Assessing Access to Pediatric Dental Services via Clinical Referrals

BY

Lisa Rawle
B.D.S., University College Cork, Ireland 2014

THESIS

Submitted as partial fulfillment of the requirements
for the degree of Master of Science in Oral Sciences
in the Graduate College of the
University of Illinois Chicago, 2023

Chicago, Illinois

Defense Committee:

Dr. Brittaney Hill, DDS, MS, MPH, Department of Pediatric Dentistry,
Thesis Committee Chair & Advisor
Dr. Charles LeHew, PhD, Department of Pediatric Dentistry
Dr. Scott Tomar, DMD, Dr.PH, Department of Pediatric Dentistry
Dr. Alejandra Valencia, DDS, MPH, MS, Department of Pediatric Dentistry

Dedication

I would like to dedicate this thesis to my parents, who gave me everything so I may reach my dreams. To my sisters, Jenny and Adi, whose continual love and support I am forever grateful for. Finally, to my husband Paul, who has made my dream our dream and my life a constant adventure.

Acknowledgements

- I would like to acknowledge my Thesis Committee.
- I would most especially like to thank Dr. Brittaney Hill my primary mentor, who has been such a support throughout my thesis project. I am so grateful to have had the opportunity to learn from her clinically and throughout this research project.
- I would like to acknowledge Dr. LeHew, whose passion for this research was tangible and whose assistance in data analysis was greatly appreciated.
- I would like to acknowledge Dr. Tomar for his insight and experience, which he kindly shared.
- I would also like to thank Dr. Valencia for her expert insight and advise.
- I would also like to acknowledge my co-residents whose support I have so greatly appreciated.

Table of Contents

TABLE **PAGE**

Abbreviations

UIC- University of Illinois Chicago

AAPD-American Academy of Pediatric Dentistry

COD- College of Dentistry

ASA - American Society of Anaesthesiologists

ECC- Early childhood caries

S-ECC- Severe early childhood caries

DMFT- Decayed, Missing or Filled teeth

GPs-General Practitioners

QOL- Quality of life

COE -Comprehensive Oral Exam

POE- Periodic Oral Exam

PI - Principal Investigator

GA- General Anaesthesia

Summary

According to Dye et al. (2012), an estimated 46% of US children ages 2–19 years have dental caries and almost one in six US children aged 5–19 years have untreated dental decay. A disproportionate number of children with caries are from low-income families and there is higher prevalence of caries among racial and ethnic minorities (Dye et al., 2012).

One of the main barriers to children reaching better oral health is limited access to dental health services (Zhou et al., 2014). Barriers to accessing healthcare services are multifactorial- patient, provider, and the system. Some barriers at the patient level include parents' education, socioeconomic status, behavioral beliefs, and subjective norms. Barriers can also be financial, e.g. transportation costs and the time off work necessary to bring the child to the dentist.

A recent study showed 14% of dentists in Illinois participate in Medicaid for example but the actual number may be less due to discrepancies in the register of providers (Serban et al. 2022). The data from the Illinois Medicaid/Chip Public Insurance Program All kids shows that in 2016, Only 5% of dentists in Cook county provided any restorative treatment for at least 200 Medicaid/Chip children up to the age of 18. Overall, in Illinois, the restorative figures are low with 6% of 1-5-year-olds receiving restorative treatment, 21% of 6-9 year olds, and 22% of 10-14 year-olds.

The literature confirms that a larger proportion of pediatric dentists see Medicaid patients relative to general practitioners (GPs). Some reasons cited by GPs for not seeing Medicaid patients that are cited in the literature include reimbursement rates, failed appointment and unreliable patients, difficulties with paperwork, and lack of respect by other dentists for participating in Medicaid (Nebeker et al., 2014). There is, however, little evidence in the literature regarding referral rates to pediatric dental departments for restorative care. This is what we aimed to observe by using the records of patients that attended UIC COD for a comprehensive dental evaluation between 2019 and 2021.

We wanted to determine what percentage of referrals into our clinics from 2019 to 2021 were for patients who previously had preventive dental treatment provided by another dentist. We were also interested in looking at the ages of these patients, their medical status, and their quantifiable oral health status. We also collected the patient's area of residence, Chicago downtown, Suburbs, downstate, in hopes of identifying trends in referrals based upon location of patient and/or referring dentist.

I. Summary of background

Dental caries is the leading chronic disease among children worldwide, and minority and poor children are more likely than non-minority or wealthier children to have their dental caries go untreated. If we can identify barriers to pediatric dental services, then we may be able to effectively create and implement targeted interventions that will increase access to pediatric dental care for the children who need it most.

The University of Illinois Chicago College of Dentistry (UIC COD) is the largest provider of dental services for the Medicaid-insured pediatric population in Illinois, and it receives referrals from across the state. Many new patients at the College's Pediatric Dentistry Clinic arrive in need of restorative dental care (fillings, extractions, crowns), but had already received recent preventive care (cleanings, fluoride, sealants) elsewhere. Are children insured by Medicaid receiving preventive care but not restorative care? If so, we may need to formulate strategies to employ more dental practitioners to provide restorative dental services in addition to preventive dental services.

The proposed study was a retrospective chart review/audit in which investigators examined the charts of pediatric patients ages 1–17 years who were were seen in the UIC COD Post-Doctoral and Pre-Doctoral pediatric clinics for comprehensive examinations during 2019–2021. The aims of the study were to:

1. Determine the percentage of patients being referred to our clinic who had previously received preventive care.

2. Identify associations between patient demographic characteristics and referral for restorative care.

I.A Aims

The aims of this study were to:

1. Determine the percentage of patients referred to our clinic for restorative care who had previously received preventive care by an outside dentist within the preceding six months.
2. Identify associations between patient demographic characteristics and receipt of a referral for restorative dental care.

I.B Null hypotheses:

1. There is no statistically significant difference between the proportion of children referred to UIC COD for restorative care that have previously received preventive care from a dentist and those who have not previously received preventive care.
2. There is no statistically significant association between patient demographic characteristics and referral to UIC COD for restorative care.

I.C Alternative hypotheses:

1. There is an increased proportion of children referred to UIC COD for restorative care that have previously received preventive care from a dentist and those who have not previously received preventive care.
2. There is a statistically significant association between patient demographic characteristics and referral to UIC COD for restorative care i.e. younger patients, those with higher ASA, those living in rural areas are referred more.

I. Background

Dental caries is a sugar-dependent infectious disease (Robert et al., 2007). Acid is produced as a by-product of the breakdown of dietary carbohydrates by plaque bacteria, which causes a PH drop at the tooth's surface (Robert et al., 2007) In response, calcium and phosphate ions in the enamel surface diffuse out of the surface resulting in demineralization (Robert et al., 2007). That process is reversed as the pH rises again (Robert et al., 2007). Dental caries is thus a dynamic process characterized by episodic demineralization and remineralization occurring over time (Robert et al., 2007). If destruction predominates, ongoing diffusion of the mineral content will occur, leading to loss of physical tooth structure, or cavitation (Robert et al., 2007).

Dental caries is the leading chronic disease among children worldwide. According to the CDC, 13.2% of children aged 5–19 years in the United States had untreated dental caries in 2015–2018 (Dye et al. 2012). An estimated 46% of US children ages 2–19 years had experienced dental caries. A disproportionate proportion of children with caries were from low-income families or from some racial and ethnic minorities (Dye et al. 2012).

II.A Consequence of Dental Caries

Oral health is a fundamental constituent of overall health. Early childhood caries (ECC) has negative outcomes, not only for the teeth of the affected child but also for their general well-being and development. ECC is defined by the American Academy of Pediatric Dentistry (AAPD) as one or more decayed, missing because of caries or filled surfaces in any primary tooth' under the age of six (Garcia et al. 2015). The AAPD defines S-ECC (severe

early childhood caries) as any sign of smooth surface caries in a child less than three years old. S-ECC from ages three through five is defined by one or more cavitated, missing because of caries or filled smooth surfaces in primary maxillary anterior teeth, or a DMFT (decayed missing or filled score) of greater than or equal to six at age five (Garcia et al. 2015). Delays in treatment due to access issues negatively impact children's health and well-being and are very costly.

When Shepherd, et al. (2002) interviewed nearly five hundred and ninety eight-year-old children, it came to light that almost half of them had suffered dental pain. The pain was so intense that over seventy percent of those affected had not been able to eat, thirty-one percent had experienced trouble sleeping, twenty-seven percent had difficulty playing, and eleven percent reported missing school. In addition to pain, dental caries can lead to dental sepsis, which can progress to cellulitis and to Ludwig's angina (Lin et al., 2009). Ludwig's angina is a swiftly progressing cellulitis of the floor of the mouth that threatens the airway. One-third of Ludwig's angina cases occur in children and teenagers (Lin et al., 2009). The condition is potentially fatal and has a mortality rate of 10-17% in pediatric patients (Lin et al., 2009). The mortality risk is greater in those with medical condition. Management requires specialist tertiary care, including IV antibiotics, maintaining the airway, and drainage.(Davies et al., 2002; Lin et al., 2009). Two American children tragically passed away as a result of complications related to odontogenic infections (Adair, 2007).

Delays in the treatment of dental caries can lead to extraction being the only possible treatment option. Subsequently, premature loss of primary molars can cause problems such as mid-line deviation, dental crowding, impaction of permanent teeth, or ectopic eruption of permanent teeth, causing a crossbite (Zou et al., 2018).

Several studies have revealed an association between ECC and failure to thrive. Acs et al. (1999) found that children with "nursing caries" weighed substantially less than controls (approx. 1kg less), and were a lot more likely to weigh less than eighty percent of their ideal body weight. Clarke et al. (2006) showed that S-ECC's association with anemia is significant. This is important as a chronic iron deficiency in infancy is linked with impaired brain development and function. This can cause poor school performance. Sadly the scientific literature shows that cognitive scores and behavior do not get better, even after iron supplementation, if chronic iron deficiency occurs during infancy period (Pollitt, 2000). Several papers have reported that chronic inflammation, such as from an abscess, can initiate inhibition of erythropoiesis, which leads to 'anemia of chronic disease' (Means, 2003; Sheiham, 2006). Pain due to ECC may also lead to failure to thrive due to reduced food intake and disturbed sleep which in turn affects growth (Sheiham, 2006).

Blumenshine et al. (2008) investigated the relationship between oral health status and school performance was examined while accounting for controlled variables. They found that parents were over two times more likely to report poor academic performance when a child had poor oral health in addition to general health. Children with either poor oral or general health were nearly one and a half times more likely to have a report of poor school performance. (Finucane 2012). A study by Jackson et al. 2011 also found that children with poorer oral health status were more likely to suffer from dental pain, miss more school, and perform badly in school. Their findings caused them to suggest that improving children's oral health status may be instrumental to improving their education (Jackson et al., 2011). Pain due to ECC can lead to medical problems due to the inappropriate use of over-the-counter pain medications which can lead to the need for E.D. visits and possibly admission. Acetaminophen is commonly used to manage decay- related pain in children. Hepatotoxicity

may occur due to excessive ingestion of acetaminophen given by parents to control their child's dental pain. This is a growing concern in pediatric emergency medical care (Casamassimo et al., 2009; Squires et al., 2006).

II.B Medicaid/CHIP

One of the main obstacles to children achieving ideal oral health is limited access to dental health services (Amin et al. 2014). Barriers to accessing healthcare services are multifactorial, and include factors operating at the patient, provider, and system levels (Amin et al. 2014). Parental barriers include parents' education, socioeconomic status, behavioral beliefs, and subjective norms (Badri et al. 2014). Barriers can be financial e.g. cost of dental care, transportation costs and time off work to bring the child to the dentist.

Created in 1965, Medicaid is a joint federal and state program that provides free or low-cost health coverage to millions of Americans (Kreider et al. 2016). The federal government provides a portion of the funding and sets guidelines for the program, but the administration, reimbursement model, and eligibility criteria for Medicaid programs vary among the states. Illinois covers all income-eligible children under Medicaid, regardless of immigration status using state-only funds since 2022 (KFF, 2023). Illinois began covering adults ages 42 to 54 who are not otherwise eligible due to immigration status in 2022 using state-only funds (KFF, 2023). The state had previously expanded coverage to adults age 55 and above regardless of immigration status (KFF, 2023). For adults, adults 42+ years of age can be qualified for emergency medical benefits. CHIP (Children's Health Insurance Program, 2023) is an insurance program that provides low-cost health coverage to children in

families that earn too much money to qualify for Medicaid but not enough to buy private insurance.

As of November 2022, over forty million children were enrolled in either Medicaid/CHIP in the U.S., although this figure is expected to drop as Medicaid coverage was extended for families under the 'continuous enrolment provision' included in the 'Families First Coronavirus Response Act' (FFCRA) (ADA, 2023). This provision required states to provide ongoing coverage for Medicaid enrolees until the end of the month of the public health Covid emergency (PHE) in order to obtain enhanced federal funding. By preventing states from disenrolling people from Medicaid coverage, this policy has helped families to maintain health insurance coverage during the pandemic. Currently, over one and a half million children in Illinois were enrolled in Medicaid or CHIP (Illinois Department of Human Services,2023.).

There are 7,192 total dental care HPSAs in the U.S. (2020) with 31.75% of percentage of dental needs met and over sixty-nine million people live in those areas. (KFF, 2022). There is a lot of discrepancy between states. Guarnizo-Herreno in 2014 found that dentist supply had a significant effect on better oral health in 1-10-year-olds on all oral health outcomes. They found odds of decay were lower by 50% and the odds of bleeding gums lower by 80% with an extra dentist per 1000 population for this cohort.

The statistics for Medicaid access for the pediatric populations are worse in rural areas than in metropolitan areas. Medicaid-enrolled children live further from the nearest dentist and drive longer dentists to reach their dentist compared to privately insured children in Iowa. Urban dentists were .5 miles from each other, and rural providers were 8 miles from

each other (McKernan et al. 2016). That study by McKernan et al. 2016 found lower dentist bypass in the Medicaid-insured population than among private insurance patients. This was because patients with Medicaid insurance in the study did not travel further to see a dentist due to the increased travel costs associated. In a study in South Carolina, they found rural patients "regardless of race were more likely to have adverse outcomes compared to urban white children'' (Brock Martin et al. 2012).

Take Illinois for example, between 1999 to 2000 (Byck et al. 2002) one quarter of children in rural areas received 'any dental care' this was lower than statewide thirty-three percent, and metro-central thirty-five percent. At that time 16/74 counties in Illinois had no dentist enrolled to treat Medicaid patients. Over half of the state of Illinois is a dental professional shortage area currently (Oral Health in Illinois, 2020) with only 29% of dental needs being met in the state (KFF, 2022).

II.C Access to care:

Caregivers' lack of understanding of dental care and chronic dental conditions plays a role in accessing dental services. In a study, 19% of children given baseline referrals in kindergarten in Ohio sought and received dental treatment in a 9-month interval. Ten out of the thirty children in this study who received Urgent Care referrals received the care they needed. This proportion was even after multiple reminders and calls from staff and teachers (Nelson et al. 2012).

Finding a dental provider to treat Medicaid patients is a significant obstacle to attaining dental care. There are discrepancies in the number of dentists actually on the

registry of Medicaid dental providers in Illinois as providers may still appear on the registry but no longer work in that practice or accept Medicaid patients (Warder et al. 2017). There are also small numbers of Medicaid patients admitted to practices e.g. 100 Medicaid patients in total (Logan et al. 2015). Some states have extremely poor rates of dentists enrolled in Medicaid, with approx. 14% in Illinois (Serban et al., 2022).

A lack of accessible dental providers may lead patients to seek care at hospital emergency departments (EDs) to attend to their urgent dental needs. Seventy-five percent of patients using hospital EDs for dental reasons are individuals who have Medicaid or no insurance (Meyer et al. 2017). Difficulties with scheduling and multiple referrals and dysfunction within the delivery of dental care were cited also as issues leading to ED pain appointments. One in four caregivers reported difficulty in being able to access specialty care in a study by Kreider et al. (2016) (with some evidence those enrolled in CHIP experiencing more difficulty).

In a study carried out across the U.S. of pediatric and adolescent patient's E.D. visits between 2014 and 2015 by Claiborne et al., (2019) 365,000 E.D. visits were for non-traumatic dental issues with 60% of those attending on Medicaid Insurance and the main causes over nineteen percent were related to hard tissue disease, over twenty-five percent pulp/periapical, nearly eight percent periodontal disease, and the remainder were grouped as other dental diseases. In 2014, dental-related total ED charges in the United States were estimated at approx.. $2.4 billion dollars. The average hospital charge was $992 (Claiborne et al. 2019).

There are several dentist-related issues regarding dentist enrollment in Medicaid. According to the literature poor remuneration & missed appointments are often cited as a reason dentists don't want to see Medicaid patients (Decker S., 2011), (Nebeker C. et al. 2014). Concerns about what other dentists would think of them were cited as the reason for dentists not participating in Medicaid in Florida (Logan et al. 2015). Dentists also reported factors such as an excess of complicated paperwork as reasons not to partake in Medicaid. Dentists surveyed also recalled seeing Medicaid patients and doing the treatment pro-bono due to difficulties in navigating the Medicaid system and reported discomfort for the patient and it being degrading to these patients (Logan et al. 2015). Dentists also said that referrals and subsequent wait times for specialists were disincentives to engage in the program. They didn't feel they had adequate support to treat this cohort as if the treatment was beyond their scope of practice and comfort. They felt they didn't have anyone to refer the patients to (Logan et al. 2015).

The majority of dentists are located around cities and metropolitan areas where the majority of providers want to settle. This leads to a large discrepancy and lack of rural providers causing drastic urban/rural differences in access to care. However, In a study across all of the States (by Serban et al. 2022), Participation in Medicaid and CHIP was lowest among urban dentists, less than thirty percent in both programs and highest among rural dentists, around forty percent in both programs. In this study by Serban et al. (2022) urban dentists accounted for most of the dentist population, over eighty percent compared to five percent in rural, and participation in Medicaid and CHIP was substantially lower among general dentists, less than thirty percent compared to pediatric dentists, fifty-seven percent in both programs. The population of each state was made up of eighty-four percent general dentists and three percent pediatric dentists.. General practitioners may not be comfortable treating pediatric patients. Behavior norms for children of different ages are not familiar to

them (Brill et al. 2001). More pediatric dentists see Medicaid patients relative to General practitioners. The increase in preventive treatments is proportional to the number of pediatric dentists per 100,000 Medicaid-enrolled children who benefited from preventive care in a given year (Heidenreich et al. 2015).

The UIC COD serves as the largest provider of pediatric dental services for the Medicaid population, and we receive referrals from across the state of Illinois. We have noticed that many of our new patients come to our clinic in need of restorative dental care (fillings, extractions, crowns), but that they have already received preventive care (cleanings, fluoride, sealants). Are children insured by Medicaid receiving preventive care and not restorative care? If so, we may need to target ways to employ more dental practitioners to provide restorative dental services, in addition to preventive dental services.

We aimed to determine what percentage of referrals into our clinics from 2019 to 2021 were for patients who had previously received preventive dental treatment by another dentist. We were also interested in looking at the ages of these patients, their sex, their medical status (ASA), and their quantifiable oral health status. We also collected the patient's area of residence, Chicago downtown, Suburbs, downstate, in hopes of identifying trends in referrals based upon location of patient and/or referring dentist.

III. Methods/Materials:

III.A Ethical Approval

The Institutional Review Board of the University of Illinois Chicago (UIC) granted approval to conduct this study on March 24, 2022 (Appendix A). No external funding was utilized for this project.

III.B Study Site

This study was conducted in the Pediatric Dentistry Department at the UIC COD.

III.C Eligibility Criteria

Study participants were selected from a pool of patients who presented to the UIC COD Pediatric Dentistry Post-Graduate (PG) or Pre-Doctoral (PD) clinics for an initial comprehensive examination between January 1, 2019 and December 31, 2021 (identified by code D0150 being completed in their axiUm electronic health record).

Table I. Subject Eligibility Criteria

Inclusion Criteria	Exclusion Criteria
• Children age 1 to 17 years • At least one fully erupted primary or permanent tooth • Comprehensive examination between January 1, 2019 and December 31, 2021 (identified by	• Children younger than 1 year of age or older than 17 years of age • Children with no erupted teeth

code D0150 not being present in their axiUm EHR).	• Children seen for visits other than a comprehensive exam

The medical status of patients selected were evaluated according to the American Society of Anesthesiologists (ASA) Classification system. Please see table 2 below.

Table II. American Society of Anesthesiologists (ASA) Classification System

Category	Definition
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

III.D Study Sample Power

In order to determine the sample size we would require, a prospective power analysis was carried out after data collection was started. A two-sample T-test assuming equal variance was used to compare the control group to our test group. The tests concluded that for a sample size of 600 patients the study results would exhibit over 97% power to detect significant differences between the groups.

III.E Study Design

Subject identification and enrollment incorporated the electronic dental record software program used throughout UIC COD, axiUm. A list of axiUm chart numbers of patients ages 1–17 years who had been identified in the axiUm system as having a comprehensive examination (code D0150) between January 1, 2019 and December 31, 2021 was shared with the PI directly from the IT Department (axiUm Support Staff) at the UIC COD via a password-protected UIC email account.

The PI reviewed the axiUm charts of those individuals and determined their eligibility based upon the eligibility criteria listed above (Table 1). The PI randomly selected charts by randomizing them on Excel by year and selecting the first eligible 200 per year from 2019 to 2021.

III.F Data Extraction

After receiving the list of eligible subjects provided by the axiUm Support Staff, the PI assigned a unique study number to each eligible subject. The unique study number was linked to the patient's EHR chart number and this was kept on a separate document in a password protected desktop computer at UIC COD in locked Room 267. Only the Principal Investigator and research team had access to this document.

For all eligible participants, the PI reviewed the electronic dental records, abstracted all necessary information, and recorded it on the data collection sheet attached to this protocol.

The following data was extracted from the patients' axiUm records:

- Age
- ASA status
- Home ZIP code
- Referred/ non-referred
- History of dental check-up in the preceding 6 months
- Preventive dental treatment in the preceding 6 months- (dental cleaning, fluoride varnish application, or fissure sealant application)
- If restorative treatment was completed or required
- Number of carious teeth- primary/permanent or both
- Number of teeth present- primary/permanent/both

The proportion of teeth with caries was calculated as proportional to the number of teeth in the mouth on the day of the initial exam. The distance from the patient's home address to UIC COD was calculated using their ZIPCODE and the address of UIC COD using Google Maps. If referred by a dental practice the distance from the referring dental practice ZIPCODE to UIC COD was calculated using Google Maps.

III.G Study Sample

After the PI had completed collecting all of the data for the eligible 2019 group, the PI rearranged the patients' EHR chart numbers on Microsoft® Excel 2021 (Microsoft Inc., Redmond, WA, USA) so the patient order would be random. This would give more of an annual representation of the data. The PI selected 200 randomly ordered EHR numbered charts to be included in final data analysis.

Going forward the research team decided it would be more time efficient if the PI randomized the order of the 2020 EHR chart numbers on Microsoft® Excel 2021 (Microsoft Inc., Redmond, WA, USA) at the start to give an accurate representation of the annual data

for 2020. This randomization was complete and then the PI recorded the data for the 200 eligible subjects. This same process was completed for 2021, leading to the collection of data for 200 additional subjects.

Once the data of six hundred subjects was collected, patient identifying numbers were excluded from final data entry. The Microsoft Excel data of all 600 subjects was then transferred and analyzed using SPSS version 28 (IBM Statistics, Armonk, NY).

IV. Data Analysis:

Data analysis included the use of both univariate descriptive statistics and bivariate statistics. Univariate descriptive statistics, consisting of frequency, mean, and standard deviation, were used to assess demographic information. Bivariate statistics, included Chi-Square tests and Mann-Whitney, were used depending on the level of measurement and distribution of the dependent variables, as appropriate.

V. Results

Of the 600 pediatric dental patients selected for this study, 329 (55%) had been referred to UIC COD by a dentist and 271 (45%) had not been referred.

Table III describes demographic characteristics of the sample. The mean age of patients from the sample studied who attended UIC COD Pediatric Dental Department for an initial exam between 2019 and 2021 averaged just under six years of age and there was no significant difference in mean age of referred and non-referred patients.

Patients travelled, on average, just under 30 miles. However, referred patients averaged slightly further travel distances, although that difference was not statistically significant (p=.131).

A Mann-Whitney U test compared the ASA statuses of the referred group and the non-referred group, yielding a p-value of 0.038. Nearly eighty-five percent of referred children were healthy compared to over ninety percent of non-referred patients. Over eleven and a half percent of referred patients had mild systemic disease in our sample compared to nearly eight percent in the non-referred group. Over three and a half percent had severe systemic disease in the referred group when compared to nearly two percent in the non-referred group.

The sampled patients attending UIC Pediatric Dental Department for an initial exam between January 2019 and December 2021 came from 211 unique ZIP codes across Illinois. Forty-three of the patients' ZIP codes were in Chicago and 168 were outside Chicago. The ZIP codes of the referred and non-referred patients were very diverse and did not show a large majority of referrals coming from any specific ZIP code or from a few select ZIP codes. Of those who were referred, 17 (5%) came from ZIP code 60629, followed by 12 (3.6%) from ZIP code 60804. Of patients who had not been referred, 11 (4.1%) came from ZIP code 60629 and 11 (4.1%) were from ZIP code 60632.

Mann Whitney testing showed that referred patients had a larger proportion of their teeth affected by caries than did patients who had not been referred by a dentist (.33 v. .27; p <.001) This applied to both the total number of teeth with caries and to the percent of teeth with caries. Referral status had no association with the number of teeth the children had present in the mouth.

Table III:Patient Demographics: Means and Standard Deviations.

Variable	Whole Sample	Dentist-Referred	Not-Referred	p for Referral Status Comparisons
Age in Years (mean +/- SD)	5.7 ± 3.0	5.6 ±2.99	5.5 ±3.23	.415
Distance Travelled (mean +/- SD)	27.6 ± 31.7	29.74±34.37	25±27.99	.131
Number of Teeth (mean +/- SD)	20.9± 3.03	21.04± 2.93	20.74 ± 3.14	.217
Number of Teeth with Caries (mean +/- SD)	6.24±4.44	6.93±4.32	5.41±4.45	**<.001**
Percent of Teeth with Caries	30%±.22	33% ±.21	27%±.23	**<.001**

Of those referred by a dentist, 63.8% had an initial exam or recall exam six months or less before their initial exam at UIC COD, compared to 47.2% of the patients who had not been referred (see table IV). A dental cleaning (prophylactic treatment) was carried out in 60.2% of referred patients versus 45.8% of non-referred.

Statistical comparisons of dentist-referred and non-referred patients are depicted in Table IV. Dentists referring patients tended to complete the check-ups 'COE' or 'POE's while non-referred patients had fewer 'COE/POE' completions. Similarly, more dental

cleanings were completed in the referred group compared with the non-referred patients with significance p<.001 (table IV). More fluoride applications were observed among the referred patients and fewer for the non-referred patients with significance (table IV).

We used Fishers exact instead of Pearson's Chi Square test because of small numbers in cells to determine if restorative treatment was completed upon attendance and found the differences between referred and non-referred not to be significant (p=.086). Similarly, the number of patients who attended in the referred and non-referred groups with all of their treatment completed was so low that Fisher's correction for small numbers was applied. In this case, the difference between referred and non-referred patients was statistically significant and the null was rejected (p=0.013). For sealant application differences between the referred and non-referred patients, as before, the test is not significant (see table IV). A very small percentage in either group had sealants so Fishers exact test was used=.239 (see table IV).

Table IV: Treatments Received and Treatments Needed

Variable	Whole Sample	Dentist-Referred	Not-Referred	χ2 (df)	p for Referral Status Comparisons
POE/COE	56.3% (n=338)	63.8% (n=210)	47.2 % (n=128)	16.64(1)	<.001
Prophy	53.7% (n=322)	60.2% (n=198)	45.8% (n=124)	12.44(1)	<.001
Fluoride Varnish	50.3% (n=302)	56.83%(n=187)	42.4%(n=115)	12.33(1)	<.001
Sealants	11.0% (n=66)	12.5% (n=41)	9.2%(n=25)	1.59(1)	.207*
Restorative work completed	1.5% (n=9)	0.6% (n=2)	2.6% (n=7)	3.92(1)	.086*
Treatment completed	1.5% (n=9)	.30% (n=1)	2.95% (n=8)	7.053(1)	0.013*
Treatment needed	92.5% (n=555)	97.0% (n=319)	87.1% (n=236)	20.89(1)	<.001

***Fisher's Exact Test**

VI. Discussion:

In 2012 there was an increase in payment for preventive dental services in Illinois for Medicaid patients but there was no such increase for restorative services. The goal of this study was to determine if the patients being referred for restorative needs were having preventive dental treatment carried out by their primary provider prior to referral. Our aim was to ascertain if there was a difference in demographics between those being referred into our clinic versus those who were not referred.

V.A Findings & Relevance to the literature

Our study is the first we are aware of in the U.S. that looked at patient demographics and referral pattern of Medicaid dental pediatric patients attending a specialty clinic in order to ascertain preventive and restorative treatment history and needs. Similar studies examining dental access for Medicaid patients in other states have interviewed general dentists regarding their self-reported treatment or referral of this cohort. Some studies have looked at dentist payment histories for Medicaid treatment services for patients that have been enrolled for more than 90 days in Medicaid to determine treatments carried out for these patients, whether they were preventative or restorative but have not determined completion of treatment or if dental needs were met.

According to Oral Health Illinois 2020 "most shortage areas in Illinois are assigned specifically to the low-income or Medicaid populations in counties or census groups, not the general population". (Oral Health in Illinois, 2020) The areas of the state needing the most additional dentists include the West, South and area near the North sides of Chicago and Champaign, Tazewell, and Winnebago counties (Oral Health in Illinois, 2020). The patients from our sample came from 211 ZIP codes. There are 1,389 ZIP codes in Illinois and 67 ZIP codes in Chicago. The highest number of patients, 4.7% (n=28) lived in ZIP code 60629, which is the South West of Chicago and corresponds to Chicago Lawn, West Lawn, West Elsdon, Gage Park, Clearing, Ashburn and Garfield ridge (Chicago Health Atlas, 2023). That ZIP code has a population that is 73.6% Hispanic and 17.6% Black (2017–2021) (Chicago Health Atlas, 2023). Of those who were referred 5% (n=17) came from 60629, followed by 3.6% (n=12) from 60804. 60804 is Cicero, Illinois, which is west of Chicago. The population of Cicero is nearly 89% Hispanic followed by 28.5% White (US Census, 2023). Of those who were not-referred, 4.1% came from 60629 (n=11) and 60632 (n=11). 60632 also is

South-West of Chicago and encompasses Archer Heights, Brighton Park, Gage Park, West Elsdon, South Lawndale, Garfied Ridge and McKinley Park. Nearly 83% of this area is made up of Hispanic residents followed by 9% White residents. There is a lot of overlap between the 60632 and 60629 community areas. The findings of our study corroborate the findings of the Oral Health Forum in Chicago that 60629 and 60632 are two zip codes with high dental need (Chicago Department of Public Health, 2015). Their study found that 50% of the students they examined had urgent dental needs and lacked access to providers (Chicago Department of Public Health, 2015). The Oral Health Forum has achieved significant success in this area and by designing a model to meet the treatment navigation needs of this Medicaid population and in the first year of the pilot 71% of the children were taken to a dentist to receive care (Chicago Department of Public Health, 2015).

The study data was collected from the charts of patients that attended UIC COD Pediatric Dental Department during 2019–2021. An equal amount of patients' data was collected per year and they were randomly selected to ensure variability of data from different time points in the year. The COVID-19 pandemic in 2020 may have affected the data for 2020, with showed a decline in initial COE exams that year (down nearly 2,000 from 2019) because many patients who attended during the pandemic were referred for emergency treatment needs. However, the patients' charts for 2020 were randomly selected so they would be proportionate to the year overall and not specific to a certain season or time relative to the pandemic. This study contained quite a large sample size (n=600) and the power was determined to be over 97% to accurately detect the differences between the groups.

The mean age between referred patients and the control group did not differ significantly in our study. The mean age of subjects was 5.7 years (SD 3.0), which did not differ significantly between patients who had been referred by outside dentists and those who

had not. Other studies such as by Schulman et al., in West Virginia in 2008 showed 63% of dentists weren't even willing to perform an exam on a child under 2 years old themselves. In New York Garg et al., 47% of GPs reported not seeing children younger than 2 years old. Also, Seale and Cassamasimo found in their study of US dentists that less than one-half of their respondents often or very often performed exams on children under three. In a study by McQuistan et al. nearly one of five responding dentists often/always referred children aged 3 to 5 years suggests that general dentists rely on pediatric dentists to provide a moderate amount of care to preschool-aged children. Interestingly, in our study sample we did not find an increased number of younger children being referred to our clinic as you would expect given the current literature. There was no significant difference in the distance travelled from their homes to UIC COD between those who were referred and those who were not referred for an initial exam between 2019 and 2021.This was contrary to our expectations because we hypothesized that the distances traveled by those who were referred would be higher due to a sparsity of general dentists and pediatric dentists in rural areas of Illinois (Byck et al. 2002).

It is widely cited in the literature the difficulties that special needs patients in the U.S. encounter when trying to find dental providers comfortable treating them (Kerins et al., 2011). When we examined preventive treatments, referring dentists completed fewer dental cleanings and fluoride applications on children with mild and severe systemic disease. This suggest that the tendency of dentists to do the preventive dental treatment diminishes when the children have systemic diseases. We postulate that in general, patients with a higher ASA status may self-refer to specialty clinics such as ours, assuming that community dentists are not comfortable treating them.

More patients had had a check-up within six months of their attendance at UIC COD compared to non-referred patients, and more dental cleanings were completed among the referred patients compared to the those who were not referred. These findings suggest that dentists who are referring patients to our clinic are completing dental prophylaxes for their patients prior to referring them to UIC COD.

Fluoride varnish is a very simple and effective preventive measure where 5% or 22,600 ppm fluoride is placed on teeth to increase acid resistance and promote remineralization and decrease demineralization of the teeth. This is a very simple preventive measure that can be utilized to reduce caries incidence in younger children with poor oral hygiene and higher caries rates and can be repeated multiple times a year (2-4) determined by caries risk (Bonetti D. & Clarkson J.E. 2016). Illinois Medicaid increased the amount of reimbursement for cleanings and fluoride varnish application in 2012, but there was no such increase for restorative services. The prevalence of fluoride varnish application was much higher among referred patients compared with non-referred patients. That finding indicates that referring dentists were applying fluoride varnish in the six months prior to referring their patients to UIC COD.

Fissure sealants are a very effective measure to reduce the incidence of caries on permanent molars (Naaman et al., 2017). If a patient had a fissure sealant placed on one of the erupted first permanent molars, they were classified as having sealants. Interestingly, a very small percentage in either group had received one or more sealants placed.. That finding could be due to a variety of causes. The Healthy Smiles Healthy Growth study 2018-2019 found in their study of nearly three thousand children that 53% of third graders in Illinois had at least one sealant placed (Illinois Department of Public Health, 2020). They found that non-

Hispanic black children had the lowest sealant rates at nearly 46% followed by Asians at 49% (Illinois Department of Public Health, 2020). The average age of the children in our study was just under six which could have played a role in our figures and we didn't study races/ethnicities, which could have explained our findings based on the Healthy Smiles Growth study findings (Illinois Department of Public Health, 2020).

Some of the patients may not have had erupted or sufficiently erupted first permanent molars to seal prior to the time of referral. Another possible reason could be difficulties encountered by dentists in isolating these teeth and maintaining a dry field for the placement of sealants. The cooperation of young children could also be an issue with fissure sealant placement. However, the literature shows the use of glass ionomer-based sealants to be as effective in reducing caries incidence and could be utilized as a preventive measure for patients when cooperation and behavior do not permit the placement of resin-based sealants, which are much more moisture sensitive (Beiruti et al. 2006).

We found that very few children had their restorative treatment completed upon attendance at the UIC COD and there was no statistically significant difference between referred and non-referred groups. This is not surprising because many patients are referred to UIC COD for treatment.

Chalmers (2017) looked at Medicaid data to assess if reimbursement rates for dentistry and access to dental care were directly related across all the states. They found that you could increase access for children in states with low density of dentists and low participation in Medicaid by increasing reimbursement rates. They found nothing to support that higher payment for services resulted in the overuse of services for children who had access. This could be very beneficial in Illinois as the 2022 data shows nearly 3 million

people live in designated dental health professional shortage areas and only 29% of overall dental needs are met in Illinois. An increase in payment in line with the increase for preventive services that occurred in 2012 would increase the number of practitioners able to see more of these patients for restorative procedures. Medicaid reforms in Connecticut, Maryland and Texas showed a reduction in unmet dental need among children in Texas (Nasseh & Vujicic, 2014). This was supported by a study of Medicaid reforms in Virginia that showed 'a significant increase in provider participation (Brickhouse et al.,2021). In Conneticut, fee increases in 2008, to match approximately the 70th percentile of the market fees for dental care in 2005 increased dental participation by 72% and utilization rates increased from nearly 46% in 2006 to nearly 72% in 2012 (Nasseh & Vujicic, 2014). The unmet dental needs of lower SES Connecticut children were reduced.

I also believe that a change in Medicaid administrative burdens or assistance to practices in navigating the system would also increase the number of providers seeing these patients as this was often cited in the literature as a barrier to providers caring for this cohort. There is a lot of literature that supports that dental practices using DSOs or Dental Support Organisations which are independent business supports that contract with dental practices in the US. are more likely to engage with Medicaid system. Brickhouse et al., 2021 They found in this study that there was a significant penetration of DSO providers as regards number of providers seeing Medicaid patients, number of patients per provider and the number of claims per provider in Virginia. They examined the trends over a nine year period.
If practices received extra administrative assistance or if Medicaid could reduce the administrative burden for providers in Illinois this could also contribute to an increase in providers and decrease the number of children in Illinois with unmet dental needs.

An increase in line with the increase for preventive services, that increased dentists' use of preventive dental treatments, which occurred in 2012, would increase the number of practitioners happy to see more of these patients for restorative procedures. Medicaid reforms in Connecticut, Maryland and Texas showed a reduction in unmet dental need among children in Texas (Nasseh & Vujicic, 2014). This was supported by a study of Medicaid reforms in Virginia that showed 'a significant increase in provider participation' Brickhouse et al. (2021). In Connecticut also, fee increases in 2008, to match approximately the 70th percentile of what the market fees were for dental care in 2005 (Beazoglou et al., 2015). This increased dental participation by 72% and utilization rates increased from nearly 46% in 2006 to nearly 72% in 2012 (Beazoglou et al., 2015). These figures are very high but these increased rates coincided with the economic downturn and really reduced unmet dental needs of lower SES children there (Beazoglou et al., 2015).

If practices received extra administrative assistance or if Medicaid could reduce the administrative burden for providers in Illinois, this could also contribute to an increase in providers and decrease the number of children in Illinois with unmet dental needs.

The other most commonly cited issue for practitioners not seeing Medicaid patients is broken appointments. Often patients of lower SES face more barriers in accessing care and practitioners have to have empathy and understanding that the traditional appointment system may not work as well for these patients. Perhaps additional support contacting families prior to their appointments and informing them of policies in practices regarding number of missed appointments prior to not being seen and encouraging them to reach out and reschedule if unable to make appointments would result in less missed appointments and more cost-effective practices.

V.B Limitations

One limitation of the study was that patients often attend the UIC COD Pediatric Dentistry Clinic when they are experiencing pain, swelling, or infection and initially require urgent care. This often means that patients' initial comprehensive oral exam was their second visit, after they had already experienced dental extractions or emergency treatment. That common pattern of treatment seeking could have reduced the percentage of carious teeth among children who had been referred for care as well as those who had not.

In addition, patients may not have been enrolled in Medicaid previously and may have paid for care privately. This may have led to inaccuracies in assessing previous check-ups and preventive dental care. Because UIC is a teaching institution, variability in dental students' and residents' charting and treatment planning is inevitable. . Inaccuracies in charting caries lesions or data collection by practitioners seeing patients for their comprehensive oral examination is also a limitation which could have led to errors being entered into the dataset. This is also true with the documentation of ASA status. If the treating provider did not classify the patient as having a medical condition or there was no note in the chart in this regard, it was not possible to for the PI to classify the patients' ASA status appropriately could have led to under reported in this regard.

Some referrals to UIC COD were illegible and providers did not print their name or write their practice address or number, which made it impossible to record the ZIP codes of some referring practices. It is also hard to say if reasons for referral were lack of provider comfort in treating young children or issues related to Medicaid reimbursement. More data from providers would be illuminating as to their main reason for not treating this cohort. Such information may help inform Illinois Medicaid policy and increase provider participation, which could significantly improve the oral health of children covered by Medicaid.

V.C Future Directions:

Building on this study, the next step would involve surveying Illinois dentists and assessing their practices and perceptions about treating Medicaid-insured pediatric patients and identifying perceived barriers to participation. With current information, policymakers could make informed decisions regarding increasing Medicaid reimbursement rates. If dentists express concerns regarding the behavior management of young children, perhaps relevant continuing education could be implemented. Additional measures could be taken in predoctoral dental school curricula to increase students' training and exposure to pediatric patients. Such enhancement could increase dentists' comfort level in treating children, including restorative procedures.

VI. Conclusion:

Compared with non-referred patients, referred patients had a higher mean number of carious teeth (0.33 ± 0.21 v. 0.26 ± 0.22; $p<.001$), were more likely to have received a dental cleaning (60.2% v. 45.4%; $p<.001$) and fluoride varnish (56.8% v. 42.1%; $p<.001$), but were not more likely to have had sealants placed (12.5% v. 9.2%; $p=.239$). The data suggest that

dentists outside of UIC COD frequently complete basic prophylactic services and then refer pediatric patients for restorative care. That finding may be attributable to increased reimbursement rates for prophylactic care and stagnant rates for restorative care, or lack of comfort in providing restorative care for young children.

Appendix A

Exemption Granted

March 24, 2022

Lisa Rawle
Pediatric Dentistry

RE: **Protocol # 2022-0326**
"Evaluating access to pediatric dental services via clinic referrals"

PIs must complete a COVID-19 Human Subjects Research Review Worksheet for a protocol COVID safety assessment prior to initiating or re-starting any research activities that require in-person contact between research subjects and staff during the COVID-19 pandemic.

For additional information about this process, please refer to the Human Subjects Research Review page on the OVCR website. If you need assistance, questions may be directed to research@uic.edu.

Dear Lisa Rawle:

Your Claim of Exemption was reviewed on **March 24, 2022.** It was determined that your research meets the criteria for exemption as defined in the U.S. Department of Health and Human Services Regulations for the Protection of Human Subjects [45 CFR 46.104(d)].

Exemption Granted Date: March 24, 2022
Sponsor: None

The specific exemption category under 45 CFR 46.104(d) is: 4

Waiver of HIPAA Authorization:
A waiver of HIPAA Authorization has been granted [45 CFR 164.512(i)(1)(i)] for the use of protected health information (PHI) for research purposes. Please note that disclosure of PHI outside of the UIC covered entity requires a Data Use Agreement.

You are reminded that investigators whose research involving human subjects is determined to be exempt from the federal regulations for the protection of human subjects still have responsibilities for the ethical conduct of the research under state law and UIC policy.

Please remember to:

→ Use your research protocol number (2022-0326) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with the policies of the UIC Human Subjects Protection Program (HSPP) and the guidance ***Investigator Responsibilities***.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact me at choehne@uic.edu or (312) 355-2908, or the OPRS office at (312) 996-1711.

Sincerely,
Charles W. Hoehne
Assistant Director, IRB #7
Office for the Protection of Research Subjects

cc: Marcio Da. Fonseca
Brittaney Hill

CITED LITERATURE

Acs, G., Shulman, R., Chussid, S., & Ng, M. (1999). The effect of dental rehabilitation on the body weight of children with early childhood caries. Pediatric dentistry, 21, 109-113.Adair

1. Amin, M. S., Perez, A., & Nyachhyon, P. (2014). Barriers to utilization of dental services for children among low-income families in Alberta. J Can Dent Assoc, 80, e51.

2. Badri, P., Saltaji, H., Flores-Mir, C., & Amin, M. (2014). Factors affecting children's adherence to regular dental attendance: a systematic review. The Journal of the American Dental Association, 145(8), 817-828.

3. Beazoglou, T., Douglass, J., Myne-Joslin, V., Baker, P., & Bailit, H. (2015). Impact of fee increases on dental utilization rates for children living in Connecticut and enrolled in Medicaid. The Journal of the American Dental Association, 146(1), 52-60.

4. Beiruti, N., Frencken, J. E., Van 't Hof, M. A., & van Palenstein Helderman, W. H. (2006). Caries-preventive effect of resin-based and glass ionomer sealants over time: a systematic review. Community dentistry and oral epidemiology, 34(6), 403-409.

5. Blumenshine, S. L., Vann Jr, W. F., Gizlice, Z., & Lee, J. Y. (2008). Children's school performance: impact of general and oral health. Journal of public health dentistry, 68(2), 82-87.

6. Bonetti, D., & Clarkson, J. E. (2016). Fluoride varnish for caries prevention: efficacy and implementation. Caries research, 50(Suppl. 1), 45-49.

7. Brickhouse, T. H., Dahman, B. A., Peters, B. W., Liu, H., & Kumar, A. M. (2021). The impact of dental Medicaid reform on dental care provider activity and market penetration of dental support organizations. The Journal of the American Dental Association, 152(10), 822-831.

8. Brill, W. (2002). Behavior of pediatric dental patients throughout the course of restorative dental treatment in a private pediatric dental practice. Journal of Clinical Pediatric Dentistry, 26(1), 55-60.

9. Brock Martin A., Vyavaharkar M., Veschusio C., Kirby H., Matern Child Health J (2012) 16;203-211 Rural-Urban Differences in Dental Service Utilisation Among an Early Childhood Population Enrolled in South Carolina Medicaid

10. Byck, G. R., Walton, S. M., & Cooksey, J. A. (2002). Access to dental care services for Medicaid children: variations by urban/rural categories in Illinois. The Journal of Rural Health, 18(4), 512-520.

11. Chalmers N., Children's Access to Dental Care Affected by Reimbursement Rates, Dentist Density and Dentist Participation in Medicaid AJPH Oct 2017, Vol 107, No 10

12. Chi, D. L., & Leroux, B. (2012). County-level determinants of dental utilization for Medicaid-enrolled children with chronic conditions: how does place affect use?. Health & place, 18(6), 1422-1429.

13. Chicago Health Atlas. (2023) Accessed on February 10, from https://chicagohealthatlas.org/

14. Chicago Department of Public Health. Implementation of a Dental Case Management Pilot Project Targeting Chicago Public School Children with Urgent Treatment Needs (2015)

15. Claiborne, D. M., Kelekar, U., Shepherd, J. G., & Naavaal, S. (2021). Emergency department use for nontraumatic dental conditions among children and adolescents: NEDS 2014-2015. Community Dentistry and Oral Epidemiology, 49(6), 594-601.

16. Clarke, M., Locker, D., Berall, G., Pencharz, P., Kenny, D. J., & Judd, P. (2006). Malnourishment in a population of young children with severe early childhood caries. Pediatric dentistry, 28(3), 254-259.

17. Davies RG, Harris NA, Gemmell L. Ludwig's angina. Clinical Intensive Care 2002; 13(1): 43-45.

18. Decker, S. L. (2011). Medicaid payment levels to dentists and access to dental care among children and adolescents. Jama, 306(2), 187-193.

19. Dental Care Health Professional Shortage Areas. (Kaiser Family Foundation, 2022). Accessed on Feb 18, 2023 from https://www.kff.org/other/state-indicator/dental-care-health-professional-shortage-areas-hpsas/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

20. Dye, B. A. (2012). Oral health disparities as determined by selected healthy people 2020 oral health objectives for the United States, 2009-2010 (No. 100). US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

21. Finucane, D. (2012). Rationale for restoration of carious primary teeth: a review. European Archives of Paediatric Dentistry, 13, 281-292.

22. Garcia, R., Borrelli, B., Dhar, V., Douglass, J., Gomez, F. R., Hieftje, K., ... & Tinanoff, N. (2015). Progress in early childhood caries and opportunities in research, policy, and clinical management. Pediatric dentistry, 37(3), 294-299.

23. Garg, S., Rubin, T., Jasek, J., Weinstein, J., Helburn, L., & Kaye, K. (2013). How willing are dentists to treat young children?: a survey of dentists affiliated with Medicaid managed care in New York City, 2010. *The Journal of the American Dental Association*, *144*(4), 416-425.

24. Guarnizo-Herreño, C. C., & Wehby, G. L. (2014). Dentist supply and children's oral health in the United States. American journal of public health, 104(10), e51-e57.

25. Gupta, N., Yarbrough, C., Vujicic, M., Blatz, A., & Harrison, B. Medicaid fee-for-service reimbursement rates for child and adult dental care services for all states, 2016. Health Policy Institute Research Brief. American Dental Association. April 2017.

26. Heidenreich, J. F., Kim, A. S., Scott, J. M., & Chi, D. L. (2015). Pediatric dentist density and preventive care utilization for Medicaid children. Pediatric dentistry, 37(4), 371-375.

27. Illinois Department of Public Health. Healthy Smiles Healthy Growth 2018-2019 (2020) Accessed on February 19, 2023 from https://dph.illinois.gov/content/dam/soi/en/web/idph/files/publications/hshg-201819-report-final-2-21-2020.pdf

28. Illinois Department of Human Services. The Children's Health Insurance Program. (n.d.) Accessed on Feb 20,2023 from https://www.healthcare.gov/medicaid-chip/childrens-health-insurance-program/

29. Jackson, S. L., Vann Jr, W. F., Kotch, J. B., Pahel, B. T., & Lee, J. Y. (2011). Impact of poor oral health on children's school attendance and performance. American journal of public health, 101(10), 1900-1906.

30. Kerins, C., Casamassimo, P. S., Ciesla, D., Lee, Y., & Seale, N. S. (2011). A preliminary analysis of the US dental health care system's capacity to treat children with special health care needs. Pediatric dentistry, 33(2), 107-112. Kreider, A. R., French, B., Aysola, J., Saloner, B., Noonan, K. G., & Rubin, D. M. (2016). Quality of health insurance coverage and access to care for children in low-income families. JAMA pediatrics, 170(1), 43-51.

31. Lin, H. W., O'Neill, A., & Cunningham, M. J. (2009). Ludwig's angina in the pediatric population. Clinical pediatrics, 48(6), 583-587.

32. Logan, H. L., Catalanotto, F., Guo, Y., Marks, J., & Dharamsi, S. (2015). Barriers to Medicaid participation among Florida dentists. Journal of health care for the poor and underserved, 26(1), 154.

33. McKernan, S. C., Pooley, M. J., Momany, E. T., & Kuthy, R. A. (2016). Travel burden and dentist bypass among dentally insured children. Journal of Public Health Dentistry, 76(3), 220-227.

34. McQuistan, M. R., Kuthy, R. A., Daminano, P. C., & Ward, M. M. (2006). General dentists' referrals of 3-to 5-year-old children to pediatric dentists. *The Journal of the American Dental Association*, *137*(5), 653-660.

35. Means Jr, R. T. (2003). Recent developments in the anemia of chronic disease. Current hematology reports, 2(2), 116-121.

36. Medicaid State Fact Sheets Illinois. Kaiser family foundation (October, 2022). Accessed on Feb, 18 2023 fact-sheet-medicaid-state-IL (kff.org)

37. Medicaid/CHIP Coverage of Lawfully-Residing Immigrant Children and Pregnant Women. Kaiser Family Foundation (January 1, 2023). Accessed on February 10, 2023 https://www.kff.org/health-reform/state-indicator/medicaid-chip-coverage-of-lawfully-residing-immigrant-children-and-pregnant-women/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D#note-6

38. Meyer, B. D., Lee, J. Y., Lampiris, L. N., Mihas, P., Vossers, S., & Divaris, K. (2017). " They told me to take him somewhere else": Caregivers' experiences seeking emergency dental care for their children. Pediatric dentistry, 39(3), 209-214.

39. Naaman, R., El-Housseiny, A. A., & Alamoudi, N. (2017). The Use of Pit and Fissure Sealants-A Literature Review. Dentistry journal, 5(4), 34. https://doi.org/10.3390/dj5040034

40. Nasseh, K., & Vujicic, M. (2015). The impact of Medicaid reform on children's dental care utilization in Connecticut, Maryland, and Texas. Health services research, 50(4), 1236.

41. Nebeker, C. D., Briskie, D. M., Maturo, R. A., Piskorowski, W. A., Sohn, W., & Boynton, J. R. (2014). Michigan dentists' attitudes toward Medicaid and an alternative public dental insurance system for children. Pediatric Dentistry, 36(1), 34-38.

42. Nelson, S., Slusar, M. B., Albert, J. M., & Riedy, C. A. (2017). Do baby teeth really matter? Changing parental perception and increasing dental care utilization for young children. Contemporary clinical trials, 59, 13-21.

43. Oral Health in Illinois. (2020). Dental health professional shortage areas. Retrieved from https://oralhealthillinois.org/data-and-maps/workforce/dhpsas/

44. Pollitt, E. (2000). Developmental sequel from early nutritional deficiencies: conclusive and probability judgements. The Journal of nutrition, 130(2), 350S-353S.

45. Robert, H. S., Amid, I. I., & Nigel, B. P. (2007). Dental caries. The Lancet, 369(9555), 51-59.

46. Shulman, E. R., Ngan, P., & Wearden, S. (2008). Survey of treatment provided for young children by West Virginia general dentists. Pediatric dentistry, 30(4), 352-357.

47. Seale, N. S., & Casamassimo, P. S. (2003). Access to dental care for children in the United States: a survey of general practitioners. The Journal of the American Dental Association, 134(12), 1630-1640.

48. Serban, N., Anderson, A., Oberst, G., Edupuganti, N., Ramachandran, R., Solipuram, S. R., & Lu, T. (2022). Assessment of Dentist Participation in Public Insurance Programs for Children in the US. JAMA Network Open, 5(7), e2221444-e2221444.

49. Sheiham, A. (2006). Dental caries affects body weight, growth and quality of life in pre-school children. British dental journal, 201(10), 625-626.

50. Shepherd, M. A., Nadanovsky, P. A. U. L. O., & Sheiham, A. (1999). The prevalence and impact of dental pain in 8-year-old school children in Harrow, England. British dental journal, 187(1), 38-41.

51. Squires Jr, R. H., Shneider, B. L., Bucuvalas, J., Alonso, E., Sokol, R. J., Narkewicz, M. R., & Hynan, L. S. (2006). Acute liver failure in children: the first 348 patients in the pediatric acute liver failure study group. The Journal of pediatrics, 148(5), 652-658.

52. U.S. Census Bureau. (2023) Quickfacts Cicero town Illinois. U.S. Department of Commerce. Retrieved February 18, 2023 from U.S. Census Bureau QuickFacts: Cicero town, Illinois

53. Warder, C. J., & Edelstein, B. L. (2017). Evaluating levels of dentist participation in Medicaid: A complicated endeavor. The Journal of the American Dental Association, 148(1), 26-32.

54. Zhou, J. Y., Elyasi, M., & Amin, M. (2017). Associations among dental insurance, dental visits, and unmet needs of US children. The Journal of the American Dental Association, 148(2), 92-99.

55. Zou, J., Meng, M., Law, C. S., Rao, Y., & Zhou, X. (2018). Common dental diseases in children and malocclusion. International journal of oral science, 10(1), 7.

VITA

Name:	Dr Lisa Rawle
Education:	B.D.S. - University College Cork (UCC) School of Dentistry, Cork, IRL August 2009 - June 2014 Pediatric Dental Residency, UIC College of Dentistry, Department of Pediatric Dentistry — Resident M.S. - University of Illinois Chicago (UIC), Chicago, IL July 2021 present M.P.H. - University of Illinois Chicago (UIC), Chicago, IL September 2022 – present. Focus on Health Policy and Administration
Teaching:	University College Cork July 2020- July 2021 Pediatric Dental Department
Honors:	Graduated UCC (University College Cork) BDS with Honors