Medical professionals' oral health knowledge, attitudes & related practices performed for high caries-risk children

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Recommendation Citation
MEDICAL PROFESSIONALS’ ORAL HEALTH KNOWLEDGE, ATTITUDES AND RELATED PRACTICES PERFORMED FOR HIGH CARIES-RISK CHILDREN

by

Yousef Mohammed Yousef

An Abstract

Of a thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Oral Science in the Graduate College of The University of Iowa

December 2011

Thesis Supervisor: Professor Peter Damiano
ABSTRACT

The past few decades have witnessed an increased focus on the importance of oral health on the social, psychological and developmental well-being of children. Although effective and advanced dental prevention measures and treatment options are increasingly available, dental decay remains one of the most common chronic childhood diseases in the United States and around the world. (Passel, 2002) Recently, the World Health Organization Assembly called attention to the significant burden oral disease has maintained in all countries around the world. In response to this issue there has been renewed focus on combating access to oral health care issues. (WHO, 2010)

One approach that has been suggested is the utilization of non-dental health professionals in assessing oral health, performing basic preventive steps and referral of high-caries risk children for further care. These non-dental professionals are often in a better position to evaluate children at an early age, are more likely to see poor children early and to provide care for them on a continuing basis when compared to dentists. (Lewis, 2004)

However, several barriers have been mentioned in the literature that prevent or deter these non-dental health professionals from taking on a more active role in this access to care issue. Of which, has been a reported lack in oral care education and training for medical care professionals. Additionally, collectively few studies have specifically identified the importance of different suggested influencing factors. (Mouradian, 2005)

In our present paper, we reported on three main studies that were conducted in an effort to better understand these barriers. In our first study a 22-item survey was mailed to all licensed pediatricians in the state of Iowa. The main research questions revolved around what factors influence the ability and willingness of Iowa pediatricians' to assess and refer high caries-risk children. In our second and third studies we targeted Saudi medical interns with an electronic educational intervention program over the course of a month. Both a pre- and post-
test were performed to evaluate the effectiveness of this program in improving intern's knowledge, willingness, and comfort levels in identifying children who are at high risk for developing dental caries. Appropriate bivariate and regression analysis methods were used to analyze the data.

Collectively, these three analyses lead us to several main conclusions and future education recommendations. Educating medical practitioners and students about basic oral health recommendations and referral guidelines provides an excellent opportunity to alert medical professionals about the importance and timing of these dental referrals. Ultimately, earlier referrals by physicians can help improve dental utilization among high risk children, especially among lower income and rural families. Additionally, providing these medical professionals with experience opportunities in assessing the oral health of young children may improve both physician willingness and likelihood to perform various oral health practices for young children. Overall, increasing both knowledge and personal experience of training physicians' could lead to greater comfort levels in dealing with oral health issues affecting young children. Furthermore, establishing effective care coordinator services to assist in linking various health care professionals more directly; may also increase physician willingness to assess and refer high-caries-risk children by making the referral process easier for physician offices. This step helps in saving time and effort, two deterrents noted by physicians.

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December 2011

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PH.D. THESIS

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ACKNOWLEDGMENTS

This journey has been a personal test of will. Although several obstacles presented themselves along the way, I always believed I would be able to produce a fruitful effort in the end. The tireless support, understanding and enthusiasm of my committee provided the backbone I needed to fulfill this project.

I am extremely thankful to all of my committee members, Drs Damiano, Weber-Gasparoni, Murph, Nothwehr and Qian, for sharing their expertise, knowledge and valuable insights that were critical to the successful completion of this study. I would like to thank you all for your patience and guidance throughout this process, it was very much appreciated.

My special thanks to all my friends and colleagues in the Department of Preventive and Community Dentistry.

Finally, I would like to thank my beautiful, loving wife Tahani for her unconditional love and support, and my daughters Jena and Hawra for always putting a smile on my face. Having you all to come home to made getting through the days much easier.
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One approach that has been suggested is the utilization of non-dental health professionals in assessing oral health, performing basic preventive steps and referral of high-caries risk children for further care. These non-dental professionals are often in a better position to evaluate children at an early age, are more likely to see poor children early and to provide care for them on a continuing basis when compared to dentists.

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CHAPTER I
INTRODUCTION

The introduction section is divided into the following subsections: 1) Overview; 2) Background and rationale of the proposed research; 3) Previous work; 4) Problem statement; 5) Study purpose and significance.

Overview

In the following project we attempt to add to the oral health promotion and disease prevention literature through two studies that both target non-dental health professionals. The first study targets pediatricians in Iowa with a written survey containing questions on oral health knowledge, practices, and referral patterns and potential barriers. In the second study, Saudi medical interns are targeted with an electronic informational intervention covering several basic oral health issues and subsequently, their oral health knowledge, willingness to perform several oral health practices and self-expressed future intentions pertaining to these practices were assessed with a similar survey to the first study.

Given the scarcity of research in this area it is still unclear whether non-dental health care professionals’ are able and/or willing to adequately identify and/or address oral health problems in children at high risk for oral disease. Furthermore, additional information is needed on the characteristics of medical health care providers that influence their decisions and willingness to refer children who are at risk for dental disease to a dentist. As a result the present studies were performed to determine the comprehension of medical providers regarding basic oral health knowledge and oral disease prevention; their abilities and willingness in identifying children who are at high risk for dental caries and other oral health problems; and to enhance their confidence in performing the needed risk assessments and referrals.
**Background and Rationale of Proposed Research**

In 2008, the World Health Organization (WHO) Assembly -again- called attention to the significant burden oral disease has maintained in all countries around the world. The WHO Global Oral Health Program (ORH), ”one of the technical programs within the Department of Chronic Diseases and Health Promotion”, approach to improving oral health globally, especially among the elderly, children and lower income populations, is based on the 2007 World Health Assembly Resolution of integrated health promotion and disease prevention.

Given the importance of oral health as an integral part of complete health and a fundamental factor of quality of life, the ORH has implored the world community to prioritize the integration of oral health with other community general health programs. The WHO has also supported the work towards the reorientation of oral health systems from their treatment basis to systems directed towards disease prevention and health promotion. This recommendation was made in light of the conclusions of “the Ottawa Charter, the primary health care concept and the Jakarta Declaration on leading Health Promotion into the 21st Century. In addition, global goals for oral health by the year 2020 are specified for development of quality of oral health systems”. (WHO, 2010)

In the U.S. this reemphasis on oral health and its importance to the general well being of the individual and the community was made through the 2000 Surgeon general’s report on Oral Health in America (Surgeon General, 2000). This renewed focus and heightened awareness of the public towards oral health served to drive the dental community to explore feasible and effective solutions for several evident oral health problems.

Although effective and advanced dental prevention measures and treatment options are increasingly available, dental decay remains the most common chronic childhood disease in the United States with an estimated 2.5 million children aged 2 - 5 years suffering from tooth decay
(Passel, 2002). Additionally, the prevalence of caries - about 50% in mid-childhood - has not changed in recent years. (Passel, 2002)

Multiple studies have described disparities in oral health with an estimated 25% of the child population between the ages of 5 and 17 in the U.S. suffering approximately 80% of the total caries. (Surgeon General, 2000; Passel, 2002) This disproportionate amount of dental disease - in particular dental caries- concentrated in children from poor and underserved families, contributes to the current problem in access to dental care.

Multiple studies have documented the lack of access and utilization of dental services by children who are Medicaid eligible that is, children from poorer families. (Bloom, 1992; Children's dental services under Medicaid-access and utilization; Monheit, 1992; US Inspector General, 1996; Newacheck, 1997; Mayer, 2000; Newacheck, 2000; General accounting office, 2001; Edelstein, 2002; Krol, 2004). Documentation shows that only 1 child out of every five in Medicaid receives dental treatment. Additionally, close to 75% of children ages 3 to 4 years have not made the recommended number of dental visits (Bright Futures in Practice, 1996). These unmet oral health needs of children - specifically those who are at higher risk - raise questions regarding the effectiveness and capacity of the dental and auxiliary health care professionals (dental assistants, hygienists, etc) and their receptiveness to their role in the treatment of children.

Similarly, in Saudi Arabia, the past few decades have witnessed an increased focus on oral health and the social, psychological and developmental consequences of untreated oral disease. Although children may be affected by one of any number of oral diseases, dental caries, as a disease is influenced by several determinants, which include social and educational background, dietary factors, oral hygiene practices, frequency of dental visits and fluoride experiences. Several studies (Al Wazzan, 2004; Al-Yousef, et al; 2002; Gandeh, et al, 2000; Al Sekait, et al, 1998; Wyne et al, 1995; Al Shammary, et al 1990) over the past two decades that have focused on dental
caries prevalence, severity, distribution among geographical areas and age groups, and overall patterns of spread have indicated that as a disease, dental caries remains the most prevalent chronic childhood disease facing the children of Saudi Arabia. Similar to other developing nations caries rates remains high, especially in the primary (childhood) teeth. (KSA- Annual health report, 1999).

Several recent clinical studies (Amin, et al 2009; Al-Malik, et al 2003; Paul, 2003) have demonstrated carious levels at around 70% in children under the age of 5 years. Additionally, these studies have indicated that a very small proportion of young children are caries free, at an average of 12% along different age intervals and geographical areas.

Furthermore, several factors associated with high levels of dental caries among children under 5 years old have been recognized (Amin, et al 2009). The main factor identified was a lack of oral health knowledge among parents and children, and subsequently a lack of adequate oral hygiene practices. Another primary factor identified by researchers was a lack of regular dental visits by children, with approximately 60% having never been to a dentist by age 5 (Amin, et al 2009). This lack of appropriate access appeared to be more prominent in rural areas (Amin, et al 2009).

In 2007, the Saudi Arabian Ministry of Health and a newly structured Health Services Council published their customary future 5-year strategic health plan for the country (MOH, 2007). In this plan several of the key challenges facing health care in Saudi Arabia were outlined and the proposed solutions and regulatory reforms were also identified. One of the main problems identified was a clear lack of efficiency in the service delivery system. This lack of efficiency has been illuminated in the lack of coordination among public systems and with the private sector; a lack of health care planning resulting in duplication and lack of effective integration among the primary, secondary, and tertiary care systems; and the absence of a modern incentive-based medical care provider payment systems. One of the main factors leading to this has been an
absence of data that would help in appropriate decision- and policy-making, especially regarding possible avenues of coordination among the multiple public agencies in the finance and delivery of patient health care (MOH, 2007).

As a result there has been a push to improve quality of care, access and efficiency issues related to the current health care system. Most notably, the Health Services Council has been directed to oversee coordinating all health care providers into a national and integrated system that would also include the private sector. This would also involve coordination with the established educational and training institutions in Saudi Arabia to provide data needed to make essential policy and evidence based decisions regarding health care issues (MOH, 2007). Additionally, there has been increased focus on developing a merged public health delivery system with a national public health strategy focused on primary care and prevention. (MOH, 2007) To assure efficiency this would also include the development of effective referral guidelines and a human resources master plan for the country (MOH, 2007).

**Previous Work**

In response to these abovementioned challenges, previous studies have focused efforts on looking at alternative approaches to increase access to dental care. One avenue that has been suggested, by both medical and dental public health researchers (Lewis et al, 2000; Mouradian et al, 2000; Pierce et al, 2002; Rozier et al, 2003; dela Cruz et al, 2004; Gonzales et al, 2004), for improving access to oral health care has been attempting to recruit primary care physicians to play a more active role with regard to oral health issues. The fact that they are more likely to see children (regardless of income or coverage) at a young age (Lewis et al, 2000; Lewis et al, 2004) and visits occurring in a more regular fashion (Schafer et al, 2000; Mouradian et al, 2003), permit them to play a vital role in the oral health of children. As a consequence, these medical health care professionals are in an opportune position and see children at an early age allowing them to
perform simple yet essential oral health activities that would in turn lower the burden on dental professionals and increase the likelihood that dental care for these patients would be met. This is especially evident with the ever-declining pediatric dentistry faculty and specialist's workforce in Iowa and the apparent unwillingness or inability of general dentists to cope with young children.

The fact that this area has not been fully utilized is primarily a product of insufficient research into the factors affecting physicians’ oral health knowledge, comfort levels in assessing dental caries risk and the need for dental referral. In fact, a visible response to the Surgeon Generals’ Oral Health Report was the development and advocacy for oral health training programs for medical residents and practicing physicians (Douglas, et al, 2009). These programs were advocated by the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the Society of Teachers of Family Medicine (STFM) (Douglas, et al, 2009). These training programs focused on preparing physicians to perform oral health screenings, preventive strategies, and aid in appropriate referrals to dentists (Douglas, et al, 2009). Furthermore, medical schools have introduced and developed voluntary dental rotations and mandated curricular classes focused on oral health education for family medicine residents (Douglas, et al, 2010). Several initiatives engaging practicing physicians in oral health activities have demonstrated improved access and reduced dental disease in children, but evaluation of all programs is essential to determine cost effectiveness and outcomes.

Unfortunately, there has been a noticeable separation of medical and dental education and delivery of care, as physicians have had little involvement in oral health care of children. (delacruz, 2004) The initiatives of AAP, AAFP, STFM, and others have helped break down this traditional separation (Douglas, et al, 2009). However, the knowledge base for inclusion of non-dental health care professionals in oral health care remains scarce, as collectively few studies have looked at the effectiveness and outcome results of medical students' education and training in oral
health. “Collaboration between physicians and dentists should be encouraged at all levels of education to ensure improvement of the oral health of America's children” (Douglas, et al, 2009). This statement echoes especially true regarding the health care studies done in Saudi Arabia.

Krol (Krol, 2004) reviewed the literature on pediatric oral health training for pediatricians at the undergraduate, residency and practitioner level and concluded that there was insufficient content and no coherent approach for integrating oral health into pediatric training. Another survey addressing the adequacy and comprehensiveness of dental instructions in U.S. and Canadian medical schools reported that comprehensive instructions on dental topics did not take place in any of the surveyed schools. (dela Cruz, 2004)

**Problem Statement**

Although efforts have been made towards better understanding the best approaches to build inter-professional cooperation that may help alleviate access to care barriers several questions still remain regarding non-dental health care professionals' abilities and willingness to adequately identify oral health problems and children at high risk for oral disease. Are physicians being taught basic dental knowledge in medical schools? What topics are being taught and in what capacity? Is the training at an adequate level to instill confidence and competency? Furthermore, what characteristics of medical providers influence their referral of children who are at risk for dental disease to a dentist? Are public health care programs sufficiently linking physicians and dentists in a way that would facilitate referral systems?

Consequently, the following research projects attempt to determine the comprehension of medical providers regarding basic oral health knowledge and oral disease prevention; their abilities and willingness in identifying children who are at high risk for dental caries and other oral health problems; and to enhance their knowledge and associated confidence in performing the needed risk assessments and referrals through an educational intervention.
**Study Purpose and Significance**

The primary purposes of the first study that targets pediatricians in the State of Iowa was to evaluate Iowa pediatricians’ oral health knowledge, oral health related practices, factors influencing their willingness, perceived comfort and ability to assess caries-risk in children and to refer high caries risk children to dentists for treatment. Of particular concern were the referral capabilities and barriers that medical care providers have when attempting to refer high-caries risk children. The findings of this study attempt to identify and clarify these influencing factors and provide groundwork towards future analytic and intervention studies and policies.

In our second study we attempted to address these issues by targeting Saudi medical interns. The primary focus of this study was to assess the effectiveness of an electronic informational intervention on improving primary care practitioners' knowledge, willingness, and comfort levels in identifying children who are at high risk for developing dental caries.

The aims proposed by this study were put forth at a very opportune time; given the current developmental timeline of health care in Saudi Arabia. To begin with, our program targeted medical interns who, in the present health care system, represent the first line of care as the majority of graduates work within the primary care network. (KSA- Annual health report, 1999) Secondly, given the expected reforms to the health care system – some of which have already passed – these physicians will not only be expected to assess health care needs as a part of their regular role but will also assume check-points of referral in all health care matters, including dental health care needs. (MOH, 2007) Thirdly, given that the population of Saudi Arabia is a very young one, with 50% of the population being under the age of 15 years and 12% under the age of 5 years, there is a clear need to develop programs that assess barriers to access of care for children. Additionally, the emphasis of the Ministry of Health has turned towards a more efficient inter-disciplinary delivery system of health care services which in turn would help lessen increasing
health care concerns. Ultimately, determination of the effectiveness of performing an educational intervention for Saudi medical providers focused on oral health may help improve young Saudi children’s ability to access needed oral health care services more readily and efficiently.

Lastly, it is important to note that both these studies attempted to address a gap in the oral health promotion and prevention literature regarding the lack of adequate information on the willingness and capability of non-dental health professionals in assessing and performing several oral-health related practices.
CHAPTER II

LITERATURE REVIEW

The literature review section is divided into the four general sections: 1) Oral Health in the U.S. (Iowa) and related barriers; 2) Oral Health in Saudi Arabia and related barriers; 3) Addressing access to care issues; 4) Summary statement; 5) Purpose of the thesis.

**Oral Health in the U.S. and Related Barriers**

**Oral Health of Children in the U.S.**

Oral health has long been restricted to the health of teeth. Over the past several decades multiple studies and the scientific literature have shown that this simplification and restricted association is not accurate. Oral health goes well beyond the health of teeth to include the entire oral and craniofacial well-being of a person (Surgeon General, 2000). Additionally, for children the implications of the health of these structures go beyond appearance to include the functional, nutritional and psychological development of a child. (Surgeon General, 2000)

Moreover, oral health can be a sign of general health and well-being. It is this message that the Surgeon General's Report in 2000 tried to convey. (Surgeon General, 2000) This report was based on a comprehensive review of the published scientific literature. It served to summarize the state of oral health in the United States, through a broad account of oral and craniofacial conditions; their distributive statistics, the characteristics of those at most risk and the steps that had or were being taken to combat these diseases and conditions.

Despite the advances in oral health care and oral disease prevention, the prevalence of caries has not decreased in the past decades. (Surgeon General, 2000; Oral Health in the United States: the national survey, 1986-87; Edelstein, 1995) The prevalence of caries is approximately 50 percent in mid childhood (Healthy People 2000) with the percentage increasing to 78% among 17
year olds (Oral health of the United States children, 1986-87). Moreover, in 1995, a review of the 1986-87 survey of oral health among schoolchildren conducted by the National Institute of Dental Research, showed that the survey “fail[ed] profoundly to reflect the extremity and severity of this [dental caries] still highly prevalent condition of childhood.” (Edelstein, 1995) This failure was reflected in the fact that dental disease in the primary dentition was ignored. (Edelstein, 1995)

Caries remains the most common chronic childhood disease (Nelson, 1996; (Healthy People, 2000; Oral Health in the United States: the national survey, 1986-87) in the United States. It is 5 times more common than asthma and 7 times more common than hay fever (Surgeon General, 2000). In spite of the fact that caries is a preventable infectious disease, close to 2.5 million American children between the ages of 2 and 4 are affected today. (Passel, 2002)

Parents are increasingly aware of the detrimental health and financial consequences of caries. They have noted in national surveys (National Health Interview Survey, 2001; Edelstein, 1999) that dental needs were the most common of all unmet health needs.

Disparities in Caries Distribution in the U.S.

One of the major findings highlighted in the "Oral Health in America Report" by the Surgeon General in 2000 was the evidence of "profound and consequential oral health disparities within the U.S. population.” (Surgeon General, 2000) It is widely recognized that roughly 25% of the child population (which is around 20 million children) suffer 80% of the burden of total caries. (Surgeon General, 2000; The Reforming States Group, 1999) Those mostly affected are the very young children, children from low socioeconomic and minority families, those living in rural areas and children with special needs. (National Call to Action to Promote Oral Health) Children from poor families are 3 times as likely to have unmet dental care needs compared to children from high-income families. (Edelstein, 2002; Waldman, 1998) Similar disparities in oral disease and lack of oral health care span through all stages of childhood development (US Inspector General, 1996).
Low-income preschool children are twice more likely to have cavities than are higher income children. (Mouradian, 2000) The level of difference between low and high-income children decreases somewhat in school-aged children, but remains apparent. Studies show that low-income school-aged children have 1.2 -2.2 times more decayed teeth, and adolescents have 1.2 times more decayed teeth than do their more affluent peers. (Edelstein, 2002) The latest National Health Interview Survey series carried out in 2001 (National Health Interview Survey, 2001) indicated that approximately 3.7 million children between the ages of 2 and 17 (6%) stated that their unmet dental needs were because their families could not afford dental care.

Disparities in Oral Health Care in the U.S.

Disparities in oral disease are furthered by disparities in attaining appropriate oral health care. Children from middle and high income families experience twice as many preventive dental visits, including cleanings, fluoride treatments and sealants as do poor or near poor children. (Edelstein, 2002)

Furthermore, although low-income children have the highest rates of dental insurance coverage in general because of Medicaid; "most low-income children enrolled or eligible in Medicaid do not obtain dental services." (Children's Dental Services under Medicaid –Access and Utilization) As a result, Medicaid-eligible children who have cavities have twice the number of decayed teeth and twice the number of dental visits for pain relief than children from higher income families. (Edelstein, 2002) In addition, they have fewer total dental visits and fewer preventive dental visits, which in turn increase the future burden of disease in these low-income children. These disparities continue into adolescence and young adulthood. (Edelstein, 2002)

The disproportionate amount of dental disease, the increasing number of children from poor and underserved families represented (Passel, 2002) and the lack of equivalent preventive dental care for these children are clearly linked to problems in access to dental care. Multiple
studies have documented the lack of access and utilization of dental services by children who are Medicaid eligible. (Bloom, 1992; Children's dental services under Medicaid-access and utilization; Monheit, 1992; US Inspector General, 1996; Newacheck, 1997; Mayer, 2000; Newacheck, 2000; General accounting office, 2001; Edelstein, 2002; Krol, 2004).

The recent US Inspector General, 1996’s report shows that only 1 child out of every 5 poor children enrolled in Medicaid receives preventive dental care in a given year. Additionally, nearly 75% of children who are 3 to 4 years of age have not made the number of dental visits recommended by Bright Futures (Bright Futures in Practice, 1996), an oral health project supervised by the National Maternal and Child Oral Health Resource Center in collaboration with federal, state, and local agencies; which aims to improve oral health services for infants, children, adolescents, and their families. (Bright Futures in Practice, 1996)

**Oral Health in Iowa**

In 2005, the Oral Health Bureau within the Iowa Department of Public Health (IDPH) conducted its seventh annual open-mouth survey (Oral Health Survey Report: FY05) of third grade children in Iowa. The survey collected data pertaining to the payment source of dental care, participation in free/reduced lunch programs, recency of a child's last dental visit, and whether or not a child had a usual dental provider. In addition, oral examinations were conducted to determine "the number of children with at least one permanent first molar with a sealant, the number of children with at least one cavitated lesion in any tooth, and the number of children with at least one restored (filled) tooth." These screenings were conducted by dental hygienists who were recruited and subsequently underwent calibration training via the Iowa Communication Network (ICN). It should be noted that the dental screenings were done visually with only the aid of a toothbrush.

The results of this open-mouth survey indicated that out of the 1115 students screened (from the 1701 students randomly selected for screenings); 27.1% participated in the free/reduced
lunch program; of which 29.8% were not insured for dental care and 17.9% were covered under Medicaid or Hawk-I (Iowa's State Children Health Insurance Program). Of those children in the free/reduced lunch program, 25.1% had at least one cavitated lesion (20.1% of those in Medicaid/Hawk-I) compared to 14.5% of children not eligible for the free/reduced lunch program.

The Oral Health Bureau reported an overall increase of children with a dentist compared to 2004, with an increase from 87% to 91.4% for children with no dental insurance and from 80% to 84% for children on Medicaid or Hawk-I. Additionally, they reported an overall increase in sealant rates from 43.3% to 59.9%. However, they attributed these increases in percentages of children with a dentist and with a sealant to an overall decrease in the number of low-income children surveyed in 2005 compared to previous years. (Oral Health Survey Report: FY05) It is also important to note that 25.5% of children under Medicaid or Hawk-I had not had a dental visit within the past year and 61.5% had not seen a dentist within the past 6 months, compared to an average of 20.6% and 68.8% in respective categories for all children.

The report concluded that there was a marked under-use of cost-effective preventive measures, particularly among low income and minority children. The report suggested a need to better identify children eligible for Medicaid or Hawk-I, support care-coordination efforts through Iowa's Title V child health contractors, and encourage and increase collaboration with medical providers to assess the oral health of infants and children and then refer them to a dentist by age one. (Oral Health Survey Report: FY05)

A recent review in 2005 (Rodgers,2005) summarized the strengths, weaknesses and overall status of the oral health of Iowa children based on data collected through Medicaid, oral health surveys, school-based sealant programs, and summary reports of meetings and forums discussing oral health within the state. Several key points can be deduced from this summary regarding access and utilization of dental care by the children of Iowa:
Similar to national trends, children of low-income families, those with no insurance or those covered through Medicaid have more untreated decayed teeth compared to the overall rates for children.

"Between 2000 and 2004, there has been a steady increase in the percentage of Medicaid children receiving any dental care. Although this is somewhat encouraging, there are two points to keep in mind. First, these rates reflect "any" dental service based on one billing to Medicaid. With oral health issues this is hardly satisfying; as the goal is to provide comprehensive and complete oral health care"(Rodgers, 2005), additionally this doesn't equate to each child having a dental home where they can access care (Rodgers, 2005). Secondly, the results also reveal that still "more than 50 percent of Medicaid enrolled children are not receiving any dental services." (Rodgers, 2005)

A major reason put forth by the authors as contributing to the increased overall enrollment rates and dental services rates was” the combination of additional services provided by dental hygienists  and improved care coordination and referral effects…” (Rodgers, 2005)

Another prominent barrier to access to care is the shortage in dentists, particularly in rural Iowa. The report stated that "currently 71 of Iowa's 99 counties are designated as dental health professional shortage areas (HPSA)." (Rodgers, 2005)

Overall rates show that the number of children without dental insurance is increasing and those with private insurance is decreasing. This is alarming given that the Surgeon General's Reports states that children without dental insurance are more than two times less likely to access care than children with insurance (Surgeon General, 2000)

In 2005, a survey was conducted to evaluate Iowa's medical managed care plans from the consumer's perspective. (Tyler, 2006) The survey was done by the Public Policy Center at the University of Iowa as part of the ongoing quality assurance activities of Iowa Managed Medicaid
care program (Tyler, 2006) run by the Iowa Department of Human Services. The survey specifically assessed patients’ (children's and adults') perceptions regarding access to care and utilization of health care services in Iowa, including dental care. They were also asked for their overall ratings of their health care plan and their attitudes towards health care professionals.

Two health plans exist for medical health care services in Iowa, the Coventry Health Care plan, which is contracted by the state of Iowa to provide health plans for the counties of Black Hawk and Butler. The rest of the state is covered by Medipass, the state primary care coverage plan. With regard to children under Medicaid coverage, 800 children from each health care plan (Medipass and Coventry) were randomly selected to be surveyed. Demographic information, in addition to their perceptions (parent's or guardian's perception) on access, utilization of dental health care services and dental professionals was collected. Eighty-five percent of all respondents were the child’s mother, and 5% were the child’s father. Overall results showed a response rate of 52 percent with the majority of respondents being Caucasian (80%), in school or daycare (75%) and with a mean age of 7 years.

With regard to access of health care in general, the majority of respondents stated that needed health care was always easily accessible (54%) and care was always provided quickly (65%).

Specific to dental care, 44 percent of respondents for children 3 years old and above stated a need for dental care within the last 6 months and 21% (1 out of 5) stated that they had an unmet need for dental care within the last 6 months. The most common reason cited was difficulty finding dentists that accepted Medicaid (90%). Other problems mentioned as barriers affecting access to dental care included; dental needs not being covered by Medicaid (73%), difficult getting appointments (74%) and the high costs (70%). (Tyler, 2006) The high number (90%) of those reporting difficulty in finding dentists that accepted Medicaid patients is somewhat surprising;
given that State surveys show that over 80 percent of dentists see Medicaid patients to some degree. (Tyler, 2006) Additionally, 7.7 percent of responding parent's cited dental, tooth or mouth problems as chronic (lasting more than 3 months) problems their child suffers from.

The report also concluded that overall ratings for children's dental health were significantly worse than ratings for general physical health as "only 30% thought their child had excellent dental health compared to 47% with excellent physical health." (Tyler, 2006) Thirty-nine percent had not been to the dentist within the last year, 27% had never been to the dentist, including 77 percent of those under the age of 3. These numbers correspond relatively well to that of the open-mouth survey of third-graders of Iowa schools, (Oral Health Survey Report: FY05) as previously described.

Dental health in Iowa, especially for Medicaid covered children, remains an area in need of focus. Clearly patient's perceptions reflect the dental health status related to children in Iowa. With as many as 1 out of 5 children (Tyler, 2006) having unmet dental needs and as many as 1 out of 3 (Tyler, 2006) having never been to the dentist; much needs to be done to increase the linkage between children in need of dental care and the providers.

**Access to Health Care in the U.S.**

The lack of access to appropriate dental care has been attributed as one of the key underlying factors leading to this disproportionate burden of oral disease. (Surgeon General, 2000) The most common obstacles to adequate access to dental care have been identified in multiple studies. (Bloom, 1992; Children's dental services under Medicaid-access and utilization; Monheit, 1992; Edelstein, 2002; Mayer, 2000; Newacheck, 1997; Newacheck, 2000; Krol, 2004; National call to action to promote oral health; General Accounting Office, 2001, Washington; US Inspector General, 1996)
Barriers are discussed separately, as follows:

Lack of Financial Resources or Insurance Coverage

Lack of financial resources or insurance coverage is a serious barrier to access, as documented by the finding that children are 2.6 times more likely to have medical insurance than dental insurance (Surgeon General, 2000), and children with no health insurance are 2.5 times less likely than medically insured children to receive dental care. (Bloom, 1992; Monheit, 1992) More than half of low-income children without health insurance had no preventive dental care visits. (Edelstein, 2002) Levels of unmet dental needs among low-income children who had private health insurance coverage but no dental benefits were similar to those among uninsured children (Edelstein, 2002). Geographic misdistribution of clinicians (only 6% of dental need was met in over 1100 Health Professional Shortage Areas (HPSA) Nationwide (Surgeon General, 2000)) also contributes to the access problem, and an estimated 25 million individuals residing in HPSA lack adequate dental care (Surgeon General, 2000).

Lack of Perceived Need or Value for Dental Care

Lack of perceived need or value for dental care, is another access barrier. For children this may present as lack of parent and/or caregiver knowledge and appreciation of the importance of oral health and failure to recognize the devastating effects of neglected oral decay. This is reflected by the findings that Medicaid eligible children are less likely to receive dental care compared to children from middle and upper income families, despite Medicaid's dental coverage provisions (Edelstein, 2002). Inadequate numbers of dentists who are treating or who are willing to treat Medicaid eligible children, only 10% of dentists who participate nationwide (US Inspector General, 1996) also is a significant barrier to access. Furthermore, many dentists have cited low reimbursements, frequently broken appointments and complex administration procedures as being the main reasons for low participation in the Medicaid program. (Mayer, 2000; Edelstein, 2002)
The Decline in Dentists in Iowa

Compounding previously discussed barriers, is the ever-aging dentist population (Casamassimo, 2004; Livingston, 2004) with an estimated 35 percent of all fulltime dentists over the age of 55. In the State of Iowa, 56 percent of all dentists are over the age of 50. The number of dentists entering into the dental field annually in Iowa has declined from 54 in 2000 to 44 in 2005.

Over the past 8 years the number of dentists exiting due to retirement, inactiveness, relocation out of the State or death has balanced the number of entering dentists. However, by 2014, the number of retiring dentists is expected to exceed those entering into the dental profession. In addition, over the next 20 years, the growth of dental graduates in Iowa is estimated at 1% per year, while the number of practitioners leaving practice is estimated at 2.1% per year. Furthermore, with an annual population growth of 2-3%, this in turn, has lead to a declining dentist to population ratio with an estimated average of 48 dentists per 100,000 population. (Kuthy, 2006) Thus in Iowa, access issues are likely to become more acute in future years. (Oral Health Survey Report: FY05)

In contrast, there are an estimated 166 physicians per 100,000 population, and more importantly they are of a younger age composition. (Kuthy, 2006)

Overall, the unmet oral health needs of children - specifically those who are at higher risk - raise questions regarding the effectiveness and capacity of the dental and general health care professionals and their receptiveness to their role in the treatment of children.

Care Coordination

Care coordination helps to bring children together with timely and appropriate dental care. This may include assisting families in transporting children to the dental office, keeping track of the child's appointments, as well as referring children who do not have a specific dentist or dental home to an appropriate dental provider. Therefore it follows that adequate information regarding the parameters of a dental home should be collected and analyzed. Specifically,
information should be gathered about aspects related to characteristics of patients, the dental delivery system and (the focus of this paper) access and referral for dental care.

In the late 1990's, several meetings were held between key organizations within the state of Iowa, with the Iowa Department of Public Health as chair agency. The intent of their meetings was to develop and put forth a statewide plan to address the major health problems and challenges facing Iowans. Titled as "Healthy Iowans 2010", this plan was intended to be a companion to the national plan "Healthy People 2010." Healthy People 2010 was a nationwide effort to improve the health of Americans and tackle the health related challenges and barriers.

The "Healthy Iowans' 2010" highlighted four key themes of interest: empowerment, eliminating health disparities, collaboration, and dynamic change. (Healthy Iowans 2010, 2005) Specific strategies were established to better (Healthy Iowans 2010, 2005) identify goals and establish action steps to make sure that resources and efforts were targeted to the most pressing health related issues and allocated to the sections of the population that are in most dire need of aid.

Included in the proposal of "Healthy Iowans 2010", chapter fifteen focuses on oral health. Access to care was identified as the primary oral health problem facing the State's population over the next 10 years. (Healthy Iowans 2010, 2005) Certain sections of the population were considered to be at most risk. These (similar to national trends) included: low-income children, racial and ethnic minorities and special health care needs children. (Healthy Iowans 2010, 2005) The report also identified common barriers to access to care for the populations most at risk. The most common barriers identified were lack of financial resources; lack of a perceived need or value for dental care; lack of motivation to seek care; perceived lack of availability of providers: and lack of trained specialists and/or facilities.

Furthermore, the chapter puts forth several suggestions and focus areas in need of development and improvement. As access to oral health care was identified as the primary oral
health problem facing Iowans; the chapter noted that efforts needed to be directed towards "building better networks of communication and linkage between health care providers and health-related organizations and agencies." (Healthy Iowans 2010, 2005) The redistribution and reorganization of both human, financial and health resources would serve to target dental-delivery services such as care-coordination services, that are directed towards assisting people in overcoming barriers to access to care. (Healthy Iowans 2010, 2005)

The Dental Home

In 2005, the Iowa State Board of Health included under section 7 of the Iowa Medicaid Reform Act an enactment policy (Dental Home for children) (Medicaid Reform Act, 2005) that stated that "by July 1, 2008, every recipient of medical assistance who is a child 12 years of age or younger shall have a designated dental home and shall be provided with the dental screenings and preventive care identified in the oral health standards under the early and periodic screening, diagnostic and treatment (EPSDT) program." The Bill also states that "the definition of a "dental home" has not yet been established." (Medicaid Reform Act, 2005)

This is not surprising, given the multiple and conceptually different definitions of a "dental home" within the literature. These differences in definitions inevitably result in different levels of responsibility, (Linkage Analysis and the dental home, 2006) so that the term "Dental Home" may have a variety of meanings. The American Dental Association adapted the following definition of a dental home in 2005: "the ongoing relationship between the dentist who is the primary Dental Care provider and the patient, which includes comprehensive oral health care, beginning no later than age 1 as pursuant to ADA policy." (ADA, 2005) This definition seems to place emphasis on the dentist or dental auxiliary as a single provider dental home. (Linkage Analysis and the dental home, 2006)
The American Academy of Pediatric Dentistry (AAPD, 2004) based their policies related to the dental home on the 1992 American Academy of Pediatrics' definition of a "Medical Home" for children (AAP, 1992). This policy has a more inclusive nature towards the professionals included in the dental home and a broader comprehensive and team approach in the management of oral health of a child. As stated in these policies, "Referral by the primary care physician or health provider has been recommended, based on risk assessment, as early as 6 months of age, 6 months after the first tooth erupts and no later than 12 months of age." (AAPD, 2004) Similarly, the American Academy of Pediatrics also emphasizes "the importance of establishing a dental home by age 1 for children deemed at risk for dental caries." (AAP, 2003)

With inclusion of the dental home concept within the Iowa Medicaid Reform Act, establishment of a definition of a "dental home" is essential for Medicaid eligible children in Iowa. Such a definition will characterize its limits, so that plans can be developed to appropriately implement this concept.

**Oral Health in Saudi Arabia and Related Barriers**

**Saudi Arabia, a Demographic View**

The Kingdom of Saudi Arabia has made clear developmental strides over the past four decades, none more apparent than advancements made in health and medical care. Compared to countries with similar income levels Saudi Arabia boasts comparable general health indicators including infant mortality rates, maternal mortality rates, life expectancy at birth, immunization levels and infectious disease outbreaks are at or around global averages. These advancements become increasingly important given that population growth and fertility rates are above most countries in the region as well as countries comparable in income levels. In 2007, the national demographic census (Central Department of Statistics) put the total population count of Saudi Arabia just under twenty-five million, a quarter of which reside in the capital, Riyadh. When
assessing the breakdown of the population, 12% are children under the age of five and almost half of the population is below the age of twenty. Those aged sixty-five and above represent only 2.5% of the population. As a result, the bulk of education and health initiative currently focus on the younger section of the population.

**Health Care in Saudi Arabia**

The healthcare system in Saudi Arabia is considered a national health care system, where in the government plays the lead role in providing health care services to the population through a number of government agencies. Over the past decade there has been an increased role expected and played by the ever-growing private sector in the provision of health care services (Alyousef, et al, 02).

The Ministry of Health (MOH) is the major government agency responsible for overseeing, monitoring, regulating and providing preventive, curative and rehabilitative health care for the country’s population (KSA Health Report, 99). Primary health care services are provided through a national network of health care centers (approximately 2000 centers with a higher physician-to-population ratio (9/10,000 with Saudi physicians representing 19.3%) in relation to other countries worldwide that have comparable income levels. spread out through the Kingdom) (KSA Health Report,99). Additionally, there is a network of general and specialist hospitals (220 hospitals) to which advanced cases are referred for care. However, Saudi Arabia’s hospital bed-to-population ratio is much lower than other countries worldwide that have comparable income levels (KSA Health Report,99).

Furthermore, the Ministry of Defense and Aviation, the Ministry of Interior and the Saudi Arabian National Guard all have specialists hospitals that provide secondary and tertiary care to specific enrolled security and armed forces populations as well as educational and training opportunities to medical students and interns Additionally, the country’s universities provide,
through their medical colleges or hospitals, specialist curative services and medical education and training programs, while they also conduct health research in collaboration with other research centers (KSA Health Report, 99; Alyousef, et al, 02).

When assessing the role of the private sector, there has been a steady increase in care provided by these institutions. This is apparent in the percentage of out-patient visits to its facilities increasing from 12.1 percent of total out-patient visits in 1994 to 24.1 percent in 2006 and in-patients in private hospitals as a percentage of the total in-patients increasing from 16.6 percent in 1994 to 43.4 percent in 2006 (KSA Health Report, 99).

**Oral Health of Children in Saudi Arabia**

As previously mentioned, Saudi Arabia has made significant steps towards development on many key aspects of social growth, including health care. However, dental caries as a disease is influenced by several determinants, which include social and educational background, dietary factors, oral hygiene practices, frequency of dental visits and fluoride experiences. Several studies (Alwazzan, et al, 04; Paul, et al, 03; Gandeh, et al, 2000; Alghanim, et al, 98; Almoudi, et al, 96; Wyne, et al, 95; Almas, et al, 93; Magboul, et al, 92; Akpata, et al, 92; Alsammary, et al, 90; Alsekait, et al, 88) over the past two decades that have focused on dental caries prevalence, severity, distribution among geographical areas and age groups, and overall patterns of spread have indicated that as a disease, dental caries remains the most prevalent chronic childhood disease. Similar to other developing nations (Beiruti, et al, 2000; Jason, et al, 93; AlMughery, et al, 91; Skougaard, et al, 91; Ghandour, et al, 88) caries rates remains high, especially in the primary teeth. Among children under the age of 5 the mean dmft (i.e. the number of decayed, missing, and filled teeth) is around 6.5 per child (Yee, et al, 2002).

These previous epidemiological studies (Beiruti, et al, 2000; Jason, et al, 93; AlMughery, et al, 91; Skougaard, et al, 91; Ghandour, et al, 88) have indicated that a very small proportion of
young children are caries free at an average of 12% along different age intervals and geographical areas. The majority of children surveyed did not visit a dentist until the fifth year of life.

On average, for every 10,000 Saudi citizens there is one dentist serving their needs. Of those dentists, Saudi dentists make up 30.9%. Adding to this was a noted scarcity of oral health related knowledge and practices among preschool children in the Middle East, especially in Saudi Arabia (Alyousef, et al., 02).

Challenges Facing the Current Health Care System and Proposed Reforms

There are several serious challenges that face the current health care system in Saudi Arabia, specifically having to do with efficiency issues, effectiveness of health care delivery and quality of care provided, as well as issues pertaining to financial sustainability given the growing population. As stated by the Ministry of Health and the newly structured Health Services Council, the main problems include the following:

1. “There is a lack of data for decision-making, and policy-making is not coordinated among the multiple public agencies which finance and deliver health care.

2. Based on current and future socio-economic trends, the Government, which currently accounts for 80 percent of all health spending, can no longer afford free lifetime coverage for the Saudi population and heavy subsidization of expatriate health costs (especially the burden of providing healthcare yearly to a million pilgrims during the pilgrimage). Even under its current expenditure levels, if the KSA had transitioned to the age/sex structure of the U.S., it would currently be spending in excess of 8 percent of its GDP on health.

3. The Kingdom’s performance could be enhanced in a number of important public health areas including nutrition, smoking, injury/accident control, reproductive health, and prevention.

4. There are serious inefficiencies in the service delivery system including:
a) a focus on curative as opposed to preventive care;

b) a 65% hospital occupancy rate which, if perpetuated into the future, would result in 9,000 additional needed beds in 2020.

c) lack of coordination among public systems and with the private sector;

d) lack of planning resulting in duplication and lack of effective integration among the primary, secondary, and tertiary care systems;

e) centralization of authority limiting managers from responding to local conditions;

f) absence of modern incentive-based medical care provider payment systems.

5. There is little use of state-of-the-art quality of care systems, and there are major access concerns in some areas” (KSA Health report, 99).

As a result there has been a push to improve quality of care, access and efficiency issues related to the current health care system. Most notably, the Health Services Council has been directed to oversee coordinating all health care providers into a national and integrated system that would also include the private sector (Alyousef, et al, 02). This would also involve coordination with the established educational and training institutions in Saudi Arabia to provide data needed to make essential policy and evidence based decisions regarding health care issues (Alyousef, et al, 02). A clear increase in funds has also been allocated towards conducting studies and research in the domain of health services both at the local and at the national level.

Furthermore, due to relatively small number of Saudi graduates from the medical educational and training institutions and thus the present and expected shortage of qualified health personnel, the Labor Force Council in Saudi Arabia recently (2002) adopted a strategy for the development of the national labor force in the health sector that focuses on increasing the capacity level in the seven already established health colleges and institutes; encouraging non-educational hospitals to establish their own training centers; establishing more teaching and training hospitals;
using non-conventional educational systems and enlarging the base of medical postgraduate studies and the realm of graduating physicians and support staff (Alyousef, et al, 02).

Health Care Financing and Expenditure

Out of the total governmental budget in 2006, 6% was allocated to the Ministry of Health which accounts for 44% of all health care expenditure (KSA Health report, 99). An additional 37% of health care expenditures are covered by other associated government funded public health care providers (KSA Health report, 99). This amounts to a total of an estimated 11 percent of the total Government budget being devoted to public spending on health. In light of this, Saudi Arabia’s public share of health care costs is well above both the regional average and global average for countries comparable in income levels (WHO, 2010; Yee, et al, 02). This is also true for the per capita public provided health care spent. However, although Saudi Arabia’s health care spending per capita is above the regional average it remains below the average per capita found in other countries worldwide that have similar income levels (WHO, 2010).

Saudi Arabia’s main source of revenue (75%) is through sales of natural resources (largely based on oil and gas revenues) (KSA Health report, 99). The Ministry of Finance allocates portions of these revenues based on line item allocations for specific expense categories such as salaries, maintenance, new projects, etc. There is a strong incentive to spend all allocated funds because funds that remain unspent may lead to a reduction in future allocations.

Thus, from the financial perspective and to ensure the availability of financial resources to meet the growing health care needs of the population two major reforms have been proposed (Alyousef, et al, 02). The first is the application of a “cooperative health insurance system” that requires all employers to purchase private (cooperative) health insurance for their employees and their dependents. This change will have profound implications for the current national health care system. For example, this is expected to lead to the establishment of a large private/cooperative
health insurance industry and the related need for an insurance regulatory structure, and the development of accreditation standards for hospitals, physicians, and insurers. Furthermore, there will be a need to modify the accounting system in public facilities to bill private insurers, and adopt standardized coding and provider payment methods. Additionally, this change is expected to lead to a reduction in public subsidies for private sector expatriates in public facilities, as well as higher health care utilization and expenditures as a result of more formalized insurance coverage.

(Alyousef, et al., 02).

The second area of reform has been the encouragement of the private sector to undertake a greater role in financing and construction and management of health care facilities. Additionally, private sectors are encouraged to seek better coordination and integration between government agencies providing health care services with the aim of ensuring optimal utilization of available resources. (Alyousef, et al., 02)

From a practical standpoint these areas of reform will help improve the quality and access of health care. However, it should be noted that these proposed reform rules and regulations should not be developed in the absence of relevant data and statistics (KSA Health Report, 99). Currently, important health information is lacking. This includes associated health economics information related to national health accounts; necessary data for decision making such as information of burden of disease; morbidity and mortality by income class, demographic characteristics, and geography; household health spending; utilization information for the non-MOH systems and private sector; unit cost information; information on quality of care and consumer satisfaction; and insurance coverage (KSA Health Report, 99). Therefore, all sectors involved in the provision of health services should take part in establishing and sustaining the necessary health information system to support the following activities:

1. Promote evidence based policy-making;
2. Assure efficiency in the delivery system by developing need based facilities and a human resources master plan for the country;

3. Modify current planning assumptions on the basis of this plan;

4. Promote efficient resource allocation by combining/coordinating the multiple public delivery systems and the private sector based on this plan;

5. Assure quality by developing accreditation and other quality standards for facilities and manpower;


An effective, future National Public Health Strategy being sought by the Saudi Ministry of Health is one focusing on primary health care, reproductive health, prevention, AIDS, substance abuse/tobacco, accident control, nutrition and non-communicable diseases; and the availability of public and/or private supplementary insurance to cover services and amenities not included in the publicly-mandated standard benefit package (Alyousef, et al, 02) Furthermore, there is an essential need for this system to contain measures of access and quality monitoring and assessment (Alyousef, et al, 02; Yee, et al, 02). It is apparent from recent reports (Alyousef, et al, 02; KSA Health Report, 99) pertaining to the health care system in Saudi Arabia that having one merged public delivery system with effective referral guidelines, and built on a strong base of medical education and training strategies is not only essential for improving access to care but also lifting the ever-increasing financial burden on the government.

**Addressing access to care issues**

In response to these overall issues compromising adequate access to oral health care, especially among children and lower economic families, previous studies have focused on two
significant approaches. The first of these approaches looked at the dental work force and shortage areas. The other approach was focused on non-dental professionals as resources in combating these disparities.

With regards to the first approach – the dental work force, the main aspects of interest have been: evaluating and improving the dental curriculum, and addressing the problem of an aging pediatric dentistry workforce. These efforts have attempted to better prepare general dentists for pediatric patients and to increase pediatric dentistry specialists. The overall attitude of recent graduating dentists regarding child patients has been guarded at best. This is apparent given that "the American Dental Education Association (ADEA) conducts an annual survey of graduating U.S. fourth-year dental students. Each year these dental students are asked to rate their satisfaction with the time devoted to instruction in different clinical disciplines. Pediatric dentistry had enjoyed ratings in the upper 90s (on a 100-point scale) until 1993, when satisfaction began to decline. From 1996 - 1998, the level of satisfaction with adequacy of time devoted to their pediatric dentistry education among graduating fourth year students fell into the 80s."(Seale, 2003) With this decreased satisfaction with the time and training devoted to preparing dental students in pediatric dentistry, graduating general dentists' willingness and preparedness to deal with children in the dental office has also decreased. (Seale, 2003; Inglehart, 2004) This in turn limits the number of professionals competently able to address dental care access issues affecting children. Not surprisingly, the 2010 progress report on the Iowa Oral Health Program, a hands-on infant oral health program for the dental students at the University of Iowa supervised by the Dental College, concluded that students who had rotated through the associated WIC program were significantly more likely to see young children in their future practices (Weber, et al, 2010). Unfortunately, few dental schools report having any hands-on experience related to infant oral health care with 51% report having no rotations devoted to this (Seale, et al, 2003).
Furthermore, other factors that may influence the capacity of the dental work force adequately trained to treat children, include (Mouradian, 2000; Mouradian, 2001) the following: the projected shortages of dental school faculty in the near future (70 percent of all dental school faculty are 50 years or older, and 40 percent are projected to retire by 2010); the declining revenue streams for publicly funded higher education; the geographic misdistribution of the dental work force which is significantly under represented in more than 2000 dental health profession shortage areas, encompassing more than 40 million people living primarily in rural and inner city areas and the corresponding need to eliminate disparities in oral health status among those underserved populations. In a review of Dental Curriculums in 2004, (Kassebaum, 2004) Kassebaum and others showed that although dental schools increased their capacity for dental students, 70% of schools at the time of the study had at least three faculty vacancies. In a 2002 synopsis (Casamassimo, 2004) of the pediatric dentistry faculty work force in the United States, the authors demonstrated that the majority of student body expansions were not accompanied by increase in faculty positions, that is dental programs often expanded while already in faculty deficits, and out of those few schools that did add faculty (17 of 46 in the study) almost 60% had unfilled positions.

Additionally, other areas of interest in this regard have included evaluating the number of children treated by general dentists, general dentists' perceptions of their educational experience in pediatric dentistry and their perceived needs for continuing education in this field. In a national survey (Seale, 2003) of general practitioners, published in the December 2003 edition of the JADA (Journal of American Dental Association), Seale et al found that although 90 percent of general practitioners saw children younger than 4 years of age, they saw very few children with high levels of caries or children covered by Medicaid. Additionally, providers' responses about desirability of additional training in pediatric dental procedures generally revealed low levels of interest. (Seale, 2003)
Furthermore, a recent survey (Wolfe, 2006) of 1,521 Iowa general dentists (47% responded with usable surveys) addressing knowledge, attitudes and behavior regarding the age 1 dental visit revealed that 76% of respondents were familiar with the American Academy of Pediatric Dentistry (AAPD) age 1 dental visit recommendation. However, 34% of these general dentists believed age 3 was an appropriate age for the first dental visit. Additionally, similar to the national survey, although only 36% believed a child should be seen before age 2, 66% reported actually seeing these children and just above half expressed a willingness to see them. It was also showed that willingness of dentists to see children younger than 2 years, was significantly associated with more recent graduation (p<0.0001); having knowledge of AAPD recommendations (p<0.0027); seeing children younger than 2 years.

Concerning the second approach (the utilization of non-dental professionals) in addressing the matter of oral health disparities, non-dental professionals are often in a better position to evaluate children at an early age. Studies (Spisak, 1999; Newacheck, 2000; Lewis, 2000; AAP, 2000; Schafer, 2000; Hendricson, 2001; Mouradian, 2003; Rozier, 2003 Bader, 2004) have shown that primary care medical providers are more likely to see poor children early and to provide care for them on a continuing basis when compared to dentists. For example, as stated by the Department of Health and Human Resources (DHHS) in 1998, 89% of poor children had a usual source of medical care, far surpassing the estimated 20% of Medicaid children 0-18 years who had a preventive dental visit, or the less than 1% of Medicaid eligible children receiving a dental visit in their first year of life. (US Inspector General, 1996) It should be noted, that although the AAPD recommends performing the first oral evaluation at 12 months of age or younger, in a 1997 survey of AAPD members, 72.6% agreed with the policy, but only 46.6% actually practiced it. (Erikson, 1997)

Additionally, children are 2.6 times more likely to have medical insurance than dental insurance. (Surgeon General, 2000) The U.S. Preventive Services Task Force recently advised
medical health providers to initiate oral health education and guidance such as nutritional counseling, use of fluoride supplements, tooth brushing for kids, in addition to counseling adolescents on smoking cessation. (US Preventive Services Task Force, 2004) However, it is unclear if physicians are prepared to undertake such oral health initiatives.

Unfortunately, collectively few studies have looked at medical students' education and training in oral health. Krol (Krol, 2004) reviewed the literature on pediatric oral health training for pediatricians at the undergraduate, residency and practitioner level and concluded that there was insufficient content and no coherent approach for integrating oral health into pediatric training.

Another survey addressing the adequacy and comprehensiveness of dental instructions in U.S. and Canadian medical schools, reported that comprehensive instructions on dental topics did not take place in the surveyed schools. (Curtis, 1985)

The lack of access, specifically for children in poor or minority families, is anticipated to worsen. Kinlaw (Kinlaw, 2001) anticipated that changes in state and federal Medicaid legislation will lead to increases in the number of Medicaid eligible recipients, and that this would further complicate and contribute to the access dilemma. "If Medicaid remains the predominant vehicle for dental care financing for low-income, high-caries risk patients, we may never see an amelioration of disparities in care, unless this situation changes." (Kinlaw, 2001) Additionally, a 1999 report, (the Reforming States Group) by the Reforming States Group on Pediatric Dental Care, on dental care access for children enrolled in CHIP and Medicaid, stated that "… [the] discount between the presence of dental disease and access to care is worsening despite public health and dental care programs for poor children."

More information regarding oral health status and needs is required to improve oral health, eliminate disparities and target access problems "…data on state and local populations, essential for program planning and evaluation, are rare or unavailable and reflect the limited capacity of the U.S.
health infrastructure for oral health." (Healthy Iowans 2010) As a result, attention must be drawn to
the dental delivery system infrastructure, through increasing the supply of dentists and "building
links between providers and organizations and agencies that work with people at risk." (Healthy
Iowans 2010)

The Role of Physicians

Primary care providers' (physician's) potential involvement in aspects of child oral health
evaluation, referral and preventive care is increasingly becoming an area of research and
investigation. The fact that they are more likely to see children (regardless of income or coverage)
at a young age (Lewis, 2000; Lewis, 2004) and visits occurring in a regular fashion (Schafer, 2000;
Mouradian, 2003), permit them to play a vital role in the oral health of children. This potential is
impeded by several factors.

Several studies (Krol, 2004; Ismail, 2002; Bader, 2004; Mouradian, 2005) have pointed out
that the amount and content quality of oral health education and training provided to medical
students at all levels of their medical training is grossly inadequate and incomprehensive.

In 2002, a systematic review (Services Task Force, 2004) conducted for the U.S. Preventive
Service Task Force investigated eleven aspects pertaining to the role of physicians in child oral
health. These aspects were assessed for the strength of evidence supporting them and represented as
the following questions: "the accuracy of screening by primary health care workers in identifying
children who are at elevated risk for dental caries or need referral to a dentist; whether their
referrals result in children making a dental visit; the appropriateness of their prescription of dietary
fluoride supplements or application of fluoride varnish; parental adherence to their
recommendations for either fluoride regimen and the resulting caries prevention; and the effects of
their counseling on patient adherence to caries preventive behaviors and caries rates" (Services
Task Force, 2004). Dietary fluoride supplements, fluoride varnish application and the
appropriateness of the supplementation decision were judged to be adequate and effective in the prevention of dental caries, while the remaining eight questions were judged to have poor evidence supporting physicians' effectiveness in administration or abilities. Nonetheless, within recent years there have been several attempts to enhance primary care providers' capabilities and further their capacities to take on oral health responsibilities.

In 2003, a publication by Rozier and colleagues evaluated the development, implementation, and preliminary outcomes of the "Into the Mouths of Babes" preventive dentistry program, which in 2001 was implemented statewide in North Carolina. (Rozier, et al, 2003). The intervention focused on having primary care providers in community health clinics (mainly pediatricians and family physicians) conduct a dental disease risk assessment, needs-based referrals to a dentist, fluoride varnish application, and education of parents or guardians in the care of the child’s oral health. Health care professionals conducting these interventions were reimbursed by Medicaid for up to six preventive visits over a 1 year period. All providers underwent training in the dental procedures to provide these preventive dental services. In order to be eligible for reimbursement they were also required to complete an American Medical Association (AMA)-approved Continuing Medical Education (CME) course offered by the North Carolina Society of Pediatrics and North Carolina Academy of Family Physicians. (Rozier, 2003) "During this course, participants [were taught] to: 1) Describe the early childhood caries problem and its causes; 2) Conduct a caries risk assessment for infants and toddlers and identify risk factors for dental disease; 3) Perform a dental screening and identify deviations from normal; 4) Describe the role of fluorides in the prevention of tooth decay and apply fluoride varnish to the teeth of high-risk infants and toddlers; and 5) Counsel caregivers on methods for attaining oral health for their children." (Rozier, 2003)
In addition to the one-and-one-half-hour CME course, providers were given a packaged tool-kit that consisted of a handout of the CME presentation; educational materials for parents, clinical practice guidelines on risk assessment, screening, and referral; product information on fluoride varnish and a poster outlining the clinical steps for varnish application in the exam room.

Results of this evaluation, encouragingly, indicated that between the start of the statewide project in 2001 and December 2002, 1,595 medical professionals were trained. The majority of whom (approximately one-half) were pediatricians or family physicians, the remainder included registered nurses, physician assistants, nurse practitioners, and other health care professionals working in medical clinics. Results also showed that there was a 2.8-fold increase in the number of practices submitting claims for reimbursement for preventive visits. Additionally, the number of follow-up visits also increased "from 24 percent in the first quarter of 2001 to 41 percent in the last quarter of 2002." (Rozier, 2003)

The researchers concluded that the intervention demonstrated the willingness of primary medical care providers to provide preventive dental services. However, they also pointed out that several key questions have yet to be addressed. Specifically with regards to determinants of preventive dental service adoption, its effectiveness, cost-effectiveness, or patient acceptance had not been assessed.

Additionally, as part of the “Into Mouth of Babes” program a retrospective chart audit of medical records related to preventive oral health services (POHS) provided by pediatric medical residents for Medicaid patients who were less than 3 years of age at the University of North Carolina pediatric clinics over a period of 2.5 years yielded several encouraging results. Thirty-eight percent of the patients received one or more IMB follow-up visits. Fourteen percent of children were referred to a dentist. The authors concluded that preventive oral health initiatives in
an academic setting improved access to oral health care for underserved children and contributed to the financial capability of the clinic (Grant et al, 2007).

In 2004, researchers in Kentucky developed and reported on a 3-year longitudinal Oral Health Education curriculum (POHEK) that targeted family medicine residents. This curriculum was designed to train family medicine residents to "(1) perform oral health screening and risk assessment, to (2) recognize and manage common oral conditions for children ages 5 years and under and to (3) provide oral disease prevention education and services." (Gonzales, 2004) A survey instrument was developed and analyzed to determine the curriculum content. "The survey questions were based on curriculum guidelines of the Accreditation Standards for Pediatric Dentistry Programs from the American Dental Association’s Commission on Dental Accreditation. Results from the survey led to the development of a curriculum map used to develop instructional materials for faculty and residents." (Gonzales, 2004) Additionally, a series of development workshops were conducted for the Pikeville Osteopathic Medical School and University of Kentucky faculty "to prepare them to supervise their residents in basic oral health risk assessment, oral exams, and fluoride treatments". (Gonzales, 2004) Subsequently, the educational (16-hour didactic) and hands-on (4-hours during the community medicine block rotation) training sessions were implemented in the resident training programs of both medical schools.

Pre- and post-written assessments, measuring knowledge and attitudes were administered. (Gonzales, 2004) This was supplemented with a clinical-skills assessment at the end of the 2 half-day dental rotation sessions. (Gonzales, 2004) Results at baseline indicated an overwhelming sense of obligation to "play an important or somewhat important role in the oral health of their patients" (all but one of the 23 residents reported this). However, this sense was obstructed by a perceived lack in knowledge and skills needed to assume this role (approximately 50% of residents rated their knowledge as “poor” with the remaining rating it as “fair”. (Gonzales, 2004) Following the
training course there was a significant increase in self-rated knowledge of the oral cavity (P<.0001), familiarity with specific dental concepts such as pit and fissure sealants (P<.0001) and fluorosis (P<.0001). (Gonzales, 2004) Residents were also more likely to "talk to patients about oral health during prenatal counseling." (Gonzales, 2004)

Given the relative similarities between Kentucky and Iowa as far as health services distribution, both states being primarily rural, results of the previous intervention are encouraging. This is especially important given the higher percentage of designated Health Profession Shortage Areas (HPSA) in Iowa, 71% of counties in Iowa compared to 40% of counties in Kentucky. (Gonzales, 2004)

Similarly, in an effort to identify the most effective method for educating medical practitioners in oral health related practices Slade, et al in 2007 targeted 1400 pediatric and family physician practices in North Carolina in randomized controlled trial with three different educating interventions. Namely, didactic training and course materials in oral health screening, referral, counseling and application of fluoride varnish; similarly to first group in addition to weekly conference calls providing advice and support; and lastly adding to the previous two with in-office visits providing hands-on advice and support. In all three groups, physicians were reimbursed $38–$43 per preventive dental visit. The authors found that regardless of the method used, a “relatively high proportion of practices enrolled in this study appeared capable of adopting these preventive dental services” with an overall increase of 10% of Medicaid children receiving preventive care (Slade et al, 2007).

A 2002 article in the Journal of Pediatrics, reported on a study to "determine the accuracy of pediatric primary care providers’ screening and referral for Early Childhood Caries." (Pierce, 2002) This was done through comparing "independent, blinded oral screening results and referral recommendations made by primary care providers [at a private pediatric group practice in North
Carolina that serves a large volume of Medicaid patients] with those of a pediatric dentist [considered as the reference gold standard]." (Pierce, 2002) The pediatric physicians received a 2-hour training session in infant oral health. This training session included instructions "on how to recognize a cavitated carious lesion and how to determine when a dental referral is needed." (Pierce, 2002) Appropriate calibration and comparative analysis were performed to establish reliability and validity of the examinations conducted by the pediatric dentist. (Pierce, 2002)

The final results indicated that the pediatric primary care providers reported a mean of 0.25 cavitated teeth per child, similar (difference not statistically significant) to the 0.30 reported by the pediatric dentist. (Pierce, 2002) However, sensitivity and specificity tests indicated that "the primary care providers tended to under-count the number of teeth with carious lesions". (Pierce, 2002) Additionally, with regard to dental referrals, "the providers as a whole tended to under-refer, and only 70% of children with evidence of dental disease received a referral." (Pierce, 2002)

The authors concluded that this 2-hour training session "achieved an adequate level of accuracy in identifying children with cavitated carious lesions." (Pierce, 2002) However, they did stress the need for additional research into factors needed to optimize pediatric primary care providers’ abilities to accurately identify and subsequently refer children, based on their needs, for appropriate dental care. They also mentioned that the results suggested the capacity to incorporate dental screenings into pediatric practices in a manner rendering them effective in dental disease detection and intervention. (Pierce, 2002)

In line with the previous study, a 2004 article (Cruz, 2004) also published in the Journal of Pediatrics investigated screening practices and referral patterns of pediatric primary care providers in North Carolina, and the characteristics that influence their decision to refer. This cross sectional survey of 169 primary care clinicians, included physicians, physician assistants and nurse practitioners, who were participants in the randomized control trial evaluating the “Into the mouth
of babes (IMB)” program (a new medical program in North Carolina). The survey included questions pertaining to four areas related to oral health knowledge, opinions, behaviors and self-perceived competencies, as well as six oral health related activities such as, dental screening, risk assessment, referral, counseling, fluoride use and follow up.

Variables considered when constructing questions on referral included questions on the likelihood of referring children, factors considered in making a decision to refer and methods used. Questions related to referral were restricted to children 0 to 3 years of age regardless of medical eligibility. When asking about screening and referral behaviors, factors considered were adapted from the socio-ecological framework (Skolos, 1992) developed in 1992 on the impact of personal and environmental factors on behavior. Based on this, factors chosen were related to: 1) provider characteristics (provider type, gender, practice experience, board certification, training in oral health during or after professional education, hours worked, teaching of residents, oral health knowledge, opinions, confidence, and behaviors); 2) their practice (setting, number of providers, patient volume, and busyness [patients per hour]); 3) their patients (tooth decay status, insurance status, immigrant status, and English speaking); and 4) their practice environment (perceived difficulty of referral for routine or urgent care and perceived or actual availability of dental care providers) all of which “could potentially influence referral decision making process.” (Cruz, 2004)

The authors reported that only 1% “rarely examined a child for a dental disease” and only 6% "did not refer”. Fortunately, the authors found that more than 90 percent of the study sample reported referring infants and toddlers for dental care as part of their regular practice. Of those who referred, 54 percent made an appointment for the child by directly calling a dental office. Nearly 78 percent based their referrals on the suspected presence or risk for dental decay. Interestingly, physician assistants or nurse practitioners referred more often than physicians.
Two significant predictors of referral in this study were the degree of health care provider confidence and the number and extent to which providers saw children on a daily basis. Those who were not in group practices, were board certified, graduated 20 years ago or more, saw 80 or more patients per week, had more than 60 percent of their total patient pool as infants and toddlers per week [OR 0.24, 95% CI .08-.69], and saw more than 3.5 patients per hour were all significantly less likely to refer at-risk children for dental care. Providers who had high confidence in their ability to perform oral screenings and risk assessments, had a high opinion of the value of screening for disease and risk, and frequently performed caries risk assessments were significantly more likely to report referral of children. Those who had confidence in their referral decisions were actually 5 times more likely to refer.

No patient characteristics were significantly associated with decisions or practices of referral. However, 76 percent of the respondents reported difficulty in referring Medicaid eligible children for dental care. The only environmental characteristic found to be important was low overall referral difficulty (they were 5.9 times [95% CI: 1.66 – 15.12] more likely), which had a positive effect on referral behavior. It was encouraging to note that 72 percent of respondents answered 19 knowledge questions correctly and averaged over 4.0 on the 5 point Likert – Scale, with regards to prioritizing dental disease prevention. Interestingly, “provider characteristics such as oral health education in professional training and knowledge did not help to explain referral practices”(Cruz, 2004) as the authors had hypothesized. They attributed this inability to link referral patterns to oral health knowledge to the "lack of variability in scoring with the available sample size.” (Cruz, 2004)

It is important to note that although overall outcomes of this study were encouraging, several aspects of the methodology limit the applicability and external validity of the findings. As mentioned by the authors, the sample participants were recruited to the trial because they responded to advertisements which offered continuing medical education through a Medicaid program.
targeting preventive dental care for infants and young children. (Cruz, 2004) Not surprisingly, providers reported seeing Medicaid eligible children at a larger percentage (40%) than national survey averages (26%). (Cruz, 2004) As expected with the low socioeconomic status of their patient pool, a high proportion (73% compared to national levels of only 16% (Vargas, 1998)) of their patients suffered from dental caries. Additionally, the sample size was relatively small with only 138 respondents. The authors also stated that experience with “children with dental problems coupled with interest in enrolling in a new preventive dental program could result in their [the respondents] having a higher level of oral health awareness than other practitioners and placing more importance on prevention and treatment of dental problems.” The authors also mentioned “difficulty (collectively more than 60%) in referring children with developmental delays, the very young and those who are on Medicaid or uninsured.” However, they did not specify what factors influenced this difficulty.

The authors made several key conclusions from this survey. First, “the two most important factors affecting the likelihood of referral of high risk children were confidence in screening-risk assessment and self perceived referral difficulty.” (Cruz, 2004) In addition, they concluded that “successful models that both develop the dental workforce and integrate it with medical care need to be developed before substantial progress can be made in resolving problems in access to dental care.” (Cruz, 2004) Finally, they stated that "instructional efforts to increase providers' dental knowledge or opinions of the importance of oral diseases are unlikely to be effective in increasing dental referral unless they include methods to increase confidence in providers' ability to identify and appropriately refer children with disease.” (Cruz, 2004)

A 2007 article focused on encouraging caries risk assessment by physicians as a first step in a comprehensive protocol for infant oral health care. The authors emphasized that even with improved referral of children at age 1 by physicians, this would not be practically effective with
regards to access of care unless the dental community took on “the responsibility of being willing and well-prepared to accept them” (Ramos-Gomez et al, 2007).

In a national survey conducted in 2000, Lewis et al (Lewis, 2000) surveyed a sample of 1600 pediatricians ranging in age between 25-65 years. This sample was randomly selected from the national listing of pediatricians through the American Medical Association (AMA) Master file. (Lewis, 2000) The survey collected information regarding: 1) practitioner characteristics (board certification, year of graduation, number of years in practice, number of hours in oral health training) (Lewis,2000); 2) information regarding their practice pool (including number of patients seen a week, number of hours a week providing patient care and racial/ethnic discrimination) (Lewis,2000); and 3) information pertaining to their practices (practice type, reimbursement type and urban/rural practice location). (Lewis, 2000)

In addition, questions were categorized into four topic elements: 1) knowledge and familiarity with preventative therapies (Lewis, 2000) e.g. caries presentation, fluoride varnish and sealants; 2) knowledge about current policies and recommendations on oral health promotion for pediatricians; 3) Experience with dental problems and barriers to professional dental care (Lewis, 2000); and 4) willingness and agreement with fluoride varnish application.

Sixty-two percent of survey recipients responded. Results were that “…more than one third reported no instruction in dental health-related subjects in medical school and 42.3% reported no dental health –related instructions in their residency.” (Lewis, 2000) Only 9% answered all four "knowledge on preventive therapies" questions correctly. Although 79.5 percent reported knowledge about dental sealants only,”50.9% said they were familiar enough [with sealants] that they could explain sealants to patients” (Lewis, 2000) in a confident manner. Only 22 percent said that they were familiar with fluoride varnish, but “74% expressed a willingness to apply fluoride varnish in their practice.” (Lewis, 2000) The majority of the respondents (85%) reported a high
likelihood to “examine a child’s teeth for cavities and provide preventive consulting at well-child care visits for children under 5 years” (Lewis, 2000) and 90 percent reported that such activities “should be part of routine well-child care visits.” (Lewis, 2000)

Similar to a study by dela Cruz et al (previously mentioned -under The Role of Physicians section), the majority of respondents (85.4%) did not agree with AAPD recommendations (Lewis, 2000) (Cruz, 2004) to refer children to dentist by 12 months of age. “47% reported seeing early childhood caries (ECC) at least once a month and almost two thirds reported seeing cavities in school-aged children at least once a month.” (Lewis, 2000) More than half reported difficulty referring “uninsured patients and those needing sliding payment scale (55.1%) or the uninsured” (Lewis, 2000) with an emergency dental problem (50.9%).

Although the authors cited a possible overestimation by respondents regarding the “frequency with which they participate in oral health preventive activities” (Lewis, 2000); results suggest an overwhelming willingness of pediatricians to participate in oral health care, including oral-health related counseling and preventive therapies. However, general pediatricians did cite difficulties in referring some “subgroups of patients” in need of professional dental care as “over one half reported difficulties in referring the uninsured and more than one third (38%) reported difficulty referring Medicaid patients”. (Lewis, 2000) Unfortunately, several important questions were not addressed. For example, questions pertaining to reasons why there was difficulty in referral or what perceived barriers were there for these subgroups were not asked.

Finally, the authors concluded that there was a lack of training and information on oral-health related issues for pediatricians, which may limit their ability to promote and counsel patients on oral-health related topics.

The report (Momany, 2005) on outcomes of care for Iowa Medicaid Managed care enrollees for the State Fiscal Years 2003 and 2004 provides good insight into the contrast of dental versus
medical visits obtained by Medicaid enrollees. Results showed that Medipass coverage comprised up to 56.1% of Medicaid recipients in 2004. The rates of children receiving any dental visit through Medipass were 19.7% for 1-3 year olds; 60.9% for 4-6 year olds; 64% for 7-11 year olds; 58.1% for 12-15 year olds and 50.2% for 16-18 year olds. Children were categorized into these five age categories by the authors. In contrast, the rates of children seeing a primary care provider were significantly higher, 92.4% for 1-2 year olds; 83% for 3-6 year olds; 82.6% for 7-11 year olds; and 81.4% for 12-19 year olds. Their results further suggest the need to incorporate non-dental professionals within Iowa, to increase access to dental care, and thus decrease dental health disparities.

A culmination of the increased focus on dental care access issues and the potential involvement of non-dental health care professionals over the past decade was the 2009 Institute of Medicine conference on the “sufficiency of the U.S. oral health workforce in the coming decade” (Special Issue, 2010). In a special 2010 edition of the Journal of Public Health Dentistry, the publication of the American Association of Public Health Dentistry, multiple articles pertaining to this specific access to care issue were covered. These articles focused on recent trends in the oral health workforce, the barriers to adequate access to oral health care, the disparities in the burden of oral disease as a result of the inability of the current dental workforce to meet oral health needs, as well as discussions regarding issues raised at the 2009 conference (Special Issue, 2010).

Regarding the current dental health workforce, the authors describe the oral health care system in the United States as a “loosely organized patchwork comprised largely of private practices serving the vast majority of residents and a similarly piecemeal safety net system addressing a portion of unmet need” (Wendling, 2010). The majority of dental health care is provided by the private practice establishments. Payments are usually done through third party payors or direct payments by consumers (Wendling, 2010; Brown, 2005). This private
establishment system (about approximately 92 percent of professional active dental practitioners) serves approximately two-thirds of the US population (Wendling, 2010). Adding to this is the fact that these two-thirds are for the most part “ambulatory, not economically disadvantaged, generally healthy and not living in remote or institutionalized settings” (Brown, 2005). The other third of the population that has difficulty accessing available oral health care providers is “typically poor, institutionalized or homebound, beset with multiple co-morbidities, or living in remote areas (Brown, 2005). This latter third usually has access to a set of services that includes private practitioners participating in Medicaid, dental school clinics, the Veteran’s Administration, Federally Qualified Health Centers, etc (Edelstein, 2010). Adding to this, is the academic trend of dental schools over time to develop educational curricula in line with the needs of the private sector given that it makes up the bulk of the oral health care delivery system (Brown, 2005). As a clear result of this, less focus is placed on providing dental students with hands-on experiences when dealing with young and/or underserved child patients, as evidenced by the fact that 51% of dental schools report having no rotations devoted to these experiences (McWhorter, et al, 2001).

This variability in what health care providers are available makes it difficult to fully understand or quantify the actual capacity of the current system to provide services (Edelstein, 2010). However, what is clear is that the system as it currently exists is unable to adequately fulfill the populations’ oral health needs (Edelstein, 2010).

This special edition also contains several articles (Wendling, 2010; Edelstein, 2010; Hilton, et al, 2010; Gehshan, et al, 2009) focused on recent dental workforce issues, such as different framework models that target reducing racial/ethnic and economical class disparities; how to effectively reach rural areas with needed dental care and assisting special health care need groups. Additionally, the edition proposed the use of certain principles taken from national and international authorities on public health issues that could become the basis of a more unified and
efficient oral health care delivery system (Tomar and Cohen, 2010). “These principles include standards for system orientation and performance (comprehensive and evidence based), professional conduct (ethical and culturally competent), and finally, a system's relationship to society (empowering)” (Tomar and Cohen, 2010).

Implementing such principles to form what may be viewed as the ideal health care delivery system faces several serious feasibility barriers, not the least of which is the disproportion of the dental profession’s numbers capacity and dental health care needs of the population, a dilemma in many nations around the world. Recent statistics from the American Dental Education Association (ADEA), the American Dental Association (ADA), and the Health Resources and Services make this disproportion very apparent (Hilton, et al, 2010). As the authors note, in the US there are over 4,200 Designated Dental Health Profession Shortage Areas (DHPSA) that is equivalent to about 49 million people. In order to adequately serve this population you would need approximately 9,000 additional dentists and an associated additional 15,200 dental assistants and 11,000 dental hygienists (Hilton, et al, 2010). These numbers do not take into account the aging and retiring dental population or the projected national population increase. Additionally, there is an expected increase in life expectancies and improvement in oral disease prevention that would lead to a greater number of teeth that need care (Wendling, 2010; Hilton, et al, 2010). Again it becomes apparent that “the overall adequacy of the workforce across the dimensions of practice location, skill-set, and propensity toward working with underserved populations is unclear” (Edelstein, 2010).

Wendling and others have pointed to the probability of unused resources in the current oral health care delivery system but reiterate the notion that this capacity may be unwilling to treat the populations most in need, for any number of reasons, or unavailable to those locations (Wendling, 2010). It is in this context that expanding the oral health workforce through changing dental
schools’ approach to education and public health advocacy, expanding the roles of dental assistants, hygienists and therapists, suggesting new workforce models and strategies, and the inclusion of non-dental health care professionals, all provide feasible potential solutions to the ever-increasing dental demands nationally and internationally.

**Oral Health and General Health, the Inter-relation**

It is essential to note the significant consequences of neglected oral and craniofacial disease; and the social, health and economical impacts of lack of oral health care; on a developing child. Multiple studies (Gorlin, 1990; Holister, 1993; The face of a child) have pointed to these consequences and impacts. "Oral-facial pain as a symptom of untreated dental and oral problems and as a condition in and of itself is a major source of diminished quality of life." (Surgeon General, 2000)

Dental caries can compromise a child's ability to chew, bite and swallow food; resulting in limited food selection, poor growth, poor nutrition and delayed development. (Holister, 1993) This is specifically apparent with early and extensive tooth decay. (Surgeon General, 2000) Additionally, Carious teeth in the primary (childhood) dentition may be a predictor of higher levels of future dental decay, and potentially increase children's hypersensitivity to subsequent pain associated with dental problems. (Surgeon General,2000) Decayed teeth may also act as a source for the spread of infection, which if left untreated may lead to serious life-threatening conditions. (Surgeon General, 2000)

Severe caries in children may disrupt sleeping habits, reduce their play and school activities and diminish their educational learning because of the associated pain. (Gift, 1992) As noted in previous studies, children lose an estimated 52 million hours of school time per year as a result of oral disease and dental visits. (Gift, 1992) This figure is magnified substantially in children from poor families; as poor children experience almost 12 times as many restricted activity days as a
result of poor oral health compared to their peers from higher income families. (US General Accounting Office, 2001) Early childhood caries (caries affecting the upper anterior as well as the posterior teeth in very young children) is associated with "sleep deprivation, depression, and multiple adverse psychological outcomes." (Surgeon General, 2000)

National surveys (National Health Interview Survey, 2001; Gift, 1992) of affected people and parents of affected children have reported – as some of the impacts of oral disease on overall quality of life - limitations in verbal and non-verbal communication, social interaction, and intimacy. In addition, caries may contribute to loss of self-image, self-esteem, anxiety, depression and social stigma; "these in turn may limit educational, career and marital opportunities and affect other social relations." (Surgeon General, 2000)

**Educational Interventions**

Unfortunately, collectively few studies have looked at medical students’ education and training in oral health. Krol (2004) reviewed the literature on pediatric oral health training for pediatricians at the undergraduate, residency and practitioner level in U.S. medical institutions and concluded that there was insufficient content and no coherent approach for integrating oral health into pediatric training. Another survey addressing the adequacy and comprehensiveness of dental instructions in U.S. and Canadian medical schools, reported that comprehensive instructions on dental topics did not take place in the surveyed schools. (Curtis et al, 1985)

Primary care physician's potential involvement in aspects of child oral health evaluation, referral and preventive care is increasingly becoming an area of research and investigation. The fact that they are more likely to see children (regardless of income or coverage) at a young age (Lewis et al, 2000; Lewis et al, 2004) and visits occurring in a regular fashion (Schafer et al, 2000; Mouradian et al, 2003), permit them to play a vital role in the oral health of children.
This potential, however, is impeded by several factors. Multiple studies (Ismail et al, 2002; Bader et al, 2004; Krol, 2004; Mouradian et al, 2005) have pointed out that the amount and content quality of oral health education and training provided to medical students at all levels of their medical training is grossly inadequate and incomprehensive. Nonetheless, within recent years there have been several attempts to enhance primary care providers' capabilities and further their capacities to take on oral health responsibilities.

The "Into the Mouths of Babes" (IMB) preventive dentistry program that was implemented statewide in North Carolina focused on educating various health care professionals to conduct dental disease risk assessment, needs-based referrals, fluoride varnish application, and parental dental education. Participating professionals needed to attend continuing education courses in order to be eligible to receive reimbursements. (Rozier et al, 2003)

Results of this evaluation, encouragingly, showed that there was a near 3-fold increase in the number of practices submitting claims for reimbursement for preventive visits. Additionally, the number of follow-up visits nearly doubled between the first quarter of 2001 and the last quarter of 2002. (Rozier et al, 2003).

Furthermore, a 2003 Hughes and colleagues (Hughes, et al, 05) reviewed the Indiana SCHIP initiative to improve access to care for Medicaid-enrolled children by increasing reimbursement rates. The review showed that this increase positively affected access to care rates for this population. (Hughes, et al, 05) In 2000 claims involving oral health care for Medicaid enrolled children was 1096, a clear increase from 770 claims in 1997 (Hughes, et al, 05). However, they also reported that the majority of dentists in the State were still not accepting Medicaid enrolled children and approximately 60% of enrolled children did not have any dental visits during the previous year (Hughes, et al, 05).
The researchers concluded that the intervention demonstrated the willingness of primary medical care providers to provide preventive dental services. However, they also pointed out that several key questions have yet to be addressed. Specifically questions regarding determinants of preventive dental service adoption, its effectiveness, cost-effectiveness, and patient acceptance had not been assessed.

In 2004, researchers in Kentucky developed and reported on a 3-year longitudinal Oral Health Education curriculum (POHEK) that targeted family medicine residents. This curriculum was designed to train family medicine residents to "(1) perform oral health screening and risk assessment, to (2) recognize and manage common oral conditions for children ages 5 years and under and to (3) provide oral disease prevention education and services" (Gonzales et al, 2004). A survey instrument was developed and analyzed to determine the curriculum content. "The survey questions were based on curriculum guidelines of the Accreditation Standards for Pediatric Dentistry Programs from the American Dental Association’s Commission on Dental Accreditation. Results from the survey led to the development of a curriculum map used to develop instructional materials for faculty and residents" (Gonzales et al, 2004). Additionally, a series of development workshops were conducted for the Pikeville Osteopathic Medical School and University of Kentucky faculty "to prepare them to supervise their residents in basic oral health risk assessment, oral exams, and fluoride treatments" (Gonzales et al, 2004). Subsequently, the educational (16-hour didactic) and hands-on (4-hours during the community medicine block rotation) training sessions were implemented in the resident training programs of both medical schools.

Pre- and post-written assessments, measuring knowledge and attitudes were administered (Gonzales et al, 2004). This was supplemented with a clinical-skills assessment at the end of the 2 half-day dental rotation sessions (Gonzales et al, 2004). Results at baseline indicated an overwhelming sense of obligation to "play an important or somewhat important role in the oral
health of their patients” (all but one of the 23 residents reported this). However, this sense was obstructed by a perceived lack in knowledge and skills needed to assume this role (approximately 50% of residents rated their knowledge as “poor” with the remaining rating it as “fair” (Gonzales et al, 2004). Following the training course there was a significant increase in self-rated knowledge of the oral cavity (P<.0001), familiarity with specific dental concepts such as pit and fissure sealants (P<.0001) and fluorosis (P<.0001). Residents were also more likely to "talk to patients about oral health during prenatal counseling" (Gonzales et al, 2004).

Similarly, in an effort to identify the most effective method for educating medical practitioners in oral health related practices Slade, et al in 2007 targeted 1400 pediatric and family physician practices in North Carolina in randomized controlled trial with three different educating interventions. Namely, didactic training and course materials in oral health screening, referral, counseling and application of fluoride varnish; the second group was similar to the first group but was aided with weekly conference calls providing advice and support; and the final group was given, in addition to that of the previous two groups, in-office visits providing hands-on advice and support. In all three groups, physicians were reimbursed $38–$43 per preventive dental visit. The authors found that regardless of the method used, a “relatively high proportion of practices enrolled in this study appeared capable of adopting these preventive dental services” with an overall increase of 10% of Medicaid children receiving preventive care (Slade et al, 2007).

A 2002 article in the Journal of Pediatrics, reported on a study to "determine the accuracy of pediatric primary care providers’ screening and referral for Early Childhood Caries" (Pierce et al, 2002). This was done through comparing “independent, blinded oral screening results and referral recommendations made by primary care providers [at a private pediatric group practice in North Carolina that serves a large volume of Medicaid patients] with those of a pediatric dentist [considered as the reference gold standard]” (Pierce et al, 2002). The pediatric physicians received
a 2-hour training session in infant oral health. This training session included instructions "on how to recognize a cavitated carious lesion and how to determine when a dental referral is needed" (Pierce et al, 2002). Appropriate calibration and comparative analysis were performed to establish reliability and validity of the examinations conducted by the pediatric dentist (Pierce et al, 2002).

The authors concluded that this 2-hour training session "achieved an adequate level of accuracy in identifying children with cavitated carious lesions" (Pierce et al, 2002). However, they did stress the need for additional research into factors needed to optimize pediatric primary care providers’ abilities to accurately identify and subsequently refer children, based on their needs, for appropriate dental care. They also mentioned that the results suggested the capacity to incorporate dental screenings into pediatric practices in a manner rendering them effective in dental disease detection and intervention (Pierce et al, 2002).

In line with the previous study, a 2004 article (dela Cruz et al, 2004) also published in the Journal of Pediatrics describes screening practices and referral patterns of pediatric primary care providers in North Carolina, and the characteristics that influence their decision to refer. This cross sectional survey of 169 primary care clinicians, included physicians, physician assistants and nurse practitioners, who were participants in the randomized control trial evaluating the “Into the Mouth of Babes” (IMB) program (a new medical program in North Carolina). The survey included questions pertaining to four areas related to oral health knowledge, opinions, behaviors and self-perceived competencies, as well as six oral health related activities such as, dental screening, risk assessment, referral, counseling, fluoride use and follow up.

Variables considered when constructing questions on referral included questions on the likelihood of referring children, factors considered in making a decision to refer and methods used. Questions related to referral were restricted to children 0 to 3 years of age regardless of medical eligibility. When asking about screening and referral behaviors, factors considered were adapted
from the socio-ecological framework (Stokolos, 1992) developed in 1992 on the impact of personal and environmental factors on behavior. Based on this, factors chosen were related to: 1) provider characteristics (provider type, gender, practice experience, board certification, training in oral health during or after professional education, hours worked, teaching of residents, oral health knowledge, opinions, confidence, and behaviors); 2) their practice (setting, number of providers, patient volume, and busyness [patients per hour]); 3) their patients (tooth decay status, insurance status, immigrant status, and English speaking); and 4) their practice environment (perceived difficulty of referral for routine or urgent care and perceived or actual availability of dental care providers) all of which “could potentially influence referral decision making process” (dela Cruz et al, 2004).

The authors reported that only 1% “rarely examined a child for a dental disease” and only 6% "did not refer”. Fortunately, the authors found that more than 90 % of the study sample reported referring infants and toddlers for dental care as part of their regular practice. Of those who referred, 54 % made an appointment for the child by directly calling a dental office. Nearly 78 % based their referrals on the suspected presence or risk for dental decay. Interestingly, physician assistants or nurse practitioners referred more often than physicians. The study also identified two significant predictors of referral; the degree of health care provider confidence and the number and extent to which providers saw children on a daily basis.

It is important to note that although overall outcomes of this study were encouraging, several aspects of the methodology limit the applicability and external validity of the findings. Namely, the sample participants were recruited to the trial because they responded to advertisements which offered continuing medical education through a Medicaid program targeting preventive dental care for infants and young children (dela Cruz et al, 2004). Not surprisingly, providers reported seeing Medicaid eligible children at a larger percentage (40%) than national
survey averages (26%). Furthermore, given their interest in enrolling in a new preventive dental program it is expected that participants have a higher level of oral health awareness than other practitioners and place more importance on prevention and treatment of dental problems.

This proposed program targeting Saudi medical interns, to our knowledge, is the first to be done in the Middle-east. In line with previous work, the focus of the educational intervention will be on infant oral health and age of referral with emphasis on Early Childhood Caries prevalence, etiology and prevention. A baseline and 6-month post-survey will be administered to assess oral health knowledge, attitudes, behaviors and self-perceived competencies. Questions used in the survey will be based on items and variables mentioned in the literature (Curtis et al, 1985; Erikson et al, 1997; Sanchez et al, 1997; AAP, 2000; Lewis et al, 2000; Schafer et al, 2000; Ismail et al, 2002; Pierce et al, 2002; AAP, 2003; Rozier et al, 2003; Seale et al, 2003; Bader et al, 2004; dela Cruz et al, 2004; Krol, 2004; Mouradian et al, 2005) as factors influencing physicians’ role in oral health-related issues and points of further exploration that had not been addressed previously.

Although there are relative similarities between the medical educational system in Saudi Arabia and that used in the U.S., there are several health-care system and social differences that have led to the adoption of a different educational intervention. The intervention will target medical interns as opposed to established physicians given that they are expected to be more positively motivated to attain the needed knowledge and training to gain comfort in identifying high-caries risk and appropriate referral practices. This is because social norm dictates physician knowledge in all aspects of health rather than a specific area (generalist vs specialist views of health care professional). Additionally, the internship year is considered by the medical school as a time allocated to professional confidence and mastery crystallization.

Web-based Interventions
In our proposed educational intervention with Saudi medical interns we attempted to target the population with electronic educational packages as opposed to in-person training or lectures/seminars or the distribution and use of paper-based materials. This included providing the targeted population with periodic informational emails and short message service (SMS) messages over a period of a month, throughout which, participants were provided with the opportunity to directly communicate with researchers to answer any questions or provide additional educational information if needed.

This method of administering educational material and/or training has recently become an area of increased focus as a means of enhancing educational or behavioral program participation (Fotheringham, et al, 2000). The majority of this focus has been on the use of internet-based strategies in smoking cessation and weight loss programs (Leslie, et al, 2002). The use of internet technology in delivering educational material targeting medical health care providers as part of their training or as a strategy to encourage attitude or behavioral change has not been adequately studied in the literature; however, several studies (Alex, et al, 2008; Ritterband, et al, 2006; Franklin, et al, 2005; Marshall, et al, 2003; Leslie, et al, 2002; Fotheringham, et al, 2000) that have looked at electronic means of education have indicated that there are no statistically significant differences in the effectiveness of electronic based interventions compared to traditional paper based interventions. Furthermore, a 2005 study by Douglass, et al concluded that there was no significant difference in knowledge obtained between physicians targeted with training in person and those targeted with web-based training.

Modern methods and technologies of information delivery and distribution have several potential benefits. These include speed of delivery, openness of communication, convenience, flexibility, and the low cost of delivery (Marshall, et al, 2003; Fotheringham, et al, 2000). Additionally, there is the potential to target, reach and affect a large number and different groups of
people in a variety of settings that can add to the generalizability of the results (Danaher, et al, 2009; Marshall, et al, 2003; Marcus, et al, 1998). Some aspects associated with web-based interventions that merit further discussion include recruitment success and methods, and the measures or degree of engagement.

Reports regarding recruitment success differ widely when it comes to web-based interventions and programs. Some published reports “have cited highly successful recruitment efforts”, whereas “others have described how recruitment plans had to be adjusted in reaction to unsatisfactory initial results” (Mckay, et al, 2008; Gordon, et al, 2006). An important aspect that relates to the extent of participation or recruitment is the modality used in marketing the program or intervention in addition to how the program is presented to the eligible participants (Danaher, et al, 2009). The modality used to deliver information about the program can enhance website exposure which results in greater recruitment (Thompson, et al, 2008). Presentation that focuses on the program benefits, usefulness, ease of use and credibility all help to distinguish the program and influence the eligible participants’ decision to participate (Danaher, et al, 2009). Additionally, Glasgow and colleagues (Glasgow, et al, 2007) found that involvement of senior staff or health care professionals with a personalized letter significantly enhances participation.

Based on the website set-up and design, participants are able to decide on what content they desire to review, the time they spend on the website and how often they want to log in and review the information (Danaher, et al, 2009). There is accumulating evidence that many participants of Web-based interventions exhibit less program engagement than program developers envisioned (Eysenbach, 2007). Measuring engagement provides the researchers with multiple benefits. For example, the applicability of the program; being able to better identify components of the website that are useful, engaging and which may help explain any observed intervention effect (Danaher, et al, 2009).
There are several tracking measures that can be used as objective gauges of website-use by participants in a web-based program. Such measures include: monitoring server log-in or web-page views, the duration of time spent reviewing the content of the website, the number of click-throughs to additional links provided on the website page, specific component views or usage. Additionally, some previous research studies have used these factors as proxy-measures of participant motivation (Danaher, et al, 2009).

Unfortunately, these measures also come with certain challenges regarding the accuracy of engagement measurement (Danaher, et al, 2006). For example, interpreting exactly what web-page views is measuring can be difficult because viewing numbers or duration can be influenced by the web-page design and presentation and overall organization (Danaher, et al, 2009). Additionally, it is difficult to ascertain whether the time spent on the web-page is being used to actively view the contents of the site or may be due to other factors, such as, multi-web-page viewing.

Furthermore, when comparing the effectiveness of engagement measures is attempted between studies it is important to consider the operational definitions used for each measurement (Danaher, et al, 2009). For instance, what constitutes a web-page view or visit can vary greatly based on the operational definition. Some researchers have defined web-page visits in terms of the number of times a participant returns to a website with a break of at least 30 minutes; whereas others have used the number of days that at least one visit per participant occurred (Danaher, et al, 2009; ComScore, 2009).

In general, this method of administering educational training has not been adequately studied in the literature (Marshall, et al, 2003). However, the literature has mentioned multiple benefits of using electronic or web-based educational programs over other targeted delivery systems. These include, the convenience provided to both the researcher in terms of material delivery and data collection as well as to the participants in terms of flexibility to view and use
material at their own pace and on their own schedule. Additionally, there is the potential to reach and influence a broader, more variable audience with a novel approach that may be more appealing especially when targeting younger age-groups (Marshall, et al, 2003; Fotheringham, et al, 2000). On the other hand, there are several barriers associated with the use of technology in information delivery. Two main obstacles to the successful use of electronic means information delivery are cost and access (Marshall, et al, 2003).

Overall, although, comparative research comparing print versus electronic-based programs is very limited in scope, a 2005 study by Douglass, et al did conclude that there was no significant difference in knowledge obtained between physicians targeted with training interventions done in person and those targeted with a web-based training session (Douglass, et al, 2005).

Theoretical Background in Educational Intervention

The main theory that lends itself to this proposed educational intervention targeting Saudi medical interns program and intervention activities is the Social Cognitive Theory. This theory was presented and studied in depth by Bandura in the late sixties and early seventies. (Glanz, et al, 2002) It synthesizes a multitude of “previously disparate cognitive, emotional, and behavioristic understandings of behavioral change” (Glanz, et al, 2002). In doing so, the Social Cognitive Theory permits the application of these constructs to health behaviors and behavioral change in many different disciplines. Many of these constructs have in fact been used in designing health promotion interventions. In summary, these many constructs revolve around a triangle of three main headings, namely: constructs related to the person or individual, those related to the environment, and those related to the behavior itself.

The focus of our proposed program is on improving the knowledge and comfort levels of physicians with the goal of ultimately influencing behavior. However, it is important to remember that the targeted behavior and performance are affected by many factors and not merely the
knowledge component of the problems facing high caries risk children; so for this intervention to be successful it is important to incorporate all aspects of the theory’s triangle into the designing of the questionnaires and intervention activities. In the following, I will briefly touch on the constructs that are incorporated in our proposed program.

The most prominent construct related to our proposed program is the self-efficacy construct. In our present study we will use comfort level as a measure of the self-efficacy construct which has also been referred to as the confidence level or surety of an action in face of adversary or barriers. Formally, self-efficacy is defined as “the person’s confidence in performing a particular behavior and in overcoming barriers to that behavior”. (Mckenzie, et al, 2009) Self-efficacy is very important in this conquest because it has been shown to be predictive of personal investment into or willingness to perform a task and the level of performance attained. (Mckenzie, et al, 2009) In order to reach the targeted learning and behavioral objectives of this intervention we will target increasing the self-efficacy related to oral health assessments of the participating individuals (medical interns). This will be incorporated into the educational material provided to the interns that will increase knowledge related to infant oral health, oral disease risk factors and the skills required to perform an oral health assessment and examination. As will be mentioned under program activities section, both observational and active learning techniques will be used to introduce and promote the knowledge and skills required to perform the targeted behavior.

For improved self-efficacy the participants must first understand the behavior and feel capable of performing it (behavioral capability), feel that they will be able to manage children of this age group (emotional coping responses) and feel a specific value of performing this behavior (expectancies); all of which will be addressed in the educational material and accompanying educational websites. These three previous components on their own are additional constructs of
the Social Cognitive Theory that fall under the behavior heading. However, they also add to the concept of building self-efficacy at the individual level.

An additional construct of importance in our intervention is the setting of a supportive environment or external situation. The availability of needed educational material and referral documents to the interns is important in providing an environment set up to refer high risk patients. Furthermore, creating a working environment that promotes global health including oral health as a norm and not an afterthought is also important in affecting the interns’ behavior.

The ultimate goal of this body of work is to improve access for young children to oral health services and treatment through earlier referral of high risk children by trained, knowledgeable physicians. The proposed program targets several of the primary sequential steps towards that future goal, specifically understanding the behavior and increasing confidence in identifying high risk children and the need for referrals. Through successful incremental tasks a person gains increased expectations of success and mastery of skills, which ultimately improves persistence, performance level, and ultimately, behavior change (higher referral rates of high risk children).

Finally, there are other concepts that are encompassed in the Mastery Modeling Program. Several aspects of building individual self-efficacy and an appropriate environment for behavior modification are consistent with the Mastery Modeling program that was introduced as a program to improve motivation and self empowerment through self-efficacy training. This program focuses on building self confidence and belief in an individual’s ability to perform a specific activity through several educational incremental steps. This is done by having an individual with expertise in an area train a group of relative novices how “to cope with an otherwise fearsome situation”. (Reeve, 2009) In our case, we will include the earlier learning steps of this program that promote awareness of the needed skill set and barriers that may arise in integrating oral health education and
assessment of children activities into overall child health assessment. These steps are those that will focus on helping the medical interns better understand the component skills of the activity; emphasize the areas of probable worry for relative novices; provide an expert modeling the behavior or activity; and demonstrate how to integrate these component skills into an overall visual simulation performance. (Reeve, 2009) It is beyond the capacity of this intervention to include the remaining learning steps that, in summary, build self-efficacy through actual performance with corrective feedback from an expert as well as by watching peer performance. However, given that the target group will be undergoing a pediatric rotation in group structure, we will include a question in the follow-up survey addressing whether group discussions and encouragement have been acquired within the group that would also have a positive effect on self empowerment and confidence. It is clear from the previous that several aspects of the motivational Mastery Modeling program integrate well with the constructs of the Social Cognitive Theory.

The Internet in Saudi Arabia

In 1999, the population in Saudi Arabia was introduced to the technological eruption in information as internet service first became available to the public. Initial connections were all run through a state server, the Saudi Telecom Company. Internet connections and websites were monitored through the King Abdul Aziz City for Science and Technology. Initially, use was restricted to government and academic institutions but broadened to the wider public in July of 2001 with the introduction of an Asymmetric Digital Subscriber Line service in all major cities. In 2001, the number of broadband users approximated 14,000.

By April 2003, the number of internet providers in Saudi Arabia had grown to 21 operational Internet Service Providers, providing internet access to about 1.6 million users. The King Abdul Aziz City for Science and Technology continued to be the State run monitor on
internet access and safety. By the end of 2006, the number of users had more than doubled to approximately 4.7 million users.

The method of providing the Saudi medical interns with before and after surveys as well as with the educational emails was chosen after confirming that all students had ready access to the internet and email services. This information was gained through in-depth interviews with the faculty and staff at King Saud University Hospital, College of Medicine. In fact, students not only had access to the web but were actually required to maintain contact with and gain important information from the College through their email accounts.

**Summary Statement**

Access to dental care for children is increasingly becoming an area of concern and focus for many health care organizations around the world. One potential avenue for overcoming this problem has been to include non-dental professionals as adjuncts of care, specifically targeting children who are at high risk for dental caries.

Several surveys within the US and elsewhere have provided evidence that general physicians, family practice physicians and pediatricians, as well as medical adjuncts are more than capable and in many cases are willing to provide preventive dental care and can be trained to do so. Because physicians and other primary care providers typically see very young, poor and minority children at early stages of life and on a regular schedule, they are optimally positioned to facilitate the needed dental care for this underprivileged population. It is also valuable that these non-dental professionals can provide high risk patients with appropriate dental education and referrals to dental providers. (Gonzales, 2004; Pierce, 2002)

There are, however, several obstacles to the provision of these much needed services. There is an obvious gap in knowledge, as demonstrated by the systematic review of the literature by Bader et al in 2004; twelve out of 102 articles identified were reviewed in detail and only 1 study
on the effectiveness of primary care clinicians in making dental referrals was found. The study conducted in 1998 by McCunniff et al (McCunniff, 1998), assessed the effectiveness of dental screenings and referrals made by health care professional at the Women, Infants and Children (WIC) Program on utilization rates of dental services for eligible low-income children. Results showed that children who were referred following an intra-oral screening examination were approximately twice as likely to have made a dental visit in their lifetime (37%) than children who were not referred (19%). However, the study did not control for time elapsed since the time the referral had been made. Additionally, when controlled in a multivariate analysis for child age, maternal age, household size, presence of dental insurance, and mother's perception of the child's dental needs, dental visit rate differences were not significant.

There is also a need to focus attention and efforts towards increasing the amount and competency of oral health knowledge and training in medical schools and residencies. (Mouradian, 2003) In addition, it is essential to recognize the historic gap between medicine and dentistry (Formicola, 2002), and the associated organizational and administrative separation. Cooperation between the two professions is crucial to the success of any effort to increase access and utilization of dental care services by those in most need. This is especially true given the prominent level of physicians reporting difficulty in referring patients for dental care. (Lewis, 2000) Furthermore, in Saudi Arabia, for example, one of the major factors leading to the present inefficiencies and expensive healthcare costs has been an absence of data that would help in appropriate decision- and policy-making, especially regarding possible avenues of coordination among the multiple public agencies in the finance and delivery of patient health care (MOH, 2007).

**Purpose of the thesis**

Consequently, both studies seek to add to the slowly growing literature pertaining to the improved cooperation and coordination between the different health care professions; specifically
regarding the inclusion of non-dental health care providers in dental disease prevention. The primary aims of the presented studies are to evaluate the primary care providers (pediatricians and medical interns) oral-health and prevention knowledge; factors influencing their perceived ability to perform dental assessments, counseling and ultimately dental referrals adequately and in a timely manner. The study will also assess providers’ self-evaluated awareness and attitudes towards dental education and care. The first project tackled these through a survey to address questions regarding the knowledge, behavior and comfort levels of non-dental health care professionals (i.e. pediatricians) in assessing, treating and referring children in need of dental care in Iowa. The second project provided Saudi medical interns at King Saud University Hospital with electronic educational material and used a survey to assess changes in knowledge, attitudes or oral-health related practices following this intervention.

The expectation is that these studies will help oral-health care providers better understand the obstacles faced by other health-care providers. The ultimate results of this research may help initiate a more practical and combined health and dental care approach to overcoming these obstacles and thus, improving access to oral-health care for young children.
CHAPTER III

GENERAL MATERIALS AND METHODS

The materials and methods section of this study is divided into the following subsections: 1) Overview; 2) Iowa Study; 3) Saudi Study; Both (2) and (3) including [Research Questions; Dependant and Independent Variables; Hypothesis; Program Activities; Study Population; and Recruitment of Subjects and Questionnaire Distribution]; 4) Sample Size and Power; 5) Study Design; 6) Data Management; 7) Data Analyses; and 8) Human Rights.

Overview

The past few decades have witnessed an increased focus on oral health and the social, psychological and developmental consequences of untreated oral disease. Although children may be affected by one of any number of oral diseases, dental caries remains the most common chronic disease of childhood in the U.S and also in Saudi Arabia.

In Iowa, the recent oral health report in Healthy Iowans 2010 identified access to dental care as the primary oral health problem facing the population of the State of Iowa. Furthermore, children under age 3, children with special health care needs and children in low-income families or minority households and those living in rural areas tend to have the most difficulty in accessing needed dental care.

In Saudi Arabia, several recent clinical studies (Amin, et al 2009; Al-Malik, et al 2003; Paul, 2003) have demonstrated carious levels at around 70% in children under the age of 5 years. These studies have identified multiple factors associated with the high levels of dental caries among children under 5 years old. The main factors identified were lack of oral health knowledge among parents and children, and subsequently a lack of adequate oral hygiene practices. The other primary factor identified by researchers was a lack of regular dental visits by children with approximately
60% having never been to a dentist by age 5 (Amin, et al 2009). This lack of appropriate access appeared to be more prominent in rural areas (Amin, et al 2009).

One avenue that has been suggested in combating this problem and improving access to care has been attempting to recruit primary care physicians (Lewis et al, 2000; Pierce et al, 2002; Rozier et al, 2003; dela Cruz et al, 2004; Gonzales et al, 2004) to play a more active role with regards to oral health issues. Unfortunately, these studies are few and limited in their generalizability.

Furthermore, there have been no studies to our knowledge that have assessed physicians’ or medical students’ oral health knowledge or comfort levels in assessing dental caries risk and need for dental referral in Iowa nor in Saudi Arabia, specifically for children at high caries risk. Given the renewed focus on oral health prevention and care in both populations; as well as the identification of access to care issues as a major problem facing young children; in addition to the latest demographics showing that 65% of the population in Saudi Arabia is under the age of 15 years, there is a clear need to develop programs that would address barriers to access of care and regular dental treatment that would help alleviate this increasing health care concern.

More information is needed to determine primary care practitioners' attitudes, willingness, abilities, and comfort levels in identifying children who are at risk for dental caries. Ultimately such a determination may lead to an improved ability to refer these children.

**Iowa Study**

**Research Questions**

I. The primary research questions of interest were:

1. What factors influence Iowa pediatricians’ frequency of referring high caries risk children under age 3?
2. What factors influence the perceived comfort levels of Iowa pediatricians’ frequency of referring high caries risk children under age 3?

II. Secondary research questions included:

1. What is the level of Iowa pediatricians’ knowledge regarding oral health issues for children under age 3?
2. What oral health practices are Iowa pediatricians performing for high caries risk children under age 3?
3. How willing are Iowa pediatricians to perform oral-health directed procedures for high caries risk children under age 3?

Dependant Variable(s)

There were two primary dependent variables discussed in this study. The first was the frequency with which Iowa Pediatricians’ refer high caries risk children under age 3.

This variable was defined and explored by several survey questions outlined in the following:

a) **Question (13-h):** How FREQUENTLY during a well child visit do you or your staff (Refer to a dentist in the area) for children age 0-3?

b) **Question (19):** What CRITERIA do you use for deciding what children (age 0-3) you WILL REFER to a dentist for care during a well child visit?

c) **Question (20):** This question asked whether any of the following were considered barriers to referring children (age 0-3) for dental care. These included: Lack of locally available dentists, Finding a dentist willing to accept children on public insurance (e.g. Medicaid, Hawk-I), Finding a dentist willing to accept children who are uninsured, Finding a dentist willing to accept children under the age of 3, Finding a dentist willing to accept children with a developmental disability and Oral health is of low priority for the families I see.
d) **Question (21):** This question asked physicians which methods they use when referring high caries risk children to dentists for treatment. These methods included any one of the following: Giving the caregiver the name of a dentist, calling a dental office to make the appointment, contacting a coordinator service to help in making the appointment or simply telling the caregiver the child needs to see a dentist.

The second primary variable, namely how physicians perceive their comfort levels in performing oral health related practices was defined and explored by the following survey questions:

a. **Question (17):** How COMFORTABLE do you feel in advising parents of children (0-3) on the following: Child oral hygiene, Fluoride toothpaste use, Dietary recommendations to prevent cavities and Regular dental check ups

b. **Question (18):** How COMFORTABLE do you feel doing the following for children (0-3):
   - Examine teeth for tooth decay,
   - Identify tooth decay,
   - Identify other signs of oral pathology,
   - Evaluate risk factors for tooth decay and
   - Decide if a child needs a referral to a dentist for dental care.

The secondary variables of interest, physicians’ knowledge, oral health practices performed and perceived willingness are described in the following:

1) **Level of Iowa Pediatricians’ knowledge regarding oral health issues for children under age 3,** this variable was defined by:

   a. **Question (11):** This question asked physicians their opinion on several oral health related knowledge questions that were based on questions used in the literature to assess knowledge base. These questions are listed below:
      - Bacteria that cause cavities can be transmitted from a mother to her child
• White spots on the teeth may indicate early decay
• Kids can develop cavities by drinking juice from a sippy cup throughout the day
• Children should have their teeth brushed by an adult until they are in 2nd or 3rd grade
• Brushing with fluoride toothpaste prevents cavities; while brushing without fluoride toothpaste is less effective
• Children's (age 0-3) teeth should be brushed with fluoride toothpaste
• Children (age 0-3) should have their 1st dental visit no later than 12 months of age
  b. Additionally, question (14) asks about knowledge of fluoride varnish.

2) Oral health practices performed by Pediatricians for high caries risk children under age 3, this variable was defined by:

   a. Question (13): This question asked physicians how frequently during well child visits they performed specific oral health related practices, as pointed out below:

      • Lift the upper lip to view the child's 4 upper front teeth
      • Examine a child's teeth for signs of dental decay
      • Counsel parents on the importance of regular tooth brushing
      • Counsel parents on the importance of going to a dentist
      • Discuss the importance of fluoride toothpaste use
      • Inquire whether a child is taking a bottle to bed
      • Inquire about the mother's dental health

3) Iowa Pediatricians’ willingness to identify high caries risk children under age 3, this variable was defined by:

   a) Question (15): Would you consider routinely applying fluoride varnish to high risk children during their well child visit?
b) **Question (16):** Would you be INTERESTED in participating in a continuing education course that addresses the following topics for children (age 0-3)? These included topics on fluoride varnish application, caries risk assessment, and counseling parents on oral health-related topics.

**Independent Variables**

The independent variables questioned in the survey instrument to assess these dependent variables were divided into four categories. They were derived from the literature (Curtis, 1985; Sanchez, 1997; Erikson, 1997; Sanchez, 1997; Lewis, 2000; AAP, 2000; AAP, 2003; Schafer, 2000; Ismail, 2002; Pierce, 2002; Rozier, 2003; Bader, 2004; Krol, 2004; Seale, 2003; dela Cruz, 2004; Mouradian, 2005). Additionally, variables were derived from those thought to be pertinent to the dependent variables in question. The four independent variable categories were as follows:

1) Characteristics related to the physician:
   - Physician age;
   - Physician gender;
   - Number of years in practice;
   - Physician experience with high caries risk children under age 3;
   - Number of combined hours of previous oral health education and training;
   - Perceptions regarding the importance of oral health;
   - Perceptions regarding their role in identifying high caries risk children under age 3;
   - Perceptions regarding financial compensation for oral health preventive practices for high caries risk children under age 3).

2) Characteristics associated with the physician’s practice:
   - Type of practice;
• Area of primary practice;
• Time constraints (workload).

3) Characteristics associated with the physician’s patient pool:
• Type of insurance coverage for children patients under age 3;
• Number of patients seen per week;
• Number of child patients seen per week;
• Frequency of Oral Problems presented.

4) Characteristics associated with the community:
• Finding dentists willing to see high risk children under 3;
• Finding dentist willing to accept high risk children under 3 with public insurance as payment;
• Availability of local care coordination services;
• Location (urban vs rural).

**Hypothesis**

The following hypothesis (stated in terms of “null” hypotheses) was generated to answer the primary research questions of the study pertaining to Iowa pediatricians:

There is no significant relationship between Iowa pediatricians’ frequency of referring high caries risk children under age 3 and:

a. Physician’s gender;
b. Physician’s age;c. Type of practice setting (single provider vs. group practice);
d. Number of patients seen in a week;
e. Number of children (age 0-3) seen in a week;
f. Years of professional practice;
g. Area of primary practice;
h. Knowledge regarding oral health issues for children under age 3;
i. Frequency of oral health related problems seen;
j. Performance of oral health preventive practices for high caries risk children under age 3;
k. Willingness to identify high caries risk children under age 3;
l. Perceived comfort in identifying high caries risk children under age 3;
m. Perceived barriers of referral.

There is no significant relationship between Iowa pediatricians’ perceived comfort levels in performing oral health related practices on high caries risk children under age 3 and:

a. Physician’s gender;
b. Physician’s age;
c. Type of practice setting (single provider vs. group practice);
d. Number of patients seeing in a week;
e. Number of children (age 0-3) seeing in a week;
f. Years of professional practice;
g. Area of primary practice;
h. Knowledge regarding oral health issues for children under age 3;
i. Frequency of oral health related problems seen;
j. Performance of oral health preventive practices for high caries risk children under age 3;
k. Willingness to identify high caries risk children under age 3;
l. Perceived barriers of referral.
Study Population

The study performed in Iowa targeted the population of Iowa pediatricians, as well as any clinical assistants working in the same clinics that may have had a role in addressing oral health examinations or care for children under the age of 3. This population included only those practicing in the State of Iowa. The most current list of pediatricians and pediatric clinics provided through the Medical Registry at the College of Medicine approximated the number of pediatricians practicing in the State at about 350 pediatricians. The Medical Registry is formed through the Office of Statewide Clinical Education Programs that has maintained informational tracking systems on Iowa's practicing physicians for over 30 years. They also track physician assistants, advanced practice nurses, dentists and pharmacists. The databases are updated continuously on a daily basis. The databases provide the following information: name, gender, age, degree, office address, office phone, county, professional activity, practice arrangement, specialty, specialty certifications, medical/health education information, year of graduation, and postgraduate training information.

Recruitment of Subjects and Questionnaire Distribution

In our first study, a self-administered questionnaire in booklet format and cover letter were sent to physicians whose names were provided by the Medical Registry at the College of Medicine. The survey was administered during the fall and spring semesters of the 2006-2007 and 2007-2008 school year and only pediatric physicians were asked to participate.

Two mailings were sent to all listed pediatricians. The first mailing was sent in December of 2007. The second mailing was sent four weeks later, in January 2008 following school holidays, to the non-responding physicians. Each mailing included a cover letter signed by Dr. Yousef, the primary investigator, and Dr. Weber-Gasparoni the principle thesis advisor. The cover letter explained the purpose of the survey and specified that the questionnaire could be completed in
approximately 15 minutes. The cover letter explained that by completing and returning the questionnaire, subjects were agreeing to participate in the study. A self-addressed stamped envelope was included in the packet to aid the return process of the questionnaire. To prevent subsequent mailings to subjects who responded to the first mailing, the questionnaires were labeled with a unique identification code that was provided by The University of Iowa Campus Mail services during the collecting and mailing process.

Once the questionnaires were returned, they were stored in a locked file cabinet in the Department of Pediatric Dentistry, College of Dentistry at the University of Iowa. The mailing list and codes were also stored in a locked file cabinet. Once all questionnaires were received, and data-collection ended, the code that identified the participants was destroyed. Electronics copies of the main data were stored on a password protected computer. The surveys were reviewed for completeness and clarity before submission for data entry.

**Saudi Study**

**Research Questions**

I. The primary research question of interest was:

1. How willing are Saudi Arabian medical interns’ to perform oral-health directed procedures for high caries risk children under age 5?

II. Secondary research questions include:

1. What is the perceived comfort level of Saudi Arabian medical interns’ in performing oral-health related practices for children under age 5?

2. What factors influence Saudi Arabian medical interns’ decision to refer children under age 5?
Dependant Variable(s)

There were four primary dependent variables discussed in this study, associated with the willingness or likelihood of Saudi Arabian medical interns’ to perform four oral-health directed procedures for high caries risk children under age 5. This variable was defined and explored by several survey questions outlined as follows:

a) **Question (15 second part):** For the following oral health assessments/tasks for CHILDREN (0-5): Do you believe these are the pediatrician’s RESPONSIBILITY?

b) **Question (16):** How INTERESTED would you be in participating in a continuing medical education (CME) course on pediatric oral health?

The secondary research questions of physicians’ comfort levels and decisions to refer children under age 5 are described as follows:

1) How physicians perceive their comfort levels in performing oral health related practices was defined and explored by the following survey questions:

   a) **Question (15 first part a-c):** For the following oral health assessments/tasks for CHILDREN (0-5): How COMFORTABLE do you feel in advising parents of children (0-5) on the following: How to brush correctly; sleeping with a bottle and Fluoride toothpaste use.

   b) **Question (15 first part d-h):** How COMFORTABLE do you feel doing the following for children (0-5): Examine teeth for tooth decay; Evaluate risk factors for cavities; Identify other signs of oral pathology; Assess parents oral health and Decide if a child needs a referral to a dentist for dental care.

1) How physicians make a decision to refer children under age 5, this variable was defined by:

   **Question (17):** This question asked physicians what CRITERIA they use for deciding to REFER children (age 0-5) to a dentist for care, as pointed out below
Independent Variables

The independent variables questioned in the survey instrument to assess these dependent variables can be categorized into three areas. Information was gained from the annual survey of graduating pediatric residents (Caspary, et al 2007) which was very useful when questions and variables were chosen. They were also derived from the literature (Curtis, 1985; Sanchez, 1997; Erikson, 1997; Sanchez, 1997; Lewis, 2000; AAP, 2000; AAP, 2003; Schafer, 2000; Ismail, 2002; Pierce, 2002; Rozier, 2003; Bader, 2004; Krol, 2004; Seale, 2003; dela Cruz, 2004; Mouradian, 2005). Additionally, variables were derived from those thought to be pertinent to the dependent variables in question. The four independent variable categories were as follows:

1) Characteristics related to the physician:
   - Physician age;
   - Physician gender;
   - Choice of future clinical goals;
   - Satisfaction with oral health training
   - Perceptions regarding the importance of oral health;
   - Knowledge on oral health issues;
   - Perceptions regarding their role in identifying high caries risk children under age 5.

2) Characteristics associated with the physician’s practice:
   - Choice of first intern rotation;
   - Type of Rotation (surgery vs elective vs internal medicine vs pediatrics vs obstetrics/gynecology vs emergency room).

3) Characteristics associated with the physician’s patient pool:
   - Number of patients seen per week;
• Number of child patients seen per week;
• Frequency of Oral Problems presented.

**Hypothesis**

The following hypothesis (stated in terms of “null” hypotheses) was generated to answer the primary research question of the study pertaining to Saudi interns:

There is no significant relationship between Saudi Arabian medical interns’ willingness to refer children under age 5 and:

1. Physician’s gender;
2. Physician’s age;
3. Number of patients seeing in a week;
4. Number of children (age 0-3) seeing in a week;
5. Amount of oral health-related training in medical school (pediatric residency);
6. Satisfaction with oral health training at medical school (pediatric residency);
7. Knowledge regarding appropriate age for first dental visit for children;
8. Frequency of oral health related problems seen;
9. Perceived comfort in identifying high caries risk children under age 5; and Criteria in referral decision.

**Program Activities**

The program activities consist of two major portions, namely a baseline survey and an educational intervention followed by a follow-up survey. Initially self-administered surveys were conducted to assess satisfaction with oral health training, willingness, comfort levels and criteria of referral. These were distributed during June of 2010. This was followed by a month (July’2010) long electronic educational intervention. During the 5-day week, medical interns received core health care knowledge educational emails on a daily basis. These educational emails had a simple
format: at the beginning of the email a core health care related message with basic information regarding it were presented in a one-slide power point set-up. This was followed by more detailed information on the different constructs included in the message; and at the bottom of the email a link to an educational website focused on this particular oral health care message. The main areas of oral health care that were addressed included: teaching medical students to perform a dental screening and identify deviations from normal; assessing caries risk among children under 5; describing the importance of fluoride in the prevention of tooth decay; counsel caregivers on maintaining oral health for their children; and referring high-caries risk children effectively. The participants were given a chance to ask follow-up questions via email as well as address areas of worry or anxiousness regarding specific skill sets. If the focus of the educational message is a procedure, an accompanying video demonstrating this technique or procedure was provided and acted as the primary message. In these videos the dentist modeled such procedures as a dental screening on a child under 5, the associated parental counseling, caries-risk-assessment and subsequent decision to refer. Emphasis was made on areas of worry or anxiousness regarding specific skill sets. An example of these emails is given Appendix C. In addition to the emails, participants received similar basic information text messages which acted as supplemental reinforcement of the educational message. Furthermore, the participants were provided with a package that consists of a handout of the course presentations; educational materials for parents, information on fluoride, clinical practice guidelines on caries risk assessment, and referral. Simple referral papers were attached to the post-birth immunization pamphlet usually given to the parents of newborns during the infant education clinical session.

This method of administering educational training has not been adequately studied in the literature. However, several studies (Alex, et al, 2008; Ritterband, et al, 2006; Franklin, et al, 2005; Marshall, et al, 2003; Leslie, et al, 2002; Fotheringham, et al, 2000) that have looked at electronic
means of education have indicated that there are no statistically significant differences in the effectiveness of electronic based interventions compared to traditional paper based interventions. They do, however, have the added benefits of speed, openness of communication, convenience, flexibility, and the low cost of delivery.

Finally, following the one-month educational intervention, a post-intervention survey addressing similar sections as the pre-intervention survey will be administered during August 2010. Within this follow-up survey the participants were asked to provide input into the oral health training course provided as a means of improving personal acceptance of adopting such practices. Both the pre- and post-intervention surveys were distributed and collected by the chief medical intern during regular work hours.

**Study Population**

In the second study performed in Saudi Arabia the population was made up of Saudi medical interns that may have had a role in addressing oral health examinations or care for children under the age of 5. The internship year is a one-year training program following completion of medical school that is required for all graduating medical students. The interns take part in one of six medical rotations, including: surgery, internal medicine, pediatrics, obstetrics and gynecology, emergency room and an elective rotation. This population included only those studying at the Medical Colleges of King Saud University located in Riyadh. This medical college is one of five medical colleges in Saudi Arabia. It was chosen because at it is the largest and oldest of these colleges and graduates the largest number of physicians annually. After meeting with both the Vice Dean for Academic-Affairs at the University and the Intern Supervisor at the College of Medicine; permission to conduct this intervention study was granted. All medical interns at the college were targeted which approximated a total of 300 interns.
In the summer of 2008, the researchers met with secretaries of both the fifth year students (last year of medical training) and that of the internship. Through these meetings, data specific to the student class description and make-up was obtained. This included a list of the medical students expected to graduate to the internship was obtained. Additionally, information regarding students’ location, classes, rotation cycles and time schedules during the internship was obtained.

Qualitative information was gained through in-depth one-on-one interviews with five graduating interns from the 2008 class. It was expected that through these interviews, important insight into the students’ educational experience would be gained. This insight would potentially guide intervention focus areas and question selection. The main content of this data collection focused on obtaining information about oral health-related training during medical school; including satisfaction with the knowledge content, comfort levels regarding oral health related practices, attitudes towards performing such practices, suspected barriers to performing practices and clinical time constraint issues. This data was compared to previous research in this area (see literature review). Through these interviews, it was confirmed that all students have internet access, as well as being supplied or having a cell phone, as it is required by the medical school in order to allow for communication between faculty and students.

Our proposed program targeted the population with electronic educational packages as opposed to in-person training. This included providing the targeted population with periodic informational emails and short message service (SMS) messages over a period of a month. This method of administering educational training was chosen following interviews with the medical faculty and interns at the targeted medical school given that interns communicate with faculty and between themselves almost exclusively through electronic means. These meetings with faculty also gave insight into aspects of oral health that integrate well into general health practices that are
already being implemented as part of the medical intern training program. Additionally, possible barriers that may affect the intervention were revealed and incorporated into the evaluation surveys.

**Recruitment of Subjects and Questionnaire Distribution**

In our second study, a self-administered questionnaire in electronic format was distributed to all medical interns at the King Saud University Hospital during a pre-arranged time through the assistance of the medical college secretary and chief intern. A brief explanation regarding the purpose of the survey and specifying the approximate time for completion (10 minutes) was sent out a few days prior to the actual survey letters. The subjects were also informed that by completing and electronically returning the questionnaire, they were agreeing to participate in the study. If they did not wish to participate they could do so by replying with an email stating that. The survey was administered during the late Summer – early Fall semesters of the 2009-2010 academic years.

Once the questionnaires were returned, they were stored in a locked file cabinet in the Department of Dental Public Health, College of Dentistry at the University of Iowa. Electronic copies of the main data were stored on a password protected computer. The surveys were reviewed for completeness and clarity before submission for data entry.

**Sample Size and Power**

Unfortunately, collectively few studies have looked at medical students’ education and training in oral health. This proposed program targeting Saudi medical interns, to our knowledge, is the first to be done in the Middle-East. Accordingly, most qualitative and quantitative data used was collected through our study.

In both studies surveys were sent to nearly 100% of all eligible participants. The estimated response rate ranged from 20% to 30%. Given the nature of this research project and limitation of lack of previous similar studies; this estimation was placed as a percentage goal for appropriate statistical analysis. Since no similar studies have been done before so that no analogous information
is currently available for the sample size determination; this study will provide important valuable information for planning of future studies.

**Survey Design**

Both studies were considered descriptive, cross-sectional studies of physicians in the targeted populations. The research instruments were both pre-tested, and reviewed by several faculty and staff within the University of Iowa, College of Dentistry and among the thesis committee.

The survey pertaining to the first study targeting pediatricians in Iowa (Appendix B) was sent to 10 pediatricians working at the UIHC department of Pediatrics for completion, review, suggestions and comments as a means of informal pilot testing. Similarly, it was also sent to 10 non-UIHC pediatricians. This was done through the coordination and help of Dr. Murph. They were sent out in early June of 2007 and within two weeks the completed surveys with comments were returned. After review with the committee chair, appropriate adjustments based on suggestions, clarifications and comments were made to the final survey instrument.

The questionnaire contained 18 questions with multiple sub-items in four different sections (Appendix B). These sections included, information about the physician and their patient population (questions 1 through 4, 6 and 7); information regarding satisfaction with oral-health-care training in medical school (questions 5 and 8); information regarding oral-health-related knowledge and frequency of oral health related problems (questions 10 and 11); information about willingness, interest and comfort in oral-health related education and practices (questions 12 through 14); and criteria used in referral decisions (question 15). Where appropriate, a Likert-type scale (5- and/or 6-levels) was used. For questions regarding procedural or screening information a “yes” or “no” format was used.
The survey pertaining to the second study targeting medical interns in Saudi Arabia (Appendix B) was sent to the pediatric residents working at the UIHC department of Pediatrics for completion, review, suggestions and comments as a means of informal pilot testing. They were sent out in Mid-May of 2010 and within two weeks the completed surveys with comments were returned. The questions posed have been assessed for reliability and validity (Yousef, et al 2010; Caspary, et al 2007).

Both questionnaires were developed based on items and variables mentioned in the literature (Curtis et al, 1985; Erikson et al, 1997; Sanchez et al, 1997; AAP, 2000; Lewis et al, 2000; Schafer et al, 2000; Ismail et al, 2002; Pierce et al, 2002; AAP,2003; Rozier et al, 2003; Seale et al, 2003; Bader et al, 2004; dela Cruz et al, 2004; Krol, 2004; Mouradian et al, 2005; Yousef et al, 2010) as factors influencing physicians’ role in oral health-related issues and points of further exploration that had not been addressed previously. Additionally, information on question design gained from the 2006 annual AAP Graduating Residents Survey was used. The GRS is an annual, randomly sampled national survey of graduating pediatric residents. The survey examines residents’ self-described attitudes about their residency training on oral health and their attitudes about performing oral health assessment tasks. (Caspary, et al 2007)

**Educational Intervention Focus Areas in Dental Health** (Appendix C):

1) Caries (Decay):
   - How oral health relates to general health
   - How it develops
   - Risk factors (white spot lesions, parent history, dietary and oral hygiene habits plaque…etc)
   - Consequences of caries development

2) Oral Hygiene:
• How to brush teeth at different ages and with different cooperation levels
• When to brush, when to allow children to self-brush
• Fluoride use: mechanisms of action, amount, toxicity
• 1st dental visit and regularity of visits

3) Dietary Habits:
• Recommendations for Meals/snacks
• Recommendations of using of juice, milk, soda pop
• Bottle-feeding, weaning, sippy cup

4) Examining children:
• How to examine (video)
• Identifying white spot lesions, caries
• Varnish application

5) Emergencies:
• Toothache
• Broken tooth/soft tissue energy
• Avulsed tooth (primary vs permanent)
• Objects caught between teeth

6) Pregnancy Oral hygiene advice:
• Best times for treatment
• Preventing caries/periodontal disease
• Risk of preterm & low-birth-weight babies
• Maternal levels of Strep Mutans effect on child caries

7) Why Physicians:
• Young children are seen more frequently for medical visits than dental visits
- Dentists per population (shortage) vs physician ratios
- Financial benefit with move towards insurance and payment based medical practice.

**Associated Intervention Objectives:**

**A. Learning Objectives**

1) At the end of the program, the surveyed medical interns will show a 15% increase in correct responses to the specified knowledge questions related to:
   a) How caries develops
   b) What are the risk factors associated with caries (white spot lesions, parent history, dietary and oral hygiene habits plaque…etc)
   c) The age-one dental visit
   d) The recommended infant and young child oral-hygiene practices
   e) How fluoride protects against dental caries
   f) The recommended infant and young child dietary habits
   g) The recommended oral hygiene practices during pregnancy

2) Surveyed physicians will show a 15% increase from baseline in self-reported behavioral intent regarding the involvement in oral health related practices.

3) Surveyed physicians will show a 10% increase from baseline in self-reported comfort levels in counseling parents on oral health practices and recommendations.

4) Surveyed physicians will show a 10% increase from baseline in self-reported comfort levels in performing of infant oral exams.

5) Surveyed physicians will show a 10% increase from baseline in self-reported comfort levels in performing initial emergency treatments.

**B. Behavioral Objectives**
1) Surveyed physicians will demonstrate an improvement of 10% in decisions to refer high-caries risk infants and young children compared to baseline.

**Data Management**

Data were entered into a computer file only accessible to the principal investigator upon a protective password. Subjects’ names were kept confidential and were entered into the computer using a code number. All data were double entered to assure accuracy. Both entry and double-entry of the data were done by the principal investigator.

**Data Analyses**

Descriptive statistics were computed, and descriptive frequency tables from completed questionnaires were generated. Initially, bivariate analyses were conducted to evaluate each of the candidate predictors versus the outcome of making referrals to dentist in the area. Bivariate analyses were performed to determine if there were statistically significant associations between Iowa pediatricians’ frequency of referrals and the following factors: physician age and gender, number of years in practice, physician experience with high caries risk children under age 3, type of practice, number of combined hours of previous oral health education and training, perceptions regarding the importance of oral health and physicians’ role identifying high caries risk children under age 3, type of insurance coverage and financial compensation for oral health preventive practices for high caries risk children under age 3, and perceived obstacles regarding dental referral. The association of each predictor versus outcome was estimated using chi-square test or Cochran-Mantel-Haenszel chi-square test or Fisher’s exact test for categorical predictor variables, and Wilcoxon rank-sum tests for continuous variables or variables involving the 1-5 point scale. Subsequently, variables that demonstrated statistically significant differences in the bivariate analysis (p ≤ 0.10) were used to develop a final model using forward and backward stepwise logistic regression. The possible statistical interactions between the predictor variables were also
examined. The chi-square test was performed when each of the column and row variables has 2 levels. The Cochran-Mantel-Haenszel chi-square test was conducted when the column variable or the row variable has more than 2 levels. When the sample size was small, the Fisher’s exact test was used.

When new sum variables were created, internal consistency of scale responses were assessed by Cronbach’s alpha. A reliability coefficient of 0.70 or higher was accepted, based on the widely used rule of thumb of 0.70 suggested by Nunnally (1978).

All tests had a 0.05 level of statistical significance. SAS for Windows (v9.1, SAS Institute Inc, Cary, NC, USA) was used for the data analysis.

**Human Rights**

The questionnaires were pilot-tested at the University of Iowa Hospital and Clinics using faculty members, staff and residents in the Departments of Pediatrics.

Following multiple revisions and adjustments the final survey instruments were developed and consisted of twenty-two questions and eighteen questions, respectively. Prior to the survey mailing, approval from the University of Iowa Institutional Review Board (IRB) was obtained.

For the survey instrument pertaining to the Iowa study, initial application was sent and received on 02/06/2007. Regular expedited review was requested since the study did not contain controversial aspects or involve direct human contact. After the Board approval was obtained on 03/10/2007 an additional application following modification of the survey instrument was sent and received on 10/10/2007. Final approval was obtained on 11/03/2007. Following the final approval of the research project by the Institutional Review Board, the survey was mailed. A continuing review form was sought and approved on 01/13/2010 which allowed for continued analysis of the collected data.
Similarly, regarding our second survey instrument IRB approval was sought. An initial application was sent and received on 05/18/10. Regular expedited review was requested since the study did not contain controversial aspects or involve direct human contact. The application was fortified by a signed and stamped letter of approval from the Vice-Dean for Academic Affairs and Research at King Saud University which acts as the local Institute of Board Review. Final approval was obtained on 05/25/2010. Following the final approval of the research project by the Institutional Review Board, the survey was sent.

Board approval by the review committee required that a form be completed that gave a brief description of the project, the proposed number of subjects, an abstract, potential subject risk and funding sources. Also, included was the cover (consent) letter and copy of the questionnaire to be used (Appendix B). The consent letter was formulated and return of a completed questionnaire was considered adequate consent. If subjects did not wish to participate they were asked to return the questionnaire with a note that stated “do not wish to participate” to avoid a second survey being sent to them. After four weeks, all non-responding physicians were sent a second and final follow-up questionnaire. Subjects’ confidentiality was maintained by labeling the questionnaire with a unique identification code by the University of Iowa Campus Mail Services.

Benefits

There are no direct financial or physical benefits. However, the information obtained will hopefully all allow medical health care professionals to better address and develop oral health related practices. Furthermore, the educational material provided will benefit the participants from a knowledge and confidence standpoint in dealing with young children who are at high risk for caries.
Additionally, from a societal and community health perspective, the information obtained through the Iowa study will allow both the dental and medical communities to better understand the dynamics as well as barriers obstructing the inter-professional relationship between these two societies in Iowa. This in turn will enable the health care community to address access to oral health care issues and oral health disparities between the children of Iowa. Additionally, future plans and programs for oral health care in Iowa would have a sounder foundation upon which to build. Additionally, the Saudi study is being proposed at an opportune time within the timeline of health development in Saudi Arabia. To begin with, our program is targeting medical interns who in the present health care system represent the first line of care as the majority of graduates work within the primary care network. (KSA- Annual health report, 1999) Additionally, given the expected reforms to the health care system – some of which have already passed – these physicians will not only be expected to assess health care needs as a part of their regular role but will also assume check-points of referral in all health care matters, including dental health care needs. (MOH, 2007) Given that the population of Saudi Arabia is very young, in addition to the changed emphasis by the Ministry of Health on more efficient inter-disciplinary delivery of health care services; there remains a clear need to develop programs that assess barriers to access of care for children which would help lessen these increasing health care concerns.

As a result, the areas of primary focus pertain to assessing and improving primary care practitioners' knowledge, willingness, and comfort levels in identifying children who are at high risk for developing dental caries which will ultimately help improve the ability of young children to access needed oral health care services.

Risks

This study is of minimal risk. There are no expected emotional, physical or financial risks. Regarding the possibility of loss of subject confidentiality, the research conductors made every
effort to minimize and eliminate this potential risk. A code was used to link personal information (addresses) with responses which will be kept in a password protected computer. This code will be used to link pre and post responses and will be deleted completely once analysis has been finalized.
CHAPTER IV

FACTORS AFFECTING IOWA PEDIATRICIANS’ FREQUENCY OF REFERRAL AND OTHER ORAL HEALTH-RELATED PRACTICES TARGETING HIGH CARIES-RISK CHILDREN

Abstract

Objective: This study evaluated the oral-health knowledge, practices, and factors influencing the ability and willingness of Iowa pediatricians’ to assess and refer high caries-risk children.

Methods: A 22-item survey was mailed to all licensed pediatricians in Iowa. Chi-square statistics and logistic regression models were used to analyze data.

Results: Ninety-five (34.1%) usable surveys were returned from two mailings. On questions regarding comfort levels when performing oral-health related practices on children under 3, physicians reported high levels of comfort with all specified issues. The majority of respondents routinely gave the name of a dentist to the caregiver when referring, whereas only 4% made use of local care coordination services and only 9% actually made the dental appointment. Sixty-five percent referred all children 12 months or older to a dentist in accordance with AAPD and AAP guidelines. The ability to locate a dentist willing to accept Medicaid or uninsured children was noted as the major referral barrier. Bivariate and multivariate logistic regression analyses indicated that pediatricians who had higher frequency of seeing oral-health problems (p=0. 05), greater mean total number of children seen per week (p=0.04), and believed that children should have their 1st dental visit no later than 12 months of age (p=0.02) were more likely to make frequent referrals to a dentist compared to their counterparts

Conclusions: Educating physicians about the AAPD/AAP guidelines for referring
children to a dentist by age one may help improve dental utilization among high risk children.

**Introduction**

In 2000, the U.S. Surgeon General reported on the state of oral health and oral health care in America (Surgeon General, 2000). This report helped fuel a renewed focus on oral health care from a public health perspective. As a result, there is a renewed focus in exploring additional feasible and effective solutions to the continued oral health access problems children face in the US.

Despite advancements in dental prevention measures and treatment options, dental decay still remains the most common chronic childhood disease in the United States. There are an estimated 2.5 million children under the age of 5 years old that are reported to have had tooth decay in the past year (Passel, 2002). Additionally, the prevalence of caries - about 50% in mid-childhood - has not changed much in recent years (Passel, 2002).

Several studies point to clear disparities in the extent of oral disease distribution within the U.S. population. For example, among children ages 5 to 17 in the U.S., 25% suffer approximately 80% of the total caries experience (Surgeon General, 2000; Passel, 2002). This lopsided distribution of dental disease that is concentrated in children from poor and underserved families, especially dental caries, has lead to the current dilemma in access to oral health care.

In response to these challenges of unmet oral health needs and the high risk of dental caries among poor and underserved children, previous studies have studied the effectiveness of several alternative approaches to increase access to dental care. One of these approaches has been to look toward physicians playing a bigger role in issues pertaining to oral health care. Studies have shown that primary care providers are more likely to see poor and underserved children at an earlier age and to provide care for them on a more continuous basis when compared to dentists (dela Cruz et al, 2004). For example, as stated by the Department for Health and Human Services (DHHS) in 1998, "89% of poor children had a usual source of medical care, largely surpassing an
estimated 20% of all children 0-18 years who had a preventive dental visit in the past year, with less than 1% of Medicaid eligible children receiving a dental visit in their first year of life" (dela Cruz et al, 2004). Additionally, the fact that children are almost two and a half times as likely to have medical insurance as dental insurance, may play a substantial role in medical visits at an earlier age (dela Cruz et al, 2004).

Consequently, physicians may be in a good position to examine, counsel, provide preventive therapies and refer very young high-caries risk children. In reaction to this, the U.S. Preventive Services Task Force recently advised that health providers should initiate oral health education and guidance including counseling on nutritional issues, the use of fluoride in children, tooth brushing and smoking cessation (US Preventive Services Task Force, 2004). This step is especially vital given that most physicians in the United States do not screen for signs of early childhood caries, including white spot lesions, which are the precursors of cavitation, on a routine basis (Ramos-Gomez et al, 2007).

Unfortunately, medical and dental education as well as medical and dental practies run parallel but usually separate from each other. Physicians have traditionally received little training in the oral health care of children (dela Cruz et al, 2004). Accordingly, there have been relatively few studies that have focused on the feasibility and extent of oral health education and training in medical schools or residencies.

A recent review of the literature concluded that pediatric oral health training for pediatricians whether at the undergraduate, residency or continuing education level was insufficient in content and depth. (Krol, 2004) Additionally, approaches varied and lacked consistency when incorporating oral health education and training into established pediatric medical training. (Krol, 2004) An earlier study that surveyed U.S. and Canadian medical schools for sufficiency and comprehensiveness of dental information in medical curriculums
concluded that none of the surveyed schools provided comprehensive dental education within their curriculums. (Curtis et al, 1985)

Given the scarcity of research in this area, it is still unclear whether non-dental health care professionals are able and willing to accurately identify oral health problems in children at high risk for oral disease. Furthermore, additional information is needed about the characteristics of medical health care providers that influence their decision and capability to refer children who are at risk for dental disease to a dentist.

In this study, the authors evaluated Iowa pediatricians’ oral health knowledge, oral health related practices, factors influencing their willingness, perceived comfort and ability to assess caries-risk in children and to refer high caries risk children to dentists for treatment. The findings of this study will help identify and clarify these influencing factors and provide groundwork towards future analytic and intervention studies and policies.

**Materials and Methods**

A survey was designed to assess the oral heath knowledge, as well as the willingness and comfort level to identify and refer children at high risk for dental caries. The survey consisted of 22 questions that included questions on demographics characteristics, knowledge, attitude, behavior and perceived barriers to referring children for dental care. These questions were adapted from previous research in this area (dela Cruz et al, 2004; Ramos-Gomez et al, 2007; Curtis et al, 1985; Erikson et al, 1997; Sanchez et al, 1997; Lewis et al, 2000; Schafer et al, 2000; Ismail et al, 2002; Pierce et al, 2002; AAP,2003; Rozier et al, 2003; Seale et al, 2003; Bader et al, 2004; Mouradian et al, 2005) as well as including additional variables thought to be influential in Iowa. The survey instrument was pilot-tested with 10 faculty members from the Department of Pediatrics at the University of Iowa.

The names and addresses of Iowa physicians were obtained from the Office of Statewide
Clinical Education Programs. A total of 279 surveys were mailed to almost all pediatricians in the state in December of 2007, along with a cover letter and a stamped self-addressed envelope. A second mailing was sent to non-respondents four weeks later.

The primary dependent variable in this study was the frequency with which pediatricians referred children for dental care. Chi-square tests, and non-parametric Wilcoxon rank-sum tests were used for the bivariate analyses while logistic regression models were used to determine the factors associated with the frequency of dental referral. Independent variables in the study included demographic and practice characteristics of the pediatrician, and their knowledge about oral health issues. Additionally, two new independent variables were created: the sum score of responses to frequency of seeing children with dental related problems and the sum score of comfort levels in performing oral health related practices. Both were tested for internal consistency of scale responses using the Cronbach’s alpha score and gave very acceptable reliability estimates at 0.77 and 0.93, respectively. All analyses were conducted using SAS software (v9.1, SAS Institute Inc, Cary, NC, USA). All tests utilized a 0.05 level of statistical significance.

To build the final multivariable model, all bivariate results that showed statistical significance (P≤ 0.05) were included in the logistic regression. Both forward and backward stepwise regression methods were used. This study was approved by the University of Iowa Institutional Review Board. Consent was considered obtained if the respondents voluntarily returned the survey to the principal investigator.

**Results**

From the initial 279 questionnaires mailed, 126 participants (45.2%) responded. Of these, 31 were returned stating that the physician did not wish to participate. Five surveys were completed by a nurse or marked as an “other” health-care professional, so they were excluded from the study sample. Overall there were 95 completed and usable questionnaires, giving a final
response rate of 34.1%.

To assess the potential for response bias, we compared the population characteristics of the population of pediatricians in Iowa with the responding physicians. Responding physicians were similar from an age distribution perspective, however, they were more likely to be women and practice in urban areas than all pediatricians in Iowa. Sixty-one percent of our responders were female compared to 30% of all Iowa pediatricians. Our responders had a mean age of 47 years which is similar to the Iowa average of 48 years. Concerning the location of practices, 5.3% of responders practiced in rural areas; 22.3% in suburban and 73.4% in urban areas, while the State distribution was 39%, 19% and 41% respectively.

Physicians were asked how often they saw a number of different oral-health related problems as primary complaints or incidental findings (Table 2). Nearly two-thirds of physicians cited that “a lot of cavities in a single child” were seen at least once a month or more frequently; 2% said they only saw this every few years and no respondents cited “never” seeing this. Similarly, over forty percent cited seeing children with a few decayed teeth at least once a month, and a third of respondents said at least once a week. Traumatic injuries, pain related to untreated cavities and tooth abscesses were seen much less frequently. For example, abscessed teeth were seen at least once a month or more frequently by only 4.0% of physicians. Traumatic mouth injuries were seen by nearly 80% of physicians only once every 6 months or less.

Physicians were asked about specific oral health related practices and how frequently they or any of their staff performed them (Table 3). Over 70% examined children’s upper four front teeth during an examination (lifted the lip). Approximately 71% “usually” or “most of the time” counseled their patients on the importance of maintaining good oral hygiene. The importance of fluoride use was usually or most of the time discussed by respondents. Approximately, 80% of respondents” usually” or “most of the time” referred children to a dentist in the area during a
medical care visit.

Several topics for possible continuing education (CE) courses were covered. Physicians were asked whether they were “interested” in participating in CE courses in each of the following areas: “Fluoride varnish application”, “Caries risk assessment” and “Counseling on oral health related topics.” Results showed that over 75% were interested in participating in at least one of the aforementioned courses. Twenty-two percent said they were not interested in participating in any oral health related courses.

Sixty-five percent of pediatricians referred all children 12 months or older to a dentist in accordance with AAP and AAPD guidelines on referral of children. However, 30% of physicians referred a child only if they saw a problem (e.g. tooth decay, chipped tooth, draining fistula), 2% only referred if they considered a child at high risk for cavities, and 2% rarely or never referred children they saw at well child visits to a dentist.

When asked specifically about their comfort level counseling/advising parents of children 3 years and younger about oral health issues, pediatricians were very or somewhat comfortable with “deciding if a child needs to be referred to a dentist” (83%). Regarding “oral hygiene” and “fluoride toothpaste”, 75% and 59%, of physicians noted, respectively that they were “Very or Somewhat Comfortable” with these activities. Furthermore, well over half of the respondents (74% and 65%) had the same high comfort levels regarding “examining teeth for tooth decay” and “evaluating risk factors for tooth decay”. (Table 4)

Regarding barriers to referring children to a dentist for care, the vast majority of pediatricians (74% and 85% respectively) reported “Finding dentists willing to accept children on public insurance”, and “Finding dentists willing to accept uninsured children” as major barriers to referral. Other barriers, such as “Lack of locally available dentists”, “Finding dentists willing to accept children under the age of 3” or “Finding dentists willing to accept
developmentally disabled children” were all considered barriers by about half of the pediatricians. (Table 5).

Four different methods of referral were specified and pediatricians were asked how frequently they used them 50% or more of the time. Seventy-four percent of physicians said they gave the name of a dentist to the caregiver; only 9% said they called the dental office to make an appointment for the patient; only 4% said that they contacted a coordinator service to help make an appointment for the patient; whereas 55% simply told the caregiver that the child needs to see a dentist.

The bivariate analysis revealed that there was no statistically significant difference between the pediatricians who made and those who didn’t make referrals to dentists and their gender, age, total years of professional practice, practice setting, area of primary practice, factors considered barriers, or their knowledge (p>0.05 for all instances). (Table 1)

Pediatricians who “most of the time” or “usually” made referrals to dentists had greater mean total number of patients seen in a week, and mean total number of children (age 0-3) seen in a week, and greater mean sum scores of “More frequently seeing oral health related problems” than those who never or sometimes made referrals. In addition, the pediatricians who referred most of time were more likely to think that children (age 0-3) should have their 1st dental visit no later than 12 months of age compared to those who never or sometimes made referrals (53.4% vs. 23.5%). (Table 1)

The logistic regression models regarding the pediatricians’ referrals to the dentist showed that pediatricians who saw oral health related problems more frequently, saw more young children (age 0-3) in a week, and believed children (age 0-3) should have their 1st dental visit no later than 12 months of age, were the statistically significant predictors of the frequency with which they referred to the dentist. (Table 6) The odds ratio for pediatricians’ referrals to the dentists for children between age 0 and 3 years increased by 19% for one unit increase in the sum
score of frequency of seeing oral health problems and increased by 3% for every increase in a child (age 0-3) seen in a week. The odds of believing that children (age 0-3) should have their 1st dental visit no later than 12 months of age for pediatricians who frequently made referrals was 4.87 times that of those who never or sometimes made referrals.

The total number of patients seen in a week was not a significant factor in the final logistic regression model after adjustment for other variables. Additional analysis was conducted, and the results indicated that the total number of patients seen in a week was significantly positively correlated with a total number of children (age 0-3) seen in a week (correlation coefficient =0.88, p<0.0001). This may indicate that the total of young children (age 0-3) seen in a week may have a stronger effect on the frequency of referrals than the total number of patients seen in a week. (Table 6)

**Discussion**

The main question that was addressed in this study was what factors play an important role in influencing Iowa pediatricians’ decisions to refer at-risk children to the dentist. In line with this, we also looked to identify possible factors that pediatricians view as barriers to the referral of high caries risk young children for appropriate dental care. There is a clear gap in the literature in this regard, as few studies have attempted to address this issue.

The significance of this question is growing in importance, especially given the recent law passed by the Iowa Legislature that originally specified "by July 1, 2008, every recipient of Medicaid who is a child 12 years of age or younger shall have a designated dental home and shall be provided with the dental screenings and preventive care identified in the oral health standards under the early and periodic screening, diagnostic and treatment (EPSDT) program." (Medicaid Reform Act, 2005). This date has been delayed to December 1, 2010. (Healthy Iowans 2010, 2005)

In our study, we found that physicians were doing a reasonably good job referring
children to the dentist. Well over half (65%) of the pediatricians said they were referring high-caries risk children under the age of 3 to a dentist on a routine basis. Furthermore, only 2 percent of physicians stated that they rarely or never referred children to dentists. This result is very encouraging as it falls in line with the recommendations of both the American Academy of Pediatrics and the American Academy of Pediatric Dentistry guidelines on referral of children (AAP, 2003).

In a similar study, dela Cruz et al. in 2004 found that over 90% of health-care professionals said that they referred children to a dentist as part of their regular practice. However, that was a cross sectional survey conducted on primary care clinicians who were participating in the “Into mouth of babes” (IMB) program in North Carolina. (dela Cruz et al, 2004) Thus, it would be safe to presume that the degree of enthusiasm amongst participants in that study was influential in the high percentage of referring physicians.

On the other hand, our results showed that only 1 in 3 physicians referred a child based on level of caries risk. This represents a clear opportunity for educational improvement that could be started during medical school training. This effort could be assisted by local dental colleges and dental practices providing content expertise, and informational booklets or references on the key risk factors so that physicians could make a more informed decision on the need for referral. Additionally, the respondents reported performing oral-health related practices at relatively high percentage rates, specifically those related to risk evaluation, including: examining a child’s teeth for signs of decay or other oral pathology, lifting the upper lip to assess the 4 upper front teeth, and assessing diet and fluoride use. Given this, one might expect there to be a relatively high percentage of referrals based on evaluation and risk, but this was not shown in our results. This may lead us to consider the possibility that respondents over-estimated on their reported frequency of oral- health related practices.

The ability to locate a dentist willing to accept Medicaid or uninsured children was cited
as a major factor affecting the ability to readily refer children in need of dental care by about four out of five physicians. These results were similar to the results published by dela Cruz et al. (dela Cruz et al, 2004) where 76% of respondents reported difficulty when referring Medicaid eligible children for dental care. A parallel can be drawn with the 2005 consumers’ perspective report, in which over 90% of consumers found difficulty locating a dentist that was willing to accept Medicaid patients. (Tyler, et al, 2006)

The difficulty in referring Medicaid patients is a problem even on the national stage, as reported by Lewis, et al in 2000, where 38% of surveyed pediatricians reported this as a barrier to referral of children in need of care (Lewis et al, 2000). Furthermore, this barrier is expected to increase given that the percentage of Iowa children without dental insurance is increasing (Rodgers, 2005). One of the recommendations put forth by the Iowa Department of Public Health (IDPH) to combat this issue is to increase adjunct staff responsibilities, in addition to better care coordination between health professionals (Tyler, et al, 2006). Based on our results, more needs to be done to better define this barrier and improve dentists’ acceptance rates of Medicaid and uninsured children.

A related issue, the lack of locally available dentists, was cited as a barrier to the referral of children needing dental care by half of the responding physicians. While this is still high, prior to conducting this study it was thought that this would figure as an even more prominent barrier given that 7 out of every 10 counties in Iowa qualify as a dental health professional shortage areas (Rodgers, 2005; DeGarmo, 2005). On the other hand, neither the child’s age nor the presence of developmental disability were viewed as significant barriers to referral by the physicians.

Similar to previous studies (dela Cruz et al, 2004) that asked about the method of the referral to the dentist, we found that the majority of parents or caregivers were either simply told that their child needed a dental appointment or were given contact information. These
physicians were less likely to initiate the appointment, however, only 9% of physicians or their staff called to make an appointment on a regular basis, whereas 54% of physicians in the North Carolina project did. (dela Cruz et al, 2004) Additionally, the care coordinator services available in Iowa were used by only 4% of practices. The care coordinator services represent an under used resource that could become a valuable resource for improving the effectiveness of referrals.

Bivariate analysis revealed that pediatricians were more likely to refer to dentists if they had a higher mean total number of patients seen in a week, mean total number of young children (age 0-3) seen in a week, and had a higher frequency of oral health related problems seen compared to those who “never” or “sometimes” made referrals. The experience and reinforced comfort level gained by the physicians through repeated exposure to children and oral health related problems could explain the increased likelihood to refer children at high caries-risk.

Three factors, namely the frequency of oral health related problems seen by physicians, the total number of children (age 0-3) seen in a week, and the belief that children (age 0-3) should have their 1\textsuperscript{st} dental visit no later than 12 months of age were found in the multivariable analyses to be significant predictor variables of physicians who were more likely to refer. Regarding the third factor, pediatricians who held this belief were almost 5 times more likely to make referrals compared to those who didn’t. In 2004 dela Cruz et al. also found that the degree of health care provider confidence and the number and extent to which providers saw children on a daily basis were significant predictors of referral likelihood.

Regarding the oral health related services provided in their practices, the responding pediatricians indicated high frequencies of performing all the oral health related practices that were questioned in our study, with the exception of inquiring about parental (mother) dental health. Such high frequencies were not expected prior to the study, however, these results do correlate well with the high comfort levels expressed regarding counseling on several oral health
related issues as well as comfort in performing oral examinations, assessing caries-risk and making a decision on the need for referral. Lewis et al. in 2000, found that over eighty percent of responding pediatricians reported a high likelihood of performing oral examinations and providing preventive counseling for children less than 5 years of age. Additionally, our result showed a high willingness to apply fluoride varnish with minimal to no compensation, as over 70% said that they would consider applying it on a routine basis. Similarly, Lewis et al. (Lewis et al, 2000) also found that over 70% of their respondents were willing to apply fluoride varnish in their practice.

Limitations regarding this study included a relatively low response rate, through several separate mailings, the effective response rate for this study was 45%, of which 11% were responses indicating an unwillingness or non-desire to participate. Thus the final response rate of usable surveys for statistical analysis was 34%. Previous studies (dela Cruz et al, 2004; Pierce et al, 2002; Rozier et al, 2003; Gonsalves, et al, 2004) targeting physicians on issues related to oral-health practices and attitudes usually had similar response rates, except in cases where the targeted physicians were participating in a specific oral-health program.

In testing for response bias, we found the majority of respondents were female, in their late thirties to early forties, with at least 11 years of experience, primarily private practice physicians working in a group practice setting and seeing privately- insured patients. The authors were unable, given the nature of survey studies, to verify or assess specific differences in knowledge, willingness and behavior between respondents and non-respondents.

Conclusions

Experience with seeing more children, especially more young children, was a factor found to be related to whether physicians routinely referred children for dental care. Knowledge about both the guidelines for when children are supposed to be referred for dental care (by age one) and where they can refer children covered by Medicaid, some of the most
vulnerable, provide an excellent opportunity for further educating physicians about the importance and timing of these dental referrals. More knowledge about using care coordinators to assist with dental referrals may also increase this activity by making the referral process easier for physician offices as well as more effective by making sure an appointment is actually made.
Table 1. Bivariate analysis for frequency of referral of high caries-risk children (0-3) by pediatricians

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Pediatricians</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mostly/usually refer (\geq 50%)</td>
<td>(%</td>
<td>(%)</td>
<td>p=0.24*</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>14.1</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>37.5</td>
<td>38.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.06‡</td>
</tr>
<tr>
<td></td>
<td>Years of professional practice</td>
<td>16.53</td>
<td>13.71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practice setting (majority of time)</td>
<td>(%</td>
<td>(%)</td>
<td>p=0.12†</td>
</tr>
<tr>
<td></td>
<td>University Medical Center</td>
<td>8.4</td>
<td>9.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Community Hospital</td>
<td>2.2</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private practice</td>
<td>2.1</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- solo</td>
<td>36.0</td>
<td>39.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- group</td>
<td>1.2</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Health/Community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of patients seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.049‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>99.7</td>
<td>75.65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of children (age 0-3) seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.021‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>61.42</td>
<td>43.24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Location of primary practice</td>
<td>(%</td>
<td>(%)</td>
<td>p=0.38†</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>26.8</td>
<td>29.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suburban</td>
<td>16.1</td>
<td>22.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oral health problems seen</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.011‡</td>
</tr>
<tr>
<td></td>
<td>(sum score; high score of 25)</td>
<td>14.55</td>
<td>12.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children (0-3) should have their 1 dental visit no</td>
<td></td>
<td></td>
<td>p=0.032‡</td>
</tr>
<tr>
<td></td>
<td>later than 12 months of age</td>
<td>19.24</td>
<td>18.53</td>
<td></td>
</tr>
</tbody>
</table>

* Chi-square test
† Cochran - Mantel - Haenszel chi-square test
‡ Wilcoxon rank-sum test
Table 2. Frequency distribution of oral related problems seen as primary complaints or incidental findings by pediatricians

<table>
<thead>
<tr>
<th>Oral related complaint</th>
<th>At least once a week n (%)</th>
<th>At least once a month n (%)</th>
<th>At least once in 6 months n (%)</th>
<th>At least once a year n (%)</th>
<th>At least once every few years n (%)</th>
<th>Never n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of cavities in a single child</td>
<td>14 (15.4)</td>
<td>41 (45.1)</td>
<td>24 (26.3)</td>
<td>10 (11)</td>
<td>2 (2.2)</td>
<td>0</td>
</tr>
<tr>
<td>A few decayed teeth in a single child</td>
<td>27 (29.3)</td>
<td>39 (42.4)</td>
<td>18 (19.6)</td>
<td>7 (7.6)</td>
<td>1 (1.1)</td>
<td>0</td>
</tr>
<tr>
<td>Traumatic mouth injuries</td>
<td>2 (1.8)</td>
<td>17 (15.9)</td>
<td>48 (44.9)</td>
<td>18 (16.8)</td>
<td>7 (6.5)</td>
<td>15</td>
</tr>
<tr>
<td>Pain related to untreated cavities</td>
<td>0 (0.0)</td>
<td>6 (6.5)</td>
<td>26 (28.3)</td>
<td>30 (32.6)</td>
<td>22 (23.9)</td>
<td>8</td>
</tr>
<tr>
<td>Tooth abscess</td>
<td>1 (1.1)</td>
<td>3 (3.3)</td>
<td>13 (14.1)</td>
<td>29 (31.5)</td>
<td>43 (46.7)</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 3. Frequency distribution of oral health related practices performed by physicians or their staff

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Most of the time (100%-75%) n (%)</th>
<th>Usually (74%-50%) n (%)</th>
<th>Sometimes (49% or less of the time) n (%)</th>
<th>Never n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifting the lip to examine the 4 upper front teeth</td>
<td>71 (78.0)</td>
<td>11 (12.1)</td>
<td>7 (7.7)</td>
<td>2 (2.2)</td>
</tr>
<tr>
<td>Counseling parents on regular tooth brushing</td>
<td>72 (79.1)</td>
<td>16 (17.6)</td>
<td>3 (3.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Counseling parents on regular dental visits</td>
<td>72 (80.0)</td>
<td>18 (20.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Discuss the importance of fluoride</td>
<td>52 (57.8)</td>
<td>21 (23.3)</td>
<td>15 (16.7)</td>
<td>2 (2.2)</td>
</tr>
<tr>
<td>Inquire about child’s use of bottle in bed</td>
<td>70 (76.9)</td>
<td>13 (14.4)</td>
<td>7 (7.6)</td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>Inquire about mother’s dental health</td>
<td>4 (4.4)</td>
<td>5 (5.5)</td>
<td>38 (41.8)</td>
<td>44 (48.6)</td>
</tr>
<tr>
<td>Refer to local dentist</td>
<td>49 (54.44)</td>
<td>24 (26.67)</td>
<td>16 (17.78)</td>
<td>1 (1.11)</td>
</tr>
</tbody>
</table>
Table 4. Frequency distribution of physician comfort levels in performing oral-health related practices for children (0-3)

<table>
<thead>
<tr>
<th>Oral-health practices performed</th>
<th>Very Uncomfortable n (%)</th>
<th>Somewhat Uncomfortable n (%)</th>
<th>Neutral n (%)</th>
<th>Somewhat Comfortable n (%)</th>
<th>Very Comfortable n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine teeth for tooth decay</td>
<td>5 (5.43)</td>
<td>9 (9.78)</td>
<td>10 (10.87)</td>
<td>40 (43.48)</td>
<td>28 (30.43)</td>
</tr>
<tr>
<td>Counsel on the importance of child oral hygiene</td>
<td>6 (6.52)</td>
<td>11 (11.96)</td>
<td>6 (6.52)</td>
<td>51 (55.43)</td>
<td>18 (19.57)</td>
</tr>
<tr>
<td>Counsel on the importance of fluoride toothpaste use</td>
<td>3 (3.30)</td>
<td>10 (10.99)</td>
<td>24 (26.37)</td>
<td>42 (46.15)</td>
<td>12 (13.19)</td>
</tr>
<tr>
<td>Evaluate risk factors for tooth decay</td>
<td>3 (3.26)</td>
<td>9 (9.78)</td>
<td>11 (11.96)</td>
<td>39 (42.39)</td>
<td>30 (32.61)</td>
</tr>
<tr>
<td>Decide if child needs a referral</td>
<td>6 (6.52)</td>
<td>3 (3.26)</td>
<td>6 (6.52)</td>
<td>37 (40.22)</td>
<td>40 (43.48)</td>
</tr>
</tbody>
</table>
Table 5. Frequency distribution of barriers of referral of high caries-risk children (0-3) by pediatricians

<table>
<thead>
<tr>
<th>Barriers of Referral</th>
<th>(Frequency)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of locally available dentist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>42.0</td>
<td>44.7</td>
</tr>
<tr>
<td>Not Barrier</td>
<td>52.0</td>
<td>55.3</td>
</tr>
<tr>
<td>Finding a dentist willing to accept children on public insurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>69.0</td>
<td>74.2</td>
</tr>
<tr>
<td>Not Barrier</td>
<td>24.0</td>
<td>25.8</td>
</tr>
<tr>
<td>Finding a dentist willing to accept uninsured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>79.0</td>
<td>84.9</td>
</tr>
<tr>
<td>Not Barrier</td>
<td>14.0</td>
<td>15.1</td>
</tr>
<tr>
<td>Finding a dentist willing to accept children under age 3 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>53.0</td>
<td>57.6</td>
</tr>
<tr>
<td>Not Barrier</td>
<td>39.0</td>
<td>42.4</td>
</tr>
<tr>
<td>Finding a dentist willing to accept children with developmental disabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>45.0</td>
<td>50.6</td>
</tr>
<tr>
<td>Not Barrier</td>
<td>44.0</td>
<td>49.4</td>
</tr>
<tr>
<td>Oral health is of low priority to families seen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barrier</td>
<td>31.0</td>
<td>34.1</td>
</tr>
<tr>
<td>Not Barrier</td>
<td>60.0</td>
<td>65.9</td>
</tr>
<tr>
<td>Variable</td>
<td>Odds Ratio</td>
<td>P-Value</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>The Frequency of Seeing OH Problems</strong></td>
<td>1.19</td>
<td>0.0488</td>
</tr>
<tr>
<td>Most of Time or Usually Made Referral vs. Sometimes or Never Made Referrals (11.84 vs. 9.43)</td>
<td>(1.00-1.41)</td>
<td></td>
</tr>
<tr>
<td><strong>A total number of children (ago 0-3) seen in a week</strong></td>
<td>1.03</td>
<td>0.0341</td>
</tr>
<tr>
<td>Most of Time or Usually Made Referral vs. Sometimes or Never Made Referrals (61.4 vs. 43.2)</td>
<td>(1.00-1.06)</td>
<td></td>
</tr>
<tr>
<td><strong>Children (0-3) should have their 1st dental visit no later than 12 months of age</strong></td>
<td>4.87</td>
<td>0.0196</td>
</tr>
<tr>
<td>Most of Time or Usually Made Referral vs. Sometimes or Never Made Referrals (53.4% vs. 23.5%)</td>
<td>(1.29-18.43)</td>
<td></td>
</tr>
</tbody>
</table>

*Hosmer and Lemeshow Goodness-of-Fit test (p-value=0.6751).
CHAPTER V

SAUDI MEDICAL STUDENTS’ CHILDORAL HEALTH-RELATED KNOWLEDGE, PRACTICES AND ATTITUDES

Abstract

Objective: This study evaluated Saudi medical interns’ oral-health knowledge, and other factors influencing their ability and willingness to perform oral-health related practices for high caries-risk children.

Methods: A 15-item survey was emailed to all eligible graduating fifth year medical students at King Khalid University Hospital to address these areas of interest. Chi-square statistics and logistic regression models were used to analyze data.

Results: One-hundred and twenty-one (49%) usable surveys were returned from two mailings. On questions regarding comfort levels when performing oral-health related practices on children under age 3, medical students generally noted low levels of comfort with all specified oral health practices. Regarding satisfaction of students with medical training, the majority of respondents (87.5%) rated their medical training as fair or poor in preparing them for oral-health assessments compared to only 35%, 29% and 7% of respondents giving fair or poor ratings to child abuse identification, caring for special needs patients and primary care pediatric practice, respectively. Additionally, although 90% of respondents noted that the role of primary physicians in counseling/referring children with oral health was important; 60% did not agree with the AAPD and AAP guidelines that state that all children should be referred to a dentist by 12 months of age. Multivariate logistic regression analyses revealed several statistically significant variables that predict the likelihood of performing various oral-health related practices. The choice of public-health oriented future clinical goals, the level of oral-health knowledge, how interns rated their
oral health training in medical school, and the average number of children seen per week, all - to varying degrees - proved important predictor variables for the likelihood of performing them once in practice.

**Conclusions:** More oral health-related training of medical students seems warranted and could improve their interest in providing oral-health-related screening and referrals in practice. Increasing student exposure to child patients and increasing exposures to oral-health knowledge and problems could be targeted toward students interested in primary care and public health to use resources most efficiently in the effort to combat the growing caries levels among young children in Saudi Arabia.

**Introduction**

The past few decades have witnessed an increased focus on oral health and the social, psychological and developmental consequences of untreated oral disease in Saudi Arabia. This awareness is the result of numerous studies (Al Wazzan, 2004; Al-Yousef, et al; 2002; Gandeh, et al, 2000; Al Sekait, et al, 1998; Wyne et al, 1995; Al Shammary, et al 1990) concerning dental caries prevalence, severity, distribution among geographical areas and age groups, and overall patterns of spread that have shown that dental caries is the most prevalent chronic childhood disease facing the children of Saudi Arabia. Similar to other developing nations caries rates remains high, especially in the primary (childhood) teeth. (KSA- Annual health report, 1999). Dental caries is complicated by the fact that it is influenced by several determinants, which include social and educational background, dietary factors, oral hygiene practices, frequency of dental visits and fluoride experiences.

Several recent clinical studies (Amin, et al 2009; Al-Malik, et al 2003; Paul, 2003) have demonstrated caries rates at around 70% in children under the age of 5 years. Additionally, these studies have indicated that an average of 12% of young children are caries free, along
different age intervals and geographical areas. The majority of parents of young children surveyed stated that their children did not visit a dentist until the fifth year of life on average (Amin, et al 2009).

Several factors associated with the high levels of dental caries among children under 5 years old have been recognized (Amin, et al 2009). The main factor identified was a lack of oral health knowledge among parents and children, and subsequently a lack of adequate oral hygiene practices and poor dietary habits. The other primary factor identified by researchers was a lack of regular dental visits by children with approximately 60% having never been to a dentist by age 5. This lack of appropriate access appeared to be more prominent in rural areas.

One avenue that has been suggested for combating this problem and improving access to oral health care has been attempting to recruit primary care physicians to play a more active role with regards to oral health issues (Lewis et al, 2000; Pierce et al, 2002; Rozier et al, 2003; dela Cruz et al, 2004; Gonzales et al, 2004). Unfortunately, these studies are few and limited in their generalizability.

Furthermore, there have been no studies to our knowledge in Saudi Arabia that have assessed physicians’ or medical students’ oral health knowledge or comfort levels in assessing dental caries risk and need for dental referral, specifically for children at high caries risk. Given that the population of Saudi Arabia is a very young one, with 50% of the population under the age of 15 years and 12% of whom are 5 years or younger, there is a clear need to develop programs that would address barriers to accessing care and regular dental treatment that would help alleviate this increasing health care concern. More information is needed to determine primary care practitioners' attitudes, willingness, abilities, and comfort levels in identifying children who are at risk for dental caries. Ultimately such a determination may lead
to an improved ability to refer these children. Therefore, the purpose of this study is to evaluate factors influencing Saudi medical interns’ ability and willingness to perform oral-health-related practices for high caries risk children.

**Materials and Methods**

This study targeted graduating medical students at the King Saud University Hospital (KSUH) which is the main medical institute responsible for medical education and training at King Saud University in Riyadh Saudi Arabia.

In the summer of 2009, the principal researcher met with the directing secretaries of both the fifth year students (last year of medical training) and that of the internship (mandatory one-year extended training). Through these meetings, data specific to the student class were obtained. This included a list of the medical students expected to graduate to their internship year, information regarding students’ location, classes, rotation cycles and time schedules during their final year.

Additionally, qualitative information was gained through in-depth one-on-one interviews with five graduating students from the 2008 class. It was expected that these interviews would provide important insight into their educational experiences and thus help guide question format, areas of focus and methods of survey delivery. These interviews helped in gaining initial understanding of issues related to oral health-related training during medical school; including satisfaction with the knowledge content, comfort levels regarding oral health related practices, attitudes towards performing such practices, suspected barriers to performing practices and clinical time restraint issues. This information ultimately guided in the development and selection of survey items.

The study population was made up of all graduating male and female Saudi medical students
A questionnaire was distributed during the last month (June, 2010) of the medical students’ fifth and final year. The survey instrument was a 15 question survey that was developed based on items and variables mentioned in the literature (Curtis et al, 1985; Erikson et al, 1997; Sanchez et al, 1997; AAP, 2000; Lewis et al, 2000; Schafer et al, 2000; Ismail et al, 2002; Pierce et al, 2002; AAP, 2003; Rozier et al, 2003; Seale et al, 2003; Bader et al, 2004; dela Cruz et al, 2004; Krol, 2004; Mouradian et al, 2005) as factors influencing physicians’ role in oral health-related issues and points of further exploration that had not been addressed previously. The 15 pre-tested questions demonstrated acceptable reliability and validity (AAP, 2004; Rozier, et al, 2003).

The questions posed were divided into multiple sub-domains in different sections (appendix 1). These included information about the physician and their patient population (questions 1 through 4, 6 and 7); information regarding satisfaction with oral-health-care training in medical school (questions 5 and 8); information regarding oral-health-related knowledge and frequency of oral health related problems (questions 10 and 11); information about willingness, interest and comfort in oral-health related education and practices (questions 12 through 14); and criteria used in referral decisions (question 15). Where appropriate, a Likert-type scale (5- and/or 6-levels) was used. For questions regarding procedural or screening information a “yes” or “no” format was used.

The survey was self-administered in an electronic format. All medical students are required to have an electronic account through which important college information and announcements are usually disseminated. It was distributed to the fifth-year medical students expected to graduate to the internship year in June of 2010. An email containing a brief explanation was sent out 2 weeks prior, and the student body leader also sent an informational email in this regard. These emails explained the purpose of the survey, the approximate time for completion (15
minutes) and the confidentiality of information given. The subjects were informed that by completing and returning the questionnaire, they were agreeing to participate in the study. This study was approved by the King Saud University Medical College Educational Review Board.

Chi-square tests, non-parametric Wilcoxon rank-sum tests and logistic regression models were used to analyze data using SAS software. All tests utilized a 0.05 level of statistical significance. Bivariate analysis was performed in order to determine the important variables related to the likelihood of performing oral-health-related practices by medical students. Specifically, four dependent variables were assessed. These were likelihood: to counsel on oral health issues; examine the oral cavity; perform initial emergency treatments; and refer high risk children for further treatments. Subsequently, variables that demonstrated statistically significant differences in the bivariate analysis (p ≤ 0.10) were used to develop a final model using forward and backward stepwise logistic regression.

**Results**

Of the 291 fifth year medical students, 247 graduated to the internship year and were scheduled to start in July of 2010, and thus were eligible for inclusion in this study. The remaining students either had incomplete requirements for graduation or had requested postponement of their internship start. Of these 247 eligible participants, 242 opened the survey email that was sent out in early June and 153 clicked through to the survey link. One-hundred and twenty-one completed surveys were received from two mailings for a final response rate of 49%.

From the responses to the baseline survey, it was noted that there was a response bias with female participants being more likely to participate. Fifty-four percent of responses were from male participants, however, they represented only 39% of eligible male respondents, whereas 68% of all eligible female interns responded to the survey. There were no statistically significant
differences in demographic characteristics and patient population between respondents and non-respondents in terms of age (p=0.32), the number of patients (p=0.20) and children (p=0.44) seen per week.

**Descriptive Findings**

On average, interns saw a total of 16 patients a week, of which 6 were children under 5 years of age. Additionally, the majority of respondents were slightly or moderately interested in taking CME courses focused on oral health issues, at 38% and 40%, respectively. It was also shown that interns who chose more public health oriented future clinical goals were more highly interested in taking such CME courses (p=0.00).

Regarding satisfaction of students with medical training, the majority of respondents (87.5%) rated their medical training as fair or poor in preparing them for oral-health assessments compared to only 35%, 29% and 7% of respondents giving similar ratings to child abuse identification, caring for special needs patients and primary care pediatrics practice, respectively. Similarly, 86% rated time devoted to oral-health issues as “too little”.

When asked about the frequency of encountering oral-health problems, over 80% cited that they saw the noted oral health problems infrequently, once every 6 months or less. Nearly 80% had never seen a traumatic injury to the oral cavity or an abscessed tooth. With respect to self-perceived comfort levels in performing counseling, examinations or emergency treatment related to oral-health issues on young children; respondents generally rated themselves as being neutral or uncomfortable. The only exception to this was with regards to referring high-caries-risk children with a majority of interns (65%) noting themselves as comfortable when referring.

With the exception to the question on the benefits of fluoride in preventing decay and the negative effects of continuous juice consumption through closed cups, the average correct response rate to the knowledge questions was well below 50% correct. Six out of every 10
interns did not agree with the statement that all children 12 months and older should be seen by a dentist - in accordance with the recommendations of both the American Academy of Pediatric Dentistry & the American Academy of Pediatrics.

Over 90% of respondents agreed that the role of primary physicians in counseling and/or referring children with oral health needs is an important one. Additionally, between 40% and 50% of respondents were likely to counsel on oral-health issues, examine the oral cavity and refer high caries risk children for further treatments with a dentist.

Finally, regarding basis of referral, 59% of respondents in the survey referred based on risk and 25% did so based on emergency needs. Less than 2% said they would never refer a child for oral health related needs. Only 13% noted they referred all children 12 months and older -in accordance with AAPD & AAP recommendations.

Bivariate Findings

The bivariate analysis revealed several statistically significant variables for each of the four measured dependent variables.

Likelihood to Counsel

Interns who were more likely to counsel patients on oral health issues were more likely to be female (p=0.0181), have greater interest in taking oral-health related CMEs (p=0.0006), have higher frequency of choosing public-health oriented future clinical goals (p=0.0466), a greater mean sum score on the knowledge questions (p=0.0060), and higher comfort levels in performing counseling on oral-health-related practices (p=0.0009); compared to those who were unlikely to counsel patients on oral health issues.

Likelihood to Examine

Interns who were more likely to examine young children’s teeth for problems indicated
greater interest in taking oral-health related CMEs (p=0.0144), higher frequency of choosing public-health oriented future clinical goals (p=0.0031), greater mean sum scores on the knowledge questions (p=0.0420), higher rating for their OH-training (p=0.0103), higher mean number of patients and children seen per week (p=0.005), and higher comfort levels in examining for oral-health-related issues (p=0.0429); compared to those who were unlikely to examine patients for oral health issues.

**Likelihood to Treat Emergencies**

Interns who were more likely to perform emergency dental treatment on young children had higher satisfaction ratings for their OH-training (p=0.0075) and higher comfort levels in treating emergencies for oral-health-related issues (p=0.0001); compared to those who were unlikely to treat emergencies related to oral health for patients.

**Likelihood to Refer**

Interns who were more likely to refer a child with oral health needs to a dentist had higher interest rates in taking oral-health related CMEs (p=0.0050), higher frequency of choosing public-health oriented future clinical goals (p=0.0296), greater mean sum scores on frequency of seeing oral-health problems (p=0.0085) and higher comfort levels in referring for oral-health-related issues (p=0.0855); compared to those who were unlikely to refer patients for oral health issues.

**Multivariate Findings**

The significant variables, previously mentioned, were used to develop final models for the four dependent variables using forward and backward stepwise logistic regression. Tables 7 through 10 display the final predictor variables, associated odds ratios and confidence intervals for the interns’ likelihood in performing these four oral-related practices.
**Likelihood to Counsel**

Interns who were male, had a higher frequency of choosing public-health oriented future clinical goals, and a higher sum score on the knowledge questions were 0.4, 1.4 and 1.5 times as likely to counsel patients on oral-related issues, respectively.

Interest levels in taking oral-health related CMEs and comfort levels in counseling, both of which were significant in the bivariate analysis, were not significant factors in the final logistic regression model after adjustment for other variables. Additional analysis was conducted, and the results indicated that the level of interest in taking OH-related CME was significantly positively associated with the choice of future clinical goals (p=0.0002). Also, comfort levels were positively associated with the sum score on the knowledge questions (p=0.0098). Both of which indicate that the latter variables may show a stronger effect on the likelihood to counsel.

**Likelihood to Examine**

Interns who had a higher frequency of choosing public-health oriented future clinical goals, saw a higher mean number of children per week, had a higher OH-training rating and a higher sum score on the knowledge questions were 1.9, 1.2, 2.6 & 1.3 times as likely to examine patients for oral-related issues, respectively.

The number of patients a week, interest rates in oral-health related CMEs and comfort levels in examining, which were significant in the bivariate analysis, were not significant factors in the final logistic regression model after adjustment for other variables. Additional analysis was conducted, and the results indicated that the mean number of patients seen per week and that of children seen per week were significantly positively associated (p<0.0001). This indicates that the mean number of children seen per week may show a stronger effect on
the likelihood to examine. The other variable correlations were previously explained.

**Likelihood to Treat Emergencies**

Interns who had a higher OH-training rating and a higher comfort level score were 2.7 & 3.7 times as likely to treat emergencies, respectively.

**Likelihood to Refer**

Interns who had a higher frequency of choosing public-health oriented future clinical goals and a higher sum score of frequency of seeing oral-health related problems were 1.3 & 1.2 times as likely to refer patients for oral-related issues, respectively.

Interest in oral-health related CMEs was not a significant factor in the final logistic regression model after adjustment for other variables. Additional analysis was conducted, and the results indicated that CME interest rates were significantly positively associated with choice of future clinical goals (p=0.0002). This indicates that the choice of future clinical goals may show a stronger effect on the likelihood to refer.

**Discussion**

The main questions that were addressed in this study revolved around the likelihood of physicians to perform various oral-health related practices and what factors play an important role in influencing this likelihood. In line with this, we also looked at intern satisfaction with oral health training, their public health interest, oral health knowledge, and self-perceived comfort related to oral health issues.

This program is being proposed at an opportune time within the timeline of health care development in Saudi Arabia. The country has made significant steps towards development on many key aspects of social growth, especially on issues pertaining to health care. However, there are several serious challenges facing the current health care system in Saudi Arabia.
(MOH, 2007), specifically having to do with efficiency issues, effectiveness of health care delivery and quality of care provided, as well as issues pertaining to financial sustainability given the rate of population growth. (MOH, 2007)

Given the developmental stage of the health care system in KSA, information gained from this study would help alleviate an access to care issue and improve efficiency of health care delivery. Both of these benefits address problems identified by the MOH as major deficiencies in the current health care system (MOH, 2007).

Encouragingly, a majority of our respondents agreed on the important role primary physicians can and should play in addressing the oral health care needs of young Saudi children. In contrast to this, a majority of interns noted their oral health training as being inadequate. Both of these contrasting points represent a serious gap that could be closed beneficially with an oral-health-oriented educational program or course which could be implemented as part of medical student training. This gap between what health care professionals may be willing to do –outside of their usual practice in order to improve access to care for those in need – and what they feel adequately trained to do remains an area of increasing focus and effort, as can be seen in the literature (Douglas, 2009; Mouradian, 2005; dela Cruz, 2004; Gonzales, 2004; Krol, 2004).

Gonzales, et al, in 2004 noted, from Kentucky medical residents that were surveyed, an overwhelming sense of obligation to "play an important or somewhat important role in the oral health of their patients". However, this sense was obstructed by a perceived lack in knowledge and skills needed to assume this role, with approximately half of the residents rating their oral health knowledge as “poor” and the remaining rating it as “fair”. (Gonzales, 2004) Similarly, Lewis, et al, reported in a national survey of pediatricians, that although respondents expressed
an overwhelming willingness to participate in oral health care, including oral-health related
counseling and preventive therapies, more than a third reported having had no formal
instruction in dental health-related subjects in medical school or during their residency. (Lewis, 2000)

Several aspects of this inadequacy in oral health training experience during medical
education were highlighted in our results. For example, when asked several basic oral health
related questions associated with issues related to preventive dental care and referrals for young
children, the average correct response rate was well below 50%. In similar studies done in the
U.S., respondents generally had low oral health knowledge and performed poorly on questions
to that effect. (Douglas, 2009; dela Cruz, 2004; Gonzales, 2004; Krol, 2004) Another example
of low oral health related experience pertains to the low frequency of seeing oral health
problems by the interns. Over eighty percent cited that they saw the noted oral health problems
very infrequently, every 6 months or less. Both dela Cruz and Lewis noted this ‘direct
experience’ with oral health problems as being relatively low, and as an important factor that
maybe limiting physicians ability to promote and counsel patients on oral-health related topics.
(dela Cruz, 2004; Lewis, 2000) Both knowledge and experience with oral health problems
were shown to be associated with the relatively low levels of comfort in performing various
oral health-related practices noted by the respondents in this study.

Several factors were noted to be important predictors of physician intent to perform
different oral health related practices. These included oral health knowledge, the frequency
with which interns saw oral health related problems, how high they rated their oral health
training experience in medical school, as well as how oriented towards public health their
future clinical goals were. Focusing additional oral health training for medical students on these
aspects would greatly increase this willingness to play a preventive role in the oral care of children. This is important in the respect that reinforcing performance comfort levels through educational courses and training sessions could potentially increase the frequency with which physicians refer children at high caries-risk. Ultimately, practices that interns expressed high willingness to perform could potentially lead to improved child/parent oral health knowledge, preventive activities and access to needed care through appropriate referrals, especially in rural areas.

It is important to note that although our study targeted a specific medical school in Saudi Arabia, the curriculum characteristics related to oral health training are similar to what has been reported on in the literature. Additionally, the final response rate in this study – at 49% – is comparable to that seen in similar studies (dela Cruz, 2004; Gonzales, 2004; Krol, 2004; Rozier, 2003) reported on in the literature.

**Conclusion**

The frequency with which interns saw problems and their level of knowledge related to oral-health were both shown to be important factors associated with how likely they are to perform various oral health practices for young children. Results suggest that medical schools should improve medical student experience through more exposure to patients suffering from oral health problems in addition to improving knowledge through more adept oral health training. Both provide excellent opportunities to increase training physicians’ comfort levels when dealing with the ever-increasing oral health issues affecting young Saudi children. Furthermore, these efforts can be focused more intensely on interns who chose future clinical goals oriented towards public health which was also shown to be an important factor associated with the likelihood to perform various oral health practices for young children.
Table 7. Multivariable Logistic Regression Final Model Comparing Interns who were Likely to Counsel on OH-Issues (n=55) to Those Who were Unlikely to Counsel (n=66) *

<table>
<thead>
<tr>
<th>Variable</th>
<th>Point Estimate</th>
<th>p-value</th>
<th>Adjusted Odds Ratio Interpretation</th>
<th>95% Wald Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.389</td>
<td>0.0057</td>
<td>Males had 0.4x higher likelihood</td>
<td>0.207 – 0.765</td>
</tr>
<tr>
<td>Future Clinical Goals</td>
<td>1.400</td>
<td>0.0126</td>
<td>Those who were more oriented towards public-health had 1.4 x higher likelihood</td>
<td>1.090 – 2.165</td>
</tr>
<tr>
<td>Sum Score Knowledge</td>
<td>1.454</td>
<td>0.006</td>
<td>Those with higher knowledge score had 1.5 x higher likelihood</td>
<td>1.129 – 2.062</td>
</tr>
</tbody>
</table>

* Hosmer and Lemeshow Goodness-of-Fit test (p-value= 0.6664)
Table 8. Multivariable Logistic Regression Final Model Comparing Interns who were Likely to Examine for OH-Issues (n=66) to Those Who were Unlikely to Examine (n=55) *

<table>
<thead>
<tr>
<th>Variable</th>
<th>Point Estimate</th>
<th>p-value</th>
<th>Adjusted Odds Ratio</th>
<th>Interpretation</th>
<th>95% Wald Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children seen/week</td>
<td>1.151</td>
<td>0.0139</td>
<td></td>
<td>Those who saw more children on average had 1.2x higher likelihood</td>
<td>1.013 - 1.122</td>
</tr>
<tr>
<td>OH Rating</td>
<td>2.611</td>
<td>0.0071</td>
<td></td>
<td>Those who rated their OH training higher had 2.6x higher likelihood</td>
<td>1.299 - 5.247</td>
</tr>
<tr>
<td>Future Clinical Goals</td>
<td>1.763</td>
<td>0.0129</td>
<td></td>
<td>Those who were more oriented towards public-health had 1.9x higher likelihood</td>
<td>1.127 - 2.756</td>
</tr>
<tr>
<td>Sum Score Knowledge</td>
<td>1.301</td>
<td>0.0414</td>
<td></td>
<td>Those with higher knowledge score had 1.3x higher likelihood</td>
<td>1.083 - 1.728</td>
</tr>
</tbody>
</table>

* Hosmer and Lemeshow Goodness-of-Fit test (p-value= 0.6346)
Table 9. Multivariable Logistic Regression Final Model Comparing Interns who were Likely to Treat Emergencies Related to OH-Issues (n=8) to Those Who were Unlikely to Treat Emergencies (n=113) * ^

<table>
<thead>
<tr>
<th>Variable</th>
<th>Point Estimate</th>
<th>p-value</th>
<th>Adjusted Odds Ratio Interpretation</th>
<th>95% Wald Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>OH Rating</td>
<td>2.5641</td>
<td>0.0143</td>
<td>Those who rated their OH training higher had 2.7x higher likelihood</td>
<td>1.571 - 6.356</td>
</tr>
<tr>
<td>Comfort Score</td>
<td>3.7127</td>
<td>&lt;0.0001</td>
<td>Those with a higher comfort score had 3.7x higher likelihood</td>
<td>1.7655 - 5.9152</td>
</tr>
</tbody>
</table>

* Hosmer and Lemeshow Goodness-of-Fit test (p-value=0.6900)

^ Exact conditional test used
Table 10. Multivariable Logistic Regression Final Model Comparing Interns who were Likely to Refer for OH-Issues (n=55) to Those Who were Unlikely to Refer (n=66) *

<table>
<thead>
<tr>
<th>Variable</th>
<th>Point Estimate</th>
<th>p-value</th>
<th>Adjusted Odds Ratio Interpretation</th>
<th>95% Wald Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Clinical Goals</td>
<td>1.328</td>
<td>0.0328</td>
<td>Those who were more oriented towards public-health had 1.3x higher likelihood</td>
<td>1.110 – 2.640</td>
</tr>
<tr>
<td>Sum Score Problem</td>
<td>1.208</td>
<td>0.0514</td>
<td>Those who saw more problems had 1.2x higher likelihood</td>
<td>1.083 - 1.720</td>
</tr>
</tbody>
</table>

* Hosmer and Lemeshow Goodness-of-Fit test (p-value= 0.6514).
CHAPTER VI

THE EFFECTIVENESS OF AN ELECTRONIC EDUCATIONAL INTERVENTION ON SAUDI MEDICAL INTERNS’ CHILDORAL HEALTH-RELATED KNOWLEDGE, ATTITUDES AND PRACTICES

Abstract

Objective: This study evaluated the effectiveness of an electronic educational intervention on improving medical interns’ knowledge, willingness, and comfort levels examining and referring children for oral health issues.

Methods: One-hundred and twenty-one medical interns at King Khalid University Hospital were targeted with a theory-guided month-long electronically-delivered educational program. Following the program, a 16-item survey was emailed to all participants to address the areas of interest. Bivariate analysis and linear regression models were used to analyze data.

Results: Eighty-eight usable follow-up surveys (73%) were returned from two mailings. Respondents gave a higher percentage of correct responses to the knowledge questions post-intervention compared to pre-intervention with an average increase of 63%. Additionally, nearly all respondents agreed with the statement that all children 12 months and older should be seen by a dentist in accordance with the American Academy of Pediatric Dentistry & the American Academy of Pediatrics recommendations. Pre-intervention, only four out of every ten interns agreed with this statement. Furthermore, medical interns noted improved levels of comfort with all specified oral health practices. Most notable, following the educational intervention, 91% of respondents rated themselves as comfortable in counseling, compared to
only 25.6% that did so before the educational program. The only exception on comfort issues pertained to performing emergency treatments on young children with a majority of interns (92%) still considering themselves as neutral or uncomfortable in doing so. Multiple linear regression analyses revealed several statistically significant variables that predict the likelihood of performing various oral-health related practices. Increased oral health knowledge, higher self-perceived comfort levels and seeing oral-health problems more frequently all proved important predictor variables for the likelihood of performing oral-health related services.

**Conclusions:** Providing medical interns’ with basic educational programs and training can be effective in improving their knowledge, attitudes and self-perceived comfort levels related to oral health services. Ultimately these improvements may help advance oral health care coordination efforts and young children’s access to needed oral health care services in Saudi Arabia.

**Introduction**

In 2007, the Saudi Arabian Ministry of Health and a newly structured Health Services Council published their recurring 5-year strategic health plan for the country. (MOH, 2007) In this plan several of the key challenges facing health care in Saudi Arabia were outlined and the proposed solutions and regulatory reforms were also identified. The main problems identified were related to efficiency issues, effectiveness of health care delivery and quality of care provided, as well as issues pertaining to financial sustainability given the growing population and increased expectations for care. One of the main factors deterring better development in these areas has been an absence of data that would help in appropriate decision- and policy-making, especially regarding possible avenues of coordination among the multiple public health agencies and alternative methods of providing health care. Furthermore, due to the
relative shortage in Saudi health care providers, the Labor Force Council, in 2002, adopted a national strategy focused on increasing the capacity level of existing medical and dental colleges and institutes; encouraging non-educational hospitals to establish their own training centers; using non-conventional educational systems and enlarging the realm of study for graduating physicians and supporting staff. (AlYousef, et al, 2002) Additionally, in an effort to assure higher efficiency this national public health strategy has placed renewed focus on primary and preventive care. This would also include the development of effective referral guidelines and a human resources master plan for the country. (MOH, 2007)

Over the past few decades there has been an increased focus on the importance of oral health and its integration into the overall health care needs of the population (Gandeh, et al, 2000). Similar to other developing nations in the region, caries rates have been steadily increasing, especially among younger children. (KSA- Annual health report, 1999). Recent clinical studies (Amin, et al 2009; Al-Malik, et al 2003; Paul, 2003) performed in several of the main cities in Saudi Arabia, including the Capitol Riyadh have demonstrated that almost 7 in every 10 Saudi children under the age of 5 years were suffering from carious teeth.

Furthermore, these studies have indicated that on average as few as only 1 out of 10 of young children are caries free, with the majority of these children not having seen a dentist until the fifth year of life (Amin, et al 2009; Al-Malik, et al 2003; Paul, 2003).

The main factor that has been associated with these high levels of dental caries among children under 5 years old is the lack of appropriate oral health knowledge among parents and children. Subsequently, this lack of knowledge has lead to inadequate oral hygiene practices and not maintaining regular dental visits, with as much as 60% of Saudi children having never been to a dentist by their fifth birthday (Amin, et al 2009).
Primary care physician's potential involvement in aspects of child oral health evaluation, referral and preventive care is increasingly becoming an area of research and investigation. The fact that they are more likely to see children (regardless of income or coverage) at a young age (Lewis et al, 2000; Lewis et al, 2004) and visits occurring in a regular fashion (Schafer et al, 2000; Mouradian et al, 2003), permit them to play a vital role in the oral health of children. Unfortunately, medical professionals have traditionally received little training in the oral health care of children. (dela Cruz, et al,2004) There have been relatively few studies that have focused on the feasibility and extent of oral health education and training in medical schools or residencies. As a result our understanding of factors affecting physicians’ oral health knowledge, comfort levels in assessing dental caries risk and the need for dental referral is limited. This statement echoes true regarding the health care studies done in Saudi Arabia.

The primary aim of this study is to assess the effectiveness of a theory-driven electronic informational intervention on improving primary care practitioners' knowledge, willingness, and comfort levels in identifying children who are at high risk for developing dental caries. Ultimately such a determination may help improve oral health care coordination efforts and young children’s access to needed oral health care services in Saudi Arabia.

**Materials and Methods**

This program targeted medical interns at the King Saud University Medical Hospital (KSUH). The study population was made up of 121 Saudi medical interns who had responded to a baseline survey distributed during June 2010 – the last month of their fifth year in medical school (Alyousef, et al, 2011a). The internship year is a one-year training program that follows completion of medical school which is required for all graduating medical students.
In the summer of 2009, the principal researcher met with the directing secretaries of the internship students. Through these meetings, specific student class data were obtained. This included a list of the medical students expected to graduate to their internship year and their contact information.

In the summer of 2010, a questionnaire was distributed to all graduating medical students during the last month (June, 2010) of their fifth and final year. This survey was administered to assess oral health knowledge, attitudes, behaviors and self-perceived competencies. The survey included questions pertaining to four oral-health-related activities, namely, oral health counseling, dental examinations and risk assessment, treating emergencies and referrals. Questions targeted intern oral health knowledge, opinions, behaviors and self-perceived competencies. (Alyousef, et al, 2010a)

One month later, the 121 Saudi medical interns - who had completed the baseline survey - were targeted with an electronic informational intervention over the course of 4 weeks. During the 5-day week, the interns received primary health care educational emails 3 times a week. These educational emails had a consistent and simple format: at the beginning of the email a primary health care related message with basic information regarding a primary oral health issue was presented in a one-slide Power Point set-up. This was followed by more detailed information on the different constructs included in the message. At the bottom of the email a link to an educational website that focused on this particular oral health care message was provided. Additionally, within these emails the participants were asked to provide feedback on the information presented. This was expected to improve personal acceptance and investment into adopting the promoted practices. (See Appendix C) Information regarding procedural activities was accompanied by a video demonstrating the technique or procedure. The main areas of oral health care addressed included: teaching medical students to perform a dental screening...
and identify deviations from normal; assessing factors related to caries risk among children under 5; describing the importance of fluoride in the prevention of tooth decay; counseling caregivers on maintaining oral health for their children; and referring high-caries risk children effectively. In addition to the emails, participants received similar basic information text messages as additional reinforcement of each educational message. Furthermore, to aid in behavioral change regarding referrals, basic referral papers were shown to the interns and attached to the post-birth immunization pamphlet usually given to the parents of newborns during the infant education clinical session.

Finally, following the educational intervention, a post-intervention survey addressing similar constructs as the pre-intervention survey was administered. Consent was considered obtained if the respondent voluntarily returned the survey to the principal investigator. This study was approved by the King Saud University Medical College Educational Review Board.

For each of the four dependant variables results were assessed using both bivariate correlation and multiple linear regression analyses. The four dependant variables (Likelihood to Counsel; Likelihood to Examine; Likelihood to Treat Emergencies; Likelihood to Refer) represented the change in responses from pre- to post-intervention. Statistical analysis was performed using SAS software (v9.1, SAS Institute Inc, Cary, NC, USA). All tests utilized a 0.05 level of statistical significance.

Results

Following the educational intervention period, on average 87.4% of targeted students opened each informational email. Overall, a trend of progressively increasing percentages of email openings was noted with subsequent emails. Of these students, an average of 96.5% commented favorably to a question on the benefits of the information provided and an average of 63.6% clicked the website link directing them to additional information on the specified
topic area. Of the 121 interns who responded to the baseline survey - conducted in June 2010 - 73% completed the follow-up survey after two mailings.

There was a higher response rate to the follow-up survey from female participants. Fifty-one percent of responses were from male participants, however, they represented only 68.2% of eligible male respondents, whereas 77.6% of all eligible female interns responded to the survey. There were no statistically significant differences between respondents and non-respondents in terms of age (p=0.402), the number of patients (p=0.191) and children (p=0.337) seen per week.

Descriptive Findings

Respondents to the follow-up survey showed greater interest in taking CME courses focused on oral health issues than they did at baseline. Interns who were somewhat or very interested increased to 75% from 43% in the pre-intervention survey. Interns’ rating of the importance of their role in providing oral health counseling and related referrals also increased from 65% reporting their role as very important in the pre-intervention survey to 81% in the follow-up survey.

Respondents gave a higher percentage of correct responses to the knowledge questions post-intervention compared to pre-intervention, exceeding the learning objectives that were expected prior to initiating this study. The least improvement was a 16% increase on the question related to the need for adults to assist children in brushing their teeth up to the 2nd or 3rd grade (ages 7-8 years), where post-intervention 30% answered this question correctly. The most notable improvement was on the question related to the recommended use of fluoride with children under 3, where correct responses increased from 13.8% to 82%. Additionally, following the intervention nearly all respondents agreed with the statement that all children 12
months and older should be seen by a dentist - in accordance with the recommendations of both the American Academy of Pediatric Dentistry (AAPD) & the American Academy of Pediatrics (AAP). Pre-intervention, only four out of every ten interns agreed with this statement. With respect to self-perceived comfort levels towards counseling on oral-health issues, examining the oral cavity of young children or referring high-caries-risk children; respondents generally rated themselves at a much higher degree of comfort post-intervention. For example, following the educational intervention, 91% of respondents rated them-selves as comfortable in counseling, compared to only 26% that did so before the educational program. The only exception on comfort issues pertained to performing emergency treatments on young children with a majority of interns (92%) still considering themselves as neutral or uncomfortable in doing so. With the exception of comfort performing emergency treatments, the learning objectives identified prior to initiating this study were well exceeded.

On questions pertaining to likelihood of performing different oral health related services respondents to the post-intervention survey noted higher scores compared to responses prior to the educational intervention. On average, the responders’ likelihood to perform counseling increased by 67%, examinations by 48%, treating emergencies by 38% and making dental referrals increased by 63%. Additionally, over the course of the intervention period, the frequency with which interns saw different oral health problems in children increased an average of 20%.

Finally, regarding basis of referral, 59% of respondents in the baseline survey referred based on risk alone and 25% did so based on emergency needs only. In the post-intervention survey these percentages decreased to 37.6% and 5.8%, correspondingly. Contrary to this, 56.4% noted that they referred all children 12 months and older -in accordance with AAPD &
AAP recommendations. This was an increase from 13% who reported referring on this basis in the pre-intervention survey.

**Bivariate Findings**

The bivariate analyses of change scores for all variables revealed several statistically significant predictor variables for each of the four measured dependent variables. (Table 11)

**Likelihood to Counsel**

Interns who demonstrated a greater positive change in their likelihood to counsel patients on oral health issues had a greater change in interest in taking oral-health related CMEs (p=0.0109), a greater change in mean sum score on the knowledge questions (p=0.0004), a higher change in sum score of comfort levels in performing oral-health-related practices (p<0.0001); compared to those who demonstrated less of a change in their likelihood to counsel patients on oral health issues.

**Likelihood to Examine**

Interns who demonstrated a greater positive change in their likelihood to examine young children’s teeth for problems indicated having a greater change in interest in taking oral-health related CMEs (p=0.054), a greater change in mean sum scores on frequency of seeing oral-health problems (p=0.0019), a greater change in mean sum score on the knowledge questions (p=0.0013), a higher change in sum score of comfort levels in performing oral-health-related practices (p<0.0001); compared to those who demonstrated less of a change in their likelihood to examine patients for oral health issues.

**Likelihood to Treat Emergencies**

Interns who demonstrated a greater positive change in their likelihood to perform emergency dental treatment on young children had a greater change in mean sum scores on
frequency of seeing oral-health problems (p=0.051), a higher change in sum score of comfort levels in performing oral-health-related practices (p<0.0018); compared to those who demonstrated less of a change in their likelihood to treat emergencies related to oral health for patients.

**Likelihood to Refer**

Interns who demonstrated a greater positive change in their likelihood to refer a child with oral health needs to a dentist had a greater change in mean sum score on frequency of seeing oral-health problems (p=0.0402), a greater change in mean sum score on the knowledge questions (p=0.0057), a higher change in sum score of comfort levels in performing oral-health-related practices (p=0.0002); compared to those who demonstrated less of a change in their likelihood to refer patients for oral health issues.

**Multivariate Analyses**

Using multiple regression, the four dependant variables were regressed on a linear combination of selected predictor variables that were shown to be statistically significant in the bivariate analysis (p \leq 0.1). There were strong relationships among education-related predictor variables (interest in oral-health related CMEs and the sum score on the knowledge questions; p=.0017) at the bivariate level. Interest in oral-health related CMEs, which had a weaker association with likelihood to perform, was eliminated to avoid multicollinearity. For each of the four dependant variables, unstandardized regression coefficients (b), standard error, statistical significance and 95% confidence intervals were produced. (Table 12) Final linear combinations were chosen based on statistical significance and percent of variance in the dependant variable accounted for by the given combination.

**Likelihood to Counsel**
The sum score of change in comfort levels exerted the greatest effect ($B = 0.41; p = .0007$). The sum score of change in knowledge ($B=0.20; p=0.035$) was also significant ($R^2 = 0.40$). Thus, interns who noted a higher change in scores of comfort in providing oral-health related services and scored higher on oral-health-related knowledge questions reported higher levels of likelihood in counselling young children on oral-health related issues.

**Likelihood to Examine**

The sum score of change in comfort levels exerted the greatest effect ($B = 0.28; p=.0007$). Both the sum score of change in frequency of seeing oral-health related problems ($B=0.25; p=0.0065$) and the sum score of change in knowledge ($B=0.14; p=0.017$) were also significant ($R^2 = .37$). Thus, interns who noted a higher change in scores of comfort in providing oral-health related services, saw oral-health-related problems more frequently and scored higher on oral-health-related knowledge questions reported higher levels of likelihood in examining the oral-health of young children.

**Likelihood to Treat Emergencies**

The sum score of change in comfort levels exerted the greatest effect ($B = 0.58; p<.0001$). The sum score of change in frequency of seeing oral-health related problems ($B=0.12; p=0.0211$) was also significant ($R^2 = .41$). Thus, interns who noted a higher change in scores of comfort in providing oral-health related services and saw oral-health-related problems more frequently reported higher levels of likelihood in treating oral-health related emergencies for young children.

**Likelihood to Refer**

The sum score of change in knowledge exerted the greatest effect ($B = 0.27; p = 0.014$). Both the sum score of change in comfort levels ($B=0.21; p=0.046$) and the sum score of change...
in frequency of seeing oral-health related problems (B=0.14; p=0.017) were also significant ($R^2$ = .19). Thus, interns who scored a higher change in on oral-health-related knowledge questions, noted higher scores of comfort in providing oral-health related services and saw oral-health-related problems more frequently reported higher levels of likelihood in referring young children for oral-health related issues.

**Discussion**

The main purpose of this study was to view the effectiveness of an electronic educational program in improving medical students’ oral health related knowledge, comfort levels and attitudes towards performing various oral care services for young children. Additionally, this study sought to identify factors that play an important role in influencing the likelihood of physicians performing these different oral-health related practices.

In our educational intervention we targeted Saudi medical interns with electronically delivered informational packages as opposed to in-person training or lectures/seminars or the distribution and use of paper-based materials. This method of administration was chosen based on the fact that most communication within the college is conducted via email as noted during the researchers’ meetings with administrative staff. The use of internet technology in delivering educational material targeting medical health care providers as part of their training or as a strategy to encourage attitude or behavioral change has not been adequately studied in the literature; however, several studies that have looked at competing means of education have indicated that there are no statistically significant differences in the effectiveness of electronic based interventions compared to traditional paper based interventions. (Alex, et al, 2008; Ritterband, et al, 2006; Franklin, et al, 2005; Leslie, et al, 2002; Fotheringham, et al, 2000)

Additionally, an average of 87.4% of targeted students opened each informational email and a
73% response rate to the follow-up survey was reached. We believe that the simple email format, repeated follow-up and the preliminary step of having the Dean’s office send out an email encouraging student participation led to attaining a relatively high participation rate. Both information presentation and senior staff involvement have been noted as important aspects that relates to the extent of participation and recruitment in behavioral programs. (Danaher, et al, 2009, Glasgow, et al, 2007) Furthermore, tracking measures were used in an effort to gauge website-use, component benefit and participant motivation and satisfaction with our web-based program. Such measures included: monitoring web-page views, the number of click-throughs to additional links provided on the website page, and questions about the benefit of presented information. This information gives some insight into the receptiveness towards our web-based program; however, these measures also come with certain challenges regarding the accuracy of engagement measurement. For example, interpreting exactly what a ‘web-page view’ is measuring can be difficult because viewing numbers or duration can be influenced by the web-page design and presentation and overall organization. Additionally, it is difficult to ascertain whether the time spent on the web-page is being used to actively view the contents of the site or may be due to other factors, such as, multi-web-page viewing. (Danaher, et al, 2009)

Although the presented web-based program used a simple format and was brief in duration and in intensity compared to other educational programs presented in the literature, such as the Into the Mouth of Babes (IMB) program in North Carolina, it proved to be effective in advancing participant oral-health related knowledge, attitudes and self-perceived comfort levels. Comparatively, brief training programs ranging from 2 to 20 hours, regarding infant oral health care, yielded medical providers who were able to identify dental disease risk and need for referral at rates similar to active control groups of dentists. (Gonzales, et al, 2004, Pierce,
Such studies provide evidence that minimal effort training can yield significant educational and clinical results that ultimately may improve health care coordination and access to care issues.

Following the educational intervention, nearly all respondents agreed with the statement that all children 12 months and older should be seen by a dentist - in accordance with the recommendations of both the AAPD/AAP. Pre-intervention, only four out of every ten interns agreed with this statement. In a 2004 survey of primary care clinicians participating in the IMB program in North Carolina more than 90 percent of the study sample reported agreement with this and referred infants and toddlers for dental care as part of their regular practice. (Cruz, 2004)

Similar to previous studies self-perceived comfort levels and knowledge were shown to be significant predictors of medical providers’ likelihood and ability to perform oral screenings and risk assessments. (Grant, et al, 2007, Gonzales, et al, 2004, Rozier, et al, 2003) However, in contrast to a 2004 study by Cruz, knowledge was also shown to be an important factor in explaining referral tendencies and practices. Cruz and colleagues attributed their inability to link referral patterns to oral health knowledge to the lack of variability in scoring with their available sample size. It is important to note that both knowledge and comfort level (self-efficacy) are common constructs in many behavior change theories, including the Social Cognitive Theory, and as a result are considered important factors used to bring about behavioral change.

Additionally, we noted a decrease in participants who referred children based on risk alone from 59% pre-intervention to 37.5% post-intervention. Cruz noted that nearly 78% of their participants based their referrals on the suspected presence or risk for dental decay. It is
possible that participants in our study gravitated towards referral based on AAP/AAPD recommendations given the focus of our intervention on this point. The percent of participants who referred based on this recommendation increased from 13% pre-intervention to 56.4% post-intervention. Future programs need to clearly discern between the overall encompassing recommendation and the importance, from an efficiency stand-point, to assess and refer based on risk.

Although there was a slight increase in the average frequency with which interns saw oral health problems, this factor proved to be significant for several oral-health related practices. Specifically, those practices related to hands-on interaction, namely: dental examinations and treating emergencies. Theoretically, this comes as no surprise as hands-on training is an important step in alleviating anxiety towards performing an activity and clarifying any possible barriers towards accomplishing it. (Mckenzie, et al, 2009) Previous educational programs have noted the importance of such activities as part of medical providers’ educational training. (Slade et al, 2007, Grant, et al, 2007). Given the nature of our study we were unable to verify the cause of this increase, whether this was a result of change in intern workload or actual increase in the frequency of performing oral examinations.

Overall, combinations of self-perceived comfort levels, knowledge and personal experience in seeing dental care problems yielded modest coefficients of determination for each of the dependant variables. These three factors have been suggested by the literature as significant factors affecting oral health attitudes and practices of medical providers. Thus, they have been areas of major focus and effort. Unfortunately, there has been minimal focus on assessing factors affecting change in dental care behavior and thus, it is difficult to discern the meaningfulness of our generated coefficients of determination. One possible avenue would be to conduct focus groups with medical students and
practitioners in order to attain other significant factors that have not been mentioned in the literature and that may help explain the near 60% of variability in responses that still remains.

Ideally, measurement of actual future behavior represents the best model of assessing behavioral change. The models generated from our final analyses predicted only a portion of intention, and there are likely many other factors that may be important. As outlined in the Social Cognitive Theory (Glanz, et al, 2002), environmental factors such as a mentor modeling these behaviors and social and institutional encouragement to perform them might also contribute to greater intention and ultimately greater actual behavior.

It is important to note that our study was conducted at an opportune time within the timeline of health development in Saudi Arabia. To begin with, our program targeted medical interns who in the present health care system represent the first line of care as the majority of graduates work within the primary care network. (KSA- Annual health report, 1999) Secondly, given recent and expected reforms to the health care system primary care physicians assume the role of referral hubs in all health care matters, including dental health care needs. (MOH, 2007) Thirdly, given that the population of Saudi Arabia is a very young one, with 50% of the population under the age of 15 years and 12% under the age of 5 years, in addition to the changed emphasis by the Ministry of Health on more efficient inter-disciplinary delivery of health care services, there remains a clear need to develop programs that assess barriers to preventive care which would help lessen these increasing health care concerns. Our study represents an initial step towards these goals, and although our study targeted a specific medical school in Saudi Arabia, the curriculum characteristics related to oral health training are similar to what has been reported on in the literature. Additionally, the final follow-up response rate in this study – at 73% – is comparable to that

**Conclusion**

A month-long theory-guided electronically-delivered educational program provided to medical interns during the start of their internship was effective in improving intern oral health knowledge and self-perceived comfort levels and behavioral intentions. A slight increase in the frequency with which interns saw problems was also noted over this period. Both were shown to be important factors associated with how likely interns are to perform various oral health practices for young children. Results suggest that efforts should be made to improve medical student experience through more exposure to patients suffering from oral health problems in addition to improving knowledge through focused oral health educational programs. Increased coordination between medical and dental schools can help provide physicians’ with appropriate training that will lead to increased comfort levels when dealing with the ever-increasing oral health issues affecting young Saudi children.
Table 11. Correlations among Variables Associated with Likelihood to Perform Oral-Health Related Practices #

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Likelihood to Counsel</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>2. Likelihood to Examine</td>
<td>.39**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>3. Likelihood to Treat Emergencies</td>
<td>.05</td>
<td>.42*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>4. Likelihood to Refer</td>
<td>.41*</td>
<td>.29**</td>
<td>.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Gender</td>
<td>.29**</td>
<td>.24†</td>
<td>.01</td>
<td>.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Knowledge Score</td>
<td>.40*</td>
<td>.37**</td>
<td>12</td>
<td>.29**</td>
<td>.03</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>7. Comfort Levels</td>
<td>.48*</td>
<td>.54*</td>
<td>.41*</td>
<td>.37**</td>
<td>.27†</td>
<td>.56</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Problem Frequency</td>
<td>.11</td>
<td>.38**</td>
<td>.29**</td>
<td>.25†</td>
<td>.19</td>
<td>-.09</td>
<td>.96*</td>
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<tr>
<td>9. CME Interest</td>
<td>.29**</td>
<td>.18</td>
<td>-.02</td>
<td>.13</td>
<td>.19</td>
<td>.20†</td>
<td>.15</td>
<td>.04</td>
<td></td>
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<td>10. Future Clinical Goal</td>
<td>-.08</td>
<td>.07</td>
<td>.02</td>
<td>.05</td>
<td>-.06</td>
<td>.18</td>
<td>.02</td>
<td>.19</td>
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<tr>
<td>11. Referral Basis</td>
<td>.17</td>
<td>.16</td>
<td>-.07</td>
<td>.09</td>
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<td>.19</td>
<td>.26</td>
<td>-.06</td>
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<td>.20</td>
<td></td>
</tr>
</tbody>
</table>

# Note: All Variables represent the change in scores from pre- to post-intervention

* p<0.0001; ** p<0.01; † p <0.05
Table 12. Regression Results for Change in Likelihood to Perform Oral Health Related Practices #

<table>
<thead>
<tr>
<th>Variable</th>
<th>p-Value</th>
<th>$R^2$</th>
<th>UnStd Regression Coefficient ($b$)</th>
<th>Std Error</th>
<th>95% Confidence Interval</th>
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<tbody>
<tr>
<td>Likelihood to Counsel</td>
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<tr>
<td>Intercept</td>
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<td></td>
<td>.000</td>
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<tr>
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<td>.0007</td>
<td></td>
<td>.408</td>
<td>.129</td>
<td>.198 - .711</td>
</tr>
<tr>
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<td>.189</td>
<td>.073</td>
<td>.011 - .300</td>
</tr>
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<tr>
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<td></td>
<td>.000</td>
<td>.563</td>
<td>-.194 - .290</td>
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<tr>
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<td></td>
<td>.140</td>
<td>.043</td>
<td>.026 - .143</td>
</tr>
<tr>
<td>Comfort Levels</td>
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<td></td>
<td>.280</td>
<td>.043</td>
<td>.199 - .509</td>
</tr>
<tr>
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<td>.250</td>
<td>.061</td>
<td>.049 - .289</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>Intercept</td>
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<td>.000</td>
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<td>.110</td>
<td>.045</td>
<td>.032 - .144</td>
</tr>
<tr>
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<td>.576</td>
<td>.096</td>
<td>.33 - .710</td>
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<tr>
<td>Likelihood to Refer</td>
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<td></td>
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<tr>
<td>Intercept</td>
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<td>.000</td>
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<tr>
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<tr>
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<td>.088</td>
<td>.003 - .352</td>
</tr>
<tr>
<td>Problem Frequency</td>
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<td></td>
<td>.143</td>
<td>.042</td>
<td>.025 - .151</td>
</tr>
</tbody>
</table>

# Note: All Variables represent the change in scores from pre- to post-
CHAPTER VII

GENERAL DISCUSSION AND CONCLUSIONS

Discussion

Introduction

In response to a growing global concern focused on oral health issues, especially that related to access to care for young and rural populations, several initiatives have been brought forth and studied. One such approach has been to advocate the participation of medical health care professionals in these efforts for various practical reasons that have been described and referenced previously in this paper (See Chapter II). Studies in the literature have looked at the incorporation of physicians, nurse practitioners, physician assistants and nurses in various roles with a similar goal of improving child access to needed oral health care services. Unfortunately, medical professionals have traditionally received little training in the oral health care of children. (dela Cruz, et al,2004) Accordingly, there have been relatively few studies that have focused on the feasibility and extent of oral health education and training in medical schools or residencies. A recent review of the literature concluded that pediatric oral health training for physicians whether at the undergraduate, residency or continuing education level was insufficient in content and depth. (Krol, 2004) Furthermore, educational approaches varied and lacked consistency when incorporating oral health instructions and training into established pediatric medical training programs. (Krol, 2004).

Key Questions of Interest

In line with this overall area of concern and increased focus, our three studies questioned medical professionals’ oral health knowledge, attitudes, and practices, specifically with regards to the oral health of young children. There are various population differences between Saudi
Arabia (Central Region) and the U.S. (Iowa), specifically related to demographic characteristics, social economic system as well as care importance and expectations. Also, differences exist between the two countries as far as the stage of health care development is concerned, specifically related to educational-institution capabilities, facility infrastructure, care payment system, as well as provider variability and availability. Both of these points led to the adjustment of our key questions of interest for each target population.

In our first study, the question of interest focused on Iowa pediatricians’ referral frequency, associated characteristics and influencing factors. The significance of this question has been growing in importance, especially since the passing of a law specifying that "by July 1, 2008, every recipient of Medicaid who is a child 12 years of age or younger shall have a designated dental home and shall be provided with the dental screenings and preventive care identified in the oral health standards under the early and periodic screening, diagnostic and treatment (EPSDT) program." (Iowa Medicaid Reform, 2005) This date has been delayed several times in an effort to establish improved grounds for its implementation. (Chap 15 Revision, 2010)

Our second and third research papers were done in Saudi Arabia. The initial study focused on medical professionals’ oral health knowledge, attitudes and practices. Next, a study assessing the effectiveness of an electronic educational intervention in improving participant oral health knowledge and attitudes was implemented. These studies were done at an opportune time within the timeline of health care development in Saudi Arabia. Although the country has made significant steps towards health care development on many key aspects, several serious challenges facing the current health care system in Saudi Arabia remain. (MOH, 2007) The focus of our study targeting Saudi medical interns helped provide information that may
potentially help alleviate access to care issues and improve efficiency of health care delivery. Both of these benefits address problems identified by the MOH as major deficiencies in the current health care system. (MOH, 2007)

**Key Findings**

**Physician Attitudes**

Overall physicians were very receptive to the idea of taking on certain oral health care practices, especially related to risk assessments and prevention practices as part of their daily roles. Favorable attitudes towards these issues were influenced by different factors. For Iowa pediatricians, the frequency with which they referred high risk children for oral health care was influenced by the frequency with which they saw oral health related problems, the percentage of young children (age 0-3) seen per week, and their agreement with AAP/AAPD guidelines recommending that children (age 0-3) should have their 1st dental visit no later than 12 months of age.

Similarly, for Saudi Interns likelihood of performing different oral health related practices, including referrals, was influenced by level of oral health knowledge, frequency of seeing oral health related problems, and the percentage of children seen as part of their workload. Additionally, self-perceived comfort level, which theoretically appears to be a product of these different factors, was shown to be a highly significant factor influencing attitudes towards taking on various oral care practices.

**Oral-Health Knowledge: Timing of 1st Dental Visits**

An important building block regarding the success of oral care prevention efforts relates to early referral of young children for emergency and/or regular oral care, which in turn is associated with the attitude of various health care professionals towards AAP/AAPD policies.
on timing of first dental visits. In our first study, we found that the frequency with which Iowa pediatricians referred was closely associated with their knowledge of these policy recommendations. Overall, well over half (65%) of the responding Iowa pediatricians said they were referring high-caries risk children under the age of 3 to a dentist on a routine basis.

Following the educational intervention targeting Saudi interns, nearly all respondents agreed with the statement that all children 12 months and older should be seen by a dentist - in accordance with the recommendations of both the AAPD/AAP. Pre-intervention, only four out of every ten interns agreed with this statement. In a 2004 survey of primary care clinicians participating in the IMB program in North Carolina noted that more than 90 percent of the study sample reported agreement with this and referred infants and toddlers for dental care as part of their regular practice. (Cruz, 2004) However, that was a cross sectional survey conducted on primary care clinicians who were participating in the “Into mouth of babes” (IMB) program in North Carolina. Thus, it would be safe to presume that the degree of enthusiasm amongst participants in that study was influential in the high percentage of referring physicians. (Cruz, 2004) Also, in contrast to the study by Cruz, knowledge was shown to be an important factor in explaining referral tendencies and practices. Cruz and colleagues attributed their inability to link referral patterns to oral health knowledge to the lack of variability in scoring with their available sample size. Other studies (Grant, et al, 2007, Gonzales, et al, 2004, Rozier, et al, 2003) showed that self-perceived comfort levels and knowledge were both shown to be significant predictors in medical providers’ likelihood and ability to perform oral screenings, risk assessments and referral patterns.

**Provider Experience: Frequency of Seeing Oral-Health Problems**

In both the Iowa and Saudi studies a practitioner’s personal experience with oral health
related problems was shown to be a significant factor in their comfort level and willingness to perform oral-health-related practices. This personal experience was expressed through the frequency with which they saw oral health problems in children and the number of child patients they saw as part of their weekly workload. Our results revealed that Iowa pediatricians were more likely to refer to dentists if they had a higher mean total number of young children (age 0-3) patients seen a week and had a higher frequency of oral health related problems seen. The experience and reinforced comfort level gained by the pediatricians through repeated exposure to children and oral health related problems could explain this increased likelihood to refer children at high caries-risk.

Saudi intern respondents to the follow-up survey noted a slight increase in the average frequency with which they saw oral health problems. Although this increase was modest, it was shown to be a significant predictor of likelihood to perform several oral-health related practices. Specifically, those practices related to hands-on interaction, namely: dental examinations and treating emergencies. Theoretically, this comes as no surprise as hands-on training is an important step in alleviating anxiety towards performing an activity and clarifying any possible barriers towards accomplishing it. (Mckenzie, et al, 2009) Previous educational programs have noted the importance of such activities as part of a medical provider’s educational training. (Slade et al, 2007, Grant, et al, 2007).

It should be acknowledged that the level of experience between the Saudi interns and Iowa pediatricians may be significantly different due to differences in years practicing medicine. It is important to take this into consideration when comparing the responses of both sample populations. This may explain the clearer relationship between provider experience and comfort level and willingness to perform oral-health-related practices.
Self-Perceived Comfort Levels

Both knowledge and experience with oral health problems, as mentioned previously, were shown to be associated with the levels of self-perceived comfort in performing various oral health-related practices noted by the respondents in our first two studies. This association was shown to hold true in our third manuscript following the educational intervention, as improvements in knowledge and an increase in the frequency of seeing oral health problems or personal experience were associated with an increase in self-perceived comfort.

Thus, focusing future oral health training for medical students on aspects of increased knowledge and personal experience would greatly increase this willingness to play a preventive role in the oral care of children. This is important in the respect that reinforcing performance comfort levels through educational courses and training sessions could potentially increase the frequency with which physicians refer children at high caries-risk. Ultimately, practices that interns expressed high willingness to perform could potentially lead to improved child/parent oral health knowledge, preventive activities and access to needed care through appropriate referrals, especially in rural areas.

Alternative Influencing Variables

Interestingly, although the literature has focused on these previously mentioned factors as the most influential in determining alternative providers’ attitudes and likelihood to take on oral care practices as part of their daily practices our study revealed these factors as important but not comprehensive. Specifically, self-perceived comfort levels, knowledge and personal experience in seeing dental care problems have been areas of major focus and effort. Overall, combinations of self-perceived comfort levels, knowledge and personal experience in seeing dental care problems yielded modest coefficients of determination for each of the dependant
variables. Unfortunately, there has been minimal focus on assessing the magnitude of effect these factors have on change in dental care attitudes and behavior and thus, it is difficult to discern the meaningfulness of our generated coefficients of determination. Use of focus groups with medical students and practitioners represents one possible avenue of attaining other significant factors that have not been mentioned in the literature and that may help explain the near 60% of variability in responses that still remains.

Several associations from our results stand out and warrant further comment. Of special focus are the associations related to referral practices, patterns and influencing factors. Additionally, several future educational and training opportunities present themselves as a result of gaps in the literature and associations noted in our research between the likelihood to perform oral care practices and the influence of knowledge and comfort levels on this likelihood.

**Additional Points of Interest**

**Referral Patterns**

Our results showed that only 1 in 3 Iowa pediatricians referred a child based on level of caries risk. Saudi interns fared initially higher with 2 in 3 referring based on risk. This represents a clear opportunity for educational improvement that could be started during medical school training. This effort could be assisted by local dental colleges and dental practices providing content expertise, and informational booklets or references on the key risk factors so that pediatricians could make a more informed decision on the need for referral.

An additional important point to mention is that the percentage of participants who referred children based on risk alone decreased from 60% to 38%. In a similar study, Cruz noted that nearly 78% of their participants based their referrals on the suspected presence or
risk for dental decay. (Cruz, 2004) It is possible that participants in our study gravitated towards referral based on AAP/AAPD recommendations given the focus of our intervention on this point. The percent of participants who referred based on this recommendation increased from 13% pre-intervention to 56.4% post-intervention. Future programs need to clearly discern between the overall encompassing recommendation that all children be seen by a dentist by their first birthday; and the importance, from an efficiency stand-point, to assess and refer based on risk. All children should be referred by age one, in order to establish a dental provider or dental home for that child. However, risk assessment is integral to assessing the urgency and need for a dental referral.

**Referral Barriers**

An issue further related to referral practices and patterns is the matter of barriers restricting or inhibiting referral capabilities of health care professionals. Iowa pediatricians noted difficulty in referring Medicaid patients, specifically, which is also a problem on the U.S. national stage, as reported by a 2000 national survey, where nearly four out of every ten surveyed pediatricians reported this as a barrier to referral of children in need of care. (Lewis, et al, 2000) Furthermore, this barrier is expected to increase given that the percentage of Iowa children without dental insurance is increasing. (Rodgers, 2005) One of the recommendations put forth by the Iowa Department of Public Health (IDPH) to combat this issue is to increase adjunct staff responsibilities, in addition to better care coordination between health professionals. (Tyler, et al, 2006) Based on our results, more needs to be done to better define this barrier and improve dentists’ acceptance rates of Medicaid and uninsured children.

A related issue, the lack of locally available dentists, was cited as a barrier to the referral of children needing dental care by half of the responding Iowa pediatricians. While this
is still high, prior to conducting this study it was thought that this would figure as an even more prominent barrier given that 7 out of every 10 counties in Iowa qualify as a dental health professional shortage areas (Rodgers, 2005). On the other hand, in Saudi Arabia with its developing health care system, lack of qualified dentists has a significant effect on care provision and related referrals, especially in rural and isolated areas. (Amin, 2008) For example, in AlAhsa Village Area, there are approximately 180,000 children under 5 years of age, 60% of whom had not been to a dentist by age 5. (Amin, 2008)

Any future proposals or initiatives to improve oral care practices of non-dental health care professionals, especially referral capabilities, need to tackle this issue from different fronts. This includes increasing dentist graduates and their acceptance of different population groups, especially those who are uninsured or government-insured. Additionally, there is a need to develop care coordinator services capable of bridging the gap between different health care providers. Although, the care coordinator service in Iowa is an established service, only 4% of our respondents noted taking advantage of this service when referring young children for needed oral care. As a result, this service represents an ineffectively used resource that could become a valuable resource for improving the effectiveness of referrals. Whether low utilization numbers are a result of a lack of knowledge of these services by physicians, or because they don't think the system works appropriately? Further research into why so few care coordinator services are used would be beneficial in future policy and delivery system planning.

**The Gap between Provider Willingness & Training Adequacy: Educational Implications**

Encouragingly, a majority of our respondents, in both the Iowan and Saudi studies, agreed on the important role physicians can and should play in addressing the oral health care
needs of young children. In contrast to this, a majority of respondents indicated that they felt their own oral health training was inadequate and insufficient. Both of these contrasting points represent a serious gap that remains between medical and dental professionals. This area in education represents an opportunity that could be addressed through an oral-health-oriented educational program or course implemented as part of routine medical student training. This gap between what health care professionals may be willing to do – outside of their usual practice in order to improve access to care for those in need – and what they feel adequately trained to do remains an area of continued focus and effort, as noted in the literature. (Douglas, 2009; Mouradian, 2005; dela Cruz, 2004; Gonzales, 2004; Krol, 2004)

In 2004, Gonzales and colleagues implemented an educational course that included a clinical training portion targeting Kentucky medical residents. Residents surveyed voiced an overwhelming sense of obligation to a primary role in the oral health of their patients. However, this sense of obligation was hindered by a self-perceived lack in sufficient oral health training. The majority of responding residents rated their oral health knowledge and skill level as “poor” or “fair”. (Gonzales, 2004) Similarly, in a national survey of pediatricians, respondents expressed an overwhelming willingness to participate in oral health care, including oral-health related counseling and preventive therapies. However, more than a third reported having had no formal instruction in dental health-related subjects or training during medical school or their residency. (Lewis, 2000)

Study Limitations

In general, these research studies represented an important opportunity to incorporate theoretical constructs related to behavior intent and satisfaction with health care services in a manner that lent itself to the assessment of existing oral health-related attitudes and practices,
as well as the application of an educational program in an effort to improve such attitudes and practices. However, it should be recognized that our presented studies had some potential limitations. Given the study populations chosen, the study results may only be extrapolated to populations similar to that of Iowa and Saudi Arabia, i.e. U.S. mid-western and the Mid-Eastern populations. The first two studies were also cross-sectional in nature, which limits our ability to assess causality.

Additionally, the limitations associated with administering a self-completed questionnaire, including the possible introduction of recall bias, poor memory recall, the inability to verify or expand responses, and intentional deception. The respondents may have completed surveys with what they thought to be desired by the investigators or what they thought were appropriate answers. Attempts were made to guarantee confidentiality of responses, with both the electronic and paper-based surveys; in order to increase the likelihood of honest responses.

Furthermore, specific differences in knowledge, willingness and behavior between respondents and non-respondents could not be assessed precisely due to the lack of information and the nature of our survey studies. However, general descriptive information was obtained from the original physician and intern mailing lists that were provided by the Medical Registry at the College of Medicine at the University of Iowa and the intern secretary at the College of Medicine at King Saud University Hospital, respectively. Through which we were able to verify similarities between responding and non-responding physicians in each study. Overall, our respondents and non-respondents were similar in age, gender and population workloads in each study separately.

**Future Directions**
In general, information gained from the three studies presented was expected to help better identify determinants and deterrents of medical health professionals’ willingness to embrace oral health practices targeting young, high-caries risk children. Three main factors, namely: self-perceived comfort, willingness and knowledge, have been suggested by the literature as significant factors affecting oral health attitudes and practices of medical providers. Thus, they have been areas of major focus and effort. Our results point to the need for expanded surveys or the use of focus groups with medical students and practitioners that may help clarify other significant factors that affect practitioner attitudes and that have not been mentioned in the literature. Unfortunately, there has been minimal focus on assessing other factors affecting change in dental care attitudes and behavior. Future research could concentrate on more detailed analysis of aspects not addressed in our study.

Furthermore, regarding future educational and training program, our results suggest a need to add a hands-on portion, this would aid in providing willing participants with important clinical experience. Personal experience was shown in our studies to be an important factor affecting attitudes and behaviour.

From these stand-points, our studies may be viewed as foundation studies in both populations to establish baseline data in the aspects addressed. Such data can be used to establish state-wide or nation-wide studies and programs, including continuing educational courses for physicians, training courses and establishing policies that would improve referral rates of lower income, younger children to needed dental resources.

**Conclusions**

Collectively, the results from these three manuscripts lead us to the following main conclusions:
1) Educating medical practitioners and students about the AAPD/AAP guidelines related to the timing of dental visits for young children provides an excellent opportunity to alert medical professionals about the importance and timing of these dental referrals. Ultimately, earlier referrals by physicians can help improve dental utilization among high risk children, especially among lower income and rural families.

2) Experience with seeing more children, especially more young children, was a significant factor found to be related to both physician willingness and with how likely they are to perform various oral health practices for young children. Results suggest that medical schools should improve medical student experience through more exposure to patients suffering from oral health problems in addition to improving knowledge through more adept oral health training.

3) Increasing both knowledge and personal experience of training physicians’ could lead to greater comfort levels in dealing with oral health issues affecting young children.

4) Establishing effective care coordinator services to assist in linking various health care professionals more directly; may also increase physician willingness to assess and refer high-caries-risk children by making the referral process easier for physician offices. This step helps in saving time and effort, two deterrents noted by physicians.

5) Providing physicians’ with basic educational programs and training is effective in improving their knowledge, attitudes and self-perceived comfort levels related to oral health services. Ultimately these improvements may help advance
oral health care coordination efforts and young children’s access to needed oral health care services.
This descriptive analysis was an intermediate step that aimed to present detailed information on selected variables of Saudi interns, their knowledge, practices, patient populations and attitudes towards oral health. In the main results presented on data from the second study (Chapter V), primary points were presented and multivariate logistic regression analyses were detailed and revealed several statistically significant variables that predict the likelihood of performing various oral-health related practices.
Table A1 - Summary of selected variables of Saudi Interns and their practice/patients

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<th>Variable/Characteristic</th>
<th>Frequency</th>
<th>Percent (%)</th>
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<tr>
<td>Male</td>
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<td>54.5</td>
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<tr>
<td>Adequate</td>
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Table A1-Continued

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<th>CME in Pediatric Oral Health:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Interested</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>Slight Interested</td>
<td>46</td>
<td>38.1</td>
</tr>
<tr>
<td>Moderately Interested</td>
<td>49</td>
<td>40.5</td>
</tr>
<tr>
<td>Very Interested</td>
<td>3</td>
<td>2.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If I Refer a Child, it is Mostly based on:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I would refer ALL children (12 months &amp; older) to the dentist</td>
<td>16</td>
<td>13.1</td>
</tr>
<tr>
<td>I refer HIGH RISK children to the dentist (children who are bottle fed to sleep, don’t use fluoride toothpaste, etc)</td>
<td>72</td>
<td>59</td>
</tr>
<tr>
<td>I ONLY refer children in need of EMERGENCY dental treatment (have a clear problem)</td>
<td>31</td>
<td>25.4</td>
</tr>
<tr>
<td>I RARELY/ NEVER refer children to the dentist it is not my responsibility</td>
<td>3</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Table A2- Frequency distribution of how Saudi medical Interns rate training in the following:

<table>
<thead>
<tr>
<th>Rate Training in:</th>
<th>Poor n(%)</th>
<th>Fair n(%)</th>
<th>Good n(%)</th>
<th>V.Good n(%)</th>
<th>Excellent n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care pediatric practice</td>
<td>2 (1)</td>
<td>8 (6)</td>
<td>74 (61)</td>
<td>3 (28)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Caring for children with special health care needs</td>
<td>8 (6)</td>
<td>28 (23)</td>
<td>74 (61)</td>
<td>10 (8)</td>
<td>1 (0.8)</td>
</tr>
<tr>
<td>Child abuse identification</td>
<td>4 (3)</td>
<td>39 (32)</td>
<td>68 (56)</td>
<td>8 (6)</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Assessing Children’s Oral health</td>
<td>54 (44.6)</td>
<td>52 (42.9)</td>
<td>11 (9.1)</td>
<td>3 (2.4)</td>
<td>1 (0.8)</td>
</tr>
</tbody>
</table>
Table A3- Frequency distribution of the answers for all six knowledge questions

<table>
<thead>
<tr>
<th>Knowledge Question</th>
<th>Strongly Disagree n(%)</th>
<th>Disagree n (%)</th>
<th>Neutral n (%)</th>
<th>Agree n (%)</th>
<th>Strongly Agree n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Children (age 0-3) should have their 1st dental visit no later than 12 months of age</td>
<td>2 (1.4)</td>
<td>9 (7.4)</td>
<td>60 (49.8)</td>
<td>40 (33.1)</td>
<td>10 (8.3)</td>
</tr>
<tr>
<td>2) Children should have their teeth brushed by an adult until they are in 2nd or 3rd grade</td>
<td>1 (0.8)</td>
<td>39 (32.2)</td>
<td>64 (52.9)</td>
<td>12 (9.9)</td>
<td>5 (4.1)</td>
</tr>
<tr>
<td>3) Kids can develop cavities by drinking juice from a closed cup throughout the day</td>
<td>0 (0)</td>
<td>8 (6.6)</td>
<td>40 (33.1)</td>
<td>66 (54.5)</td>
<td>7 (5.8)</td>
</tr>
<tr>
<td>4) Children's (age 0-3) teeth should be brushed with fluoride toothpaste</td>
<td>7 (5.8)</td>
<td>67 (55.3)</td>
<td>30 (24.8)</td>
<td>15 (12.4)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>5) Bacteria that cause cavities can be transmitted from a mother to her child</td>
<td>5 (4.1)</td>
<td>49 (40.5)</td>
<td>55 (45)</td>
<td>10 (8.3)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>6) Brushing with fluoride toothpaste prevents decayed teeth</td>
<td>0 (0)</td>
<td>3 (2)</td>
<td>16 (13.2)</td>
<td>77 (63.6)</td>
<td>25 (20.6)</td>
</tr>
</tbody>
</table>
### Table A4- Frequency distribution of oral related problems seen as primary complaints or incidental findings by medical interns

<table>
<thead>
<tr>
<th>Oral related complaint</th>
<th>Never ( n ) (%)</th>
<th>At least once/6mths ( n ) (%)</th>
<th>At least once a month ( n ) (%)</th>
<th>At least once a week ( n ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of cavities in a single child</td>
<td>72 (59.5)</td>
<td>42 (34.7)</td>
<td>4 (3.3)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>A few decayed teeth in a single child</td>
<td>35 (28.9)</td>
<td>72 (59.5)</td>
<td>11 (9.1)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>Traumatic mouth injuries</td>
<td>100 (82.6)</td>
<td>19 (15.7)</td>
<td>0 (0)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Pain related to untreated cavities</td>
<td>49 (40.5)</td>
<td>65 (53.7)</td>
<td>3 (2)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Tooth abscess</td>
<td>95 (78.5)</td>
<td>22 (18.2)</td>
<td>1 (0.8)</td>
<td>2 (1.4)</td>
</tr>
</tbody>
</table>

### Table A5- Frequency distribution of intern comfort levels in performing oral-health related practices for children (0-5)

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Very Un-comfortable ( n ) (%)</th>
<th>Somewhat Un-comfortable ( n ) (%)</th>
<th>Neutral ( n ) (%)</th>
<th>Somewhat Comfortable ( n ) (%)</th>
<th>Very Comfortable ( n ) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues</td>
<td>8 (6.6)</td>
<td>33 (27)</td>
<td>49 (39.5)</td>
<td>24 (19.8)</td>
<td>7 (5.8)</td>
</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td>14 (11.6)</td>
<td>50 (41.3)</td>
<td>33 (27.3)</td>
<td>17 (14)</td>
<td>7 (5.8)</td>
</tr>
<tr>
<td>Perform initial emergency dental treatment</td>
<td>32 (26.4)</td>
<td>62 (51.2)</td>
<td>18 (14.9)</td>
<td>7 (5.8)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td>4 (3.3)</td>
<td>10 (8.3)</td>
<td>42 (34.7)</td>
<td>46 (38)</td>
<td>19 (15.7)</td>
</tr>
</tbody>
</table>
Table A6- Frequency distribution of physician likelihood levels in performing oral-health related practices for children (0-5)

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Very Unlikely</th>
<th>Somewhat Unlikely</th>
<th>Neutral</th>
<th>Somewhat Likely</th>
<th>Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues</td>
<td>5 (4.1)</td>
<td>10 (8.3)</td>
<td>50 (41.3)</td>
<td>51 (42.1)</td>
<td>4 (3.3)</td>
<td></td>
</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td>3 (2)</td>
<td>15 (12.4)</td>
<td>37 (30.6)</td>
<td>58 (47.9)</td>
<td>8 (6.6)</td>
<td></td>
</tr>
<tr>
<td>Perform initial emergency dental treatment</td>
<td>18 (14.9)</td>
<td>65 (53.7)</td>
<td>30 (24.8)</td>
<td>7 (5.8)</td>
<td>1 (0.8)</td>
<td></td>
</tr>
<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td>5 (4.1)</td>
<td>10 (8.3)</td>
<td>50 (41.3)</td>
<td>51 (42.1)</td>
<td>4 (3.3)</td>
<td></td>
</tr>
</tbody>
</table>

Table A7- Frequency distribution of oral related problems seen as primary complaints or incidental findings by medical interns

<table>
<thead>
<tr>
<th>Oral related complaint</th>
<th>Never n (%)</th>
<th>At least once/6mths n (%)</th>
<th>At least once a month n (%)</th>
<th>At least once a week n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of cavities in a single child</td>
<td>72 (59.5)</td>
<td>42 (34.7)</td>
<td>4 (3.3)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>A few decayed teeth in a single child</td>
<td>35 (28.9)</td>
<td>72 (59.5)</td>
<td>11 (9.1)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>Traumatic mouth injuries</td>
<td>100 (82.6)</td>
<td>19 (15.7)</td>
<td>0 (0)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Pain related to untreated cavities</td>
<td>49 (40.5)</td>
<td>65 (53.7)</td>
<td>3 (2)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Tooth abscess</td>
<td>95 (78.5)</td>
<td>22 (18.2)</td>
<td>1 (0.8)</td>
<td>2 (1.4)</td>
</tr>
</tbody>
</table>
### Table A8- Frequency distribution of intern comfort levels in performing oral-health related practices for children (0-5)

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Very Uncomfortable</th>
<th>Somewhat Uncomfortable</th>
<th>Neutral</th>
<th>Somewhat Comfortable</th>
<th>Very Comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>33</td>
<td>49</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(6.6)</td>
<td>(27)</td>
<td>(40.5)</td>
<td>(19.8)</td>
<td>(5.8)</td>
</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td>14</td>
<td>50</td>
<td>33</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(11.6)</td>
<td>(41.3)</td>
<td>(27.3)</td>
<td>(14)</td>
<td>(5.8)</td>
</tr>
<tr>
<td>Perform initial emergency dental treatment</td>
<td>32</td>
<td>62</td>
<td>18</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(26.4)</td>
<td>(51.2)</td>
<td>(14.9)</td>
<td>(5.8)</td>
<td>(1.4)</td>
</tr>
<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td>4</td>
<td>10</td>
<td>42</td>
<td>46</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>(3.3)</td>
<td>(8.3)</td>
<td>(34.7)</td>
<td>(38)</td>
<td>(15.7)</td>
</tr>
</tbody>
</table>

### Table A9- Frequency distribution of physician likelihood levels in performing oral-health related practices for children (0-5)

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Very Unlikely</th>
<th>Somewhat Unlikely</th>
<th>Neutral</th>
<th>Somewhat Likely</th>
<th>Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>51</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(4.1)</td>
<td>(8.3)</td>
<td>(41.3)</td>
<td>(42.1)</td>
<td>(3.3)</td>
</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td>3</td>
<td>15</td>
<td>37</td>
<td>58</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
<td>(12.4)</td>
<td>(30.6)</td>
<td>(47.9)</td>
<td>(6.6)</td>
</tr>
<tr>
<td>Perform initial emergency dental treatment</td>
<td>18</td>
<td>65</td>
<td>30</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(14.9)</td>
<td>(53.7)</td>
<td>(24.8)</td>
<td>(5.8)</td>
<td>(0.8)</td>
</tr>
<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>51</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(4.1)</td>
<td>(8.3)</td>
<td>(41.3)</td>
<td>(42.1)</td>
<td>(3.3)</td>
</tr>
</tbody>
</table>
Table A10 – Bivariate analysis for likelihood of COUNSELLING on OH-related practices for children (0-5) by Saudi medical interns

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Saudi Interns</th>
<th></th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Likely to Counsel on OH Practices</td>
<td>Unlikely to Counsel on OH Practices</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>15.7</td>
<td>30.58</td>
<td>p=0.0181*</td>
</tr>
<tr>
<td>Female</td>
<td>29.75</td>
<td>23.97</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>24.7</td>
<td>24.4</td>
<td>P=0.1551‡</td>
</tr>
<tr>
<td>Number of patients seen in a week</td>
<td>(mean) 16.5</td>
<td>(mean) 16.2</td>
<td>p=0.5841‡</td>
</tr>
<tr>
<td>Number of children (age 0-5) seen in a week</td>
<td>(mean) 5.7</td>
<td>(mean) 5.2</td>
<td>p=0.2040‡</td>
</tr>
<tr>
<td>Internship rotation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likely to have practiced with children/parents</td>
<td>15.70</td>
<td>23.97</td>
<td>p=0.2929 *</td>
</tr>
<tr>
<td>Unlikely to have practiced with children/parents</td>
<td>29.75</td>
<td>30.58</td>
<td></td>
</tr>
<tr>
<td>Rate Training in assessing children’s’ OH</td>
<td>(%)</td>
<td>(%)</td>
<td>p=1.000 *</td>
</tr>
<tr>
<td>Acceptable Rating</td>
<td>24.79</td>
<td>29.75</td>
<td></td>
</tr>
<tr>
<td>Unacceptable rating</td>
<td>20.66</td>
<td>24.79</td>
<td></td>
</tr>
<tr>
<td>Future Practice Goals</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0466 †</td>
</tr>
<tr>
<td>Primary-Gov</td>
<td>19.01</td>
<td>14.88</td>
<td></td>
</tr>
<tr>
<td>Specialty-Gov</td>
<td>17.36</td>
<td>21.49</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>9.09</td>
<td>18.18</td>
<td></td>
</tr>
<tr>
<td>CME courses</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0006 *</td>
</tr>
<tr>
<td>High Interest</td>
<td>27.27</td>
<td>15.70</td>
<td></td>
</tr>
<tr>
<td>Low Interest</td>
<td>18.18</td>
<td>38.84</td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0060 ‡</td>
</tr>
<tr>
<td>(Sum score – Percentage of those who answered at least 50% correct)</td>
<td>58.2</td>
<td>25.8</td>
<td></td>
</tr>
<tr>
<td>Oral health problems seen</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.1301 ‡</td>
</tr>
<tr>
<td>(sum score – percentage of those who saw at least one of the problems listed)</td>
<td>39.7</td>
<td>50.42</td>
<td></td>
</tr>
<tr>
<td>Comfort levels</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0009* p=0.3384 p=0.4478 p=0.1425</td>
</tr>
<tr>
<td>(Percent with High comfort)</td>
<td>18.18</td>
<td>7.44</td>
<td></td>
</tr>
<tr>
<td>COUNSEL</td>
<td>10.74</td>
<td>9.09</td>
<td></td>
</tr>
<tr>
<td>EXAMINE</td>
<td>2.48</td>
<td>4.96</td>
<td></td>
</tr>
<tr>
<td>Emergency treatment</td>
<td>28.10</td>
<td>26.45</td>
<td></td>
</tr>
<tr>
<td>REFERRAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Chi-square test
† Cochran - Mantel - Haenszel chi-square test
‡ Wilcoxon rank-sum test
Table A11 – Bivariate analysis for likelihood of EXAMINING the OH of children (0-5) by Saudi medical interns

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Saudi Interns</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Likely to Examine OH children</td>
<td>Unlikely to Examine OH children</td>
</tr>
<tr>
<td>Gender</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Male</td>
<td>23.97</td>
<td>22.31</td>
</tr>
<tr>
<td>Female</td>
<td>30.58</td>
<td>23.14</td>
</tr>
<tr>
<td>Age</td>
<td>(mean)</td>
<td>(mean)</td>
</tr>
<tr>
<td></td>
<td>24.6</td>
<td>24.5</td>
</tr>
<tr>
<td>Number of patients seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
</tr>
<tr>
<td></td>
<td>18.05</td>
<td>14.3</td>
</tr>
<tr>
<td>Number of children (age 0-5) seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
</tr>
<tr>
<td></td>
<td>6.05</td>
<td>4.58</td>
</tr>
<tr>
<td>Internship rotation</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Likely to have practiced with children/parents</td>
<td>19.01</td>
<td>20.66</td>
</tr>
<tr>
<td>Unlikely to have practiced with children/parents</td>
<td>35.54</td>
<td>24.79</td>
</tr>
<tr>
<td>Rate Training in assessing children’s’ OH</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Acceptable Rating</td>
<td>35.54</td>
<td>19.01</td>
</tr>
<tr>
<td>Unacceptable rating</td>
<td>19.01</td>
<td>26.40</td>
</tr>
<tr>
<td>Future Practice Goals</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Primary-Gov</td>
<td>25.62</td>
<td>8.26</td>
</tr>
<tr>
<td>Specialty-Gov</td>
<td>18.18</td>
<td>20.66</td>
</tr>
<tr>
<td>Private</td>
<td>10.74</td>
<td>16.53</td>
</tr>
<tr>
<td>CME courses</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>High Interest</td>
<td>28.93</td>
<td>14.05</td>
</tr>
<tr>
<td>Low Interest</td>
<td>25.66</td>
<td>31.40</td>
</tr>
<tr>
<td>Knowledge</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>(Sum score – Percentage of those who answered at least 50% correct)</td>
<td>48.5</td>
<td>30.9</td>
</tr>
<tr>
<td>Oral health problems seen</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>(sum score – percentage of those who saw at least one of the problems listed)</td>
<td>96.97</td>
<td>81.82</td>
</tr>
<tr>
<td>Comfort levels</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>COUNSEL</td>
<td>12.40</td>
<td>13.22</td>
</tr>
<tr>
<td>EXAMINE</td>
<td>34.71</td>
<td>19.83</td>
</tr>
<tr>
<td>Emergency treatment</td>
<td>2.48</td>
<td>4.96</td>
</tr>
<tr>
<td>REFERRAL</td>
<td>13.22</td>
<td>6.61</td>
</tr>
</tbody>
</table>

* Chi-square test

† Cochran - Mantel - Haenszel chi-square test

‡ Wilcoxon rank-sum test
Table A12 – Bivariate analysis for likelihood of TREATING Emergencies in children (0-5) by Saudi medical interns

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Saudi Interns</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Likely to Treating Emergencies</td>
<td>Unlikely to Treating Emergencies</td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.4691*</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2.48</td>
<td>51.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4.13</td>
<td>42.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.0552‡</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.88</td>
<td>24.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patients seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.1088‡</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.0</td>
<td>16.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of children (age 0-5) seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.9373‡</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.3</td>
<td>5.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internship rotation</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.5365*</td>
<td></td>
</tr>
<tr>
<td>Likely to have practiced with children/parents</td>
<td>3.31</td>
<td>36.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlikely to have practiced with children/parents</td>
<td>3.31</td>
<td>57.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate Training in assessing children’s’ OH</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0075*</td>
<td></td>
</tr>
<tr>
<td>Acceptable Rating</td>
<td>6.61</td>
<td>47.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unacceptable rating</td>
<td>0.00</td>
<td>45.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future Practice Goals</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.4680†</td>
<td></td>
</tr>
<tr>
<td>Primary-Gov</td>
<td>1.65</td>
<td>32.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specialty-Gov</td>
<td>4.13</td>
<td>34.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>0.83</td>
<td>26.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CME courses</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.2879*</td>
<td></td>
</tr>
<tr>
<td>High Interest</td>
<td>1.65</td>
<td>41.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Interest</td>
<td>4.96</td>
<td>52.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.2642‡</td>
<td></td>
</tr>
<tr>
<td>(Sum score – Percentage of those who answered at least 50% correct)</td>
<td>50.1</td>
<td>39.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral health problems seen</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.3137‡</td>
<td></td>
</tr>
<tr>
<td>(sum score – percentage of those who saw at least one of the problems listed)</td>
<td>90.27</td>
<td>87.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comfort levels</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.1021*</td>
<td></td>
</tr>
<tr>
<td>COUNSEL</td>
<td>3.31</td>
<td>22.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXAMINE</td>
<td>2.48</td>
<td>17.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency treatment</td>
<td>4.13</td>
<td>3.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REFERRAL</td>
<td>4.96</td>
<td>49.59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Chi-square test

† Cochran - Mantel - Haenszel chi-square test

‡ Wilcoxon rank-sum test
Table A13 – Bivariate analysis for likelihood of REFERRING high risk children (0-5) by Saudi medical interns

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Saudi Interns</th>
<th></th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Likely to Refer for OH issues</td>
<td>Unlikely to Refer for OH issues</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.5525*</td>
</tr>
<tr>
<td>Male</td>
<td>38.84</td>
<td>7.44</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>47.11</td>
<td>6.61</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.4072‡</td>
</tr>
<tr>
<td></td>
<td>24.56</td>
<td>24.35</td>
<td></td>
</tr>
<tr>
<td>Number of patients seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.5110‡</td>
</tr>
<tr>
<td></td>
<td>16.5</td>
<td>15.5</td>
<td></td>
</tr>
<tr>
<td>Number of children (age 0-5) seen in a week</td>
<td>(mean)</td>
<td>(mean)</td>
<td>p=0.5066‡</td>
</tr>
<tr>
<td></td>
<td>5.4</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Internship rotation</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.8910*</td>
</tr>
<tr>
<td>Likely to have practiced with children/parents</td>
<td>33.88</td>
<td>5.79</td>
<td></td>
</tr>
<tr>
<td>Unlikely to have practiced with children/parents</td>
<td>52.07</td>
<td>8.26</td>
<td></td>
</tr>
<tr>
<td>Rate Training in assessing children’s’ OH</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.7024*</td>
</tr>
<tr>
<td>Acceptable Rating</td>
<td>46.28</td>
<td>8.26</td>
<td></td>
</tr>
<tr>
<td>Unacceptable rating</td>
<td>39.67</td>
<td>5.79</td>
<td></td>
</tr>
<tr>
<td>Future Practice Goals</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0296†</td>
</tr>
<tr>
<td>Primary-Gov</td>
<td>30.58</td>
<td>3.31</td>
<td></td>
</tr>
<tr>
<td>Specialty-Gov</td>
<td>33.06</td>
<td>5.79</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>22.31</td>
<td>4.96</td>
<td></td>
</tr>
<tr>
<td>CME courses</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0050*</td>
</tr>
<tr>
<td>High Interest</td>
<td>41.32</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td>Low Interest</td>
<td>44.63</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0899‡</td>
</tr>
<tr>
<td>(Sum score – Percentage of those who answered at least 50% correct)</td>
<td>41.3</td>
<td>35.3</td>
<td></td>
</tr>
<tr>
<td>Oral health problems seen</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.0085‡</td>
</tr>
<tr>
<td>(sum score – percentage of those who saw at least one of the problems listed)</td>
<td>92.31</td>
<td>76.47</td>
<td></td>
</tr>
<tr>
<td>Comfort levels</td>
<td>(%)</td>
<td>(%)</td>
<td>p=0.6993* p=0.2855 p=0.1134 p=0.0855</td>
</tr>
<tr>
<td>COUNSEL</td>
<td>21.49</td>
<td>4.13</td>
<td></td>
</tr>
<tr>
<td>EXAMINE</td>
<td>15.70</td>
<td>4.13</td>
<td></td>
</tr>
<tr>
<td>Emergency treatment</td>
<td>4.96</td>
<td>2.48</td>
<td></td>
</tr>
<tr>
<td>REFERRAL</td>
<td>49.54</td>
<td>4.96</td>
<td></td>
</tr>
</tbody>
</table>

* Chi-square test
† Cochran - Mantel - Haenszel chi-square test
‡ Wilcoxon rank-sum test
The Effectiveness of an Electronic Educational Intervention on Saudi Medical Students’ Child Oral Health-Related Knowledge, Practices and Attitudes

This descriptive analysis was an intermediate step that aimed to present detailed information on selected variables of Saudi interns, their knowledge, practices, patient populations and attitudes towards oral health following an educational intervention program. In the main results presented on data from the third study (Chapter V), primary points were presented and multivariate logistic regression analyses were detailed and revealed several statistically significant variables that predict the likelihood of performing various oral-health related practices.
Table A14 - Summary of selected variables of Saudi Interns and their practice/patients

<table>
<thead>
<tr>
<th>Variable/Characteristic</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Male</td>
<td>45</td>
<td>51</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 23 patients</td>
<td>10</td>
<td>11.4</td>
</tr>
<tr>
<td>24 patients</td>
<td>25</td>
<td>28.4</td>
</tr>
<tr>
<td>25 patients</td>
<td>32</td>
<td>36.4</td>
</tr>
<tr>
<td>≥ 26 patients</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>Mean 24.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total number of Patients Seen per Week</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 5 patients</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>6 to 10 patients</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>11 to 15 patients</td>
<td>26</td>
<td>29.5</td>
</tr>
<tr>
<td>16 to 20 patients</td>
<td>27</td>
<td>30.6</td>
</tr>
<tr>
<td>21 to 25 patients</td>
<td>17</td>
<td>19.3</td>
</tr>
<tr>
<td>≥26 patients</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean 17</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total number of Children Seen per Week</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 5 patients</td>
<td>46</td>
<td>52.3</td>
</tr>
<tr>
<td>6 to 10 patients</td>
<td>37</td>
<td>42.3</td>
</tr>
<tr>
<td>11 to 15 patients</td>
<td>3</td>
<td>3.4</td>
</tr>
<tr>
<td>16 to 20 patients</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>≥ 21 patients</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean 5.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adequateness of OH training time</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not sure</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Too Little</td>
<td>82</td>
<td>96.5</td>
</tr>
<tr>
<td>Adequate</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Too Much</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Importance of Physician involvement in OH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Unimportant</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Somewhat Unimportant</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Neutral</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Somewhat Important</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Very Important</td>
<td>69</td>
<td>81</td>
</tr>
<tr>
<td><strong>Future Practice Goals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Practice (Gov-based)</td>
<td>29</td>
<td>34.1</td>
</tr>
<tr>
<td>Specialty Practice (Gov-based)</td>
<td>27</td>
<td>31.7</td>
</tr>
<tr>
<td>Private Practice</td>
<td>27</td>
<td>31.7</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Table A14-Continued

<table>
<thead>
<tr>
<th>CME in Pediatric Oral Health:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Interested</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Slight Interested</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>Moderately Interested</td>
<td>49</td>
<td>57</td>
</tr>
<tr>
<td>Very Interested</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If I Refer a Child, it is Mostly based on:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• I would refer ALL children (12 months &amp; older) to the dentist</td>
<td>48</td>
<td>56.4</td>
</tr>
<tr>
<td>• I refer HIGH RISK children to the dentist (children who are bottle fed to sleep, don’t use fluoride toothpaste, etc)</td>
<td>32</td>
<td>37.6</td>
</tr>
<tr>
<td>• I ONLY refer children in need of EMERGENCY dental treatment (have a clear problem</td>
<td>5</td>
<td>5.8</td>
</tr>
<tr>
<td>• I RARELY/ NEVER refer children to the dentist it is not my responsibility</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table A15- Frequency distribution of the answers for all six knowledge questions

<table>
<thead>
<tr>
<th>Knowledge Question</th>
<th>Strongly Disagree n(%)</th>
<th>Disagree n(%)</th>
<th>Neutral n(%)</th>
<th>Agree n(%)</th>
<th>Strongly Agree n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children (age 0-3) should have their 1&lt;sup&gt;st&lt;/sup&gt; dental visit no later than 12 months of age</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>75 (88)</td>
<td>9 (10)</td>
</tr>
<tr>
<td>Children should have their teeth brushed by an adult until they are in 2&lt;sup&gt;nd&lt;/sup&gt; or 3&lt;sup&gt;rd&lt;/sup&gt; grade</td>
<td>0 (0)</td>
<td>9 (10)</td>
<td>50 (58)</td>
<td>26 (30)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Kids can develop cavities by drinking juice from a closed cup throughout the day</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>7 (8)</td>
<td>71 (83)</td>
<td>7 (8)</td>
</tr>
<tr>
<td>Children's (age 0-3) teeth should be brushed with fluoride toothpaste</td>
<td>1 (1)</td>
<td>4 (4)</td>
<td>10 (11)</td>
<td>57 (67)</td>
<td>13 (15)</td>
</tr>
<tr>
<td>Bacteria that cause cavities can be transmitted from a mother to her child</td>
<td>0 (0)</td>
<td>13 (15)</td>
<td>43 (50)</td>
<td>28 (32)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Brushing with fluoride toothpaste prevents decayed teeth</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>55 (64)</td>
<td>29 (34)</td>
</tr>
</tbody>
</table>
Table A16 - Frequency distribution of oral related problems seen as primary complaints or incidental findings by medical interns

<table>
<thead>
<tr>
<th>Oral related complaint</th>
<th>Never n (%)</th>
<th>At least once/6mths n (%)</th>
<th>At least once a month n (%)</th>
<th>At least once a week n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of cavities in a single child</td>
<td>47 (55)</td>
<td>37 (43)</td>
<td>1 (1)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>A few decayed teeth in a single child</td>
<td>20 (23)</td>
<td>63 (74)</td>
<td>1 (1)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Traumatic mouth injuries</td>
<td>56 (65)</td>
<td>29 (34)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pain related to untreated cavities</td>
<td>16 (18)</td>
<td>64 (75)</td>
<td>5 (5)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Tooth abscess</td>
<td>63 (74)</td>
<td>21 (24)</td>
<td>1 (1)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Table A17 - Frequency distribution of intern comfort levels in performing oral-health related practices for children (0-5)

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Very Uncomfortable n (%)</th>
<th>Somewhat Uncomfortable n (%)</th>
<th>Neutral n (%)</th>
<th>Somewhat Comfortable n (%)</th>
<th>Very Comfortable n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues</td>
<td>0 (0)</td>
<td>2 (2)</td>
<td>5 (5)</td>
<td>68 (80)</td>
<td>10 (11)</td>
</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td>0 (0)</td>
<td>14 (16)</td>
<td>38 (44)</td>
<td>32 (37)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Perform initial emergency dental treatment</td>
<td>8 (9)</td>
<td>48 (56)</td>
<td>23 (27)</td>
<td>6 (7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>4 (4)</td>
<td>58 (68)</td>
<td>23 (27)</td>
</tr>
</tbody>
</table>
Table A18- Frequency distribution of physician likelihood levels in performing oral-health related practices for children (0-5)

<table>
<thead>
<tr>
<th>Oral related practice</th>
<th>Very Unlikely n (%)</th>
<th>Somewhat Unlikely n (%)</th>
<th>Neutral n (%)</th>
<th>Somewhat Likely n (%)</th>
<th>Likely n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>5 (5)</td>
<td>63 (75)</td>
<td>15 (17)</td>
</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td>0 (0)</td>
<td>12 (14)</td>
<td>24 (28)</td>
<td>45 (53)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Perform initial emergency dental treatment</td>
<td>6 (7)</td>
<td>38 (45)</td>
<td>37 (44)</td>
<td>3 (3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (1)</td>
<td>49 (58)</td>
<td>34 (40)</td>
</tr>
</tbody>
</table>
APPENDIX B

COPY OF QUESTIONNAIRES

Survey Targeting Iowa Pediatricians

This survey is about your experience with oral health issues while in school, during training and in practice as well as potential interest in providing oral health-related services to young children in the future. This study is being conducted as part of a master’s thesis in Pediatric Dentistry and Dental Public Health at the University of Iowa College of Dentistry. If you have any questions or comments, please contact Dr. Yousef AlYousef at 319-400-8964 or write to: Department of Pediatric Dentistry, College of Dentistry, Iowa City, IA 52242.

Please fill out information as completely as possible. For questions requiring percentages or approximate numbers please provide your best estimate. After completion please return in the envelope provided to: 201 S. DSB, Department of Pediatric Dentistry, College of Dentistry, Iowa City, IA 52242. Thank you for your help. We appreciate your contribution!

1. Gender:  
   - Female □  
   - Male □
2. Age:  
   ___ ___ years
3. Total years of professional practice/experience:  
   ___ ___ years
4. Please indicate your profession:  
   - Pediatrician □
   - Nurse Practitioner □
   - Family Physician □
   - Physician Assistant □
   - Other (specify) ____________
5. In which setting do you spend the MAJORITY of your time:  
   - University Medical Center □
   - Staff Model HMO □
   - Community Hospital □
   - Public Health/Community Health Center □
   - Private Practice – Solo □
   - Other (specify) ____________ □
   - Private Practice – Group □
6. Approximate total number of patients you see in a week:  
   ___ ___ ___ patients
7. Approximate total number of children (age 0-3 years) you see in a week:  
   ___ ___ ___ patients
8. Your area of primary practice can best be described as:  
   - Urban (25,000 - larger population) □
   - Suburban (10,000 - 24,999 population) □
   - Rural (0 - 9,999 population) □
9. What PERCENTAGE of your patients participate in the following insurance programs:

<table>
<thead>
<tr>
<th>Insurance Program</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid/Title XIX</td>
<td>__ __ __%</td>
</tr>
<tr>
<td>Hawk-I/SCHIP</td>
<td>__ __ __%</td>
</tr>
<tr>
<td>No Insurance</td>
<td>__ __ __%</td>
</tr>
<tr>
<td>Private Insurance</td>
<td>__ __ __%</td>
</tr>
<tr>
<td>Unknown</td>
<td>__ __ __%</td>
</tr>
<tr>
<td>Other (Medicare, etc)</td>
<td>__ __ __%</td>
</tr>
<tr>
<td>Total</td>
<td>100 %</td>
</tr>
</tbody>
</table>

10. How many CREDIT hours of INSTRUCTION (approximately) did you attend on topics specifically related to DENTAL HEALTH in:

- Professional School (e.g. medicine, nursing) __ __ __ hours
- Residency or Fellowship __ __ __ hours
- Continuing Education Courses (in last 5 years) __ __ __ hours

11. In your Opinion:

<table>
<thead>
<tr>
<th>Opinion</th>
<th>YES 1</th>
<th>NO 2</th>
<th>Don't Know 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of cavities in a single child</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>White spots on the teeth may indicate early decay</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Kids can develop cavities by drinking juice from a sippy cup overnight</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Children should have their teeth brushed by an adult until they are in 2nd or 3rd grade</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Brushing with fluoride toothpaste prevents cavities; brushing without fluoride toothpaste is less effective</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Children’s (age 0-3) teeth should be brushed with fluoride toothpaste</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Children (age 0-3) should have their 1st dental visit no later than 12 months of age</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

12. Please indicate HOW OFTEN you see the following problems (either as a primary complaint or as an incidental finding) in children (age 0-3):

<table>
<thead>
<tr>
<th>Problem</th>
<th>At least Once a WEEK 1</th>
<th>At least Once a Month 2</th>
<th>At least Once in 6 months 3</th>
<th>At least Once a Year 4</th>
<th>At least Once Every Few Years 5</th>
<th>Never 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of cavities in a single child</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>A few decayed teeth in a single</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Traumatic mouth injury</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Pain related to untreated cavities</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Tooth abscesses (e.g. swollen face, gum boil)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
13. How FREQUENTLY during well child visits do you or your staff perform the following tasks for children (age 0-3):

<table>
<thead>
<tr>
<th>Task</th>
<th>MOST OF THE TIME</th>
<th>USUALLY</th>
<th>SOMETIMES</th>
<th>NEVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Lift the upper lip to view the child's 4 upper front teeth</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) Examine a child's teeth for signs of dental decay</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) Counsel parents on the importance of regular tooth brushing</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) Counsel parents on the importance of going to a dentist</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e) Discuss the importance of fluoride toothpaste use</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>f) Inquire whether a child is taking a bottle to bed</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>g) Inquire about the mother's dental health</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>h) Refer to a dentist in the area</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

14. Have you heard of Fluoride Varnish?  

Yes ☐  No ☐

Fluoride varnish is brushed on to teeth to STRENGTHEN them, PREVENT cavities and REVERSE early dental decay. It takes less than a minute to apply and can be done by auxiliary staff. A packet of fluoride varnish costs less than 50 cents per patient.

15. Would you consider routinely applying fluoride varnish to high risk children during their well child visit?

☐  Yes ➔

a) I would be willing do so regardless of compensation ☐
   b) I would have to get paid a compensation of $10-$20 ☐
   c) I would have to get paid a compensation of $20-$40 ☐
   d) I would have to get paid a compensation of $40-$60 ☐
   e) I would have to get paid $__ __ __ (Please specify) ☐

☐  No ➔  No amount could induce me to apply fluoride varnish for the following reason(s) (check all that apply):

<table>
<thead>
<tr>
<th>Reason</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I already have too much to do during a well child visit</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) Parents do not value this procedure</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) I do not see enough dental decay to warrant providing fluoride varnish</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) It is difficult to integrate these services into my practice routine</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
e) I do not know enough about it to make an educated decision at this time

f) Lack of child cooperation makes fluoride varnish application too difficult

g) It is the dentist's responsibility

16. Would you be INTERESTED in participating in a continuing education course that addresses the following topics for children (age 0-3): (check all that apply)

<table>
<thead>
<tr>
<th>YES 1</th>
<th>NO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Fluoride varnish application</td>
<td>☐</td>
</tr>
<tr>
<td>2) Caries risk assessment</td>
<td>☐</td>
</tr>
<tr>
<td>3) Counseling parents on oral health - related topics</td>
<td>☐</td>
</tr>
<tr>
<td>4) Other (specify)______________________________</td>
<td>☐</td>
</tr>
<tr>
<td>5) Not interested in dental - related courses at this time</td>
<td>☐</td>
</tr>
</tbody>
</table>

17. How COMFORTABLE do you feel in advising parents of children (0-3) on the following:

<table>
<thead>
<tr>
<th>Very Uncomfortable</th>
<th>Uncomfortable</th>
<th>Somewhat Uncomfortable</th>
<th>Neutral 3</th>
<th>Somewhat Comfortable</th>
<th>Very Comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Child oral hygiene</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) Fluoride toothpaste use</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) Dietary recommendations to prevent cavities</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) Regular dental check ups</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

18. How COMFORTABLE do you feel doing the following for children (0-3):

<table>
<thead>
<tr>
<th>Very Uncomfortable</th>
<th>Uncomfortable</th>
<th>Somewhat Uncomfortable</th>
<th>Neutral 3</th>
<th>Somewhat Comfortable</th>
<th>Very Comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Examine teeth for tooth decay</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) Identify tooth decay</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) Identify other signs of oral pathology</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) Evaluate risk factors for tooth decay</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e) Decide if a child needs a referral to a dentist</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
19. What CRITERIA do you use for deciding what children (age 0-3) you WILL REFER to a dentist for care during a well child visit?

I refer ALL children (12 months & older) I see to the dentist □
I refer ONLY if we see a problem (e.g. tooth decay, chipped tooth, draining fistula) □
I refer if we consider the child AT HIGH RISK for cavities (e.g. being on Medicaid) □
I RARELY refer children to the dentist □
I NEVER refer children to the dentist □

20. Which of the following do you consider to be a BARRIER or NOT a BARRIER when referring children (age 0-3) for dental care:

<table>
<thead>
<tr>
<th>BARRIER 1</th>
<th>NOT a BARRIER 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Lack of locally available dentists</td>
<td></td>
</tr>
<tr>
<td>b) Finding a dentist willing to accept children on public insurance (e.g. Medicaid, Hawk-I)</td>
<td></td>
</tr>
<tr>
<td>c) Finding a dentist willing to accept children who are uninsured</td>
<td></td>
</tr>
<tr>
<td>d) Finding a dentist willing to accept children under the age of 3</td>
<td></td>
</tr>
<tr>
<td>e) Finding a dentist willing to accept children with a developmental disability</td>
<td></td>
</tr>
<tr>
<td>f) Oral health is of low priority for the families I see</td>
<td></td>
</tr>
</tbody>
</table>

21. When you make a dental REFERRAL for a child (age 0-3) how FREQUENTLY do you or your staff:

<table>
<thead>
<tr>
<th>MOST OF THE TIME 1 (100% - 75%)</th>
<th>USUALLY 2 (50-74% of the time)</th>
<th>SOMETIMES 3 (49% or less of the time)</th>
<th>NEVER 4 (0% of the time)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Give the caregiver the name of a dentist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Call a dental office to make the appointment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Contact a coordinator service to help in making the appointment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Simply tell the caregiver the child needs to see a dentist</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Any additional comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
**Survey Targeting Saudi Interns**

This survey is about your experience with oral health issues in medical school, as well as potential interest in providing limited oral-health-related services to young children. This study is being conducted as part of a PhD dissertation in Oral Sciences at the University of Iowa. If you have any questions or comments, please contact Dr. Yousef AI-Yousef at 0503-123-100. Please fill out the information as **completely** as possible. We appreciate your cooperation!

1. **Gender:**
   - Female □
   - Male □

2. **Age:**  ___ ___ years

3. **Approximate total number of patients you see in a week:**  ___ ___ patients

4. **Approximate total number of children (age 0-5 years) you see in a week:**  ___ ___ patients

5. **Was the amount of training time devoted to ORAL HEALTH care appropriate?**
   - Not Sure □
   - Too Little □
   - Adequate □
   - Too Much □

6. **My 1st internship rotation is in:**
   - Pediatrics □
   - Medicine □
   - Ob/Gyn □
   - Surgery □
   - ER □
   - Elective □

7. **Please describe your future clinical practice goal:**
   - □ Primary care (Government-Based)
   - □ Specialty/Subspecialty (Government-Based)
   - □ Primary or Specialty/subspecialty (Private-Practice)
   - □ Not entering clinical practice (please specify plans)

8. **Overall, how would you rate your medical training in preparing you for each of the following activities?**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Poor □</th>
<th>Fair □</th>
<th>Good □</th>
<th>Very Good □</th>
<th>Excellent □</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care pediatric practice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caring for children for SPHCN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child abuse identification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessing Children’s Oral health</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. **How INTERESTED would you be in participating in a continuing medical education (CME) course on pediatric oral health?**
   - Not Interested □
   - Slightly Interested □
   - Moderately Interested □
   - Very Interested □

10. **In the past year HOW OFTEN did you see the following problems in children under 5 years:**

    a) A lot of decayed teeth in a single child

    | Frequency | At least Once a WEEK □ | At least Once a MONTH □ | At least Once in 6 months □ | Never □ |
    |-----------|------------------------|-------------------------|-----------------------------|---------|
    |           |                        |                        |                                 |         |
b) Only 1 or 2 decayed teeth in a single child

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c) Traumatic mouth injury (e.g. chipped tooth)

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

d) Pain related to untreated decayed teeth

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

e) Tooth abscesses (e.g. swollen face, gum boil)

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 11. Do you agree with the following:

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Children should have their 1st dental visit NO LATER than 12 months of age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Children should have their teeth brushed by an adult until they are in 2nd or 3rd grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Drinking juice from a closed cup throughout the day can cause decayed teeth in children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Fluoride toothpaste can be used for children under the age of 3 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Bacteria that cause decayed teeth can be transmitted from a mother to her child</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Brushing with fluoride toothpaste prevents decayed teeth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 12. How COMFORTABLE do you feel doing the following for children (0-5)?

<table>
<thead>
<tr>
<th></th>
<th>Very Un-Comfortable</th>
<th>Somewhat Un-Comfortable</th>
<th>Neutral</th>
<th>Somewhat Comfortable</th>
<th>Very Comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>COUNSEL patients on oral health issues, (e.g. How to brush correctly)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EXAMINE child’s mouth for problems</td>
<td></td>
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<tr>
<td>Perform initial emergency dental treatment (e.g. draining a fistula)</td>
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<tr>
<td>Decide if a child needs a REFERRAL to a dentist</td>
<td></td>
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</tbody>
</table>
13. IN FUTURE VISITS involving children under 5, how LIKELY are you to PERFORM the following:

<table>
<thead>
<tr>
<th></th>
<th>Very Unlikely</th>
<th>Somewhat Unlikely</th>
<th>Neutral</th>
<th>Somewhat Likely</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) COUNSEL patients on ORAL HEALTH issues, e.g. How to brush correctly, the importance of fluoride toothpaste, etc</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tr>
<tr>
<td>b) EXAMINE child’s mouth for problems</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) Perform initial emergency dental treatment (e.g. drain a large gum swelling)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) Decide if a child needs a REFERRAL to a dentist</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

14. How IMPORTANT is it for a primary physician to Counsel and/or Refer children with oral health needs?

Very ¹ UNimportant ☐ Somewhat ² Unimportant ☐ Neutral³ ☐ Somewhat Important⁴ ☐ Very ⁵ Important ☐

15. From what you have learned, if you decide to REFER a child for dental treatment you would base it MOSTLY on which of the following: (Please Choose ONE)

- ☐ ¹ I would refer ALL children (12 months & older) to the dentist
- ☐ ² I refer HIGH RISK children to the dentist (children who are bottle fed to sleep, don’t use fluoride toothpaste, etc)
- ☐ ³ I ONLY refer children in need of EMERGENCY dental treatment (have a clear problem
- ☐ ⁴ I RARELY/ NEVER refer children to the dentist it is not my responsibility

16. I joined the FACEBOOK page focusing on ORAL HEALTH: Yes ☐ No ☐
APPENDIX C

EXAMPLES OF EDUCATIONAL EMAILS

Fourth Issue

Oral Health issues
Knee to Knee Exam

July, 2010 Issue 4

How to Examine a Resistant Young Child

Why is this technique helpful to Physicians?

- Safe
- Applicable to any examination of the head and neck region in general (e.g. for ear infection, tonsils... etc)
- Convenient (i.e. can be done in different clinical settings)
- A teaching opportunity for the parents on how to safely restrain an uncooperative child for toothbrushing, administering medication, ... etc

To see a step-by-step explanation of how to examine a young child:

Click (here) to view our Facebook Page on Child Exams

Give Us Your Opinion!

The information presented was helpful:

Yes =  No -
Oral Health issues
What Dental Advice Can I provide Pregnant Women?

July, 2010 Issue 6

Dental Recommendations for Pregnancy

- **Periodontal disease** (severe gum disease usually due to poor oral hygiene) is associated with increased risk of preterm & low-birth-weight babies.

- Bacteria can be transmitted from mother to child through saliva.

- **AVOID sharing a toothbrush** with children to prevent bacteria transmission which helps reduce the risk of children developing Early Childhood Caries

- The first visit should be within 6 months of the first tooth eruption & no later than 1 year of age.

- A child should visit the dentist Early and regularly

What dental treatments can be done safely during pregnancy?

- **Emergency dental treatment** can be provided at ANYTIME during pregnancy.

- Routine care is best provided between the 14th and 20th week of pregnancy (2nd trimester).

Give Us Your Opinion!

The information presented was helpful:

- Yes  ☑  No ☐
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