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Social Determinants of Participation in a Home Visitation Fluoride Varnish Program

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A Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science
in Dentistry at Virginia Commonwealth University.

By

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Abstract

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VARNISH PROGRAM

By James Ethan Puryear, DDS

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Virginia Commonwealth University, 2016

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Purpose: The purpose of this study is to examine the social determinants of CHIP (Child Health Investment Partnership) of Roanoke Valley children who participated in the preventive oral health program compared to those who did not.

Methods: This is a retrospective cohort study of children (n=2,425) enrolled in CHIP of Roanoke Valley from September 2008-September 2014. Bivariate analysis and multivariable logistic regression models were used to compare age, gender, race, locality, parents' education level, age at enrollment, and length of enrollment for oral health program participants versus those who did not participate.

Results: Children who were Hispanic as well as children who enrolled in CHIP at an earlier age were more likely to enroll in the oral health program.

Conclusions: By focusing on enrolling children at earlier ages, there is the potential to increase the use of dental care to match the recommended periodicity of dental care for young children.

Introduction

Despite overall improvements in oral health, dental caries remains the most common chronic disease of childhood. In recent decades the rate of dental caries for children has increased. Between 1988-1994 and 1999-2004 the prevalence of dental caries in children ages 2-5 years old increased from 24-28 percent. Disparities are evident based on socioeconomic status with 33% of low income children experiencing 75% of the caries burden.¹⁻³

Children from low socioeconomic backgrounds are disproportionately affected both in terms of having dental needs as well as lacking access to treatment for dental disease. Only 1 in 5 children enrolled in Medicaid ever receive a preventive dental visit.⁴ Children enrolled in Medicaid face numerous barriers to care including a shortage of pediatric dentists accepting Medicaid, low parental oral health literacy, cultural barriers, and geographic barriers.

Dental decay in the primary dentition is significant for several reasons. Severe dental decay in children up to five years old often requires treatment in the operating room setting under general anesthesia, which is costly. Furthermore, caries in the primary dentition acts as the most reliable predictor of future dental caries in the permanent dentition. Children with poor oral health status are also more likely to suffer pain, miss days from school, and perform poorly in school.⁵

A child's oral health is influenced by a complex multidimensional series of factors including social factors at the child, family and community level. Child influences include

biologic and genetic endowment, health behaviors and practices, development and use of dental care and dental insurance. Family level influences include family composition, socioeconomic status family function and health status of parents. Community level influences include the physical and social environment of the child, their dental and health care system characteristics as well as their culture. Some of these influences have been shown to affect overall physical health and may be implicated in oral health given the intricate relationship between overall health and oral health.⁶

Currently there is limited research on the impact of preventive dental services within home-visitation programs 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. It has been shown that Medicaid-enrolled children who have earlier dental visits have lower costs of dental care at age five.⁷ The dental home concept is now becoming linked to a group of additional progressive policies currently being advanced by pediatric health advocates including the age one dental visit, outreach to Head Start populations, updating state Medicaid periodicity schedules, and refining clinical care through risk assessment and risk-based interventions.⁸

CHIP Home Visitation Program

The Child Health Investment Partnership of Roanoke Valley (CHIP) 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, from low-income high risk families. These services are divided into three categories: family strengthening services, mental health services, and health care coordination and supervision.

Family strengthening services are provided by a monthly home visit with a Family Case Manager. These visits provide parenting support and education, child development, kindergarten readiness and self-sufficiency and life skills development with the anticipated outcome of improving the education and employment status of parents and school success for children. Mental health services include a bi-monthly home visit with a qualified mental health professional that coordinates mental health resources, therapeutic interventions and provides advocacy and assessments. The health care component utilizes a monthly pediatric nurse practitioner visit to address asthma case management, prenatal case management, and case management for Neonatal Intensive Care Unit infants and medically fragile children.⁹ The oral health component is designated as the *Begin with a Grin* (BwaG) program. Participants are between the ages of 6 months and 36 months old. Home visits are conducted by a CHIP community health nurse and a pediatric nurse practitioner who provides the primary caregiver with anticipatory guidance regarding oral hygiene, nutrition and eliminating habits that are known to contribute to early childhood caries. The child also receives an application of fluoride varnish by the nurse.⁹

Ample evidence exists to support the use of fluoride varnish in preventing caries. Multiple studies have shown that the application of fluoride varnish to primary teeth results in a lower caries rate.¹⁰⁻¹³ Additionally, studies have shown that counseling in addition to yearly application of a fluoride varnish leads to a reduction in caries when compared to counseling alone.¹⁴ Due to the effectiveness in preventing tooth decay, the American Academy of Pediatric Dentistry recommends that children at increased risk for caries should receive a fluoride varnish treatment at least every 6 months.¹⁵

There are several characteristics of fluoride varnish that make it particularly useful and effective for young children. It is easy to apply as it does not require any special equipment and can be applied quickly and effectively in any setting. Once applied it adheres to the tooth and is activated by oral fluids. A prophylaxis may be performed prior to application but is not necessary. These characteristics allow for effective delivery even in the pre-cooperative child who is in their home rather than a dental office.

The home visitation program provided by CHIP is particularly beneficial for the high risk population that it serves. By meeting with families in their home CHIP is able to provide education and preventive services to participants who reside in rural areas who may have a lack of transportation and a lack of dental providers who accept Medicaid. Previous studies have shown that CHIP enrolled children who participated in the BwaG program had significantly higher usage of Medicaid dental benefits compared with a Medicaid only cohort. Additionally, Medicaid enrolled CHIP participants were three times more likely to have at least one dental visit compared to Medicaid-only children.¹⁶ This study gives evidence that the in-home visitation program can introduce children to a dental home and improve dental health literacy. These findings provided the impetus for the current study since participation in BwaG is not mandated.

The purpose of this study is to examine and identify what health and social determinants predict which Child Health Investment Partnership (CHIP) children participated in the *Begin with a Grin* program (BwaG). Our hypothesis is that CHIP enrolled children who participated in the BwaG program will have differing health and social determinants. Participation may vary according to the child's age, gender, race, locality in which the child resides, parents' education level, age at CHIP enrollment, and length of enrollment in CHIP. A secondary aim will be the comparison of dental disease for a subset of CHIP children that received a dental exam. We will

compare the dental disease status of children who did receive fluoride varnish at a CHIP BwaG home visit to those that did not.

Materials and Methods

Sample and data collection

This was a secondary data analysis of enrollment data and clinical records of a cohort of children enrolled in CHIP's Begin with a Grin (BwaG) (N=1375) over a four-year period (September 2008-September 2014) compared to (N=1050) whom did not participate in the program. Children were assigned a unique identification number linked to their demographic information, enrollment history, health measures, social/family/community measures, health literacy, and dental varnish and dental visits over the study period. This study was approved for exemption by the Institutional Review Board for Human Subjects at Virginia Commonwealth University.

A descriptive analysis was completed for a number of factors related to health literacy and dental utilization such as: age, gender, race, locality in which the child resides, parents education level, age at enrollment, the length of enrollment in CHIP, the outcomes of BwaG participation (yes/no) and whether the child has a visit to a dentist (yes/no). The presence or absence of dental decay will be determined on a subset of CHIP children using data collected at semi-annual calibrated visual dental exams performed by VCU pediatric dental residents. Dental caries was evaluated using the $d_1d_{2-3}f$ criteria.¹⁷ This was a visual examination that recorded both frank (d_{2-3}) and non-cavitated (d_1) carious lesions, as well as filled lesions in the teeth.

Statistical Analyses

Bivariate analysis and multivariate logistic regression models were created for BwaG participation. Bivariate analysis was used to determine the relationship between designated social determinants of program participation and dental utilization/dental disease outcomes. The models were adjusted to control for the effects of the following covariates: (1) age; (2) gender; (3) race; (4) locality in which the child resides; (5) parents' education level; (6) age at CHIP enrollment; (7) length of enrollment in CHIP. Statistical analysis was completed using SAS version 9.3.¹⁸

Results

A total of n=2,425 children were included in the study. The average age at enrollment was 0.99 years with an average length of enrollment of 23.8 months. Of these, 57% participated in BWAG. Potential social determinants including length of time in CHIP, age at enrollment, gender, locality, and race/ethnicity were included in the data.

Descriptive Analysis

Initial descriptive analyses were performed on the potential social determinants of BWAG participation and measures of dental care. These results are listed in Table 1. Participants in BWAG have been enrolled in CHIP for significantly longer than those who did not, and there was a significant difference in age at enrollment between children who participated in BWAG and those who did not. Specifically, children who did not participate were older (1.4 years old vs. 0.7) at enrollment in CHIP (p-value<0.0001) and have been enrolled for less time (9 months vs 35 months). There was also a significant association between race/ethnicity and participation in BWAG (p-value<0.0001). The primary difference in race/ethnicity distribution for the two groups was seen in percent Hispanic (15% of BWAG participants' vs 5% CHIP Only). Results from an unadjusted logistic regression model indicated that Hispanic children were 1.7 times more likely to participate in BWAG than Caucasian children (95% CI: 1.05-2.69).

Regression Analysis

An overall regression model of BWAG participation was fit with gender, race/ethnicity, locality, parent's education, total months enrolled in CHIP and the age at enrollment. The multivariable logistic model results are given in Table 2. Results indicate that after adjusting for the total months enrolled in CHIP (p-value<0.0001), age at enrollment was significantly associated with an increase in participation in BWAG (p-value<0.0001), and there was a difference in race/ethnicity (p-value=0.0478). The odds ratios for all factors are presented in Figure 1.

Overall Dental Care

In terms of dental care, participants in BWAG received more documented fluoride varnish treatments (1.17 vs 0.08, p-value<0.0001) and had more visits with a dentist outside of the BWAG program (0.92 vs 0.22, p-value<0.0001). When having a dental visit was examined as dichotomous (yes/no) variable, we found that the odds of having a dental visit was 4.9 (95% CI: 4.01-6.08) times higher for participants in BWAG than those only in CHIP (P-value<0.0001). It would be of interest to determine whether or not this increased care has resulted in better dental outcomes, but due to the nature of the program, clinical exam data was only available on a subset of participants in BWAG (n=339) who voluntarily came for the calibrated dental exams at CHIP. Among those children that participated in the dental exams, we found that 19% had existing or history of cavitated tooth decay on at least one primary tooth.

Discussion

Social determinants are thought to play a significant role in the prevalence of dental caries as well as the utilization of dental services.⁶ Children of low socioeconomic status as well as children who identify as racial or ethnic minorities are disproportionately affected by dental caries. The most recent National Health and Nutrition Examination Survey reports that children who are black or Hispanic and children whose family is below the poverty level experience more caries.² All participants in CHIP of Roanoke Valley have a household income less than 185-200% of the federal poverty level. Half of the CHIP participants examined in this study are African American, 41%, or Hispanic, 10%. Additionally, 17% of CHIP participant examined reside in an outlying rural area where transportation is more difficult and there is limited access to pediatric dental providers. Because of these characteristics CHIP participants are a particularly vulnerable population for developing dental caries.

The initial aim of our study was to identify social determinants that differed between CHIP participants who enrolled in BwaG compared to CHIP participants that did not. Of the potential social determinants examined two were considered significant in predicting participation in BwaG: age at enrollment and those who identified as Hispanic.

Participants who enrolled in BwaG were younger at enrollment (0.7 years old vs 1.4 years old). Also, these individuals had been enrolled in CHIP for a longer period of time (35 months vs 9 months). This suggests that enrolling children in CHIP at an earlier age may lead to two potential benefits: participation in BwaG and a longer enrollment period. The importance of

early intervention has been established for oral health and serves as the basis for the age one dental visit.^{19,20}

Children who participated in BwaG were five times more likely to have had a dental visit in addition to their CHIP home visits that included preventive oral health measures. The role of the pediatric nurse practitioner who conducts the home visits is to educate caretakers and promote prevention through anticipatory guidance and a fluoride varnish application. Higher utilization of dental visits suggests that the participants were more motivated to seek dental care than children who did not participate in BwaG. The educational component of the home visits may be motivating participants to seek dental care at an earlier age and may be encouraging regular dental visits once established. This is critical for a high risk population such as CHIP participants as earlier initial dental visits has been shown to lower the overall cost of dental treatment for both privately insured children and children enrolled in Medicaid.^{21,22} Additionally, children who have their first dental visit at an age older than one are more likely to have subsequent restorative and emergency visits while children who have their first dental visit by age one are more likely to have subsequent preventive visits only.¹⁹ This implies that children enrolled in BwaG may benefit from higher utilization of dental care in addition to the benefits of the home visit.

BwaG participants also received more applications of fluoride varnish than children who did not participate. Fluoride varnish is easy to apply making it an ideal medium for applying topical fluoride. BwaG participants have more opportunities to receive fluoride varnish due to the home visits and their increased utilization of dental care. The American Dental Association recommends at least two applications of fluoride varnish per year with individuals at a high risk of developing caries receiving fluoride varnish on a three-month interval. Children enrolled in

CHIP are likely to benefit from a high caries risk fluoride varnish schedule given the disparity of dental caries among children from low income families. Children who reside in outlying rural areas who primarily consume water from private, non-fluoridated wells may find the additional fluoride varnish applications to be particularly effective.

Dental exam data was collected on CHIP BwaG participants. Of these participants, 19% had a tooth with frank caries present or a tooth that was missing or restored due to caries. The most recent National Health and Nutrition Examination Survey reports that 22.7% of 2-5 year olds had a caries experience. For children 2-8 years old, caries experience and untreated decay rates are higher for children who are under 200% of the poverty level compared to children who are over the poverty level. Additionally, children who are Hispanic or African American have a higher caries experience and higher rate of untreated decay than the general population². The CHIP BwaG population is an inherently high risk population for dental caries due to its demographic make-up. Achieving a similar caries rate as the overall U.S. population suggests that the home visitation program has mitigated a proportion of disease that is typically seen at higher levels in low-income children.

Hispanic participants were more likely to participate in BwaG than any other racial demographic. This was an unexpected finding. Previous studies show that Hispanic individuals have a lower rate of utilization of dental services compared to Caucasian populations.²³ Hispanic children are also disproportionately affected by dental caries and have higher rates of untreated decay.² The increased participation of Hispanic children can likely be attributed to CHIP's Family Case Managers, two of which are Hispanic. In addition to the typical family strengthening services, these individuals provide language services and act as a cultural liaison to Hispanic CHIP families. Home visits may include interpreting reports from a child's teacher or

physician that otherwise may go misinterpreted. These Hispanic Family Case Managers are in a unique position to relate to Hispanic families culturally, allowing them to develop trust and ultimately using that trust to guide families through the health care system and help them adapt culturally. It would be useful to investigate the outcomes of these families, both in dental care and in other measures such as kindergarten readiness in future studies. It is possible that the ability to overcome language and cultural barriers may make a home visiting program such as CHIP that includes oral health prevention like BwaG particularly effective for these families.

There were several limitations of this study. The children who participated in the dental exams may show sampling bias as they were not randomly selected but were children whose parent brought them to special dental exam days at CHIP. These families may be particularly motivated to improve oral health care, although, that motivation may be driven by the CHIP home visits themselves.

Future studies should seek more information regarding the nature of dental visits for CHIP participants. Having established that CHIP BwaG participants have a higher utilization of dental care it would be beneficial to examine what types of dental visits were being utilized. Comparing the type of dental visits utilized by CHIP participants enrolled in BwaG to the type of dental visits for CHIP participants who did not participate may give insight into the cost-benefit analysis of the home visitation program. Also, comparing the tooth decay outcomes of CHIP children enrolled in BwaG compared to those who did not would give a more accurate picture of the effect that the intervention of the home visit has on decay levels.

Conclusion

The CHIP BwaG home visitation program is an effective way to increase the exposure of young children to preventive dental care. CHIP participants are more likely to participate in BwaG if they enroll in CHIP at an earlier age. Children who participate in BwaG are more likely to visit a dentist and have more documented applications of fluoride varnish than CHIP children who do not participate in BwaG. Among racial demographics, Hispanic children were more likely to enroll in BwaG than any other race or ethnicities, likely due to the trust established by CHIP's Hispanic Family Case Managers. The subset of BwaG participants who received a calibrated dental exam showed a similar caries rate to the overall U.S population of preschool aged children, not higher as would be expected with a high-risk, low-income population.

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Appendices

Table 1: Summary of CHIP Participants

Factor	BWAG Participant	CHIP Only	P-value
n (%)	1375 (57%)	1050 (43%)	
Age at Enrollment (Mean, SD)	0.7, 0.95	1.38, 1.61	<0.0001
Months Enrolled (Mean, SD)	35.07, 21.4	9.05, 9.2	<0.0001
Number of Dentist Visits (Mean, SD)	0.92, 1.42	0.22, 0.71	<0.0001
Average Dentist Visits Per Year (Mean, SD)	0.28, 0.86	0.19, 0.65	0.0070
At least 1 Dentist Visit Per Year (%)	43%	13%	<0.0001
Varnish Treatments (Mean, SD)	2.70, 1.62	0.06, 0.30	<0.0001
Average Varnish Treatments Per Year (Mean, SD)	1.17, 0.98	0.08, 0.43	<0.0001
Gender (%Male)	51%	55%	0.0958
Locality (%City)	83%	83%	0.7466
Race/Ethnicity			<0.0001
	African American	40%	42%
	Hispanic	14%	5%
	White	34%	38%
	Other	12%	15%
Guardian's Education			0.1140
	Less than High School	35%	36%
	High School/GED	50%	52%
	More than High School	15%	12%
Caries Present (n=330)	35%	Not Available	

Table 2: Multivariable Logistic Regression Model Results

Parameter	DF	Estimate	Standard	Wald ChiSq	P-Value	
Intercept	1	-1.53	0.13	138.61	<.0001	
Age at Enrollment	1	-0.30	0.04	49.78	<.0001	
Gender	1			0.36	0.5466	
		Female	0.03	0.06	0.36	0.5466
		Male		Reference		
Race/Ethnicity	3			8.01	0.0457	
		African American	-0.19	0.10	3.92	0.0478
		Hispanic	0.45	0.17	7.01	0.0081
		Other	-0.20	0.13	2.46	0.1171
		White		Reference		
Urban/Rural	1			0.55	0.4586	
		City	0.06	0.08	0.55	0.4586
		County		Reference		
Guardian's Education	2			2.20	0.3326	
		> High School	-0.09	0.12	0.60	0.4368
		High School	0.12	0.08	2.16	0.1417
		<High School		Reference		
Total Months Enrolled	1	0.12	0.01	443.25	<.0001	

Figure 1: Plot of Odds Ratios and 95% Confidence Intervals for Social Determinants of Interest

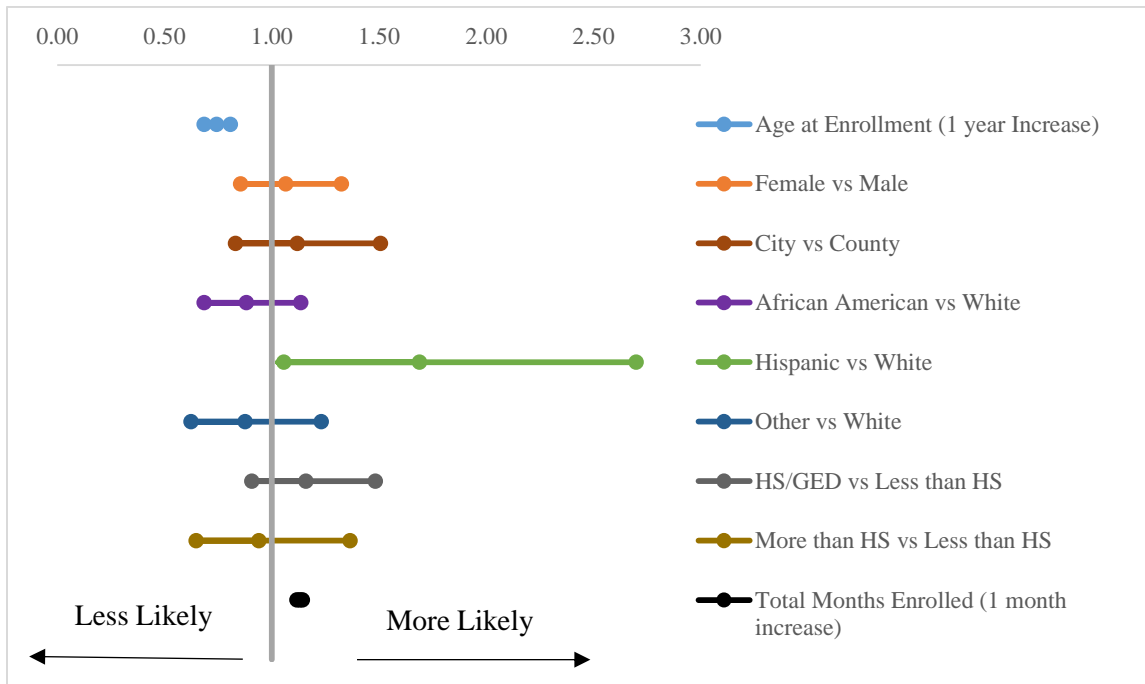
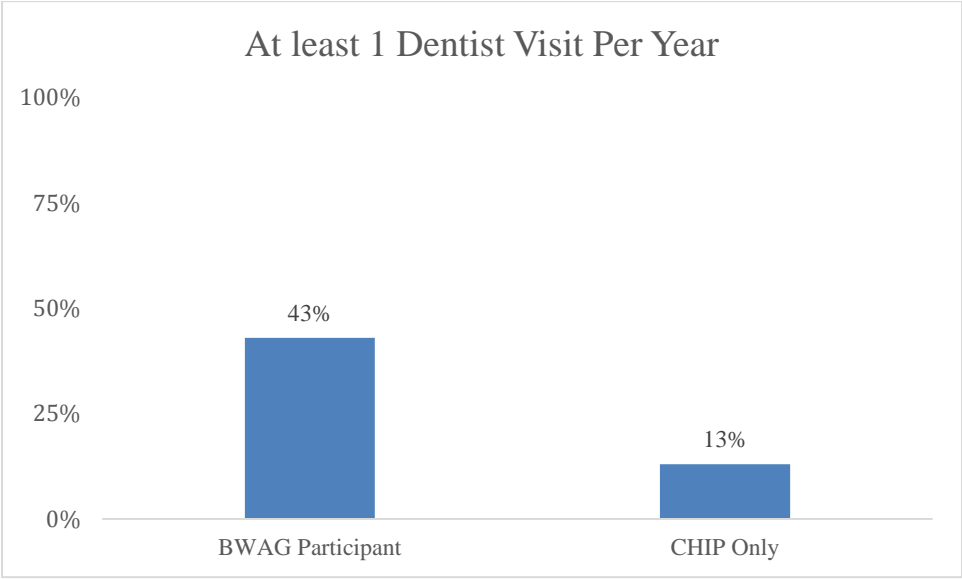


Figure 2: Comparison of BwaG participants versus CHIP only participants with at least one dental visit per year



Vita

Dr. James Ethan Puryear was born on October 4, 1983 in Wadesboro, North Carolina. He graduated from North Carolina State University with a Bachelor of Science in History in 2005. After working full-time in YMCA youth programs he returned to school at the University of North Carolina at Greensboro to complete prerequisites for a career in dentistry earning a Bachelor of Science in Biology in 2009. Dr. Puryear completed dental school at Virginia Commonwealth University in 2014 and enrolled in the Advanced Education Program in Pediatric Dentistry at Virginia Commonwealth University. He plans to practice in Christiansburg, Virginia after receiving his specialty certificate in Pediatric Dentistry in June 2016.