

The Impact of a Home Visiting Program on Children's Utilization of Dental Services

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KEY WORDS

children, dental, home visiting, utilization

ABBREVIATIONS

CHIP—Child Health Investment Partnership

PSM—propensity score matching

Dr Brickhouse conceptualized and designed the study, designed the data collection instruments, coordinated and supervised linkages, and drafted the initial manuscript; Ms Haldiman coordinated data collection and reviewed and revised the manuscript; Mr Evani provided programming for data linkages and statistical data analysis, and critically reviewed the manuscript; and all authors approved the final manuscript as submitted.

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abstract

BACKGROUND: Child Health Investment Partnership (CHIP) of Roanoke Valley is a home visiting program that promotes children's health and family self-sufficiency. CHIP's Begin With a Grin program provides preventive dental services in the home (oral health anticipatory guidance and fluoride varnish) for children aged 0 to 6 years. The purpose of this study was to compare the dental utilization of Medicaid-enrolled children in CHIP versus Medicaid-enrolled children not in CHIP.

METHODS: Using the propensity score method, control subjects were selected from the statewide Medicaid database by using a caliper-matching algorithm. A vector of chosen covariates was used to match control subjects; these covariates included risk factors, estimated propensity score, age, race, gender, and days of Medicaid eligibility. Propensity scores were developed by using a logistic regression. Differences in dental utilization outcomes were tested: ≥ 1 dental claim (logistic regression) and number of dental claims (Poisson regression) for each subject within the test period.

RESULTS: When CHIP children were compared with Medicaid-only children, the CHIP child was 3 times more likely to have at least 1 dental visit (odds ratio: 3.0 [95% confidence interval: 1.9–4.7]) and have a higher number of dental claims (ratio of estimated average number of dental claims [cases/control]: $8.60/3.05 = 2.82$ [95% confidence interval: 2.56–3.12]).

CONCLUSIONS: A home visiting model can introduce children and their families to dental prevention, improve dental health literacy, establish a dental home, and provide application of fluoride varnish. *Pediatrics* 2013;132:S147–S152

Dental disease in children is linked with failure to thrive, compromised nutrition, poor self-esteem, and impaired school performance. Significant disparities in oral health exist according to race, ethnicity, education, income, and geography. Children from low-income families experience more dental disease and have reduced access to dental care, resulting in fewer opportunities for prevention and higher levels of unmet dental treatment needs.^{1,2} Only 1 in 5 children enrolled in Medicaid ever receives a preventive dental visit, and increased levels of oral disease are being seen in this population of children.³ In the Roanoke Valley of Virginia, and most other parts of the nation, the problem is exacerbated by a shortage of pediatric dentists accepting Medicaid, a lack of parental education and literacy on oral health and hygiene, language and cultural barriers to care, and rural areas depending on private, nonfluoridated wells for water. Our goal in the current study was to assess the role of home visiting in improving the functional health literacy of parents; the access to oral health services was also examined. We hypothesized that functional health literacy would be improved when it is provided within the context of a home visitation program and that the use of dental services for children would increase as the health literacy of the parent improved.

ORAL HEALTH PREVENTION IN EARLY CHILDHOOD

Currently, there is limited research on the impact of preventive dental services within the home visit itself and its implications on children's oral health. However, there is literature that attempts to examine the theory of improved oral health for children in early-childhood intervention programs. The dental home concept is now becoming linked to a group of additional

progressive policies currently being advanced by pediatric dentistry, including the dental visit at 1 year of age, outreach to Head Start populations, updating state Medicaid periodicity schedules, and refining clinical care through risk assessment and risk-based interventions.⁴ In an issue brief by the Pew Center on the States, Kentucky's Health Access Nurturing Development Services program was reviewed as a comprehensive and promising model for integrating home visiting within a broader continuum of early-childhood services.⁵ Services to improve health care access included nurses who applied fluoride varnishes to children's teeth during home visits. Kentucky's Department for Public Health estimated that approximately \$23 million in medical costs are avoided each year due to improved health outcomes.⁶ The maternal child health workforce is well poised as a credible source of oral health anticipatory guidance and support to families in oral health education and prevention strategies.⁷

CHILD HEALTH INVESTMENT PARTNERSHIP HOME VISITATION PROGRAM

Child Health Investment Partnership (CHIP) of Roanoke Valley is a public/private-funded home visitation program that provides health care coordination and parenting support for at-risk children and their families. CHIP promotes the health of children in Roanoke, Botetourt, and Craig counties and the cities of Roanoke and Salem from birth to entry into kindergarten, and who reside in families with income 185% to 200% below the poverty level. The program works to ensure comprehensive health care, strengthen families, and coordinate community resources.

To improve the oral health of the children, CHIP seeks to address access

barriers to early oral health care through the in-home implementation of Virginia Department of Health's *Bright Smiles for Babies: Early Oral Screening and Fluoride Varnish Program*.⁸ CHIP has designated this effort as its Begin With a Grin program. In the context of a home visit, community health nurses and CHIP's pediatric nurse practitioners will apply fluoride dental varnish to the teeth of CHIP-enrolled children ages 6 through 36 months who are not currently being seen by a dentist and educate the primary caregiver regarding proper oral hygiene, nutrition, and oral health literacy in an effort to reduce high-risk behaviors that lead to early childhood caries.^{9,10} Educational tools include oversized models of the teeth and gums paired with a large toothbrush that allow community health nurses to demonstrate proper brushing and flossing technique, after which both parent and child can take turns applying the knowledge they have learned in the home visit. CHIP of Roanoke Valley is the first CHIP location in Virginia to pilot this program. It is the only known program in Virginia to address child dental health indicators in the context of a home visitation program that pairs preventive dental health care with comprehensive care coordination and wrap-around services for the entire family.

Providing in-home preventive dental services gives CHIP access to the most vulnerable children: those living in outlying, rural areas, without transportation, and without access to pediatric dental providers. By virtue of the relationship created between a family and their home visitor, CHIP has the unique opportunity to improve the early dental health of children in a high-risk, high-cost population with traditionally low levels of dental utilization.^{3,11,12} The purpose of the current study was to compare the dental utilization of

Medicaid-enrolled children in CHIP versus Medicaid-enrolled children not in CHIP.

METHODS

This study is an analysis of a cohort of children ($N = 216$) who participated in the CHIP Begin With a Grin program. The data set was created from merging the enrollment and dental claims files in Virginia's Medicaid database, cross-referenced by using the patient's encrypted Medicaid identifier. The main effect variable was whether the child was enrolled in CHIP, with the utilization of Medicaid dental services as the primary outcome. Differences in the following dental utilization outcomes were tested by using a generalized linear model: (1) ≥ 1 dental claim (logistic regression); and (2) number of dental claims (Poisson regression) for each subject within the test period. The study period was from September 2008 through March 2010. The study was approved for exemption by the Institutional Review Board for Human Subjects at Virginia Commonwealth University.

Using the propensity score method, we were able to select control subjects from the statewide Medicaid database whose vector of chosen covariates matched those of the CHIP treatment subjects. Propensity score matching (PSM) is a statistical method that uses observational data and attempts to provide unbiased estimates of treatment effects. A randomized controlled trial can provide an unbiased treatment effect because the groups will be balanced, on average, by the law of large numbers. PSM attempts to correct for selection bias in nonexperimental settings, and it therefore makes the possibility of causal inferences from observational data plausible.^{13–15}

In the current study, propensity scores were developed by using logistic regression, in which the probability of

a subject being selected for treatment (as the outcome variable) was modeled as a function of relevant covariates, such as age at Medicaid enrollment, race, gender, locality, and the number of months of Medicaid enrollment. The database of potential controls was then searched for closely matched predicted propensity scores. A caliper-matching algorithm was used to select the best-matched controls. PSM was used to obtain a 1:1 control match for each CHIP case in the Medicaid database.

The entire study sample consisted of 432 children, with 216 enrolled in the CHIP program and 216 matching non-CHIP controls all enrolled in Medicaid. The independent variable was enrollment in CHIP and Medicaid (cases) or enrollment in Medicaid only (non-CHIP controls). The outcome variable was either: (1) ≥ 1 dental claim (yes/no, in logistic regression); or (2) number of claims in the study period (in Poisson regression). The covariates were child's age at enrollment in Medicaid (months), race, length of enrollment (months), and recipient's locality. All analyses were completed by using SAS version 9.3 (SAS Institute, Inc, Cary, NC) statistical software.¹⁶

RESULTS

Propensity Score Matching

Although this was an observational study, we can take stock in the effect estimates resulting from the enrollment in the CHIP program because we selected matching controls to each case by using PSM. The predicted propensity scores for the cases and controls were generated by using a logistic regression model with the likelihood of being selected as a CHIP case based on the joint distribution of the relevant covariates as the logistic response variable.

Goodness-of-fit for propensity score in this logistic model was assessed by

using the Hosmer-Lemeshow method, and we found that the model adequately represented the data, adjusted for the propensity score. Descriptively, the increased level of dental utilization for CHIP-enrolled children is shown in the summary Fig 1. The graphic shows the frequency of dental claims for each Medicaid-enrolled child classified under cases and controls. There were significantly higher numbers of subsequent dental claims made by the CHIP-enrolled children (1757 total claims, with 55 subjects having no claims) versus the Medicaid-only control group (641 total claims, with 114 subjects having no claims).

Descriptive Results

Descriptive statistics of the study cohort grouped according to CHIP-enrolled children (cases) and Medicaid-only enrolled children (controls) are presented in Table 1. Due to PSM of the controls to the cases, as intended, we found that the frequency distributions for covariates such as age, duration of enrollment, race, gender, and locality were closely matched for each subgroup.

Table 2 presents the dental utilization outcomes of ≥ 1 dental claim and the mean number of dental claims. The percentage of CHIP-enrolled children (cases) that had ≥ 1 Medicaid dental claim was 74.5%, in contrast to the Medicaid-only children (control) group, which had 47.2% with ≥ 1 dental claim. The mean number of dental claims for CHIP-enrolled children was 8.13, and the mean number for Medicaid-only children was 2.97.

Model Results

In the logistic regression analysis comparing CHIP-enrolled children with Medicaid-only children, there was a significant difference in dental utilization. CHIP-enrolled children were found to be 3 times more likely to have at least 1 dental claim (odds ratio: 3.0 [95%

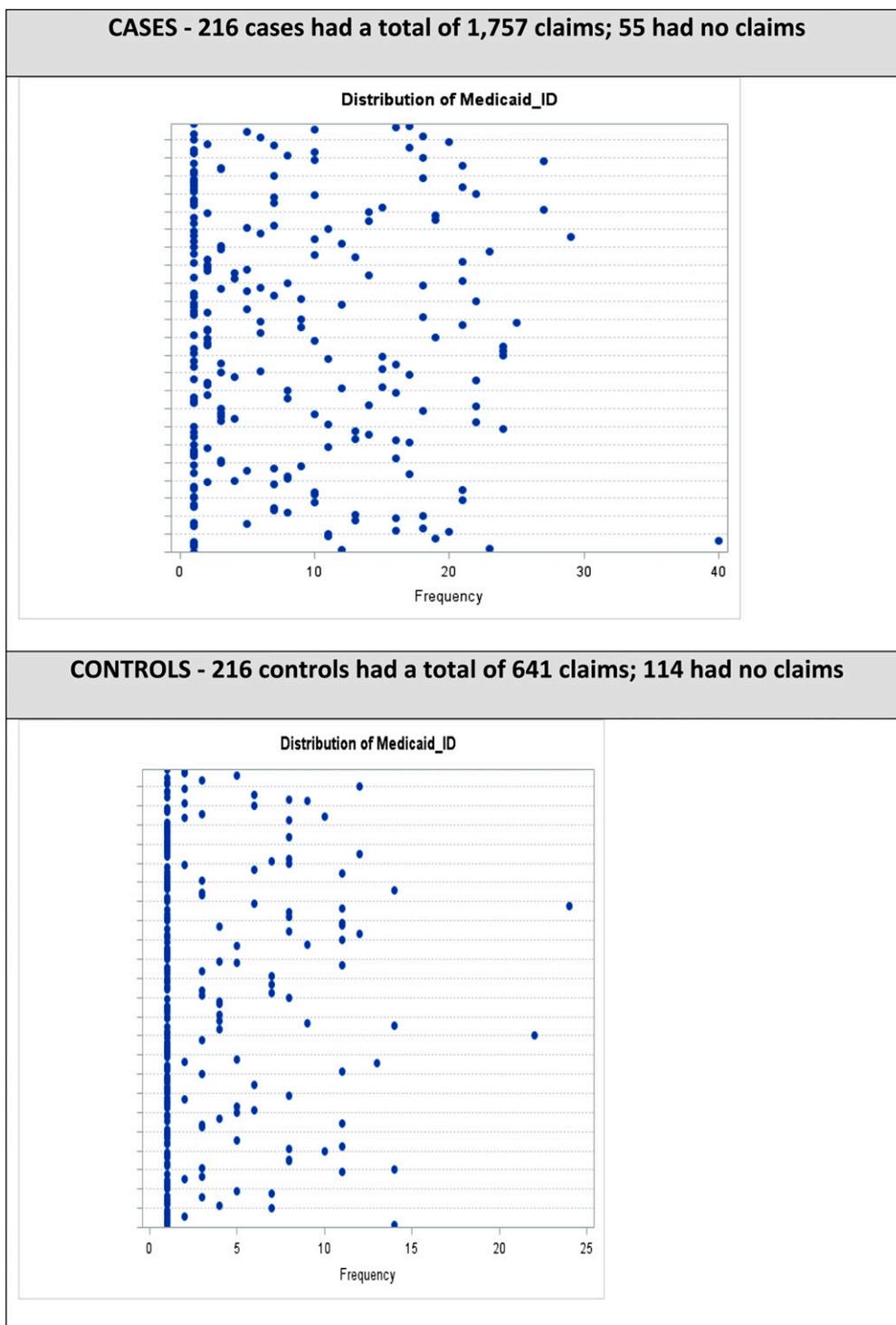


FIGURE 1

Frequency of dental claims for each child classified under cases (CHIP) and controls (Medicaid-only). X-axis: Dental claim_frequency; y-axis: individual_children.

confidence interval: 1.9–4.7]). Similarly, in the Poisson regression analysis, the average number of dental claims for CHIP-enrolled children was compared

with that of Medicaid-only children. The CHIP-enrolled children had a higher number of dental claims (ratio of estimated average number of dental claims

[cases/controls: $8.60/3.05 = 2.82$ [95% confidence interval: 2.56–3.12]). Table 3 displays the significant increase in dental utilization for children in the CHIP

TABLE 1 Descriptive Demographic Characteristics of the Study Cohort

Characteristic	Cases (<i>n</i> = 216)	Controls (<i>n</i> = 216)
Age at enrollment in Medicaid, mean ± SE, mo	1.1 ± 0.31	1.9 ± 0.10
Enrollment duration, mo	68.0	64.4
Race, <i>n</i> (%)		
White	75 (34.7)	75 (34.7)
Black	62 (28.7)	73 (33.8)
Hispanic	57 (26.4)	49 (22.7)
Other	22 (10.2)	19 (8.8)
Gender, <i>n</i> (%)		
Male	114 (52.8)	104 (48.1)
Female	102 (47.2)	112 (51.9)
Locality, <i>n</i> (%)		
Botetourt County	2 (0.9)	0 (0)
Craig County	3 (1.4)	1 (0.5)
Roanoke County	46 (21.3)	42 (19.4)
Roanoke City	164 (75.9)	171 (79.2)
Salem City	1 (0.5)	2 (0.9)

TABLE 2 Outcomes of Dental Utilization for the Study Cohort

Outcome	Cases	Controls
≥1 claim, %	74.5	47.2
No. of claims, mean ± SE	8.13 ± 0.55	2.97 ± 0.30

TABLE 3 Logistic and Poisson Regressions of Dental Utilization Adjusting for Propensity Scores

Variable	Odds Ratio	Ratio of Means	95% CI
Effect (≥1 claim): CHIP versus Medicaid-only	2.97	–	1.87–4.74
Effect (mean no. of claims per child): CHIP versus Medicaid-only	–	8.60/3.05 = 2.82	2.56–3.12

CI, confidence interval; –, not applicable.

program in contrast to Medicaid-only children.

DISCUSSION

Health literacy is believed to be an important determinant of oral health that intersects with other factors (eg, family attitudes, motivation) in numerous ways.¹⁷ Literacy is not the only pathway to improving oral health outcomes, but it is critical to the utilization of preventive dental services and the establishment of the dental home.^{18,19} Recent studies have indicated that low caregiver literacy is associated with poorer child

dental health status.²⁰ Previous research suggests that caregiver knowledge and health behaviors have a significant impact on pediatric health outcomes. These findings have important implications for home visitation programs and provide much-needed data to target wider interventions on a community level. Many community-based preventive programs for young children target caregivers with educational messages. This home visitation program, *Begin With a Grin*, is a preventive dental initiative that ties both education and preventive services with

the goal of increasing dental utilization. A home visiting program model can introduce children and their families to dental disease prevention methods, improve dental health literacy, and establish a dental home, leading to increased utilization of dental services to low-income families enrolled in or eligible for Medicaid dental benefits.

Evidence suggests that interventions to prevent dental disease downstream would incur fewer emergency and restorative services and could provide cost savings. Savage et al^{11,12} examined the cost of early dental visits (ie, the mean dental-related costs per child) according to age at the first preventive visit. They found the following costs: (1) before age 1 year: \$262; (2) age 1 to 2 years: \$339; (3) age 2 to 3 years: \$449; (4) age 3 to 4 years: \$492; and (5) age 4 to 5 years: \$546. The policy and practice implications of the findings from this study are that these programs should begin in infancy, not later in childhood as is often reported with levels of dental utilization for children very low prior to age 3 years. A next step for the analysis would be to investigate the breakdown of the total utilization under the service categories of diagnostic, preventive, restorative, or complex services for the CHIP-enrolled children versus Medicaid-only enrolled children.

CONCLUSIONS

There was a significant increase in dental utilization for children enrolled in this home visitation program in contrast to Medicaid-only enrolled children.

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