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ORAL HEALTH OUTCOMES FOLLOWING A PEDIATRIC PREVENTIVE ORAL HEALTH PILOT IN MONTANA

by

Tonette L. Hollingsworth, RDH, BSDH

A thesis proposal

submitted in partial fulfillment

of the requirement for the degree of

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Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Tonette L. Hollingsworth find it satisfactory and recommend that it be accepted.

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September 27, 2013

Tonette Hollingsworth, RDH, BSDH
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RE: Your application dated 9/23/2013 regarding study number 3973: Oral Health Outcomes of Children Following a Preventive Oral Health Pilot Program in Montana

Dear Ms. Hollingsworth:

I agree that this study qualifies as exempt from review under the following guideline: 4. Analysis of existing data sets. This letter is your approval, please, keep this document in a safe place.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You are granted permission to conduct your study effective immediately. The study is not subject to renewal.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Patricia Hunter (208-282-2179; fax 208-282-4529; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

Phone: (208) 282-2592 • Fax: (208) 282-4723 • www.isu.edu/research

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Abstract

Objective: Determine the effectiveness of the 2009 Montana Access to Baby and Child Dentistry (ABCD) Partnership Pilot.

Methods: The retrospective case-control study examined Medicaid utilization records of children who participated in the 2009 ABCD pilot program (n=97) and a randomized cohort (n=148).

Results: The populations had no statistical difference in gender (p=0.602) and age (p=0.813). ABCD children had statistically significant more decay experience (DE) than non-ABCD children with a mean DE of 1.95 and 0.48, respectively (p<0.001), which may be attributed to increased preventive dental behavior (PDB) among ABCD children (mean=2.9) versus non-ABCD children (mean=0.6; p<0.001). Age at receipt of DE and PDB was statistically significant between the two populations. ABCD children mean age of first DE was 3.8 versus 4.8 in non-ABCD (p=0.001) and 3.2 and 4.1 at the first PDB, respectively (p=0.001).

Conclusion: ABCD children were more likely to receive DE and PDB at a younger age.

CHAPTER I

Introduction

While strides were made to decrease dental decay rates and increase the population's oral health status during the mid 20th century through fluoridation of public water supplies and toothpaste, dental decay remains a significant public health concern in the 21st century (US Department of Health and Human Service [US DHHS], 2000; Vargas & Ronzio, 2006). Young children are a particularly vulnerable population due to lack of self-care (Mattheus, 2010). The analyses of several national data bases indicate the incidence of dental decay has not significantly changed since 1999 and in pediatric populations the incidence has increased (Bell, Huebner, & Reed, 2012; Dye & Thornton-Evans, 2010; Edelstein & Chinn, 2009; Kagihara, Niederhauser, &, Stark, 2009; Dye et al., 2007). Multiple studies have examined the influences adversely affecting oral health and populations at high risk for dental disease (Ismail, Sohn, Lim, &Willem, 2009; Kelly, Binkley, Neace, & Gale, 2005). In pediatric population the influences are most often related to family and community factors that increase vulnerability to oral diseases. These factors include socioeconomic status, lack of knowledge regarding preventive dental care, and public policies that affect access to dental care (Mattheus, 2010).

Fisher-Owens et al. (2007) presented a conceptual model of children's oral health that identifies child, family, and community influences based on social science and

epidemiological studies. The model identifies the interrelated and dynamic factors affecting oral health in children including genetics; biologic, social, and physical environments; health seeking behaviors of children and caregivers; and characteristics of the dental care delivery system. Each child has distinct genetic and physical attributes that contribute to the vulnerability for dental disease. At the family level, a child's attributes are impacted by the oral health status of parents, especially mothers, and a strong association exists between parental and children's health-seeking behaviors. On a community level, dental services available to children are impacted by reimbursement, public policy, the availability of providers, and provider attitudes (American Academy of Pediatrics [AAP], 2003; Grembowski, Spiekerman, & Milgrom, 2008; Isong et al., 2010; Shearer, Thomson, Broadbent, & Poulton, 2011; Vann, Lee, Baker, & Divaris, 2010). Dental care has traditionally focused on individual level interventions such as restorative treatment, dietary counseling, and reducing the level of decay-causing bacteria (AAP, 2003). However, dental research has evolved to recognize dental health is multi-factorial (Bramlett et al., 2010; Ebersole, D'Souza, Gordon, & Fox, 2012; Fisher-Owens et al., 2007).

With advances in dental sciences, general dental practitioners have not adopted many of the evidence-based public health practices, such as early oral evaluations (Hopper, Morris, & Tickle, 2011; Sbaraini, Carter, Evans, & Blinkhorn, 2013; Spallek et al., 2010). The lack of health seeking behavior by parents combined with reluctance of providers to perform oral evaluations on infants and toddlers results in delayed initiation of dental care (Divaris, Vann, Baker, & Lee, 2012; Santos & Douglass, 2008). Bouchery (2012), utilizing 2008 Medicaid data, reported only 9% of children from birth to three

years received preventive dental services. While the AAP (2003) and the American Academy of Pediatric Dentistry (AAPD, 2011) recommend initial oral examinations prior to age one, a significant portion of infants and toddlers are not receiving the recommended preventive dental care.

As publicly funded programs strive to provide access to comprehensive and cost-effective dental services, creating effective preventive programs is imperative to contain costs and improve the oral health of Americans throughout the lifespan (US DHHS, 2010). Creating community-based programs that increase the number of pediatric children receiving preventive care and the number of providers willing to accept public-funded reimbursement may create a model of care that addresses barriers and improves oral health outcomes (Sharon, Connolly, & Murphy, 2005). A significant challenge to community-based preventive interventions is the extensive investment in time that it takes to demonstrate cost effectiveness and positive health outcomes. Funding for preventive programs must often be justified to gain support of payers, policy makers, and other stakeholders. In contrast, procedures to treat dental disease are not required to meet such scrutiny. While effective health promotion should be the primary determinate of program success, evidence of economic sustainability and positive patient outcomes are necessary elements in preventive programs (McGinnis, Williams-Russo, & Knickman, 2002). Health promotion in pediatric populations is, however, an area of focus for the Centers for Medicare and Medicaid Services (CMS). In 2011 CMS issued strategies to increase the number of Medicaid-enrolled children receiving preventive dental care. Those strategies included creating programs at the state level that reach children from birth to three years of age. During this economic period when state oral health programs

are facing budgetary cut-backs, providing funding for preventive programs offers a challenge for states to implement CMS strategies.

Publically-funded health insurance programs are not the only organizations taking notice of the disparities in dental care in pediatric populations. Privately-funded public health advocacy groups such as the Pew Charitable Trust (2013), the W.K. Kellogg Foundation (2013), and the Henry J. Kaiser Family Foundation have taken an interest in the delivery of oral health services for young children in recent years (Paradise, 2012). Numerous reports and work groups have examined disparities and offered recommendations. A 2011 report of the Institute of Medicine (IOM) identified the need to implement evidence-based preventive strategies into oral health care. A symposium of the American Academy of Dental Research in November of 2011 offered an opportunity for dental researchers and other stakeholders to discuss current public health activity, research, and practices to reduce the disparities in oral health care (Ebersole et al., 2012). The complexity of influences on oral health requires policy makers, advocates, and providers to create innovative interventions to address existing barriers.

Montana's Access to Baby and Child Dentistry Partnership Pilot

The Montana (MT) Access to Baby and Child Dentistry (ABCD) Partnership Pilot program established interventions on multiple levels of influences on oral health. The pilot was an introduction to an oral health program in MT that trains dentists in pediatric oral evaluation methods, risk assessment, enhanced reimbursement for preventive services, and family-oriented education. The program was designed to address barriers to dental care and improve the outcomes for MT children (Montana Department of Public Health and Human Services [MT DPHHS], 2009).

The focus of the MT ABCD Partnership Pilot program was to initiate preventive dental care prior to age one year to promote positive oral health behaviors and outcomes through education and training of the dental community and families of Medicaid-enrolled children. The two fundamental concepts of the pilot were creating a dental home for participants and conducting a caries-risk assessment (MT DPHHS, 2009). The concept of a dental home was modeled from the medical home with the goal of creating heightened awareness of oral health through access to comprehensive dental care and family-centered education (AAPD, 2011). Family members of pediatric participants and perinatal women were counseled regarding oral hygiene, recommended dental care intervals for infants and toddlers, and the transmission of decay-causing bacteria. Dental providers were asked to conduct a caries-risk assessment on each child during oral evaluations. A risk assessment tool was developed for the ABCD pilot program to outline the preventive services that could be provided to children identified at high-risk for dental decay. High-risk children were offered increased frequency of preventive visits with enhanced provider reimbursement for preventive procedures such as: oral evaluations, caries-risk assessment, oral hygiene instruction, nutritional counseling, and fluoride varnish applications. The pilot program began as a collaborative effort between MT DPHHS, MT Dental Association, MT Primary Care Association, and local health jurisdictions. The collaboration utilized information and training from the Washington State Health and Recovery Services Administration and the University of Washington School of Dentistry to create a program that met the needs of MT children and the dental communities. The pilot's main objective was to decrease the burden of oral disease and improve oral health outcomes for Medicaid-enrolled children from birth to three years of

age. MT DPHHS (2009) issued a request for proposals (RFP) offering funding during the pilot to introduce ABCD pilot program concepts.

All MT Community Health Center (CHC) dental clinics were invited to submit a response to the RFP to increase community-based oral health education along with preventive and restorative services to pediatric children and pregnant women during the pilot period. While the target population was Medicaid-enrolled children, the pilot offered education and services to all children from birth to three years and pregnant women regardless of payer source. The pilot was initiated in five CHC dental clinics throughout the state between October 2008 and December 2009. The CHCs were asked to utilize family oral health education materials provided by MT DPHHS, increase the number of pregnant women and infants seen at each CHC dental clinic, and foster partnerships with the dental community through referral and education. Each CHC identified a Community Dental Care Coordinator to facilitate the pilot program. The coordinator was trained in MT DPHHS oral health education materials, data recording, risk assessment, oral evaluation methods for infants and toddlers, and the enhanced reimbursement dental coding for providers. At the end of the pilot each CHC provided pilot data to the MT DPHHS, Maternal and Child Health Bureau (MT DPHHS, 2009).

Statement of the Problem

Dental caries is the most prevalent chronic disease among American children (US DHHS, 2000). Recent surveillance data indicate two-to-four-year-old children are experiencing an increased incidence of dental decay and experiencing decay at an earlier age. Low-income and minority children are less likely to have access to dental services due to numerous barriers. (Bell et al., 2012; Dye & Thornton-Evans, 2010; Kagihara et

al., 2009). Oral health professionals need to identify evidence-based interventions that effectively reduce the incidence of decay and increase preventive behaviors in young children (Sgan-Cohen et al., 2013; Bramlett et al., 2010).

Purpose of the Study

The objective of the retrospective case-control study was to determine the effectiveness of the 2009 MT ABCD Partnership Pilot program to improve child participants' oral health.

Professional Significance

Several objectives in the American Dental Hygienists' Association (ADHA) National Dental Hygiene Research Agenda (NDHRA) were investigated. Utilizing ABCD pilot program data to evaluate patient outcomes enhanced the current body of preventive dental science by investigating preventive oral health interventions in a pediatric population (Clinical Dental Hygiene Care D.8, ADHA, 2007). The present study added to the body of research in public health to determine if broadening access to dental care impacted oral health outcomes (Health Promotion/Disease Prevention A.2, Health Services Research B.1, ADHA, 2007). The study investigated environmental influences in preventive dental behavior through family education, provider training, and policy changes (Health Promotion/Disease Prevention A.6, ADHA, 2007).

While only the NDHRA is identified here, the investigation of access to dental care and innovative care models have been identified by advocacy and policy makers as an area for further investigation (Sgan-Cohen et al., 2013; IOM, 2011; US DHHS, 2010; US Government Accountability Office [US GAO], 2009). Multiple studies have investigated barriers and disparities in dental care; however, few studies have evaluated

intervention strategies on multiple levels of influence to improve the oral health of the pediatric population (Mattheus, 2010; Ismail et al., 2009; Vargas & Ronzio, 2006).

Research Questions and Hypotheses

The study's research questions were:

1. What is the difference in the incidence of dental decay experience between Medicaid-enrolled children participants in the ABCD pilot program and a cohort of Medicaid-enrolled non-participant children?
2. What is the difference in preventive dental behaviors of Medicaid-enrolled children participants in the ABCD pilot program and a cohort of Medicaid-enrolled non-participant children?
3. What is the difference in the mean age of the preventive dental behavior and dental decay experience during the retrospective period of the two study populations?

Three hypotheses were investigated.

1. There is no statistically significant difference in the incidence of dental decay of Medicaid-enrolled children participants of the ABCD pilot program when compared to a cohort of Medicaid-enrolled children that did not participate in the pilot.
2. There is no statistically significant difference between the preventive dental behaviors of Medicaid-enrolled children participants of the ABCD pilot program and a cohort of Medicaid-enrolled children that did not participate in the pilot.

3. There is no statistically significant difference in the mean age of preventive dental behavior and dental decay experience during the retrospective period of the two study populations.

Definitions

Conceptual Definitions.

For the purpose of this study the following conceptual definitions were used for the variables described.

Children participants. Children from birth to 36 months that received dental care and oral health education during the ABCD pilot program (MT DPHHS, 2009).

Dental decay experience. A restorative Code on Dental Procedures and Nomenclature (CDT) procedure during the retrospective period. Codes representing a decay experience will include: "D2000-2999, restorative", "D7111, extraction, coronal remnants – deciduous tooth", and "D7140, extraction, erupted tooth or exposed root" (American Dental Association [ADA], 2012, pp. 15 & 63).

***Preventive dental behavior*.** This study utilized Medicaid records retrospectively therefore; preventive dental care will be defined as an oral evaluation. CDT codes representing an oral evaluation are:

- D0120, periodic oral evaluation – established patient;
- D0145, oral evaluation for a patient under three years of age and counseling with primary caregiver; and
- D0150, comprehensive oral evaluation – new or established patient (ADA, 2012, pp. 5-6).

Additional preventive codes will be recorded for the retrospective period in conjunction with the oral evaluation codes:

- D0425, caries susceptibility tests, which was referred to as caries risk assessment during the ABCD pilot program (ABCD MT, 2009);
- D1120, prophylaxis- child;
- D1206, fluoride varnish;
- D1203/D1208, topical application of fluoride;
- D1310, nutritional counseling for control of dental disease; and
- D1330, oral hygiene instructions (ADA, 2012, pp. 13-14).

Operational Definitions.

For the purpose of this study the following operational definitions were used for the variables described.

Participation in the ABCD pilot program. For the purpose of this study, participant children who were enrolled in the pilot at the five CHC sites in 2009.

Dental Decay Experience (DE). Due to the lack of qualitative and subjective data in this study, outcomes will be recorded as a dental decay experience during the retrospective period based on CDT procedure codes. A dental decay experience will be defined as previously outlined in the conceptual definitions.

Preventive dental behavior (PDB). The preventive dental care sought during the retrospective period by the study population. Swank, Vernon, and Lairson (1986) defined PDB as "as behavior aimed at either the prevention of dental disease or the detection of dental disease in an asymptomatic state" (p. 176).

CHAPTER II

Literature Review

The objective of the present study was to determine the effectiveness of the 2009 MT ABCD Partnership Pilot program to improve child participant's oral health. During the mid 20th century fluoridation of public water supplies and toothpaste improved the oral health of the U.S. population; however, oral health remains a significant public health concern (US DHHS, 2000; Vargas & Ronzio, 2006). The analyses of several national data bases indicate the incidence of dental decay has not significantly changed since 1999 and in pediatric populations the incidence has increased (Bell et al., 2012; Dye & Thornton-Evans, 2010; Edelstein & Chinn, 2009; Kagihara et al., 2009; Dye et al., 2007). The incidence of dental decay incidence has been investigated in multiple studies as well as the influences adversely affecting oral health and populations at high risk for dental diseases (Ismail, et al., 2009; Kelly et al., 2005). In the pediatric population, influences are most often related to family and community factors which increase vulnerability to oral disease due to lack of self-care (Mattheus, 2010). Influences include socioeconomic status; culture, education level, and perceptions of preventive care in caregivers; availability of providers; and public policies (Fisher-Owens et al., 2007; Mattheus, 2010).

Creating community-based programs that increase the number of pediatric children receiving preventive care and the number of providers willing to accept public-funded reimbursement may create a model of care that addresses barriers and improves oral health outcomes (Sharon et al., 2005). A significant challenge to community-based preventive interventions is the extensive investment in time that it takes to demonstrate cost effectiveness and positive health outcomes (McGinnis et al., 2002). As publicly funded programs strive to provide access to comprehensive and cost-effective dental services, creating effective preventive programs is imperative to improve the oral health of Americans throughout the lifespan (US DHHS, 2010). This research aimed to evaluate the MT ABCD Partnership Pilot program.

To thoroughly evaluate the pilot program, this chapter will review the following related content areas: (a) prevalence of dental decay in the U.S. pediatric population, (b) oral health disparities in pediatric children, (c) influences on preventive dental behavior, (d) preventive focused programs, (e) and the ecological perspective in oral health promotion. The literature review was conducted using CINHAL, Cochrane, Medline, Health Source, PubMed, ProQuest, and Google Scholar from September 2012 to the present. Search parameters included preventive oral health programs, pediatric caries prevention, and early childhood caries.

Prevalence of Dental Decay

In 2000, the United States Surgeon General issued the report *Oral health in America* that identified oral health as an essential component of population health. The report reviewed the need for public health entities to address disparities among various socioeconomic groups. It also outlined the lack of reduction in early childhood caries

(ECC) in primary teeth, noting an increased incidence of dental decay in preschool age children. ECC is defined by the American Academy of Pediatric Dentistry (2011) as "the presence of one or more decayed, missing or filled surfaces in any primary tooth in a child under the age of six" (p. 50). Historically, dental decay in young children was thought to be solely related to feeding practices with a bottle or breast after the first year. However, over the last several decades, dental researchers began to explore the multifactorial aspects of dental decay and ECC (IOM, 2011; Fisher-Owens et al., 2007; Gussy, Waters, Walsh, & Kilpatrick, 2006).

Bagramian, Garcia-Godoy, and Volpe (2009), in a review of global epidemiologic data on dental decay, reported in the United States 50% of five- to nine-year-old children had at least one incidence of dental decay. More importantly, no decrease in the incidence of dental decay in primary teeth was noted in the past 30 years. While global decay rates had seen a reduction in the middle 20st century, that trend may be reversing due in part to lack of preventive efforts, lack of dental services utilization in high-risk populations, and dietary changes (Bagramian et al., 2009). U.S. data in the report were based on the National Health and Nutrition Examination Survey (NHANES) which offers the most comprehensive oral health data based on questionnaires and standardized oral health examinations by trained dentists. NHANES data is collected by the National Center for Health Statistics, a branch of the Centers of Disease Control and Prevention (CDC; Dye et al., 2007)

Dye et al. (2007) examined trends in oral health in the American population by comparing NHANES data collected in 1988-1994 and 1999-2004. While the oral health status of most of the U.S. population remained unchanged, the prevalence of dental decay

in the primary dentition of preschool-aged children increased (Dye et al., 2007; Edelstein & Chinn, 2009). Dye and Thornton-Evans (2010) utilized NHANES to investigate the oral health of the American population based on Healthy People 2010 Objectives. The authors reported a statistically significant increase in dental decay incidence in two-to four-year-old children with an increase of at least 5% in each racial/ethnic group examined ($p<0.05$). When data were stratified for socioeconomic status and gender, two-to-four-year-old males had a significant increase in decay incidence from 18% to 26%. Non-poor males experienced the most significant increase with an increase from 9% to 18%. Non-poor were defined as participants with income ≥ 200% of the federal poverty level (FPL). The number of two-to-four-year-old children in the study population varied between NHANES 1988-1994 (n=3,270) and NHANES 1999-2004 (n=1,830). In 2009, Edelstein and Chinn reported similar NHANES data findings outlining 24% of preschool-aged children from two to five years of age had a decay experience, 73% of which had untreated decay. One aspect in the high incidence of dental decay in the preschool aged population was the lack of utilization of dental care (Edelstein & Chinn, 2009).

Oral Health Care Utilization in Pediatric Children

Children under the age of five are often less likely to receive preventive dental care when compared to other age groups of children (Oh, Fuller, Leonard, & Miller, 2011; Yu et al., 2002). As publicly funded dental coverage has expanded over the last several years, utilization rates have only modestly increased (Edelstein & Chinn, 2009). The lack of utilization of dental care among the preschool aged children poses a significant challenge for public health officials (Bagramian et al., 2009).

Several researchers have utilized national data to monitor children's oral health. Bell et al. (2012) utilized 2007 National Survey of Children's Health (NSCH) data to investigate oral health in children one to17 years of age (n=86,764). In the youngest population, one-to-two-year-olds, there was an association between acute oral health need and the receipt of preventive oral health care. This was in contrast to all other age groups even when stratified for variables. In the sample, only 23.7% of the one-to-two-year-old children had a preventive visit while 12.5% had an acute dental need ($p<0.01$). In three-to-five-year-old children, the same data rose to 73.2% and 22.5%, respectively ($p<0.01$). Overall, the youngest children often did not receive preventive care unless a perceived acute dental need existed. Children in older groups were less likely to have preventive care if the parent reported oral health was good or fair/poor. A significant limitation to note is survey data were based on parental recall.

In addition, Edelstein, and Chinn (2009) reviewed Medical Expenditure Panel Surveys to investigate utilization of dental care in U.S. families. In comparing 1996 data to 2004 there were only modest increases in utilization of dental services in children under the age of 6 years from 21% to 25% respectively. Higher socioeconomic status and parental education level were reported as strong indicators of increased utilization. Parents who had attained less than a high school education sought dental care for children in 25% of the population. In contrast, college educated parents sought care at a rate of 54% in the study population.

Similar findings were reported when Yu et al. (2002) utilized 1999 National Survey of American Families (NSAF) data. The NSAF data included 4529 children aged three to four years of age. Seventy-three percent of respondents reported that a child in

the age range of three to four years did not receive two dental visits in a 12 month period. Furthermore, 43.1% had not received even one dental visit during the year ($p<0.001$). NSAF data were based on parental recall without oral examinations. Yu et al. (2002) also reported that among children in the study population, over 70% had either publically or privately funded dental coverage.

Dental care utilization has a strong association with the availability of dental insurance coverage (Bramlett et al., 2010; Vargas & Ronzio, 2005; Yu et al., 2002). In a 2007 review of the National Health Interview Survey (NHIS) data, 29.0% of children covered by public health insurance had a dental visit (Isong et al., 2010). Edelstein and Chinn (2009) reported less than 35% of Medicaid-eligible children obtained dental services during a one year period in 2006. In 2004 among the Medicaid population, children under the age of six had an average of 1.6 dental visits. While the rate increased as a child ages, utilization rates remained low in the Medicaid population (Manski & Brown, 2007). Bouchery (2012) evaluated Medicaid records in nine states utilizing Mini-MAX 2008, a 5% sample of Medicaid administrative files. Twenty-one percent of the study population was younger than three years old. Among children younger than three years of age, the utilization of preventive dental care was 9% in the study population. When the utilization of all dental care was investigated, the same population only had a 14% utilization rate.

Dental care utilization is a significant concern in the pediatric population (Bouchery, 2012). Given recent surveillance data regarding increased incidence of dental decay in primary teeth, interventions that increase awareness by parents as well as medical and dental providers could increase the utilization of dental care in pediatric

populations (Bagramian et al., 2009; Dye et al., 2007). Creating effective interventions requires examination into the influences that affect utilization (Fisher-Owens et al., 2007).

Influences On Children's Oral Health

Fisher-Owens et al. (2007) created a conceptual model of children's oral health outlining the multitude of influences on the determinants of health. In this model, child, family, and community influences are dynamic and continuously interacting among various degrees of vulnerability and lengths of time. While three areas of influence are primarily discussed by Fisher-Owens et al., it is recognized that influences can impact oral health on more than one level of a child's environment at various times to create a complex interactions of influences (Bramlett et al., 2010).

Bramlett et al. (2010) tested Fisher-Owens's et al. (2007) conceptual model utilizing national data from the 2003 Nation Survey of Children's Health (NSCH), a random-digit-dialed telephone survey conducted by the CDC. The parent reported data were gathered on one child per household in the one to five year old age range (n=26,736). Only seven of the 22 domains observed in the conceptual model were not significant at the $p>0.05$ level. Of those seven domains, four were community level influences and included the community oral health environment, health care system characteristics, dental care system characteristics, and community level culture. Due to the complexity of the model, community level domains were categorized into state-level and neighborhood-level characteristics.

Community-level influences. Several aspects of the oral health environment however do contribute to the oral health status of young children (Bramlett et al., 2010).

Creating opportunities for early assessment of infants and toddlers can prevent future dental problems (American Academy of Pediatrics [AAP], 2008). Provider attitudes and willingness to provide preventive oral care contribute to the community oral health environment and the health care system characteristics (Fisher-Owens et al., 2007). Due to the separation of primary medical care from dentistry, pediatric children are often not seen by a dental provider until a need arises (IOM, 2011). Medical professionals have an opportunity to offer guidance about dental care during well-child visits (AAP, 2008).

Primary medical providers. Young children are seen by a primary care provider numerous times in the first year of life (AAP, 2008). Unfortunately, medical care providers are often not trained to conduct oral health evaluations, risk assessments, and provide preventive dental services (Jacques et al., 2010: Kagihara et al., 2009). Close, Rosier, Zeldin, and Gilbert (2010) investigated 11 barriers to adopting and implementing oral health services in a primary medical setting. The study was conducted as part of a North Carolina program, Into the Mouth of Babes, which integrated preventive dental services into primary medical care. Two hundred thirty-one medical providers were included in the study in both family medicine and pediatric practices. Forty-two percent of providers reported integrating preventive oral health services into clinical routines as the number one barrier while application of fluoride varnish was the second most reported barrier at 28.8%. Staff member resistance was noted by 25.8% of the providers. Significant barriers were most often related to time constraints during the delivery of care. Over half of the medical practices were able to overcome staff resistance by effectively training and preparing for oral health services such as fluoride varnish applications, anticipatory guidance with parents, and oral health screenings. Overall,

three out of four primary care providers were classified as early adopters and had fully integrated preventive oral health services into the care setting. Finding a dentist to refer to for dental needs was reported as a barrier by 21% of the providers.

Dental providers. Although dentists do not require training in preventive dental services, general dentists are often not comfortable providing care for pediatric populations (Wolfe, Weber-Gasparoni, Kanellis, & Qian, 2006). General dentists report lack of cooperation by pediatric patients and lack of training in pediatric evaluation methods as the most common reasons for not seeing young children (Salama & Kebriaei, 2010; Santos & Douglass, 2008). Pediatric dentists are much more likely to see children at a younger age and provide services. However, due to the lack of pediatric dentists in rural areas, referral by a general dentist may not be an option for pediatric dental care (Santos & Douglass, 2008). The AAP (2008) and the AAPD (2011) recommend primary preventive strategies be initiated prior to age one. In a study of Connecticut dentists, Santos and Douglass (2008) investigated knowledge of the age one recommendation. Ninety-eight percent of the pediatric dentists (n=60) surveyed were aware of the recommendation while only 45% of the general dentists (n=113) were aware of the recommendation ($p<0.001$).

While Santos and Douglass's (2008) investigation did not find an association between knowledge of the age one dental recommendation and date of graduation in dentists, a similar study by Wolfe et al. (2006) reported that year of graduation was significant at the $p<0.0001$ level. General dentists (n=715) that had been practicing less than ten years more often agreed with the recommendation to perform early evaluations than those who had been in practice over 20 years. Dentists that had been practicing less

than ten years were more likely to see children zero to 23 months of age (Wolfe et al., 2006). In a survey of Nebraska general dentists (n=371) Salama and Kebriaei (2010) reported dentists with fewer years of practice had a positive correlation with providing care to children under 24 months ($p<0.001$). All three studies found female dentists were more likely to see pediatric patients, although there was a smaller population of female dentists in all of the study populations (Salama & Kebriaei, 2010; Santos & Douglass, 2008; Wolfe et al., 2006).

Hopper, Morris, and Tickle (2011) reported as part of a qualitative study that while dentists believe evidence-based practice is important, dental research does not often keep up with clinical practice. Dentist respondents to the study reported that scientific research journals were often not relevant to clinical practice, reporting that colleagues, hands-on courses, and clinical experience had more impact on clinical decisions. The researchers identified two groups of dentists, early and late adopters. Late adopters often continued clinical practices they were taught in dental school and required a significant amount of evidence prior to changing clinical protocols. Reimbursement was also noted as having a significant impact on clinical decisions. The population identified as early adopters were more interested in research articles and eager to improve clinical care.

In a questionnaire, Spallek et al. (2010) asked dentists identified as early adopters to discuss barriers in implementing evidence-based practices. Respondents were chosen from a convenience sample of dentists that had attended an evidence-based conference. The respondents (n=43) reported "difficulty in changing the current practice model" and "resistance and criticism from colleagues" to be the most significant barriers to changing clinical practices (p. 199). Also, obtaining and trusting research were recorded as

significant challenges. When dentists were asked how to overcome such barriers comments included improving quality, access, and dissemination of research articles. Once practitioners have the information, encouraging change in practice and reducing financial and political barriers were noted as requirements to adopting evidence-based dentistry. Adaptation to preventive dental care is slow and complex due to provider attitudes and time constraints during delivery of care (Sbaraini et al., 2013).

Educating dental providers and parents regarding the benefits of early initiation of preventive dental care is an important aspect of health promotion (Divarius et al., 2012). In a five year study of Medicaid eligible children (n=9204) Savage, Lee, Kotch, and Vann (2004) reported children who had a preventive visit prior to age one were more likely to have subsequent preventive care ($p<0.05$) and less likely to have restorative ($p=0.18$) and emergency care ($p=0.61$). Initiation of preventive care at a younger age had a positive correlation to decreased dental costs. The study acknowledged a significant limitation based on selection bias, because parents motivated to initiate care prior to age one exhibited increased preventive behaviors. The bias may influence oral hygiene practices at home.

Exposure to fluoride is another preventive measure that may create bias. Community water fluoridation was reported as a significant influence on a child's physical environment by Bramlett et al. (2010; $p<0.01$). In the absence of community fluoridation, other topical fluoride sources have been associated with reduced incidence of dental decay (Marinho, Higgins, Logan, & Sheiham, 2009). A systematic review of fluoride varnish studies reported a reduced incidence of dental decay in primary and permanent teeth related to fluoride varnish use (Marinho et al, 2009). The authors noted

a lack of high quality research regarding fluoride varnish applications, but current evidence suggests the benefits of application two to four times a year (Marinho et al, 2009). In a policy statement, the Association of State and Territorial Dental Directors (2010) acknowledged that given the current body of evidence in dentistry, providing fluoride varnish applications for pediatric populations offers an effective preventive intervention.

Family-level influences. Young children rely on caregivers to initiate care and provide home care (Mattheus, 2010). For that reason, family-level influences exhibited a significant effect on the oral health status of children (Bramlett, et al., 2010). Influences include family composition, socioeconomic status, health behaviors and practices, and culture (Bramlett et al., 2010; Ismail et al., 2009).

The transmission of decay causing microorganisms from primary caregivers to children increases risk of dental decay; therefore, the oral health status of mothers and caregivers has a significant role in determining risk (Shearer et al., 2011; Weintraub, Prakash, Shain, Laccabue, and Gansky, 2010; Gussy et al., 2006). In a longitudinal study in New Zealand, five-year-old children (n=919) were examined to determine their oral health status and the mothers were interviewed. The cohort of children were reexamined at age 32 (n=825). An association was reported between a high rate of decay and missing teeth in the cohort and mothers who rated themselves as edentulous or in very poor oral health (n=144) during the interviews in 1977 through 1978, with a relative risk of 3.92, 95% CI [1.21, 12.64] (Shearer et al., 2011). This finding was consistent with a study conducted by Weintraub et al. (2010) that reported children (n=387) of mothers (n=179) with untreated decay were almost twice as likely to experience untreated dental decay

(OR= 1.73; *p*=0.017). Adjusting for behavior and utilization did not notably change the correlation (OR=1.89; *p*=0.012). Young children are more likely to obtain preventive dental care if the mother has a regular source of dental care (Grembowski et al., 2008).

Isong et al. (2010) reported a strong association exists between the health seeking behavior of parents and children. Regarding dental care utilization, parents that sought dental care more often had children that received dental care, OR=3.36, 95% CI [2.71, 4.18]. In the study population, 85.9% of the parents that received dental care sought care for their children while only 62.8% of children had a dental visit if parents did not seek dental care. In a qualitative study involving low-income parents (n=28), Lewis, Linsinmayer, and Williams (2010) reported several factors influence parental choices in obtaining oral health services for their children: (a) experience with their own dental health, (b) finding a source of dental care, and (c) obtaining information about oral health. While many of the parents surveyed had negative oral health experiences in their own histories, most reported they wanted to improve the oral health of their children.

Parental perceptions regarding oral health play a significant role in utilization of dental care (Divarius et al., 2012; Kelly et al., 2005). Divarius et al. (2012), as part of an ongoing prospective study, interviewed parents (n=108) regarding the oral health status of their children then examined the children. Parental assessments often overestimated the status of health, most notably in children younger than two years of age (*p*=0.049). In the study population of children under the age of two (n=61), 29 children were rated as having excellent or very good oral health status by parents. When children were examined, nine of the 29 children had treatment needs, with five having advanced treatment needs.

When dental needs are identified, children with either private or public dental coverage are more likely to receive care. Research conducted by Liu et al. (2007) found lack of insurance coverage was associated with lower utilization of preventive care and unmet dental needs (OR=2.50, 95% CI [2.35, 2.65]; $p<0.0001$). Interestingly, children that fall in >200% of the FPL more often lack dental benefits due to ineligibility for publicly funded dental programs. The Kaiser Commission on Medicaid and the Uninsured reported 29% of children in the >200% FPL group do not have dental benefits ($p<0.05$). Out of pocket expenses for children without dental benefits were $401 in 2009. Among children with dental coverage, out-of-pocket expenses were $327 for private insurance and $53 for children covered by Medicaid (Paradise, 2002).

Socioeconomic status is well documented as a strong indicator of high risk of dental decay (IOM, 2011; Bramlett et al., 2010; Polk, Weyan,t & Manz, 2010; Ismail et al., 2009; Kagihara et al., 2009; Gussy et al., 2006; Vargas & Ronzio, 2006). Children with families living below the FPL had only a 42.13% utilization rate of preventive dental care ($p<0.0001$; Liu et al., 2007). Lower socioeconomic status has also been correlated with poor homecare practices (Polk et al., 2010). In a qualitative study Kelly et al. (2005) conducted focus groups with low income parents. Parents that were less likely to utilize dental care related preventive care to home oral health practices. Among parents that sought dental care, health promotion was a theme of the responses. Parents that did not seek dental care reported emergent needs were related to dental care utilization and reported younger children did not have dental needs. The study also reported an association between dental care utilization and education level of parents. Numerous researchers have reported strong associations between education level of

parents and dental health promotion in children. (Bramlett et al., 2010; Isong et al., 2010; Polk, et al., 2010; Liu et al., 2007).

Child-level influences. The risk of developing dental decay is influenced by several family level influences that create an individual level risk (Bramlett et al., 2010). Children inherit genetic factors associated with susceptibility to decay and become colonized with decay-causing organisms through transmission from caregivers (Ismail et al., 2009; Fisher-Owens et al., 2007). Inadequate oral hygiene practices play a significant role in the decay process due to the increased number of decay-causing organisms, the increased availability of sugars and fermentable carbohydrates, and reduced exposure to fluoride toothpaste which contributes to increased risk of dental decay (Ismail et al., 2009).

Further bolstering the need for early prevention, a study conducted by Alm, Wendt, Loch, Birkhead, and Nilsson (2012) reported a child with a dental decay experience at three or six years of age were more likely to have approximal decay in permanent teeth at age 15 (OR=2.7, 95% CI [1.5, 5.1] and OR=2.5. 95% CI [1.7, 3.8], respectively; $p<0.0001$). The Swedish prospective study of 539 children conducted oral evaluations at ages one, three and, six and performed a radiographic evaluation of approximal decay at age 15. Of significant importance to the present study, the investigation revealed that failure to have a dental evaluation prior to age one was associated with a higher approximal decay experience, over four areas of decay (OR=3.8, 95% CI [.3, 13.8]) and over eight areas (OR=5.5, 95% CI [1.6, 22.4]). Variables throughout the prospective period that exhibited a significant relationship to the development of higher approximal caries in adolescence included: caries experience at

six years (OR=9.7, 95% CI [4.0, 23.6]; $p<0.0001$), mother's perception of her own oral health as less good to poor (OR=5.5, 95% CI [2.2, 13.5]; $p<0.0002$), no dental examination at age one, and increased sugar consumption (OR=10.9, 95% CI [2.6, 45.4]; $p<0.001$; Alm et al., 2012).

Pediatric Preventive Dental Programs.

Several states have created preventive oral health programs to promote health in pediatric populations and reduce dental decay. The programs are designed to increase the utilization of dental care prior to age one, educate parents in preventive oral health practices, and train health care professionals in pediatric preventive oral health services. The programs create family and community-level health promotion interventions (Rozier, Stearns, Pahel, Quinonez, & Park, 2010; Vargas & Ronzio, 2006).

A North Carolina (NC) program, Into the Mouth of Babes, created access to preventive dental screenings and fluoride varnish applications as part of well-child visits in primary medical care. The medical model for preventive dental care was created due to the lack of dental providers available to provide preventive dentistry in the Medicaid eligible population in NC (Rozier et al., 2010; Close, Rozier, Zeldin & Gilbert, 2010; Vargas & Ronzio, 2006). Rozier et al. (2010) investigated the utilization of preventive dentistry during well-child visits from 2000 to 2006 utilizing Medicaid administrative files. An increase in the number of children receiving dental services was noted during the study period in medical and dental settings. In 2006, 19.4% of children six to 11 months of age received preventive dental care during medical visits. Children were more likely to receive dental care during medical visits in areas that had a lower number of dentists and a larger population of medical providers (Rozier et al., 2010). While barriers

to providing dental care during the program were noted, 65.5% of providers studied by Close et al. (2010) began providing services approximately one month after program training. Unfortunately, physicians were more likely to include oral health services when children were age two rather than age one as recommended (AAPD, 2011; Rozier et al., 2010; AAP, 2003).

Dental providers have been reported to also show reluctance in doing oral evaluations prior to age one (Salama & Kebriaei, 2010; Santos & Douglass, 2008; Wolfe et al., 2006). In response, the University of Iowa Pediatric Dentistry Department initiated the Infant Oral Health Program (IOHP) as part of the dental curriculum. Senior pediatric dental students conducted oral evaluations on infants and toddlers and provided caregiver education during Special Supplemental Food Program for Women, Infants, and Children (WIC) visits at a local public health department. During the ten year study period, 35% of the children (n=515) seen were at high-risk for dental decay, and of the children younger than 71 months, 20% (n=266) had dental decay (Weber-Gasparoni, Kanellis, & Qian, 2010). Weber-Gasparoni et al. (2010) investigated outcomes of the pediatric training program and found most students reported the hands-on experience added value in performing oral evaluations on pediatric patients. When Iowa general dentists were surveyed in 1996 and 2005, 11% and 36%, respectively, believed children should have an oral evaluation before 24 months. The results indicate that the IOHP program in Iowa is working to change the perception of pediatric care among dental providers (Wolfe et al., 2006).

In a retrospective study Koester (2011) outlined the effectiveness of a preventive oral health program in Texas, First Dental Home (FDH). The FDH program began in

2008 and aimed to reduce the incidence of dental decay in preschool-aged children by initiating oral evaluations prior to age one, applying fluoride varnish during dental appointments, and providing oral health education to care givers. Children identified as high-risk were offered increased frequency of preventive visits. Texas Medicaid was actively involved with the program and offered enhanced reimbursement to certified providers. Koesters (2011) reviewed patient charts on the three year anniversary of the program to evaluate the effectiveness of preventive interventions. The study was conducted in a private pediatric dental practice and patient charts were reviewed for treatment of dental decay. Patient charts (n=128) were randomly selected for review and compared to a cohort (n= 67) of patient charts within the same age range. The patient charts were also stratified based on compliance with the preventive program. The FDH group did not exhibit a statistically significant difference in decay incidence during the retrospective period when compared to the cohort, 35.9% and 40.3% (p=0.550) respectively. A lower rate in the utilization of sedation for restorative care between the two groups was significant, 18.8% in the FDH group and 35.8% in the control (p=0.009). Limitations in this study include a small study population of FDH participants and a high number of the children identified with low to very low compliance in the FDH program (n=49). During the chart review, the author observed an increase in the number of children seen prior to age one with an increase from 11% in 2010 to 19% in 2011 (Koesters, 2011).

Similar to the FDH program, the Washington (WA) ABCD Program focuses on the perceptions of the dental providers, but also incorporates parental perceptions. The program was initiated in 1995 as a collaboration between public and private stake holders

to: (a) train general dentists in pediatric oral health evaluations, (b) educate parents regarding the importance of oral health, and (c) increase the number of Medicaid children receiving dental care. The program successfully increased access to dental care in Medicaid-eligible children by increasing knowledge regarding utilization of preventive care at a young age (Lewis, Linsenmayer, & Williams, 2010; Kobayashi, Chi, Coldwell, Domoto, & Milgrom, 2005; Donahue, Waddell, Plough, del Aguila, & Garland, 2005). Expenditures in dental care increased in counties that initiated the program, but the increase reflected a greater number of Medicaid-eligible children receiving preventive care at an earlier age (Riter, Maier, & Grossman, 2008; Kobayashi et al., 2005; Donahue et al., 2005).

A significant part of the WA ABCD program involved educating general dentists and staff in pediatric evaluation methods, oral health education for parents, fluoride varnish frequency, and atraumatic restorative care. Training was provided by University of WA dental faculty (Kaakko et al., 2002). In preparation for initiation of the ABCD program in WA, Milgrom and Riedy (1998) surveyed a random sample of WA dentists (n=531) to determine current participation and knowledge regarding Medicaid and willingness to provide services to low-income pediatric populations. The survey had a 70% response rate; 76.2% (n=256) of the respondents were general dentists. Sixty-two percent of the general dentists surveyed saw fewer than 25 Medicaid children in 1996. Among the dentists that reported seeing Medicaid children, only 15% of the children were of preschool age; however, one-third of the dentists reported they did not see preschool-age children. Pediatric dentists (n=11) saw significantly more Medicaid recipients, 60% reported seeing 200 or more. Overall, 55% of the dentists surveyed

reported that funding should be provided for pediatric dental care. Dentists identified low reimbursement rates as the most important barrier in providing care to Medicaid enrollees. Addressing the concerns of providers was an important aspect in developing the ABCD program in WA (Kobayashi et al., 2005; Milgrom & Riedy, 1998)

In addition to enhanced reimbursement for providers, a support system to identify potential participants and provide case management was developed for the WA ABCD program (Kaakko et al., 2002). Through funding provided by the WA Dental Service Foundation (WDSF), medical providers were included in interventions in 2001 to provide oral health screenings, oral health education, fluoride varnish applications, and referrals to a dental provider. Riter et al. (2008) reported "the number of fluoride varnish applications in medical settings in WA delivered in Medicaid-enrolled children under six increased from 145 in 2000 to 9,098 in 2007" (p.1731). While fluoride varnish applications in medical settings had been reimbursable through WA Medicaid, WDSF advocated for additional reimbursement for oral screenings and education. Through advocacy and marketing, the number of oral health services being initiated in medical settings increased. Local health departments were also given an opportunity to seek funding through WDSF to create outreach for eligible families with dental care needs. The health departments were provided start-up funding to provide administration services and case management (Riter et al., 2008; Donahue et al., 2005; Kaakko et al., 2002). Including the medical providers and health departments in the ABCD program created a multifaceted approach to increasing access to dental care in WA (Pew Center on the States, 2010).

Given the numerous levels of interventions, evaluation of the program involved obtaining Medicaid and ABCD enrollment data as well as obtaining feedback from enrolled families (Donahue et al., 2005). Utilization among Medicaid children in counties with the ABCD program remained the same from 1997 to 2002, but an increase was noted in 2003. In 2003, counties with the ABCD program had a 33.6% utilization rate compared to 27.6% in non-ABCD enrolled counties (Donahue et al., 2005). Research from one rural WA county reported similar utilization rates among children younger than four years of age, 35.8% among ABCD enrollees and 19.7% in children not enrolled (Kaakko et al., 2002). The increase was related to the added enrollment of children younger than two years of age (Kobayashi et al., 2005; Kaakko et al., 2002). Expenditures reported by Kaakko et al. (2002) showed no significant difference between ABCD participation and non-participation. The expense per child enrolled in the program (n=212) was $67.32 and was $52.44 in the non-enrolled (n=219) population (p=0.35). The findings were consistent with Kobayashi et al. (2005) that compared two WA counties, one which had implemented the ABCD program and one that had not. Mean dental expenditures in the ABCD participant county from 1995 to 2001 was $212.42 versus $198.92 in the non-ABCD county.

As part of the Kobayashi et al. (2005) research, oral examinations were conducted to evaluate outcomes. Eighteen percent of the children in the ABCD county had untreated decay compared to 22% in the non-ABCD county, although the difference was not statistically significant (p=0.26). Researchers found as ABCD participants experienced increased utilization of preventive care, non-ABCD participant rates of utilization increased as well. The increase was attributed to program marketing to

enhance knowledge regarding preventive care (Kaakko et al., 2002). The results of studies on the WA ABCD program indicate the program was effective in increasing utilization of dental services and improving the health of Medicaid children (Donahue et al., 2005; Kaakko et al., 2002; Pew, 2010).

Both the WA ABCD program and the Texas FDH program are very similar to the MT ABCD Partnership Pilot and ongoing program. To date, very little data have been examined regarding the MT ABCD pilot or program since initiation in 2009 (ABCD MT, 2012). A study on oral health in the Head Start Program in MT conducted during the 2005-2006 school year reported 39% had untreated dental decay while 58% had a decay experience (MT DPHHS, 2010). The report included data from oral health screenings in randomized public school settings (n=30) and was stratified based on free and reduced lunch program participation. Among the third graders screened, 33% had untreated dental decay and 69% had a caries experience in schools categorized with a "high participation in the free or reduce priced lunch program" (p.10). Head Start settings were selected based on the demographics of selected public schools (MT DPHHS, 2010). A limitation of the report is the examiners performing the assessments were presented with the same training material; however, they were not calibrated in gathering the assessment data.

A 2012 ABCD MT Program Report outlined program goals and the need for data analysis to evaluate program effectiveness. The report noted a 371% increase in preventive dental visits for children less than 12 months from 2007 to 2011. Based on MT DPHHS data (2013), Medicaid served 3114 patients in MT in 2007 totaling

$8,001,966 compared to 2012 in which 6748 patients were recorded with a cost of $24, 673,473.

Ecological Perspective in Oral Health Promotion

Creating programs that foster health promotion while exhibiting economic feasibility is a significant challenge in a treatment focused model of care (McGinnis et al., 2002). This review is structured around three levels of influence based on a conceptual model of children's oral health: community, family, and individual (Fisher-Owens et al., 2007). Looking at multiple levels of influence in designing and evaluating health promotion programs with an ecological approach integrates multiple theoretical and research perspectives (US DHHS, 2005; Stokols, 1996).

Human ecology is patterned from biological ecology, acknowledging that humans are affected by everything around them and are not isolated (McLaren & Hawe, 2005). Behavior is based on relationships and activities within the environment although humans can modify environmental conditions (McLaren & Hawe, 2005). Personal behavior changes are accomplished through active and passive health interventions that span biological, behavioral, and sociocultural needs while incorporating the environmental resources available in a population (McLaren & Hawe, 2005; Stokols, 1996). McLaren and Hawe (2005) define ecological perspective as "a conceptual framework designed to draw attention to individual and environmental determinants of behavior" (p. 9).

In social ecological theory (SET), health promotion involves assessing a population's environmental conditions and determining how the conditions influence health and health behaviors. The assessment includes unhealthy practices as well as behaviors that enhance health (McLaren & Hawe, 2005; Stokols, Allen, & Bellingham,

1996; Stokols, 1996). Creating an environment that supports health promotion requires collaboration between families, providers, and policy makers and creates a complex theoretical framework (Stokols, 1996; Stokols et al., 1996). Interventions are not focused solely on individuals, but the environment that influences individual behavior (Stokols et al., 1996).

A young child's environment has multiple levels of influence on health behaviors (Fisher-Owens et al., 2007; Stokols etal., 1996). On a community level, public policies and provider training programs are examples of activities children may or may not have direct interaction with but impact the health environment. Children also have direct community influences, such as culture and the quality of the social and physical environment (Stokols, 1996). Lastly, interaction with parents and other caregivers establish health behaviors (McLaren & Hawe, 2005). All of the levels of influence are not only affecting the individual, but also interacting with each other to create a dynamic, complex network (Mclaren & Hawe, 2005; Stokols, 1996).

On a community level, Medicaid policy changes in the ABCD pilot program allowed for increased reimbursement for preventive care to dental providers willing to become pediatric certified Medicaid providers. MT children under three years of age identified as high-risk of dental decay were offered increased frequency of preventive care (MT DPHHS, 2009). On a family-level the ABCD pilot program offered parents' oral health education to reduce decay transmission, improve homecare practices, and utilize preventive care (MT DPHHS, 2009). By creating interventions on community and family levels, the MT ABCD pilot program aimed to reduce dental decay in low-income children (MT DPHHS, 2009).

Summary

Over the last several decades, U.S. pediatric children have experienced an increased incidence of dental decay (Dye et al., 2007). NHANES data reported two- to four-year-old children experienced a statistically significant increase in decay, most notably in males (Dye et al., 2007). A contributing factor to dental decay is lack of utilization of preventive dental care in pediatric populations (Oh et al., 2011; Dye et al., 2007; Yu et al., 2002). Children are a particularly vulnerable population due to their dependence on family members to prevent dental decay (Mattheus, 2010).

Due to vulnerability, oral health in young children is influenced primarily by family and community determinants (Mattheus, 2010; Fisher-Owens et al., 2007). On a family-level, influences include socioeconomic status, race, and educational level of parents (Bramlett et al., 2010; Ismail et al., 2009). On a community-level, utilization of dental care prior to age one is influenced by primary care providers' and general dentists' willingness to provide preventive oral care to infants (Fisher-Owens et al., 2007; Wolfe et al., 2006). The ABCD pilot program created interventions on multiple levels of influence with an ecological perspective to foster preventive behaviors at an early age and increase utilization in high-risk populations (ABCD MT, 2012; Stokols et al., 1996).

Preventive oral health programs in other states have shown that an investment in early prevention shows modest improvements in health and utilization rates (Koesters, 2011; Rozier et al., 2010; Kobayashi et al., 2005; Kaakko et al., 2002). The ABCD program in WA has increased utilization of preventive care in pediatric populations and improved oral health in high-risk populations (Kobayashi et al., 2005; Kaakko et al., 2002). The MT ABCD pilot program was modeled after the WA program and was

introduced in five MT Community Health Centers (MT DPHHS, 2009). The present study evaluated the effectiveness of the 2009 MT ABCD pilot program to increase preventive care utilization and reduce dental decay in the pilot participants.

CHAPTER III

Methodology

Design

The purpose of this retrospective case-control study was to determine the effectiveness of the 2009 MT ABCD Partnership Pilot program to improve child participants' oral health. A review of Medicaid data files was conducted to determine the incidence of dental decay experience (DE) and preventive dental behavior (PDB) of ABCD pilot children and a randomized cohort of Medicaid-enrolled children. ABCD interventions included: (a) early preventive care based on caries-risk assessments, (b) establishment of a dental home for child participants, (c) preventive oral health education with caregivers, (d) training for providers in pediatric evaluations and, (e) enhanced reimbursement by Medicaid for preventive services in children from zero to 36 months of age (MT DPHHS, 2009). Dental providers were trained in pediatric evaluation methods by peers in small group settings prior to the pilot initiation. Parents or other caregivers were provided oral health education material in print prepared by the MT DPHHS and verbally by dental providers during CHC dental visits (ABCD MT, 2009). The program interventions were developed to introduce the ABCD program to Montana dental providers and initiate dental care earlier in the rural high-risk population.

ABCD participant children were compared to a randomized cohort of Medicaid-enrolled children during the retrospective period of October 1, 2008 to May 31, 2013. Dental claims were reviewed for ABCD child participants continuously enrolled in Medicaid during the retrospective period. A random sample of non-pilot children continuously enrolled in Medicaid was obtained to compare dental claim data. In both populations, claim data were recorded as DE or PDB to compare dental care utilization during the retrospective period. The study populations were also investigated to determine age of utilization. Ages were recorded in months based on claim data.

Medicaid data files were used to evaluate the ABCD pilot as the researcher was unable to review patient charts at each CHC dental clinic or conduct qualitative interviews with parents. Medicaid data were compiled by a MT DPHHS epidemiologist, Dorota Carpendo, MPH, and provided to the researcher with no identifiers to protect patient confidentiality.

Research Questions and Hypotheses

The study's research questions were:

1. Is there a difference in the incidence of dental decay experience between Medicaid-eligible children participants in the ABCD pilot program and a cohort of Medicaid-eligible non-participant children?
2. Is there a difference in preventive dental behaviors of Medicaid-eligible children participants in the ABCD pilot program and a cohort of Medicaid-eligible non-participant children?

3. Is there a difference in the mean age of the preventive dental behavior and dental decay experience during the retrospective period of the two study populations?

Three hypotheses were investigated.

1. There is no statistically significant difference in the incidence of dental decay of Medicaid-eligible children participants of the ABCD pilot program when compared to a cohort of Medicaid-eligible children that did not participate in the pilot.
2. There is no statistically significant difference between the preventive dental behaviors of Medicaid-eligible children participants of the ABCD pilot program and a cohort of Medicaid-eligible children that did not participate in the pilot.
3. There is no statistically significant difference in the mean age of preventive dental behavior and dental decay experience during the retrospective period of the two study populations.

Description of Setting

Research participants. Children enrolled in the ABCD pilot program were chosen by convenience at five CHC dental clinics (MT DPHHS, 2009). ABCD pilot children were selected for the study population if they were continuously enrolled in Medicaid during the retrospective period and between the age of zero and 36 months at the time of enrollment in the pilot. There were 170 children in the ABCD pilot enrolled in Medicaid at the initiation of the pilot. A total of 97 of those children were eligible for study inclusion based on Medicaid enrollment and age. The comparison group of non-

pilot children was in the same age range with continuous Medicaid eligibility for the retrospective period.

Sample description. The ABCD pilot program was initiated in five CHC dental clinics throughout MT. Four of the clinics were in cities with populations over 30,000 in the primarily rural state. One CHC dental clinic was located in Havre, MT which has a population of approximately 10,000 (US Census Bureau, 2013).

ABCD participant children eligible for the study were born between November 22, 2005 and September 2, 2009. The random sample of non-pilot children was selected from the same age range. The pilot intervention time frame was from October 2008 through December 2009. Medicaid claims data were selected from the MT Medicaid Query Path by MT DPHHS. Medicaid claims data included dates of service from October 1, 2008 to May 31, 2013. Claim data were provided to the researcher with only the month and year of service, therefore all claims were recorded from the 15th day of the month in order to calculate age at time of service. Due to income requirements in receiving Medicaid, both study populations were considered low socioeconomic status.

Sample inclusion and exclusion criteria. All ABCD pilot participants zero to 36 months at the time of enrollment and continuously enrolled in Medicaid during the retrospective period were included in the study population. In preparing for data collection, a power analysis was completed to determine the number of non-participant children needed for 80% probability in rejecting the null hypothesis. The power analysis estimated there would be 99 children in the control group with various percentages of DE and a range of non-participant children from 99-198 with a 45% incidence of DE. The power analysis revealed if 198 non-participants with 45% incidence of DE were used for

the control group, the study would have 82% power in detecting an effect of the ABCD interventions. For that reason, 200 children were selected for the comparison cohort from the Montana Medicaid Query Path with SPSS Version 21.

Human subjects' protection. To assure confidentiality based on MT DPHHS policy, data on both the study population and the cohort were provided to the researcher without identifiers to protect confidential patient information (MT DPHHS, 2013). For that reason, parental consent was not obtained for data collection.

All research conducted at Idaho State University (ISU) involving human subjects must be submitted to the Human Subjects Committee (HSC) for approval. The proposal was submitted to the ISU Human Subjects Committee and was approved for exemption of on September 27, 2013, study number 3973.

Data Collection

Data were collected by a MT DPHHS epidemiologist, Dorota Carpendo, MPH from the Montana Medicaid Query path. ABCD pilot participant (n=99) data were pulled in May 2013 for initial review. Two children in the ABCD population were excluded from the study based on age. The non-ABCD cohort (n=200) data were pulled in October 2013 and randomized using SPSS version 21. Medicaid claim data were sent to the researcher without identifiers to protect confidentiality of the study populations based on MT DPHHS policy (2013). Claim data on the randomized cohort included all medical and dental procedures performed during the retrospective period.

Procedure/protocol. ABCD child participants were included in the study population if they were continuously enrolled in Medicaid during the retrospective period and between zero and 36 months of age at the time of enrollment in the pilot. For the

non-pilot cohort, a randomized sample was obtained from the MT Medicaid Query Path for children born between November 22, 2005 and September 2, 2009, the same age range as the ABCD participants. All children in the randomized cohort were continuously enrolled in Medicaid for the retrospective period.

Instruments. ABCD participant dental claim data were pulled from the MT Medicaid Query Path in May of 2013 to determine the number of pilot participants eligible for the study. Medicaid data were obtained from the MT Medicaid Query Path regarding the non-pilot population medical and dental care procedures in October 2013. Data included all Medicaid claims during the retrospective period. Of the 200 children in the control cohort, 52 were exposed to ABCD interventions during the retrospective period. ABCD exposure was recorded if a child had an oral evaluation code as part of the ABCD program, D0145 or D0150, and any one of the following ABCD preventive services during the same date of service based on claim data:

- D0425, Caries risk assessment;
- D1310, Nutritional counseling; and
- D1330, Oral hygiene instruction.

The preceding three CDT codes were specifically for the ABCD program and offered increased reimbursement to ABCD trained dentists (ABCD Montana Program Report, 2012).

Reliability and validity. An evaluation portion of the ABCD pilot program was not designed during the program development. For that reason and due to the demographic nature of a rural state such as Montana, a secondary data source needed to be identified that could provide the researcher with a reliable data set. Medicaid records

of continuously enrolled children offer complete dental care utilization records. To reduce data errors, only one person abstracted data for the current study.

The researcher was provided CDT Medicaid claim data on all ABCD and non-ABCD children of this study. Standardized CDT codes have long been used in dentistry to document and communicate dental procedures and offer accurate records of dental services performed (ADA, 2012).

Limitations

Due to the nature of a retrospective study several limitations were identified. A significant limitation is that ABCD participants were recruited by the CHC dental clinics by convenience. The participants were not randomly selected, which may contribute to selection bias. Secondly, interventions were completed by the CHCs without researcher input. While the CHC received program training and educational material through the MT DPHHS, there may not have been consistency in diagnostics and preventive interventions. However, it is understood during health care delivery there are often significant variations in clinician knowledge and communication skills. Evaluation of the pilot will reflect variations in clinical care.

While a prospective study would have been an appropriate design for the current research questions, funding and planning did not include an evaluation at the initiation of the pilot program. Solely utilizing Medicaid data files did not allow for other variables to be considered such as parent's education level, age, marital status, and children's ethnicity. Some children in the exposure population were not eligible for Medicaid through the whole retrospective study period which resulted in a small sample population. Lastly, the date of Medicaid claims in the data set was provided to the

researcher by month and year only which required age at the date of service to be calculated from the 15th day of each month procedures were performed.

Statistical Analysis

To test the first two null hypotheses Medicaid claim data were recorded for DE and PDB for each child to determine the mean number of procedures in each study population. Due to non-normal distribution of the data, a Mann-Whitney U test was utilized to compare the mean number of PDB and DE with an alpha level of 0.05.

In answering the third hypothesis, the researcher identified the mean age of children in both populations for first experience of both dependent variables, DE and PDB. A two-sample *t*-test was utilized to compare the mean age with an alpha level of 0.05 related to DE as there was a normal distribution to the data set. For age at first PDB, a Mann-Whitney U test was used as the data did not exhibit a normal distribution. Descriptive statistics were used to report normal or non-normal data. Both dependent variables were investigated regarding the number of dental procedures and the mean, median, minimum, and maximum recorded based on age in months in both study populations.

Summary

To evaluate the ABCD pilot program, ABCD participant children enrolled at zero to 36 months who were enrolled for Medicaid throughout the retrospective period were compared to a randomized cohort of Medicaid-enrolled children in the same age and did not have ABCD program interventions. CDT codes were abstracted from the MT Medicaid Query Path by a MT DPHHS epidemiologist and provided to the researcher with no identifiers to protect patient confidentiality. Due to the use of human subject

data, the research was submitted to the ISU Human Subjects Committee for review and exempt status. Data were reported in descriptive statistics and hypothesis testing was conducted with a Mann-Whitney U test and a two-sample *t*-test ($p<0.05$).

The study manuscript will be submitted to the Maternal and Child Health Journal. Journal guidelines are presented in Appendix B.

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Appendix A

Maternal and Child Health Journal

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As this is primarily a journal devoted to population health, we are not interested in clinical case studies, in papers that are exclusively clinically focused, or in research that does not have an obvious public health focus. Research or practice-based articles from communities within the United States and from countries outside the US are welcome as long as they address issues of maternal and child health that will be of interest to more than a local audience.

Manuscript Style

All manuscripts are anonymously reviewed. Each copy of a manuscript should include a separate title page with authors names and affiliations, and these should not appear elsewhere in the manuscript. Footnotes that identify the authors should be typed on a separate page. Authors should make every effort to ensure that the manuscript contains no clues to their identities.

Abstract

- An abstract of up to 250 words is to be provided, for research articles using the headings: Objectives, Methods, Results and Conclusions and for practice or field-based articles using the headings "Purpose, Description, Assessment and Conclusion".

Key Words

- A list of 4–5 keywords is to be provided directly below the abstract. Key words should express the precise content of the manuscript as they are used for indexing purposes.

Acknowledgements

- All acknowledgments (including those for grant and financial support) should be typed in one paragraph (so−headed) on a separate page that directly precedes the References section.

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- Reports of original empirical research must include a statement in the Methods section or in a cover letter either certifying that the research was conducted in accord with prevailing ethical principles or explaining the rationale for departures form those principles.

  See the APA Publication Manual (1994) pp. 292 298.

Manuscript Length

Authors should limit original research and practice or field-based articles to 3500 words. Notes from the Field or Methodological Notes should be limited to 2500 words. As a general rule, the more concise the presentation the better. Large-scale program

evaluations, complex practice-based interventions, and some quantitative research may be allowed a few additional pages, if there is strong justification provided in a separate note to the editor. There is no need to repeat in text what is presented in tables and figures, and there is no need to repeat information from one section of the narrative to another.
Tables, figures, footnotes, and legends should appear as separate sheets appended to the end of the manuscript.
Tables

- Tables should be numbered in one consecutive series of Arabic numerals and referred to by number in the text. Each table should have a descriptive title.

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ORAL HEALTH OUTCOMES FOLLOWING A PEDIATRIC PREVENTIVE ORAL HEALTH PILOT IN MONTANA

by

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ABSTRACT

Objective: Determine the effectiveness of the 2009 Montana (MT) Access to Baby and Child Dentistry (ABCD) Partnership Pilot to improve child participants' oral health and dental care utilization.

Methods: The retrospective case-control study examined Medicaid dental utilization records of children who participated in the 2009 ABCD pilot program at zero to 3 years of age. ABCD children continuously enrolled in Medicaid during the retrospective period (n=97) were compared to a randomized cohort of children continuously enrolled in Medicaid that did not receive pilot program interventions (n=148).

Results: The populations had no statistical difference in gender ($p=0.602$) and age ($p=0.813$). ABCD children had statistically significant more decay experience (DE) than non-ABCD children with a mean DE of 1.95 and 0.48, respectively ($p<0.001$). The results may be attributed to the increased number of preventive dental behavior (PBD) in the ABCD population with mean number of 2.9 and 0.6 in the non-ABCD population ($p<0.001$). Age at receipt of DE and PDB care was also statistically significant between ABCD and non-ABCD children. ABCD children mean age of first DE was 3.8 versus 4.8 in non-ABCD ($p=0.001$) and 3.2 and 4.1 at the first PDB, respectively ($p=0.001$).

Conclusion: Children not enrolled in the ABCD pilot were less likely to receive dental care and initiated care at an older age. Although in both populations parents did not often return for PDB at the recommended program intervals. Future evaluations should include

dental provider perceptions and utilization of reimbursement coding to determine diffusion of ABCD program interventions.

Key Words: Dental care, Preventive, Pediatric, Public health interventions, Medicaid

While strides were made to decrease dental decay rates and increase the population's oral health status during the mid 20th century through fluoridation of public water supplies and formulations of toothpaste, dental decay remains a significant public health concern in the 21st century [1,2]. The analyses of several national data bases indicate the incidence of dental decay in the US population has not significantly changed since 1999 and in our youngest citizens the incidence has increased [3-7]. Dental decay is the most prevalent chronic disease among American children [1]. Multiple studies have examined the influences adversely affecting oral health and populations at high risk for dental disease [8-10].

In 2000, the United States Surgeon General issued the report Oral Health in America which identified oral health as an essential component of population health. The report also noted the lack of a reduction in early childhood caries over the last several decades [1]. Dye et al. comparing National Health and Nutrition Examination Survey data collected in 1998-1994 and 1999-2004 noted an increase in the prevalence of dental decay in primary teeth, most notably in two-to-four year old children [7]. This finding was consistent with Bell, Huebner and Reed utilizing 2007 Nation Survey of Children's Health data [3]. An important aspect in the increased incidence of dental decay in the pediatric population is lack of utilization of preventive dental care [10,11].

While the American Academy of Pediatrics and the American Academy of Pediatric Dentistry recommend initial oral examinations prior to age one, parents often do not seek preventive dental care unless there is a perceived need for acute dental care [5,12-15]. In primary medical care, young children are often seen by providers numerous times in the first year of life however, medical providers are often not trained or have

adequate time to provide oral health assessments and preventive services [16,17]. Further compounding the lack of utilization is the reluctance of general dentists to see very young children [18]. Dentists report lack of cooperation by pediatric patients and lack of training in pediatric evaluation methods as the most common reasons for not providing care in young patients [18, 19]. Pediatric dentists are more likely to see children at a younger age; however, due to the lack of pediatric dentists in rural areas such referrals may not be an option [20]. Educating primary medical providers, general dentists, and parents about the benefits of early dental care is an important intervention in oral health promotion [14].

Influences on oral health were presented in a conceptual model by Fisher-Owens et al. based on social science and epidemiological studies [21]. The model identifies the interrelated and dynamic factors affecting oral health in children including genetics; biological, social, and physical environments; health seeking behaviors of children and caregivers; and characteristics of the dental care delivery system [21]. Each child has distinct genetic and physical attributes that contribute to the vulnerability for dental disease [3,21]. At the family level, a child's attributes are impacted by the oral health status of parents, especially mothers, and a strong association exists between parental and children's health-seeking behaviors [22,23]. On a community level, dental services available to children are impacted by culture, social environment, public policy, the availability of providers, and provider attitudes [21,24]. Dental care has traditionally focused on individual level interventions such as restorative treatment, dietary counseling, and reducing the level of decay-causing bacteria [12]. However, dental research has evolved to recognize dental health is multifactorial [21,24,25]

While effective health promotion should be the primary determinate of program success, evidence of economic sustainability and positive patient outcomes are necessary elements in preventive program success [26,27]. Looking at multiple levels of influence in designing and evaluating health promotion programs with an ecological approach integrates multiple theoretical and research perspectives [28-30]. In an ecological perspective behavior changes are accomplished through active and passive health interventions that span biological, behavioral, and sociocultural needs while incorporating the environmental resources available in a population [28-30].

Creating a preventive focused environment is imperative to improve the oral health of Americans and reduce the cost of dental care throughout the lifespan [31]. In a five year study of Medicaid-enrolled children (n=9204) Savage, Lee, Kotch, and Vann reported children who had a preventive visit prior to age one were more likely to have subsequent preventive care ($p<0.05$) and less likely to have restorative ($p=0.18$) and emergency care ($p=0.61$) [32]. Pediatric preventive dental care programs have shown modest improvements in oral health outcomes and utilization in other states [33-36]. In Washington State, the Access to Baby and Child Dentistry program has shown an increase in utilization of preventive dental care and improvement in the dental health of Medicaid children [36,37]. A 2012 report regarding the I-Smile preventive dental program in Iowa noted an increase of 62% in the number of children age 0-12 receiving dental services between 2005 and 2012, with the largest increase (141%) noted in the 0-2 age group [38].

The Montana (MT) Access to Baby and Child Dentistry (ABCD) Partnership Pilot program established interventions on multiple levels of influence using an

ecological perspective. The interventions aimed to change family-level perceptions about preventive care and dental decay while changing provider attitudes about early evaluations and Medicaid reimbursement. ABCD pilot dentists were trained in pediatric oral evaluation methods, preventive care, risk assessment, and family-oriented oral health education. Providers were also asked to conduct a caries risk assessment on each child during the initial oral evaluation. High-risk children were offered increased frequency of preventive visits, up to six visits per year, with enhanced provider reimbursement for preventive procedures. Family members of pediatric participants were counseled in oral hygiene, recommended dental care intervals for infants and toddlers, and the transmission of decay-causing bacteria. By addressing barriers, the pilot provided an opportunity to increase utilization of preventive care in high-risk populations and improve oral health outcomes for MT children [39].

The focus of the MT ABCD Partnership Pilot program was to initiate preventive dental care prior to age one to promote positive oral health behaviors and outcomes through education and training of the dental community and families of Medicaid-enrolled children [39]. The purpose of the case-control study was to determine the effectiveness of the ABCD Partnership Pilot program to increase preventive dental care utilization and reduce the rate of decay experience in MT children.

Methods

To evaluate the MT ABCD Partnership Pilot program, Medicaid utilization records for the study population were retrieved from the Montana Medicaid Query Path. Dental procedure (CDT) codes were extracted for children enrolled in the ABCD pilot and a sample of non-ABCD children who were continuously enrolled in Medicaid during

the retrospective period from October 2008 to May 2013. Standardized CDT codes have long been used in dentistry to document and communicate dental procedures and submitted to Medicaid by dental providers for reimbursement of services [40].

Of the Medicaid-enrolled ABCD children age 0 to 36 months (n=170), 97 were eligible for the study based on age and continuous Medicaid enrollment. A sample of 200 children was randomized with IBM SPSS version 21.0 for the comparison cohort. Fifty-two of the comparison children were excluded from the study based on exposure to ABCD program interventions during the retrospective period. Exposure to program interventions was determined by ABCD evaluation coding (D0145, D0150) in combination with one CDT coding specific for enhanced reimbursement for ABCD trained dentists: caries risk assessment (D0425), nutritional counseling (D1310), and oral hygiene instruction (D1330) [39]. Fluoride varnish applications (D1206) were not used for the exclusion criteria as some dental providers use fluoride varnish routinely outside of the ABCD program and the service is reimbursed by Medicaid for non-ABCD trained dentists. Following the exclusion, 148 children remained in the comparison cohort. Data were analyzed without identifiers to protect confidentiality and exempt from review by the Idaho State University Human Subjects Committee, #3973.

Three hypotheses were investigated as part of this study:

- There is no statistically significant difference in the incidence of dental decay of Medicaid-enrolled children participants of the ABCD pilot program when compared to a cohort of Medicaid-enrolled children that did not participate in the pilot.

- There is no statistically significant difference between the preventive dental behaviors of Medicaid-enrolled children participants of the ABCD pilot program and a cohort of Medicaid-enrolled children that did not participate in the pilot.
- There is no statistically significant difference in the mean age of decay experience and preventive dental behavior during the retrospective period between the two study populations.

Two variables were investigated related to this study:

- Decay Experience (DE) was defined as a restorative dental filling (D2000-2999) or extraction (D7111 and D7140) [40].
- Preventive dental behavior (PDB) was defined as an oral evaluation by a dentist in a dental clinic or private dental practice. Oral evaluation CDT codes representing PDB in this study included D0120, D0145 and D0150, the latter two codes were identified in the ABCD program for enhanced reimbursement [39,40].

This study varies from other studies regarding PDB as a portion of the study population was not old enough to have a dental prophylaxis or fluoride application based on age and development of teeth. The utilization records of study participants were coded 0 for no utilization and 1 for utilization to determine the number of DE and PDB. The age at first utilization of PDB and DE was also noted for both variables based on claims data.

Data were analyzed using IBM SPSS version 21.0. Study variables were examined to compare the frequency and age of first DE and PDB in the case and control

populations. Age at first DE was the only study question with a normal distribution therefore a two-sample t-test was used in hypothesis testing. Comparison for the remaining study questions were examined using a Mann-Whitney U test due to the small population size and lack of normality.

Results

The study included 245 children continuously enrolled in Medicaid during the retrospective period, 97 ABCD enrolled children and 148 non-ABCD children. The study population was 49.8% male and 50.2% female. No statistical difference in gender was found (p=0.602). The current mean age of the children was 6.1 years in both populations. No statistical difference in age of the two groups was found (p=0.813).

ABCD children had a mean age of enrollment of 1.7 years and received PDB at a younger age following enrollment (mean=3.2, SD=1.155) than the non-ABCD children (mean=4.2 years, SD=1.536; p=0.001). Over one-third (37.6%) of the study children did not receive dental care during the retrospective period, although all of the ABCD enrolled children received care. Ninety-two (62.2%) of the 148 non-ABCD children did not receive any type of dental care.

Decay Experience

Table 1 summarizes DE and PDB in the study population. Ninety-two (37.6%) of the 245 children in the study population had a DE during the retrospective period. Twenty-eight (18.9%) of the non-ABCD children had a DE; however, only 56 (37.8%) children in that population sought any type of dental care. ABCD children had a significantly higher rate of DE (66.0%) which may be reflective of the increased diagnosis of decay related to higher utilization. The results support the study hypothesis

that there is a significant difference in the rate of DE in the two populations ($p<0.001$); however, due to a low rate of utilization of dental care in the non-ABCD population these results exhibit a higher rate of DE in the ABCD population.

Preventive Dental Behavior

A significant portion of the children (45.3%) in the study population did not receive PDB (n=111). In comparing the two study populations, 108 (73.0%) of the non-ABCD children did not seek PDB while only three children (3.1%) in the ABCD group did not receive PDB following enrollment in the program. These results indicate children in the ABCD population had increased PDB during the retrospective period which was statistically significant ($p<0.001$). Non-ABCD children were significantly less likely to receive PDB and with less frequency, although frequency of PDB in both populations did not follow ABCD program criteria for high-risk children. Only 38 (15.5%) children had four or more PDB claims, of which eight (3.2%) were in the non-ABCD population.

Age of Dental Care Utilization

Table 2 highlights findings concerning the age of dental care utilization. The mean age of first DE was higher in non-ABCD children at 4.8 years versus 4.1 years in the ABCD children, which may reflect earlier initiation of dental care in ABCD children. The age range of ABCD children with a DE (n=63) was 1.4-6.3 years compared to 2.2–7.0 years in the non-ABCD children with a DE (n=28). The results support the hypothesis there was a significant difference in age related to DE ($p<0.001$); however, due to the later initiation of care and lack of utilization of dental care in the non-ABCD population, the results reflect ABCD children experienced decay at a younger age.

Non-ABCD children experienced a one year delay in receipt of PBD in comparison to ABCD children with a mean age of 3.2 years and 4.2 years, respectively (p=0.001). However, only 40 (27.0%) of the non-ABCD children received PDB. The age range of receipt of PDB was 1.0-6.3 years in ABCD children and 1.8-7.1 years in the non-ABCD children. These results indicate that both DE and PBD exhibited a significant difference in age of utilization, although children enrolled in the ABCD pilot program experienced decay at an earlier age. This finding may also be attributed to the increased utilization of dental care in the ABCD children.

Discussion

This research aimed to evaluate the effectiveness of a preventive-focused pilot program in Montana among a population of pediatric children. Given the high rate of DE in both populations along with the low utilization of dental care in non-ABCD children, changing the perception of dental care utilization at an early age should remain the primary focus of future interventions. While the preventive interventions did not exhibit a profound reduction in DE in the ABCD population, diagnosis of dental decay at an early age may prevent more invasive and expensive dental treatment [12].

Continued focus on early preventive care may need to be initiated in settings where children actively access other public health interventions and early education rather than focusing solely on delivery of care in private dental offices and clinics. Working with Early Head Start, Women Infants and Children programs, preschools, and daycare facilities to initiate early assessments and change the perception of oral health among parents may increase the number of young children receiving dental care by the recommended age of one year [13]. Although the age of initiation of dental care was

younger in ABCD pilot program children, this study reflects that children did not often follow the recommended high-risk preventive dental care intervals. Only 15 of the children in the study population had six or more PDB appointments during the three year study time frame, which would be consistent with recommended dental care of two visits per year. While the ABCD program reimburses dentists for up to six preventive visits in a year for children identified as high-risk, only two of the children had ten or more PDB visits during the three year retrospective period.

Regarding the diffusion of the ongoing ABCD program, of the 200 children pulled for the non-ABCD cohort only 52 (26.0%) children had exposure to the current ABCD program with a mean age of exposure of 3.3 years. The low level of exposure and the age at the time of exposure to the ABCD program interventions may reflect a need to focus more attention on communication to dental providers and staff about the ABCD interventions and goals. Educating primary medical providers in early oral health evaluations and dental referrals may also offer an opportunity to increase the diffusion of the current ABCD program. Future evaluations of the ABCD program should include an evaluation of the number of providers offering ABCD interventions and the ages and frequencies of children receiving care as part of the program.

This study offers a unique perspective of preventive oral health interventions in pediatric children in Montana. The study population is small which limits the ability of the researchers to generalize study findings. While Medicaid records offer a data set of dental care utilization, the researchers understand that a prospective study would have provided an opportunity to randomize and potentially include demographic information about the study population. The data also did not offer insight in to the number of

children who failed to attend appointments related to community or family-level barriers. Creating evidence-based interventions to improve oral health outcomes requires program planners to use unique data sets and maintain transparent and detailed reporting to continue to build the body of science in dental public health initiatives when funding for program evaluation is not available.

Conclusion

The results of this study indicate that children not enrolled in the ABCD pilot were less likely to receive dental care, more likely to initiate care at an older age, and more likely to have DE upon initiation of care, findings which are consistent with previous research [32,35,36]. Children in the ABCD pilot received more PDB and an increased number of DE dental procedures. A higher rate of DE in ABCD children may reflect the increased utilization of care resulting in increased diagnosis of dental decay.

The low rate of utilization and high rate of decay in the non-ABCD population that sought dental care corresponds with previous research that indicates dental care seeking behavior of young children is often related to a perceived need by parents [3]. Given the lack of accuracy of parental oral assessments, especially in very young children, continuing to change the perception of preventive dental care at the family-level interventions through the ABCD program may offer improved oral health outcomes to Montanans [14,21]. The ABCD pilot program was successful in initiating care at a younger age but the effectiveness of the current ABCD program will need to be evaluated more thoroughly to determine oral health outcomes of children participants. Lastly, future program planning may be needed to focus on increasing the diffusion of the ABCD program.

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Table 1. Number of decay experience and preventive dental behavior in the study population

	ABCD children (n=97)	Non-ABCD children (n=148)	All study children (n=245)
Number of PDB			
Mean	2.85	0.62	1.5
Median	2	0	1
SD	2.157	1.306	2.011
n	94	40	134
p-value			<0.001
Number of DE			
Mean	1.95	0.48	1.06
Median	1	0	0
SD	2.172	1.192	1.797
n	64	28	92
p-value			<0.001

Table 2. Age of study children at first decay experience and preventive dental behavior

		Age at first DE	Age at first PDB
Non-ABCD children (n=148)	Mean	4.8	4.1
	Median	4.7	4.2
	SD	1.324	1.536
	Range	[2.2-7.0]	[1.8-7.1]
	n	28	40
ABCD children (n=97)	Mean	3.8	3.2
	Median	3.7	3.1
	SD	1.197	1.155
	Range	[1.4-6.3]	[1.0-6.3]
	n	63	94
Total (n=245)	Mean	4.1	3.5
	Median	4.2	3.3
	SD	1.308	1.349
	n	91	134
	Range	[1.4-7.0]	[1.0-7.1]
	p-value	0.001	0.001