EFFECT OF RECALL FREQUENCY FOLLOWING DENTAL TREATMENT UNDER GENERAL ANESTHESIA ON CARIES RISK IN PEDIATRIC PATIENTS

by

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ABSTRACT

Due to the early onset of caries in many children general anesthesia is often required in order to treat the dental disease. Unfortunately following dental treatment under GA, many children have caries relapse, which often requires a repeat GA in order to accomplish the new dental treatment. The objective of this study was to determine if recall frequency following treatment under general anesthesia affects the likelihood that children will require new dental treatment under a repeat GA. 674 charts were reviewed from a private Pediatric dental practice located in Winnipeg Manitoba Canada where patients who underwent a GA for dental treatment were investigated. It was found that those patients, who required new treatment following an initial treatment under GA, were less likely to receive a repeat GA for new dental treatment if they attended more frequently for a recall examination.

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1 INTRODUCTION

Dental caries is a multifactorial disease that has affected and continues to affect many people (Leong, Gussy, Barrow, De Silvia-Sanigorski, & Waters, 2013). For dental caries to occur there are 4 main criteria, which must be present. This includes the presence of a tooth surface, bacterial plaque, fermentable carbohydrates, and time (Cameron & Widmer, 2013). Even with the presence of all 4 criteria, dental caries does not affect everyone in the same manner, nor to the same degree. From a historical perspective, dental caries was a disease that primarily affected the rich, who could afford more expensive foods containing sugar (Wynbrandt, 2000). Currently, with the advent of more cheaply produced refined sugars, the converse is true (Cinar & Murtomaa, 2009). Caries is a disease that currently affects those of lower socioeconomic status with greater prevalence than those who are more affluent (American Academy of paediatrics, 2011; Irvine, Holve, Krol, & Schroth, 2011; Kamel, Thompson, & Drummond, 2013).

Although the overall rate of dental disease in the population of industrialised nations is on the decline, this is not true for children (Touger-Decker & Van Loveren, 2003). Children are affected by dental caries the most out of any other population group today, and in particular those children of lower socioeconomic status or whom reside in a rural location seem to be the most affected (Touger-Decker & Van Loveren, 2003; Jankauskiene, Virtanen, Kubilius, & Narbutaite, 2013). Canadian studies have reported early childhood caries incidence of about 5% of the entire population (Weinstein, Smith, Fraser-lee, Shimono, & Tsubouchi,1996; Al-Jewair & Leake, 2010); whereas incidence amongst high-risk, low socio-economic groups

such as immigrants and aboriginals are as high as 50-80% (Peressini, Leake, Mayhall, Maar, & Tredeau, 2004). Unfortunately dental decay can affect children of all ages including the very young. Even infants may be affected by decay not long after the eruption of their first primary teeth (Fujiwara, Sasada, Mima, & Ooshima,1991; Mattos-Graner, Zelante, Line, & Mayer, 1998). The term Early Childhood caries (ECC) has been used to describe caries in its rampant form particularly affecting young children (Mouradian, Wehr, & Crall, 2000). The American Academy of Pediatric Dentistry (AAPD) defines ECC as the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth from birth to 6 years of age (American Academy of Pediatric Dentistry, 2005).

Prevention of dental caries is also multifactorial. Caries prevention involves a regimen of adequate home oral hygiene care, a controlled diet low in fermentable carbohydrates, fluoride use, and establishment of a dental home with regular visits to the dentist (American Academy of Pediatric Dentistry: Guideline on Periodicity, 2015). Whereas caries prevention in adults is generally the responsibility of the individual, caries prevention for children often requires the aid and supervision of the child's caregiver (Finnegan, Rainchuso, Jenkins, Kierce, & Rothman, 2015). This includes helping the child with daily oral hygiene to controlling the child's diet and bringing the child to the dentist for regular dental examinations (American Academy of Pediatric Dentistry: Guideline on Caries Risk Assessment, 2015). There is however a disproportionate level of dental caries affecting those whom reside in lower socioeconomic areas and rural areas greater than those whom reside in more affluent areas and in urban environments, due in part to reduced access of care

(Schroth, & Moffat, 2005; Vargas & Ronzio, 2006). In children limitations to receiving dental care may include cost of treatment, limited/no access to a dental home, and/or poor parental attitudes on the importance oral hygiene practice (Anne, 2013; Finnegan et al., 2015.). Although dental caries is arguably the only disease that is completely preventable (Jiang, Lo, Chu, & Wong, 2014; Edelstein, Gary, Frosh, & Jayanth, 2015), dental caries prevalence in children is currently on the rise and many require dental treatment.

Often dental treatment for children, particularly the very young, requires the need for General anaesthesia (GA) in an operating room (OR) due to extent of treatment required and/or need for pharmacological management of the child patient (American Academy of Pediatric Dentistry: Guideline on the Use of Anesthesia, 2015). Dental treatment of children under general anaesthesia comes at an increased cost to both the parents and taxpayers (Oral Health in America, 2000; Milnes, 2003; Irvine et al., 2011,). Although there are many operating room facilities available to treat children, wait times for such services are on the rise (No time for complacency: Report Card on wait times in Canada, 2010). It is not abnormal for a child to wait 6 months plus in order to have his/her dental treatment accomplished (Canadian Institute for Health Information, 2013). This ultimately means that children may be in pain and at risk of oral-facial infection while awaiting treatment (Tinanoff, 2009). Not only do many children require dental treatment in the OR, but it is not abnormal to see the same child require successive treatment during his/her childhood (Foster, Perinpanayagam, Pfaffenbach, & Certo, 2006; Kakounaki,

Tahmassebi, & Fayle, 2011; El-Batwai, Panigrahi, & Awad, 2014; Deery, Welbury, & Chadwick, 2015). Along with a regimen of adequate home oral hygiene care, a controlled diet low in fermentable carbohydrates, and fluoride use, it is recommended that children see their dentists at regular intervals so that the health care professional may accomplish regular care and early detection of oral health problems (American Academy of Pediatric Dentistry: Guideline on Caries Risk Assessment, 2015). According to the AAPD children who are at a high risk of caries should be seen every 3 months, those who are at a moderate caries risk should be seen every 6 months, and those who are low risk of developing caries should be seen again within a years time (American Academy of Pediatric Dentistry: Guideline on Caries Risk Assessment, 2015). Subsequent caries detection following dental work indicates that caries preventative measures have not been taken and/or are not adequate. Ultimately this means that for many, the child's caries risk status has remained unchanged. What is not currently known or well understood is what effect dental recall frequency, following general anaesthesia, has on the caries status of the patient. This study wishes to determine if recall frequency following treatment under GA affects the likelihood that a child will require additional treatment, and if that treatment will require a repeat GA.

2 LITERATURE REVIEW

2.1 Early Childhood Caries

The prevalence of ECC is extremely high among children and is considered the most common chronic condition among children in the United States (Ng, 2003). Although the literature reports that global rates of dental disease is on the decline, ECC which affects young children, has been reported to be on the rise (Dye, Tan, & Smith, 2007). ECC is so prevalent that it is currently 5 times more common than asthma and 7 times more common than hay fever. (Oral Health in America: A Report of the Surgeon General, 2000). Worldwide ECC affects 60-90% of school-aged children and remains a major problem in both developed and developing nations (Petersen, Bourgeois, Ogawa, Estupian-Day, & Ndiaye, 2005). The Literature shows there is a high prevalence of ECC rates in Canada that disproportionately affects those who have a lower socioeconomic status, reside in rural areas, live in areas with a high proportion of aboriginal residents (Canadian Institute for Health Information, 2013), or are recent immigrants (Calvasina, Muntaneer, & Quinonez, 2015). Recent Canadian studies report a staggeringly high prevalence of ECC in children less than 4 years of age residing in aboriginal communities. Veronneau et al, 2002, reported a ECC prevalence rate of 30% in 12-24month olds among the entire Cree population of Quebec. Similarly Albert et al, 1988, reported a 55% ECC prevalence among the 24-36month old Inuit population of the NWT, and Schroth et al, 2005, reported a 53% ECC Prevalence rate among four Manitoban Aboriginal communities.

Not only can ECC affect the dentition and oral health of a child, but it can also have adverse effects on the child's overall health, wellbeing, and quality of life (Filstrup, Briskie, Da Fonseca, Lawrence, & Wandera, 2003). Adverse sequelae of ECC may include pain (Clemenitino, 2015), speech problems (Clementino, 2014), loss of appetite (Clementino, 2014), loss of sleep (Cunnion, Spiro, Jones, Rich, & Papageorgiou, 2010), poor school performance (Casisimo, Thikkurissy, Edelstein, & Maiorini, 2009), and growth and developmental disturbances (Casissimo et al., 2009). Children who experience dental caries in infancy or as toddlers have a greater risk for subsequent caries in the primary (Colak, Dulgergil, Dalli, & Hamidi, 2013) and permanent dentitions (Colak et al., 2013; Ezeldeen, Gizani, & Declerck, 2015). Also, dental caries, if left untreated may result in life-threating conditions such as ludwigs angina, facial cellulitis, and cavernous sinus thrombosis. (American Academy of Pediatric Dentistry: Guideline on Management Considerations for Pediatric Oral Surgery and Oral Pathology, 2015). Due to age and complexity of the required treatment it is often necessary to complete the treatment under general anesthetic in surgical or hospital care settings.

2.2 General Anesthesia to treat ECC

According to the American Academy of Pediatric Dentistry Pediatric Oral Health Research and Policy Center, General anesthesia can be described as a

medical procedure, which places the patient in an unconscious state, allowing for the safe delivery of medical, dental, and surgical procedures (Pediatric Oral Health Research and Policy Center, 2012). Treatment for ECC is often accomplished under general anesthesia when a young child is unable or unwilling to cooperate for necessary dental procedures due to extensive treatment needs, anxiety, age, maturity, or medical conditions (American Academy of Pediatric Dentistry: Guideline on Behaviour Guidance for the Pediatric Dental Patient, 2015). Although ridding a child of dental decay has a positive impact on her quality of life (Gaynor & Thompson, 2012), dental treatment accomplished under GA comes at an increased risk of morbidity (Aitkenhead, 2005; Harris & Chung, 2013) and mortality (Aitkenhead, 2005; Cassisimo et al., 2009.) for the patient, with sore throat post operatively being the most common side effect (Aitkenhead, 2005).

Pediatric dental treatment under GA is by far the most common reason for day surgeries in Canada, where 19000 day surgery operations for treatment of ECC occur in hospitals each year Canada wide (Canadian Institute for Health Information, 2013). Every year in Manitoba more than 2000 children with ECC attend a hospital to undergo dental treatment under GA, and many more attend a private health care facility (Schroth & Smith, 2007).

It has been reported in the literature that following treatment for ECC under GA, the overall quality of life and well being of the child is greatly increased

(Acs, Pretzer, Foley, & Ng, 2001; Thomson & Malden, 2011; El_batawi et al., 2014; Cantekin, Yildirim, & Cantekin, 2014). While many children receive access to dental care under general anesthesia, many more are left untreated. Wait times for Pediatric dental surgeries are unacceptably long in Canada, and only 50-59% of patients who are awaiting treatment are treated within a medically acceptable time frame (No time for complacency: Report Card on wait times in Canada, 2010). Another barrier to the access of dental care is that the costs for having dental treatment under GA are substantially high (Milnes, 2003; Irvine et al., 2011). In Manitoba, $3.5-4 million federal dollars are spent every year in dental fee remuneration alone (Schroth & Smith 2007), and a recent Canada wide database published in 2012 reported federal anesthesia related costs for treatment off ECC under GA at $21.2 per annum (Canadian Institute for Health Information, 2013).

The current dental care system is privatized and fee for service, which marginalizes Canada's working class lowest income families, of whom up to 50% do not have any form of dental insurance coverage (Anne, 2013). Furthermore since 1980 public funding for dental health in Canada has been declining, as well as the cost for dental treatment increasing, making dental care more difficult to access for patients with public insurance (Anne, 2013). With long hospital wait times to have dental treatment done under GA and financial barriers to care, many children with ECC are left susceptible to the sequelae of dental disease including pain, infection, loss of school days,

difficulties in school, higher treatment costs (Tinanoff & Reisine, 2009), and thus have a decreased overall quality of life (Acs et al., 2001; Thomson & Malden, 2011: El-Batawi et al., 2014; Cantekin et al., 2014)

2.3 Recall Examinations

The American Academy of Pediatric Dentistry recommends a risk-based recall examination frequency, only after completing a caries risk assessment (CRA) for each patient (American Academy of Pediatric Dentistry: Guideline on Caries Risk Assessment, 2015). CRA tools outlined in the AAPD guidelines, allow dental providers to identify oral health indicators, which categorize each patient as low, moderate, or high risk for developing caries (American Academy of Pediatric Dentistry: Guideline on Caries Risk Assessment, 2015). It has been reported in the literature that the best predictor for future caries is past caries experience, thus although patients are caries free following full mouth rehabilitation under GA, they are initially categorized as being high-risk for developing new caries. (Al-Shalan, Erickson, & Hardie, 1997; Seppa & Hausen,1988; Schwendicke, 2013). Caries is a multifactorial transmissible disease that is entirely preventable (Jiang, et al., 2014; Edelstein et al., 2015) and preventative programs tailored for each patient should be unique in order to have a maximum effect in caries risk reduction and prevention (Ramos-Gomez, Crystal, Ng, Crall, & Featherstone, 2010). CRA tools in the AAPD guidelines indicates that High-caries risk patients should return every three months for a recall

examination (American Academy of Pediatric Dentistry: Guideline on Caries Risk Assessment, 2015), so that preventative dental care can be accomplished and reinforced at the first and each subsequent visit (Almeida, Roseman, Sheff, Huntington, & Hughes, 2000). Incidence of caries can be reduced or prevented by a number of measures including systemic water fluoridation, professional topical fluoride application, and placement of dental sealants (Mouradian et al., 2000). Monitoring of adequate plaque removal and the provision of oral hygiene instructions to a patient during preventative recall examinations is equally as important (Abou El-Yazeed, Ezzat, El-Dokky, & El-Mansy, 2012). Nutritional and diet counselling to the patient and family by a dental home has also been shown to reduce the rate of caries in young children (Kierce, Boyd, Rainchuso, Palmer, & Rothman, 2016).

Following dental rehabilitation under GA there is a need for a comprehensive and frequent provision of these preventative strategies in order to prevent caries relapse (Amin, Bedard, & Gamble, 2010), yet the literature reports that truancy rates for recall examination following GA are frequently high (Foster et al., 2006; Powers, Mathu-Muju, & Bush, 2009; Jamieson & Vargas, 2009; Mathu-Muju, 2010). Currently most models of reimbursement for dental preventative recall care by public and private dental insurance companies, do not reflect the 3month suggested preventative recall interval of the

American Academy of Pediatric Dentistry's CRA tools for high-risk patients (Tinanoff, 2012). Furthermore many children who reside in a rural location may not have direct access to a dentist for preventative recall care (Schroth & Moffat, 2005, Vargas & Ronzio, 2006). Implementation of the American Academy of Pediatric Dentistry's CRA protocols, with increased preventative recall frequency has recently been shown to be effective in reducing caries in high-risk patients (Ng, Ramos-Gomez, & Lieberman, 2014) and thus may be an ideal way to prevent recurrent or new caries in patients following dental treatment under GA.

2.4 Repeat General Anesthesia

Unfortunately, following treatment under GA for full mouth rehabilitation, many children require new treatment due to caries relapse (Foster et al., 2006; Amin et al., 2010; Berkowitz, Amante, Kopycka-Kedzierawski, Billinigs, & Feng, 2011; EzEldeen et al., 2015; Amin, Nouri, ElSalhy, Shah, & Azarpazhooh, 2015). Accomplishing full mouth dental rehabilitation under GA is done under ideal conditions, allowing for better restorative treatment when compared to other modalities of treatment (Eidleman, Faibis, & Peretz, 2000). Yet the literature reports that due to caries relapse, a subsequent dental treatment under GA is often required (Foster et al., 2006; Kakounaki et al., 2011, El-Batwai et al., 2014; Deery, et al., 2015). A Study by Almeida et al., 2000, reported a caries relapse rate of 79% within 2 years following full mouth rehabilitation under GA, with 17% requiring a second GA for new

treatment within a mean time of 17.7months.

Factors reported in the literature that may be associated with the need for an additional GA include, absence of community water fluoridation (Kamel et al., 2013), failure to attend the immediate follow-up appointment (Foster et al., 2006), and having treatment done under GA by a general dentist (Schroth & Smith, 2007). Furthermore, Sheller et al., reported that there are common characteristics which may preclude a child needing a successive GA which include carious involvement of incisors, persistent use of a nursing bottle at the time of GA, the parent not brushing child's teeth, poor cooperation, and lack of follow-up dental care (Sheller, Williams, Hays, & Mancl, 2003). The need for a repeat GA further adds to the already long waiting times for children awaiting to have dental treatment under GA (No time for complacency: Report Card on wait times in Canada, 2010; Canadian Institute for Health Information, 2013), as well as further depletes financial, and professional medical and dental resources that are already limited (Anne, 2013).

3 OBJECTIVES

This retrospective cohort study wishes to determine if recall frequency of dental visits is associated with the need for any additional care for children following treatment done under general anaesthetic. There are many studies that investigate caries risk in children including, diet, socioeconomic status, and oral hygiene practice and the need for dental treatment in children. There are few studies, which investigate caries risk as a function of recall examination intervals of patients following treatment in the OR. We wish to examine the interval in which patients seek recall examination by their dentist following treatment under general anaesthesia and associate it to the need for any additional dental treatment in the future.

4 HYPOTHESIS

The null hypothesis is that there will be no relationship between recall frequency and the need for successive restorative treatment under GA or in the dental chair. The alternative hypothesis is that those patients who attend regular recall examinations following dental treatment under GA, will be less likely to require successive restorative treatments under GA or in the dental chair. It is also expected that in comparing modalities of proposed treatment for those who require new restorative treatment following treatment under GA; that those who have had a higher recall frequency will be less likely to require a repeat GA for restorative treatment, and be more likely able to be treated in the dental chair.

5 MATERIALS AND METHODS

A Submission of this retrospective data review study proposal was made to the University of Manitoba's Research ethics board (REB) for review on November 27, 2014 and approved on Dec 09, 2014 (Ethics#H2014:376). An annual renewal was submitted to the REB on October 21, 2015, approved on December 04, 2015 and expires on December 09, 2016. (See Appendix A)

5.1 Sample Selection

The patients selected for this retrospective cohort study were those who presented for dental treatment under general anesthetic from Jan 01, 2010 to Dec 30 2011, at Children's Dental World (CDW), a private dental facility located in Winnipeg, Manitoba, Canada. Data was originally also to be collected from the hospital based University of Manitoba Pediatric Graduate Dental Clinic, but due to the infancy of the program (started in 2012) there were not a sufficient number of patients who were healthy and had a sufficient duration of time for follow up recall appointments. Also there were a disproportionately large number of patients from the Hospital based program whom were medically compromised (ASA III and ASA IV), which severely limited the number of eligible patients for this study. The decision was made to select samples solely from CDW and a total of 2696 records of patients whom underwent GA for dental treatment were obtained. Data was collected from every fourth chart in chronological order, yielding a total of 674 charts reviewed. The principal investigator manually reviewed each

chart and eliminated charts that did not meet the inclusion criteria from the statistical analysis. Descriptive data however was collected from all of the 674 charts and used for descriptive analysis.

The following inclusion and exclusion criteria was used for sample selection:

5.1.1 Inclusion criteria:

1. Patients who had dental treatment under GA
2. First GA Dates between Jan 01, 2010-Dec30 2011
3. Patient who had at least one recall exam following GA

5.1.2 Exclusion criteria:

1. Medically compromised or Special health care needs patients
2. Patients who had their first GA prior to Jan 01, 2010
3. Patients who had no recall exam following GA

5.2 Data Collection

The principal investigator was the sole collector of all data obtained in this study. A total of 674 charts were manually reviewed and alpha-numerical data from each chart was documented on individualized data collection sheets (see appendix B). Fifteen items of interest were reviewed and collected for each chart: (1) Age at time of GA, (2) Date of birth, (3) Gender, (4) First three digits of postal code, (5) type of insurance, (6) ASA Classification, (7) Date first seen for exam, (8) Date of first GA, (9) Date last seen, (10) Recall exam or lost to follow-up, (11) Date of first recall exam following GA, (12) Number of recalls since GA, (13) Presence or absence of

new caries (14) Date new caries detected (if applicable), (15) If new caries was detected, was GA recommended for treatment. The start date of data collection was March 01, 2015 and was completed on July 15 2015. As many of the patients included in this study are active patients who may be continually seen on an ongoing basis; in order to keep data collection consistent, any data present for any patient beyond March 01, 2015 was omitted from being collected.

5.3 Data Handling

Following the manual review and collection of data from all 674 charts on paper data capture sheets; the data was transferred into a digital format using Microsoft Excel for Windows. All of the paper data capture sheets were subsequently destroyed by shredding. The data was then divided into four treatment groups:

- (CHAIR_TREATMENT)): Consisted of patients requiring new treatment following GA, which could now be completed in the dental chair.
- (GA_TREATMENT): Consisted of patients requiring new treatment following GA, that required a repeat GA in order to complete the treatment.
- (NO_TREATMENT): Consisted of patients who did not require any new treatment following GA at any follow-up recall exam.
- (LOSS_TO_FOLLOW_UP): Consisted of patients whom never attended a recall appointment following their GA appointment.

Patients in the (LOSS_TO_FOLLOW-UP) group were not included in the statistical analysis, but the data obtained was included in the descriptive analysis.

5.4 Statistical Analysis

Statistical analysis of the data was performed using SPSS 20.0 for Windows by a biostatistical consultant from the George and Fay Yee Center for Healthcare Innovation at the University of Manitoba. Statistical analysis was made through univariate comparisons between patient factors (i.e. gender, insurance, urbanity, ASA classification, age at time of initial GA, time from treatment under GA to first recall, and recall frequency) and modality of treatment (i.e. CHAIR_TREATMENT, GA_TREATMENT, and NO_TREATMENT) employing the Kruskal-Wallis and Chi-square tests. For all statistical analysis P-values of <0.05 were considered statistically significant.

6 RESULTS

6.1 Summary Statistics

Out of the 674 charts reviewed there were 49.11% female and 50.89% males who underwent GA for dental rehabilitation from Jan 01, 2010-Dec30 2011. The average age at the time of first GA was 61.52 months. 49.26% had private insurance, 41.25% had public insurance, and 9.50% had no insurance whatsoever. The majority of patients were urban dwellers (63.35%) vs. rural dwellers (36.35%), and ASA-I category patients (92.73%) vs. ASA-II category patients (7.27%). From the total 674 charts reviewed, a total of 410 patients (or 60.83%) were lost to follow-up as they were never seen again following treatment under GA. Out of 264 patients seen at least once following treatment under GA, a total of 147 (or 55.68%) required new dental treatment, and a total of 32 (or 12%) required subsequent dental treatment under a repeat GA.

6.2 Univariate comparisons between patient factors and treatment groups

6.2.1 Gender

Following dental rehabilitation under GA, a total of 116 out of 331 females and 148 out of 343 males attended at least one recall appointment. There were no significant differences between males and females requiring new treatment under a subsequent GA, requiring new dental treatment in the dental chair, or not requiring new treatment at any recall appointment.

Tables 6.2.1 – Analysis Using Gender

Frequency Row Pct	Table of Gender by GA_treat			
	GA_treat			
Gender	Chair Treatment	GA Treatment	No Treatment	Total
Female	55 47.41	15 12.93	46 39.66	116
Male	60 40.41	17 11.64	71 47.95	148
Total	115	32	117	264
Frequency Missing = 410				

Statistics for Table of Gender by GA_treat

Statistic	DF	Value	Prob
Chi-Square	2	1.8196	0.4026
Likelihood Ratio Chi-Square	2	1.8244	0.4016
Mantel-Haenszel Chi-Square	1	1.7157	0.1903
Phi Coefficient		0.0833	
Contingency Coefficient		0.0830	
Cramer's V		0.0833	

6.2.2 Insurance

A total of 17 out of 64 patients without insurance, 142 out of 332 with private insurance, and 105 out of 278 with public insurance attended for at least one recall exam following treatment under GA. There were no significant differences between insurance type and requiring new treatment under a subsequent GA, requiring new dental treatment in the dental chair, or not requiring new treatment at any recall appointment.

Tables 6.2.2. – Analysis Using Insurance

Frequency Row Pct	Table of insurance by GA_treat			
	GA_treat			
insurance	Chair Treatment	GA Treatment	No Treatment	Total
None	7 41.18	1 5.88	9 52.94	17
Private	66 46.43	12 8.57	64 45.00	142
Public	42 40.00	19 18.10	44 41.90	105
Total	115	32	117	264
Frequency Missing = 410				

Statistics for Table of insurance by GA_treat

Statistic	DF	Value	Prob
Chi-Square	4	6.0833	0.1930
Likelihood Ratio Chi-Square	4	5.9959	0.1995
Mantel-Haenszel Chi-Square	1	0.0055	0.9407
Phi Coefficient		0.1524	
Contingency Coefficient		0.1506	
Cramer's V		0.1077	

6.2.3 Urbanity (rural vs. urban)

Following treatment under GA, 60 out of 247 patients whom reside rurally and 204 out of 427 patients whom reside in the city attended for at least one recall examination. There were no significant differences between urbanity and requiring new treatment under a subsequent GA, requiring new dental treatment in the dental chair, or not requiring new treatment at any recall appointment.

Tables 6.2.3 – Analysis Using Urbanity (rural vs. urban)

Frequency Row Pct	Table of AREA by GA_treat				
		GA_treat			
AREA		Chair Treatment	GA Treatment	No Treatment	Total
RURAL		26 44.07	10 16.95	24 38.98	60
URBAN		89 43.35	22 10.84	93 45.81	204
Total		115	32	117	264
Frequency Missing = 410					

Statistics for Table of AREA by GA_treat

Statistic	DF	Value	Prob
Chi-Square	2	1.8851	0.3896
Likelihood Ratio Chi-Square	2	1.7943	0.4077
Mantel-Haenszel Chi-Square	1	0.2955	0.5867
Phi Coefficient		0.0848	
Contingency Coefficient		0.0845	
Cramer's V		0.0848	

6.2.4 ASA Classification

A total of 243 out of 625 ASA-I patients, and 21 out of 49 ASA-II patients attended at least one recall exam following treatment under GA. There were no significant differences between ASA Classification and requiring new treatment under a subsequent GA, requiring new dental treatment in the dental chair, or not requiring new treatment at any recall appointment.

Tables 6.2.4 – Analysis Using ASA Classification

Frequency Row Pct	Table of asa by GA_treat				
		GA_treat			
asa		Chair Treatment	GA Treatment	No Treatment	Total
1		105 43.15	29 12.03	109 44.81	243
2		10 47.62	3 14.29	8 38.10	21
Total		115	32	117	264
Frequency Missing = 410					

Statistics for Table of asa by GA_treat

Statistic	DF	Value	Prob
Chi-Square	2	0.3657	0.8329
Likelihood Ratio Chi-Square	2	0.3684	0.8318
Mantel-Haenszel Chi-Square	1	0.2742	0.6005
Phi Coefficient		0.0374	
Contingency Coefficient		0.0373	
Cramer's V		0.0374	

6.2.5 Age at GA

In comparing age at the time of treatment under GA, there were no significant differences between age of those requiring new dental treatment in the dental chair, or those not requiring new treatment at any recall appointment. However the age of patients at the time of initial GA whom required a repeat GA were significantly different (P value < 0.0001) compared to patients whom did not require a repeat GA. On average those that required a repeat GA were 41.2 months (median 38 months) of age compared to those that required new dental treatment in the dental chair being on average 63.5 months (median 56.5 months) of age, and those who required no treatment at any recall exam being on average 60.4 (median55.5) months of age.

Tables 6.2.5 – Analysis Using Age at GA

Analysis Variable : Age_at_GA_MONTHS						
GA_treat	N Obs	Mean	Median	Minimum	Maximum	Std Dev
Chair Treatment	115 43.6%	63.5438596	56.5000000	31.0000000	163.0000000	23.1479047
GA Treatment	32 12.1%	41.2187500	38.0000000	23.0000000	78.0000000	13.3458569
No Treatment	117 44.3%	60.3706897	55.5000000	0	150.0000000	21.1094581

Kruskal-Wallis Test	
Chi-Square	34.1773
DF	2
Pr > Chi-Square	<.0001

6.2.6 Time from GA to first recall appointment

Time from treatment under GA to first recall examination was extrapolated from the raw data and compared between treatment groups. There was a significant difference (P- value = 0.0110) with time to first recall exam, between those requiring a repeat GA, those requiring treatment in the chair or those requiring no treatment at any recall exam. On average patients requiring a repeat GA attended for their first recall exam at 18.16 months (median 14 months) following GA, those requiring new dental treatment in the dental chair attended for their first recall exam at 13.12 months (median 10 months) following GA, and those requiring no treatment at any recall exam attended for their first recall exam at 11.43 months (median 10 months) following GA.

Tables 6.2.6 – Analysis Using Time from GA to first recall appointment

Analysis Variable : Time_First_Recall						
GA_treat	N Obs	Mean	Median	Minimum	Maximum	Std Dev
Chair Treatment	115 43.6%	13.1228070	10.0000000	1.0000000	57.0000000	9.8359467
GA Treatment	32 12.1%	18.1562500	14.0000000	4.0000000	51.0000000	12.0164118
No Treatment	117 44.3%	11.4347826	10.0000000	1.0000000	38.0000000	6.9675066

Kruskal-Wallis Test	
Chi-Square	9.0216
DF	2
Pr > Chi-Square	0.0110

6.2.7 Recall frequency

Recall frequency was significantly different for patients who required a repeat GA for new dental treatment compared with patients whom did not require a repeat GA for new dental treatment, or did not require dental treatment at any recall exam (P value <0.0001). On average those patients requiring a repeat GA attended at an average recall frequency of every 15.3 months (median 19.0 months), those requiring treatment in the dental chair attended an average recall frequency of 10.15 months (median 9.66 months), and those patients not requiring dental treatment at any recall appointment attended an average recall frequency of 8.42 months (median 9 months).

Tables 6.2.7 – Analysis Using Recall Frequency

Analysis Variable : Recalls_per_month						
GA_treat	N Obs	Mean	Median	Minimum	Maximum	Std Dev
Chair Treatment	115 43.6%	0.0985234	0.1034483	0.0175439	0.2000000	0.0395715
GA Treatment	32 12.1%	0.0652716	0.0526316	0.0169492	0.2000000	0.0442162
No Treatment	117 44.3%	0.1187591	0.1111111	0.0263158	1.0000000	0.0946191

Kruskal-Wallis Test	
Chi-Square	25.3798
DF	2
Pr > Chi-Square	<.0001

7 DISCUSSION

This study wanted to determine if the rate of recall frequency following dental treatment under GA could be correlated to the need of requiring new dental treatment in the future. This study also wished to determine if the rate of recall frequency for those requiring new dental treatment affected whether or not the patient required a repeat GA vs. treatment in the dental chair. A total of 674 charts of patients who underwent an initial GA for dental treatment from Jan 01, 2010 to Dec 31, 2011 were reviewed. From the 674 charts reviewed a total of 264 patients were seen at least once for a recall examination following treatment under GA, and 147 (or 55.68%) of the patient's required new dental treatment at a follow-up exam. This finding is similar to the findings of Berkowirz et al., 1997, who reported that 50% of children attending a recall examination following general anesthesia required additional treatment and Eidelman et al., 2000, reported that 59% of children treated under GA required new dental treatment. 32 patients out of the 264 patients seen again following dental treatment under an initial GA (or 12.1%), required new dental treatment to be accomplished under a repeat GA. Worthen et al., 2000, similarly reported that 20% of the young patients in their study required a subsequent GA for new dental treatment, and Almeida et al., 2000, reported that 17% of patients who underwent dental treatment under GA required a repeat GA for dental treatment within a 2 year time period. In this study 117 patients did not require new

treatment at any recall examination. A total of 410 patients were lost to follow-up and never seen again for a recall examination whatsoever.

On average, patients requiring a repeat GA for new dental treatment waited significantly longer to attend their first recall visit following GA, attended for regular recall examinations at a significantly lower frequency following GA, and were significantly younger at the time of initial GA than patients requiring new treatment in the dental chair. A possible explanation as to why younger patients treated under GA may require a repeat GA in the future may be related to new teeth erupting following the initial treatment.

7.1.1 Time to first recall and need for repeat GA:

The average time to first recall for those requiring a repeat GA for new dental treatment was 18.15 months (median 14 months), for those requiring new treatment in the dental chair was 13.12 months (median 10 months), and for those not requiring new dental treatment was 11.4 months (median 10 months). In general, as the time to first recall appointment increased following GA, the invasiveness of treatment modality required to treat the patient also increased.

7.1.2 Recall frequency and need for repeat GA:

The average recall frequency for patients requiring a repeat GA for new dental treatment was 15.3 months (median 19.0 months), for those requiring

treatment in the dental chair was 10.15 months (median 9.66 months), and for those not requiring new dental treatment was 8.42 months (median 9 months). In general, as recall frequency increased following GA, the invasiveness of treatment modality required to treat the patient decreased.

7.1.3 Age and effect for the need of repeat GA:

The average age at the time of initial GA for patients requiring new dental treatment under a repeat GA was 41.22 months (median 38 months) and for those requiring treatment in the dental chair was 63.54 months (median 56.5 months). Although age had no significant bearing on whether or not the patient would require new treatment following GA, the younger the patient was at the time of initial GA, the increased likelihood that new treatment, if required, would require a repeat GA in order to accomplish the treatment. The mean age of patients at the time of initial GA who required a repeat GA for new dental treatment was 41.2 months (median 38 months), whereas those who were able to be treated in the chair for new dental treatment was 63.54 months (median 56.5 months). The average age at the time of repeat GA for new dental treatment in this study was 64.4 months which is higher than reported in a study by Sheller et. al., 2003, who reported the average age of repeat GA being years (or 56.4 months) of age.

7.2 Considerations

It is important to note that very few patients who were seen again following treatment under GA returned for a follow-up exam within a 3 month or even a 6 month time frame. Only 8 out of 264 (or 3.0 %) of the patients who were seen again were seen within 3 months following GA, and 26 out of 264 (or 9.8%) were seen again within a 6 months time frame following GA (see Raw data 1). Furthermore in looking at recall frequency rates, only 3 out of 264 (or 1.1%) of the patients attended at a recall frequency of at least 3 month intervals and 21 out of 264 (or 8.0%) of the patients attended at a recall frequency of at least 6 month intervals (see Raw data 2). The AAPD guidelines indicate that high-risk patients should return at least every 3 months, moderate risk patients should be seen at least every 6 months, and low risk patients should be seen at 6-12 month intervals (American Academy of Pediatric Dentistry, 2015). All patients included in this study were at high risk for developing new caries following GA, however the majority of patients seen again in this study attended for recall examinations at a 6-12 month intervals, which is a frequency normally recommended in patients who are at low risk for developing caries. Many more attended at a frequency of greater than 12-month intervals, which was especially true for those requiring a repeat GA for new dental treatment. Gender of the patient, location of residence, ASA classification, and insurance type had no significant impact on patients requiring new dental treatment under GA,

requiring new dental treatment in the chair, or not requiring new treatment at any recall exam following GA.

7.3 Limitations

This study had a large loss to follow-up in that many patients failed to attend for any recall examination following treatment under GA. High delinquency rates for follow-up or recall examinations have similarly been reported in other studies (Almeida et al., 2000; Powers et al., 2009; Kakaounaki et al., 2011). A comparison was made between patient factors in this study and rates of delinquency to (see Raw data 3). Interestingly the highest rates of delinquency were among patients who did not have insurance coverage and patients who lived rurally vs. urban, suggesting lack of access to care being part of the reasoning behind loss to follow-up. Furthermore the facility (CDW) where data was collected has many patients whom attended for treatment under GA, through referral from their dental home. Many patients lost to follow-up in this study may have returned for recall examination at their dental home, and thus lost for data collection in this study.

7.4 Hypothesis Revisited

After completing this study it has been concluded that:

1. We reject the null hypothesis that there will be no relationship between recall frequency and the need for successive restorative treatment under GA or in the dental chair as there was significant difference ($P < 0.0001$) between recall frequency in those who required new dental treatment in the chair, those who required new dental treatment under a repeat GA, and those who did not require any new treatment at any recall exam following their initial dental treatment under GA.
2. We accept the alternative hypothesis that those patients who attend regular recall examinations following dental treatment under GA, will be less likely to require successive restorative treatments under GA or in the dental chair and that in comparing modalities of proposed treatment for those who require new restorative treatment following treatment under GA; that those who have had a higher recall frequency will be less likely to require a repeat GA for restorative treatment, and be more likely able to be treated in the dental chair

8 CONCLUSION

Results from this study indicate that there is an association between recall frequency and the need for new treatment following dental treatment under general anesthesia. More specifically the findings of this study suggest that children who attend more regularly for recall examinations following treatment under GA, are less likely to require new dental treatment in the future, as well as are less likely to require a repeat GA in the event that they do experience caries relapse. If increased recall frequency can reduce the likelihood that a child will require new treatment, or a repeat GA following an initial GA, then we may possibly reduce the associated costs and risks of treatment, while increasing the quality of life of children. Overall this study has shown that recall frequency following treatment under GA can affect the need for new treatment.

9 RAW DATA

1: Time to 1st recall appointment compared to number of patients in each treatment modality					
Time to 1st Recall	**Total Number of Patients**	**No Tx required**	**Pt Requires New Tx**	**Pt Requires Tx in chair**	**Pt Requires GA Tx**
0≤3 months	8	5	3	3	0
3≤6 months	18	6	12	10	2
6≤12 months	132	66	66	55	11
>12 months	106	40	66	47	19

2: Recall frequency compared to number of patients in each treatment modality					
Recall frequency	**Total Number of Patients**	**No Tx required**	**Pt Requires New Tx**	**Pt Requires Tx in chair**	**Pt Requires GA Tx**
0≤3 months	3	3	0	0	0
3≤6 months	18	14	4	3	1
6≤12 months	158	69	86	78	8
>12 months	88	31	57	34	23

3: Patients never seen again following GA compared to patient factors				
Patient Factor	**Total**	**Total percent**	**Total lost to follow-up**	**Percent lost to follow-up**
Gender:				
- Male	331	49.11	215	65.0%
- Female	343	50.89	195	56.9%
Insurance:				
- None	64	9.50	47	73.4%
- Private	332	49.26	190	57.2%
- Public	278	41.25	173	62.2%
Area:				

- Rural	247	36.65	187	75.7%
- Urban	427	63.35	223	52.2%
ASA:				
- ASA-I	625	92.73	382	61.1%
- ASA-II	49	7.27	28	57.1%

10 APPENDIX

Appendix A: University of Manitoba Research Ethics Board Approval Forms

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UNIVERSITY OF MANITOBA | BANNATYNE CAMPUS

Research Ethics Board

HEALTH RESEARCH ETHICS BOARD (HREB)

CERTIFICATE OF FINAL APPROVAL FOR NEW STUDIES

Delegated Review

PRINCIPAL INVESTIGATOR:	INSTITUTION/DEPARTMENT:	ETHICS #:
Dr. O. Mohammad	UofMéPediatric Dentistry	H2014:376
APPROVAL DATE: December 9, 2014	**EXPIRY DATE:** December 9, 2015	
STUDENT PRINCIPAL INVESTIGATOR SUPERVISOR (if applicable): Dr. C. Lekic		

PROTOCOL NUMBER:	PROJECT OR PROTOCOL TITLE;
NA	Does Dental Recall Frequency Affect the Need for Subsequent Dental Treatment, Following Treatment Performed under General Anesthesia in Children?
SPONSORING AGENCIES AND/OR COORDINATING GROUPS: Pediatric Dentristry Graduate Program	

Submission Date of Investigator Documents:	HREB Receipt Date of Documents:
October 16 and November 27, 2014	October 20 and November 29, 2014

THE FOLLOWING ARE APPROVED FOR USE:

Document Name	Version(if applicable)	Date
Protocol: Revised Submission		submitted November 27, 2014
Consent and Assent Form(s):		
Other: Data Collection Sheet		November 27, 2014

CERTIFICATION

The above named research study/project has been reviewed in a ***delegated manner*** by the University of Manitoba (UM) Health Research Board (HREB) and was found to be acceptable on ethical grounds for research involving human participants. The study/project and documents listed above was granted final approval by the Chair or Acting Chair, UM HREB.

HREB ATTESTATION

The University of Manitoba (UM) Research Board (HREB) is organized and operates according to Health Canada/ICH Good Clinical Practices, Tri-Council Policy Statement 2, and the applicable laws and regulations of Manitoba. In respect to clinical trials, the HREB complies with the membership requirements for Research Ethics Boards defined in Division 5 of the Food and Drug Regulations of Canada and carries out its functions in a manner consistent with Good Clinical Practices.

QUALITY ASSURANCE

UNIVERSITY OF MANITOBA

Research Ethics - Bannatyne
Office of the Vice-President (Research and International)

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Canada, R3E 0W3
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HEALTH RESEARCH ETHICS BOARD (HREB)

CERTIFICATE OF ANNUAL APPROVAL

PRINCIPAL INVESTIGATOR:	INSTITUTION/DEPARTMENT:	ETHICS #:
Dr. O. Mohammad	U of M/Pediatric Dentistry	HS17861 (H2014:376)
HREB MEETING DATE (If applicable):	**APPROVAL DATE:** December 4, 2015	**EXPIRY DATE:** December 9, 2016
STUDENT PRINCIPAL INVESTIGATOR SUPERVISOR (If applicable):		

PROTOCOL NUMBER:	PROJECT OR PROTOCOL TITLE:
NA	Does Dental Recall Frequency Affect the Need for Subsequent Dental Treatment, Following Treatment Performed under General Anesthesia in Children?
SPONSORING AGENCIES AND/OR COORDINATING GROUPS: Pediatric Dentistry Graduate Program	

Submission Date of Investigator Documents:	HREB Receipt Date of Documents:
October 21, 2015	October 22, 2015

REVIEW CATEGORY OF ANNUAL REVIEW: **Full Board Review** ☐ **Delegated Review** ☒

THE FOLLOWING AMENDMENT(S) and DOCUMENTS ARE APPROVED FOR USE:

Document Name(if applicable)	Version(if applicable)	Date

Annual approval

*Annual approval implies that the most recent **HREB approved** versions of the protocol, Investigator Brochures, advertisements, letters of initial contact or questionnaires, and recruitment methods, etc. are approved.*

Consent and Assent Form(s):

CERTIFICATION

The University of Manitoba (UM) Health Research Board (HREB) has reviewed the annual study status report for the research study/project named on this ***Certificate of Annual Approval*** as per the category of review listed above and was found to be acceptable on ethical grounds for research involving human participants. Annual approval was granted by the Chair or Acting Chair, UM HREB, per the response to the conditions of approval outlined during the initial review (full board or delegated) of the annual study status report.

HREB ATTESTATION

The University of Manitoba (UM) Health Research Board (HREB) is organized and operates according to Health Canada/ICH Good Clinical Practices, Tri-Council Policy Statement 2, and the applicable laws and regulations of Manitoba. In respect to clinical trials, the HREB complies with the membership requirements for Research Ethics Boards defined in Division 5 of the Food and Drug Regulations of Canada and carries out its functions in a manner consistent with Good Clinical Practices.

Appendix B: Data Capture Sheet

Data Collection/Capture Sheet

Date of Data Collection (DD/MM/YY): □□/□□/□□

Data Elements to be collected:

Demographic data and identifiers

1. Age (YY/MM): □□/□□
2. Birthdate (DD/MM/YY): □□/□□/□□
3. Gender: □ (f-1; m-2)
4. Pts. first 3 digits of postal code: □□□
5. Type of Insurance: □ (none=0, Private = 1 and Public = 2)
6. ASA Classification of the pt. □ (ASA I=1, ASA II= 2, ASA III=3, ASA IV=4)

Data elements from chart or database

Treatment Details:

7. Identify Date When Pt. first seen for exam: □□/□□/□□DD/MM/YY
8. Identify Date When Pt. had Treatment under GA: □□/□□/□□ (DD/MM/YY)
9. Date of treatment (under GA) was performed: □□/□□ (YY/MM)
10. Was there any recall Exam after GA?: □ (Y=1 N=2)
11. Date of first Recall Exam after GA □□/□□/□□ (DD/MM/YY)
12. How Many recalls has Pt had since GA □
13. Date of recall exam when new caries detected □□/□□/□□ (DD/MM/YY)
14. Does Pt Require New treatment at any Recall Exam □ (Y=1, N=2)
15. If Yes to 14. Was GA recommended to treat PT □ (Y=1, N=2

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