 1 predictor depends upon another.

Table 6. Predicted Percentage of Procedure Types by Practice Type and Practice Location*

Procedures	Practice Type	Location (%) Metro.	Urban	Rural	Completely rural
DXS	GP	34	33	32	31
	PD	31	29	28	28
	PH	27	27	28	28
	All	33	31	31	30
PS	GP	45	41	38	36
(OPP+SL)	PD	43	38	36	33
	PH	63	61	57	56
	All	45	40	39	42
CS	GP	21	26	30	33
(OCP+EXT)	PD	27	33	37	40
	PH	9	12	15	16
	All	22	29	29	28

*Predicted values take into account all factors identified by the log-linear regression model.

procedures in rural areas could be at least partly due to the lower-than-adequate amount of fluoride in the water of several nonfluoridated rural areas in the state of Virginia (less than 1 ppm fluoride), resulting in those children experiencing a higher level of tooth decay.

Conclusions

1. The mixture of procedure type varied significantly, depending on: (1) practice type; (2) location; and (3) significant provider status.
2. The GP performed a significantly greater percentage of diagnostic procedures to their Medicaid patients than did PD and PH dentists.
3. The percentage of preventive procedures performed by PDs and GPs was not significantly different, but was significantly lower than those performed by PH dentists.
4. Pediatric dentists performed a significantly greater percentage of corrective procedures than both GP and PH dentists.
5. The completely rural areas had the largest percentage of significant providers.
6. Practitioners located in metropolitan practice settings had increased diagnostic and preventive services, with a decreased level of corrective services compared to completely rural practitioners. The composition of services for PH dentists did not differ noticeably in metro vs completely rural practice settings.

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