Early Childhood Caries under General Anesthesia: a Burden Analysis

THESIS

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By

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Abstract

Purpose: The overall objective of this study was to identify the economic burden of treatment of early childhood caries (ECC) under general anesthesia (GA) at a large urban tertiary care facility. A secondary aim was to compare quality of life indicators to child-specific (health status, socioeconomics, and number of teeth restored) variables.

Methods: This IRB approved cross-sectional study consisted of a cohort treated at the Nationwide Children's Hospital Dental Clinic Surgery Center. Parents of qualifying patients were asked to complete a pre-operative and day-of-surgery 'balance sheet' outlining associated costs (both dollars and time). Following surgery, families were contacted within 48-72 hours of surgery to complete a post-operative balance sheet.

Results: Data from 105 families were collected and analyzed. Children treated had a mean of 8.4 teeth restored. The mean reported annual income for families was $26,447. Families traveled a mean of 104 ± 84 miles one way to access dental care. Families spent a mean of $32.50 ± 69.17 on visits related to ECC care under GA. Parents lost a mean of 10.5 hours ± 11.6 from work and a mean of 4.9 ± 6.8 hours of sleep taking care of their children. Nineteen percent of parents reported missing at least one meal to bring their child to the surgery appointment.

Conclusion: The burden of ECC and its treatment under GA go beyond the visible dental restorative work to include significant economic and time costs.

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Chapter 1: Introduction

Dental care has been identified as the most prevalent unmet health need in U.S. children.[1] About 2% of infants in the U.S. age 12 to 23 months have at least 1 tooth with questionable decay, and 19% of children 24 to 60 months of age meet the criteria for ECC (Early Childhood Caries).[2] Research has shown that children living in poverty suffer twice as much tooth decay as their more affluent peers, in which case their disease is more likely to go untreated.[3] Furthermore, one in four American children are born into poverty (annual income of $17,000 or less for a family of four).[2] This combination of inadequate access to dental care and poor nutritive choices results in more than half of the 4 million children born annually to have cavities by the time they reach the second grade.[4]

Measuring and Defining "Oral Health-Related Quality of Life"

The concept of health-related quality of life (HRQoL) has been researched heavily over the last several decades, but only recently has become of significant interest within the field of dentistry. This may reflect the fact that we no longer aim just to prolong life, but to render it free of disease and make it better. The issues addressed by the terms "health-related quality of life" and "quality of life" are important determinants of care seeking, adherence to treatment regimens, and satisfaction with care received.[5]

Over the years several explanations have been expressed, however the exact definition is still unresolved. Locker has varying descriptions of quality of life including: "when talking about oral health, our focus is not on the oral cavity itself but on the individual and the way in which oral disorders, diseases and conditions threaten health, well-being, and quality of life" and "the extent to which oral disorders affect functioning and psychosocial well-being".[5] Baens-Ferrer et al.[6] describe the concept as "multidimensional, including factors such as: absence of symptoms, absence of pain or discomfort, social-emotional functioning, perceptions of oral health, and satisfaction with oral health". It is clear to see that these descriptions encompass a broad aspect of human life.

To date, there are a number of measures to assess OHRQL, with several more being developed.

Oral Health-Related Measures	
Social Impacts of Dental Disease	Oral Impacts on Daily Performances (OIDP)
General (Geriatric) Oral Health Assessment Index (GOHAI)	Subjective Oral Health Status Indicators (SOHSI)
Dental Impact Profile (DIP)	Oral Health-Related Quality of Life Measure
Oral Health Impact Profile (OHIP)	Dental Impact on Daily Living (DIDLS)
Child Oral Health Quality of Life Questionnaire (COHQoL)	Oral Health Quality of Life Inventory
Child Oral Impacts on Daily Performance (OIDP)	OHRQOL for Dental Hygiene
Early Childhood Oral Health Impact Scale (ECOHIS)	Parental-Caregivers Perceptions Questionnaire
Family Impact Scale	Surgical Orthodontic Outcome Questionnaire (SOOQ)

Table 1.1 Oral Health-Related Quality of Life Measures[5,7,8]

Although these measures do provide valuable information, due to the controversy of the definition of OHRQL, it remains uncertain as to whether the measures are useful for oral research and practice.[9] Furthermore, many measures that claim to assess health-related quality of life or quality of life have been criticized because they reflect the values and concerns of physicians, social scientists or other experts rather than patients or persons and what they consider to be relevant.[5] Therefore, when assessing quality of life components, it is suggestive that their significance and meaning are unique to the individual.[10]

Influences on Children's Oral Health

An increasing number of studies identify factors which influence a child's oral health. In the past decade, a seminal model by Fisher-Owens et al[11] expanded dental disease epidemiology from a basic biological model to incorporate additional influential factors in the social and physical environments of children, including socioeconomic status, ethnicity, culture, stress, health behaviors, and the health care system. Although these factors seem individualized, their interactions are very complex, and poorly understood.

Fisher-Owens et al.[11] describes influences of oral health based on a child, family, and community level. The child-level influences include: genetics and biological factors, physical (shorter height and low birth weight) and demographic (race and ethnicity) factors, health behaviors and practices (exercise and nutrition), development (school

performance), the child's level of self-esteem, and the number of primary care visits the child has attended. Also, previous caries experience is a significant predictor of future caries. On the family-level, influences include: family structure (single-parent household), family function (effective/ineffective responses to stress), socioeconomic status (plays a role in the types of foods people buy), health behaviors (prenatal vitamins), and social support (strong support system leads to less risk-taking behaviors, such as tobacco and alcohol use). Within the community-level, influences may include: social environment (neighborhood safety and educational attainment), social capital, physical environment (fluoridation of water, healthy food options), dental and health care systems (is preventive care available?), and culture (diet, attention to dental hygiene, health beliefs).[11] In 2009, Casamassimo et al.[12] modified the Fisher-Owens concept into a morbidity pyramid for ECC.

Figure 1.1 Morbidity and Mortality Pyramid of ECC[12]

This pyramid illustrates that while we understand that there are additional morbidities associated with ECC, very few studies have quantified these morbidities into concrete terms.

Dental Decay Affects the Quality of Life of Children and Families

It is well established that, dental disease can affect a child's overall development and well-being.[12,13,14,15,16] Research suggests that decay can affect a child physically, emotionally, and intellectually.[15] As a result, many children will experience disruption of eating habits, sleeping patterns, disposition, and school performance. ECC may even lead to a lack of self-esteem resulting in a lower level of social functioning.[15] Anderson et al.[17] found that before dental treatment under general anesthesia (GA), 48% of children had complained about their teeth, 43% had problems eating certain foods, 61% had difficulty finishing meals, 35% did not sleep well, and 5% had shown some form of negative behavior. Another study found that ECC patients weighed 13.7 less than 80% of their ideal weight, thereby satisfying one of the criteria for the designation of failure to thrive.[13]

Blumenshine et al.[14] states that poor oral health was 1.4 times more likely to correlate with poor school performance, and according to the CDC, more than 51 million school hours are lost each year because of dental-related illness.[3] Similarly, Mouradian et al.[1] found that children with dental problems lose an estimated 52 million school hours annually. However, this number may be a misrepresentation since the study does not

define the type of dental problems, or the venue in which the treatment was completed, which caused such a significant amount of school to be missed.

Pain is often a complaint among children with dental decay. In an unpublished study by Allen et al.[18], the average time a child spent in pain before accessing dental care was 17.7 days (±2.2 days). In 2006, another study reported that 16% of five-year-olds and 26% of 12-year-olds have experienced pain over the last 12 months.[15] With such a high percentage of children experiencing pain for such a long duration of time, it is clear how children's and families' lives can be affected.

ECC may further impact families, whereby parents/caregivers feel a sense of guilt for their child's condition. Further concerns include: treatment costs, the ability to access care, and stress related to the attention of the affected child. These quality of life issues may affect families daily, leading to sleep loss, time lost from school and work, exhausted wages, travel expenses, and expenditures related to pain medication and other medical costs.

The Burdens of Dental Decay

Research has shown that ECC is more prevalent among families of lower socioeconomic status, and in certain ethnic or cultural groups.[19] Culture has been shown to affect prevention and care-seeking behavior.[11] Parental stress of daily life has also been noted as being influential on the care of their child's teeth.[20] Likewise, Reisine et al.[21] reports that dental knowledge and life stress contribute as predictors of decayed, missing, or filled surfaces on primary teeth. He classifies the types of stress experienced

by parents as: economic; sociodemographic (employment, marital discord and number of other children); maternal psychological (daily tasks of parenting, worries about a child's well-being); and child-related (behavior, eating habits and dental health care).[20]

Two common difficulties among people in lower socioeconomic groups are: 1) the caregivers often have less autonomy in their jobs making it difficult to take time away from work to regularly attend dental appointments and 2) they are not financially able to support the burden of paying for travel expenses, day-care, dental treatment, and the incurred lost wages. Mouradian et al.[1] notes that access to oral health care for near-poor families, who do not qualify for Medicaid or SCHIP, may be limited by the lack of employer-based dental insurance and the exclusion of dental-related conditions from definitions of medical necessity. They also found that even for children covered by Medicaid, only 1 in 5 children received preventive oral care for which they are eligible.[1] Unfortunately, this lack of utilization of preventive services was a result of the parents being unable to leave work.

Due to the fact that culture and socioeconomic status play a role in dental decay, children coming from high-risk populations are in great need of preventive care. However, all too often these children do not receive preventive services as a result of the aforementioned reasons. Hence, many high risk children do not access dental care until the disease is extensive, in which case general anesthesia (GA) is the most cost-effective and compassionate way of treating their dental needs.

Prevention is the Key

Financially, ECC can be a very costly disease to treat. Depending upon the extent of decay, and the manner in which treatment is completed, costs can range from hundreds to thousands of dollars. If treatment is completed under GA, the expenses include not only the dental treatment costs, but also operating room expenses and the cost of the anesthetic agent. A study done by Lee et al.[25] in 2001, determined the mean GA charge (excluding the cost for dental procedures) was $2,326.

The American Dental Association's (ADA) charges related to GA are the following: GA for the first 30 minutes = $64 (code D922) and each additional 15 minutes = $21 (D9221).[22] So with thousands of children annually in the United States receiving GA to have their dental needs treated, expenditures are in the millions of dollars for treatment of a disease which is largely preventable.[12] With an expense of this nature, it is clear how ECC poses an economic burden among families, employers, insurance companies, and public health care programs. This speaks to the argument that early and routine preventive care, fluoridation, and sealants can be cost-effective in reducing disease burden and associated expenditures.[23]

Recent studies have demonstrated that children who had their first preventive dental visit by age 1 were more likely to have subsequent preventive visits but were not more likely to have subsequent restorative or emergency visits.[2] It is predicted that the annual cost savings of regular screening and intervention are $66-$73 per tooth surface.[23] Preventive services can also be cost-effective in terms of indirect costs such as time and wages lost from work. In one year, 148,000 hours of work was lost per 100,000 workers

due to dental visits.[24] Therefore, the consequences of one individual's work loss multiplied over the employed population in the U.S. could result in millions of hours of lost productivity in any given year.[24] Lee et al.[25] further describe societal costs extending beyond hours lost from work and income forgone. Other costs that must be taken into account include: children missing school due to pain or dental appointments or for school nurses or teachers who must take time with such children, in which case, little has been reported in the literature relative to societal cost comparisons for children's dental care. Lee et al.[25] concluded that the mean societal cost (including lost wages, but excluding dental procedural costs) was $2,698.

Parental Acceptance of General Anesthesia for Dental Rehabilitation

Parental acceptance of general anesthesia relative to other behavior management techniques has increased over the past 2 decades.[26] According to Eaton et al.[26], today general anesthesia is ranked as the third most acceptable technique below tell-show-do and nitrous oxide. This was not the case 25 years ago, as shown by Murphy et al.[5] in 1984. His study found that parents were most accepting of tell-show-do and least accepting of the papoose board and general anesthesia, not to mention that, parents of higher social status demonstrated less approval for general anesthesia than did parents of low social status.[26] A similar study done in 1991 showed that general anesthesia ranked the least acceptable of the behavior management techniques among parents.[27] Over the years as opinions have changed and more people are familiar with outpatient surgeries, many feel that general anesthesia allows for high-quality dental care to be completed

safely and efficiently. Furthermore, it may prove to be the choice of behavior management technique for treating special needs patients and children with severe dental decay. However, despite its many advantages, there is a higher level of risk and cost involved, as compared to conventional care.

According to Kanellis et al.[28], the average cost for dental care provided to a child in a hospital operating room under GA was $2,009 per case, compared with $104 for non-hospitalized children[29]. In one study, hospitalization increased the cost to as much as $6,000 per patient.[29] The breakdown of costs consisted of "sixty-two percent of the allowed charges were for the hospital costs, 22% for the dentist's care, and 16% for the anesthesia care".[28] It is common within health economic studies that cost data come from administrative sources such as hospitals, health insurance companies, and health care providers.[30] However, this data fails to include expenditures like travel expenses, OTC medications, and other miscellaneous health care costs.

It has been shown that families can accrue significant financial and non-monetary expenses throughout the course of the GA process.[25,28,29] Pain medication, travel expenditures, lost wages, dietary changes, daycare, and hotel and parking are among the most substantial monetary expenses. However, it is important to keep in mind the non-monetary factors like sleep loss, missed meals, and missed school. Having sleep disrupted frequently because a child awakes with dental pain or having to prepare different food because a child's teeth hurt can be burdensome on families.[17] Because there is often a considerable amount of time which passes from initial dental exam to the surgery date, the child's and families' quality of life can be impacted for quite some time.

No research to date has explored the widespread impact that the treatment of dental caries under general anesthesia has on families. Anderson et al.[17] reports that out of 44 families, 21 had incurred a loss of income before their child's GA. In the same study, 66 parents or caregivers arranged time away from work on the day of surgery, and 47% of those lost income as a result.[17] Another study done by Holt et al.[30], showed that out of 103 children, 79 adults took time from work, 29 of those incurred a loss of salary, and 34 families had to make arrangements for the care of their other children.

The primary reason for dentally related time loss seems to be difficulties in obtaining care during non-work of non-school hours.[24] Other factors affecting total time lost from work due to oral health care consist of: previous time loss, low income, being non-White, having poorer oral health, and having greater treatment need.[24] Thus, the burdens of ECC expand through community levels to affect society as a whole.

Quality of Life Following General Anesthesia

OHRQOL has been used to measure the oral health outcomes for children following dental rehabilitation under GA. In a study by Acs et al.[31], an improvement in pain was the predominant outcome, while children with special health care needs were more likely to have improved eating and sleeping abilities and significantly improved overall health.[6] Parent's also reported more smiling, improved school performance, and increased social interaction after the procedure.[20] Also, following therapeutic intervention, ECC children exhibited significantly increased growth velocities, reflecting the phenomenon of catch up growth.[13,16]

Despite such a positive change in the QOL of the child and their families, it is unrealistic to assume that their long-term overall oral health will improve. One study found that only 10% of patients returned for recall visits once treatment was completed.[32] This low recall rate may be that parents do not consider the need for dental visits after treatment is complete since the child is no longer in pain.[32] Consequentially, studies have shown that once a child receives dental treatment under GA, they are much more likely to receive it again in the future.

Almeida et al.[33] showed that 33 of 42 ECC children had detectable lesions at subsequent recall visits and of the 42 patients 17% required retreatment under general anesthesia within two years following their initial full-mouth rehabilitation. Among parents of children who received GA again, Amin et al.[34] found that they perceived their child to be less susceptible to new cavities because all the teeth were now "fixed" and they were less motivated to spend time and energy on their child's oral health. In a similar study done by Amin et al.[34], parents of children who underwent GA again had poor dental self-efficacy related to their child, which stemmed from: (1) own poor childhood dental care; (2) inadequate or incorrect knowledge; (3) limited family income; and (4) external influences (i.e. access to dental services and commercial products). Therefore, to improve children's oral health we need a better understanding of how parents' beliefs and attitudes are operationalized within the context of the family, and in relationship to the surrounding external environment.[35] There is need for further research to examine the widespread impact of treatment of dental caries under general anesthesia,

including the overall burden and financial costs for the family. The overall objective of this study was to identify the burdens of general anesthesia placed upon families.

Specific Aim

The specific aim of this study is to compare indicators of quality of life and see if they differ as a function of gender, ASA status, socioeconomic status, medical care costs, time, and number of teeth restored.

Chapter 2: Methods

Sample

This IRB-approved cross-sectional study, examined a population of healthy, English-speaking children with American Society of Anesthesiologists (ASA) I or II classifications. Children had no previous history of dental rehabilitation under GA, and there were no age criteria to participate in this study. A follow-up interview was essential to the study design, therefore the patient/caregiver who did not have a telephone or who were non-English speaking were excluded.

The sample were the parents/primary caregivers of children receiving dental rehabilitation under GA in the Dental Surgery Center at Nationwide Children's Hospital. While the child was being treated under GA, the parents/caregivers were informed of the study, invited to participate, and consent verbally obtained. The parent/caregiver was given an incentive to participate in the study, which included a $25 gift card to a grocery store or a $20 gas card; this research was supported by a Nationwide Children's Hospital Intramural Grant #241209.

Procedure

The parent/caregiver was asked to fill out demographic information, along with data under the "Pre-operative" and "Day of Surgery" columns on the survey form

(Appendix A). If a parent/caregiver declined, or refused to fill out the required data, the survey was not included in the study. A standardized telephone interview was performed in which the parent/caregiver was contacted approximately 48-72 hours following surgery to collect data within the "Post-operative" column (Appendix A). Four operators collected the "Pre-operative" and "Day of Surgery" data, while only one operator contacted the families by phone. In obtaining the "post-operative" information, a standardized script was used in which the phone operator requested to speak with the caregiver who filled out the "pre-operative and "day of surgery" data. If the phone operator could not contact the family within 72 hours, they were disqualified from the study. The incentives were mailed to the patient upon completion of the post-operative phone call.

Parameters Measured

To fulfill the objectives of this study it was important to measure several key parameters, including the distance families traveled, time lost from work/school, sleep loss of child and caregiver, number of teeth treated, yearly family income, and other ancillary medical costs.

These parameters were developed to determine the amount of burden that families undergo throughout the GA process. The distance the families traveled, along with the related travel expenses, allowed us to obtain a general idea of the access to care that our participating families endure. The time lost from work and school puts into perspective the income foregone and the time burden placed on the families. Additionally, the sleep

loss of the child and the caregiver is another factor that represents the time burden that families undergo. The number of teeth treated was valuable to determine whether a correlation existed between it, and the distance the families traveled, their yearly income, and whether it affected the families' quality of life. The other ancillary medical costs included: expenses related to pain medication, parking, and medical or physician bills. The yearly family income was obtained from the caregiver so as to reveal whether it correlated with the aforementioned factors.

Statistical Analysis

A power analysis was completed with the data collected. Utilizing a power of .8 and an alpha of .05, it was concluded that a minimum of 100 subjects would be needed to exhibit statistical significance so as to either reject of not reject the null hypothesis. Data was analyzed using the two-tailed student's t-test for the continuous variables and the Fishers-exact test for the categorical variables.

Chapter 3: Results

A total of 123 families qualified for the study by filling out the "pre-operative" and "day of surgery" data at the time of the GA appointment. Eighteen of these surveys could not be included in analyses due to errors or omissions in their completion, presumably the phone operator could not attain "post-discharge" information. Therefore, data from 105 (85%) families were used.

Age, Gender, and ASA Status

Ages of the patients ranged from 1yr, 9months to 20yrs. Fifty-one males (48.6%) and 54 females (51.4%) participated in the study. Sixty-eight patients (64.8%) were ASA I, 35 (33.3%) were ASA II, and only one (.1%) was ASA III. Of 105 study patients, 76 (72.3%) of the cases had the mother accompany the child to the GA appointment and complete the data sheet; the father attended 20 (19%) of the cases, and an "other 3rd party guardian" attended in 7 of the cases (6%) of the time. Table 3.1 displays the breakdown of the demographic data.

Gender	ASA Status	Guardian
Males-51 (48.6%)	I-68 (64.8%)	Mother-76 (72.3%)
Females-54 (51.4%)	II-35 (33.3%)	Father-20 (19%)
	III-1 (<1%)	Other 3rd party-7 (6%)

Table 3.1 Demographic Data

Income

Table 3.2 illustrates the yearly income levels of the families participating in the study based on the FPL.[36] Twenty-two (21%) of the families' incomes were 200% of the Federal Poverty Level (FPL), 5 (4.7%) were between 176%-200% of the FPL, 17 (16.2%) were between 151%-175% of the FPL, 4 (3.8%) between 134%-150% of the FPL, 16 (15.2%) between 101%-133% of the FPL, 14 (13.3%) between 76%-100% of the FPL, 14 (13.3%) between 51%-75% of the FPL, 6 (5.7%) between 26%-50% of the FPL, and 11 (10.5%) were <25% of the FPL.[36]

Income Level[36]	Number of Families
200%	22
176-199%	5
151-175%	17
134-150%	4
101-133%	16
76-100%	14
51-75%	14
26-50%	6
<25%	11

Table 3.2 Yearly Income Status of Study Cohort[36]

Assistance Received for Transportation

Only 8 (7%) families received assistance for transportation costs. The breakdown of assistance was $1-10, $11-20, $21-30, $31-40, $41-50, and $50+. One family received $1-10, two received $11-20, one $21-30, three received $31-40, one received $41-50, and none received greater than $50. Typically, the families obtained the travel money from publicly-funded assistance programs. Figure 3.1 represents the assistance the family received for transportation.

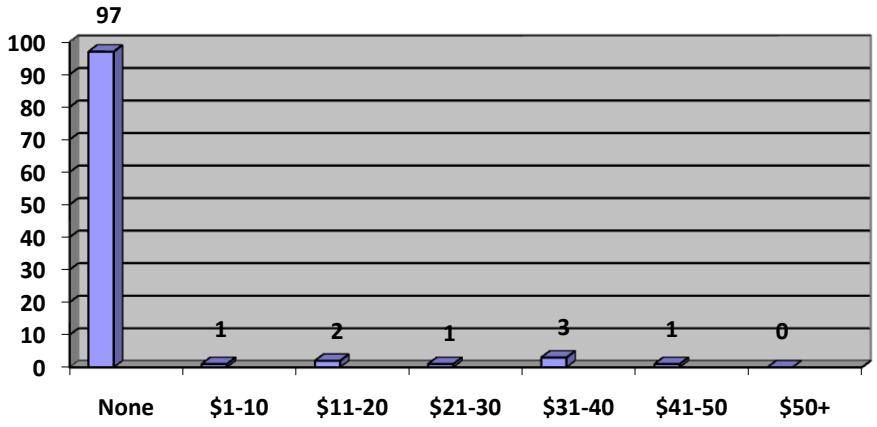

Figure 3.1 Transportation Assistance

Treatment Completed

The mean number of teeth treated was 8.2. Treatments varied from stainless steel crowns (including kinder crowns), pulpotomies, composites (including strip crowns), and extractions. The treatment was completed by either full-time faculty or residents at

Nationwide Children's Hospital as it was more convenient to obtain information needed from the patient's chart. Also, it allowed a more standardized approach to treatment planning to be incorporated. Table 3.3 shows the number of teeth treated according to the therapy done.

	Stainless Steel Crowns	Pulpotomies	Composites	Extractions	Total
Study Cohort	435±2.87	141±1.73	201±2.39	243±2.01	879±3.60

Table 3.3 Treatment Completed by Therapy

Socio-economic Costs

The results of the data sheets are presented in Table 3.4. No parents/caregivers reported missing any meals pre-operatively for the H&P, and there was no cost of medication on the day of surgery due to the child being NPO prior to the surgery. The cost of travel was calculated using the following formulas (travel expense was calculated using the average price of fuel during the month in which the child/family traveled for the associated appointment and 22.5mpg being the average mileage a vehicle got during the last U.S. Transportation Bureau survey in 2007[37]):

Pre-operative: (mileage) * (gas)[38] / 22.5mpg[37] = travel expenses ($)

Day of surgery: (mileage (to DSC & daycare)) * (gas)[38] / 22.5mpg[37] = travel expenses ($)

Post-operative: (mileage (pain medication)) * (gas)[38] / 22.5mpg[37] = travel expenses ($)

Total: (pre-op + day of surgery + post-op) = total travel expenses ($)

The mileage and travel expenses reflect "one-way" travel, so values must be multiplied by 2 to attain the total distance traveled with travel expenses. No "post-operative" data was obtained after 72 hours of the GA appointment.

	Pre-operative	Day of Surgery	Post-operative	Total
Missed work (hrs)	3.6±5.7	4.6±4.5	2.4±4.8	10.5±11.6
Missed school (hrs)	1.7±3.5	2.3±3.2	1.6±3.8	5.5±8.5
Sibling/s missed School (hrs)	.6±2.2	.6±2.1	.1±1.0	1.4±4.5
Sibling/s missed Daycare (hrs)	.6±3.7	.3±1.5	.1±.8	.9±4.9
Sleep loss of Parents (hrs)	2.2±4.3	1.9±3.1	1.0±2.5	4.9±6.8
Sleep loss of Child (hrs)	1.7±5.1	1.2±1.6	1.0±2.2	3.7±6.4
Cost of parking ($)	1.70±1.73	2.00±1.07	0±.20	3.63±2.28
Cost of medications ($)	6.93±25.25	--	3.49±5.13	13.76±31.34
Mileage (miles)	48±45	57±55	3±6	104±84
Travel expenses ($)[37,38]	5.06±5.03	7.12±9.41	.34±.67	15.11±37.53
Number of missed Meals	--	Yes-20 No-85	Yes-0 No-105	

Table 3.4 Data Sheet Results of Study Cohort

Five (4.7%) families reported having to spend the night in a hotel prior to their GA appointment as a result of the distance that they had to travel to get to the Nationwide Children's Hospital Dental Surgery Center. Three of these families spent $1-10, one spent $41-50, and another spent $50+.

Pain

Using a pain scale of 0-10, pre-operatively 59 (56.2%) patients were not complaining of pain, and on the day of surgery 64 (61%) were not in pain; the parent/caregiver reported this information, not the patient themselves. Figure 3.2 displays the number of children in each pain scale category from 0-10, both pre-operatively and on the day of surgery. The mean pain scores for both pre-operative and day of surgery measures were <1.

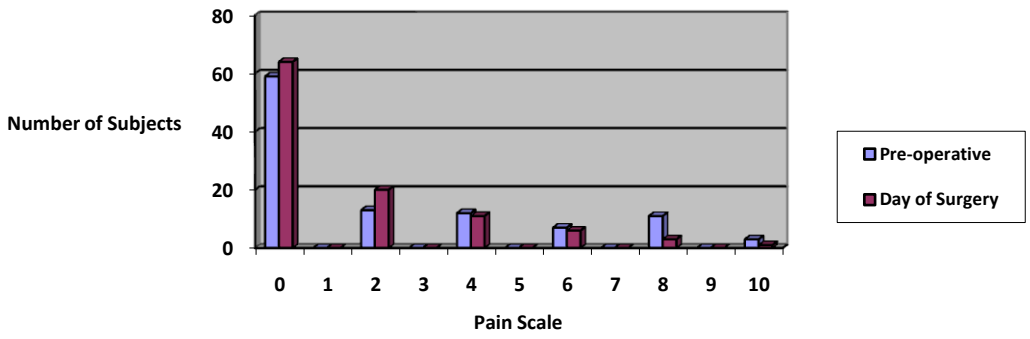

Figure 3.2 Pain Scale of Patients

Post-operative Complications

Only 61 (58%) patients required pain medication post-operatively. Of the cases that required pain medication, Motrin was given in 44% of the cases, Tylenol was given 30% of the time, and the alternation of both medications occurred 26% of the time. In 80% (84) of the cases, the child did not have difficulty eating after the dental treatment, nor did they have difficulty playing in 89% (93) of cases. The post-operative results are shown in Table 3.5.

	Pain Medications	Child had difficulty Eating	Child had difficulty Playing
Post-discharge	Motrin-27 Tylenol-18 Motrin/Tylenol-16	Yes-21 No-84	Yes-12 No-93

Table 3.5 Post-operative Complications

Correlations

Table 3.6 reflects the relationship of ASA II status patients with child-specific variables.

ASA II patients	p-value
Money spent on pain medication	.691
Number of teeth treated	.328
Sleep loss of caregivers	.199

Table 3.6 T-test Analysis of ASA II status patients

Table 3.7 presents the association between income level and quality of life indicators; student's t-test was used to run the statistics for all variables except the hours of work missed, in which case the Fisher's exact test was utilized.

Income related to:	p-value
Money spent on traveling	.658
Distance to access treatment	.300
Number of teeth treated	.714
Hours of work missed	.260
Hours of school missed	.534
Caregivers sleep loss	.215

Table 3.7 Statistical Analysis of Quality of Life Indicators Based on Income Levels

Figure 3.3 displays the relationship between the amount of money that families spent on pain medications and the number of teeth that the child had treated, p=.224. Figure 3.4 shows the distance that families traveled to receive treatment vs. the number of teeth the children had treated.

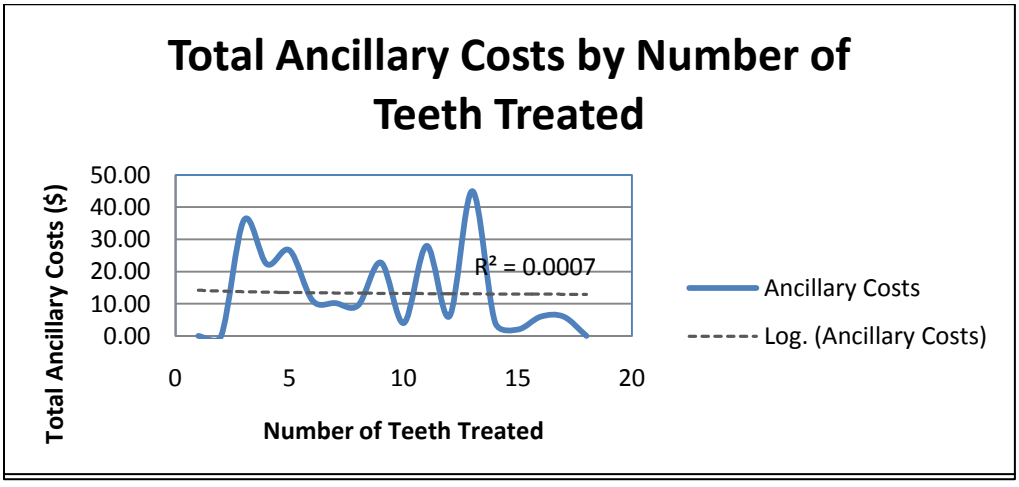

Figure 3.3 Ancillary Costs Related to Number of Teeth Treated

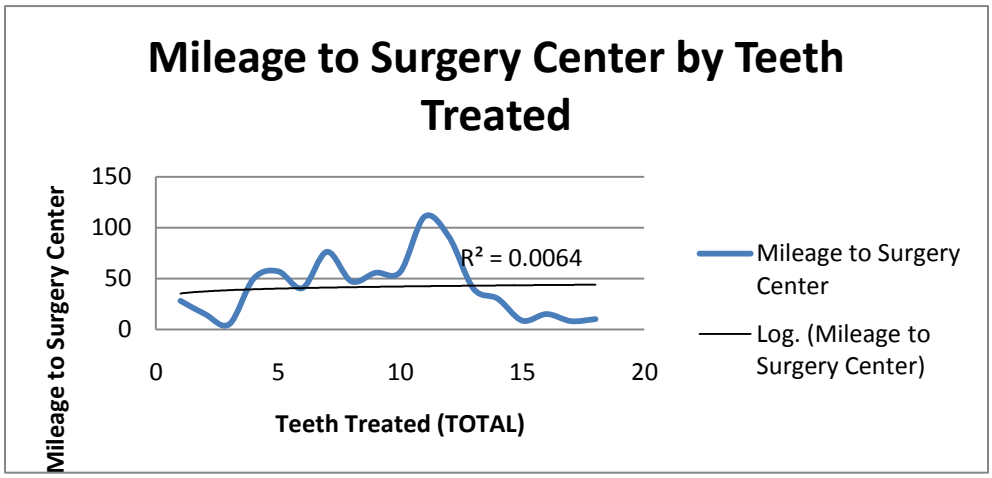

Figure 3.4 Mileage Traveled vs. Number of Teeth Treated

Chapter 4: Discussion

The overall objective of this study was to identify the burdens of general anesthesia placed upon families. The specific aim of this study is to compare various indicators of quality of life and see if they differ as a function of gender, ASA status, socioeconomic status, medical care costs, time, and number of teeth restored.

Age, Gender, and ASA Status

There was a wide spread in the ages of the patients (1yr7mo-19yr1mo) who participated in this study, since there was no specific age criteria set in the methodology. This age variability probably had an effect on the number of hours of school missed as many of the patients treated under GA were younger than school-age and the older patients may have been special needs who do not attend school; however, this association was not analyzed further.

Due to the fact that the patients treated in the Dental Surgery Center at Nationwide Children's Hospital are primarily of ASA I and II status, health status did not appear to be associated with the number of teeth treated in each group, p=.328. This was interesting to note as "children with special health care needs (SHCN) are at increased risk for dental disease".[6] Medications and poor oral hygiene are often the culprits for the

rise in dental decay. It is common for children's medications to contain sweeteners, so caregivers will not have compliance issues, and "providing effective and efficient oral health care to children with SHCN is especially challenging for caregivers and dental providers".[6] Additionally, ASA status did not affect the amount of money spent on pain medications, p=.691, nor did it correlate with sleep loss of the caregiver, p=.199.

Income

As shown in figure 3.1, a large amount (21%) of the families who participated were below the FPL[36]. Through statistical analyses it was depicted that income did not have an effect on the distance families traveled, p=.300. This data is noteworthy as many lower SES families qualify for Medicaid, therefore, one would think they would travel further to find providers who will accept their insurance. The data from the 2001 National Household Travel Survey[39] supports this prediction as well by stating, travel distances were greatest among households in the $20,000 - $44,999 income bracket, and lowest among households earning $70,000 or more per year. Also, no relationship was found between income and money spent on traveling (p=.658) to receive dental treatment under GA.

In this study, children of lower SES were not shown to have more teeth treated than those of higher SES (p=.714). This is interesting to note, as ECC is more prevalent among families with lower socio-economic status.[19] Fisher-Owens et al.[11] states that parents' education and income impact their children's oral health status. Surprisingly, SES did not result in families missing more time from work (p=.260), school (p=.534), or

losing more sleep (p=.215). This data is noteworthy as travel time is inversely related to income[39], and evidence indicates that ECC results in lost workdays for caregivers who have to stay at home to take care of their child, or spend time and money in accessing dental care[7]. Gift et al.[24] agrees by saying, the lower socioeconomic individual bears the combined burden of an increased number of lost work and school hours and of restricted activity days.

Treatment Completed

There was no significant association between the number of teeth a child had treated and the money spent on pain medications, p=.224. The average teeth treated was 8.2. Many of the patients received stainless steel crowns-435 and extractions-243, averaging 4 and 2 respectively per patient. This data is very similar to a study done by Vinckier et al.[40] which found that the mean number of 7.2 primary teeth were filled and 1.8 extracted per patient.

Stainless steel crowns are typically done on younger patients with high caries risk, so for these younger patients to not require pain medication is surprising. It was undetermined, of the number of extractions performed, which were primary and permanent teeth treated; in which case, one would presume that permanent teeth extractions would require pain medication more frequently than primary teeth extractions. The phone operator did perceive that caregivers had pain medication within the household to distribute to their child for post-operative pain, in which case the data would be skewed, since the family did not purchase more medication.

Also, there was no significant relationship between the distance the family traveled and the number of teeth treated. Strikingly, with such significant distances the families traveled, one would presume they are not accessing care as often, leading to more treatment needs.

Socio-economic costs

The most significant expense that families faced when bringing their child to Nationwide Children's Hospital for dental rehabilitation under GA were travel expenses. The average amount that families spent was $32.50 and the average distance traveled was 103.5 miles. This distance is considerably higher than the average according to a study done in 2001[39], which reported that rural trips averaged 17.5 miles, versus 8.3 miles for urban residents. The same study showed that low-income families, households in the bottom fifth of the income distribution (roughly $15,000 or less), spent 8.2% of income for gasoline in 1999, increasing to 10.4% in 2005 for expenses related to seeking medical care.[39] With Americans making an estimated 5.9 billion trips for medical/dental care in 2001, the cost of transportation can cause a substantial financial burden on many families.[39] Furthermore, pre-operatively caregivers reported spending as much as $154 on medical costs and traveling as far as 154 miles to get to their H&P appointment. Post-operatively families reported spending up to $22.00 on pain medications and traveling an average of 3 miles to purchase these medications. Markedly, two families reported as spending $169.00 on other ancillary costs.

Pain and Post-operative Complications

The mean pain scores pre-operatively and day of surgery were <1. Pre-operatively 56.2% of patients were not complaining of pain and 61% on the day of surgery did not complain of pain. These numbers are strikingly low, as the average number of teeth treated was 8.2. In fact, kids with less teeth treated complained of being in more pain, although the difference was 0.4 on the pain scale. It is interesting to note that with treatment needs being high, more children did not experience pain (especially since ECC is a chronic disease). One possible explanation for this finding is that the waiting time between the initial exam and the general anesthesia appointment were short (2-3months) comparatively.

Post-operatively 58% of patients required pain medication; this number correlates well with the low number of post-operative complications experienced. Vinckier et al.[40] found similar results in the 2001 study, which reported that side-effects following the procedure were minimal and post-operative pain was reported by none of the children. In 80% of the study participants the child did not have difficulty eating post-operatively, nor did they have difficulty playing in 89% of cases. On the other hand, Needleman et al.[41] found that ninety-five percent of children had postoperative pain of moderate intensity which required attention.

Limitations of the Study

It was challenging to obtain the post-operative information between 48-72 hours via the phone, otherwise, more subjects could have been included. The results of this

study were based on a convenience sample of families that came to the Dental Surgery Center at Nationwide Children's Hospital for GA treatment, there was no control group involved, and the families could only be English-speaking. Recall bias may have affected the "pre-operative" and "day or surgery" data, since both were obtained on the day of the GA appointment. The study design allowed for minimization of recall bias post-operatively since data was not utilized if the phone operator could not contact the family within 48-72 hours after the GA appointment. Furthermore, the amount spent on fuel is slightly inaccurate as the average miles/gallon value according to the U.S. Bureau of Transportation[37] was used in the calculations.

Chapter 5: Conclusions

Children with early childhood caries receiving treatment under general anesthesia show improvement in their overall quality of life, as well as overall health.[6,8,13,16,17,31] However, achieving an improved quality of life causes society, and the families, significant burdens financially and socially.[2,12,21,22,24,28,39] Savage et al.[2] agree by saying, ECC represents a significant financial and societal burden, but it is a preventable condition. It is also a condition for which the timeliness of prevention and/or early intervention is critical. Being as dental decay is a preventive disease, thousands of dollars could be saved every year for not only the individual families, but society as a whole.

The aim of this study was to present clinicians with evidence that general anesthesia can be burdensome on families beyond the costs of dental treatment alone. There is strong evidence in the literature that parents or caregivers of young children experience significant quality of life issues because of their children's health problems and treatment experiences.[7] However, more research needs to be done to investigate the depth of these burdens, and their overall affects on families, including quality of life.

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Appendix A: Survey Form

Quality Assurance - Familial Cost of Pediatric Dental Rehabilitation under General Anesthesia

Subject___ Residence Zip Code_____ **Male ___ Female ____ YEARLY INCOME $_____**	**Person completing survey :** mother father other 3rd party guardian **Assistance received for transportation $_____**

GA as Repeat Visit Y N	**Surgery Date_____ TX: # SSC ___, #pulpotomies ____, #ext_____**
Today Rescheduled visit? Y N Why: Illness NPO Other	**History and Physical Date _____ Restorations ____ Number of Teeth with Caries____**

DIRECT COSTS/EFFECTS		PRE-OPERATIVE	DAY OF SURGERY	POST-DISCHARGE	TOTALS
	Hours form School and Work	Parents Lost work _____hrs School missed for H&P _____hrs Siblings school lost _____hrs Siblings daycare lost _____hrs	Parents Lost work _____hrs School missed _____hrs Siblings school lost _____hrs Siblings daycare lost _____hrs	Work missed AFTER day of surgery ___hrs School, Child lost _____hrs Sibling School lost _____hrs Siblings daycare lost _____hrs	Total Work Lost , Parents _____ hrs Total School Lost Child _____ hrs Total School Lost, Sibs _____ hrs Total Siblings daycare lost _____hrs
	Sleep	Lost Sleep Parents _____hrs Lost Sleep Child _____hrs	Lost Sleep Parents _____hrs Lost Sleep Child _____hrs	Lost Sleep Parents _____hrs Lost Sleep Child _____hrs	Lost Sleep Parents _____hrs Lost Sleep Child _____hrs
	Medical Care $	Medical Costs $_____ Parking $_____	Sibling daycare $_____ Overnight Hotel stay $_____ Parking $_____	Cost of medications given $_____ Additional daycare required for sibs $_____ Parking $_____	Total Ancillary Costs $_____ Parking $_____
	Mileage	Mileage to H&P Site _____miles	Mileage to DSC _____miles Mileage to daycare _____miles	Mileage to get medications _____miles	Total mileage _____
	Other	Child's pre-operative pain scale 0 2 4 6 8 10	Child's day of surgery pain scale 0 2 4 6 8 10 Parent missed meals nursing child Y N	Name of Pain Med _____ Child difficulty eating Y N Child difficulty playing Y N Parent missed meals nursing child Y N	

Appendix B: Telephone Script

Hi, this is _____ from Nationwide Children's Hospital.

I am calling from the Dental Surgery Center. Did I catch you at a good time? I would like to talk to you about the care that your child _____ received recently.

While you were at our Surgery Center, you agreed to answer some questions regarding the burden this procedure has placed on your child and family. I would like to ask some follow-up questions now that the surgery is completed. This information will be used to help us make the system work better, and hopefully give us a better understanding into the costs that go into dental surgery.

First, I would just like to ask some questions about how your child is doing now that he/she is home:

- Did your child have any problems with nausea/vomiting, fever, pain management, nose bleeds, breathing problems, sore throat, or other problems I have not mentioned?
- Were all your questions answered about caring for your child at home and managing their pain?
- Is there anything we could have done differently to make your hospital experience better?

I do have just a few more questions to ask you if that's ok?

- How much work did you miss after the day of the surgery? How many hours of school did your child miss after surgery? Did any siblings miss school? If so, how many hours? Was any daycare missed following the surgery? Was there any money spent on daycare for siblings? How many hours of sleep did you and your child lose after you got home from the hospital, if any? Did your child have any difficulty eating or playing following the surgery? Did you miss any meals nursing your child? Did your child receive any medications since the surgery? If so, what kind? How

much money did you spend on the medications? How many miles did you have to travel to get the medications? Was there any money spent on parking after the surgery?

Are there any questions you would like to ask, or comments you would like to make regarding your child's appointment or care?

I want to thank you for your time. Have a good night.