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Longitudinal Study of the Effectiveness of the South Carolina Medicaid Policy for the Application of Fluoride Varnish for Children Age Three and Under

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LONGITUDINAL STUDY OF THE EFFECTIVENESS OF THE SOUTH CAROLINA MEDICAID POLICY FOR THE APPLICATION OF FLUORIDE VARNISH FOR CHILDREN AGE THREE AND UNDER

by

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ABSTRACT

In South Carolina, the burden of dental decay disproportionately affects disadvantaged children enrolled in Medicaid (Dye et al., 2012; Martin et al., 2012; Ayers et al., 2013). To address this oral health disparity, South Carolina's Medicaid Program initiated payment to physicians for the delivery of fluoride varnish (FV), an evidence-based preventive dental service at the well-child visit, to children up to thirty-six months of age. Fluoride varnish has been found to reduce dental decay by thirty-seven percent when applied two to four times a year (Weyant et al., 2013; Marinho et al., 2013).

Two retrospective cohort studies were undertaken to assess the effectiveness of FV policy, using deidentified billing records for 52,841 children insured by SC Medicaid. The first study found that during SFY2008-2013, the FV rates per child-year delivered by physicians and dentists were 1 percent and 23 percent respectively. A policy intended to increase the provision of FV through pediatric primary care was not successful, possibly due to restrictions imposed on length of time between FV administrations and decrease in the number of EPSDT visits for two and three year olds. The second study, examining the relationship between receipt MFV and well-child visits, found the strongest effect was in rural, primary care HPSAs and pediatric practices.

Results highlight the importance of examining the intended and unintended consequences of health services policy. These analyses provide a baseline of knowledge upon which SC DHHS can utilize, in collaboration with key stakeholders, to develop

policy improvement strategies to increase access to fluoride varnish in the pediatric primary care system.

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LIST OF ABBREVIATIONS

AAP..... American Academy of Pediatrics

AAPD..... American Academy of Pediatric Dentistry

ADA..... American Dental Association

ARF……Area Resource File

ASTDD……American Association of State and Territorial Dental Directors

BOTH_FV……..……FV from Physician and Dentist

CAT.....Caries Assessment Tool

CDT……...Current Dental Terminology Codes

COHA……...Chapter Oral Health Advocate

CHIP……...Children's Health Insurance Program

CHIPRA……..Children's Health Insurance Program Reauthorization Act of 2009

CMS……..Centers for Medicare and Medicaid

COHC…….……Community Oral Health Coordinator

CSHCN ..... Children with Special Health Care Needs

DFV.....Dentist Administered Fluoride Varnish

DHPSA……...Dental Health Professional Shortage Area

DRS……Division of Research and Statistics

ECC.....Early Childhood Caries

EPSDT .....Early Periodic Screening Diagnostic Treatment

FTE……..Full Time Equivalent

FV ..... Fluoride Varnish

FQHC.....Federally Qualified Health Center

HRSA.....Health Services, Resources and Administration

HPSA ……..……..Health Professional Shortage Area

IMB……...……Into the Mouths of Babes

MFV.....Physician Administered Fluoride Varnish

MS.....Mutans streptocci

PCHPSA……..……Primary Care Health Professional Shortage Area

QTIP……...Quality through Technology and Innovation in Pediatrics

RHC ..... Rural Health Center

RUCA…….Rural Urban Commuting Area Codes

SC DHHS..... South Carolina Department of Health and Human Services

SCFY.....South Carolina Fiscal Year

SC RHRC..... South Carolina Rural Health Center

SC SORH..... South Carolina State Office of Rural Health

USDA……United States Department of Agriculture

WCV .....Well child visit

US DHHS..... United States Department of Health and Human Services

CHAPTER 1

INTRODUCTION

Nationally and in South Carolina (SC), the burden of dental decay disproportionally affects disadvantaged children enrolled in the Medicaid program (Beltrán-Aguilar 2005; Guarnizo-Herreño et al., 2012; Dye et al., 2012; Martin et al., 2012; Ayers et al., 2013). Tooth decay not only causes pain, but also detrimentally affects a child's ability to eat, speak, attend school, and, in extreme cases, can result in the child's death (US DHHS 2000; Jackson et al., 2011). To reduce oral health disparities, state Medicaid programs have implemented physician reimbursement policies for the application of fluoride varnish in pediatric primary care. Fluoride varnish, an evidence-based preventive dental service, has been found to reduce dental decay by thirty-seven percent in primary teeth when applied two to four times a year (ADA 2006; Weintraub et al., 2006; Weyant et al., 2013; Marinho et al., 2013). These Medicaid policies hold potential to influence access to an effective means to address early childhood caries.

In response to national trends, the South Carolina Department of Health and Human Services (SC DHHS) implemented a policy effective August 1, 2007, allowing the reimbursement of medical providers for application of fluoride varnish every six months as part of the Early Periodic Screening, Diagnostic and Treatment (EPSDT) visit, commonly known as the well-child visit (WCV). Since then, physicians have been reimbursed for applying fluoride varnish in conjunction with conducting the Caries Assessment Tool (CAT), providing oral health anticipatory guidance and making

referrals to dentists (SCDHHS 2007).

While the explicit intent of SC's policy was to increase access to fluoride varnish in the medical setting, the implicit intent is to provide a catalyst for linking the child to a dentist. This policy would allow children at risk for dental caries to receive: 1) the ADA recommended dosage of two to four applications of fluoride varnish each year (Weyent et al., 2013) and 2) comprehensive dental care if indicated (SCDHHS 2007). This dissertation will examine the policy's effect on children's access to fluoride varnish in the medical and dental practices.

This study builds upon the findings from FFY2008, the first full year of implementation of the Medicaid policy change, which found 23 percent of Medicaid enrolled children from 6 months to 36 months of age received fluoride varnish provided by a physician or dentist (Martin et al., 2012). This will be the first longitudinal study to examine how fluoride varnish utilization varied across child demographics, residential factors and medical practice types.

The overarching objective of this study is to determine the effectiveness of the Medicaid policy enacted in August 2007 in achieving its intended outcomes as set forth in the July 2007 SC DHHS Bulletin. The structure of the policy includes the following requirements for physician and dentist reimbursement for fluoride varnish code DCT1206:

1. Primary Care Physician: applies fluoride varnish during the EPSDT well-child visit two times a year (once every six months)
    a. Provides parent/caregiver with oral health anticipatory guidance

b. Conducts caries risk assessment

c. Makes referral to a dentist

2. Dentists: applies fluoride varnish two time a year (once every six months)
3. From age 3 to 21, only the dentist can be reimbursed for fluoride varnish;

This dissertation includes two studies that examine the effectiveness of the policy as implemented during the study years, SFY2009 -SFY2013.

Study 1: Identifying Policy Roadblocks to Oral Health Integration into Primary Care.

The first study addressed in this dissertation characterized the delivery of fluoride varnish by physicians and dentists for Medicaid enrolled children from 12 months of age to 47 months. Study 1 addresses the following questions:

1. What proportion of Medicaid enrolled children receive one or more fluoride varnish (FV) services each year from:
   1.1. A physician – medical fluoride varnish (MFV)
   1.2. A dentist – dental fluoride varnish (DFV)
   1.3. Both a physician and a dentist - MFV + DFV (BOTH_DFV)
   1.4. Any fluoride varnish – all FV (any_FV)
2. What child and residential factors modified the relationship between receipt of MFV and the receipt of DFV?

The hypothesis for Study 1 was that children's' demographic and residential characteristics will modify the relationship between their receipt of MFV and DFV.

Study 2: Delivery of Medical Fluoride Varnish: Variation by Race and Rurality

Study 2 examined the association of rates of physician-applied fluoride with receipt of EPSDT visits by children's race, geographic residence and type of medical provider.

The research questions addressed by Study 2 are:

1. What proportion of the population received one or more EPSDT visits during the study period?
2. What proportion of the study population received one or more MFV services during the study period?
3. What proportion of the children received each EPSDT visit as specified by the SC DHHS Periodicity Schedule (i.e. 12, 24, 18, 24 and 36 months)?
4. What proportion of the children receiving each EPSDT visit also received a MFV?
5. Do rural/urban residence, primary care HPSA status and race modify the relationship between receipts of MFV?

The hypothesis tested in Study 2 was that rural/urban residence, primary care Health Professional Shortage Area status and practice types modify the relationship MFV and EPSDT visits.

CHAPTER 2

LITERATURE REVIEW

2.1 BACKGROUND

Despite the fact that oral health is a significant component of children's general health, dental caries persists as the most common childhood disease in the United States (US DHHS 2000). Although a largely preventable disease, dental caries among children under age five is a growing problem in the United States, with approximately 28% of all children 2 to 5 years of age having experienced tooth decay (Dye et al., 2007). Even more alarming is the fact that of these children, 72% of their tooth decay remains untreated (Dye et al., 2007). Untreated tooth decay can adversely affect sleeping, eating, school attendance, and in extreme cases, result in death (Jackson et al., 2011; US DHHS 2000). The burden of ECC disproportionately affects disadvantaged minority children. Black, Mexican-American, and poor children have higher prevalence rates of untreated tooth decay than non-Hispanic white and non-poor children (Beltrán-Aguilar 2005, Dietrich et al., 2008, Dye et al., 2012, Guarnizo-Herrefio et al., 2012). Yet, despite their higher prevalence of dental caries, minority and poor children are less likely to access dental care (Bloom et al., 2010; Isong et al., 2010; Edelstein & Chinn 2009; Dietrich et al., 2008;Vargas & Ronzio 2002, 2006). Hence, the standards established by the American Academy of Pediatric Dentistry (AAPD), the American Dental Association (get reference) and the American Academy of Pediatrics (AAP) recommend establishing a

dental home for children by one year of age are not achieved for our vulnerable populations who could benefit from early access to preventive strategies (AAPD 2010, AAP 2003).

Since nearly eighty two percent of all children enrolled in Medicaid and the Children's Health Insurance Program (CHIP) received a well child check up in 2009 (Kenney 2012), oral health policies supporting the AAP's recommendation for an oral health assessment by a pediatric health care professional by 6 months of age (AAP 2003) have garnered national momentum. South Carolina Department of Health and Human Services (SC DHHS) implemented a Medicaid policy allowing for reimbursement of medical providers for application of fluoride varnish as part of the Early Periodical Screening, Diagnostic and Treatment (EPSDT) visit for children aged three years and under on August 1, 2007.

Single-state empirical studies to determine the impact of Medicaid policy changes have found mixed results in regards to the effectiveness of the policy in increasing access to fluoride varnish for young children (Rozier et el., 2003, 2010; Okunseri et al., 2009; Isong et al., 2011). This study will build upon 2008 SC study, the first full year of implementation of the Medicaid policy change, which found 23 percent of Medicaid enrolled children from 6 months to 36 months of age received fluoride varnish provided by a physician or dentist (Martin et al., 2012). This will be the first longitudinal study to examine how fluoride varnish utilization varied across different populations and medical/dental provider and practice characteristics.

2.2 THE BURDEN OF EARLY CHILDHOOD CARIES IN SOUTH CAROLINA

Dental caries that occur in our young children, commonly referred to as early

childhood caries (ECC), are defined by the American Academy of Pediatrics as one or more decayed, missing or filled teeth in a child under the age of six years (AAPD 2011). Children age three or under who experience dental caries are considered to have severe early childhood caries (AAPD 2011).

Because of its high proportion of poor communities, South Carolina's (SC's) level of tooth decay is a particularly salient problem (Martin et al., 2010). The 2013 Oral Health Needs Assessment found forty percent of SC's kindergarten and third grade children have experienced tooth decay (Ayers et al., 2013). The largest disparity in the burden of dental disease was found in Medicaid enrolled children who suffered a twenty three percent higher caries experience rate as compared to their non-Medicaid enrolled counterparts (Ayers et al., 2013). Higher rates in caries experience rates were also found for black and Hispanic children as compared to white children (Ayers et al., 2013).

In addition, SC's rural children, experience higher rates of caries and untreated tooth decay compared to their urban counterparts (Carslon et al., 2008; Ayers et al., 2013). Barriers to dental care in rural areas include fewer dentists per population, fewer dentists who participate in the Medicaid program, and longer travel times and distances to reach health care providers compared to urban areas (Skillman et al., 2010; Lacey & Canterberry 2010; Knapp & Hardwick 2000; Probst et al., 2001). The combined effect of dental workforce issues and extensive travel times result in reduced access to preventive dental services in rural communities (Martin et al., 2012).

Since ECC is one of the strongest predictors of future tooth decay (O'Sullivan & Tinanoff 1996; Alm et al. 2012), the high prevalence in tooth decay among children portends to a significant oral health threat in SC.

2.3. LINKING SCIENCE AND PROFESSIONAL RECOMMENDATIONS

Dental caries, a multifactorial disease, results from the presence of a group of tooth adhering bacteria, primarily mutans streptococci (MS) (Loesch 1969), which metabolize dietary carbohydrates, especially refined sugars, to produce acids that demineralize the tooth surface (Tinnaoff et al., 2002; Bader et al., 2004; Caufield & Griffen 2000). The initial colonization of the infant's oral cavity occurs through transmission of the bacteria from the mother or primary caregiver to the child (Li & Caulfield 1995).

If demineralization of the enamel continues, non-reversible cavities will occur. Newly erupted teeth may be more susceptible to ECC due to the immaturity of the enamel and therefore be a contributing factor to the dental disease process in early childhood (AAPD 2011). Progression of the dental caries process can result in pulpitis and has been associated with facial cellulitis and systemic infections (Chou et al., 2014). Dental caries not only causes pain, but also detrimentally affects a child's ability to eat, speak, attend school, and in extreme cases, can result in the child's death (US DHHS 2000; Jackson et al., 2011).

The ECC disease process supports a multifactorial approach that reduces the burden of cariogenic bacteria, the intake of dietary sugars and includes preventive therapies such as fluoride varnish, which have been found to increase the resistance of the tooth to the demineralization process (2006 Warren et al., 2009, Weyant et al., 2013, Chou et al., 2014)

Fluoride varnish, a sticky resin, contains a high concentration of fluoride which when applied to teeth sets quickly in the presence of saliva (ASTDD 2010). Fluoride

varnish inhibits the demineralization of caries-free teeth by depositing a temporary layer of calcium fluoride-like material. This layer slowly dissolves over time, requiring repeated applications to maintain the effectiveness of fluoride varnish as a primary preventive agent (Beltran-Aguilar E, et al., 2000 Featherstone, J.D. 2006). Additionally, the application of fluoride varnish on children's teeth plays a secondary preventive role when applied to teeth with enamel that is demineralized or with what is also known as 'white spot lesions'. The calcium fluoride, which forms in the lesion with the application of the varnish, enhances remineralization of the demineralized enamel (AAPD 2013; Zero D et al., 2001). Thus, reversing early tooth decay.

A recent Cochrane Review found the application of fluoride varnish two to four times a year is associated with a thirty seven percent reduction in decayed, missing and filled tooth surfaces of primary teeth (Marinho et al., 2013). Weintraub and colleagues' two-year randomized controlled study found the combination of parental counseling and the application of fluoride varnish significantly decreases incidence of early childhood caries in young children (Weintraub et al., 2006).

Risk-based utilization of fluoride varnish has been shown to be effective and cost-effective in reducing decay (Kumar & Moss 2008). The American Academy of Pediatric Dentistry, the US DHHS Maternal and Child Health Bureau Expert Panel and the American Dental Association (ADA) have identified Medicaid participating children under the age of six to be at high risk for tooth decay (Alturam Institute 2007). Other contributing factors to risk for ECC include whether the child's mother or siblings have experienced dental caries, if the child has special health care needs and if the child consumes a diet of sweets and complex carbohydrates (Dye et al., 2007).

The AAP oral health policy, which include oral health risk assessments, nutritional counseling, anticipatory guidance, application of fluoride varnish and referral to dentists provides a common sense approach to reverse the trajectory of dental disease in our youngest children (Dye et al., 2004; Tinanoff & Palmer 2003; Nunn et al., 2009; Warren et al., 2009; AAP 2003; Marinho 2013).

A longitudinal study of a Iowa birth cohort found only 2 percent of the children received a dental visit and fluoride service by age one, 11 percent by age two and 26 percent by three years (Slayton et al., 2002). Medicaid data from 2002 to 2008 found variation in dental utilization among the states for children age three and under from only 2 percent in Florida, Missouri, Michigan and North Dakota to 30 percent in North Carolina (Hakim et al., 2012). Only 10 percent of children under age three enrolled in South Carolina's Medicaid program received a dental visit in 2007 (Hakim et al., 2012). Pediatricians and family physicians provide opportunities to increase access preventive oral health services typically up to twelve times a year up to the age of three years (Berg & Stapleton 2012) and create linkages to dental providers through referrals of infants and toddlers to community dentists.

2.4. ADVOCACY EFFORTS TO ADVANCE PHYSICIAN REIMBURSEMENT FOR FLUORIDE VARNISH

The Pew Charitable Trusts Children's Dental Campaign and the American Dental Association has been a significant partner in the AAP's advocacy campaign for the adoption of Medicaid reimbursement policies, which allow physicians to be reimbursed for the application of fluoride varnish for young children (AAP 2013). In 2009, the American Dental Association (ADA) Foundation worked with the AAP to develop and implement the Chapter Oral Health Advocate initiative, which 1) provides a 'train the

trainer' concept for pediatricians in conducting early childhood oral exams and applying fluoride varnish, and 2) conduct advocacy training for pediatric oral health promotion policy.

Martin and colleagues reported that two-thirds of the states in 2009 had adopted fluoride varnish policies for non-dental clinicians (SCRHRC 2012). By spring 2012, an AAP survey found diffusion of this Medicaid policy strategy to 88 percent of the states. Due to dental workforce shortages and lack of dentists participating in Medicaid programs, these state policies provide a catalyst for additional access points for young children entering the dental safety net system via pediatric primary care providers (dela Cruz 2004).

While all states use standard Current Dental Terminology (CDT) codes, the payment for the fluoride varnish service varies from a low of $9 for the application of fluoride varnish to a high of $57 that includes an oral evaluation and counseling (AAP 2013).

North Carolina, who implemented their Medicaid reimbursement policy 2000, reimburses for $15.61 for application of fluoride varnish and $35.38 for an oral exam, risk assessment and parental counseling delivered at a single visit by trained medical providers (AAP 2013). By 2006, diffusion of the intervention resulted in nearly 30 percent of well child visits for children from six months to 3 years of age included the oral health preventive service in NC (Rozier et al 2010).

2.5 EPSDT VISIT - MECHANISM FOR POLICY IMPLEMENTATION

Federal mandates for state Medicaid programs requires coverage of clinical preventive services for children under the Early and Periodic Screening, Diagnostic and

Treatment program (EPSDT).

The EPSDT visit, commonly referred to as well child visit (WCV) includes four types of screening: medical, vision, hearing and dental. While states have the authority to establish their own periodicity schedules, the federal recommendations encourage adoption of the American Academy of Pediatrics periodicity schedules (Peters, C.P. 2006). In 2009, eighty two percent of Medicaid and the Children's Health Insurance Program (CHIP) enrolled children received an EPSDT or WCV (Kenney, G.M. 2012). A recent Medicaid study conducted in Iowa found children who received WCVs between one and three were more likely to experience earlier dental visits as compared to children who did not receive WCVs during the same time period (Chi et al., 2013).

While the dental screening may be included, as part of the EPSDT required physical exam, it does not meet the requirement for a dental exam. Therefore, the medical provider is required to refer the child to a dentist for a dental exam consistent with the state's periodicity schedule, which in SC is from birth to twenty-one years of age (CMS 2014). Primary care physicians are more likely to refer children to a dentist with early signs of dental decay or at high-risk ECC with the majority defining a referral as giving the parents a list of dentists (dela Cruz et al., 2004). A recent North Carolina study found that children age two to 5 years of age referred by a medical provider to a dentist were three time more likely to have a dental visit (Beil & Rozier 2010).

Dental services provided by the state dental Medicaid Program for children must minimally include: relief of pain and infections, restoration of teeth and maintenance of dental health. Some states like SC who provide coverage for the CHIP program through a Medicaid expansion are required the EPSDT benefit to those children (CMS 2014).

2.6 SOUTH CAROLINA MEDICAID PHYSICIAN REIMBURSEMENT POLICY FOR FLUORIDE VARNISH

The South Carolina Dental Medicaid policy enacted in August 2007 was designed to increase access to fluoride varnish for children ages three and under in an effort to reduce ECC. The specific parameters of the policy (Table 2.1) requires that the provision of fluoride varnish in the primary care setting occur during the EPSDT visit every six months (>180 days) and in a dental setting every six months (>180 days). In addition, physicians are required to conduct a Caries Assessment Tool (CAT), to provide anticipatory guidance to the parent or caregiver and a referral to a dentist is required as part of each EPSDT/fluoride varnish visit. After 36 months, children will receive fluoride varnish in the dental setting.

While the explicit intent of the policy is to increase access to fluoride varnish in the medical setting, the implicit intent is to provide a catalyst for linking the child to a dentist. This would allow children at risk for dental caries to receive the ADA recommended dosage of fluoride varnish three to four times a year (Weyent et al., 2013) and to receive comprehensive dental care if indicated (SCDHHS 2007).

Since receipt of fluoride varnish is required to be delivered only at the EPSDT visit, the Medicaid schedule for EPSDT visits for young children is a critical factor in access to this preventive service. While the fluoride varnish policy addresses the fluoride varnish needs of children receiving their EPSDT visits up to their second birthday in the medical setting, the impact diminishes significantly after age two due to the decreased number of reimbursable EPSDT visits in the second and third years (Table 2.2). In addition, while the third year ESPDT visit may occur between 36 and 47 months, the

physician can only be reimbursed for fluoride varnish in the child's 36th month. Another contributing factor to consider in SC is children's EPSDT utilization patterns. In 2002, only 11 percent of South Carolina Medicaid enrolled children received an EPSDT visit in their first year and 27 percent in their second year of life (Pittard et al., 2012). If the low rates of EPSDT utilization have persisted, the receipt of the EPSDT visit may be a limitation of these studies due to the direct linkage between the EPSDT visit and the application of fluoride varnish.

SC DHHS Dental Medicaid Policy Changes

Figure 2.1 includes a timeline of SC DHHS policy for fluoride varnish changes during the study period. The original policy bulletin included training that did not include a fluoride varnish component. Revision to the training requirement was released in March 2008 and included two options: the Maternal and Child Oral Health or AAP Oral Health training modules (SC DHHS 2008).

Due to budget restraints, the initial Medicaid reimbursement rate for fluoride varnish for both medical and dental providers of $17 was reduced in April 2009, April 2011 ($16.39) and July 2011($15.89), which resulted in a 6.5 percent overall reduction in the reimbursement rate. In August 2010, the Dental Medicaid program implemented a new code, D0145 – Dental Oral Evaluation/Counseling for children age three and under, which is reimbursed at the same rate as a periodic exam. All exam codes and child prophylaxis codes experienced the same reductions as the fluoride varnish codes. In January 2013, the reimbursement code for fluoride varnish was changed to D1208.

Medicaid and the Dental Safety Net System

Access to an effective dental safety net system focused on early and regular evidence-based preventive dental services for poor young children, is an *essential* component in ensuring their oral health. The safety net represents a highly variable blend of community resources designed to overcome the barriers to access to dental care in rural communities including Federally Qualified Health Centers (FQHCs), Rural Health Clinics (RHCs) and public health clinics (Edelstein 2010). The federally qualified health centers (FQHCs) in SC include organizations receiving grants under Section 330 of the Public Health Service Act (PHS). FQHCs, which receive an enhanced Medicare and Medicaid reimbursement rate, are required to serve an underserved area or population, offer a sliding fee schedule, and provide comprehensive health services (DHHS CMS 2014). Some tribal organizations and FQHC Look-Alikes, organizations are eligible according to PHS Section 330, but do not receive grant funding, may also be eligible for an enhanced Medicare and Medicaid reimbursement rate (DHHS CMS 2014). South Carolina has 19 FQHCS, 2 Look-Alike programs and a statewide Migrant Health Voucher Program, which consists of 130 delivery sites in 41 of the 46 counties (SC PCA 2012). SC Department of Health and Environmental Control also provides EPSDT visits at local health departments.

The Rural Health Clinic Act (P.L. 95-210) of 1977 was introduced to address physician workforce shortages in rural communities by increasing utilization of mid-level health care providers, physician assistants and nurse practitioners in rural areas (HRSA 2006). A Rural Health Clinic (RHC) is required to be located in an area defined by the U.S. Census Bureau as non-urbanized and designated as a Medically Underserved Area

(MUA), Health Professional Shortage Area (HPSA) or a governor designated health services shortage area approved by HRSA (HRSA 2014). Currently, there are 116 Rural Health Clinics in SC (SCSORH 2013).

The initial Medicaid Fluoride Varnish policy, August 1, 2007, allowed the physician to bill for the procedure code using Current Dental Terminology (CDT) D1206 (SCDHHS). Effective May 1, 2009, SC DHHS changed the reimbursement methodologies for both FQHCs and RHCs. The change for the RHCs was supportive in that they would continue to submit claims for D1206, for fee for service reimbursement in addition to the Healthcare Common Procedure Coding System (HCPCS) encounter code T1015. In contrast, the FQHCs were required to include the application of fluoride varnish in the all-inclusive HCPCS encounter code T1015 paid to the FQHC. Hence, the policy would be considered restrictive in that it removed the monetary incentive to apply fluoride varnish to Medicaid enrollees established by the August 1, 2007 SC DHHS policy.

In 2010, the SC Department of Health and Human Services (SC DHHS) was awarded a five year CHIPRA Quality Demonstration Grant (also known as QTIP) for the development quality improvement tools for South Carolina pediatric practices. In 2011, the SC QTIP project selected oral health quality indicators for pediatric practices. In July 2011, national and state early childhood oral health experts provided training and resources for the pediatric practices. 2.7 CONCEPTUAL MODEL

The conceptual model for this dissertation uses the Gelberg-Andersen Behavioral Model for Vulnerable Populations (Gelberg, Andersen & Leake, 2000), which expands

upon the original Anderson Behavioral model's predisposing, enabling and need variables to include specific vulnerabilities among young children and their communities that create significant barriers for access to dental care in both the medical and dental setting (Anderson 1968).

In August 1, 2007, SC DHHS initiated the ability for physicians to be reimbursed for the application of fluoride varnish as part of the EPSDT visit for children up to 36 months of age. An exploratory study conducted to examine the early impact of the Medicaid fluoride varnish reimbursement policy found twenty-three percent of the Medicaid enrolled children age three years and under had received one fluoride varnish service in 2008 (Martin et al., 2010). In order to identify unintended and unexpected consequences of policy, Sabatier recommends looking backwards over a period of time to fully understand the impact of a policy (2007). This retrospective study will work backwards from SCFY2013 to the SFY2009 in order to understand the implementation trajectory of the policy.

Predisposing Variables

Predisposing variables, factors that included are the child's age, race and sex. Lack of access for young children, especially under the age of three is limited by dentists' willingness to provide dental care to this age group as well as low participation rates of dentists in the Medicaid program (Seale & Caramassimo 2003). Inequalities in the burden of dental disease for minority children are well documented in the literature (Beltrán-Aguilar 2005, Dietrich et al., 2008, Dye et al., 2012, Guarnizo-Herrefio et al., 2012). Yet, despite their higher prevalence of dental caries, children living below the Federal

Poverty Level are more likely to have untreated dental decay (Dye et al., 2007) and less likely to access dental care (Bloom et al., 2010; Isong et al., 2010; Edelstein & Chinn 2009; Dietrich et al., 2008;Vargas & Ronzio 2002, 2006).

One predisposing variable, which falls into the vulnerable domain is residential rurality. While the most recent census reports a slowing of total population growth between 2000 and 2010, 83 percent of the population growth was attributed to increases in minority populations (Johnson 2012). While rural poverty rates vary in the United States, the South is home to 43.1 percent of the rural population (USDA 2013). In addition, the rural poverty rate is 22.1 percent in the South as compared to 13.6 percent in the Midwest (USDA 2013). For children under the age of six years, the rates of poverty impacts the lives of nearly 56 percent of black children residing in rural communities (Mattingly & Bean, 2010). Concentrated poverty in communities magnifies poor outcomes in children such as physical and mental health and the quality of their education (Bishaw 2011).

Residents of rural communities are less likely to have access to adequately fluoridated public drinking water as compared to their urban counterparts which in turn increases their risk for dental disease beginning in early childhood and extending through their lifespan (Hendryz et al., 2011; Skillman et al., 2010). Hence, adding an additional risk factor to a vulnerable populations living in rural communities.

After controlling for population density and income, the dentist to population rate for rural counties is 29 dentists per 100,000 persons, while the rate for urban counties is 62 dentists per 100,000 persons in urban counties (NRHA 2001). Other barriers include lack

of dentists who participate in the Medicaid program, and longer travel times and distances to reach dental providers (Skillman et al. 2010 Wall & Brown, 2007; Probst et al. 2001). The combined effect of dental workforce issues and extensive travel times result in reduced access to dental services in rural communities.

The enabling domain includes availability of specific medical and dental provider types such as pediatricians, family practice physicians, pediatric dentists and general dentists to provide fluoride varnish. The Bureau of Health Professions, which is under the Health Services and Resources Administration (HRSA), oversees classification of Health Professional Shortage Areas (HPSA). HPSA designations are designed to identify areas experiencing health care workforce shortages limited to primary care HPSAs (PCHPSA), dental HPSAs (DHPSA) and mental Health HPSAs.

First, 'rational' areas are demarcated for the delivery of primary medical care and dental services. A 'rational' area includes a county or contiguous counties in which population centers are within 40 minutes of travel time of each other or a neighborhood and communities of 20,000 or less, for which populations exhibit a similar socioeconomic status and demography and have limited interactions outside of their areas.

An area is considered to have a geographic dental workforce shortage if the population to full time equivalent (FTE) dentist ratio is at least 5,000:1 or the population to FTE dentists ratio is between 5,000:1 and 4,000:1, and exhibits an unusually high need for dental services. An additional criterion is that dental providers in contiguous areas are not accessible to the population (HRSA 1993).

A geographic primary care workforce shortage is based on a population to FTE primary care physician ratio of 3,500:1 or the population to FTE physician ratio is between 3,000:1 and 3,500:1 and exhibit unusually high need for primary care services.

Both primary medical care and dental HPSAs are classified into three categories: geographic, population or no HPSA designation. A geographic HPSA reflects a county that meets HRSA criteria for a primary care medical or dental workforce shortages area. A population HPSA reflects a county that, while not meeting the shortage criteria for the entire county, has a population group within the county that meets the shortage criteria. No HPSA reflects as a county that does not meet the criteria for either a geographic or population HPSA.

Access to an effective dental safety net system, another focused on early and regular evidence-based preventive dental services for young children, is an essential component in ensuring children's oral health as well as overall health and an enabling factor in the conceptual model. The health safety net represents a highly variable blend of community resources designed to overcome the barriers to access to dental care in such as Federally Qualified Community Health Centers, Rural Health Clinics (medical only) and private medical and dental practices.

Medicaid/CHIP participation is included as a vulnerable domain since it well documented that access to dental care is limited for children participating in Medicaid/CHIP.

Measure of evaluated need utilized in this dissertation is children with special health care needs as defined by the HRSA, Maternal and Child Health Bureau

(McPherson 1998). Children with special health care needs are more likely to experience unmet dental care needs (Lewis et al., 2005; Iida et al., 2010). Residence in rural areas, poverty and the severity of the child's condition further exacerbates access to dental care for CSHCNs (Skinner et al, 2006; Lewis et al., 2009).

From the primary health care provider perspective, nearly 90 percent of severely affected CSHCN report receipt of health care from a personal medical provider (Lewis et al., 2005; The Medical Home 2002). Hence, medical providers provide an important access point for preventive dental care for young CSHCNs.

Outcome Variables

The impact of the SC DHHS fluoride varnish reimbursement policy for physicians will be assessed using two types of dental service utilization linked to receipt of fluoride varnish by a physician*:* 1) child's receipt of fluoride varnish in the medical setting (MFV) and 2) receipt of fluoride varnish in the dental setting (DFV). Figure 2 is a representation of the conceptual model using the expanded vulnerable population model.

Table 2.1: Medicaid Fluoride Varnish Policy for Physician Reimbursement

Provider	**Special Requirements**	**Interval**	**Age**	**Referral to Dentist**	**Other services required**
Physician	Required to deliver ***only*** during child's EPSDT visit	Every six months or >180 days	Up to 36 months	Required	Caries Assessment Tool; Anticipatory Guidance
Dentist	None	Every six months or >180 days	Up to 21 years of age	Not applicable	None

Table 2.2: EPSDT Visits Reimbursed by SC Medicaid by Age Group

Age Group Years	**Age Group Months**	**EPSDT Visits Reimbursed by Medicaid**	**Total Medical**	**Total Dental**	**Total Medical & Dental**
			Opportunities		
1	12-23 months	12 months [12-14 months]	1	2	3
		15 months [15-17 months]			
		18 months [18-20 months]			
2	24-35 months	24 months [21-24 months]*	1	2	3
3	36-47 months	36 months**	1	2	3
Total 0-3 years			**3**	**6**	**10**

*EPSDT visit may occur in either 1-2 or 2-3 year age group
**Physician reimbursed *only* if EPSDT visit occurs during *36 month*
Note: Both physicians and dentists can only be reimbursed for FV is time span is *>180 days*

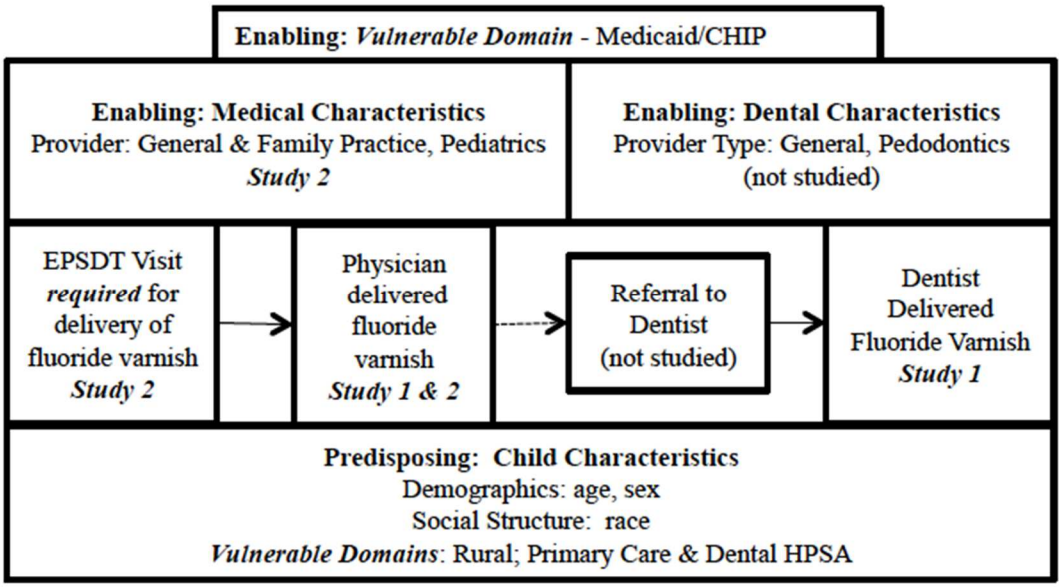

Figure 2.1: Conceptual Model for Fluoride Varnish Reimbursement Policy Study (Adapted from the Gelberg-Andersen Behavioral Model for Vulnerable Populations. Gelberg, Andersen & Leake, 2000).

CHAPTER 3

METHODS

3.1. OVERVIEW

On August 1, 2007, SC DHHS initiated the ability for physicians to be reimbursed for the application of fluoride varnish as part of the EPSDT visit for children up to 36 months of age. An exploratory study conducted to examine the early impact of the Medicaid fluoride varnish reimbursement policy found twenty-three percent of the Medicaid enrolled children age three years and under had received one fluoride varnish service in 2008 (Martin et al., 2010).

In order to identify unintended and unexpected consequences of policy, Sabatier recommends looking backwards over a period of time to fully understand the impact of a policy (2007). For this retrospective study, we will examine the receipt of MFV and DFV from SFY2009 to SFY 2013 in order to understand the implementation trajectory of the policy.

3.2 CONCEPTUAL MODEL

Recognizing that public health interventions to improve health are influenced at multiple levels, this study utilizes the Gelberg-Andersen Behavioral Model for Vulnerable Populations (Gelberg, Andersen & Leake, 2000) to inform the variables use

to examine the predisposing, enabling and vulnerable factors that shape health and dental care utilization of vulnerable children from 12 months to 47 months of age enrolled in Medicaid.

3.3 DATA

Data is derived from the SFY2009-2013 Medicaid enrollment files merged with Medicaid medical and dental claims history files, and the Area Resource file. Continuous enrollment in Medicaid was defined as enrolled in Medicaid for at least 9 months of each SFY. SC requires an active re-enrollment process and the small gap allows some flexibility for parents in re-enrolling their children in Medicaid (Martin et al., 2012). Figure 3.1 describes the flow of the data as children enter the study at 12 months of age.

Children identifiers were linked across years by matching information on: social security number, first name, middle initial, last name, date of birth, race, sex, county of Medicaid eligibility and RUCA status. All deindentified files were merged together by the Division of Research and Statistics at the South Carolina Budget and Control Board (DRS). This file was merged with Medicaid claims history files for medical and dental utilization among all children identified in the retrospective cohort. The Area Resource File (ARF) for 2009 to 2013 was used to obtain SC county-level primary care and dental Health Professional Shortage Areas status as well as RUCA codes. Counties with RUCA codes 4-10 were defined as rural and counties with RUCA codes 1-3 were defined as urban (Morrill et al. 1999).

Table 3.1 includes complete list of the outcome and control variables used in the study, the source of the data and the type of variable utilized in the analyses is.

SC DHHS approved the application for the data included in this study. The University of South Carolina's Institutional Board approved this study.

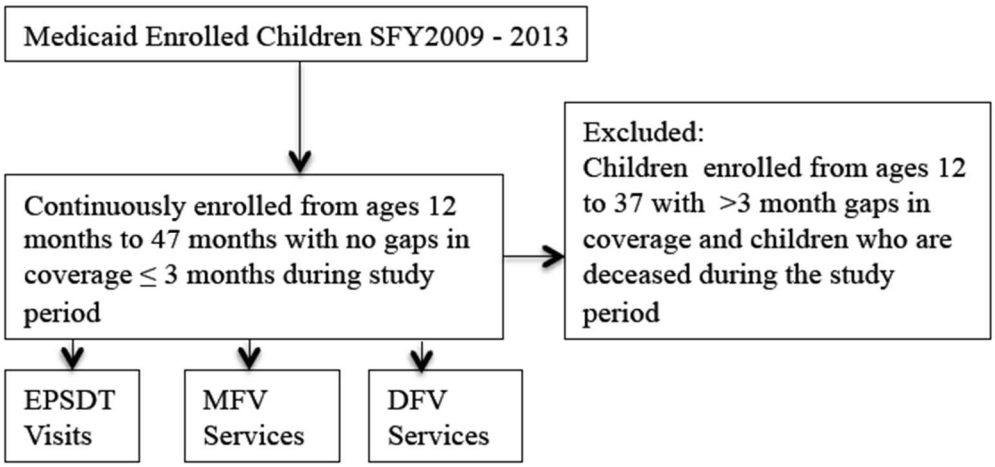

Figure 3.1 Study Data Flow Chart

Table 3.1: Description of Study Variables

Variables	Source	Type
Dependent Variables Received Fluoride Varnish by Dentist (DFV)	1	Dichotomous
Primary Independent Variable Received Fluoride Varnish by Physician (MFV)	1	Dichotomous/ Count
Other Explanatory/Control Variables Received EPSDT - Well Child Visit	1	Dichotomous/ Count
Child's Age Groups (Child's age in days from birth at entry into study and at each EPSDT, MFV and DFV services by SCFY	1	Categorical/ Continuous
1 year olds [12 - 23 months]		
2 year olds [24-35 months]		
3 year olds [36-47 months]		
Child's Race Categories	1	Categorical
White		
Black		
Other		
Child's Sex	1	Dichotomous
Female		
Male		
Dentist Provider/Pricing Specialty (30,31)		Dichotomous
Dentistry		
Pedodontics		
Medical Provider/Pricing Specialty (other than 30,31)	1	Categorical
General Practice + Family Practice		
Pediatrics		
County Characteristics		
Health Professional Shortage Areas: Dental and Primary Care	2	Categorical
Rural/Urban Designation [RUCA 1-10]	2	Dichotomous

1. SC Medicaid claims data
2. Area Resource File

CHAPTER 4

STUDY 1: INDENTIFYING POLIY ROADBLOCKS TO ORAL HEALTH INTEGRATION INTO PEDIATRIC PRIMARY CARE

4. 1 ABSTRACT

State Medicaid policies for physician reimbursement for the application of fluoride varnish provide a mechanism for integration of oral health into primary pediatric care focused on the prevention of early childhood caries. In August 2007, South Carolina's Medicaid Program initiated payment to physicians for the delivery of fluoride varnish (FV) to children ages thirty-six months and under. During the study period (SFY2008-2013), the FV rates per child-year delivered by physicians and dentists were 1 percent and 23 percent respectively. A policy intended to increase the provision of FV through pediatric primary care was not successful, possibly due to restrictions imposed on length of time between FV administrations and decrease in the number of EPSDT visits for two and three year olds.

Key words: Medicaid, fluoride varnish, pediatric primary care physicians, dentists.

4. 2 INTRODUCTION

Since nearly eighty two percent of all children enrolled in Medicaid and the Children's Health Insurance Program (CHIP) received a well child check up in 2009 (Kenney et al., 2012), oral health policies supporting the American Academy of Pediatrics' (AAP) recommendation for an oral health assessment by a pediatric health care professional by six months of age have garnered national momentum (AAP 2003). South Carolina Department of Health and Human Services (SC DHHS) implemented a Medicaid policy allowing for reimbursement of medical providers for application of fluoride varnish, a evidenced-based preventive dental service (Weyant et al., 2013), as part of the Early Periodical Screening, Diagnostic and Treatment (EPSDT) visit for children aged thirty-six months and under on August 1, 2007 (SC DHHS 2007).

Nationally and in South Carolina (SC), the burden of dental decay disproportionally affects disadvantaged children enrolled in the Medicaid program (Guarnizo-Herreño & Wehby, 2012). Tooth decay not only causes pain, but also detrimentally affects a child's ability to eat, speak, attend school, and, in extreme cases, can result in the child's death (US DHHS 2000; Jackson et al., 2011).

Because of its high proportion of poor communities, South Carolina's (SC's) level of tooth decay is a particularly salient problem (Martin et al., 2012). The 2013 Oral Health Needs Assessment found forty percent of SC's kindergarten and third grade children have experienced tooth decay (Ayers et al., 2013). The largest disparity in the

burden of dental disease was found in Medicaid enrolled children who suffered a twenty three percent higher caries experience rate as compared to their non-Medicaid enrolled counterparts (Ayers et al., 2013). Higher rates in caries experience rates were also found for black children as compared to white children (Ayers et al., 2013).

Medicaid data from 2002 to 2008 found marked variation in dental utilization among the states for children age three and under from only 2 percent in Florida, Missouri, Michigan and North Dakota to 30 percent in North Carolina (Hakim et al, 2012). Only 10 percent of children under age three enrolled in South Carolina's Medicaid program received a dental visit in 2007 (Hakim et al., 2013). Pediatricians and family physicians provide opportunities to increase access to preventive oral health services up to twelve times a year up to the age of three years (Berg & Stapleton, 2012) and to create linkages to dental providers through referrals of infants and toddlers to dentists (Beil & Rozier 2010).

The Pew Charitable Trusts Children's Dental Campaign and the American Dental Association have been significant partners in the AAP's advocacy campaign for adoption of Medicaid reimbursement policies, which allow physicians to be reimbursed for the application of fluoride varnish for young children (AAPD 2013). In 2009, the American Dental Association (ADA) Foundation worked with the AAP to develop and implement the Chapter Oral Health Advocate (COHA) initiative, which 1) provides a 'train the trainer' concept for pediatricians in conducting early childhood oral exams and applying fluoride varnish, and 2) conducts advocacy training for pediatric oral health promotion policy (AAP 2013).

Martin and colleagues reported that two-thirds of the states in 2009 had adopted fluoride varnish reimbursement policies for non-dental clinicians (Martin et al., 2012). By spring 2012, an AAP survey found diffusion of this Medicaid policy strategy to 88 percent of the states (AAP 2013). Due to dental workforce shortages and lack of dentists participating in Medicaid programs, these state policies provide a catalyst to produce additional access points for the receipt of oral health preventive services by young children through pediatric primary care (dela Cruz et al., 2004)

Twenty-seven states reimburse physicians by bundling the application of fluoride varnish with an oral health risk assessment and anticipatory guidance under the Current Dental Terminology (CDT) FV code. The range of payment for FV within these states ranges from a low of $9 to a high of $53.30 (AAP 2013). Eleven states unbundle the FV related services in order to separately bill for each service. The range of total reimbursement in these states ranges from $32 to $86.22 (AAP 2013).

North Carolina, who implemented their Medicaid reimbursement policy 2000, reimburses for application of fluoride varnish, an oral exam, risk assessment and parental counseling delivered at a single visit by medical providers trained in the Into the Mouth of Babes (IMB) program (AAP, 2013). By 2006, diffusion of the IMB in NC resulted in integration of fluoride varnish into nearly 30 percent of the well child visits for children from six months to 3 years of age (Rozier et al., 2010). North Carolina studies have found statewide reductions in dental caries and caries related treatments for children receiving IMB (Achembong et al., 2014; Kranz et al., 2014; Divaris et al., 2014).

The Centers for Medicare and Medicaid (CMS) has established the standard of

care for state pediatric dental Medicaid programs that recommends applications of fluoride varnish every 3 to six months for children at high risk for tooth decay (CMS 2013). The AAPD, the US DHHS Maternal and Child Health Bureau Expert Panel and the American Dental Association (ADA) have identified Medicaid participating children under the age of six to be at high risk for tooth decay (Altarum Institute 2007).

The South Carolina Dental Medicaid physician reimbursement for the delivery of fluoride varnish policy, initiated in August 2007, was designed to increase access to an evidence-based dental preventive service for children ages three and under in an effort reduce ECC[4]. Fluoride varnish has been found to reduce dental decay by thirty-seven percent in primary teeth when applied to teeth two to four times a year (Weintraub et al., 2006; Weyant et al., 2013; Marinho et al., 2013). The payment for MFV is derived from the dental Medicaid budget in SC (AAP 2013). It is important to note, SC DHHS also initiated CDT1206 for fluoride varnish for dentists on August 1, 2007 (Matthews 2015).

While the explicit intent of the SC policy was to ensure the provision of fluoride varnish in medical setting occurs during the EPSDT visit every six months (>180 days) for children up to 36 months, the implicit intent was to provide a catalyst for linking the child to a dentist to ensure receipt of fluoride varnish two times every six months (>180 days) and comprehensive care if indicated. Hence, the ultimate goal of the policy was for horizontal integration of oral health into a pediatric primary care system that includes both medicine and dentistry.

Additional fluoride varnish reimbursement criterion for physicians include conducting a caries risk assessment, providing anticipatory guidance to the parent or

caregiver and referring the child to a dentist (SC DHHS 2007). After 36 months, children will receive fluoride varnish only in the dental setting.

For the medical opportunities, we aligned the age groups with the potentially billable EPSDT visits allowing for the 181-day interval requirement (Figure 4.1). The dental opportunities were also based on the 181-day interval, which is the norm for dental recalls. The greatest potential for physician applied fluoride varnish is from ages 12 to 35 months due to the EPSDT periodicity schedule. While AAP recommends an EPSDT visit at 30 months of age (AAP 2008), the SC Medicaid program does not reimburse for the visit. The age three EPSDT visit may occur between 36 and 47 months; however, the application of MFV may be reimbursed by Medicaid only occur during the thirty sixth month.

The purpose of this study is to examine the effect of the policy on the delivery of fluoride varnish to children from 12 to 47 months by physicians and dentists in order to increase our understanding of horizontal integration of oral health into the pediatric primary care system.

4.3 DATA AND METHODS

The analytical data file was constructed using child-year observations in order to estimate population-averaged effects. The EPSDT and dental periodicity schedules were defined in SFYs consistent with the SCDHHS FV policy criterion (SCDHHS 2007). After omitting missing rural observations and restricting the study to children served by private physicians and dentists, the resulting sample size was 52,841 children

representing 126,464 child-year observations. Our aaaInstitutional Board approved this study.

Data is derived from the SFY2009-2013 Medicaid enrollment files merged with Medicaid medical and dental claims history files, and the Area Resource file. Continuous enrollment in Medicaid was defined as enrolled in Medicaid for at least 9 months of each SFY. SC requires an active re-enrollment process and the small gap allows some flexibility for parents in re-enrolling their children in Medicaid (Martin et al., 2012).

Children identifiers were linked across years by matching information on: social security number, first name, middle initial, last name, date of birth, race, and gender. All files were merged together by the Division of Research and Statistics at the South Carolina Budget and Control Board (DRS).

The primary outcome variable utilized in this study is a binary indicator of whether a child received one or more fluoride varnish service per year delivered by a physician (MFV), a dentist (DFV) and both a physician and dentist (BOTH_FV).

Controls for confounding include an array of child characteristics including the child's age (years), race and residential factors including rurality and federally designated Primary Care and Dental Health Professional Shortage Area (HPSA).

Race is categorized as black, white and other. The other category includes: more than one race, Federally Recognized Native American, Other Native American, Alaska Native, Asian, Other/Unknown, Native Hawaiian/Pacific Islander and Hispanic.

Rurality, defined by the US Department of Agriculture's Rural-Urban Community

Area (RUCA) codes, is a binary indicator for whether a child resided in a rural county during a specific year of the study. Counties with RUCA codes 4-10 were defined as rural and counties with RUCA codes 1-3 were defined as urban (Morrill et al., 1998).

The Bureau of Health Professions, which is under the Health Services and Resources Administration (HRSA), oversees classification of Health Professional Shortage Areas (HPSA). HPSA designations are designed to identify areas experiencing health care workforce shortages to PCHPSAs and DHPSAs. Counties were defined as having a PCHPSA or no PCHPSA and having a DHPSA and no DHPSA.

4.4 STATISTICAL ANALYSIS

The study is a retrospective secondary analysis of a cohort of South Carolina Medicaid children from 12 to 47 months of age enrolled in Medicaid between SFY2009 – 2013. Descriptive analyses were performed on all study measures using chi-square analyses. We present the descriptive characteristics stratified by child and community demographics on a categorical variable for the receipt of FV that includes delivered by:

- A physician – medical fluoride varnish (MFV)
- A dentist – dental fluoride varnish (DFV)
- Both a physician and a dentist (BOTH_DFV)
- Any fluoride varnish (any_FV)

Pooled multivariate logistic regression models were estimated to identify factors associated with higher likelihood of a child receiving one or more MFV and one or more DFV. Predictors included age, sex, race, and urban/rural, PHPSA and DHPSA. Because

the dataset included multiple observations per child that can bias results, we controlled for clustering around the child in the logistic regression analysis.

Since the sample was missing 959 rural observations, the rural/urban status was investigated to determine the independence of the missing data. The results did not change, which confirmed the absence of selectivity bias due to the missing observations.

All analyses will be conducted in Stata/IC 13 (Statacorp, College Station, TX) using a 0.05 significance level.

4.5 RESULTS

Exhibit 2 presents the baseline characteristics of the cohort, which comprise the analytical sample of 52,841 children. The proportion of females and males included in the study population were nearly equal (50.79% and 49.21%, respectively). Forty-seven percent of the children were black, nearly 33 percent white, and 19.4 percent comprised the other category. Seventy-one percent of the children resided in urban areas and 24 percent were rural residents.

The proportion of children residing in both counties with primary care and dental HPSA designations were (85% and 83%, respectively). Fifteen percent and sixteen percent of the children lived in areas without a primary care and dental HPSA designation respectively.

Because this was a longitudinal study, a child contributes to multiple years in the study as they age. The second set of columns in Exhibit 2 shows the characteristics of the child-years observed. With the exception of age and residence, the distributions were

similar. There was a 3 percent shift from rural to urban residence over the study period, which indicates geographic relocation of some children.

Exhibit 3 presents the distribution of FV delivery across physicians, dentists, and both practitioners. The MFV rate per child-year was 1.3 percent as compared to the DFV rate per child-year of nearly 28 percent. The rate for receipt of FV from both physicians and dentists per child-year was less than one third of one percent.

The MFV rate for rural areas was nearly 3 percent per child-year, while the rate for urban areas was less than 1 percent per child-year. In contrast, the DFV rate was lower in rural areas (24 percent per child-year) than the rate in urban areas (28.5 percent per child-year).

PCHPSAs had higher MFV rates (1.5 percent) per child-year than counties without this designation (0.5 percent). Conversely, counties with no DHPSA designation had the highest DFV rate, 38 percent, compared to the child-year rate of 25 percent in counties with DHPSAs.

Exhibit 4 illustrates the modes of FV delivery by age. The children with the highest MFV rates (1.76 %) were children in the 1-year-old age group (12-23 months), while the highest DFV rates (42%) were within the 2-year-old-age group (24-35 months) (Exhibit 4). The dentist delivered fluoride varnish rate per child-year for children from 12 to 23 months was nearly 13 percent.

Children who were black and those included in the other category had higher MFV and DFV rates as compared to children who were white. There was no significant difference in sex distribution for either the MFV or DFV rate.

The rates per child-year for the delivery of FV to children by both providers were less than one percent across all child characteristics.

In the logistic regression model, living in a rural community increased the odds of a child receiving fluoride varnish (FV) from a physician by four times (4.21, 95% CI=[3.72, 4.76), as compared to their urban counterparts. In addition, children who resided in PCHPSA counties were at increased odds of receiving physician delivered FV as compared to children residing in counties without PCHPSA designation (Exhibit 5).

The results from DFV logistic regression strategy indicate that children in rural areas were at lower odds of receiving fluoride varnish from a dentist compared to their urban counterparts. Confirming the bivariate comparison, children who resided in DHPSAs counties had decreased odds of receiving dentist delivered FV as compared to children residing in counties without a DHPSA designation.

Children identified as being black were at increased odds of receiving MFV (1.67, 95% CI [1.46, 1.92]) as compared to children who were white. The odds of children identified as black or other receiving DFV were positive but lower as compared to physician delivered FV.

With each year of age, the odds of receiving fluoride varnish from a dentist increase, while increasing age has a negative effect on the odds of receiving fluoride varnish from a physician.

There are several limitations to this study. First selection criterion, which allowed only enrolled in Medicaid with no gaps in coverage greater than three months may result

in a population that does not represent the children who may have received coverage less than nine months of the SFY.

By utilizing only paid Medicaid claims, we may be missing the delivery of some MFV services. A study linking patient encounter forms with paid Medicaid claims for oral health preventive services, found encounter forms without matching dental Medicaid claims forms[28].

Although, FQHCs and RHCs are components of the pediatric primary care system, they were not included in this analysis due SCDHHS reimbursement policy clarifications that took place during the study period (SCDHHS 2011).

Lastly, results from this study may not be generalizable to other dental Medicaid programs in other states.

4.6 DISCUSSION AND CONCLUSION

These results highlight the importance of assessing Medicaid policy to inform improvements for effective integration of oral health prevention into the pediatric primary care system.

Our finding of higher rates of physician delivery of FV in rural areas aligns with results from extant studies investigating the impact of physician reimbursement for fluoride varnish (Okunsari et al., 2010; Rozier et al., 2010). This finding is important in light of the negative effect of rurality on the delivery of dental fluoride varnish. While children who have primary healthcare providers have an increased likelihood of receiving dental care, the effect has been found to diminish in rural areas (Martin et al., 2009;

Martin et al., 2012). The lower rate of dentist applied fluoride varnish in rural areas may be due to several access factors including a lower dentist to population rate, increased travel distance to dental care, and lower average work hours of dentists in rural versus urban areas (Lacey & Canterberry 2012; Knapp & Hardwick 2000; Probst et al., 2007).

Since potential opportunities for MFV are limited to one well-child visit in the child's second and third years of life, the DFV rates per child-year (42%) are promising compared to the national study of Medicaid claims, which found only 10 percent of SC's Medicaid enrolled children with a dental visit in 2007 (Hakim et al, 2012).

This study found horizontal integration of fluoride varnish between physicians and dentists was minimally present in the medical setting; however, dentists were providing fluoride varnish to these young children. Fifteen years after the release of the Surgeon General's report on oral health (US DHHS 2000) the medical-dental divide persists nationally (Donoff et al., 2014). While this study is not exhaustive in nature, it does point out some fundamental flaws in the policy itself that may have impacted its adoption by physicians. Collaboration between medicine and dentistry in SC to identify improvements in the structure, process and outcomes of the current Medicaid fluoride varnish policy would be a bold step in improving not only the oral health but also the overall health of young children.

Table 4.1:Opportunities for receipt of fluoride varnish from physicians and dentists (based on the SCDHHS EPSDT Periodicity Schedule and from Dentists based on the interval criteria (>180 days) by Age (years, months)

Age - years	**Age Group – months**	**EPSDT Visits Reimbursed by Medicaid**	**Total Medical**	**Total Dental**	**Total Medical & Dental**
			Opportunities		
1	12-23 months	12 months	2	2	4
		15 months			
		18 months			
2	24-35 months	24 months	1	2	3
3	36-47 months	36 months**	1	2	3
Total 0-3 years			4	6	10

*Physician reimbursed *only* if EPSDT visit occurs during the child's *36 month*

Table 4.2: Child characteristics at entry into study and by child-year

	Entry into study		Child-year	
Characteristics	No.	%	No.	%
Total	52,841	100.00	126,464	100.00
Age				
1 year olds	45,342	85.81	62,787	49.65
2 year olds	4,925	9.32	32,589	25.77
3 year olds	2,574	4.87	31,088	24.58
Sex				
Female	26,001	49.21	62,410	49.35
Male	26,840	50.79	64,054	50.65
Race				
White	17,654	33.41	41,545	32.85
Black	24,949	47.22	59,778	47.27
Other	10,238	19.38	25,141	19.88
Level of Rurality				
Rural	12,766	24.16	27,735	21.93
Urban	40,075	75.84	98,729	78.07
Primary Care HPSA	45,028	85.21	107,955	85.37
No PCHPSA	7,813	14.79	18,507	14.63
Dental HPSA	44,068	83.40	103,933	82.19
No DHPSA	8,773	16.60	22,529	7.81

Table 4.3: Modes of receipt of fluoride varnish by child-year characteristics, SFY2008 – 2013

FV	MFV	DFV	MFV + DFV	No FV	Any FV
	N and Percent	N and Percent	N and Percent	N and Percent	N and Percent
	1,661 (1.31)	34,809 (27.52)	371 (0.29)	89,623 (70.87)	36,84 1(29.13)
Age Groups*					
1 year olds	1.76	12.80	0.32	85.12	14.88
2 year olds	1.39	42.42	0.44	55.75	44.25
3 year olds	0.32	41.66	0.09	57.93	42.07
Sex					
Female	1.29	27.42	0.31	70.99	29.01
Male	1.34	27.63	0.28	70.75	29.25
Race*					
White	0.82	25.17	0.17	73.85	26.15
Black	1.71	28.69	0.27	69.34	30.66
Other	1.20	28.66	0.56	69.58	30.52
Level of Rurality*					
Rural	2.97	23.96	0.26	72.80	27.20
Urban	0.85	28.53	0.30	70.32	29.68
Primary Care HPSA*	1.45	27.10	0.31	71.14	28.86
No PCHPSA	0.51	30.00	0.19	69.29	30.71
Dental HPSA*	1.31	25.26	0.21	73.22	26.78
No DHPSA	1.34	37.98	0.67	60.02	39.98

p = <0.01

Table 4.4: Pooled Logistic Regression Model for modes of fluoride varnish: 1 or more physician delivered fluoride varnish (MFV), 1 or more dentist delivered fluoride varnish (DFV) and 1 or more any fluoride varnish (Any FV)

	Model 1: 1> MFV - Pooled Logistic Regression OR [95% CI]	Model 2: 1> DFV – Pooled Logistic Regression OR [95% CI]
Total Observations	126,464	126,464
Age (in years)	0.37* [0.34, 0.40]	1.10* [1.08, 1.13]
Female	0.99 [0.89, 1.10]	0.98 [0.95, 1.01]
Race		
Black	1.67* [1.46, 1.92]	1.14* [1.09, 1.18]
Other	1.86* [1.59, 2.18]	1.11* [1.06, 1.17]
White (reference)		
Rural	4.21* [3.72, 4.76]	0.89* [0.85, 0.80]
Primary Care –HPSA	4.58* [3.81, 5.55]	1.28* [1.17, 1.32]
No PCHPSA (reference)		
Dental –HPSA	0.29 [0.24,0.34]	0.46* [0.44, 0.48]
No DHPSA (reference)		
SCFY	1.50* [1.41, 1.58]	2.36* [2.31, 2.41]

p = <0.01

CHAPTER 5: DELIVERY OF MEDICAL FLUORIDE VARNISH: VARIATION BY RACE AND RURALITY

5.1 ABSTRACT

Objective: State Medicaid physician reimbursement policies provide a catalyst to produce additional access points for the receipt of fluoride varnish by young children. The objective of this study of fluoride varnish for children enrolled in South Carolina Medicaid is to examine the association of rates of physician applied fluoride with the children's race and rural residence.

Methods: The sample is composed of children from 12 to 47 month who were enrolled in SC Medicaid between SFY 2009-2013. Data were derived from SC Medicaid medical and dental claims and the Area Resource File. The dataset was created linking child identifiers across data files and years. Negative binomial regression models were estimated to address overdispersion of the count data relative to the Poisson.

Results: Rural/urban residents and dental Health Professional Shortage Area status modified the relationship between EPSDT and the receipt of fluoride varnish with its strongest effect was in rural areas, areas designated as primary care health professional shortage areas and pediatric practices.

Conclusions: Our results highlight the importance of examining the effectiveness of fluoride varnish Medicaid policy. Rural/urban residence, primary care Health Professional Shortage Area status and practice types modified the relationship between receipt of fluoride varnish and EPSDT visits such that the strongest effect was in rural, primary care HPSAs and pediatric practices.

5.2 INTRODUCTION

The burden of dental decay disproportionally affects disadvantaged children enrolled in the Medicaid program (Guarnizo-Herreño & Wehby, 2012; Dye et al., 2012; Martin et al., 2012). Tooth decay not only causes pain, but also detrimentally affects a child's ability to eat, speak, attend school, and, in extreme cases, can result in the child's death (USDHHS 2000; Jackson et al., 2011). Because of its high proportion of poor communities, South Carolina's (SC's) level of tooth decay is a particularly salient problem (Martin et al., 2012). The 2013 Oral Health Needs Assessment found forty percent of SC's kindergarten and third grade children have experienced tooth decay (Ayers et al., 2013). The largest disparity in the burden of dental disease was found in Medicaid enrolled children who suffered a twenty three percent higher caries experience rate as compared to their non-Medicaid enrolled counterparts (Ayers et al., 2013). Higher rates in caries experience rates were also found for black children and children residing in rural areas (Ayers et al., 2013). Despite these dental needs, only 10 percent of children under age three enrolled in South Carolina's Medicaid program received a dental visit in 2007 (Hakim et al., 2012).

Since nearly eighty two percent of all children enrolled in Medicaid and the Children's Health Insurance Program (CHIP) received a well child check up in 2009

(Kenney et al., 2012), oral health policies supporting the American Academy of Pediatrics' (AAP) recommendation for an oral health assessment by a pediatric health care professional by six months of age have garnered national momentum (AAP 2003).

The South Carolina Dental Medicaid physician reimbursement for the delivery of fluoride varnish policy, initiated in August 2007, was designed to increase access to an evidence-based dental preventive service for children ages three and under in an effort reduce ECC (SC DHHS 2007). Fluoride varnish has been found to reduce dental decay by thirty-seven percent in primary teeth when applied to teeth two to four times a year (Weyant et al., 2013; Weintraub et al., 2006; Marinho et al., 2013). The policy required the fluoride varnish to be delivered to children during the EPSDT at six-month intervals (SC DHHS 2007).

Additional fluoride varnish reimbursement criterion for physicians include conducting a caries risk assessment, providing anticipatory guidance to the parent or caregiver and referring the child to a dentist (SC DHHS 2007). After 36 months, children will receive fluoride varnish only in the dental setting.

The Centers for Medicare and Medicaid (CMS) has established the standard of care for state pediatric dental Medicaid programs that recommends applications of fluoride varnish every 3 to six months for children at high risk for tooth decay (CMS 2013). The AAPD, the US DHHS Maternal and Child Health Bureau Expert Panel and the American Dental Association (ADA) have identified Medicaid participating children under the age of six to be at high risk for tooth decay (Altarum Institute (2007).

To understand the impact of the policy, it is important to unpack the 'black box'

of the policy criterion, one of which is the requirement that fluoride varnish be delivered as part of the EPSDT visit. The SC DHHS Medicaid periodicity schedule requires a total of 5 EPSDT visits during the study period:

1. 12 month visit (Range: 12-14 months)
2. 15 month visit (Range: 15-17 months)
3. 18 month visit (Range: 18-20 months)
4. 2 year visit (Range: 21-24 months)
5. 3 year visit (fluoride varnish by physician can only be reimbursed during 36th month)

The interval between fluoride varnish services must be greater than 180 days. Additional fluoride varnish reimbursement criterion for physicians include conducting a caries risk assessment, providing anticipatory guidance to the parent or caregiver and referring the child to a dentist (SC DHHS 2007). After 36 months, children will receive fluoride varnish only in the dental setting.

The purpose of this study is to examine for children enrolled in South Carolina Medicaid the association of rates of physician applied fluoride varnish with the children's race and rural residence.

5.3 METHODS

Study Population and Data Sources

The study population was derived from the SFY2009-2013 Medicaid enrollment files merged with Medical and dental fluoride varnish claims history files and the Area Resource File. Ninety percent of the children were continuously enrolled for three or

more years. Continuous enrollment was defined as children enrolled in Medicaid for at least nine months of the SFY.

Children identities were linked across years by matching information on: social security number, first name, middle initial, last name, date of birth, race, and sex. The Division of Research and Statistics at the South Carolina Budget and Control Board (DRS) merged all files. Enrollment history data provided demographic characteristics such as age, race and sex. Geographic location was based on the US Department of Agriculture's Rural-Urban Community Area (RUCA) codes, as a binary indicator for whether a child resided in a rural county during a specific year of the study. Counties with RUCA codes 4-10 were defined as rural and counties with RUCA codes 1-3 were defined as urban (Morrill & Cromartie 1998).

Conceptual Model

The conceptual model for the study (Figure 2) uses the Gelberg-Andersen Behavioral Model for Vulnerable Populations (Gelberg et al., 2000), which expands upon the original Anderson Behavioral model's predisposing, enabling and need variables to include specific vulnerabilities among young children and their communities that create significant barriers for access to dental care in both the medical and dental setting (Anderson 1968).

Predisposing variables that impact health care utilization included were the child's age at visit, race and residential factors including rurality and federally designated Primary Care and Dental Health Professional Shortage Area (PCHPSA, DHPSA). Race is categorized as black, white and other. The other category includes: more than one race,

Federally Recognized Native American, Other Native American, Alaska Native, Asian, Other/Unknown, Native Hawaiian/Pacific Islander and Hispanic.

The enabling domain includes for the medical profession, family practitioners, general practitioners and pediatricians.

Outcome Measures

The fluoride varnish measures include 1) a count of the number of total fluoride varnish (MFV) services applied in the medical setting; and 2) a binary variable for the EPSDT with MFV or EPSDT. All three measures have been constructed based on the age ranges specified by the SC DHHS periodicity schedule for EPSDT visits (SC DHHS 2015).

After omitting missing rural observations and restricting the study to children served by private physicians and dentists, the resulting sample size was 52,450 children. Our Institutional Board approved this study.

Statistical Analysis

Descriptive analyses were performed on predisposing and enabling categorical variables using chi-square analyses. We present the receipt of each EPSDT visit (1-5) by: 1) the percentage who receive an EPSDT visit, 2) count of children receiving EPSDT visit and 3) the percentage who receive fluoride varnish at EPSDT visit (MFV).

First, it should be noted that the outcome variable, MFV, was skewed (skewness=7.8 , kurtosis=75.04). By relaxing the strict mean-variance relationship of the Poisson distribution, negative binomial regression allows the variance to exceed the mean

by a scalar multiple of the square of the mean. Coefficient estimates generated by negative binomial regression can be exponentiated to yield estimated incidence rate ratios. Hence, the results can be interpreted as the increase or decrease in ratio of the total number of MFVs for the children receiving compared with the children receiving EPSDT.

Since the sample was missing 959 rural observations, the rural/urban status was investigated to determine the independence of the missing data. The results did not change, which confirmed the absence of selectivity bias due to the missing observations.

All analyses were conducted in Stata/IC 13 (Statacorp, College Station, TX) using a 0.05 significance level.

5.4 RESULTS

Table 1 presents the characteristics of the cohort, which comprise the analytical sample of 52,450 children. The proportion of females and males included in the study population were nearly equal (49.2 percent and 50.8 percent, respectively). Forty-seven percent of the children were black, nearly 33 percent white, and 19 percent comprised the other category. Seventy-six percent of the children resided in urban areas and 27 percent were rural residents.

The proportion of children residing in both dental and primary care health professional area designations were 83 percent and 85 percent, respectively. Seventeen and fifteen percent of the children resided in areas without a dental or primary care HPSA designation respectively.

Significant differences were present between children receiving an EPSDT visits and those MFV at an EPSDT in the bivariate analysis for all predisposing and enabling variables except for sex (Table 2). Ninety one percent of the children received on or more EPSDT visits during the study period. While there were no significant differences by sex, there were for children included as black or other had EPSDT rates one percent higher as compared to children who were white. The largest significant difference was between children in receipt of an EPSDT visit was for children residing in rural areas with a rate of 86 percent as compared to those in urban areas with nearly 93 percent rate. The EPSDT rates in both PCHPSAs and DHPSAs were both higher, nearly 91 percent, than the rates for children not residing in either HPSA type.

Of the children receiving one or more EPSDT visits, only 2.43 percent received one or more fluoride varnish services in the medical setting (MFV). While there were no significant differences by sex, there were racial differences with children identified as other with 3 percent, as black with 2.92 percent as compared to those identified as white with an MFV rate of only 1 percent.

While rural children have lower EPSDT rates (85.59 percent), their MFV rate was higher (3.7 percent) as compared to non-rural children (2.06 percent). MFV rates were higher for residence in a PCHPSA as compared to a non-PCHPSA residence. Children residing areas with non-DHPSA status, had MFV rates over 2 percent higher as compared to children in DHPSAs.

While EPSDT rates for children served by general and family practitioners as compared to pediatricians were 96.13 and 96.90 percent respectively, the MFV rates were

significantly different, 0.43 percent for general/family practitioners and 2.74 percent for pediatricians.

When examining the county level MFV rates, there were eleven counties with no MFV activity and thirty-two counties with rates less than fifteen percent. The outlier was the county where fifty-two percent of the children residing in the counties received MFV. It is important to note that this county is primarily served by the pediatric practice of SC's AAP Chapter Oral Health Advocates (COHA), who have received training in developing and implementing a practice-based oral health integration model (Lewis et al, 2013).

Figure 2 and Table 3 presents the distribution of children receiving an EPSDT visit and children receiving EPSDT and MFV (EPSDT+MFV), grouped by allowable age windows for each visit. The rates for receipt of an EPSDT were highest for 12-month and 15-month EPSDT visits (61 percent and 51 percent, respectively). Of the children receiving an EPSDT visit, the highest rates for receipt of MFV were present for the 24-month visit (1.88) and the 18-month visit (1.39), which had the lower rates for receipt of an EPSDT visit (45.4 and 49.7 percent, respectively). While nearly all children (91.13%; Table 2) received one or more EPSDT visits, these were not necessarily timely. A substantial minority, ranging from 39 to 55 percent, of the children did not receive EPSDT visits at appropriate ages (Table 3).

We next examined the number of MFV applications received by each child, using a log-linked negative binomial model. In this model, we interpret incidence-rate ratios based on the exponentiated coefficients from the model[19]. Children receiving an EPSDT visit as compared to those not receiving an EPSDT visit, while holding all variables

constant in the model, are expected to have a rate of 1.07 times greater for the number of MFVs received. The expected rates of receipt of MFV for children with a reported race of black or other are 1.80 and 1.87 times greater as compared to their white counterparts. The MFV rates for children residing in rural areas and communities designated as PCHPSAs were five times higher as compared to urban residents and residents of non=PCHPSA counties. There was no difference in the MFV rates by sex. Children receiving MFV from pediatricians had a MFV visit rate nine times greater than children receiving their health care from family and general practitioners. Since pediatricians provided health care for eighty seven percent of the population compared to thirteen percent who utilized a general/family physician for their care, this is an important finding.

5.5 DISCUSSION

This study unravels an important factor, EPSDT visit rates, which may contribute to the effectiveness of the SCDHHS Medicaid reimbursement policies on the receipt of fluoride varnish from medical practitioners. Approximately 35 to 55 percent of the children do not receive the 12, 15, 18, 24 and 36 months visits in an appropriate timeframe. Selden's study of compliance with well child visits using Medical Expenditure Panel Survey was consistent with our finding reporting the largest percentage of children receiving the 12-month EPSDT visit. While the MEPS study found an inverse relationship between age and receipt of EPSDT, our finding report the same trend until the thirty-sixth month EPSDT visit, when the percentage of EPSDT visits increased to 50 percent (Selden 2006). Our findings for disparities among children

who are white and black and who reside in rural and urban areas are consistent with national data (Selden 2006; Abdus & Selden 2013).

The interval between visits is generally every three months for the 12 to 24 month EPSDT visits, while the policy requires 6-month (180 days) intervals for the receipt of fluoride varnish. In addition, the interval between visits also needs to be examined to maximize opportunities to access fluoride varnish from physicians. North Carolina, for example, originally implemented a 90-day interval between MFV but now uses a 60-day interval to increase access to the preventive service (Quiñonez, et al., 2008)

While children who have primary healthcare providers have an increased likelihood of receiving dental care, the effect has been found to diminish in rural areas (Martin et al., 2009). Access to dental care in rural areas may be limited by lower dentist to population rates, increased travel distance to dental care, and lower average work hours of dentists in rural versus urban areas (Martin et al, 2009; Martin et al., 2012; Skillman et al., 2010). In addition, children residing in rural communities are less likely to have access to fluoridated water, which in itself puts them at greater risk for dental caries (Skillman et al., 2010).

Our finding of higher rates of physician delivery of FV in rural areas aligns with results from extant studies investigating the impact of physician reimbursement for fluoride varnish[30]. Since the 2013 S.C. children's oral health needs assessment found disparities in the dental caries rate for children living in rural communities and for children who are black (Ayers et al., 2013), these findings hold promise for increasing

access to physician applied fluoride for these vulnerable children, especially in pediatric practices.

The largest disparity in the burden of dental disease was found in Medicaid enrolled children who suffered a twenty three percent higher caries experience rate as compared to their non-Medicaid enrolled counterparts (Ayers et al., 2013), which in turn provides an incentive for the Medicaid program to improve the structure, process and outcomes of the policy in an effort to prevent early childhood caries.

In 2010, the SC Department of Health and Human Services (SC DHHS) was awarded a five year CHIPRA Quality Demonstration Grant (also known as QTIP) for the development quality improvement tools for South Carolina pediatric practices. In 2011, the SC QTIP project selected oral health quality indicators for pediatric practices and provide training and resources from national and state early childhood oral health experts to initiate oral health integration into their practices. The SCDHHS in collaboration with the SCAAP has agreed to sustain QTIP, which in turn, provides a vehicle to fully integrate oral health into child health systems for young children (SCDHHS 2015).

While pediatricians serve the larger percentage of Medicaid enrolled children in this study, it is important that their lessons learned are shared with not only their colleagues but also general and family practitioners that serve pediatric populations.

This study points to some challenges within the structure, processes and outcomes of the policy itself that pediatricians are uniquely positioned to take on a leadership role in engaging SCDHHS Medicaid and key early childhood stakeholders the SC Society of Family Medicine, the SC Dental Association, Women Infants and Children's Program,

Early Head Start and the Maternal and Infant Child Health Home Visitation Program, to generate policy revisions that not only increase access to MFV but strengthen the early childhood health care system.

5.6 LIMITATIONS

There are several limitations to this study including first, the selection criterion that allowed only children continuously enrolled in Medicaid with no gaps in coverage greater than three months may result in a population that does not represent the children who may have received coverage less than nine months of the SFY.

Another limitation is that by utilizing only paid Medicaid claims, we may be missing the delivery of some MFV services. A study linking patient encounter forms with paid Medicaid claims for oral health preventive services, found encounter forms without matching dental Medicaid claims forms (Pahel et al., 2011).

Although, FQHCs and RHCs are components of the pediatric primary care system, they were not included in this analysis due SCDHHS reimbursement policy clarifications that took place during the study period. FQHCs were required to include physician-applied fluoride varnish in the all-inclusive Healthcare Common Procedure Coding System encounter code T1015 while RHCs were able to submit fluoride varnish claims using the D1206 procedure code during the study period (SCDHHS 2011).

Lastly, results from this study may not be generalizable to other dental Medicaid programs in other states.

5.7 CONCLUSIONS

While children who have primary healthcare providers have an increased likelihood of receiving dental care, the effect has been found to diminish in rural areas (Martin et al., 2009). Access to dental care in rural areas may be limited by lower dentist to population rates, increased travel distance to dental care, and lower average work hours of dentists in rural versus urban areas (Martin et al., 2009; Martin et al., 2012; Skillman et al., 2010). In addition, children residing in rural communities are less likely to have access to fluoridated water, which puts them at greater risk for dental caries (Kumar et al., 2010).

Our finding of higher rates of physician delivery of FV in rural areas aligns with results from extant studies investigating the impact of physician reimbursement for fluoride varnish (Okunseri et al., 2009). Since the 2013 S.C. oral health assessment of children's dental disease found disparities in dental caries rate for children living in rural communities and for children who are black (Pahel et al., 2011), these findings hold promise for increasing access to physician applied fluoride for these vulnerable children, especially in pediatric practices.

The largest disparity in the burden of dental disease was found in Medicaid enrolled children who suffered a twenty three percent higher caries experience rate as compared to their non-Medicaid enrolled counterparts (Ayers et al., 2013), which in turn, provides an incentive for the Medicaid program to improve the structure, process and outcomes of the policy in an effort to prevent early childhood caries

Table 5.1 Demographic Characteristics of the Study Population

Characteristics	No.	%
Total	52,450	100.00
Sex		
Female	25,805	49.20
Male	26,645	50.80
Race		
White	17,527	33.42
Black	24,757	47.20
Other	10,166	19.38
Level of Rurality		
Rural	12,574	26.97
Urban	39,876	76.03
Primary Care HPSA	44,644	85.12
None	7,806	14.88
Dental HPSA	43,681	83.28
None	8,769	16.72

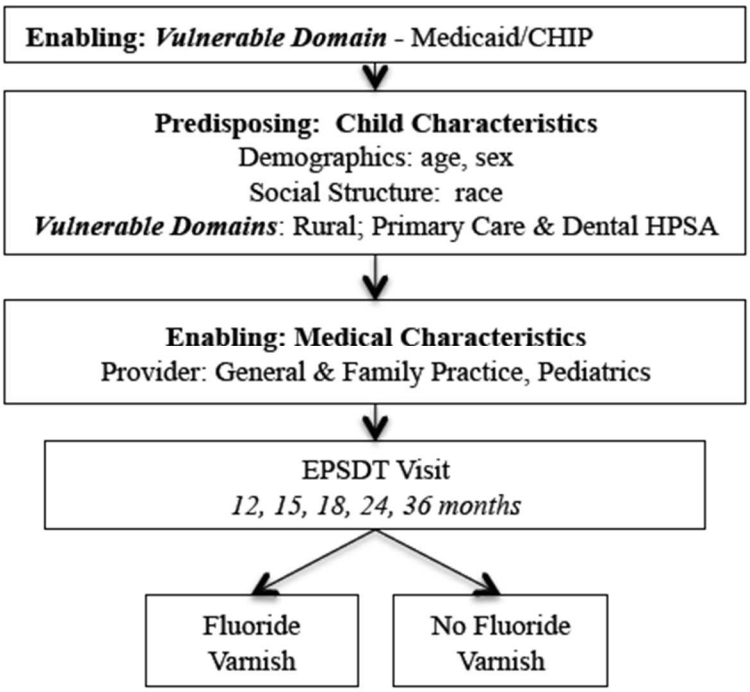

Figure 5.1 Conceptual Model for the Stud

Table 5.2: Characteristics of children by receipt of one or more EPSDT visits and receipt of MFV

	Total Child Population N=52,450			Total Children Receiving ≥1 EPSDT N = 47,796		
Total Child Population N=52,450	No EPSDT Visit N =4,654	≥1 EPSDT Visits N = 47,796	p-value	*No* Medical Fluoride Varnish N = 46,633	≥ 1 Medical Fluoride Varnish N= 1,163	p-value
EPSDT Visit	8.87%	91.13%		97.57%	2.43%	
Sex			0.189			0.29
Female	8.71%	91.29%		97.49%	2.51%	
Male	9.03%	90.97%		97.64%	2.36%	
Race			0.000			0.000
White	8.09%	91.91%		98.65%	1.35%	
Black	9.35%	90.65%		97.08%	2.92%	
Other	9.05%	90.95%		96.86%	3.14%	
Level of Rurality			0.000			0.000
Rural	14.41%	85.59%		96.29%	3.71%	
Urban	7.13%	92.87%		97.94%	2.06%	
Primary Care HPSA			0.000			0.000
HPSA	9.10%	90.90%		97.42%	2.58%	
None	7.58%	92.42%		98.41%	1.59%	
Dental HPSA			0.000			0.000
HPSA	9.22%	90.78%		97.95%	2.05%	
None	7.13%	92.87%		95.69%	4.31%	

Table 5.3: Receipt of EPSDT and Receipt of EPSDT and Medical Fluoride Varnish

EPSDT Visit	Total Population	Percentage with EPSDT Visit	Total EPSDT Visits	Percentage with MFV
Visit 1: 12 months	52,450	61.49	32,253	0.87
Visit 2: 15 months	52,450	51.12	26,813	0.58
Visit 3: 18 months	52,450	49.71	26,073	1.39
Visit 4: 24 months	52,450	45.37	23,790	1.88
Visit 5: 36 months	52,450	50.17	26,160	0.59

Table 5.4: Factors Contributing to Receipt of any Medical Fluoride Varnish

Total Observations - 48,047	Estimate [95% CI]	Incidence Rate Ratio [95% CI]
EPSDT Visits	0.07* [0.025, 0.11]	1.07* [1.03, 1.12]
Sex		
Female	-0.002 [-0.12, 0.011]	1.00 [0.89, 1.12]
Male (reference)		
Race		
Black	0.59* [0.44, 0.74]	1.80* [1.55, 2.09]
Other	0.63* [0.46, 0.80]	1.87* [1.58, 2.22]
White (reference)		
Level of Rurality		
Rural	1.68* [1.55, 1.82]	5.38* [4.70, 6.16]
Urban		
Primary Care –HPSA		
PCHPSA	1.67* [1.47, 1.87]	5.31* [4.34, 6.50]]
No PCHPSA (reference)		
Dental – DHPSA		
DHPSA	-1.56* [-1.72, -1.40]	0.21* [0.18, 0.25]
No DHPSA (reference)		
Medical Practice Types		
Pediatrics	2.27* [1.86, 2.68]	9.66 [6.43, 14.5]
Family /General Practice (reference)		

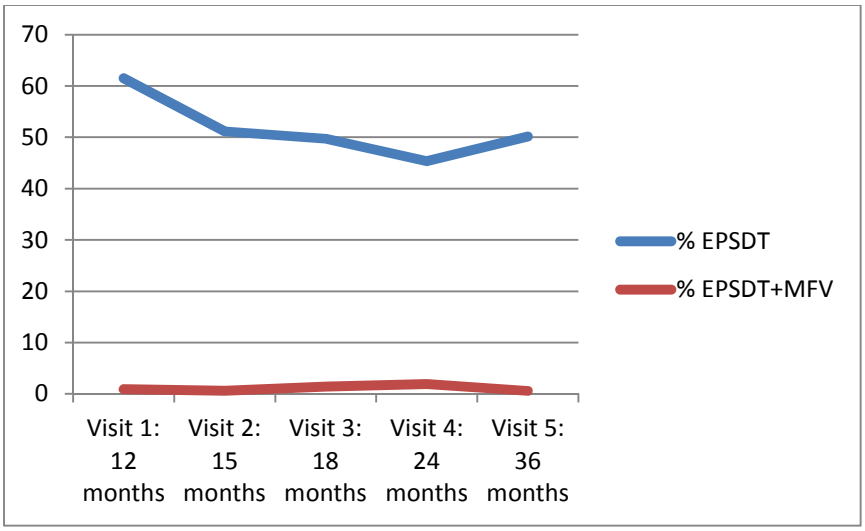

Figure 5.2: Percentage of children receiving an EPSDT visit or an EPSDT visit with fluoride varnish (EPSDT+MFV

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 KEY FINDINGS

Policy and practice changes may be needed to more fully reach the goal of horizontal integration of oral health into the pediatric primary care system to increase access to fluoride varnish in both the medical and dental setting.

6.2 POLICY RECOMMENDATIONS

Periodicity Schedule: The primary objective of the policy was to provide an oral health preventive service package that included fluoride varnish (2-4 times a year), caries risk assessment, anticipatory guidance and referral to a dentist for Medicaid enrolled children up to 36 months of age (Bright Futures 2014). Effective integration oral health in the first three years is dependent upon a SC EPSDT periodicity schedule consistent with the Bright Futures Guidelines, which provide guidance to assist physician and dentists in pediatric preventive care (Bright Futures 2013). Currently, SC does not have a dental EPSDT periodicity schedule.

In addition, the interval between visits also needs to be examined to maximize opportunities to access fluoride varnish from both physicians and dentists. North Carolina, for example, originally implemented a 90-day interval between MFV but now

uses a 60-day interval to increase access to the preventive service (Quiñonez et al., 2008, AAP 2013).

Referrals: Referrals between providers provide the pathway to improving oral health outcomes, ensuring a continuum of care for young children (Reynolds & Sutherland 2013). Horizontal integration of oral health into pediatric primary care is dependent upon and effective referral system between medical and dental providers. Medical providers with oral health training reported their most common method of referring a child to a dentist was to give the caregiver the name of a dentist (dela Cruz et al., 2004).

Mechanisms for referrals need to be examined from an internal lens within medical and dental practice operations, as well as from the community lens, which consists of care coordination programs such WIC, Early Head Start, Healthy Start and the Maternal, Infant and Child Home Visitation program that can act in support of children utilizing medical and dental preventive services.

SC DHEC currently has the authority through Act 235 to implement a community oral health coordinator; however, no funding has been allocated for this new workforce model. Hence, it would be beneficial to develop a COHC model that support activities related to creating and sustaining pediatric primary care systems that integrate oral health activities for young children. A study found dental case managers effective in increasing access to dental care (Greenberg et al, 2008).

Training: Effective training that includes preventive dentistry, knowledge, skills, and confidence in planning and implementing practice organizational changes is essential to facilitate integration across medical and dental settings. The outcomes of a survey of participants of the IMB demonstration in North Carolina support the value of specific training in preventive dentistry for medical providers including office-based operational system to ensure effective integration of oral health into pediatric primary care (Close et al., 2010).

Reimbursement: A study of physicians in Massachusetts identified the Medicaid reimbursement rate of $26 to be a barrier in adopting fluoride varnish. There is considerable range in reimbursement rates among the states reimbursing physicians for fluoride varnish. Some states, like South Carolina, bundle the payment for fluoride varnish to include the oral exam, caries risk assessment, and referral to a dentist, while others like North Carolina reimburse $15.61 for fluoride varnish and $35.38 for the oral exam, risk assessment and referral (AAP 2013). South Carolina currently reimburses $15.89 for the delivery of fluoride varnish by a physician or a dentist (SC DHHS 2011). No studies have been conducted to understand the relationship of the fluoride varnish reimbursement rate to the delivery of the service to children less than 36 months for either physicians or dentists.

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