Examining the Effectiveness of Early Dental Visits in Three Practices

BY

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THESIS

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LIST OF ABBREVIATIONS

AAP	American Academy of Pediatrics
AAPD	American Academy of Pediatric Dentistry
ASA	American Society of Anesthesiologists
dmfs	decayed, missing, and filled primary tooth surfaces
dmft	decayed, missing and filled primary teeth
DMFS	decayed, missing, and filled permanent tooth surfaces
DMFT	decayed, missing and filled permanent teeth
GEPD	Glen Ellyn Pediatric Dentistry
IWS	Infant Welfare Society
UIC	University of Illinois at Chicago

Summary

The purpose of this study was to evaluate the relationship between early dental visits and caries experience in children. The existing literature has highlighted the relationship between early dental visits and lower costs associated with future dental care. However, no study to-date has been published comparing various clinic types, the subsequent adherence to the American Academy of Pediatric Dentistry recommendation of each clinic type and the effect on children's decayed, missing, and filled teeth (dmft). The main hypothesis of this study was that children who attended early dental visits before 18 months of age, regardless of clinic type, exhibited lower dmft scores by 4 years of age.

This retrospective study was conducted through a chart audit of three clinics. Upon randomly selecting subjects who met the inclusion criteria, age at first dental visit, number of recalls, and dmft score were recorded.

A total of 296 subjects met the inclusion criteria. Data analysis confirmed several findings from previously published studies. Subjects with first dental visits before 18 months of age had a significantly lower dmft than those who presented after 18 months of age $t(172) = 2.923$, $P=.004$. In addition, subjects who were compliant with recalls had a significantly lower dmft $t(274) = 3.86$, $P<.05$. Both of these results confirmed the hypotheses of this study.

In conclusion, this study confirmed several findings from previous research studies regarding the significance of early dental visits and its role in reducing future caries experience. Regardless of the clinic type, private or public, it was clear that compliance with AAPD recommendations and frequent recalls resulted in a lower dmft score, and better oral health for the pediatric patient.

1. INTRODUCTION

1.1 Background Information

The American Academy of Pediatric Dentistry (AAPD) recommends that all children have their first dental visit by the first year of life (AAPD, 2016). Dental caries in children is the most prevalent disease in childhood, occurring 5 to 8 times more often than asthma (National Institutes of Health, 2014). The rationale for early dental visits is to reduce the child's future dental risk, improve their oral health, thereby reducing associated dental costs in the future (Nowak, et al, 2016). There are clear relationships between the socio-economic demographics of dental care, and adherence to AAPD recommendations. There also appears to be a financial and health centered advantage to early dental visits.

1.2 Purpose of the Study

The current literature does not necessarily indicate which demographic is more likely to adhere to the AAPD guideline of age 1 dental visits. We also have yet to directly compare the effectiveness of early dental visits between the privately insured population and the Medicaid population. Are children served within the Medicaid setting just as likely as those seen with private insurance to require less restorative procedures due to the early dental visit? Are there discrepancies between the frequencies of dental visits between both populations that result in a more favorable outcome for children in each group? This research study aims to provide findings that will further highlight the impact of the early dental visit within various populations in the Chicago area.

1.3 Null Hypotheses

1. There is no difference in dmft score by 48 months of age, between children who present for the first dental visit after 18 months of age, regardless of clinic type, and those who present for the first dental visit by 18 months of age.

2. There is no difference in compliance with recall visits among the three practices examined.

3. There is no difference in dmft scores by 48 months of age, between children who are compliant with periodic recalls and those who are not compliant with periodic recalls.

2. REVIEW OF LITERATURE

2.1 Current Guidelines

- The AAP recommends that all children have their first dental visit by 12 months of age (2016).
- The AAPD recommends that all children have their first dental visit by the eruption of the first tooth, or 12 months of age (2016).

2.2 Review of the Literature

The AAPD has recommended that all children have their first dental visit and establish a dental home, by 12 months of age, at the latest. Various studies to date have explored the significance of early dental visits, the concept of a "dental home" and the cost related benefits within the pediatric population. For example, Bhaskar and Divaris conducted a systematic analysis of 24 studies to review and summarize the effectiveness of early preventive dental visits and the effect on children's oral health outcomes (2014). The largest study included reported an association between early visits and fewer future restorative visits and expenditures. However, this study primarily examined patients utilizing Medicaid insurance, thereby only truly examining a specific population/demographic type.

The AAPD recommendation has also been supported by the study conducted by Nowak and Casamassimo, which outlined the significant differences in treatment needs between "early starters", children who visited the dentist before 4 years of age, and "late starters", those who received preventative care after 4 years of age (2016).

The study's population was derived from clinics led by Church Street Health Management, which primarily serves children from low- income backgrounds who utilize Medicaid benefits for dental care.

These groups of children were compared in terms of average number of dental treatments, and cost of dental treatments over an eight-year period. The late starter group had a greater number of treatment appointments as well as a greater treatment cost over the eight-year period. Children who had their first dental visit at 4 years of age or older had a total cost of $360.13 more than children who were seen before four years of age. In addition, children who had their first dental visit at 4 years of age or older had approximately 4 more restorative care appointments over the eight year time period. This study clearly emphasizes the impact of providing children with preventive dental visits at an earlier age.

In addition, Savage and Lee examined a cohort of North Carolina children enrolled in Medicaid from birth to 5 years of age, in order to determine the effects of early dental visits on future use and costs of dental services (2004). Upon examining variables such as "age at first dental visit" and "type of visit", it was determined that pre-school children who utilized early preventive dental care had fewer dentally related costs, compared to those who began care at a later time. While this finding was enlightening, the caries level of each child was not determined, and outcome measures were solely based on dental claims. In addition, the population examined was also strictly limited to those of a lower-income background, such as Medicaid patients, which prevents generalization of the results to other socio-economic groups.

While previous studies generally focused on the lower-income, underserved population, Kolstad and Zavras examined the costs and benefits of the age one visit for the privately insured

(2015). They examined the specific CDT dental procedure codes and the amount remunerated for each claim. In addition, they calculated the "prevention potential" of the age one dental visit-average number of complex procedures per child ratio of Group 1 (minor restorative) to determine how many complex procedures would have been expected from children in the other groups. Using claims from Delta Dental, they were able to calculate the "prevention potential" of the age one dental visit. The amount of complex procedures performed in each group was divided by the total number of children within the group, resulting in a specific ratio; 0.19 for Group 1. The total number of children in each group was then multiplied by Group 1's ratio, 0.19, resulting in an expected number of complex procedures, assuming that the children in the other groups had attended an initial dental visit before 12 months of age. The "prevention potential" for each group was then calculated by subtracting the expected number of complex procedures from the actual, observed number of complex procedures billed out through claims. By summing up the prevention potential of the 5 groups the study's population would have hypothetically received 2500 fewer complex procedures over the five years. The study also discovered that a majority of children in the privately insured population did not have their first dental visit until after three years of age. The average annual cost for children who had their first dental exam after two years was statistically higher than the annual cost for children who had their first dental visit by age one $P=1.4 \times 10^{\wedge -2}$. These findings support the need for the age one dental visit within the privately insured population from the cost standpoint.

In order to examine the compliance with AAPD recommendations within the context of private insurance, McKernan aimed to evaluate the availability of general dentists to treat very young children in the rural state of Iowa. Administrative data from Delta Dental of Iowa (DDIA)

was evaluated, and various characteristics of providers willing to treat this patient population were also identified. According to McKernan, "all children from birth through 17 years old, enrolled for any length of time in DDIA during the calendar year, 2005 or 2012, were included in the analysis (2016). It was determined that younger providers were significantly more likely than those over 55 years of age to treat children less than two years of age. Although many general dentists are aware of the AAPD recommendation regarding early dental visits and report their willingness to treat this patient population, "less than one in five dentists actually submitted a claim for treating a child younger than two years old among this privately insured population" (McKernan and Singhal, 2016). These general providers may feel that they lack training in the behavior management skills required to treat children to the appropriate standard of care. This finding could also be due to lack of broad awareness among parents regarding AAPD recommendations, as well as provider preferences in patient demographic.

In order to further examine the implications of the AAPD recommendation for an "early dental visit", Malik-Kotru examined the racial differences regarding the frequency of first dental visits within a socio economically deprived region in Connecticut. The data represented within the study reflected children obtaining a first dental visit at a Federally Qualified Health Center (FQHC), which primarily provides services for underserved and uninsured populations. Data were collected on 176 children, such as age at first dental visit, ethnicity, gender, as well as a proper medical history and dental findings. Upon analyzing the data, it was discovered that children were attending their initial dental visits at an average age of 48 months. In addition, Hispanic children visited the dentist at a much younger age than their Caucasian counterparts, attending at a mean age of 43 months, compared to 62 months for Caucasian children, and 51

months for African Americans (Malik-Kotru and Kirchner, 2009). These findings demonstrate that there is a significant ethnic disparity regarding early dental visit attendance, even within clinics geared towards serving minority populations. In addition, there appears to be a lack of awareness of AAPD recommendations regarding the age at which the first dental visit should occur.

Although most of the existing literature firmly supports the significance of the early dental visit, Shenkin's study provided an alternative perspective regarding the necessity of early preventive care. The study aimed to determine the number of dental procedures at ages 43 to 72 months among children who received a preventive dental visit before 18 months of age, and those who received them up to 42 months of age. A retrospective cohort study was conducted, examining 19888 children enrolled in North Carolina Medicaid for at least 12 months who had a paid claim from October 1999 to December 2006. Children had to be enrolled for at least a year after their preventive dental visit to be included in the study. The key outcome measure were the claims filed for restorative dental treatment. According to Shenkin,"children who had a primary or secondary preventive dental visit before 18 months had no statistical difference in treatment rates from 43 to 72 months, compared with other children" (2013). In addition, children who were considered "low risk" for decay prior to 18 months of age may obtain no additional benefit from an early dental visit. However, high-risk children were most likely to benefit from early dental visits.

Although Shenkin's study provided unique findings and nuances regarding the necessity of early dental visits, the investigation relied on administrative data that had no diagnostic codes. This study does not account for parents who are more aware of the significance of preventative

dental care and are more likely to bring their children to the dentist before 18 months of age. These parents are theoretically more likely to implement better oral hygiene practices into their children's routine dental care, thereby reducing the likelihood of future restorative dental claims.

Blackburn's study also stands in contrast to AAPD recommendations, by stating "there was no association with subsequent caries related expenditures and preventive dental care from PCPs", thereby concluding that there was no evidence of a benefit of early preventive dental care (Blackburn et al, 2016). A retrospective cohort study was conducted utilizing administrative data of 19658 children continuously enrolled in Medicaid from birth for 3 or more years beginning September 2007 through October 2012. Analyses were restricted to enrollees with at least 1 paid claim, and preventive dental visits and expenses were identified during the first 2 years of life. All types of oral health providers, general and pediatric specialists, were compared to primary care medical providers in terms of preventative care and expenditures. Propensity score matching was used to account for biases related to differences between children receiving and not receiving early preventive dental care during their first 2 years of life. The propensity score accounted for all inpatient diagnoses, procedure codes and pharmacy claims from date of birth to the second birthday. Propensity scores also allowed for matching of children who received preventive care from dentists and medical providers. Results indicated that dental preventive care resulted in an increase of 0.14 caries related visits as well as a $40.77 increase in dental costs when compared with medical primary care providers (Blackburn et al, 2016). According to these models of comparison, Blackburn concluded that children who attended preventive dental visits with dentists were more likely to require restorative care in the future, thereby increasing subsequent costs (2016).

In addition, children receiving preventive dental care from primary medical providers had similar caries-related visits and expenditures compared with children without preventive dental care during that two year time frame.

Though Blackburn's study aimed to analyze the impact of primary and preventive care on future caries rates, the juxtaposition of primary physicians with dentists is inherently problematic, as physicians are not adequately trained to diagnose dental decay; and may not recognize the initial stages of a carious process. In addition, such a study can be easily misinterpreted, and portray dental providers as financially focused and recommending unnecessary treatment, rather than patient focused. By utilizing the diagnoses of dentists alone in our chart audit, we allowed for consistent examination of all subjects from a dental perspective to determine the effects of preventive care throughout various practice types in the state of Illinois.

3. Materials and Methods

3.1 Source and Number of Subjects

A retrospective chart audit was conducted among three pediatric dental practices in the state of Illinois: two Medicaid centered practices and a private insurance-based practice. The first location was the University of Illinois at Chicago Department of Pediatric Dentistry, a public dental clinic serving primarily Medicaid patients. The second location, Infant Welfare Society, was a sliding scale pediatric dental clinic located within a larger community health center, with other medical specialties such as pediatrics and women's health. The third location, Glen Ellyn Pediatric Dentistry, was a privately owned, insurance-based practice located in the suburbs.

3.2 Sample Selection

a. Inclusion Criteria:

- Children who fulfilled a "first dental visit" before and after 18 months of age
- Medically healthy, ASA 1 children
- Child must be at least 48 months at time of inclusion in study.

b. Exclusion Criteria:

- Children classified as ASA 2 or above
- Children who are less than 48 months of age at the start of the study

3.3 Study Design

A chart audit was implemented for this investigation. The research project relied on compiling existing data from previous or current patients within the respective dental clinics;

UIC, IWS and GEPD.

The initial goal was to obtain 100 subjects per clinic site. The records at these practices were examined for children who met the eligibility criteria. The subjects were followed up to 48 months of age.

Although the AAPD recommends that children have their first dental visit by 12 months of age, a pilot study completed at UIC before official data accumulation highlighted the sparsity of subjects who actually had their first dental visit before year one. Due to the lack of subjects who met this criteria, the benchmark for attending an early dental visit was increased to 18 months of age.

From a total of 296 subjects, 100 were randomly selected from UIC. Ninety six were selected from Infant Welfare Society of Chicago, while 100 subjects were included from Glen Ellyn Pediatric Dentistry. Although there were slightly less subjects included from IWS, the number of subjects obtained from each clinic site was sufficient to determine significance according to our power analysis.

The UIC pediatric dental clinic serves as a safety net clinic with a large patient population. The clinic receives referrals from general and pediatric dental practices throughout the state, while also accepting walk-in patients requiring a dental home and comprehensive care. It also receives referrals from the University of Illinois Hospital. The UIC pediatric dental clinic is staffed by pediatric dental residents as well as pediatric dental faculty, who provide treatment to patients primarily on Medicaid.

The community health center, Infant Welfare Society of Chicago, (IWS) featured in this

study also serves as a safety net clinic catering to the low-income and underserved population.

It is analogous to a Federally Qualified Health Center (FQHC), which qualifies for enhanced reimbursements from Medicare/Medicaid, provides comprehensive services to an underserved region or population, offers a sliding fee scale and employs an ongoing quality assurance program. Although IWS is not specifically classified as an FQHC, it operates similarly by housing pediatric medical, optometry, and women's health clinics. The facility provides a convenient environment for patient referrals, as mothers can be referred directly to the dental clinic for their children's exams and dental needs. Studies have shown that adequate coordination of care within FQHCs are beneficial as "children who also received any medical well-child visits at FQHCs were more likely to have earlier first dental visits" (Malik-Kotru and Kirchner, 2009). IWS is staffed by physicians, nurses, pediatric dental specialists as well as general dentists. The dental clinic primarily receives referrals from general dentists, Head Start Programs and pediatricians throughout the Chicago metro region. By largely accepting Medicaid patients and providing services on a sliding fee scale, IWS is able to cater to the high need populations within the city of Chicago.

In contrast, Glen Ellyn Pediatric Dentistry (GEPD) is a private clinic where children are solely treated by pediatric dentists. General dentists, pediatricians and families of existing patients primarily refer these patients. As the patient population is largely middle-class or higher in socio-economic standing, the practice primarily accepts private insurance as a method of payment.

The records at the University of Illinois at Chicago College of Dentistry pediatric dental clinic, Infant Welfare Society and Glen Ellyn Pediatric Dentistry were examined for charts which

met the inclusion criteria.

Since all 3 clinics utilize electronic medical records to manage patients' health information, a list of patients' numbers which corresponded to patients who met the inclusion criteria for the study was generated. Charts were examined in a random order until the necessary number was obtained for each clinic site. Afterwards, the patient numbers were destroyed, leaving only de-identified data for all subjects.

Each chart that met the inclusion criteria was examined and data was extracted on the variables of interest. Insurance type, age at first dental visit in months, dmft scores and number of recall visits were entered into an Excel spreadsheet (Figure 1) and then transferred to SPSS. Approval of the study was obtained from the University of Illinois at Chicago Institutional Review Board, protocol #2011-0410 (Appendix B).

DATA ABSTRACTION

Subject	Clinic type	dmft	Age in months	Age at first dental visit	Insurance type	Number of recalls
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
18						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Figure 1. Abstraction Sheet for Data Collection.

3.4 Dental Chart Review

In order to allow for consistency in operational definitions and evaluation of data, the dmft measure is most appropriate, as it was also "the most frequently used index" in studies examining the frequency and prevalence of early childhood caries (Klein and Palmer, 1938). Patients'dmft scores are commonly used as the primary outcome measure when examining the efficacy of various preventive interventions. The "dmft" index, originally proposed by Klein, is specifically defined as the "summation of the decayed, missing and filled dental surfaces" based on all twenty primary teeth (1938). As highlighted by Gruebbel, the dental service needs and behaviors of subjects can vary between different communities and dmft scores serve as a "baseline predicated on adequate data for planning an effective dental health program and for appraising whatever procedures are used to prevent and to control dental diseases" (1944). Therefore, the consistency between the various clinic types regarding charting of carious lesions and existing restorations allows for a valid calculation and analysis of dmft scores for subjects included in the study.

The subject's current age in months was determined by accounting for the current date at time of calculation and date of birth. By examining each chart's demographic information, the insurance type was determined for each subject. The age of first exam, was based on the initial comprehensive exam at each clinic, when the D0150 code was billed out by the provider. The number of recall visits was based on the number of D0120 codes billed out by the provider by 48 months of age. Finally, the dmft score was calculated based on the number of primary teeth that had charted decay (d), had been extracted and were therefore missing (m), and had a restoration, or were filled (f).

This information was extracted from each patient's odontogram, as various providers charted radiographically and clinically visible caries on each tooth at previous initial visits and recall visits. Those values were added together for a total dmft score per subject.

3.5 Statistical Analysis

Statistical analysis was completed using SPSS 22.0 for Windows (IBM-SPSS, Armonk NY). Independent T-tests were utilized in order to determine if there were statistically significant differences between those who attended a first dental visit before 18 months, and those who attended after 18 months of age. ANOVA tests were utilized with Post-Hoc Bonferroni corrections, in order to determine if there was a significant difference in the dmft of subjects at various practice types, as well as the direction, positive or negative, of this difference.

4. Results

Table I references Hypothesis #1 which compares subjects' compliance with attending an initial dental visit by 18 months of age with their corresponding dmft. Age One Compliance specifically refers to patients who attended a first dental visit at or before 18 months of age (compliant), compared to those who attended after 18 months of age (non-compliant). It was determined that subjects who attended the first visit after 18 months had a significantly higher dmft of 3.23, compared to those who attended a visit before 18 months, with a dmft score of 1.81.These results were statistically significant, with $p<.05$.

Hypothesis #2 states that there is no significant difference between the three clinic types, in terms of recall visits. In order to truly examine recall compliance in a standardized format, the rate of recall compliance was calculated. Rates are defined as the number of events divided by the time frame in which events can occur. To determine the rate of recall compliance, or "recall compliance frequency", the number of recall visits was divided by the number of months the child was in the system. This allowed for a standardized comparison of children who were in the various clinic systems for different lengths of time in an equivalent manner. Both the number of visits and the time in which visits are possible (for each child separately) are accounted for in the resulting fractions. Table II exhibits the results of the ANOVA tests employed to test the second hypothesis. Since $p<.05$, there are significant differences in recall compliance between the three clinic types. At a $p<.05$, UIC has a significantly lower value of recall compliance than IWS and GEPD. In addition, IWS had a higher value of recall compliance, but this finding was not significant, $p=.078$. The study demonstrated that subjects at the community health center (IWS) and Glen Ellyn Pediatric Dentistry (GEPD) had more recall visits than University of Illinois-Chicago (UIC), $F(2, 293) = 31.4$, $P<.05$.

These results are also supported by various histogram figures. Figure 2 highlights the recall compliance of UIC, which exhibits a skewness to the right, indicating that subjects at this location exhibit much lower values of compliance. This can be graphically compared to the histograms of the IWS and GEPD (Figures 3 and 4), which display values largely clustered around the mean, and corresponding higher values of recall compliance.

Hypothesis #3 states that subjects that are compliant with recalls exhibit lower dmft values. In order to standardize the comparison, the "recall compliance frequency" was examined in terms of its mean and median throughout the patient population. The overall median value of recall compliance frequency was 0.0385. Therefore, "recall compliance dichotomized" was defined as recall compliance frequency values >.0385 (compliant) and recall compliance frequency values <.0385 (non-compliant). Non-compliant subjects had a mean dmft of 3.77 and the compliant subjects' mean was 1.94. An independent samples t test showed the mean difference to be significant ($t(274) = 3.87$, $p < .01$).

Table III provides a summary of the various variables examined within the study population, compared between all three clinics. For example, the mean dmft values differ greatly, with GEPD and UIC presenting with 0.66 and 5.81 respectively. Recall visits also highlight the differences between the clinics with UIC and GEPD presenting with 1.35 and 2.20 respectively.

TABLE I

STATISTICS REGARDING OVERALL COMPLIANCE WITH EARLY DENTAL VISITS AND THE MEAN dmft.

Group Statistics

	AgeOneCompliance	N	Mean	Std. Deviation
dmft	.00 (non-compliant)	219	3.23	4.37
	1.00 (compliant)	77	1.81	3.36

TABLE II

ANOVA : COMPARISON OF RECALL VISITS BETWEEN CLINIC TYPES

(I) Clinic	(J) Clinic	Mean Difference (I-J)	Std. Error	Sig.
UIC	IWS	-3.28 x 10^-2	4.27 x 10^-3	.00
	GEPD	-2.32 x 10 ^-2	4.22 x 10 ^-3	.00
IWS	UIC	3.28 x 10^-2	4.27 x 10 ^-3	.00
	GEPD	9.55 x 10^-3	4.27 x 10 ^-3	.08
GEPD	UIC	2.32 x 10 ^-2	4.22 x 10 ^-3	.00
	IWS	-9.55 x 10^-3	4.27 x 10 ^-3	.08

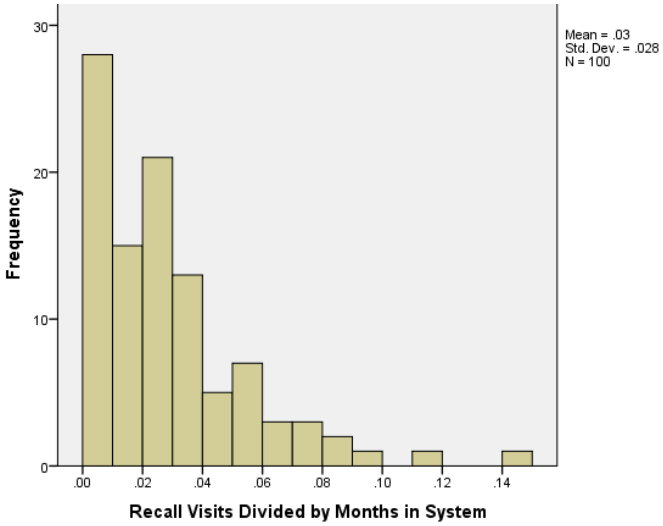

Figure 2. Recall Visits Divided by Months in System (UIC)

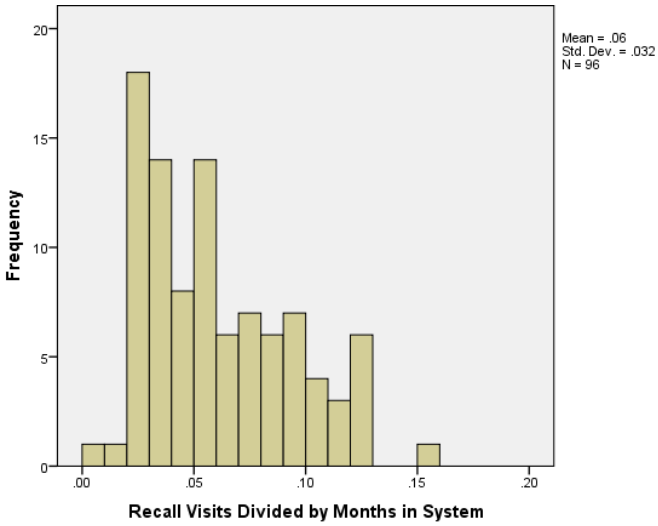

Figure 3. Recall Visits Divided by Months in the System (IWS)

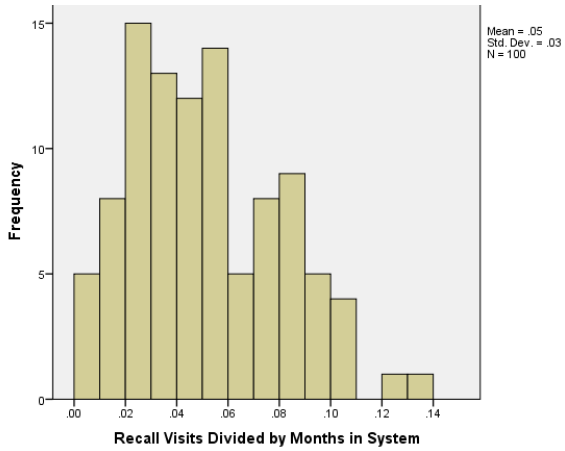

Figure 4. Recall Visits Divided by Months in the System (GEPD)

TABLE III

STATISTICAL SUMMARY OF STUDY POPULATION

	dmft mean/SD		Child's Age in Months mean/SD		Child's Age at First Dental Visit in Months mean/SD		Number of Recall Visits mean/SD		Months in Clinic System mean/SD		Recall Compliance Frequency mean/SD	
All Clinics	2.86	4.17	70.48	16.33	25.59	9.96	1.86	1.27	44.89	17.59	.05	.03
UIC	5.81	4.89	77.16	15.17	26.69	11.17	1.35	1.29	50.47	19.39	.03	.02
IWS	2.09	3.13	59.01	9.00	23.19	9.59	2.06	1.10	35.81	9.49	.06	.03
GEPD	0.66	2.08	74.84	17.17	26.81	8.63	2.20	1.25	48.03	18.40	.05	.02

5. Discussion

5.1 Explanation of Results

The study resulted in significant findings that can be explored from a variety of perspectives. Throughout all three practices, subjects who presented for the first dental visit before 18 months of age had a significantly lower dmft, than those who presented at a later age. Patients who are adherent to guidelines on attendance might also be expected to be compliant with hygiene recommendations. Therefore, these children present for subsequent recalls with lower caries rates, due to the combination of early efforts at anticipatory guidance by the dental providers, as well as the motivation and probable literacy of the parents involved in their dental care.

The second hypothesis resulted in interesting discoveries due to the comparison of the various practice types as well as the resulting levels of recall compliance. Subjects treated at the Infant Welfare Society had a significantly higher recall compliance rate than UIC. This can be attributed to the integrated care model employed by the health center, as it caters to adults, as well as children within a common location. Expecting mothers, or new mothers presenting for a well-woman medical exam, or a well-child exam at the pediatrician are easily referred to the pediatric dentist for an initial exam, and can be scheduled that same day. In addition, physicians can easily examine patients' charts within the electronic medical record and determine if the child has had an initial dental visit, thereby creating effective referral patterns within the community health center. As multiple specialties are present in the same location, parents are more apt to view Infant Welfare Society as a medical and dental home, where the needs of the entire family can be addressed. The location of the clinic is also conducive to the patient

population served, as it is easily accessible through various modes of public transportation, thereby allowing for ease of appointment attendance.

In contrast to IWS, UIC is a state institution that primarily serves patients with Medicaid insurance. Due to the poor Medicaid reimbursement rates in the state of Illinois, many providers refer patients reliant on this coverage to UIC Pediatric Dentistry. Since few private dentists accept Medicaid, UIC frequently serves patients who commute long distances to receive care. Typically, these patients will receive a periodic exam and prophylaxis at their local dentist's practice, which they may consider to be their "dental home", and then opt to receive actual restorative care at UIC. Therefore, the pediatric dental residents and specialists tend to serve a transient population, who receive treatment through various modes of behavior management, ranging from Nitrous Oxide to General Anesthesia, and subsequently return to their local dentists for periodic recalls and prophylaxis. Parents of the children treated frequently change addresses and contact numbers, resulting in difficulty maintaining communication and follow-up with these families. Unfortunately, this pattern of referrals is not necessarily conducive to UIC's mission to serve primarily as a dental home. Since the patient population seen at UIC tends to return to their local providers, the clinic demonstrates much lower recall compliance, as graphically represented in Figure 2. The graph is largely skewed to the right, indicating that a significant amount of subjects do not return for regular recalls. This drastically differs from Figure 4, which illustrates a broader spread graphically, and a subsequently greater recall compliance for IWS.

Figure 4 also illustrates the greater recall compliance displayed at GEPD, which primarily serves patients of a higher socio-economic status who present with private insurance. Although GEPD did not display significantly higher levels of recall compliance than IWS, the

recall compliance frequency was significantly greater than that of UIC. It is interesting to note that though IWS serves a primarily lower income population, while GEPD serves patients of a higher socioeconomic status, their recall compliance frequencies are quite similar. Both practices tend to consistently emphasize the significance of prevention, follow-up care and place a high emphasis on parental education. By promoting the concept of a dental home, parents are encouraged to regularly attend the scheduled recalls as they build familiarity and patient-doctor relationships with the providers at these practices.

The dmft scores at 48 months of the various subjects between the three practices also correspond with the recall compliance levels. As noted in Table III, GEPD presented with the lowest dmft, at 0.66, while IWS and UIC displayed dmft scores of 2.09 and 5.81 respectively. These dmft values indicate the dichotomy of low caries risk and high caries risk populations served at GEPD compared to IWS and UIC. While the community surrounding GEPD largely includes parents who have the financial resources to provide their children with healthy nutrition, as well as the allotted time to tend to their behavioral and health centered habits, the populations served at UIC and IWS tend to struggle with obtaining solid financial footing, as the parents juggle multiple responsibilities in order to provide the necessities of life for their children. These contrasting lifestyles may also play a role in oral health behavior and consequently, dmft. It also illustrates how the combination of probable greater health literacy, and recall compliance can result in much lower dmft scores within a patient population.

Increasing the benchmark age to eighteen months allowed for inclusion of subjects who may have displayed variations in dental development and eruption patterns. Patients'dmft scores were the primary outcome measure, and was calculated at 48 months. The patients were

specifically followed to 48 months in order to ensure that the primary dentition was the focus, and permanent teeth were not included in the study. Age at first dental visit was calculated based on the initial completed code for the comprehensive exam, D0150. However, since each clinic maintains independent records that are not merged with other dental clinics, it was not possible to confirm that the D0150 code had only been billed once for any particular subject. Though this information may be relatively accessible at clinics which primarily treat children on public assistance, the myriad of insurances and dental plans utilized throughout the three clinics would not allow for a strict confirmation of a one time comprehensive visit. Although referrals are acknowledged as an important source of patients at UIC and IWS, the study did not specifically examine which clinics within the larger Chicago region commonly referred patients to these institutions.

There are, however, some limitations involved in the execution and data accumulation aspects of the study. In the age of technological advancements to patient care, it was expected that the clinics would utilize electronic health records to maintain up to date, patient information. Due to the various types of electronic databases available, data collection was conducted by examining a variety of interfaces; Axium, EagleSoft and Open Dental. Though all interfaces allowed for sufficient chart examination, various layouts limited the degree to which patient odontograms could be examined, based on date of most recent visit. This limitation required the investigator to peruse various uploaded treatment plans for printed odontograms, in order to calculate an accurate dmft for each subject.

Various confounding factors, such as family demographics, socio-economic status, and modes of transportation, were not examined in this investigation. In addition, the study did not

account for the difference in training/expertise of the providers at various clinics, such as general dentists compared to pediatric dental specialists. Due to the succinct nature of a chart review as well as the preservation of anonymity of all subjects, it would be difficult to obtain such data while relating it to the extent of compliance, or lack thereof, with initial comprehensive visits and recall visits.

5.2 Comparison of the Findings Compared to Previous Studies

The present study found a significant relationship between early dental visits before 18 months of age, and lower dmft scores by 4 years of age., which is consistent with the findings of most related published studies. There have previously been no published studies that have examined the pediatric patient population between various clinic types, their adherence to AAPD recommendations and concurrent effect on caries experience.

5.3 Significance of the Study

Despite the much acclaimed guideline regarding early dental visits before age one, pediatric dentists still find that many children do not attend an initial comprehensive dental visit until much later, primarily 3 years or older. It is critical to therefore, examine the true extent of compliance, or lack thereof, to the AAPD recommendation, and its subsequent effect on children's oral health. In addition, identifying clinic models that result in children attending more periodic recalls allows for a thorough analysis regarding the population that should be appropriately targeted, and effective methods to increase their recall-compliance.

This study also supports the importance of establishing a dental home for the child patient, as consistency in recall visits also played a significant role in decreasing caries, and

consequently, future restorative care.

5.4 Implications for Future Research

Future studies need to examine referral sources for early pediatric dental visits, whether parents are generally referred by pediatricians or general dentists for comprehensive care. This would allow for a study analyzing the most effective methods through which parents can be informed of the significance of providing their child with early preventive care. The reason for the referrals should be examined, such as a specific dental concern, or for general preventive care.

Additionally, future research should include studies analyzing which care models are significantly more likely to result in parents adhering to the AAPD recommendation, multispecialty clinics, such as community health centers, or general dental clinics that also intermittently treat children. The educational component could also be explored, in order to determine the role of assistants and hygienists within these practice models regarding anticipatory guidance and encouraging healthy dental behaviors.

Research examining a larger sample size, as well as the modes of transportation frequently utilized to attend the dental visits at various practice types could also help highlight the challenges potentially involved in attending early dental visits.

6. Conclusions

1. There is a significant difference in dmft score by 48 months of age, between children who present for the first dental visit after 18 months of age, regardless of clinic type, and those who present for the first dental visit by 18 months of age.

2. There is a significant difference in compliance with recall visits among the three practices examined.

3. There is a significant difference in dmft scores by 48 months of age, between children who are compliant with periodic recalls and those who are not compliant with periodic recalls.

4. Age at first dental visit, and recall compliance are important contributing factors to children's oral health.

5. The cost benefit analysis highlighted by Nowak and Casamassimo in previous studies stands supported, as early dental visits result in reduced discomfort to the pediatric patient, lower dmft scores and improved oral health.

6. Different practice types exhibit different compliance rates in terms of periodic recalls.

7. Subjects who exhibited greater compliance with periodic recalls demonstrated lower caries rates, as indicated by their dmft scores.

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APPENDIX A

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Request for Modification and/or Information
Initial Review - Claim of Exemption

June 17, 2016

20160641-97910-1

Abimbola Olutimehin, DDS
Pediatric Dentistry
801 S. Paulina Street, M/C 850
Chicago, IL 60612
Phone: (713) 397-9670

RE: Research Protocol # 2016-0641
"Examining the Effectiveness of Early Dental Visits in Three Practices"

Dear Ms. Olutimehin:

Your request for a Claim of Exemption to your research protocol was reviewed on June 17, 2016. It was determined that the following is required:

1. In order for this research to qualify for an exemption, the data to be analyzed must NOT include any Protected Health Information. The data abstraction sheet, however, indicates date of birth will be recorded. Given this, please:
   1.1. Revise the data abstraction sheet to eliminate the dates of birth; or
   1.2. Withdraw this Claim of Exemption and instead submit an Initial Review Health and Biological Sciences application for expedited IRB review.
2. Please submit a copy of your (Abimbola Olutmehin) HIPAA research training certificate.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
06/15/2016	Initial Review	Exempt	06/17/2016	Modifications Required

When submitting your response provide **1 original and 2 copies** (3 packets total) of the following collated materials:

When submitting your response, provide the following:
1. A cover letter that references this letter and that responds to each specific item by listing the IRB's requirements from this letter. Please use the same numbering system as in the IRB's letter and list your responses after each item.
2. A copy of this letter.
3. For modifications that involve the research protocol, application form, and/or supporting documents:

a. Provide the revised documents with the modifications and information incorporated. Please note that only new and/or revised documents should be provided. Previously submitted documents for which no specific modifications have been requested do NOT need to be included in the response submission.
b. **Please highlight** or shade the additions and ~~strike through~~ the deletions on each revised document.
c. Include the next sequential **version number and date on each page**. (Note: The tech team may wish to include additional text noting that the electronic file version should also be updated prior to upload, but this would not need to go in the letters.)

4. For modifications that involve the recruitment, informed consent, and/or HIPAA authorization document(s)/process:

a. Provide the revised with the modifications and information incorporated. . Please note that only new and/or revised documents should be provided. Previously submitted documents for which no specific modifications have been requested do NOT need to be included in the response submission.
b. Include both a tracked and clean version of each revised document. On the tracked version, please **highlight** or shade the additions and ~~strike through~~ the deletions. The clean version will be date-stamped upon approval for use with subjects.
c. Include a **short descriptor** (to describe each document and differentiate among various documents in the same research protocol) in the footer of each page.
d. Include the next sequential **version number and date** in the footer of each page. (Note: Same as 3.b., above.)
e. Be sure the pages are numbered: Page 1 of #, Page 2 of #.

Based on your response, the OPRS has the authority to ask further questions, seek additional information, require further modifications, or refer the research for IRB review.

Please note that you ***may not*** implement your research until you receive a ***written notice of IRB approval or an exemption determination***.

If you do not respond to the IRB's request within 90 days of this letter, the submission may be withdrawn from the review process.

If you have any questions or need further help, please contact the OPRS office at (312) 996-1711 or me at (312) 355-2908.

Sincerely,

Charles W. Hoehne, B.S., C.I.P.
Assistant Director, IRB #7
Office for the Protection of Research Subjects

Enclosure(s): None

cc: Mary Claire Garcia, Pediatric Dentistry, M/C 850
Marcio Da. Fonseca, Pediatric Dentistry, M/C 850

APPENDIX B

UNIVERSITY OF ILLINOIS
AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Exemption Granted

July 18, 2016

Abimbola Olutimehin, DDS
Pediatric Dentistry
801 S. Paulina Street
M/C 850
Chicago, IL 60612
Phone: (713) 397-9670

RE: Research Protocol # 2016-0641
"Examining the Effectiveness of Early Dental Visits in Three Practices"

Sponsors: None

Please be reminded of the need to address HIPAA requirements at the non-UIC data collection sites.

Dear Dr. Olutimehin:

Your Claim of Exemption was reviewed on July 18, 2016 and it was determined that your research meets the criteria for exemption. You may now begin your research.

UIC Exemption Period:	**July 18, 2016 – July 18, 2019**
Performance Site:	UIC
Data collection sites:	Infant Welfare Society of Chicago, UIC Pediatric Dentistry Clinic and Glen Ellyn Pediatric Dentistry
Subject Population:	De-identified medical records initially collected for clinical purposes from January 1, 2011 through May 31, 2016.
Number of Subjects:	375 (maximum of 125 subjects from each site)

The specific exemption category under 45 CFR 46.101(b) is:
(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

UIC HIPAA Waiver:

APPENDIX C

Apr. 27. 2016 2:19PM No. 0044 P. 2

Infant Welfare Society of Chicago

April 8, 2016

Re: Data Collection for Dr. Abimbola Olutimehin at Infant Welfare Society of Chicago

I, _____Sheila Hall, DDS_____, (VP of Dental Services at Infant Welfare Society of Chicago), agree to support the study by Dr. Olutimehin, Dr. Garcia and Dr. LeHew. This letter certifies that the director of the practice has fully read the protocol associated with the research study. The practice is prepared to support the project fully. Specifically, the practice has agreed to grant the principal investigator access to the patient files, and will provide a list of eligible patients, while allowing the investigator to gather the required data from the selected files. In order to protect the patients' health information, only investigators will be allowed access to the computer which stores the database of information, such as codes and variables. The medical record numbers of subjects who meet the criteria will be recorded into an original file. These subjects will then be entered into an Excel file and randomized accordingly. Once the data has been examined for accuracy, the column with specific medical record numbers will be deleted, thereby creating a de-identified data set. This will allow for thorough inclusion of all qualified subjects while protecting all patients' personal health information.

Mary Claire Garcia DDS MS

Mary Claire Garcia, DDS MS

Associate Dentist, Co-Investigator

Sheila Hall DDS

Sheila Hall DDS

VP of Dental Services, Infant Welfare Society of Chicago

APPENDIX D

Glen Ellyn Pediatric Dentistry, P.C.

Practice Limited to Pediatric Dentistry

March 10, 2016

Re: Data Collection for Dr.Abimbola Olutimehin at Glen Ellyn Pediatric Dentistry

I, Lance Lambert ,(owner of **Glen Ellyn Pediatric Dentistry)** , agree to support the study by Dr. Olutimehin, Dr.Garcia and Dr.LeHew. This letter certifies that the owner of the practice has fully read the protocol associated with the research study. The practice is prepared to support the project fully. The practice has agreed to grant the principal investigator access to the patient files, and will provide a list of eligible patients, while allowing the investigator to gather the required data from the selected files. In order to protect the patients' health information, only investigators will be allowed access to the computer which stores the database of information, such as codes and variables. The medical record numbers of subjects who meet the criteria will be recorded into an original file. These original file numbers will then be entered into an Excel file and randomized accordingly. Once the data has been examined for accuracy, the column with specific medical record numbers will be deleted, thereby creating a de-identified data set. This will allow for thorough inclusion of all qualified subjects while protecting all patients' personal health information.

Mary Claire Garcia, DDS MS

Associate Dentist, Co-Investigator

Lance Lambert, DDS

Owner,Glen Ellyn Pediatric Dentistry, PC

Lance Lambert, DDS **M. Claire Garcia, DDS, MS** **Joyce J. Koh, DDS** **Richard Facko, DDS**
45 S. Park Boulevard, Suite 105 Glen Ellyn, Illinois 60137 (630) 858-8755 Fax (630) 858-6204

VITA

Abimbola Olutimehin, D.D.S.

EDUCATION:

University of Illinois at Chicago, Chicago, Illinois
Pediatric Dentistry Certificate
July 2015 – June 2017

University of Texas School of Dentistry at Houston, Houston, Texas
Doctor of Dental Surgery
August 2011 – May 2015

University of Pittsburgh, Pittsburgh, PA
Bachelor of Arts in Sociology
September 2007 – May 2011

EXPERIENCE:

The Children's Clinic
Volunteer Dentist
April 2017 – April 2017

CERTIFICATION:

Basic Life Support, June 2016
Pediatric Advanced Life Support, August 2016

PROFESSIONAL MEMBERSHIP:

American Academy of Pediatric Dentistry
American Dental Association
Illinois Society of Pediatric Dentistry
Chicago Dental Society