2010

The Effect of Medicaid Policy Reform on Dental Utilization Rates for Children

Matthew Winheim
Virginia Commonwealth University

The Effect of Medicaid Policy Reform on Dental Utilization Rates for Children

by

Matthew A. Winheim

Tegwyn H. Brickhouse DDS PhD.

Department of Epidemiology and Community Health
Master of Public Health Program
MPH Research Project: EPID 691

Virginia Commonwealth University
Richmond, Virginia

May 2010

5/10/2010

Table of Contents

Acknowledgements ……..…….. i

Abstract ……..…… ii

Introduction/Background ……...……... 1

Objectives ……..…… 7

Methods ……...…… 7

Results ……...…...…… 10

Discussion ……...…… 13

Conclusions …… 15

Appendix 1 - Tables/Figures ……..……...…….. 16

References ……..…….. 23

List of Tables and Figures

Tables

1 …… Descriptive Statistics for Pre and Post Reform Groups

2…….. Unadjusted Utilization Characteristics of Pre- and Post- Reform Groups

3…… Least Square Means from Regression Model for Utilization Characteristics of Pre- and Post- Reform Groups. Adjusted for gender, race, age, citizenship, geographic location, length of enrollment and gaps in enrollment

4…….. Pre vs. Post Reform Multivariate Logistic Regression Results

5…… Unadjusted Utilization Characteristics for Pre- and Post- Reform Groups Stratified by Length of Enrollment

6…… Least Square Means for Utilization Characteristics of Pre- and Post- Reform Groups Stratified by Enrollment Length. Adjusted for gender, race, age, citizenship, geographic location, and gaps in enrollment

7…… Multivariate Logistic Regression Results for Pre vs. Post Reform Periods Stratified by Enrollment Length. Odds Ratios are adjusted for gender, race, age, citizenship, geographic location, and gaps in enrollment

Figures

1…… LS Means for Pre and Post Reform Groups Stratified by Length of Enrollment. Adjusted for gender, race, age, citizenship, geographic location, and gaps in enrollment.

2…… Odds Ratios for Pre vs. Post Reform Periods within each Enrollment Length Group, adjusted for gender, race, citizenships, age, geographic location, and gaps in enrollment.

Acknowledgements

This research was supported by a NIH/NIDCR grant: K22DE016084 and by the Virginia Department of Medical Assistance Services. Additionally, I would like to thank Ms. Caroline Stampfel for her outstanding insights into sophisticated SAS coding, and Dr. Al Best for offering his expertise in proper biostatistical modeling and design. Finally, I offer a special word of thanks to Dr. TegwynBrickhouse, for the support she offered out of her passion for pediatric dentistry and heart for public health. She continues to inspire me to couple sound epidemiological methods with unwavering commitment to understanding the actual lives that stand to be impacted by our work.

Abstract

Background: Regular access to dental services is a well-known factor in the oral health and development of children.[1] As such, the United States federal government mandates each state to include dental services for children enrolled in Medicaid through the age of 21. Despite this mandate, the utilization rate of dental services among Medicaid enrolled children has remained remarkably low.[2] In July 2005, Virginia implemented a sweeping Medicaid policy reform titled "Smiles for Children," specifically aiming to increase Medicaid pediatric dental utilization rates. The purpose of this study aims to assess the effect of this 2005 policy reform on the utilization of dental services by children enrolled in Medicaid.

Objective: The purpose of this study is to examine the impact of the 2005 Virginia Smiles for Children Medicaid policy reform on the utilization of dental services among Medicaid enrolled children.

Methods: This was a retrospective cohort study of children (pre-reform n=559,820, post-reform n=690,538) enrolled in Virginia Medicaid from 2002 through 2008. Descriptive statistics and repeated measures multivariate logistic regressions were used to determine the relationship between enrollment (Pre- and Post-policy reform) and the utilization of dental services (1+ Dental Visits vs. No Dental Visits).

Results: Descriptive analysis of the cohort found that 34% of pre-reform children had a dental visit while 44% of post-reform children. The logistic regression models revealed that children in the post reform period were 1.39 as likely to have had a dental visit. Stratifying for enrollment length reveals that as the length of exposure time to the post-reform policy increases, the odds of having a dental visit also increase as compared to the pre-reform period: for 31-36 months of enrollment the odds increase 1.54 times.

Conclusions: Medicaid policy reform can significantly improve access to dental services for children and can therefore play an important role in promoting public health.

Introduction/Background

According to section 1902(a)(43) of the Social Security Act, dental services are a mandatory Medicaid benefit for children under 21. Despite this federal mandate, the utilization of dental services among Medicaid children is consistently well below the utilization rates of children with private dental insurance. [2,3,4] The public health concerns associated with low dental utilization rates among Medicaid children are seen in literature tying low socioeconomics with increased risk of poor dental health in children. [1,6,7] The literature further identifies an association between poor childhood dental health and poor dental heath later in life.[8,9] In adults, dental health disease has been correlated to other health concerns including cardiovascular disease and poor pregnancy outcomes.[10,11] Therefore access to pediatric dental services among the Medicaid population has important public health implications both for the immediate and long term overall health of children.

Medicaid operates as a partnership between federal and state governments. The dental services mandated by the federal government are administered according to specific legislative actions of each individual state government. The literature indicates that policy reform can have significant impacts on utilization rates.[12,13,14] In recent years, several states, including Virginia, passed significant Medicaid reform legislation aimed at increasing dental utilization rates among Medicaid enrollees. Virginia law brings the

executive responsibilities for Medicaid under the Virginia Department of Medical Assistance Services (VDMAS). VDMAS contracts with several Managed Care Organizations (MCOs) to provide health care benefits to eligible Medicaid recipients. Until 2005, Virginia Medicaid clients received dental coverage as part of their overall Medicaid benefits package. As such, each individual MCO administered dental services, while at the same time managing general health care for its Medicaid clients. However, under this administrative model, utilization rates for dental services among Medicaid enrollees were quite low. For fiscal years 2002 and 2003, VDMAS reported the overall pediatric dental utilization rates of 23.4% and 28.9% respectively.[15]

Other states also have a history of low utilization rates with respect to dental services among Medicaid enrolled children. A recent study by Fisher et al. reported the rates for physician and dental services accessed among Medicaid eligible children, age 2-16. The data came from the third National Health and Nutrition Examination Survey, and found that while 81% of children insured by Medicaid utilized services from a physician at least one time in the previous year, only 39% of these children reported accessing dental services.[2] A 2005 cross-sectional study illuminated the dental utilization disparity among Medicaid enrollees by exploring the utilization rates among Iowa adults who were eligible for dental benefits under Medicaid with those enrolled in a private dental insurance agency. The researchers found that 69.3% of the adults in the privately insured group had at least one dental visit in the past year. This was significantly different from the 27.2% of Medicaid enrollees that utilized the dental services they were eligible to receive.[16] While the study did not directly speak to pediatric dental utilization rates, it

does point to the fact that poor dental utilization rates seem to be endemic to the Medicaid system initially developed.

Several states, including, Alabama, Michigan, South Carolina, and Tennessee, took legislative action to improve the utilization rates of dental services among Medicaid enrollees. At the center of each of these reforms lay an increase in reimbursement rates for dental providers rendering services to Medicaid enrollees and outreach to non-participating dental practitioners. However, each state approached the administrative elements of dental services under Medicaid uniquely.[12]

Dental utilization rates among Medicaid enrolled children in Alabama were reported to be roughly 26% in 1999, and the number of participating dental practitioners was on the decline. Under the direction of the Alabama Dental Association, the Alabama Dental Task Force identified four major policy areas in the dental branch of Medicaid that could improve access and utilization of dental services: 1) simplification of prior authorization process, 2) expanding the number of dental procedures covered by Medicaid, 3) targeting reimbursement rates for specific codes, 3) clarification of benefits and limits. In order to address these barriers, the Smile Alabama program was developed, which included an increase in reimbursement rates to 100% of the average rates paid by Blue Cross and Blue Shield for all but 9 dental codes (which were increased to 70%), simplification of administrative processes, outreach and education for both practitioners and consumers. By 2002, Alabama saw a 57.1% increase in pediatric dental service utilization. [17]

Michigan also addressed poor dental utilization rates for Medicaid enrollees by contracting with Delta Dental, a major private dental insurance agency, to direct the

administration of Medicaid dental services in Michigan. This policy change resulted in dentists receiving 100% of the payment normally paid by Delta Dental for covered procedures, and made Medicaid administrative paperwork for a Medicaid patient almost identical to that of a patient privately insured with Delta Dental. At the end of the first year, Michigan's Medicaid program saw a 31% increase in the rate of Medicaid-enrolled children who received dental care, alongside an increase in the number of dentists participating in Medicaid. [18]

Similar to the rates in Alabama and Michigan, the dental utilization rate among Medicaid enrollees in South Carolina was 25.5% in 1997. From 1998 to 2000, South Carolina undertook major Medicaid reform in an effort to improve these utilization rates. Unlike Michigan and Alabama, which tied their reimbursement increases to the rates of a single dental insurance agency, South Carolina chose to increase reimbursement to the 75th percentile of South Carolina dentists' charges. Prior to 2000, South Carolina dentists received payment for roughly 35% of the charges billed to Medicaid. In addition to the substantial reimbursement increase, the state's Medicaid reform included improving the billing administrative tasks, active recruitment of dental providers to participate in Medicaid, and efforts to improve patient compliance with appointments and treatment. In a 2005 study by Nietert et al. the South Carolina Medicaid reform of 2000 was determined to have had a significant positive impact on the utilization of dental services among children. Specifically, these 2000 data suggest that the downward trend in Medicaid enrollees receiving dental services and a decline in services being rendered were reversed due to the State's Medicaid reform.[19] The state of Tennessee also increased its reimbursement rates to the 75th percentile of regional dental fees, and aimed

to improve dental utilization rates through policy change by "carving-out" dental care from the state's managed care contract for Medicaid. In 2002, Tennessee contracted with Doral Dental to administer all dental related Medicaid benefits. This reform came in conjunction with active recruitment of state dentists to participate in Medicaid, and improvements in the methods for billing Medicaid services and receiving reimbursement. The utilization rates for Tennessee have improved from 24% to 47%. [20]

Legislative actions linked to improved utilization rates of dental services among Medicaid enrollees have also played a role in similar programs related to access to care such as State Children's Health Insurance Programs.[21,22] The overwhelming implication of public policy on dental services reflects the fact that state lawmaking bodies have the ultimate authority in regulating health practitioners.[23] This makes Medicaid policy reform a crucial component to addressing oral health disparities among under privileged populations and addressing the public health concerns associated with poor dental health. Healthy People 2010 included a goal to increase the proportion of low-income children and adolescents who received any preventive dental service during the past year. Specifically, HP2010 aimed to see 57% of this population receiving preventative dental services in a given year.[3]

Given Virginia's historically low utilization rates, VDMAS established an advisory committee of dentists to identify possible Medicaid reform that could improve the number of Medicaid enrollees that utilize their dental benefits, and increase the number of dentists participating in Medicaid. The Dental Advisory Committee identified four reasons for non-participation commonly cited by Virginia dental providers. These include, reimbursement rates for providers, administrative complexities associated with

the Medicaid dental program, workforce issues, and client issues such as education, outreach and case management for broken appointments.[15]

Specifically, in 2004, VDMAS contracted with seven different MCOs, each of which could then subcontract dental services to other health care organizations. The administrative complexities that propagated in addition to low reimbursement rates and poor patient behavior is thought to have deleteriously impacted dental provider participation in Medicaid. Furthermore, according to a 2004 VDMAS report, an analysis of the top 20 dental procedures billed by Medicaid providers indicated that Medicaid reimbursement equates to approximately 57% of the average fees paid by commercial carriers.[15] The resulting complexity for dental services under Medicaid, and exceedingly low reimbursement rates for dental providers, often precluded dental providers from treating Medicaid patients.

In response to the findings of the advisory committee, the Virginia State Legislature amended the Medicaid law to allow VDMAS to "carve-out" dental services from the Medicaid managed care model. VDMAS then contracted with Doral Dental to administer the Medicaid dental benefits of all Medicaid enrollees, and to manage reimbursement to participating dentists. The new dental Medicaid program is called Smiles for Children, and came with a minimum 28% increase in reimbursement rates for all approved procedures. Additionally, VDMAS and the Virginia Dental Association actively recruited additional dental providers to accept Medicaid.

In 2006 VDMAS reported that 235 new dental providers began offering care to Medicaid patients as a result of the Smiles for Children program, and further reported that the

program was responsible for 40,000 more children utilizing dental services under Medicaid.[24]

Objectives

The goal of this analysis is a rigorous statistical analysis of dental utilization rates among Medicaid enrolled children from 2002-2005 as compared with those children enrolled in the Virginia Smiles for Children program from 2005-2008.

Methods

Retrospective cohort data from July 1, 2002 through June 30, 2008 for every child eligible to receive dental benefits through Virginia's Medicaid program were obtained from VDMAS. These data included individual enrollment information and any dental claims filed for each child. The study was approved for human subjects by the Virginia Commonwealth University Institutional Review Board.

Virginia's Smiles for Children Medicaid reform policy took effect on July 1, 2005; therefore this study defined dental utilization in the pre-policy reform group as having had at least one dental claim between July 1, 2002 and June 30, 2005. Dental utilization in the post-policy reform period was defined as having had at least one dental claim anytime between July 1, 2005 and June 30, 2008. All analyses were conducted using SAS 9.2.[25]

Two repeated measures logistic regression models were developed using PROC GENMOD with Class, Model and Repeated Subject /Within statements to compare the rate of children having had at least one dental claim across the two study periods. The models examine the effect of enrollment period on utilization of dental services while appropriately controlling for the fact that some subjects have utilization measurements

within both study periods. The first regression examined the dependence of dental utilization on enrollment in the pre- or post-policy reform periods. The second regression analysis modeled the dependence of utilization on enrollment in the pre- or post- policy reform periods but also stratified by six-month periods of enrollment time. In the second model, enrollees were grouped according to their length of enrollment in each of the two study periods. Both regressions included the same set of seven covariates, which included gender (Male vs. Female), citizenship status (US citizen vs non-US citizen), race (White, Black, Hispanic, Other and Unknown), age, geographical classification (Urban, Mixed-Urban, Mixed-Rural, Rural), length of enrollment, and gaps in enrollment. The second model also included an interaction term between period of enrollment and length of enrollment in order to stratify by six-month enrollment time.

Federal Information Processing Standard (FIPS) codes were included for each enrollee's county or city location. These codes were used to control for the potential impact of geographic location of enrollees on dental utilization rates. Members were categorized by their reported FIPS code into one of four geographic regions (Rural, Mixed Rural, Mixed Urban, and Urban) according to the Isserman definitions and the Center for Rural Health Policy Education and Research.[26]

Since six-month intervals is a commonly used timeframe for children receiving routine dental care, members were grouped according to their total days of enrollment within each study period for the purpose of stratifying by enrollment length as follows: 0-6 months, 7-12 months, 13-18 months, 19-24 months, 25-30 months, or 31-36 months of enrollment.[27]

Medicaid enrollees are required to report any changes in personal circumstances that may affect their eligibility within 10 days of the change, and an eligibility review must be completed at least once a year.[28] This means that Medicaid enrollees may have gaps in their enrollment, which could affect their utilization of Medicaid services. For the purposes of this research a gap in enrollment time was defined as 30 or more days of non-enrollment between two enrollment periods. Members were categorized as having zero gaps, one gap, two gaps, or three or more gaps within each study cohort period.

The authors excluded from the analysis members with a date of first dental visit prior to their date of first enrollment. Also excluded were twenty members in each study period reporting FIPS codes that did not correlate to a known Virginia county or city. In total, 8,239 members in the pre-reform group and 2,985 members in the post-reform group were excluded from the analysis.

Results

Descriptive Analysis

Descriptive statistics for both study cohorts are described in Table 1. Significant differences during initial analysis were observed in utilization rates within each of the demographic characteristics (all values for Pearson $X^2 > 4.13$, $p < 0.042$). Table 2 displays the number of children in each of the two policy reform groups that had at least one dental visit and the number of subjects that did not have any dental visits. An initial pooled t-test reviled that the percentage of post-reform enrollees having at least one dental visit, 44.2%, was significantly greater than the percentage of pre-reform enrollees, 34.4% ($t = 112.59$, $p<0.0001$).

Overall Regression Model Results

Without adjusting for any covariates, children in the post-reform period had 1.51 times the odds of having a dental visit as compared to the pre-reform group (OR 1.51, 95%CL [1.503, 1.526]). It was found that children in the post-policy reform group had 1.39 times the odds of utilization (OR 1.39, 95%CL [1.38,1.40]) after adjusting for gender, race, citizenship, age, geographic location in Virginia, gaps in enrollment, and length of

enrollment. Least Square Mean utilization percentages for the two study periods and the adjusted odds ratio from the repeated measures multivariate logistic regression are shown in Table 3, while Table 4 displays the complete results of the regression model.

Regression Model Results Stratified by Length of Enrollment

The effect of enrollment in either of the two study periods on utilization rates was found to depend significantly on the length of time that a child was enrolled in their respective study period (Cochran-Mantel-Haenszel $X^2 = 6508$, df=1, $p<0.0001$). Table 5 displays the number of children enrolled in each of these stratified time periods as well as the crude rates of utilization and odds ratios comparing the utilization rates between enrollment periods across the length of enrollment. Prior to adjusting for covariates, there appears to be a general increase in the likelihood of utilization as length of enrollment increases, with almost no difference in the 0-6 months of enrollment group, and a 54% increase in odds in the 31-36 months of enrollment group. A second repeated measures multivariate logistic regression model controlled for gender, race, citizenship, age, geographic location in Virginia, gaps in enrollment and length of enrollment while also testing the association between dental utilization rates in the pre and post policy reform periods stratified across six month enrollment durations from 0-6 months of enrollment up to 31-36 months of enrollment. Table 6 displays the resulting Least Square Mean Utilization percent within each of the stratified time periods as well as the resulting adjusted odds ratios for utilization. As can be seen in Table 6 and Figure 1,

there is almost no difference in the rate of utilization of dental services between the 0-6 month groups, but the rate of utilization increases significantly as length of enrollment increases, with 60% and 70% children in the pre- and post- reform 31-36 month groups respectively, having had at least one dental visit. Most importantly, the odds ratios displayed in Table 7 and Figure 2 indicate that as the length of exposure time to the post-reform policy increases, the odds of having a dental visit also increase as compared to the pre-reform period. The odds ratios in 13-18 month (OR 1.323, 95%CL [1.29,1.36]), 19-24 month (OR 1.315, 95%CL [1.29, 1.340]) and 25-30 month (OR 1.339, 95%CL [1.31, 1.37]) enrollment lengths are all significantly greater than the 0-6 month (OR 0.950, 95%CL [0.910, 0.993]) and 7-12 month (OR 1.200, 95%CL [1.17, 1.23]) enrollment lengths, but not significantly different from each other. However, the Children enrolled in the post-reform period for 31-36 months had 1.53 times the odds of having a dental visit as compared with children enrolled for the same length of time in the pre-reform period (OR 1.53, 95%CL [1.51, 1.55]).

Discussion

Access to dental health services for children is a well-known factor in promoting long-term dental health and preventing early childhood caries. Additionally, early childhood caries have been found to be associated poor overall health later in life and are known to reside more commonly among lower socioeconomic classes.[7] As a result, the Federal Government requires each state to include dental benefits in the Medicaid healthcare package for eligible children under the age of 21. Including these benefits is an important first step in promoting dental health among children, but children must actually access a provider willing to participate in the Medicaid program for the policy to yield a positive effect in pediatric dental health and public health in general.[29] Therefore, the findings of this study become increasingly important.

The results of this study indicate the 2005 Medicaid policy reform was significantly associated with an increase in dental utilization rates among children in Virginia. The strength of this association is maintained even after controlling for likely covariates. Perhaps the most important findings lie in the results of comparing the pre and post reform periods stratified for length of enrollment. The stratified analysis indicates that children with longer enrollment times benefited from as much as a 53% increase in

likelihood of having a dental visit. Observing the increased likelihood of utilization stratified by length of enrollment points toward a "quasi dose-response effect." This is important for at least two reasons. First, children enrolled in Medicaid for greater lengths of time are necessarily in lower socioeconomic categories for greater lengths of time, which is a known risk factor for poor oral health. This means that the effect associated with the 2005 policy reform has its greatest effect in one of the most targeted segments of the Medicaid population. Second, given that a child is implicitly more likely to have had a dental visit the longer they are enrolled in any dental insurance program, finding an effect in the lengthier enrollment periods further strengthens the conclusion that the policy reform is strongly associated with an increase in utilization rates.

In addition to the stratified analysis, this study has several strengths. First, the data included every Medicaid child in Virginia during the 2002 to 2008 study period. This grants sufficient statistical power through the large sample size, and also allows the researchers to make conclusions regarding the actual status of the population of interest with greatly reduced risk of selection bias. The study also utilized a robust statistical test and controlled for several important potential confounders. At the same time, the Smiles for Children program included several components to its policy reform, and this study cannot make claims as to the degree to which specific elements of the policy impacted utilization rates. Another weakness in this study has to do with treating utilization in a dichotomous fashion. Future studies would benefit from treating utilization in a continuous fashion. Along these lines, the specific types of care being delivered were not factored into the study design, which will necessarily correlate to the impact the policy reform has on public health.

A study of this kind contributes to the body of literature in a number of important ways. To begin with, this study is retrospective over six years and is, to-date, the most lengthy cohort study on dental Medicaid policy reform. In addition, several states have attempted Medicaid policy reform aimed at improving pediatric dental utilization rates, but such policy is still in its relative infancy. The findings in this study suggest that Virginia's policy could serve as a model for other states striving to improve dental utilization rates. Finally, the positive association between Medicaid policy reform and increased pediatric dental utilization rates found in this study now warrants additional research into the policy's impact on the type of dental care delivered, and the rate at which this care is delivered.

Conclusions

The 2005 Virginia Medicaid policy reform had a significant, and positive, impact on pediatric dental utilization rates. Such policy has the potential to continue to greatly improve access to dental services for children and ultimately to improve long-term oral health in the state of Virginia. States considering measures to improve access to dental care for Medicaid enrolled children will find Virginia's policy reform to be a suitable model for successfully improving pediatric dental utilization rates.

Appendix 1 Tables and Figures

Table 1 Descriptive Statistics for Pre and Post Reform Groups

	Pre-Reform Period (n = 559,820) 2002-2005			Post-Reform Period (n = 690,538) 2005-2008		
	Enroll Total n	Enroll %	Utilization % and 95% Confidence Limits*	Enroll Total n	Enroll %	Utilization % and 95% Confidence Limits*
Gender						
Female	275049	49.13	35.03 [34.9, 35.2]	345062	49.97	44.89 [44.7, 45.1]
Male	284771	50.87	33.71 [33.5, 33.9]	345476	50.03	43.55 [43.4, 43.7]
Race	n	%	% Use and 95%CL	n	%	% Use and 95%CL
White	224886	40.17	35.42 [35.2, 35.6]	264429	38.29	44.12 [43.9, 44.3]
Black	251943	45.00	34.98 [34.8, 35.2]	291863	42.27	47.80 [47.6, 47.9]
Hispanic	61972	11.07	28.55 [28.2, 28.9]	96328	13.95	37.48 [37.1, 37.8]
Other	20359	3.64	32.98 [32.3, 33.6]	27448	3.97	41.87 [41.3, 42.5]
Unknown	660	0.12	23.33 [20.0, 26.6]	10470	1.52	15.40 [14.7, 16.1]
Citizenship	n	%	% Use and 95%CL	n	%	% Use and 95%CL
US Citizen	549802	98.21	34.34 [34.2, 34.5]	673637	97.55	44.37 [44.3, 44.5]
NON-US Citizen	10018	1.79	35.32 [34.4, 36.3]	16901	2.45	38.24 [37.5, 39.0]
Geographic Locations	n	%	% Use and 95%CL	n	%	% Use and 95%CL
Rural	121591	21.72	37.60 [37.3, 37.9]	146301	21.19	46.32 [46.1, 46.6]
Mixed Rural	78429	14.01	33.07 [32.7, 33.4]	96855	14.03	43.11 [42.8, 43.4]
Mixed Urban	51730	9.24	33.86 [33.4, 34.3]	67638	9.80	43.14 [42.8, 43.5]
Urban	308050	55.03	33.50 [33.3, 33.7]	379724	54.99	43.89 [43.7. 44.0]
Enrollment Gaps	n	%	% Use and 95%CL	n	%	% Use and 95%CL
No Gaps	346880	61.96	41.01 [40.8, 41.2]	399586	57.87	51.44 [51.3, 51.6]
1 Gap	201054	35.91	23.20 [23.0, 23.4]	272343	39.44	34.00 [33.8, 34.2]
2 Gaps	11632	2.08	29.25 [28.4, 30.1]	18190	2.63	38.72 [38.0, 39.4]
3+ Gaps	254	0.05	28.74 [23.1, 34.3]	413	0.06	38.42 [33.7, 43.1]
Enrollment Length	n	%	% Use and 95%CL	n	%	% Use and 95%CL
0 -6 Months	92709	16.56	4.29 [4.2, 4.4]	89201	12.92	4.39 [4.25, 4.52]
7-12 Months	95038	16.98	15.97 [15.7, 16.2]	100035	14.49	19.28 [19.0, 19.5]
13-18 Months	64759	11.57	22.90 [22.6, 23.2]	76462	11.07	28.92 [28.6, 29.2]
19-24 Months	63706	11.38	33.77 [33.4, 34.1]	77603	11.24	40.58 [40.2, 40.9]
25-30 Months	56608	10.11	44.3 [43.9, 44.7]	70948	10.27	51.21 [50.8, 51.6]
31-36 Months	187000	33.40	59.78 [59.6, 60.0]	276289	40.01	69.58 [69.4, 69.7]
Average Age	Mean 7.30		SD 4.72	Mean 8.25		SD 5.59

Table 2 Unadjusted Utilization Characteristics of Pre- and Post- Reform Groups

	2002 - 2005 Enrollment Period		2005 - 2008 Enrollment Period	
Utilization	**N**	**%**	**N**	**%**
No Dental Visits	367464	65.64%	385169	55.78%
1+ Dental Visits	192356	34.36%	305369	44.22%
Total	559820	100.00%	690538	100.00%
Unadjusted Odds Ratio and 95% Confidence Limits			**1.51 [1.503, 1.526]**	

Table 3 Least Square Means from Regression Model for Utilization Characteristics of Pre- and Post-Reform Groups. Adjusted for gender, race, age, citizenship, geographic location, length of enrollment and gaps in enrollment

Enrollment Period	Least Sq Mean Utilization %	Std Error on Least Sq. Mean %
2002-2005 Enrollment Period (Pre-Reform)	23.59%	0.0231
2005-2008 Enrollment Period (Post-Reform)	29.98%	0.0230
Adjusted Odds Ratio	**OR 1.386 Std. Error: 0.0054 95% CL [1.376, 1.397]**	

Table 4 Pre vs. Post Reform Multivariate Logistic Regression Results

	b	(SE)	OR	95%CI	Z	p-value
05-08 Period vs. 02-05 Period	0.327	0.004	1.39	[1.376, 1.397]	83.68	<0.0001
Geographic Location						
Rural vs. Urban	-0.004	0.006	1.00	[0.984, 1.008]	-0.70	0.4813
Mixed Rural vs Urban	-0.099	0.007	0.91	[0.893, 0.919]	-13.85	<0.0001
Mixed Urban vs Urban	0.009	0.008	1.01	[0.994, 1.025]	1.17	0.2414
Citizenship Status						
US Citizen vs Non-US Citizen	0.018	0.016	1.02	[0.986, 1.051]	1.07	0.2850
Gender						
Female vs Male	0.074	0.005	1.08	[1.067, 1.087]	16.44	<0.0001
Race						
Unknown vs White	-0.194	0.029	0.82	[0.778, 0.871]	-6.73	<0.0001
Other vs White	0.073	0.013	1.08	[1.049, 1.102]	5.81	<0.0001
Hispanic vs White	-0.044	0.008	0.96	[0.942, 0.971]	-5.74	<0.0001
Black vs White	-0.167	0.005	0.85	[0.837, 0.855]	-30.70	<0.0001
Age	0.060	0.0004	1.06	[1.061, 1.063]	136.45	<0.0001
Enrollment Gaps						
3+ Gaps vs No Gaps	-0.191	0.082	0.83	[0.703, 0.970]	-2.32	0.0200
2 Gaps vs No Gaps	-0.151	0.013	0.86	[0.837, 0.882]	-11.38	<0.0001
1 Gap vs No Gaps	-0.079	0.005	0.92	[0.915, 0.933]	-15.79	<0.0001
Enrollment Length						
7-12 vs 0-6 Months	1.469	0.013	4.34	[4.236, 4.452]	116.07	<0.0001
13-18 vs 0-6 Months	1.974	0.013	7.20	[7.021, 7.381]	154.67	<0.0001
19-24 vs 0-6 Months	2.481	0.013	11.95	[11.659, 12.247]	197.68	<0.0001
25-30 vs 0-6 Months	2.917	0.013	18.49	[18.030, 18.952]	231.57	<0.0001
31-36 vs 0-6 Months	3.536	0.012	34.33	[33.535, 35.146]	295.00	<0.0001

Table 5 Unadjusted Utilization Characteristics for Pre- and Post- Reform Groups Stratified by Length of Enrollment

	2002 - 2005 Enrollment Period		2005 – 2008 Enrollment Period		
Length of Enrollment	No Dental Visits N (%)	1+ Dental Visits N (%)	No Dental Visits N (%)	1+ Dental Visits N (%)	Unadjusted OR and 95% CL
0-6 Months	88731 (95.71%)	3978 (4.29%)	85289 (95.61%)	3912 (4.39%)	1.02 [0.979,1.070]
7-12 Months	79860 (84.03%)	15178 (15.97%)	80748 (80.72%)	19287 (19.28%)	1.25 [1.228,1.287]
13-18 Months	49930 (77.10%)	14829 (22.90%)	54350 (71.08%)	22112 (28.92%)	1.37 [1.337,1.403]
19-24 Months	42192 (66.23%)	21514 (33.77%)	46110 (59.42%)	31493 (40.58%)	1.34 [1.310,1.369]
25-30 Months	31536 (55.71%)	25072 (44.29%)	34616 (48.79%)	36332 (51.21%)	1.32 [1.291,1.350]
31-36 months	75215 (40.22%)	111785 (59.78%)	84056 (30.42%)	192233 (69.58%)	1.54 [1.520,1.558]

Table 6 Least Square Means for Utilization Characteristics of Pre- and Post- Reform Groups Stratified by Enrollment Length. Adjusted for gender, race, age, citizenship, geographic location, and gaps in enrollment

	2002 - 2005 Enrollment Period		2005 – 2008 Enrollment Period		
Enrollment Length	LS Mean Utilization %	SE	LS Mean Utilization %	SE	Adjusted Odds Ratio and 95% CL
0-6 Months	4.67%	0.0277	4.45%	0.0273	**0.95** [0.910,0.993]
7-12 Months	15.85%	0.0246	18.44%	0.0241	**1.20** [1.173,1.228]
13-18 Months	22.85%	0.0247	28.15%	0.0241	**1.32** [1.292, 1.355]
19-24 Months	33.03%	0.0243	39.34%	0.0239	**1.31** [1.287, 1.344]
25-30 Months	43.03%	0.0244	50.29%	0.0240	**1.34** [1.310, 1.369]
31-36 months	56.59%	0.0237	66.59%	0.0236	**1.53** [1.512, 1.547]

Table 7 Multivariate Logistic Regression Results for Pre vs. Post Reform Periods Stratified by Enrollment Length. Odds Ratios are adjusted for gender, race, age, citizenship, geographic location, and gaps in enrollment.

05-08 Period vs 02-05 Period Stratified by Enrollment Time				
	b	(SE)	OR	95%CI
0-6 Months	-0.0508	0.0223	0.950	[0.910, 0.993]
7-12 Months	0.1824	0.0119	1.200	[1.173, 1.228]
13-18 Months	0.2800	0.0122	1.323	[1.292, 1.355]
19-24 Months	0.2740	0.0110	1.315	[1.287, 1.344]
25-30 Months	0.2920	0.0112	1.339	[1.310, 1.369]
31-36 Months	0.4248	0.0057	1.529	[1.512, 1.547]

Figure 1 LS Means for Pre and Post Reform Groups Stratified by Length of Enrollment. Adjusted for gender, race, age, citizenship, geographic location, and gaps in enrollment.

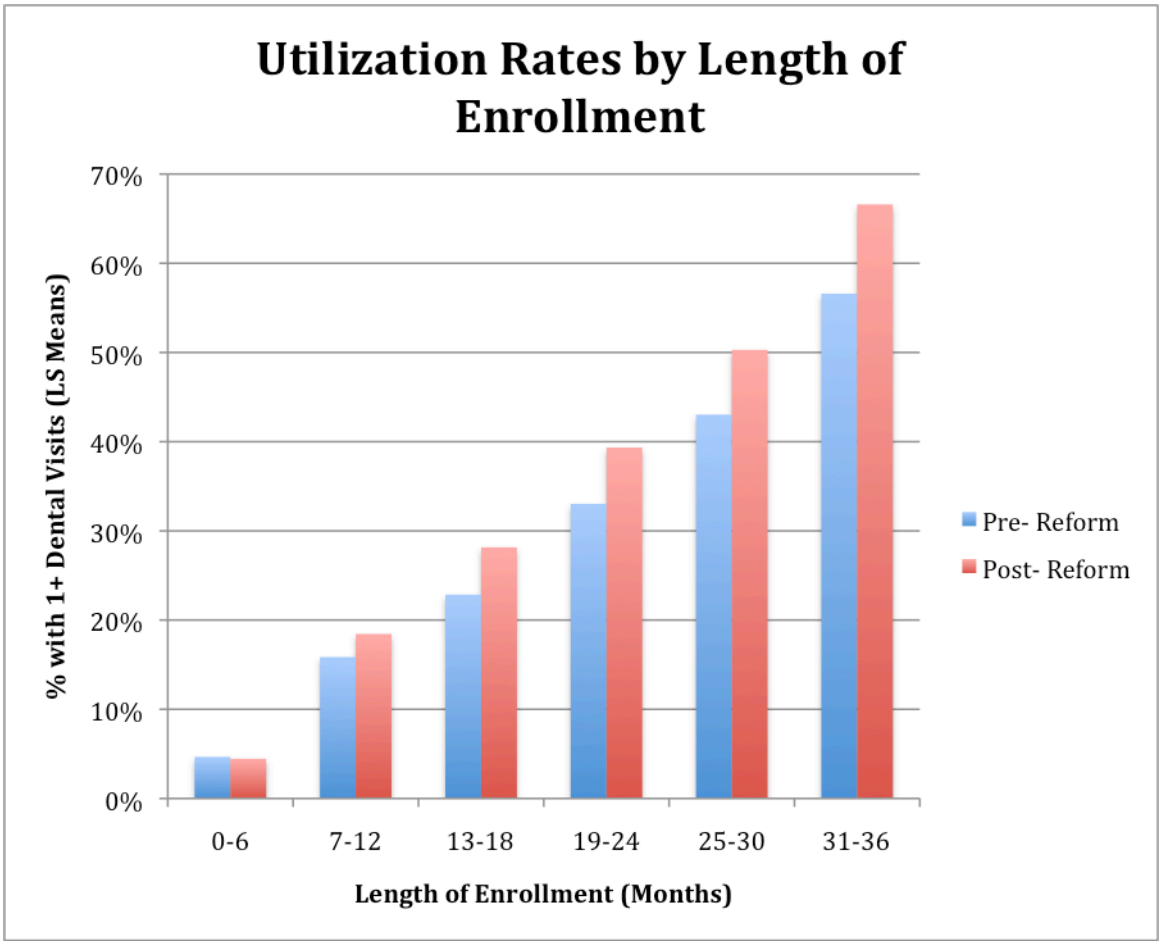
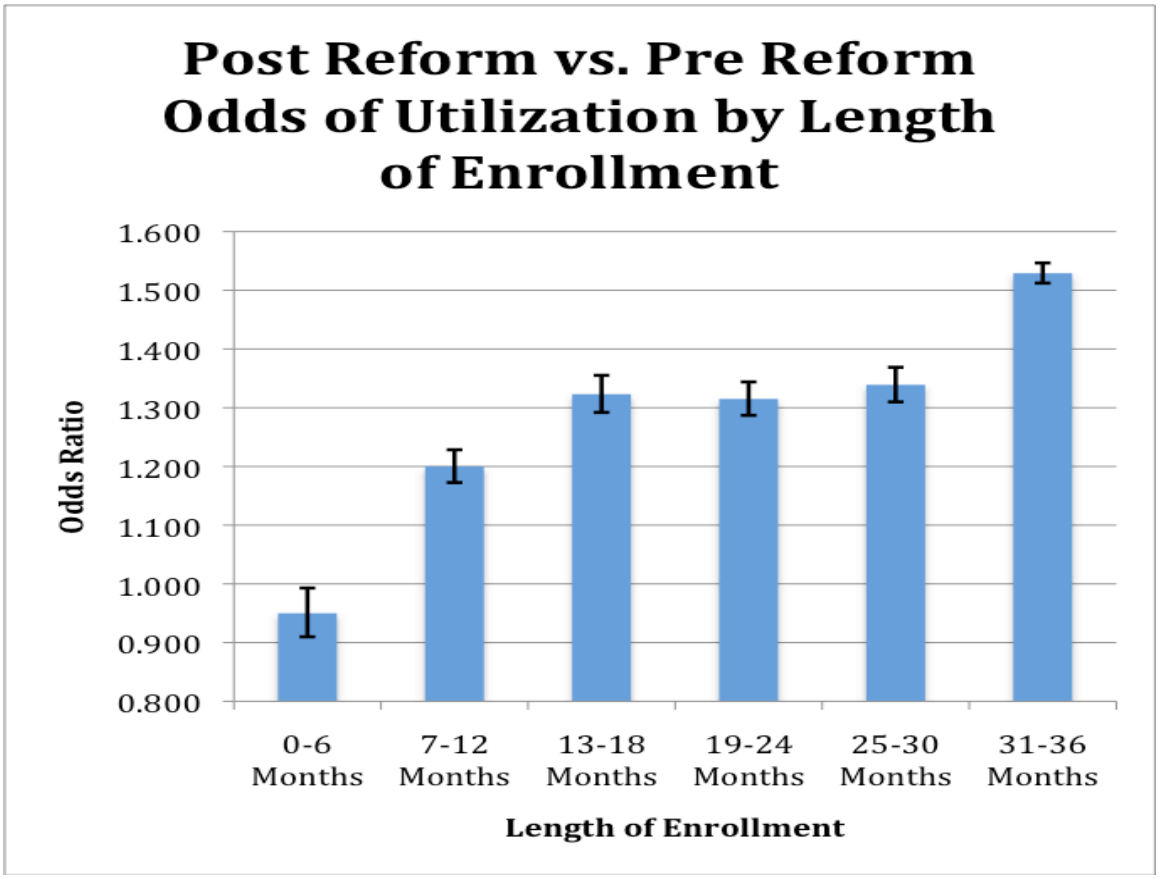


Figure 2 Odds Ratios for Pre vs. Post Reform Periods within each Enrollment Length Group, adjusted for gender, race, citizenships, age, geographic location, and gaps in enrollment.



References

References

1. Edelstein BL. Disparities in oral health and access to care: findings of national surveys. *Ambulatory Pediatrics*. 2002;2(2):141-147.
2. Fisher MA, Mascarenhas AK. Does Medicaid improve utilization of medical and dental services and health outcomes for Medicaid-eligible children in the United States? *Community Dent Oral Epidemiol*. 2007; 35:263-271.
3. US Department of Health and Human Services. Healthy People 2010. http://www.healthypeople.gov/document/html/objectives/21-12.htm
4. Virginia Department of Medical Assistance Services. Annual report on the
5. Greenberg BJS, Kumar JV, Stevenson H. Dental case management: increasing access to oral health care for families and children with low incomes. *JADA*. 2008;139:1114-1121.
6. Vargas CM, Ronizo CR. Disparities in early childhood caries. BMC Oral Health 2006, 6(supp 1):S3. 1-5.
7. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988-1994. *JADA*. 1998;129:1229-1238.
8. Thomson WM, Poulton R, Milne BJ, Caspi A, Broughton JR, Ayers KMS: Socioeconomic inequalities in oral health in childhood and adulthood in a birth cohort. *Community Dent Oral Epidemiol* 2004, 32(5)**:**345-353.
9. Savage MF, Lee JY, Kotch JB, Vann, Jr WF. Early Preventive Dental Visits: Effects on Subsequent Utilization and Costs. *Pediatrics*. 2004;114;e418-e423.
10. Boggess KA. Maternal oral health in pregnancy. *Obstet Gynecol* 2008;111(4):976–86.
11. Iwai T. Periodontal bacteremia and various vascular diseases. *J Period Res*. 2009;44(6):689-694.
12. Borchgrevink A, Snyder A, Gehshan S. The effects of Medicaid reimbursement rates on access to dental care. *National Academy for State Health Policy*. 2008; 1-41. Accessed 9/09 at www.nashp.org/Files/CHCF_dental_rates.pdf .
13. Brickhouse TH, Rozier RG, Slade GD. Effects of enrollment in Medicaid versus the state children's health insurance program on kindergarten children's untreated dental caries. *Am J Pub Health*. 2008;98(5):876-881.

14. Damiano PC, Momany ET, Carter KD, Jones MP, Askelson NM. Time to first dental visit after initially enrolling in Medicaid and s-schip. Medical Care, 2008, 46(2):1234-1239.

15. Virginia Department of Medical Assistance Services. Report on dental access and reimbursment. December 2004. DMAS 2004-RD197. Accessed 9/09 at http://www.dmas.virginia.gov/downloads/studies_reports/2004-RD197.pdf.

16. Sweet M, Damiano, Rivera E, Kuthy R, Heller K. A comparison of dental services received by Medicaid and privately insured adult populations. *JADA* 2005; 136:93-100

17. Greene-Mclntyre M, Finch MH, Searcy J. Smile Alabama! Initiative: Interim results from a program to increase children's access to dental care. *Rural Health Care Access*. 2003; 19(5):407-415.

18. Eklund SA, Pittman JL, Clark SJ. Michigan Medicaid's healthy kids dental program: An assessment of the first 12 months. *JADA*. 2003; 134:1509-1515.

19. Nietert PJ, Bradford WD, Kaste LM. The impact of an innovative reform to the South Carolina dental Medicaid system. *Health Services Research*. 2005; 40(4):1078-1091.

20. American Dental Association. State and Community Models for Improving Access to Dental Care For the Underserved— A White Paper. Chicago: American Dental Association: 2004.

21. Brickhouse TH, Rozier RG, Slade GD. The effect of two publicly funded insurance programs on use of dental services for young children. *Health Serv Res*. 2006;41(6):2033-53.

22. Wang H, Norton EC, Rozier RG. Effects of state children's health insurance program on access to dental care and use of dental services. *Health Serv Res*. 2007;42(4):1544-63.

23. Gehshan S, Snyder A. Why public policy matters in improving access to dental care. Dent Clin N Am 2009 53:573-589.

24. Virginia Medicaid/FAMIS dental program. December 2006. DMAS 2006-RD376. Accessed 9/09 at http://www.dmas.virginia.gov/downloads/studies_reports/2006RD376_Dental_Access_Rpt.pdf.

25. *The data analysis for this paper was generated using SAS software, Version 9.2 of the SAS/STAT System for Windows XP Professional. Copyright © 2008 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.*

26. Virginia Department of Health. Virginia Rural Health Plan. Appendix D. 2008 Accessed 4/10 at http://www.va-srhp.org/docs/va-rhp-final.pdf.

27. American Dental Association Council on Scientific Affairs. Professionally applied topical fluoride: evidence-based clinical recommendations. J Am Dent Assoc 2006 Aug;137(8):1151-9.

28. Department of Medical Assistance Services. Medicaid and FAMIS-Plus Handbook. January 2010. www.dmas.virginia.gov.

29. US Department of Health and Human Services Centers for Medicare & Medicaid Services. 2008 National Dental Summary. January 2009. Accessed 9/09 at http://www.cms.hhs.gov/MedicaidDentalCoverage/Downloads/natdensum011209.pdf.

Vita

Matthew Winheim was born in Philadelphia, PA December 16, 1982. He is a citizen of the United States and currently resides in Richmond, VA. Matthew received his undergraduate degree in Chemistry from Virginia Tech in 2005.