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Factors influencing pediatric oral health-related quality of life: a preliminary analysis of the Boston POQL Project

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FACTORS INFLUENCING PEDIATRIC ORAL HEALTH-RELATED QUALITY OF LIFE: A PRELIMINARY ANALYSIS OF THE BOSTON POQL PROJECT

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ABSTRACT

Objective: This study will examine whether there are variations in children's pediatric oral health-related quality of life (POQL) based on socioeconomic status, ethnicity, and disability.

Design: This study is a preliminary analysis of a survey and clinical data of 27 pediatric patients and their parents from 'Caries Severity and QOL in Underserved Populations' project. We surveyed and collected data from parents and children ages 3-14 between April 2011 and March 2012 from the dental clinic at Franciscan Hospital for Children.

Results: The mean age of the patients participated in this study were 4.77. The highest PSR and PRC scores were "PSR: Distress Score" (25.85) and "PRC: Physical Score" (24.91). Parent's POQL score was 18.87 and child's POQL score was 17.51. Out of 27 patients, 25 (92.59%) had at least one oral disease and 2 (7.41) were disease free. Nearly 42% parents said their children's oral health got worse during the past year but their overall health was reported to be

in a good shape. More than three quarters of the patients had Medicaid / MassHealth for dental insurance. Twenty parents said they have never smoked or quit smoking (76.92%) while 6 parents reported they were currently smoking (23.08%). Approximately 46% of the patients were "White / Caucasian" and 27% was "Hispanic" origin.

Discussion: The data indicate that there is a correlation between socioeconomical status and a relatively high number of decayed teeth. It also indicates that the child's oral health not only affects the child's own POHQL but also influences the parent's QOL. Future analyses of the data will determine whether these observations are true with a larger sample size.

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ABBREVIATIONS

ADHD	Attention Deficit Hyperactivity Disorder
BR	Breno Reboucas
ECC	Early Childhood Caries
EVG	Excellent, Very good, or Good
FP	Fair, or Poor
IRB	Institutional Review Board
ID	Identification
NHANES	National Health and Nutritional Examination Survey
Non-REM	Non-Rapid Eye Movement
OHIP	Oral health impact profile
OQOL	Oral health-related quality of life
POHQL	Pediatric oral health-related quality of life
POQL	Pediatric oral health-related quality of life measuring device
PRC	Parent Report on Child
PSC	Parent Self Report
PSR	Parent Report on Child
REM	Rapid Eye Movement
RM	Raffi Miller
SARS	Severe Acute Respiratory Syndrome
TS	Talia Schechter

INTRODUCTION

Background

The oral health status of Americans has continuously improved over the past century.[1-3] As more parts of the country were supplied with fluoridated water after World War II, there was a dramatic decline in dental caries among Americans.[3] Approximately 144 million (including 60 million children) Americans now have access to fluoridated water. In addition to the tap water, most of the toothpaste sold in the U.S. contains fluoride.[4] According to The National Health and Nutritional Examination Survey (NHANES) in 1996, among children between the ages of 6 and 18 years, there has been a 76.9 percent decline in untreated caries and a 79.1 percent decline in untreated carious surfaces from early 1970's to early 1990's.[5] Moreover, it is evident that both dentists and patients are gaining advanced knowledge in dentistry and treatment options.[6] As a result, there has been great strides in the progression from dental restorative care to preventive care over the last 50 years.[7] These trends are reflected in the data collected between 1988-1994 and the data collected between 1999-2004; the use of dental sealants increased, while the prevalence of dental caries decreased.[1] Oral health trends of children below the poverty level correlate with the overall trend but some groups of wealthy children have also shown a downward trend in oral health status.[2] Even with these opposing trends, children from high-income households often receive far more necessary dental care than

children from low-income households.[8] This difference suggests that socioeconomic and poverty status are two very important factors that affect children's oral health.

Health

Health is a very important part of everyday life. John Morgan, the author of *A Discourse Upon the Institution of Medical Schools in America,* describes health as "that choice seasoning which gives a relish to all our enjoyments".[20] Health and being healthy sound very familiar but the concept of health is not so simple.

The World Health Organization defines 'health' as "a state of complete physical, mental and social well-being and not only the absence of disease and infirmity".[9] Illness, on the other hand, is defined as

> "a state of disturbance in the normal functioning of the total human individual including both the state of the organism as a biological system, and of his personal and social adjustments".[16]

There are no universal indicators in measuring health. As a result, it is very common for clinicians and researchers in the medical field to focus mainly on physical outcomes of disease to define 'health'.[10] Some of the common physical indicators used include mortality, morbidity, and disease incidence rates, which represent only a small portion of health.[11] Including the severity of dysfunction, discomfort and disability, and assembling a variety of concepts and indicators will

yield an outcome that better satisfies the definition of health.[10, 12] Future debates will no doubt lead to better integration of abstract concepts and a wide variety of indicators to better define health.[12]

Health Triangle

Sally Nutter, the author of *The Health Triangle*, suggests that the broad concept of health is simplified to three different aspects (physical, social, and mental/emotional health) on an equilateral triangle (Figure 1).[21] Three equal sides on the triangle imply that the three components have to be equally balanced to reach the ideal state of well-being.

Figure 1: Health Triangle. Adapted from "Health Triangle Activities".[24]

Physical health involves the condition of the human body and how it functions anatomically.[22] It is usually divided into five different categories; exercise (weight management), nutrition and diet, sleep, alcohol and drugs, and sexual health.[23] Good physical health can be maintained with a balanced diet, regular sleep cycle, exercise, and avoiding the use of alcohol and drugs.[21-23] The majority of people tend to picture examples related to physical health when they think of health but at the same time, they usually neglect the importance of physical health.[21, 23] "To keep the body in good health is a duty, otherwise we shall not be able to keep our mind strong and clear". This famous saying from Buddha implies that a good physical health is a crucial stepping stone to both mental and social health.

The way we feel, think and act to cope with life define mental health.[25] Factors that influence mental health are learning, stress management, sleep, and mental illnesses/disorders.[22]

Learning is a relatively permanent change in skills, behaviors, knowledge, and values that result from experiences.[22, 27] Learning is an essential part of mental health because it enhances self-confidence, self-awareness, and self-perception.[22]

It is impossible to completely avoid stress in life. However, it is possible to manage the stress level to minimize its effect on mental health or body as a whole. When we are stressed, stress hormones such as cortisol are produced which circulate through the blood. When the concentration of cortisol is increased in the blood, it negatively affects the brain cells (especially the neurons in the hippocampus). A common mental illness associated with high level of stress is depression. "A significant psychological factor in understanding depression is reactivity to stress".[27]

A regular sleep pattern is another important factor for mental health. There are two different cycles of sleep; Rapid Eye Movement (REM) and non-Rapid Eye Movement (non-REM) stages. During REM sleep, also known as a normal stage of sleep, brain temperature, metabolic rate, and neuronal activity increase.[27] Opposite characteristics are observed during non-REM sleep; neuronal activity, metabolic rate, and brain temperature decrease to their lowest level.[27] Even though both stages are crucial for a regular sleep cycle, REM sleep is more important in order to maintain good mental health.

> "Early anecdotal reports of disturbed behavior after REM sleep deprivation suggested that REM sleep is important for mental health...also some reports indicate that REM sleep facilitates learning or memory".[27]

In addition, other studies strongly show the close relationship between REM sleep and neural maturation.[27]

When mental health is poorly maintained for a long period of time, it may lead to mental illnesses. Common mental illnesses include anxiety disorders (obsessive-compulsive disorder, panic disorder, social phobia, and so on), attention deficit hyperactivity disorder (ADHD), depression, and eating disorders.[25] It is very easy to overlook the condition of one's mental health because unlike physical health, it usually does not show any symptoms until the situation goes extremely bad. The signs are often expressed physically (i.e. suicide, weight gain or loss, and self-injury), so this is why all three components of the health triangle are equally important.

The last component that completes the health triangle is social health. Unlike physical and mental health, social health can be viewed from two viewpoints - a society's perspective or an individual's perspective. The society's viewpoint of health is determined by how equally the individuals within a society are treated without any preferences or prejudices.[28] Social health of an individual deals with

> "that dimension of an individual's well-being that concerns how he gets along with other people, how other people react to him, and how he interacts with social institutions and societal mores".[28]

Social health of an individual can be further divided into; public health, family relationships, and peer relationship.[22]

Public health involves preventing disease, prolonging life and promoting health to enhance wellness of individuals and the society as a whole.[22, 29] A good example to emphasize the importance of public health would be the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003. During the outbreak, 8,273 cases were reported worldwide and resulted in 775 deaths where the majorities were infants, young children, and elderly.[30] The primary way the SARS virus is transmitted is by person-to-person contact, which suggests that the SARS outbreak could have been more minimized if people were more diligent with respect to personal hygiene.

Families are groups of people that make up the society. A single unit of family might be small, yet extremely special as family members are the ones that are closest to an individual. Thus, harmonious family relationships are essential for people to stay socially healthy. An ideal family relationship is seen when members cooperate, support and love each other to ameliorate problems and be responsible for their roles within the family.[22]

Peer relationships deal with how individuals interact with friends and other people in the society. Peer relationships are as important as family relationships, especially when young children are becoming adolescents as they are more vulnerable to what others think and act. It is not uncommon to encounter news about bullying at school, which sometimes ends with victims committing suicide.

This is a good example of how peer relationships can influence all three pillars of the health triangle. Healthy peer relationships are those where peers support one another leading to increase happiness and self-esteem.[22]

Health-Related Quality of Life (HRQOL)

Health-related quality of life (HRQOL) is a crucial part of the outcomes of medical treatment and is a good indicator of the "impact of the disease process on physical, psychological and social aspects of a person's life and feeling of well being".[14] HRQOL is a concept that has many variables and according to the World Health Organization, the five most important factors that define HRQOL are; *physical health, mental health, social functioning, role functioning,* and *general health perceptions.*[15] Alternatively, Patrick and Bergner categorizes HRQOL by; *duration of life, impairments, functional status, health perceptions,* and *opportunities.*[13]

Health Survey SF-36 Form

In order to measure this complicated concept, a health survey 'SF-36' was developed by Ware and his colleagues in 1993.[17] Since the development, the SF-36 has been continuously revised and improved, and its second version is now available in more than 140 languages.[18] As shown in Table 1, the SF-36 contains 36 short questions with a list of 11 answer choices to choose from. The most notable advantage of the SF-36 over majority of health surveys is that it is

generic; it can be used universally without being restricted to individual's age, gender, and presence of disease.[19] There are eight sections (Vitality, Physical Functioning, Bodily Pain, General Health Perceptions, Physical Role Functioning, Emotional Role Functioning, Social Role Functioning, and Mental Health) and each section contains 2-10 questions from the SF-36.[17-19] These sections are then separated into two larger categories; Physical Health and Mental Health.[19] Physical Role Functioning, Bodily Pain, Physical Functioning, and General Health Perceptions fall into the Physical Health category, whereas Vitality, Social Role Functioning, Emotional Role Functioning, and Mental Health fall into the Mental Health category.[19] The answers from each section and category is then converted to scores which can be analyzed to make a comparison between different groups of data.[17, 19] Since the SF-36 is a generic survey, the comparisons can be made in both general and specific populations.

Label	SF-36 QUESTIONS
GH1	1. In general, would you say your health is:
HT	2. **Compared to one year ago**, how would you rate your health in general **now**?
	3. The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? Is so, how much?
PF01	a. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports
PF02	b. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
PF03	c. Lifting or carrying groceries
PF04	d. Climbing **several** flights of stairs
PF05	e. Climbing **one** flight of stairs
PF06	f. Bending, kneeling, or stooping
PF07	g. Walking **more than a mile**
PF08	h. Walking **several blocks**
PF09	i. Walking **one block**
PF10	j. Bathing or dressing yourself
	4. During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?
RP1	a. Cut down on the **amount of time** you spent on work or other activities
RP2	b. **Accomplished less** than you would like
RP3	c. Were limited in the **kind** of work or other activities
RP4	d. Had **difficulty** performing the work or other activities (for example, it took extra effort)
	5. During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)
RE1	a. Cut down on the **amount of time** you spent on work or other activities
RE2	b. **Accomplished less** than you would like
RE3	c. Didn't do work or other activities as **carefully** as usual
SF1	6. During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?
BP1	7. How much **bodily** pain have you had during the **past 4 weeks**?
BP2	8. During the **past 4 weeks**, how much did **pain** interfere with your normal work (including both work outside the home and housework)?
	9. These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks**—
VT1	a. Did you feel full of pep?
MH1	b. Have you been a very nervous person?
MH2	c. Have you felt so down in the dumps that nothing could cheer you up?
MH3	d. Have you felt calm and peaceful?
VT2	e. Did you have a lot of energy?
MH4	f. Have you felt downhearted and blue?
VT3	g. Did you feel worn out?
MH5	h. Have you been a happy person?
VT4	i. Did you feel tired?
SF2	10. During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?
	11. How TRUE or FALSE is **each** of the following statements for you?
GH2	a. I seem to get sick a little easier than other people
GH3	b. I am as healthy as anybody I know
GH4	c. I expect my health to get worse
GH5	d. My health is excellent

	SF-36 RESPONSE CHOICES
1.	Excellent, Very good, Good, Fair, Poor
2.	Much better now than one year ago, Somehwat better now than one year ago, About the same as one year ago, Somewhat worse now than one year ago, Much worse now than one year ago
3.	Yes, limited a lot; Yes, limited a little; No, not limited at all
4. & 5.	Yes, No
6.	Not at all, Slightly, Moderately, Quite a bit, Extremely
7.	None, Very mild, Mild, Moderate, Severe, Very severe
8.	Not at all, A little bit, Moderately, Quite a bit, Extremely
9.	All of the time, Most of the time, A good bit of the time, Some of the time, A little of the time, None of the itme
10.	All of the time, Most of the time, Some of the time, A little of the time, None of the time
11.	Definitely true, Mostly true, Don't know, Mostly false, Definitely false

Table 1: Health Survey SF-36 . SF-36 contains 36 short questions with a list of 11 answer choices to choose from. The most notable advantage of the SF-36 over majority of health surveys is that it is generic; it can be used universally without being restricted to individual's age, gender, and presence of disease. Adapted from Ware *et al.*[17]

Oral Health-related Quality of Life (OQOL)

Oral Health-related Quality of Life (OQOL) is a self-report construct specifically pertaining to the functional, social and psychological impacts of oral health and oral disease.[10] As with HRQOL, OQOL is a multidimensional complex of different but related components. These components include survival; history of oral disease and impairment; pain and discomfort associated with chewing and swallowing; emotional functioning associated with smiling; social and cultural functioning; and perceptions of good oral health.[11] OQOL can be viewed from two interrelated perspectives; how the oral cavity affects the body as a whole; and how the overall health and HRQOL affect the oral cavity and OQOL.[11] Figure 2 shows how different factors ("oral disease and tissue damage", "oral pain and discomfort", "oral functional limitation", and "oral disadvantage") influence each other to determine "self-rated oral health".

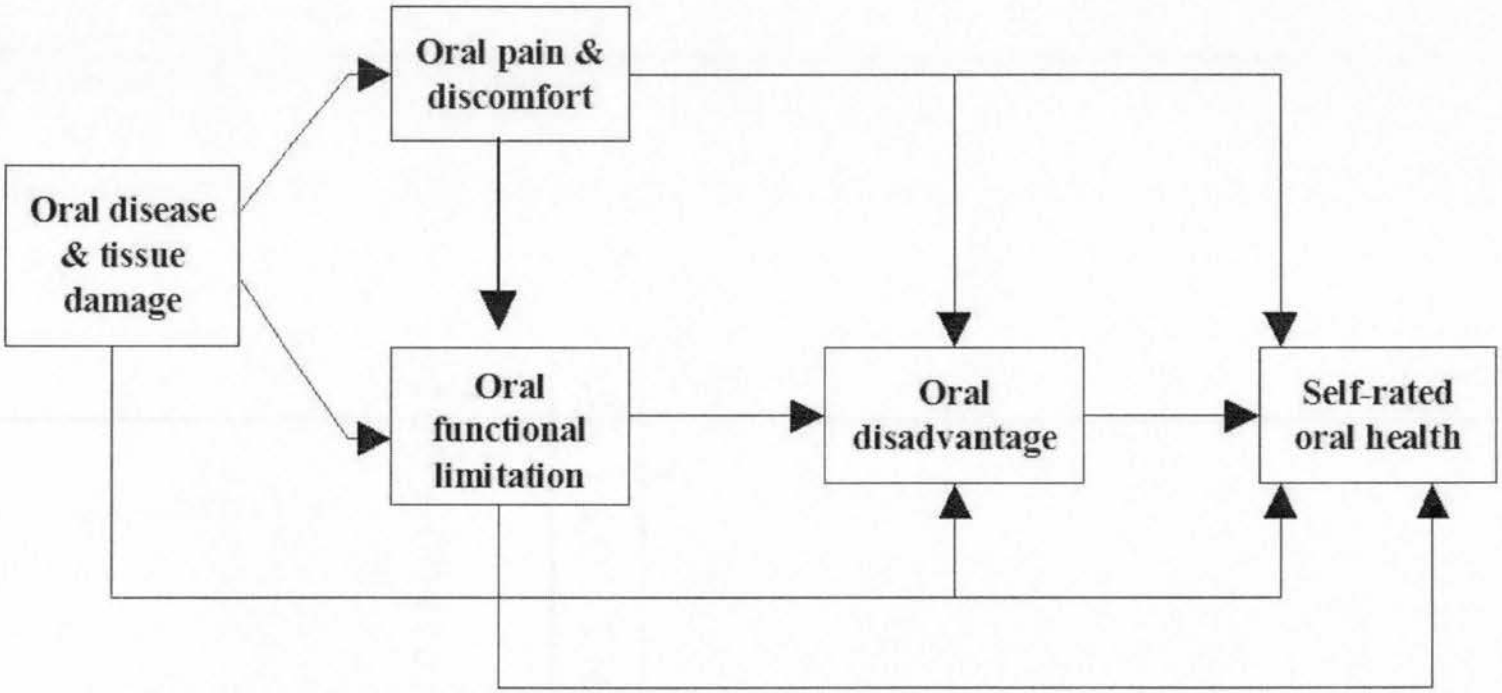

Figure 2: Multidimensional Conceptual Model. There are hierarchical relationships between "oral disease and tissue damage", "oral pain and discomfort", "oral functional limitation", and "oral disadvantage" and they eventually affect "self-rated oral health". Adapted from Gilbert *et al.*[34]

Oral Health Impact Profile (OHIP)

Clinicians and researchers have faced many difficulties in assessing OQOL due to the lack of methods in measurements of the levels of dysfunction, discomfort and disability associated with oral disorders. In order to approach OQOL more efficiently, Oral Health Impact Profile (OHIP) was developed by Slade and Spencer in 1994.[33] The OHIP has 49 questions grouped into seven dimensions (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap).[33] The OHIP has been used by clinicians and researchers as a measuring device for the social impact of oral diseases and other oral health outcomes.

Pediatric Oral Health-related Quality of Life (POHQL)

Early OQOL studies focused mainly on elderly and adult groups.[31] However, as early childhood caries (ECC) has been affecting many young children in the United States and around the world, the interest on this topic has been shifting toward children's oral health during the past decade.[32]

There are many factors that affect pediatric oral health. In order to approach the factors that affect the Pediatric Oral Health-related Quality of Life (POHQL) more comprehensively, Fisher-Owens and colleages developed a multidimensional, multilevel conceptual model. This model, as depicted in Figure 3, not only introduces a variety of factors that influence the POHQL but also shows how

critical it is to understand that "influences do not act in isolation but rather via complex interactions".[26] It is extremely important to understand how they are interrelated because most of the problems associated with the POHQL are so complex and interrelated that removing a single cause will not yield fruitful results. The concentric circles in the figure represent three different levels of the model; community-level, family level, and child-level. As it is represented in the diagram, there is a hierarchical relationship between the levels; the child-level is influenced by the family-level and the community-level, and the family-level is influenced by the community-level.

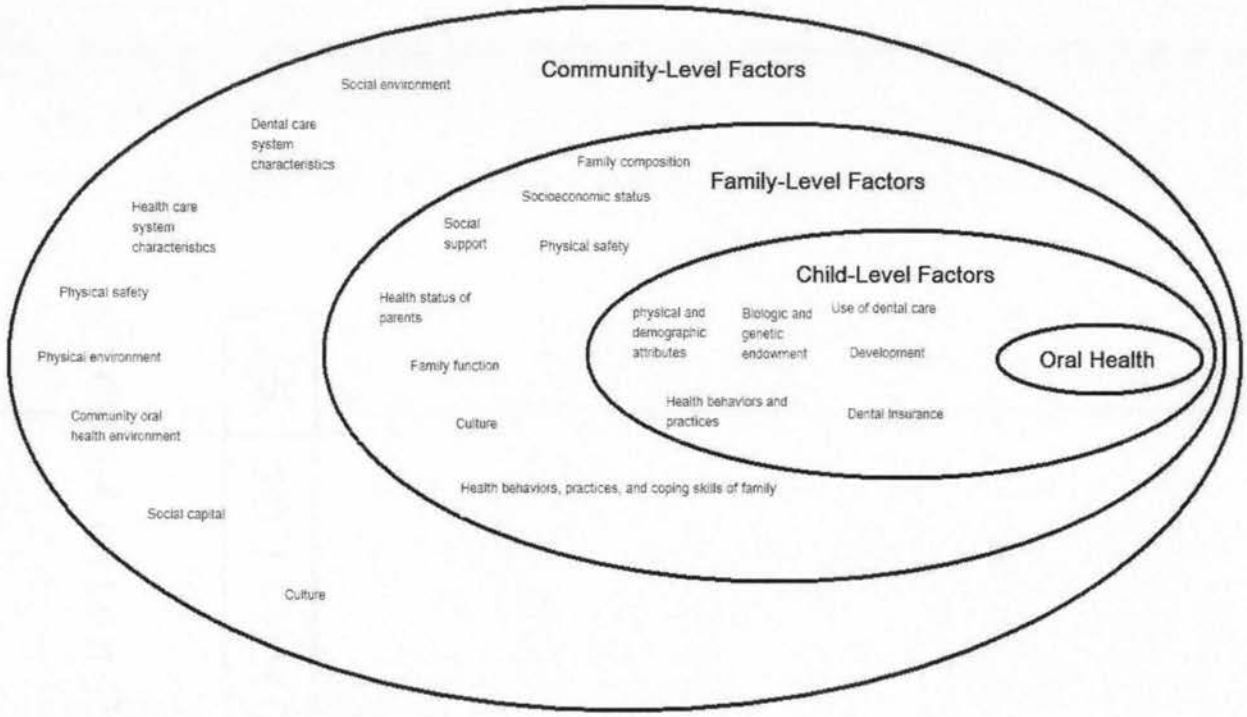

Figure 3: Interrelated Factors influencing Child's Oral Health. The community-level factors can affect the family-level and child-level factors, and the family-level factors can affect the child level factors. Adapted from Fisher-Owens.[26]

Specific Aims

The purpose of this study is to examine the variations in pediatric oral health-related quality of life (POQL) in underserved populations based on race/ethnicity, gender, disability, socioeconomic status, parents' smoking history and Medicaid eligibility. The study will also examine the changes in POQL post-treatment of dental caries. Hypotheses that were tested are:

Hypothesis I: Children with unfilled caries and parents who smoke will have poorer POQL. Additionally, poorer POQL will be correlated with minority, disability and low socioeconomic status (including those on Medicaid).

Hypothesis II: Male children will have more caries and poorer POQL than female children.

Hypothesis III: Treatment of caries will improve POQL of the patients over a 6 month follow up.

To test these hypotheses, we will:

1. Use initial screens and POQL from dental clinics in Franciscan Hospital for Children to obtain patients' information and status.
2. Use follow-up POQL from the two dental clinics above to compare with the initial data.

3. Divide the data based on race/ethnicity, gender, disability, socioeconomic status, parents' smoking history and Medicaid eligibility and perform analyses to determine the relationship between these factors and POQL.

The goal is clarify the role of social, economic, racial, ethnic and disease factors that affect pediatric oral health in underserved populations in the greater Boston area.

STUDY DESIGN AND METHODS

Design and Human Subjects Approval

This study is a preliminary analysis of an on-going survey and clinical data of 27 pediatric patients and their parents from 'Caries Severity and QOL in Underserved Populations' project. This project was approved by the Institutional Review Board (IRB) at Boston University Medical Campus and Franciscan Hospital for Children, Brighton, MA. Data has been collected at both locations since April 2011 and the end date is to be determined. All parents with children ages 3-14 gave written informed consent for their own and their child's participation in the study. All children ages 8-14 also gave written informed assent for their own participation in the study.

Sample

We surveyed and collected data from parents and children ages 3-14 between April 2011 and March 2012 at Franciscan Hospital for Children.

Location	Age	Accompanying Guardian	Language Spoken	Reading Comprehension
Franciscan Hospital	3-14	At least one	English	English

Table 2: **Study Sample Inclusion Criteria.** Data collected are from parents and children ages 3-14 between April 2011 and March 2012 from the dental clinic at Franciscan Hospital for Children

Procedure

An investigator approached and asked parent(s) or legal guardian of children ages 3-14 to participate in the study during their child's first visit to the dental clinic. This process occurred prior to patient's dental appointment to avoid any delay. After parent/guardian's permission, an investigator provided a brief description of the study, answered questions the parent/guardian and children may have. The parent/guardian completed an informed consent and the POQL questionnaire. The children ages 8-14 were asked to sign the informed assent and complete the POQL questionnaire. Once the children completed the questionnaire, they were rewarded with a $5 McDonald's gift card.

Each envelope containing informed consent and/or assent, completed questionnaires, and oral health screener was assigned an identification (ID) number. The oral health screeners were completed by pediatric dental residents based on the dental examination, any radiographs that were taken during the treatment, and the medical history provided by the parent/guardian. Investigators wrote the patient's name and medical record number along with the ID number on a master linking file and stored it securely, separate from the envelopes. After the master linking files were made, the envelopes with the patient's initial visit material and blank questionnaire were stored at Franciscan Hospital until the

patient's follow up visit in approximately 6 months. During the 6 months interval, the investigator brought the completed questionnaires and signed consent forms to the data analyst for coding and data entry. After double data input, questionnaires and consent forms were stored in folders labeled "completed questionnaires" and "signed consent forms", respectively.

When the patient returned for a follow up, one of the investigators asked the parent/guardian and children to complete the second POQL questionnaire that had the same questions as the initial one. Once the children completed the questionnaire, they received a $5 McDonald's gift card. The oral health screeners were again completed by pediatric dental residents based on the dental examination, any radiographs that were taken during the treatment, and the medical history provided by the parent/guardian. After the completion and data entry of two sets (initial and follow up) of questionnaires, the labeled envelope was destroyed and the research material was stored securely until the completion of the study.

Intraexaminer reliability was performed by investigator Raffi Miller (RM), who trained investigators Breno Reboucas (BR) and Talia Schechter (TS) on completion of oral health screener form. To test intraexaminer reliability, RM completed oral health screener forms for 5 randomly selected patients of the first 25 patients examined. Once intraexaminer reliability has been established with

RM, he trained BR and TS, and interexaminer reliability will be performed between RM and BR, BR and TS, and TS and RM, with each completing 25 oral health screener forms and then redoing the oral health screener forms for 5 randomly selected patients. Once interexaminer reliability has been established, any of the investigators RM, BR, or TS continued to complete oral health screener forms for patients involved in the study on a biweekly basis.

Outcomes of interest

The primary outcomes of interest were obtained from the POQL questionnaires and oral health screeners. Clinicians and researchers used the POQL instrument to collect data from the patient and parent-reported oral health-related quality of life of patients.

Analysis

Mean values were calculated by dividing the sum of the values of interest by the number of values (N). Frequency distributions were described. Answers to the questions in the POQL questionnaire have impact scores ranging from 1-12. Burden, Distress, Emotional, Physical, Role and POQL Parent Report on Child and Parent Self Report Scores in Table 4 are means of the impact scores converted to 0-100 scale using a program called *SAS version 9.2,* (Cary , N.C.).

RESULTS

Ages, tooth counts, treatment history, and oral health conditions of the patients participated in this preliminary study are reported in Table 3. Total number of patients who reported their ages was 26 (1 patient missing); the rest of the variables are reported by all 27 patients. The average age of the patients was 4.77, which falls on the lower end of the targeted age range (from 3 to 14). The treatment that was completed the most was "fillings" (0.63), followed by "crowns" (0.48), and then "extractions" (0.22). The mean value of "decay" (6.04) was approximately 23 times higher than the mean value of "sealants" (0.26). Among the 27 patients, the average value of having white lesions turned out to be 0.07.

Variable	N	Mean
Age	26	4.77
Crowns	27	0.48
Decay	27	6.04
Extractions	27	0.22
Fillings	27	0.63
Sealants	27	0.26
Teeth	27	20.30
White Lesions	27	0.07

Table 3: Oral Health Conditions. Ages, tooth count, treatment history, and oral health conditions of the patients are indicated. Column "N" lists the number of patients, column "Mean" lists the average values for each variable.

In the POQL survey, 26 parents rated the health of their children's teeth and mouth (Table 4). The majority of parents (~66%) chose either "fair" or "good"; 8 parents rated their children's oral health as "fair" (30.77%) and another 9 parents rated child's health as "good" (34.62%). There were 4 parents who chose "poor" or "very good" (15.38%). Only 1 parent said the child's oral health was "excellent" (3.85%). So when grouped together, 14 parents rated it as "excellent", "very good", or "good" (53.85%); 12 parents rated it as "fair" or "poor" (46.15%). Table 4 also lists frequency and percentage values of five possible answers to the question "Compared to one year ago, how would you describe the health of

your child's teeth and mouth now?" ("much worse", "somewhat worse", "about the same", "somewhat better", or "much better"). Two parents answered "much worse" (7.69%); 9 parents answered "somewhat worse" (34.62%); 8 parents answered "about the same" (30.77%); 4 parents answered "somewhat better" (15.38%); and 3 parents answered "much better" (11.54%) than a year ago. Cumulatively, 11 parents said their children's oral health got worse to some degree (~42%), 8 parents said it was about the same (~31%), and 7 parents said it got better to some degree (~27%).

Child's oral health	Frequency	Percent
Poor	4	15.38
Fair	8	30.77
Good	9	34.62
Very good	4	15.38
Excellent	1	3.85
EVG	14	53.85
FP	12	46.15
Child's oral health compared to 1 year ago	**Frequency**	**Percent**
Much worse	2	7.69
Somewhat worse	9	34.62
About the same	8	30.77
Somewhat better	4	15.38
Much better	3	11.54

Table 4: Child's Oral Health of Study Participants. Column "Frequency" lists the number of patients applicable to "Child's oral health" and "Compared to 1 year ago" variable, and column "Percent" lists the percentage values based on the "Frequency" numbers. "EVG" stands for excellent, very good, or good. "FP" stands for "fair" or "poor". 26 patients were included in this data.

Table 5 reports the child's race as follows; 12 "White / Caucasian" (46.15%), 7 "Hispanic" (26.92%), 2 "Asian" (7.69%), 1 "Black or African- American" (3.85%), and 4 were other races not indicated (15.38%).

Child's race	Frequency	Percent
Asian	2	7.69
Black or African-American	1	3.85
Hispanic	7	26.92
White / Caucasian	12	46.15
Other	4	15.38

Table 5: Child's Race Reported by Study Participant Parents. Column "Frequency" lists the number of patients applicable to each "Child's race" variable, and column "Percent" lists the percentage values based on the "Frequency" numbers. 26 patients were included in this data

A total of 26 parents who answered the questions regarding dental insurance all had a dental insurance for their children. According to Table 6, patients with Medicaid or MassHealth far outnumbered private and other insurance. Twenty patients had Medicaid / Mass Health (76.92%), 4 patients had private insurance and 2 patients had other insurance.

Insurance	Frequency	Percent
Medicaid / MassHealth	20	76.92
Other	2	7.69
Private	4	15.38

Table 6: Type and Presence of Insurance in Study Participants. Column "Frequency" lists the number of patients applicable to each "Insurance" variable, and column "Percent" lists the percentage values based on the "Frequency" numbers. 26 patients were included in this data.

Table 7 shows the number of new patients who had and did not have oral disease upon their first dental examination. Out of 27 patients, 25 (92.59%) had at least one oral disease and 2 (7.41) were disease free. So patients present with oral diseases were approximately 23 times higher than the "No disease" patients. In addition, "Disease Present" to "No Disease" ratio would be 12.5 to 1.

Oral Health	Frequency	Percent
Disease Present	25	92.59
No Disease	2	7.41

Table 7: Presence of Oral Disease in New Study Patients. Column "Frequency" lists the number of patients applicable to each "Health" variable, and column "Percent" lists the percentage values based on the "Frequency" numbers.

All 27 parents who participated in this study said their children brushed their teeth at least once a day; 10 of them brushed "once a day" (37.04%) and 17 of them brushed "more than once a day" (62.96%) (Table 8).

Additionally, the question "who brushes your child's teeth?" was evaluated from 27 parents. Approximately 52% of them answered that "both parent and child" brushed the children's teeth. 1/3 of them said that the children brushed their teeth by themselves, and only 2 of them answered that they helped their children with brushing their teeth (Table 8).

Brushing per day	**Frequency**	**Percent**
Once a day	10	37.04
More than once a day	17	62.96
Who brushes child's teeth	**Frequency**	**Percent**
Child	9	33.33
Parent	2	7.41
Both parent and child	14	51.85
Other	2	7.41

Table 8: Brushing Frequency and Patterns of Participants. Column "Frequency" lists the number of patients applicable to "Brushing per day" and "Who brushes child's teeth" variables, and column "Percent" lists the

percentage values based on the "Frequency" numbers. 27 patients were included in this data.

When the study participant parents were asked the question "in general, how would you rate the health of your teeth and mouth?", two answered that it was "excellent" (7.69%); 3 said it was "very good" (11.54%); 11 said it was "good" (42.31%); 7 said it was "fair" (26.92%); and 3 said it was "poor" (11.54%). Approximately 62% of the 26 parents thought their oral health was "EVG" and 38% of them thought it was "FP".

Table 9 also shows the parent's own personal experiences with their dentists in the past. Three parents answered that their experiences were "excellent" (12%); 6 of them answered the care was "very good" (24%); 9 said it was "good" (36%); 3 said it was "fair" (12%); and 4 answered it was "poor" (16%). Overall, 18 people had an above average ("excellent", "very good", or "good") past experiences (72%), while 7 people had "fair" or "poor" experiences with their dentists (28%)

Parent's oral health	Frequency	Percent
Poor	3	11.54
Fair	7	26.92
Good	11	42.31
Very good	3	11.54
Excellent	2	7.69
EVG	16	61.54
FP	10	38.46
Parent's experiences with dentist	**Frequency**	**Percent**
Poor	4	16.00
Fair	3	12.00
Good	9	36.00
Very good	6	24.00
Excellent	3	12.00
EVG	18	72.00
FP	7	28.00

Table 9: Study Participant Parent's Oral Health Quality and Personal Experiences with Dentist. Column "Frequency" lists the number of patients applicable to "Parent's oral health" and "Parent's experiences with dentist" variables, and column "Percent" lists the percentage values based on the "Frequency" numbers. "EVG" stands for excellent, very good, or good. "FP"

stands for "fair" or "poor". 26 patients were included in "Parent's oral health" data and 25 patients were included in "Parent's experiences with dentist" data.

A total of 12 parents indicated that they previously smoked (46.15%) and 14 parents indicated they have never smoked in their lifetime (53.85%) (Table 10).

Twenty parents said they have never smoked or quit smoking (76.92%) while 6 parents reported they were currently smoking (23.08%).

Parent Smoked in the Past	**Frequency**	**Percent**
Yes	12	46.15
No	14	53.85
Parent Currently Smokes	**Frequency**	**Percent**
Yes	6	23.08
No	20	76.92

Table 10: Smoking Patterns of Study Participant Parents. Column "Frequency" lists the number of patients applicable to each "Parent ever smoked" variable, "Parent smokes now" variable and column "Percent" lists the percentage values based on the "Frequency" numbers. 26 patients were included in this data.

Study participants parent's education level is reported in Table 11. Eleven parents were a "high school graduate" (44%); 7 reported "some college or 2-year degree or technical school" (28%); 5 indicated they were a "4-year college

graduate" (20%); 1 parent reported that they were "less than high school graduate" (4%); and one additional parent indicated they had received a "graduate degree" (4%).

Parent Education Level	Frequency	Percent
Less than high school graduate	1	4
High school graduate	11	44
Some college or 2-year degree or technical school	7	28
4-year college graduate	5	20
Graduate degree	1	4

Table 11: Education Level of Study Participant's Parents. Column "Frequency" lists the number of patients applicable to each "Parent education level" variable, and column "Percent" lists the percentage values based on the "Frequency" numbers. N= 25 patients.

"Burden", "distress", "emotional", "physical", "role", and "POQL" (PRC and PSR) scores are reported in Table 12 and 13. The scores are calculated from the impacts of each item ("how often did this happen?" and "how bothered were you?" sections from the POQL survey) which range from scores of 1 to 12. The impact scores were normalized and the scores are converted into a scale of 0 to 100, with "0" being totally no problem to "100" being worst problem.

Variable	N	Mean
PRC: POQL Score	27	17.51
PRC: Physical Score	27	24.91
PRC: Role Score	27	3.09
PRC: Emotional Score	27	17.39

Table 12: Parent Report on Child Scores. The scores are calculated from the impacts of each item ranging from 1 to 12.. Column "N" lists the number of patients, column "Mean" lists the average values for each variable. PRC is Parent Report on Child.

"PRC: POQL Score" is a parent report on child's total Pediatric Oral Health-related Quality of Life score based on other PRC scores. These PRC scores include the "Emotional score", "Physical score", and "Role score". The mean value for child's total POQL score turned out to be 17.51.

"Emotional score" is a parent report on child that shows the child was emotionally affected by his or her oral health. In order to generate this score, three PRC questions from the POQL questionnaire were used; "Was your child angry or upset because of his or her teeth or mouth?", "Did your child feel worried because of his or her teeth or mouth?", and "Did your child cry because of his or her teeth or mouth?". The mean score from 27 patients was 17.39 (Table 12).

"Physical score" is a parent report on child about how the child's oral health physically influenced him or her. The POQL questions that were used in this

category were "Did your child have pain because of his or her teeth or mouth?" and "Did your child have trouble eating any foods (hard / hot / cold) because of his or her teeth or mouth?" The mean value for the "physical score" was 24.91, which was second highest mean value in Table 12.

"Role score" is a parent report on child regarding how the child's role was negatively affected by his or her oral health. This score was determined by a single question in the POQL survey; "Did your child miss school or daycare because of his or her teeth or mouth?" The mean from 27 patients was 3.09 and it was the lowest average score in Table 12.

Variable	N	Mean
PSR: POQL Score	27	18.87
PSR: Burden Score	27	9.57
PSR: Distress Score	27	25.85

Table 13: Parent Self Report Scores. The scores are calculated from the impacts of each item ranging from 1 to 12. Column "N" lists the number of patients, column "Mean" lists the average values for each variable. PRC is Parent Report on Child. PSR is Parent Self Report and POQL is Pediatric Oral Quality of Life.

"PSR: POQL Score" is a parent self-report of total Pediatric Oral Health-related Quality of Life score based on two other PSR scores. These PSR scores include

the "Burden score" and the "Distress score". The mean value for child's total POQL score turned out to be 18.87.

"Burden score" is a parent self-report that represents how burdensome the health of the child's teeth and mouth to the parents, which ended up negatively influencing the parents' everyday routine. The score was calculated based on three questions from the POQL questionnaire; "Did your child have pain because of his or her teeth or mouth?", "Did you miss work because of your child's teeth or mouth?", and "Did your child need more attention from you than usual due to his or her teeth or mouth?" The answers from all 27 patients were used to generate the mean score of 9.57, which was the second lowest mean value in Table 13.

"Distress score" is a parent self report that deals with how the parents were stressed or psychologically suffered from the child's oral health. The questions that were used from the POQL questionnaire to generate the "distress score" were; "Were you worried about paying for your child's dental treatment?", "Did you feel guilty because of problems with your child's teeth or mouth?", "Did you feel angry or frustrated because of problems with your child's teeth or mouth?", and "Did you feel helpless because of problems with your child's teeth or mouth?". The average "distress score" was the highest mean value in Table 14, which was 25.85.

Linear regressions tested the relationships between caries and parent reports on their child's quality of life (POQL) and how the child's oral health affected their daily lives (PSR). The number of decayed teeth was significantly related to PSR ($p=0.014$; adjusted R-squared=0.19). However, in this small sample, the number of decayed teeth was not significantly related to POQL ($p=0.15$; adjusted R squared=0.04) nor was it related to current smoking status of parents ($p=0.16$; adjusted R square = 0.04).

Summary

The mean age of the patients participated in this study was 4.77 and they had approximately 6 decayed teeth on average. The highest PSR and PRC scores were "PSR: Distress Score" (25.85) and "PRC: Physical Score" (24.91). Parent's POQL score was 18.87 and child's POQL score was 17.51. Out of 27 patients, 25 (92.59%) had at least one oral disease and 2 (7.41) were disease free. Nearly 42% parents said their children's oral health got worse during the past year but their overall health was reported to be in a good shape. More than ¾ of the patients had Medicaid / MassHealth for dental insurance. Twenty parents said they have never smoked or quit smoking (76.92%) while 6 parents reported they were currently smoking (23.08%). Approximately 46% of the patients were "White / Caucasian" and 27% was "Hispanic" origin.

DISCUSSION

The Boston POQL Project targeted parents and children ages 3-14 at Franciscan Hospital for Children to measure their QOL and OQOL. The mean age of the children that participated in this study was 4.77, which is on the lower end of the age range. This phenomenon was observed because it is more common to see dentists for the first time when children are younger. So the majority of new patients were younger than 8 years. In addition, the mean value of "decay" is highest in because patients as parents often wait until they get dental caries or other oral diseases to see dentists. This assumption is evidenced by the results that approximately 42% of parents said that their children's oral health worsened when compared to 1 year ago. One possible reason behind this might be explained socioeconomically as limited access to dental health benefits and expensive dental care costs are known issues that have been negatively influencing POHQL.

According to Table 13 and 14, the highest or worst average score turned out to be "PSR: Distress score", which indicates how the parents were stressed or psychologically suffered from the child's oral health. Of importance was that overall PSR scores were related to number of carious teeth.

The second highest mean score was "PRC: Physical score", which indicates the impact of a child's oral health on their physical condition. It is very interesting to observe that the score measuring the parent's stress level is worse than the score directly measuring the child's physical discomfort indicating parent's empathy for their children which implies that the child's oral health not only affects the child's own POHQL but also influences the parent's QOL. This hypothesis is further evidenced when the parent's and the child's POQL mean scores are compared; the parent self-reported PSR score was 18.87 and the parent report on child POQL score was 17.51.

Future Research

This preliminary study identified a number of potential correlations and variables related to POQL, however, the sample size was unfortunately too small to report statistically significant conclusions. Also, this study was not able to include the patient's 6-month recall data. The 6 month recall data will show how patient's POQL and parent's QOL change following dental treatment. The Boston POQL Project members are currently recruiting new patients and will continue to do so until the sample size reaches sufficient statistical power to test to what extent oral disease affects parent reported quality of life in their children and the importance of oral disease in their day-to-day lives.

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