

**AN ANALYSIS OF DENTAL EMERGENCY CASES MANAGED AT BC CHILDREN'S
HOSPITAL**

by

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Abstract

Objective: To explore factors contributing to a reported increase in emergencies presenting to the Department of Dentistry at BCCH over recent years by investigating the “who, what, when and why” of their hospital management.

Methods: A two-phase study incorporated quantitative (retrospective chart review) and qualitative (personal interview) elements. *Phase 1*- Records of 300 emergencies from 2009 to 2013 were systematically selected and reviewed. Patient demographics; source of referral; time/day of visit; nature, scope and management of emergency; and follow-up care were analyzed (Pearson’s Chi-squared Tests and Odds Ratios). *Phase 2* - Twenty-five interviews with parents of children who recently experienced dental emergencies were recorded and analyzed for common themes in reported factors/circumstances.

Results: Emergencies included dentoalveolar trauma (56.7%), pain of dental origin (20%), swelling from advanced dental disease (13.3%), and ‘other’, unrelated to trauma or caries (10%). Common patient characteristics were: healthy, male, young age (<7 years old), proximity of residence to the hospital and low socioeconomic status. Primary source of referral was the emergency department; emergencies presented equally throughout the week. No immediate intervention was necessary for the majority of cases and follow-up with a community dentist was advised. Factors contributing to a parent’s decision to seek emergent dental care in a hospital setting included: perception of urgency; concern for their child’s well being; desire for reliable

care by a reputable institution; limited understanding of dental disease and consequences of poor oral care; and financial and access to care barriers.

Conclusion: Dentoalveolar trauma and untreated advanced dental caries compel families to seek hospital-based dental emergency services. More aggressive efforts to improve awareness of the importance of early dental visits; development of curricula emphasizing management of anxious children and exposure to pediatric emergencies; and reinforcing the ethical responsibility of dentists to provide after-hours emergency care may help to reduce burden on hospital resources.

Preface

This thesis is original, unpublished, independent work by the author. Identification and design of this research project were by the author under the direction of her research supervisor, Dr. Karen Campbell. Data collection was conducted by the author with assistance from a summer research student and an objective facilitator with experience in qualitative research, Dr. Tracy Wong. Data analysis was conducted by the author with the guidance of Dr. Wong and statistical consultant, Rick White. Regular committee meetings were held with the supervisory committee, consisting of Drs. Karen Campbell, Rosamund Harrison, Tracy Wong and Ran Goldman.

Ethical approval for the study was granted by the UBC Children's & Women's Clinical Research Ethics Board [H12-01393]. The online ethics training module Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS2: CORE) was issued and completed by the author on November 30th, 2012.

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Chapter 1: Introduction

Oral health is a key component of overall health and poor oral health in children may adversely affect growth and development, susceptibility to other diseases and quality of life [1]. The World Health Organization defines oral health as “a state of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss and other diseases and disorders that limit an individual’s capacity in biting, chewing, smiling, speaking and psychosocial well being” [2]. Worldwide, 60-90% of school children have dental cavities, often leading to pain and discomfort, and 16-40% of children 6 to 12 years of age are affected by dental trauma due to unsafe playgrounds and schools, road accidents or violence [2]. According to the Canadian Health Measures Survey, nearly 60% of children 6 to 19 years of age have or have had a “cavity” [3].

Current oral health care challenges for children in British Columbia include: high prevalence of dental disease, insufficient public funding and limited access to dental providers [4]. In light of these issues, the Children’s Dentistry Task Force was convened by the British Columbia Dental Association (BCDA) to strategize ways to improve the dental health of children in this province. Interestingly, the Task Force [4] reported that the number of dental emergency cases managed at BC Children’s Hospital (BCH) had more than quadrupled from 283 in 2005 to over 1200 children in 2011. To investigate the reasons behind this alarming finding, members of the BC Society of Pediatric Dentists were consulted; their explanations included:

“Recent economic downturn has resulted in [the public] becoming more reliant on public dental benefits”;

“The closure of the second operating room at BCCH resulting in decrease in access to GA dental treatment”;

“Inequities between the public dental fee guide and the BCDA fee guide leading to balanced billing ... which creates financial barriers for families”;

“BCCH dental department has become regarded by the dental, and the wider, community as a place for all children... this change in perception has likely led to more healthy children presenting at the hospital with dental emergencies”.

Despite these reflections, it remains unclear to what degree these factors have contributed to the reported phenomenon. As further stated in the report, solutions will not be found without closer investigation into “*what is going on and why*”. Careful research and study of this phenomenon will lead to more accurate explanations.

The introduction that follows will provide suitable background to support this research investigating dental emergencies managed by the Dentistry Department at BCCH (DD-BCCH). First, an overview of recent population growth in BC will be provided, followed by an explanation of the operations and dental emergency protocols at BCCH, and a brief description of common childhood dental emergencies and management. Further, this section will include a review of what is understood from literature about pediatric dental emergencies in hospitals, the issues related to dental care access and will conclude with a description of the mixed methods methodology developed for our investigation of dental emergencies managed by DD-BCCH.

1.1 British Columbia’s Growing Population

The population in the province of British Columbia is rapidly growing. As of July 1, 2014, British Columbia’s population was estimated to be over 4.6 million people. Total

population increase for the province over the past year was in excess of 48,000 from international immigration, interprovincial migration and natural increase [5, 6]. Migration has been the main driving factor in BC's growth for the past three decades and is expected to account for an even larger share in the next decade due to a steady decline in natural increase and an increase in immigration [7]. According to the 2001 Census, more than one million immigrants were living in BC [8] with eighty-five percent settled in the province's Lower Mainland [7], which is located in the southwestern corner of British Columbia and encompasses the Greater Vancouver Area and Sunshine Coast. It is the most densely populated region in Canada with approximately 473 people per km².

In spite of the fact that over 70.5% of recently immigrated individuals are of working age, immigrants to BC lag behind their Canadian-born counterparts in employment and income levels [9]. The unemployment rate for recent immigrants (i.e., arrival within 5 years) was reported to be nearly 10% in 2006 [8] and over 12% in 2010 [9]. Thirty-four percent of those employed were considered low income and main contributors to income were government transfers, such as child benefits [10]. Recent immigrants were less likely to work in occupations related to business, finance and administration and more likely to work in sales and service [8].

1.2 BC Children's Hospital (BCCH)

British Columbia Children's Hospital (BCCH) is the province's only specialty pediatric hospital. It is a 180-bed, UBC-affiliated tertiary care teaching center based in Vancouver, and serves a culturally and medically diverse population of children from all socioeconomic groups. BCCH provides expert care and vital health services for the province's most medically complex, seriously ill or injured children that may not be available anywhere else in BC. BCCH is the

province's major treatment, teaching and research facility for child health, with over 200,000 children cared for on an annual basis [11].

1.2.1 BCCH Dentistry Patient Criteria

The Department of Dentistry at BC Children's Hospital (DD-BCCH) delivers comprehensive dental care and specialized surgical care for children with special health care needs (CSHCN) and healthy young children whose needs cannot be met in a conventional dental office. A referral from a health care professional is required and eligibility criteria are as follows:

- Children, 48 months of age and under with severe caries, and/or
- Children, under 17 years of age with a significantly compromising medical condition (e.g., cancer, organ transplant, congenital heart disease, cleft lip and/or palate, craniofacial anomaly, physical disabilities, medically diagnosed behavior management issues such as developmental delay or autism).

Clinic hours are Monday through Friday from 8:00am to 4:00pm. DD-BCCH also provides 24-hour 'on-call' service for emergency dental care. After-hours emergency patients must register through the emergency department (ED). As is the case in many other children's hospitals across North America, patients are assessed and treated by pediatric dental specialists-in-training under the supervision of attending dental staff (pediatric dentists and oral surgeons) [11, 12].

1.2.1.1 Patient Load and Waiting Times

DD-BCCH is a busy department and presently receives an average of 100 new patient referrals every month requesting consultation and treatment. Preventive and ongoing dental care are a significant part of the services provided to medically fragile and other children that cannot be managed in an outpatient dental setting. Patients are triaged depending on the urgency of the care required. The wait time for consultation is based on priority and may be up to three months,

with routine dental rehabilitation cases waiting an additional six months before treatment under general anesthesia can be accomplished [13].

1.2.1.2 Evolution of Dentistry as a Hospital Service

Prior to 2009, DD-BCCH was less busy and experienced yearly dental resident turnover. Newly graduated dentists enrolled in a one-year General Practice Residency program through the University of British Columbia were the first-line dental providers with respect to patient care. Dental documentation was sent to the health records department to be filed in the hospital patient chart. Unfortunate consequences of this records management system included delayed filing and/or misfiling of documentation, or even missing patient information. As a result, inaccurate collection and tallying of patient numbers and procedural statistics proved difficult. In 2009, DD-BCCH implemented within department dental charts for each patient consulted and treated to aid on-going patient care delivery and further development of Dentistry as a formal hospital service. This process, along with the addition of the graduate training program in Pediatric Dentistry improved patient documentation and facilitated the management of the rapidly growing patient pool within the Dental department.

1.2.2 BCCH Emergency Service Model

1.2.2.1 Dentistry Department

DD-BCCH fields consultation requests for a wide spectrum of dental emergencies, varying in urgency and necessary treatment. These include dentoalveolar trauma, pain or swelling from untreated dental decay, and rarely, other emergencies unrelated to trauma or caries (e.g., pathology, orthodontic concerns). Emergencies involving permanent tooth fractures exposing pulp tissue, permanent tooth displacements, avulsions, facial cellulitis and uncontrolled post-operative oral hemorrhage are among those requiring urgent intervention.

Emergency consultation may be requested by varying sources: emergency department at BCCH, other departments within BCCH, community dentists or specialists, other health care professionals, and parents/caregivers of “active” patients with ongoing care at DD-BCCH.

For dental emergency consultation requests during clinic hours, patients are directed to the Ambulatory Dental Clinic and assessed by trainees (i.e., General Practice Residents (GPRs) or pediatric dentistry graduate students) under the supervision of attending pediatric dentists. After hours emergency care is provided by trainees with an assigned attending pediatric dentist or oral surgeon available for consultation. Of note, after April 2013, the GPR program was phased out of DD-BCCH and therefore the GPRs were no longer involved in on-site patient care. Hence, from that point on, all “front line” dental emergency management was provided by specialist-trainees from the UBC pediatric dentistry graduate program.

1.2.2.2 Emergency Department

In the current after-hours service model, a child presenting to BCCH with an urgent dental concern is directed to the emergency department (ED), where (s)he is quickly assessed by a trained triage nurse stationed at the “Emergency Report Here” desk. The emergency is triaged in accordance to the Canadian triage and Acuity Scale Paediatric Guidelines (PaedCTAS) [14]. This information is passed on to the “Urgent Care” section of the ED for review by an attending physician. The patient is examined by an ED physician or a medical resident supervised by an attending staff physician. A dental concern may be managed in one of three ways:

1. In the case of a permanent tooth avulsion with less than two hours extraoral time, the patient is sent directly to the “Critical Care physician” who will replant the tooth, then advise the Dentistry department (8am-4pm) or page the dentist on call (after 4pm);

2. One-third of cases are directed to DD-BCCH (8am-4pm) or dentist on call (after 4pm) for further assessment/management;
3. Two-thirds of cases are deemed non-urgent and discharged with appropriate supportive care instructions/information, such as a list of local dentists, pain management instructions, or a prescription for oral antibiotics [15]. In some cases, if the attending physician feels the case may meet hospital criteria, a non-urgent consultation request will be faxed to the Dentistry Department to initiate further review.

1.3 Dental Emergencies that Typically Present to a Tertiary-Care Children's Hospital

1.3.1 Dentoalveolar Trauma

Andreasen's modification of the World Health Organization Classification is widely used to classify intraoral traumatic injuries [16, 17]. Fractures may involve the crown, root or bony alveolus. Dental hard tissue fractures are classified as 'uncomplicated' (enamel and/or dentin involvement only) or 'complicated' (the fracture has pulpal involvement). Injuries to the periodontal supporting tissues of the teeth are classified as: concussion, subluxation, lateral luxation, intrusion, extrusion and avulsion. Any particular trauma case may present with multiple injuries of varying type and degree, and in combination.

1.3.1.1 Management

Management of primary dentition trauma is kept simple and held to basic principles due to patient behavior and limited lifespan of primary teeth. The main management objective is to mitigate damage to the developing successor tooth.

Prognosis for permanent teeth generally decreases as time-to-management increases. Displacement or luxation injuries, particularly avulsions, require urgent treatment to optimize both pulpal and periodontal outcomes.

1.3.1.2 Sequelae of Dental Trauma

There are many potential outcomes from dental trauma; some will necessitate further treatment while others may be managed with periodic observation and radiographic monitoring. Outcomes may include colour changes within the coronal portion of the tooth; pulp canal obliteration or calcification of the root canal space (PCO); pulpal necrosis (PN); root resorption and tooth loss.

With respect to colour changes, pink discoloration may be a sign of intrapulpal hemorrhage, especially when it becomes apparent immediately following trauma. It may also represent internal resorption if the discolouration appears some time later. Yellow is often a late-appearing sign of pulp calcification or PCO. Dark (grey, blue or brown) discoloration may be a result of hemoglobin components from a pulpal bleed degrading within the dentinal tubules, or, if later appearing, a sign of PN.

Pulp canal obliteration is an inflammatory-induced pulpal response to traumatic injury, characterized by slowly progressive obliteration of canals with reparative or dystrophic dentin. The majority of teeth with this condition remain vital and intact while a very small number may progress to PN [18].

An injured tooth demonstrating clinical and/or radiographic signs of PN must be treated endodontically or, in rare circumstances, extracted. Should treatment be delayed and PN progress to a fulminating pulpal infection, poorer long-term outcomes are generally observed.

Surface root resorption occurs when minor injury is inflicted to the root surface. At the cellular level, the injured periodontal ligament tissue is removed and new cementum is generated. Inflammatory resorption is mediated by the immune system and often initiated from the ingress of microorganisms via extra-alveolar sources or infected pulpal tissues. This form of resorption can appear in the early post-trauma period and is a rapidly progressive process that leads to loss of root mass unless endodontic therapy is initiated. In contrast, replacement resorption is a much slower process that occurs when significant amounts of dentin and cementum are exposed to unhindered osteoclastic activity. Replacement resorption results in ankylosis, arrested alveolar growth in the growing child and most often, because the process cannot be reversed, the tooth is eventually lost.

In summary, emergent trauma may result in significant morbidity and in some instances requires immediate attention and vigilant follow up monitoring. Outcomes are predictable yet variable and may take time to develop. Timely, accurate assessment is necessary to determine the full scope of injuries at presentation in order to guide necessary interventions and predict probable long-term outcomes for the patient and their family.

1.3.2 Dental Caries

Dental caries is a multifactorial, carbohydrate-modified, infectious disease caused by cariogenic bacterial insult to dental hard tissues. It is the most common chronic disease of childhood, five times more common than asthma and four times that of childhood obesity [19]. Although it is a commonly recognized childhood condition, it disproportionately affects those children at risk due to low socio-economic circumstance [20] and compromised medical status [21, 22]. Although considered multifactorial in etiology, three essential factors for initiation and progression of decay include: a susceptible host, cariogenic bacteria, and fermentable

carbohydrates. The caries process has variable expression over time and is a dynamic process of demineralization and remineralization.

1.3.3 Caries Management

Canada's universal healthcare system does not include dental care [23]. The high cost of dental rehabilitation is the main reason people avoid visiting the dentist and are likely to go without care [24, 25]. Canada's vulnerable groups, which includes young children and adolescents, are more likely to have untreated dental decay, gum disease and dental pain [25].

Children who are unable or unwilling to tolerate dental treatment in a conventional dental setting require adjunct services (i.e., sedation or general anesthesia) to enable dental providers to safely perform restorative procedures. In many cases, pre-school-aged children lack the psychological and emotional maturity to cooperate and remain still for complex dental treatment and those with severe developmental disabilities are incapable of full cooperation [13]. Children with special health care needs may be medically fragile and therefore best managed for such procedures in a hospital setting. Adjunct services are not only costly but also limited in accessibility especially for families in BC. Few practitioners offer such procedures in the community and long wait-times exist for hospital services [26].

1.3.3.1 Sequelae of Untreated Dental Caries

Sensitivity and pain may be experienced as caries extends into dentin and pulp. Dentinal tubules contain nerve fibers surrounded by fluid. The "hydrodynamic theory" proposes that pain is felt when stimuli to exposed dentinal tubules create fluid movement and nerve compression [27, 28]. As caries progress toward the pulp, pulpal inflammation will ensue. Pulpitis is thought to increase pressure within the pulp tissue and irritate the sensory nerves. This inflammation, if treated early, is reversible.

When inflammation remains untreated or the pulp is affected by caries, moderate to severe inflammation occurs along with areas of necrosis. This pain may be triggered by a chemical or thermal stimulus or arise spontaneously, thereby identified as irreversible pulpitis. Endodontic treatment or extraction is indicated for the tooth and analgesia using pharmacologic agents may only provide short-term relief.

If the inflammatory process is allowed to progress, the pulp will continue to necrosis and accumulate toxins that spread to the apical tissues. Acute periradicular pain can be excruciating, last for days and be difficult to control with simple oral analgesics. Spread of infection into the furcal or periapical tissues forms a localized osteolysis and/or soft-tissue parulis; however infection can further track through the bone to the bony periosteum or through soft tissues along fascial planes to cause cellulitis or an extraoral swelling of head or neck tissues. Usually the patient's quality of life is severely compromised at this stage.

Fascial spaces are connective tissue-lined potential spaces that can be distended by purulent exudate from infections. Spread of infection occurs through the path of least resistance and is primarily determined by muscle attachments. The main fascial spaces involved in an odontogenic infection from a maxillary tooth may include the canine, buccal and infratemporal spaces. Infection may spread superiorly and cause periorbital or orbital cellulitis, damaging the vascular and neural components of the orbit. Bacteria can also readily invade and contaminate the cavernous sinus via the venous circulation, resulting in thrombosis. Mandibular odontogenic infections commonly erode into the buccal vestibule; however may spread into the buccal, submental, submandibular, and sublingual spaces. Bilateral submental, submandibular and sublingual space infection is a rapidly progressing cellulitis known as Ludwig's angina, which can cause airway obstruction, track downward to the mediastinum and lead to death. Other

consequences of cellulitis may include trismus and refusal to eat or drink, resulting in dehydration and hypovolemic shock.

Fascial space infections in children are serious, life-threatening infections requiring immediate medical and surgical intervention and are usually managed with a team approach. These infections can induce significant morbidity and may require hospital admission for proper management. The source must be identified and eliminated, and the infection managed aggressively with both antibiotics and incision/drainage procedures. For the majority of pediatric cases, surgical management under general anesthesia, carried out in a hospital operating room is necessary to bring these serious infections under control.

In summary, dental caries is a common childhood disease that has the potential to cause significant compromise to quality of life, ability to function and serious morbidity if not managed appropriately. Unfortunately, CSHCN and economically disadvantaged children become most vulnerable to the negative sequelae of dental caries. Should treatment be delayed due to financial or other reasons, these children are highly at risk for dental pain and infection requiring emergency management.

1.3.4 Emergencies Unrelated to Trauma or Caries

1.3.4.1 Pathology

Although trauma and caries are primary reasons for patients to present with a dental emergency, there are patients who may present to a hospital with acute exacerbations of undiagnosed or previously unmanaged pathology [29]. In children, the most common are gingivitis, traumatic ulcers and oral manifestations of viral, bacterial and fungal infections [29, 30]. Suspected pathologic lesions should be referred to a specialist in oral medicine/oral pathology, or oral surgery for biopsy to confirm the diagnosis and arrange treatment.

1.3.4.2 “Non-emergencies”

A small number of patients present with a problem that is not a “true” emergency, therefore inappropriate for management in a hospital emergency department. Exfoliating and erupting teeth, orthodontic concerns, broken or dislodged appliances are examples of common “non-emergencies” [29, 31]. In most cases, one would assume there is a lack of understanding of what services an emergency department should provide or perhaps they are unsure where to find assistance for their concern.

1.4 Review of Literature Relating to Hospital-based Dental Emergencies

Untreated dental decay and dentoalveolar trauma are by far the most common reasons caregivers seek emergency dental care for their children. Untreated decay was noted to be of higher prevalence than trauma in Belfast, Ireland [32], Montreal, Canada [29] and Houston, Texas [31], whereas, the reverse was noted in Seattle, Washington [33].

Characteristics of dental trauma presenting to various children’s hospitals have been well documented. Males have been shown to exhibit a higher prevalence of dental trauma compared to females [29, 31-35]. Most studies report this to be true for all age groups [31-34], while others do not report gender-based differences in children less than 3 years old [29, 35]. The mean age of children sustaining dentoalveolar trauma has been reported to be younger than 5 years old, with the majority of injuries occurring in 2 year olds [32, 34, 36-38]. Some studies have shown a second increase in children between the ages of 5 and 9 [32, 34, 35, 38, 39].

There are conflicting results identifying seasonal peaks for dental trauma. Despite using similar methodologies, many studies report the peak to be late spring and summer months [32, 34, 36, 39], while others report fall [40] or winter [38]. Battenhouse et al. [37] and Schwartz [29]

report similar findings that approximately 40% of emergency dental trauma visits occur during non-clinic hours. Lombardi et al. [34] found that the frequency during clinic hours was highest at noon and 1pm, while those who presented after hours arrived between 5pm and midnight.

Falls are the most common cause of dentoalveolar trauma in children; children under 5 most commonly fall indoors, while those 5 and older experience injuries associated with sports and activities [34, 38]. Dentoalveolar trauma most commonly involves the maxillary incisors in both the primary and permanent dentition [17, 32, 35]. In the primary dentition, the most common injury is displacement [17, 34, 38] and fractures in the permanent dentition are predominant [17, 34]. Treatment for dental trauma has been less reported. Forty percent of cases were comprised of examination alone [34, 41]. Other reported procedures included extractions for the primary dentition [34, 38, 41], and temporary “bandage” restorations and splints for permanent dentition [34, 36].

While it is recommended by professional dental associations [42, 43] that children have their initial visit to the dentist by 1 year of age, most do not. Lombardi et al. found that the emergency visit was the first contact with a dentist for 47% of children and 83% of those were less than 4 years old [34]. Families of injured children who have yet to establish regular dental care often turn to hospitals for emergency dental treatment. A number of studies have confirmed that the most efficient venue for treating minor dental trauma is in a dental clinic setting, where supporting resources are available for definitive treatment and later, follow-up can be arranged there [34, 44, 45]. Further, Wagle et al. [45] compared the time interval between occurrence of dental injury and receiving treatment in a hospital setting with that of a private pediatric practice. They found that children who seek emergency care in a hospital setting experienced significantly

greater delays due to: further distance traveled, longer wait for administration services and triage, and time spent making appropriate referrals. [45].

Evidence from the literature suggests that the ED is evolving from a place for major dental trauma treatment to a source of primary care. Failure to establish a dental home by age 1 may also be a contributing factor to the high prevalence of children presenting with emergencies related to dental pain or abscess from untreated decay. The Healthcare Cost and Utilization Project (HCUP) reported US nationwide data on ED visits for dental-related conditions in 2009 and researchers found that dental caries was the first-listed diagnosis for nearly half (42%) of visits [46]. Battenhouse et al. [37] reported that 45% of almost 1500 pediatric dental emergency visits in one calendar year at Children's Hospital of Pittsburgh, PA was attributed to dental caries and abscess formation. At Columbus Children's Hospital in Ohio, Wilson et al. [47] described the types of non-traumatic emergencies presenting to the ED during a one-year period, noting caries was reported as the primary diagnosis in 73% of the cases. A five-year study at Texas Children's Hospital in Houston [31] reported 42% of 1102 dental emergencies were related to advanced dental disease.

Despite the commonality of caries-related dental emergencies, this issue has not been investigated to the depth that trauma-related dental emergencies have been studied in pediatric literature. The male predominance noted with dental injuries has not been similarly observed with caries-related emergencies [32, 48]. Also, the majority of patients with caries-related emergencies were younger than 7 years old [29, 32, 49].

Wilson et al. [48] reported a higher incidence of caries-related ED visits in the month of August. They attributed this peak to postponement of treatment in early summer months and also due to the "dental check-up" requirement pre-requisite to new school year enrollment. Graham et

al. [49] reported their largest volume of caries-related ED visits to have occurred in the autumn months. Further, they reported that the clear majority presented during the week as opposed to a weekend visit, and favoured daytime visits over evening or night.

HCUP reported that incidence rates for ED visits for dental-related conditions in 2009 were four times higher among patients from the lowest income communities [46]. A ten-year study by Zeng et al. [36] at Seattle's Children's Hospital evaluated trends in patients seeking emergency dental care. They found that 31% of children presenting with a caries-related dental emergency had no medical insurance and 22% received Medicaid benefits. Graham et al. [49] found that almost one-half of the accounts changed status during the billing process, with the majority being entered as "private pay" upon admission, but changing to "bad debt" or "charity" after the registration records were processed or collection attempted.

Emergency treatment for caries was documented in two studies. In one study, patients were treated by the ED physicians according to their signs and symptoms and then referred to a dentist for definitive treatment [49], and in the study by Wilson and colleagues [48], tooth extractions were the only active intervention performed; an extraction was performed in 45% of cases and of these, 60% were for children less than 7 years old.

Undeniably, the existing literature on pediatric dental emergencies is not without limitations and there is considerable lack of knowledge on this topic from Canadian and BC institutions. In fact, the majority of the studies are based on retrospective record review carried out in major hospitals within the US. Very few studies have investigated this issue in Canada and none in the past two decades. Despite acknowledgement that the ED is not an optimal place for routine or minor dental emergencies, little has been reported on longitudinal trends related to their continued use. Also the study methodology used does not explore the rationale behind the

parent's decision to seek care for an emergent dental need at a hospital as opposed to a dental office and therefore this important aspect remains poorly understood.

1.5 Access to Dental Care

1.5.1 Dental Home and Anticipatory Guidance

The “dental home”, established by the AAPD in 2003, was a concept modeled after the “medical home” as proposed in the 1990s by the American Academy of Pediatrics [50]. In theory if there was an established link for primary care (i.e., the “medical home”), there was less dependence on emergency care facilities and overall, care was more cost-effective since more expensive and invasive treatments were avoided. In the same light, the dental home is designed to ensure that each child receive the care that will optimize his or her oral health. The AAPD and its Canadian partner, the CAPD, recommends parents and caregivers establish a dental home by 12 months of age [42, 50]. A dental home should provide comprehensive oral health care, including prevention, diagnosis and treatment of disease based on individual caries risk assessment and anticipatory guidance. Referrals to specialists should be made without delay when care cannot be directly provided.

Sheller et al. [51] found that the first dental visit for 52% of children under the age of 4 was for a caries-related emergency visit, and similarly, Zeng et al. [36] reported that 62% of children seen for dental emergencies in a children's hospital had no regular source of dental care. Early detection and management of oral conditions can improve a child's oral health, general health and well-being; whereas, untreated dental disease can result in exacerbated problems which lead to more extensive and costly care [52].

Anticipatory guidance is a proactive, developmentally-based counseling technique that focuses on the needs of a child at each stage of life. The focus of anticipatory guidance is to provide practical information to parents/caregivers so they will anticipate impending changes, maximize their child's developmental potential, and identify special needs [5]. In oral health-related anticipatory guidance, parents are counseled in oral hygiene, home and office-based fluoride therapies and diet. Parents are educated on topics regarding oral habits, dental injury prevention and expected developmental changes. As an example of the positive effect that anticipatory guidance can provide, one randomized controlled study demonstrated that information given proactively to first-time mothers improved management of their child's teething symptoms [22].

1.5.2 Dental Care Benefits in Canada & Financial Barriers

Canadians pay for dental services in one of three ways: self-pay, directly out of pocket; public insurance or government-subsidized programs (e.g., Non-Insured Health Benefits [NIHB] for First Nations); or private dental insurance (direct purchased or employment-related). According to the Canadian Health Measures Survey 2007-2009, 62% of Canadians have private insurance; 6% are supported by public or government assistance; and 32% have no insurance [3].

Treatment of dental disease is very costly, comparable cost-wise to cancer and cardiovascular disease [53]. A Canadian study by Brodeur et al. revealed that decay rates were 2.5 times greater in children from the lowest income level as compared to higher income families [54]. Another study positively correlated receiving dental care with dental insurance, household income and education level [55].

Dental benefits fall under provincial and federal jurisdiction [3] and in 2003, Canada was ranked second-last among members of the Organization for Economic Co-operation and

Development in public financing of dental care [56]. Children of low-income families typically are eligible for some form of government-funded support or some form of public program to aid access to dental services; however, programs vary widely in terms of coverage and tend to focus on treatment rather than preventive care.

1.5.3 Community Dentists' Willingness to Treat Children

It is not uncommon for publicly funded dental services to have lower fee-reimbursement than rates based on private insurance coverage. Discrepancies between public and private reimbursement rates place publicly funded patients at a disadvantage by not being readily accepted by all dentists [55, 57].

Early dental visits are known to improve oral health thereby reducing future costs [58, 59]; however, it is unclear the extent to which private dental practices see children, especially those less than 4 years old. In 2000, only 21% of US children less than 6 years old had been to a dentist [60]. An Ohio study found that general dentists were more likely to see 3-5 year olds than 0-2 year olds, and of those seeing the youngest group of children, only 31% said that they had a high comfort level [57]. Recent data in New York reported similar findings that only 47% of general dentists saw children 2 years and under, with one of the main reasons cited as “discomfort with small children” [61]. Recent Canadian data from the 2011 BCDA Membership Survey [62] showed that 97% of general dentists in BC treated children less than 12 years old, 78% saw children less than 2 years old and 12% of responding dentists were still unaware of the CDA [42] and BCDA [63] recommendation for a first dental visit within six months of the eruption of the first tooth or by one year of age.

Practitioners who reported having dental school educational experiences that involved both hands-on procedures and lectures were significantly more likely to perform those

procedures than practitioners who had lecture/laboratory-only or no educational experiences. Only one-quarter of predoctoral programs in the United States uniformly provide clinical hands-on experiences with infant oral examinations [64]. Two factors identified in the Surgeon General's Report [65] affecting dental school education included a shortage of dental school faculty and an overcrowded dental curriculum. Seale and Casamassimo reported that one-third of pediatric dental programs had one or more unfilled full-time faculty positions and the average faculty to student ratio was sometimes as high as one to eleven [66]. Without sufficient faculty, dental schools must select well-behaved, low-carries-risk children whom students can treat with less supervision rather than the full range of children requiring dental care.

A recent survey investigating program content in accredited Canadian dental schools reported that many are teaching their students about the recommended age for a first dental visit. One hundred percent of dentistry programs and 56% of dental hygiene programs recommended a first visit by 12 months of age. Infant and toddler oral health was noted as a component of schools' curricula; however, some noted barriers to this included lack of time, available patients, program resources, and finances [67].

1.5.4 Community Dentists' Responsibility and Willingness to Treat Emergencies

The College of Dental Surgeons of BC (CDSBC) defines a dental emergency as any situation in which "a person needs immediate attention to deal with uncontrolled bleeding, uncontrolled swelling, traumatic injury or uncontrolled severe pain" [68]. The College emphasizes the professional obligation of all dentists to respond to, consult with and provide care for any person presenting with an emergency, or make alternative arrangements in their absence [69]. Dentists must ensure that they, or another dentist, are available to respond to emergencies after regular office hours.

Many dentists find pediatric emergencies challenging, intimidating and disruptive due to their sporadic occurrence and need for immediate management. Emergencies, by nature, occur at unexpected times and knowledge of the latest treatment protocols for trauma, in particular, is significant to outcome [70, 71]. Worldwide studies evaluating general dentists' recognition and management of dentoalveolar injuries found that knowledge was inadequate [72-75]. Frujeri and Costa (2009) have confirmed that continuing dental education improves adequate management of dentoalveolar emergencies [76].

One study in Illinois sought to measure dentists' willingness to provide treatment for acute oral injury to children on public rather than private insurance. [55]. While holding all other variables constant, these researchers determined that dentists were less likely to see a child for an urgent dental complaint if the child had public insurance, but were more willing to attend if parents were able to pay in cash. Sadly, this finding suggests that patient access to emergency treatment hinges largely on the likelihood of the dentist receiving payment.

To summarize, despite vigorous campaigns to promote the “dental home for every child by the first birthday” concept, it is apparent that although the intent may be understood, delivering the full scope of services of a dental home is not something embraced by all dental providers. It remains that quite a significant number of children have a dental emergency as their first dental experience, and in some cases, in a hospital ED. It seems that the willingness for community-based dental providers to treat pediatric emergencies or, for that matter, children at all largely stems from the level of comfort instilled by their training, and the likelihood to be reimbursed for the care provided.

1.6 Deeper Insight With Addition of Qualitative Methodology

A mixed methods approach may assist investigation of the BCDA's reported rise in the incidence of dental emergency visits managed by DD-BCCH [4]. In particular, the qualitative aspect of such an approach should derive richer information and broader insight to the issue. This will undoubtedly be of value to both the department, BC's dental community and beyond. A retrospective review of patient records is a commonly utilized method of obtaining information on the *Who*, *What* and *When* of pediatric dental emergency visits. In recent years, more studies using qualitative methodology have entered medical and dental investigations. Addition of a qualitative analysis may help to explain the *Why* of the issue, i.e., why did caregivers choose to seek emergent dental care at a hospital as opposed to a dental office?

The aim of qualitative research is to gain an in-depth understanding of the social world through a study of people's circumstances, experiences, perspectives and histories [77]. It is a study of words and their meanings in different contexts [78]; the *what* and *why* about a phenomenon are addressed. Qualitative researchers collect and analyze themes in observations, transcripts or documents, revealing insights that may not be captured with quantitative methods. Qualitative and quantitative research may be considered complementary rather than oppositional approaches to research. Qualitative methodology allows close interaction with a participant to gain a deeper understanding of a situation from the perspective of that participant; whereas, quantitative methods allow researchers to test a theory using hard, reliable data in a structured environment [79].

1.6.1 Common Theoretical Approaches

Some widely recognized approaches to qualitative research include ethnography, phenomenology and grounded theory. Ethnography has traditionally been used in anthropology

to study culture of a defined group [80]. It is the long-term study of social interactions, behaviors and perceptions of a group to understand shared beliefs and practices from an ‘insider’s’ perspective [81]. Phenomenology, first developed by Edmund Husserl, investigates a phenomenon or a “lived” experience by focusing on what these experiences mean to the participants involved [80]. These accounts are used to locate and explain the universal nature of the experience [82]. Glaser and Strauss’s (1967) grounded theory is aimed at gaining a higher level of understanding about social interactions or experiences that is ‘grounded’ in or derived from, a systematic analysis of data [83]. Grounded theory is “the discovery of theory from data” rather than testing or verification of existing theories [84]. A variety of qualitative research strategies are available to researchers when addressing a research problem or objective.

1.6.2 Data Collection Strategies

In qualitative research, interviews may be used to gather information relating to the research question(s). Interviews may be conducted individually or with several participants as group interviews, where the conversation is primarily between the interviewer and each of the participants in turn. An alternative interviewing method is focus groups, where key issues of interest are introduced to a group for interactive discussion moderated by a facilitator [78]. Individual interviews may be beneficial when researching motivations, decision-making processes, confidential issues and is particularly useful if participants are geographically distanced. On the other hand, group discussions may empower participants to talk about a sensitive topic when in the company of people who have experienced a similar problem [77] and encourage discussion beyond what can be achieved in a one-on-one interview [85].

Interviews may be loosely structured, where participants raise and share issues that are important to them about a particular topic; or guided, through the use of questions that deliberately steer or focus the discussion on particular areas of interest [78].

A fundamental principle underlying most data collection in qualitative research is to ask open-ended questions and listen actively [78]. Open-ended questions are designed to encourage participants to express their own opinions and reveal their knowledge. These questions allow participants to expand on their thoughts without leading them to a specific or predetermined conclusion [79]. Active listening involves close attention to verbal (hesitations, tone) and nonverbal (body language) communication. These cues are important in understanding the intent and true perspective of the participant.

1.6.3 Data analysis strategies

Qualitative data analysis typically begins after initial data has been gathered and is continuous throughout the research project. Initial data analysis leads to modifications and informs further data collection.

The first step in data analysis is to transcribe then immerse oneself in the data to gain familiarity and find meaning. Transcription of the words and paralinguistic cues (hesitations, pauses, stumbles) allows researchers to gain more meaning from the transcript [78]. Through repeated reading of transcripts and listening to the recordings of interviews, ideas are incubated and possible analyses are generated, bringing clarity of the issue being investigated [86].

Thematic analysis is a commonly used qualitative methodology, involving the identification of codes, themes and domains from the collected data. A code is a word, phrase or segment of the text that contains information relating to a particular point being made [86, 87]. A word, phrase or segment may be attributed to more than one code. As more information is

gathered, more codes may be added or existing codes refined. Codes that share a relationship are then linked to produce initial themes. A theme requires moving beyond a description to an explanation or interpretation of the issue being investigated [86] and what the data means to the researcher. Themes can then be grouped into overarching domains [88, 89].

Data collection and analysis is continuous until theoretical saturation [83], or a point of redundancy has been achieved, i.e., no new information is being gathered about the topic under study.

In summary, as the pediatric population in BC increases, one may expect a similar increase in patient numbers presenting with various concerns to BCCH. This highlights the need for DD-BCCH to evolve accordingly to best meet the demands that will be placed upon it. Current literature confirms that the majority of pediatric dental emergencies are from minor injuries or untreated decay that is best managed at a dental clinic. A better understanding of what is driving this reported demand for dental emergency care at a hospital setting is warranted. Reasons for seeking care at a hospital are less clear as it is difficult to extract in-depth information about a family's decision from looking at past patient records. To our knowledge, no studies have been published on dental emergencies presenting to BC Children's Hospital nor have studies interviewed parents regarding their choice to seek treatment at a hospital.

Chapter 2: Purpose

2.1 Research Problem

In 2012, based on raw data collected by DD-BCCH, a 4-fold increase in the number of dental emergency cases managed at the British Columbia Children's Hospital was reported in the period from 2005-2010 [4]. Despite an increase in dental providers within DD-BCCH during this time period, regular patient referrals experienced substantial wait times for routine dental treatment. If indeed DD-BCCH had experienced a 4-fold increase in emergencies in recent years, it follows that patient wait-times may have been extended by virtue of the department's pre-occupation managing a burgeoning caseload of emergent patients. Generally, emergency cases demand priority over routine referrals for dental care. Therefore, those children who are only able to be managed in the hospital setting (i.e., children with special health care needs and younger healthy children with extensive dental disease) may have been placed at a possible disadvantage. The BCDA report also served as a strong reminder that periodic review of cases managed by DD-BCCH is necessary, especially with recent changes made within the department. A close examination of cases is necessary to verify high standard of patient care, re-evaluate emergency management protocols, ensure best allocation of available resources and implement changes as necessary to ensure that DD-BCCH is able to carry out its mandate.

2.2 Research Objectives

The main objective of this study was to better understand why DD-BCCH had experienced this reported increase in demand for emergency dental care in recent years. A closer investigation into "*what is going on, and why*" is needed to explore the factors contributing to

this reported increase and further, to identify solutions and implement changes as required. We also wished to explore who is presenting with dental emergencies, what types of emergencies are common, when are they seeking care and why they are choosing BCCH. Study results will help DD-BCCH better plan for resources, revise protocols and streamline operations. Information gained may provide the basis for recommendations to educators and regulatory bodies on how to best manage pediatric dental emergencies.

This study aims to:

1. Characterize a systematic sample of dental emergency cases managed by DD-BCCH documented from January 1, 2009 to December 31, 2013;
2. Explore the potential factors contributing to this increased demand for emergency dental care.

Chapter 3: Methods

3.1 Study Design

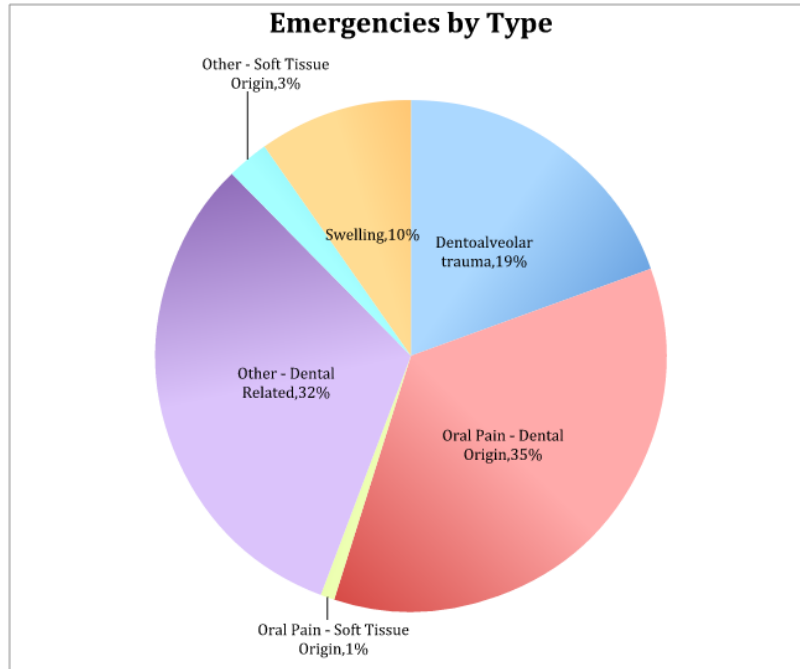
In order to satisfy the aims and objectives of the study, a two-part design incorporated both quantitative and qualitative elements. Phase 1, the quantitative element, consisted of a retrospective chart review of dental emergency cases over a finite time period with the intent to record descriptive characteristics associated with the visit. Phase 2, the qualitative element, involved questioning and communication with caregivers that had recently experienced a dental emergency visit to BCCH with their child, with the intent to gain in-depth information regarding their decisions and experiences related to the visit.

Human ethics approval was granted by the UBC Children's & Women's Clinical Research Ethics Board [Certificate H12-01393].

3.2 Phase 1. Retrospective Chart Review (Quantitative)

Pilot research based on a convenience sample of 100 charts (**Figure 3.1**) was carried out in the summer of 2012 by a summer research student. Results from this project triggered concern regarding the distribution of the types of emergencies. Of significance was the large percentage of patients presenting with "Other" dental emergencies that were unrelated to trauma or caries. These results were used to secure funding for the present systematic study investigating recent dental emergencies managed by DD-BCCH.

Figure 3-1 Emergencies by Type, Pilot Data, DD-BCCH, 2011



Using the pilot data, a sample size calculation using the proportions for dental decay (i.e., oral pain and swelling) and dentoalveolar trauma determined that a sample of 300 charts would be able to detect precise estimates for the types of cases that presented in our five-year period (with a 95% CI of 5.2 and 4.3, respectively).

A dental emergency was defined as: ‘any caregiver-initiated, unscheduled visit to BCCH with the intent to address swelling, pain or trauma deemed of dental origin’. Three hundred dental emergency patient charts managed by the Dental Department at BC Children’s Hospital (DD-BCCH) over the time period January 1st, 2009 to December 31st, 2013 inclusive were systematically selected and reviewed.

The sample pool of dental emergency cases for the study time period was identified through a search in X-TRAC¹ and MSP¹, the primary databases used for DD-BCCH Accounts. These databases were searched using standard dental emergency billing codes used by DD-BCCH: 01205 (provincial dental fee guide emergency examination code) and 27000 (Medical Service Plan emergency examination code) to identify the potential emergency cases.

Systematic sampling was done using the following protocol:

For each month of the 5-year period, the first 5 dental emergency cases by date of presentation were selected for review. Cases with incomplete documentation were excluded and the next consecutive chart was identified. This process was continued until 5 cases from each month were obtained to create the study sample of 300 cases. This form of systematic sampling effectively distributed the cases to account for any potential seasonal differences; for example, a higher incidence of dental trauma/accidents may be expected in the summer months.

Data collected from the chart review consisted of: patient demographic information including age, gender, city of residence, income level; source of referral; time and day of visit; nature, scope and management of the emergency; and recommended follow-up care. All data was de-identified and recorded in a database program Excel® 2007, Microsoft Corporation (Redmond, WA). Thirty cases (10%) were entered by a separate examiner to verify inter-examiner reliability. R (R Core Team, 2014) was used for analysis. Pearson's Chi-squared Tests and Odds Ratios were used for bivariate analyses. P value of < .05 was used to indicate statistical significance and simulated p values were used when a table contained any small cell counts to correct for possible inaccuracies in the p value.

¹X-TRAC and MSP are custom designed Dental Management Systems by Computer Station Medical Management Systems (Richmond, BC) for Accounts management by DD-BCCH. MSP (Medical Service Plan) is used for government-funded services and Extract for all other sources of funding (self-pay, private insurance).

3.3 Phase 2. Focus Group/Personal Interview

One-on-one communication with families through focus groups or interviews was planned to further explore the circumstances and discuss in detail what factors prompted them to seek emergency dental care at BCCH, rather than at a dental office in their community. Direct communication gives caregivers an opportunity to express their opinions and experiences in their own words and ask for clarification of questions. People who may be reluctant to fill out questionnaires or cannot write down their thoughts on a topic are often willing to express themselves to an interested interviewer. Such detailed information was not readily available in chart documentation and therefore, invaluable to aid our understanding of the research problem.

3.3.1 Inclusion Criteria

Inclusion criteria for parents were as follows:

- 1) Had a child who experienced a dental emergency within the previous six-month period;
- 2) Consent to participate in a focus group or personal interview to discuss the factors or circumstances that prompted them to seek emergency care at BCCH;
- 3) Be able to communicate/comprehend English, independently or aided by a self-provided interpreter.

3.3.2 Recruitment

Recruitment for this phase of the study began in May 2013. A ‘letter of information’ (**Appendix A**) was mailed to all parents/caregivers of children that had dental emergencies within the previous six months (Nov 2012 – May 2013). A total of 94 letters were mailed out.

A follow-up telephone call was made to the same parents/caregivers (84/94 or 89% were successfully contacted) with an invitation to attend a focus group. Options for focus groups

included weekdays (Monday, Wednesday, Friday or Tuesday, Thursday on alternating weeks) and weekends (Saturdays); in the morning (9am), afternoon (1pm) and evening (7pm); at a site close to their place of residence (e.g., community center, public library, coffee shop). These focus-group sessions were planned for the months of July and August 2013.

Only four participants were successfully scheduled using this recruitment process. In light of these poor recruitment numbers, a ‘permission to contact’ form (**Appendix B**) was implemented at DD-BCCH in June 2013 to enhance awareness of the study and bolster recruitment efforts. Parents/caregivers with a child presenting for an emergency were approached by the treating dentist and given preliminary information about the study. They were invited to sign the ‘permission to contact’ form, which meant they were consenting to be contacted at a later date for this research. The contact information options on the form also offered some flexibility so the caregiver could indicate their preferred method of contact.

3.3.3 Participation Incentives

As an expression of gratitude for their participation, parents/caregivers were offered refreshments and on-site childcare during the interview, reimbursement for parking or public transportation costs, and a gift card for \$15 with eligibility for a larger gift card draw to be held at the completion of the study.

3.3.4 Data Collection Instrument

An interview guide (**Appendix C**) was designed with input from the supervisory committee. The questions were ‘open-ended’ to increase interaction and discussion among participants. The questions were designed to provide deeper insight into why parents chose to bring their child specifically to BCCH and what factors (e.g., urgency of situation, behavioral challenges) or barriers (e.g., financial) contributed to this decision. The supervisory committee

reviewed and discussed all questions until consensus was achieved on the seven-item interview guide.

A trained, objective facilitator was engaged to lead the group discussions/interviews. A summer research dentistry student and the co-investigator attended as silent observers to assist and record non-verbal interactions. The sessions were to be audio-recorded to enable transcription and analysis.

3.3.5 Limitations/Barriers to Recruitment

Focus group recruitment for this participant pool proved difficult for a variety of reasons. Summer months with favorable weather conditions may have resulted in reduced availability or willingness to participate due to family vacations, summer camps and outdoor activities. Families with multiple, young, medically compromised, and/or behaviorally difficult children may have found travel and meetings difficult to manage. Further, parents/caregivers may have been reluctant or embarrassed to share private information or lack interest in contributing to research and improving emergency care when there was no direct or immediate benefit in doing so.

3.3.6 Modified Study Design

Because of recruitment challenges, the focus group approach was changed to one-on-one interviews. Parents/caregivers were re-contacted via telephone with an invitation to participate in a personal interview in person or by telephone. Interviews were conducted using the original focus group guide by either the facilitator or investigator. All interviews were audio recorded to facilitate transcription and analysis at a later date.

3.3.7 Determination of Saturation

The interviewers reviewed the transcripts after each interview to determine if data saturation had been achieved. Preliminary trends (codes, themes, domains) from a total of 19 interviews were presented to the supervisory committee. Based on their review and recommendations, the 19 interviews were grouped by emergency type and further purposive recruitment/interviews were conducted to ensure a diversity of participants with respect to emergency type, patient characteristics and parent demographics. This was concluded when the committee agreed that the goal of data saturation was fulfilled for each emergency type category: 8 for dentoalveolar trauma, 13 for caries-related and 4 for “other” dental emergencies, unrelated to trauma or caries.

3.3.8 Data Analysis

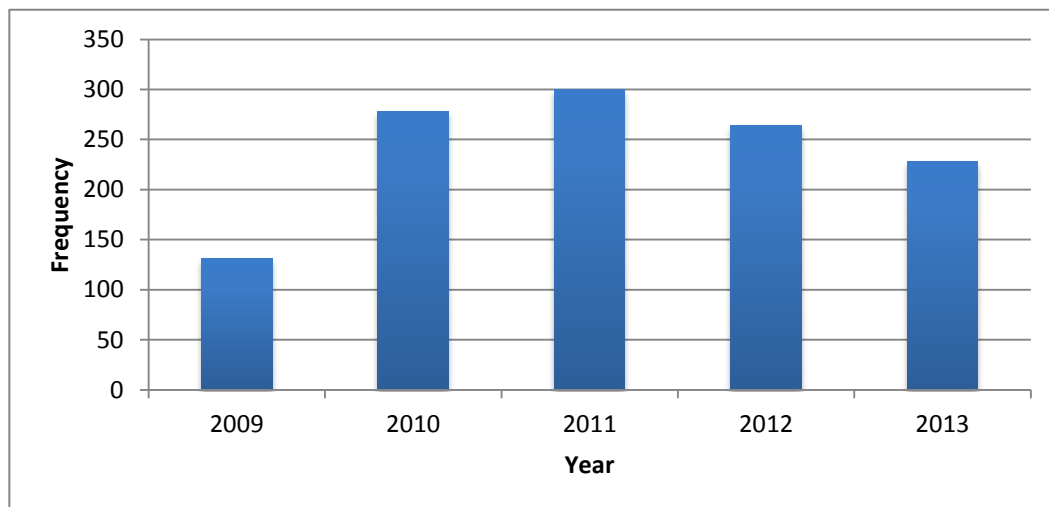
The confidentiality of participants and their children was maintained by removing names and identifiers during transcription. Thematic analysis was used to interpret the interviews. The transcripts were coded line by line to identify, categorize and describe phenomena found in the text. The initial transcripts and preliminary codes were reviewed, discussed and agreed upon by the investigator and facilitator. As more data was gathered, transcripts were carefully coded and compared to previous codes; codes were modified when deemed necessary. The facilitator performed coding on five transcripts to compare with coding interpretation by the investigator for consistency. Codes were used to develop tentative themes or interpretations about these data. Finally, themes were further refined and combined into overarching domains.

Chapter 4: Results

4.1 Quantitative Analysis

Over the 5-year study period, 1201 patients were seen in total for dental emergencies: 131 in 2009, 278 in 2010, 300 in 2011, 264 in 2012 and 228 in 2013 (**Figure 4.1**). Of these, 300 charts were reviewed and analyzed.

Figure 4-1 Total Emergency Cases Managed by DD-BCCH



Demographic characteristics of the patients presenting with dental emergencies are summarized in **Table 4.1**. Children ranged in age from 10 months to 17 years (mean age 2.2 years, SD.=1.07). The highest frequencies were in the 0-3 years (n=90/300, 30%) and 4-7 years (n=103/300, 35%) age groups. The remaining patients were between the ages of 8-11 (n=52/300, 17%) or greater than 12 years old (n=55/300, 18%).

A gender imbalance favouring males (n=184/300 or 61.3%) was noted. Most patients were otherwise healthy (n=260/300, 86.7%), but some had 1-2 co-morbidities (n=29/300, 9.7%).

Asthma and autism were the commonly occurring concurrent medical diagnoses and few children had greater than 2 reported co-morbidities (n=11/300, 3.7%).

Nearly half of the patients presenting with an emergency lived within a 15 km radius of BCCH (n=147/300, 49%), and the numbers decreased as distance increased: 16-30 km (n=64/300, 21%), 31-45 km (n=56/300, 19%), and >45 km (n=32/300, 11%). Children from families with lower annual household incomes² presented most commonly. The lower 3 income brackets: <50K (n=63/300, 21%), 50-60K (n=78/300, 26%), and 60-70K (n=73/300, 24.3%) were roughly equally represented and fewer children presented from families of higher annual household incomes.

² Median Household Income range was obtained using the postal code of the documented home address:
<http://globalnews.ca/news/370804/income-by-postal-code/>

Table 4-1 Patient Demographic Information (n=300)

	Frequency (n)	Percentage (%)
Age (in years)		
0-3	90	30.0
4-7	103	34.3
8-11	52	17.3
12+	55	18.3
Gender		
Males	184	61.3
Females	116	38.7
Medical Status		
Healthy	260	86.7
1-2 Co-morbidities	29	9.7
2+ Co-morbidities	11	3.7
City of Residence		
Within 15km	147	49.2
16-30km	64	21.4
31-45km	56	18.7
>45km	32	10.7
Annual Household Income (\$)		
<50 000	63	21.0
50-60000	78	26.0
60-70000	73	24.3
70-80000	50	16.7
>80000	36	12.0

Dental emergencies by type (**Table 4.2**) included: dentoalveolar trauma (n=170/300 or 56.7%), oral pain from dental origin (n=60/300 or 20%), swelling from advanced dental disease (n=40/300 or 13.3%), and ‘other’ dental emergency, unrelated to trauma or caries (n=30/300 or 10%).

Table 4-2 Dental Emergency Types

	Frequency (n)	Percentage (%)
Type of Emergency		
Dentoalveolar Trauma	170	56.7
Oral Pain – Dental related	60	20.0
Swelling – Advanced decay	40	13.3
Other – Dental related	13	4.3
Other – Soft tissue related	17	5.7

Details regarding the day, time and referral source of the dental emergencies are shown in **Table 4.3**. No significant peaks were observed throughout the week or on weekends, but slightly more children presented on Thursdays (n=51/300, 17.0%). A slight peak in occurrence was seen in the afternoons (n=115/300, 34%) with the least number of patients presenting during the night (n=44/300, 14.8%). The primary source of referral was the emergency department (n=268/300, 89%); other referral sources included other BCCH departments/services (n=13/300, 4%), parents/guardians (n=9/300, 3%) and other medical/dental professionals (n=10/300, 3.4%).

Table 4-3 Emergency Case Characteristics

	Frequency (n)	Percentage (%)
Day of Week		
Sunday	37	12.3
Monday	49	16.3
Tuesday	39	13.0
Wednesday	32	10.7
Thursday	51	17.0
Friday	43	14.3
Saturday	49	16.3
Time of Day		
Morning (0800 – 1159)	67	22.6
Afternoon (1200 – 1559)	115	38.7
Evening (1600 – 1959)	71	23.9
Night (2000 – 0759)	44	14.8
Referral Source		
Emergency Department	268	89.3
Other Dept within BCCH	13	4.3
Parent/Caregiver	9	3.0
Other medical/dental professional	10	3.4

Management of dental emergencies and recommendations for follow-up care are summarized in **Table 4.4**. No immediate intervention was necessary for more than half of all cases (n=159/300, 53%). In these cases, patients were examined, families received a diagnosis, reassurance of the situation, oral care information and pain management instructions. For the 141 children who needed it, immediate interventions included extractions (n=60/141, 43%), anterior restorations (n=53/141, 37%) or other management (i.e., antibiotics, consult with another service, care under general anesthesia; n=28/141, 20%).

Follow-up care with a community dentist was advised for the majority of cases (n=219/300, 73%) regardless of emergency type or emergency management. Seventy-six of 300 cases (25%) had follow up care with DD-BCCH: 42 cases (14%) in the ambulatory clinic and 34 (11%) treated on a subsequent day under general anesthesia. The remaining 5 patients (2%) were referred to other specialists for further management.

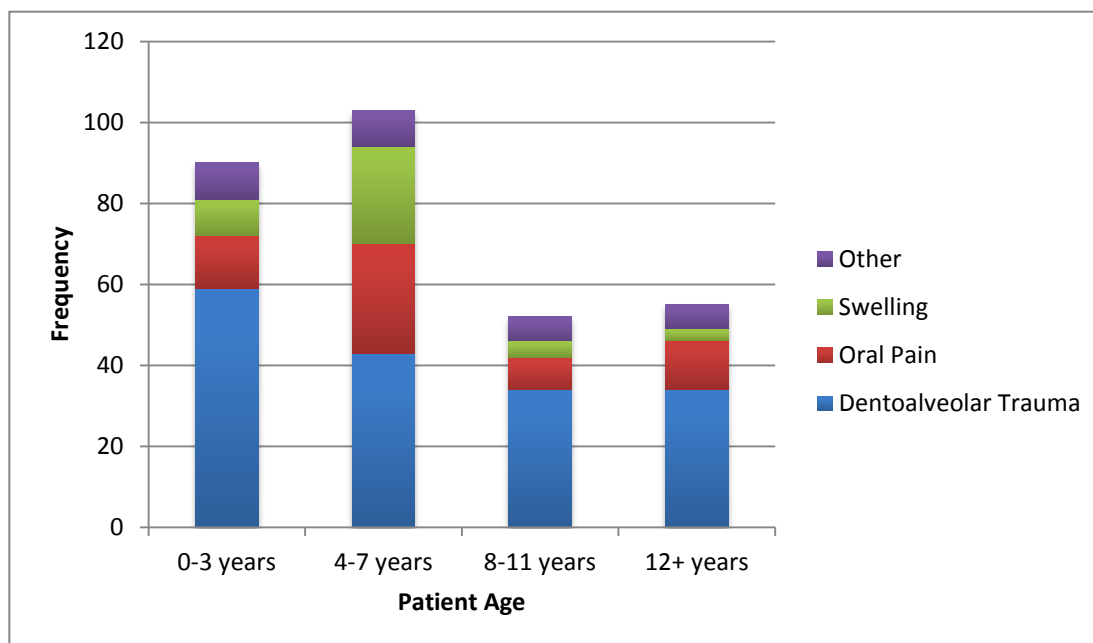
Table 4-4 Management and Follow-up Care of Emergency Cases

	Frequency (n)	Percentage (%)
Management		
No active treatment	159	53.0
Extraction	60	20.0
Restoration	53	17.7
Other *	28	9.3
Follow-up Care		
BCCH – Clinic	42	14.0
BCCH – General Anesthesia	34	11.3
Private Practice Dentist	219	73.0
Other Medical/Dental Professional	5	1.7

* Other – general anesthesia, antibiotics, referral to another specialty

Pearson's Chi-squared tests and Odds ratios were utilized to analyze variables by emergency type. As shown in **Figure 4.2**, dentoalveolar trauma was seen most commonly in the youngest age group (n=59/90, 66%) and sequelae of untreated dental decay (i.e., oral pain from dental origin and swelling) were seen more commonly in the 4-7 age group (n=51/103, 50%) ($\chi^2 = 22.83$, $p < .01$). The odds that a patient presented with a dentoalveolar trauma compared to oral pain of dental origin was 2.8 times higher for children aged 0-3 than for those in the 4-7 year age group (95% CI of 1.24 and 6.71).

Figure 4-2 Emergency type and Patient Age

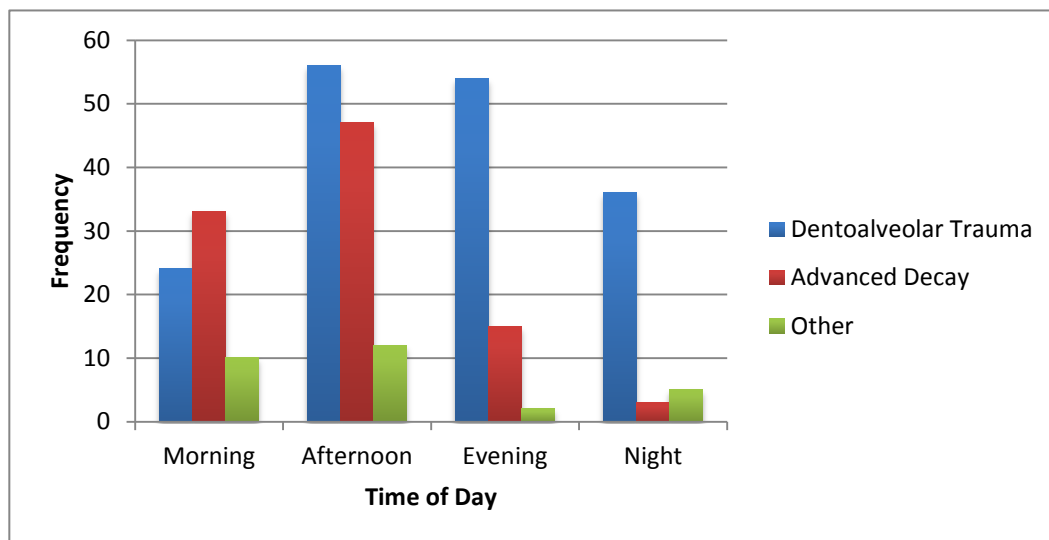


Although the majority of patients presenting with dentoalveolar trauma and advanced decay were healthy (n=159/170, 94% and n=80/100, 80%), patients who reported having at least one co-morbidity presented more commonly with oral pain (n=17/40, 43%), than trauma (n=11/40, 28%) ($\chi^2 = 27.00$, $p < .01$).

Patients presenting with dentoalveolar trauma lived in close proximity to BCCH ($\chi^2 = 32.7$, $p < 0.01$). The odds that a patient presented with dentoalveolar trauma compared to oral pain of dental origin is 4.3 times higher for patients who live within a 15km radius of BCCH than 31-45km away (95% CI of 1.76 and 11.07) and 4.8 times higher for patients living >45km away (95% CI of 1.63 and 13.99).

As illustrated in **Figure 4.3**, patients with advanced decay presented in the morning (n=33/67, 49%) or afternoon (n=47/115, 41%) and those with dentoalveolar trauma presented most commonly in the afternoon (n=56/115, 49%) or evening (n=54/71, 76%). The emergency type that presented most commonly on a Saturday or Sunday was trauma (n=63, 73%). ($\chi^2 = 30.43$, $p=0.03$).

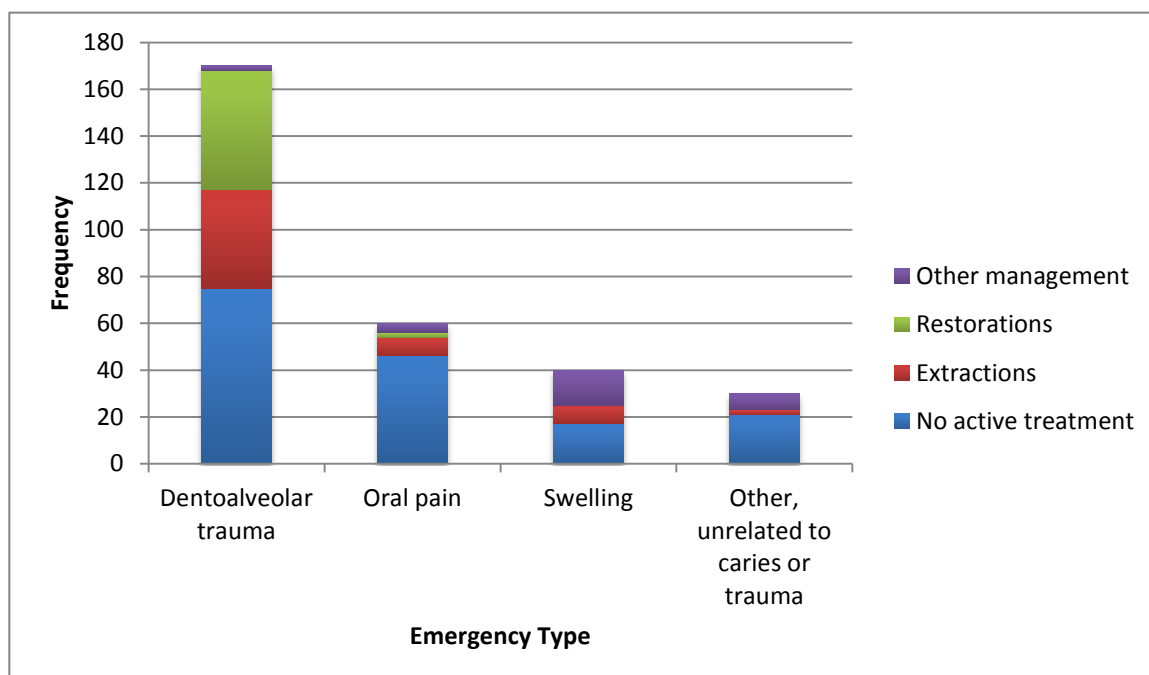
Figure 4-3 Emergency type and Time of Occurrence



Management differed by emergency type (see **Figure 4.4**). No active intervention was required for 75/170 cases (44%) of dentoalveolar trauma; 46/60 cases (77%) of oral pain; 17/40 cases (43%) of swelling; and 21/30 (70%) cases of ‘other’ dental emergencies, unrelated to trauma or caries.

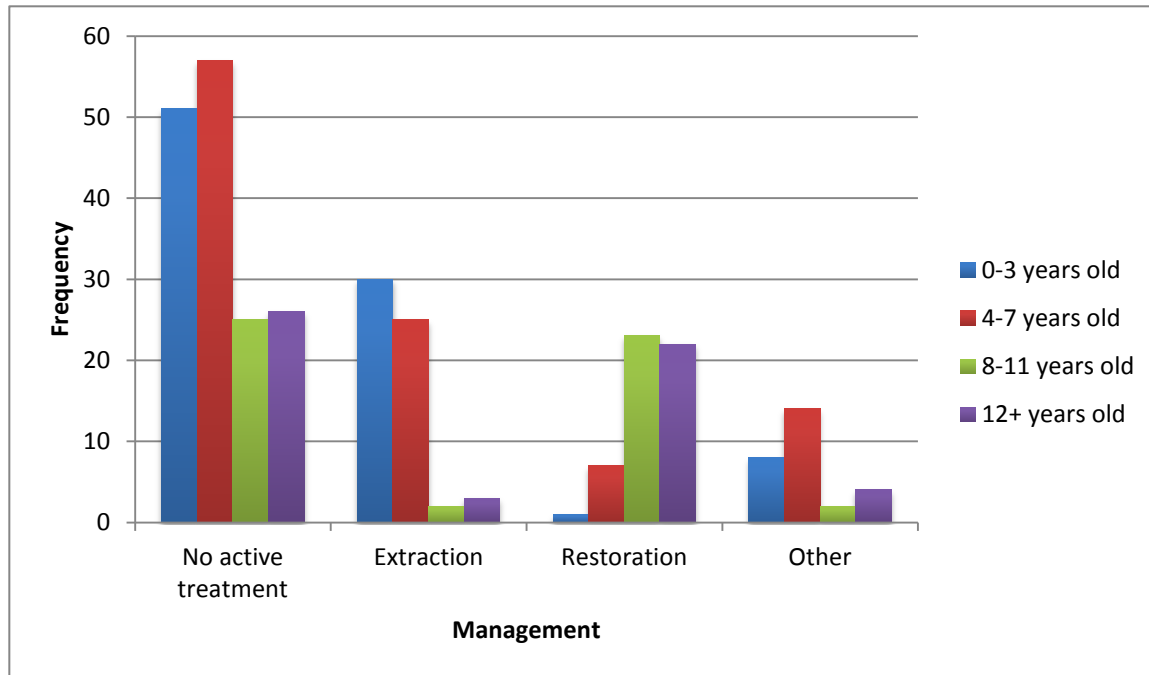
For cases requiring active intervention at DD-BCCH, 42/96 (44%) cases of dentoalveolar trauma required emergency extractions in the dental clinic and 51/96 (53%) cases received anterior restorations with or without a splint. Eight out of 18 patients with oral pain (44%) required immediate extractions and only 2 (11%) received restorations. Eight out of 25 cases (32%) of patients presenting with swelling from advanced dental disease were treated with extractions and 2/9 cases (22%) of emergencies unrelated to caries or trauma required extractions. Other management included antibiotics, consult with another service, or care under general anesthesia.

Figure 4-4 Emergency type and Management



When immediate intervention was indicated, younger patients (0-3 and 4-7 age groups) were treated with extractions, while older patients (8-11 and 12+ age groups) were treated with restorations. ($\chi^2 = 82.48$, $p < .01$). See **Figure 4.5**.

Figure 4-5 Emergency Management and Patient Age



The majority of children in all groups by emergency type were advised to seek follow-up care in the community. A large proportion of children with co-morbidities were followed at BCCH (n=28/40, 70%), while only 18% (n=48/260) of healthy children had a subsequent appointment there ($\chi^2 = 49.6$, $p < .01$). The odds were 11.1 times less likely that a healthy patient (compared to one with co-morbidity) was seen at DD-BCCH for follow-up rather than with a community dentist (95% CI of 4.8 and 25).

Trends emerged over the 5-year study period. Consistent characteristics of dental emergency patients were: young age (<7 years old), male, healthy, from families of lower socioeconomic status living in close proximity (<15km) to BCCH.

To summarize, dentoalveolar trauma was consistently the primary reason for an emergency visit, although a peak in patients presenting with dental-related oral pain was noted in 2011. This peak positively correlated with the number of females presenting for dental emergencies in 2011. More males in 2010 and 2013 correlated with a higher occurrence of dentoalveolar trauma in those years. Patients presented in the afternoon, randomly throughout the week and were largely referred to dentistry from the emergency department. The majority required no urgent intervention and were advised to follow-up with a community dentist for regular and definitive dental care.

4.2 Qualitative Analysis

Information about parent and patient characteristics acquired through the interview process is presented in **Appendix D**. The domains understood and interpreted from the data and associated themes are presented accompanied by supporting quotes from participating parents.

4.2.1 Participant Characteristics

In all, twenty-five parents of children presenting with a recent emergency to DD-BCCH were interviewed by the researchers over a 10-month period. As a result of purposive sampling, types of emergencies were well distributed: eight interviews involved dentoalveolar trauma, seven were associated with oral pain of dental origin and six involved swelling from advanced dental decay and four were regarding ‘other’ dental emergencies, unrelated to trauma or caries. More mothers than fathers agreed to be interviewed, and a variety of ethnic groups were represented.

4.2.2 Thematic Analysis

Following the first review of transcripts, the researchers agreed to divide interview transcripts into three groups of interest: dentoalveolar trauma (n=8), caries-related (n=13) and “other” dental emergencies (n=4). Researchers were interested in exploring data from the major types of presenting emergencies (i.e., dentoalveolar trauma and caries-related). Thematic analysis was completed for the trauma and caries groups, which comprised greater than 90 percent of the emergency cases managed by DD-BCCH over the 5-year study period. (An example of the analysis process is presented in **Appendix E** for the financial issues domain).

Domains relating to the experiences of families in the **dentoalveolar trauma** group were:

- Urgency
- Concern for child’s well being

- Trust

Domains identified in the **caries-related** group were:

- Financial issues
- Limited knowledge
- Distress
- Dental attendance

One domain common to **both** groups was:

- Access to emergency care

It is not uncommon for themes and domains to have overlapping components.

Corresponding themes for each domain have been underlined in the following text along with exemplars of quotes from participants, *in italics*.

4.2.2.1 Dentoalveolar Trauma Group

4.2.2.1.1 Urgency

Parents perceived a need for urgent ‘hospital-based’ care for their child’s emergency. Parents/caregivers were often shocked and scared by the incident (i.e., dentoalveolar trauma), leading to a panicked response.

Mother 1: “He started really bleeding from his mouth and then he started crying... you just freak out so I perceived it to be very serious”

Mother 5: “I couldn’t think straight and I rushed [to BCCH]”

Caregivers reported physiologic reactions, such as changes in heart rate and breathing.

Mother 6: “My heart stopped and I couldn’t think straight; I just needed some help”

Mother 2: “I felt sick to my stomach when I saw him bleeding”

Others reported an inability to wait for further instructions and felt the need to proceed with action to better care for their child.

Mother 2: “So I called the nurse’s line but they’re like ‘press 1 for poison, press 2 for’ and I’m like ughh I’m not waiting”

Mother 4: “I need something done now!”

4.2.2.1.2 Concern for child’s wellbeing

Parents and caregivers expressed concern for their child’s overall wellbeing following the accident that led to the dental trauma. Some parents were concerned about bleeding or other concurrent injuries.

Mother 7: “He started really bleeding from his mouth and then he started crying”

Father 3: “A chunk of his lip was gone too”

Others were only reassured after their child was examined by a physician.

Mother 7: “[The doctor] said his headache is normal and told me to watch him for other signs like throwing up and fainting”

Parents of children with co-morbidities were primarily concerned that the trauma would impact normal functions or have unrecognized discomfort.

Mother 4: “His aspiration risk is high and we didn’t want him to aspirate anything, so just in case”

Mother 8: “We never know if she’s in pain because she can’t talk or express to us yet”

4.2.2.1.3 Trust

A perception of superior care at BCCH was noted in the reported comments of caregivers following their child’s dentoalveolar trauma. Some parents commented on their trust in the skills of the dentist as an important factor.

Mother 5: “When you think about coming to Children’s Hospital, you just feel like you’re in more trained hands... I don’t think I would have the trust in my dentist that I did coming here”

Mother 1: “The dentist said I’m not going to see this two year old, he won’t sit still”

Some parents were advised to seek care at BCCH from trusted family members or close friends.

Mother 1: “My mom also works in the Fraser Health region and she said to just go to Children’s and they’ll be able to help you better there”

Mother 6: “Luckily I was with my girlfriend who said [BCCH] would help”

Families recalled a pleasant or satisfactory previous experience at BCCH that contributed to their decision-making process.

Mother 4: “I’ve brought her [to BCCH] before and that’s why I know any problems related to children, that’s the best service you can get”

4.2.2.2 Caries-Related Group

4.2.2.2.1 Financial issues

The cost of dental care is a common concern (**Appendix E**). An important factor contributing to untreated caries for families whose child presented with a caries-related emergency was the high cost of dental treatment.

Mother 2: “I have really low income so... for me to go to the dentist, it’s so expensive”

Mother 5: “The check-ups cost money. I take my daughter to the dentist when I know there’s a problem”

Parents and caregivers without additional dental insurance faced financial hardship in obtaining needed restorative treatment for their child.

Father 8: “I guess the main problem is always the money because it is so expensive and we don’t have a dental plan”

Father 1: “He’s already used up all the insurance we have and now must self-pay”

There was a false perception of free dental treatment in a hospital setting. Parents were mistaken that all dental treatment provided in a hospital would be billed through Medical Service Plan.

Father 1: “Financially, it was better to go through the Children’s Hospital because they were going to pay for the dental”

Mother 12: “We didn’t have to pay because we have his care card”

4.2.2.2.2 Limited Knowledge

A lack of knowledge of the caries process and dental development was evident in the interviews. Parents made comments that revealed intake of highly cariogenic foods and caries-contributing habits.

Mother 7: “I didn’t think putting him to bed with the bottle would do this”

Mother 11: “She’s a fussy eater so I give her some snacks whenever she wants. It’s so she gains some weight”

Parents were unrealistically hopeful that problems would not arise when leaving dental decay untreated for numerous years.

Mother 10: “I was hoping that the teeth will be okay until they fall out because they are baby teeth”

Many parents were aware of the problem but did not foresee the consequences of leaving decay untreated. They were unaware of the severity of the problem and failed to recognize early signs and symptoms of tooth decay.

Mother 11: “I didn’t think [the cavities] would spread so fast like that so she would wake up with infection”

Mother 13: “When he woke up, his face was very swollen from just one cavity that we didn’t know was so deep”

4.2.2.2.3 Distress

Parents expressed the need for a solution when caries became extensive and symptomatic disrupting quality of life.

Mother 6: “Now she’s crying always and I can’t sleep so I really had to go to the Children’s Hospital then”

Mother 3: “Even the tylenol wasn’t calming her down so we kept her from school”

4.2.2.2.4 Dental attendance

For many of the children presenting with a dental emergency, this experience was their first dental visit. Parents admitted to not seeking regular dental care for their children.

Mother 11: “I was going to wait until she gets older and listens better”

Mother 9: “We don’t have a dentist we see regularly”

Participants who had sought previous treatment expressed dissatisfaction with previous dental treatment and lost confidence in the dentist's skills.

Mother 5: "She had fillings at our home dentist but then she got a toothache in it anyways. So she had to come [to DD-BCCH] to get it pulled out"

4.2.2.3 Dentoalveolar Trauma and Caries-Related Groups

4.2.2.3.1 Access to emergency care

The domain of access to care was common to both the dentoalveolar trauma and caries-related groups and elicited much frustration from caregivers. Dentists' refusal to see their child due to his/her age was the biggest parental complaint in accessing care in the community.

Father 1 (Caries): "Our family dentist does not like doing kids' cavities"

Mother 1 (Trauma): "The dentist said I'm not going to see this two year old"

Many parents/caregivers expressed difficulty reaching a dentist outside regular office hours for immediate care.

Mother 6 (Caries): "We called a few places, some of them were closed, some of them picked up and said they weren't taking any patients or they didn't do after-hours, things like that"

When a dentist was contacted or seen, some caregivers felt that he/she was not comfortable treating the problem that their child presented with.

Father 3 (Trauma): “We went first to the dentist and he told me to go to the hospital to get treatment because his lip was cut”

Mother 13 (Caries): “[the dentist] felt like he wasn’t equipped to handle [the dental infection] and his recommendation was that we go to BC Children’s Hospital”

Others felt they could not get treated in a timely fashion.

Mother 2 (Caries): “They wanted me to wait another three and a half months before they would fix the tooth and the nerve was exposed”

Chapter 5: Discussion

Our study has demonstrated that dentoalveolar trauma and untreated advanced dental caries will compel families to seek hospital-based dental emergency services. In the five-year study period, it was determined that there was a two-fold increase in the number of dental emergencies managed by the Department of Dentistry at BC Children's Hospital. The natural progression of untreated dental disease leads to pain that becomes difficult to manage, spread of infection and significant medical morbidity. The sporadic nature of traumatic dental emergencies and their continually evolving management strategies present challenges to the community-based dental provider. Unexpected costs related to dental care can impose significant financial burden and therefore economically disadvantaged families tend to rely on the use of hospital dental departments for primary care when in need. Factors that contribute to a parent's decision to seek emergent dental care in a hospital setting as opposed to a community-based dental office include their perception of urgency and concern for their child's wellbeing; a desire for reliable care by a reputable institution; their lack of understanding of dental disease and consequences of poor oral care; and finally, financial and access to care barriers.

Although the numbers of dental emergencies doubled over the study period, a closer look revealed that the increase was not due to a consistent upward trend. There was an increase from 2009 to 2011, followed by a modest decline from 2011 to 2013. Interestingly, this pattern parallels the population changes of 1 to 4 year olds as reported by BC Stats [6], which corresponds to the age group with the highest proportion of presenting emergencies in our study sample. Immigration to the province in recent years may also be contributing to the overall increase in dental emergencies. Canada welcomed 252,172 immigrants in 2009, reflecting a 33% increase from the previous ten-year period. Newly-immigrated families face numerous

challenges in re-settlement and those who have not established a dental home or are of low socioeconomic status tend to rely on hospital services for primary health care.

Dentoalveolar trauma contributed to over half of the dental emergency cases managed by DD-BCCH over the five year study period. A similar proportion has been reported south of the border at Seattle Children's Hospital and Regional Medical Center [33]. Canadian data available from Montreal Children's Hospital, now over twenty years old, found dentoalveolar trauma secondary to dental pain caused by caries. The difference in proportions of trauma and caries-related dental emergencies may be attributed to differences in emergency department management protocols and criteria used to initiate referral to Dentistry. Likely, a much higher proportion of caries-related emergencies would be noted at BCCH if all dental emergencies, not just those referred to Dentistry, were considered.

Dentoalveolar trauma was reported most commonly in the 0 to 3 year old age group followed by the 4 to 7 year olds. This finding is in agreement with previous studies that found two peaks in age groupings for traumatic dental emergencies. Falls and injuries are not uncommon amongst very young children, since neuromuscular reflexes, coordination and balance are under-developed. Children of elementary school age are increasingly encouraged to be more physically active yet may be more trauma prone when attempting new sports and activities. Outside of school, children may be involved in play with varying levels of supervision.

Of the emergent trauma cases studied, ninety-four percent of patients were healthy, did not meet hospital criteria for ongoing dental care in the Dental Department and were advised to follow up with their family dentist or a private practice pediatric dentist of choice. Hospital-based follow up care was arranged for children with medical or behavioral co-morbidities requiring access to hospital services for their management, and for severe injuries requiring time

dependent treatment that may be difficult to arrange in the community. An example of this would be in the case of a replanted permanent incisor; a pulpectomy is mandated within 10 to 14 days to prevent the onset of inflammatory resorption.

We also found that dentoalveolar trauma occurred nearly two times more frequently in boys than girls in our sample. This difference was consistent with evidence from the trauma literature suggesting that boys are more active, involved in more physical contact sports, engage in more risk-taking behaviors and present with more somatic injuries, including dentoalveolar trauma [90, 91]. Still, forty-four percent of trauma cases in this study required no immediate intervention apart from reassurance and relief of symptom advice, such as soft diet and pain management. Mild injuries, such as concussions, subluxations and uncomplicated enamel fractures are best treated conservatively with symptomatic care and monitoring for signs of healing or need for further intervention. Injuries involving the permanent teeth (children > 6years old) generally required temporary bonded restorations and splints for stabilization. Close monitoring and future intervention by a dentist (e.g., splint removal, definitive restoration) were further recommended as follow up care for these cases. The majority of the time, any follow up care needed was of a suitable nature to be provided outside a hospital setting.

Trauma, by nature, occurs sporadically and presents regularly from Monday to Friday. Not surprisingly, patients presented more commonly on weekends, in the afternoons and evenings when children are released from school, are participating in after-school activities and have 'free' time.

There were several key factors identified by parents regarding their decision to seek emergency care at BCCH for dental trauma. Perceived urgency and concern for their child's well being, trust in the institution and access to care issues were all identified as important factors.

Children presenting with systemic signs and symptoms, such as bleeding, swelling and prolonged crying were highly expressed as worrisome factors, leading parents to a preference for hospital care. A previous negative experience at a dental office or, conversely, a good experience at BCCH also contributed to the parental decision-making process. Several participants identified a lack of available dentists with knowledge of trauma management in the Lower Mainland.

Yet, for less complicated trauma (i.e., no symptoms of closed head injury such as loss of consciousness, vomiting or nausea), it seems mutually beneficial for the family and the healthcare system to seek care for daytime emergencies at a community dental office. However, access to community dental offices after hours and on weekends proves to be more challenging; therefore, hospital dental services may be the only option in these cases. This was supported by the findings from a random phone survey outside of business hours of 15 Vancouver-area dental offices, carried out by the investigator using a “hypothetical” pediatric dental emergency situation. There was considerable difficulty reaching a dentist willing to provide urgent treatment.

The other major presenting emergency type was odontogenic in nature; 20% of children presented with pain from dental caries and another 13% with swelling from advanced dental disease. Although a similar proportion was reported at Seattle Children’s Hospital and Regional Medical Center [33], our results appear to be significantly lower than that reported in other pediatric hospitals. Children’s Hospital of Pittsburgh attributed 45% of dental emergencies to dental decay [37], Columbus Children’s Hospital reported caries as the primary diagnosis in 73% of emergency cases [47], and Children’s Medical Center of Dallas reported diagnosis of caries in 48% and periapical abscess in 47% of ED patients [49]. The variation between emergency department management protocols for patients presenting with dental pain may contribute to the

lower reported percentage of our study. Anecdotal reports from BCCH emergency room physicians revealed that approximately two out of three of patients presenting after hours with a dental concern are deemed non-emergent and subsequently redirected to a community dentist without paging Dentistry service. These cases would primarily include symptomatic caries with no clinical evidence of abscess.

One may argue that children 4 to 7 years old are at highest risk for untreated dental caries. Children of this age vehemently express their preferences and struggle for autonomy and independence. These behavioral tendencies along with increasing body mass and strength challenge any parent's ability to carry out good oral hygiene, not to mention the dentist's struggle to complete invasive dental treatment. At this stage of development, the child does not have the ability to comprehend that caries must be restored to avoid future suffering. Our study noted that a dental emergency related to odontogenic infection was seen most commonly in children of this age group, followed by children 0 to 3 years old. Primary molars, on average, are erupted and in occlusion by 2.5 to 3 years of age. In-vitro studies on primary teeth have shown caries to penetrate through enamel and reach dentin in an 18-month window [92], after which, the probability of pain, infection and child/family quality of life impairment increases.

This study echoed the need for strategies to provide caries-related dental emergency treatment in an environment that is more efficient and definitive than a hospital setting. Patients with advanced decay presented commonly during working hours, that is, in the mornings or afternoons with no peak identified on weekends. As demonstrated in this study, comprehensive care cannot be provided in most situations, inconvenience is created for families and perhaps even further delays treatment. Seventy-seven percent of those presenting with caries-related pain were managed with over-the-counter pain medication and another significant proportion of those

presenting with varying degrees of swelling were prescribed antibiotics, followed by discussion regarding the best avenue for definitive dental rehabilitation.

Children presenting after hours with untreated severe early childhood caries meeting DD-BCCH criteria for comprehensive dental rehabilitation were more often rescheduled in Dentistry's Ambulatory Clinic at a time when thorough examination could be carried out in ideal conditions and a treatment plan formulated. Therefore, patients presenting with odontogenic infections were more likely to have follow-up at DD-BCCH than those presenting with trauma. Once dental rehabilitation was complete, the patient was redirected into the community for routine care.

Based on the qualitative analysis of this study, themes that arose included limited knowledge about dental disease, poor dental care, financial limitations and barriers to care. Parents interviewed were generally unaware of the consequences and potential sequelae of untreated decay in primary teeth. This lack of knowledge and poor oral care practices led to unmanageable tooth pain and infection that resulted in a visit to the ED. Consistent with the literature reviewed on this topic, financial and access to care barriers contribute largely to the problem. Specifically, high costs associated with dental rehabilitation, lack of 100% dental coverage and the need to direct money to other family necessities were identified factors. Many parents expressed difficulty in finding a dentist who was able to treat their children, especially if their child was less than cooperative.

Lastly, a small number of families presented to DD-BCCH with a concern that, from a dental provider's perspective, was not a true emergency. Examples of "non-emergencies" were exfoliating teeth, malpositioned or ectopically erupting teeth, and orthodontic complications such as broken or dislodged appliances. Parental concerns congregated around uncertainty of what

they were seeing in their child's mouth and wanted the opinion of a knowledgeable practitioner. Dental emergencies of this nature may have been avoided if families had established a relationship with a dentist, received regular care, were provided information anticipating growth and development changes in their child and were available for consultation after working hours.

5.1 Study Strengths and Limitations

To our knowledge, this study is the first to incorporate qualitative methodology in its review of pediatric hospital-based dental emergencies. This explanation has provided much needed depth to our understanding of a parent's motivation to seek dental care at a public hospital. Few Canadian hospitals have studied and reported data on dental emergency care and no previous study has investigated the cases managed at BC Children's Hospital. Our study described patient characteristics of those presenting to the ER with dental emergencies, and identified domains that represented the reasoning and experiences underlying a parent's decision to seek hospital care rather than care at a community-based dental office.

Our study is not without limitations. Systematic sampling was utilized to account for any potential seasonal differences and avoid overrepresentation of dental emergencies during peak trauma seasons. The selected cases (n=300) were well-distributed (**Appendix F**). However, this type of sampling was not truly random and this may not account for all selection biases.

Retrospective chart reviews present inherent limitations. Dental records of the emergency visits were completed by numerous practitioners and varied in detail and terminology between dentists. Careful interpretation was required and errors may still have been possible in spite of determining inter-examiner reliability for ten percent of records.

Results may have presented differing proportions if all dental emergencies presenting to the ED were considered. Many dental emergencies were triaged and dismissed by the emergency physician who felt that care could be deferred and thus, the possibility that a parent's dental concern was overlooked or superseded by more urgent trauma or illness.

The qualitative portion of the study had challenges related to recruitment. Initially, focus groups were planned for the purpose of data gathering but securing participants proved very challenging. In spite of arrangements and confirmation of availability, location, date and time, participants failed to present with reasons being that they "forgot" or "other things came up". Seasonal, family and social factors, such as busy summer schedules, households with multiple children and reluctance to share private information, were thought to be barriers to recruitment.

As a result, the qualitative methodology was modified from focus groups to personal interviews. As previously mentioned, one-on-one interviews have some disadvantages compared to focus groups. Focus groups tend to promote participant brainstorming and "feeding off" one another's comments providing better depth into an issue. When interviewed alone, individuals may be hesitant to talk about a sensitive topic. They may feel obliged to give the most socially-acceptable response to a question or may say what they think the researcher wants to hear. Many of our interviews were held over the phone where nonverbal communication was impossible to detect; important cues from body language and facial expressions may have been lost.

As customary for qualitative research, the sample of parents who participated was purposively selected based mostly on their child's presenting emergency type. Parents who volunteered to share their experiences may have been willing because they wished to praise a good experience or critique a bad experience. Some participants wandered off topic and needed

to be guided back to the original questions. Therefore, interviewers must be careful not to unintentionally encourage or discourage the expression of particular opinions.

5.2 Conclusions

Children presenting with dentoalveolar trauma or caries-related emergencies at DD-BCCH were typically less than 7 years old, male and otherwise healthy. These children were from families of lower socioeconomic status who lived in relatively close proximity to the hospital. No immediate intervention was necessary for over half of the cases and management included reassurance, oral care information, pain management instructions and discussion of further management with a community dentist. ‘Other’ dental emergencies, unrelated to caries and trauma were few in number with the majority of cases related to oral manifestations of systemic infections.

Urgency and parental concern for their child’s well being were the primary domains that arose from the interviews. Parents expressed confidence in the staff at BCCH and felt a pediatric hospital would address their concerns and care for their child’s dental needs in a timely manner. Access to a care provider in the community, or lack thereof, led parents to seek emergency dental care at the hospital for their child. The majority of patients did not receive regular dental care in an established dental home and parents found it difficult to locate a dentist immediately available to see their child. Financial barriers along with limited knowledge of potential sequelae to untreated caries escalated a problem to a situation where parents felt it was necessary to seek emergency dental care at a hospital.

The majority of dental emergencies are preventable. Parental education, safety precautions and close supervision will decrease the occurrence of dentoalveolar trauma,

especially in very young children. Establishing an early relationship with a dentist and attending routine prevention visits will be more economical for families than visiting a dentist only when problems arise and extensive treatment necessary. Reducing the number of dental emergency cases presenting to a pediatric hospital will decrease the burden on hospital resources and allow those who require hospital services to receive care in a more timely fashion.

5.3 Recommendations

The information and context from this investigation of dental emergencies managed by DD-BCCH should concern medical and dental health care professionals, educators and dental regulatory bodies. Primary care health practitioners have frequent interaction with infants and their parents in the early years of life. With this in mind, they can play a significant role in the prevention of early childhood caries and oral injuries by providing assessment, education, intervention and appropriate connection to a dentist or dental home.

Establishing a dental home for every child by the first birthday can go a long way to ensure that parents are given the anticipatory guidance regarding injury prevention, oral hygiene practices and healthy dietary habits. Specific advantages of this age-appropriate counseling with parents include decreasing the likelihood that caries will progress to a severe nature, and reducing the incidence of dentoalveolar injuries in very young children through safety-awareness at home, in transit and at play. This study suggests that more aggressive efforts are necessary to improve parent or caregiver awareness about the first dental visit and facilitate early establishment of a dental home.

Ideally, all community dentists should be armed with the skills needed to conduct infant, child and adolescent oral health exams, and manage most routine pediatric dental emergencies,

thereby sparing the hospital for more appropriate cases of serious infections and complicated trauma. One way for dental professionals to build the skills and confidence in behavior management and communication would be to incorporate sufficient time treating these types of patients in their training. Development of dental school curricula should emphasize dental care for anxious children and exposure to pediatric emergencies. To best equip currently practicing general dentists with these skills, development of regularly recurring continuing education courses incorporating the latest evidence-based trauma management protocols would be helpful. However, offering these courses does not guarantee participation. It would be interesting to hear from the dental providers what their concerns are related to managing pediatric dental emergencies; perhaps there is an unwillingness to be available to patients at all hours, a lack of comfort treating a child under duress late at night or a fear of litigation should the outcomes be poor.

Dental regulatory bodies could play a role to reinforce the ethical responsibility of dentists to better provide for after-hours emergency care access for their patients. As this study revealed, most emergencies do not require immediate intervention. Contact and communication with a dentist, appraisal and reassurance of the situation with a plan for follow up care in the office at a more convenient time would alleviate much burden on hospital emergency departments.

The results of this investigation demonstrated that parents have much to contribute to the discussion regarding pediatric dental emergency care at a hospital. We recommend other pediatric hospitals, especially in Canada to conduct qualitative studies with varying methodologies (e.g., focus groups, surveys with open-ended questions) on this issue as a means to compare similarities and differences in reported factors. Further research is needed to explore

the emergency care policies and availability of pediatric dentists in BC, who by virtue of their specialty training should be well versed on the management of uncooperative children and pediatric dental emergencies.

Collaboration of families, dental professionals, pediatric dental specialists, regulatory bodies and policy makers is needed to find solutions to overcome the financial barriers preventing children from receiving dental care. One suggestion is the creation and validation of billing codes that could be used when extra time or effort was involved in managing difficult children. Increasing reimbursement to dentists may increase the number of providers willing to provide care and as a result enable more children to receive the required dental care.

In summary, a two-fold increase that paralleled the child population increase in BC in the study's time period was noted in the number of dental emergencies managed by the DD-BCCH. The majority of emergency cases were comprised of preventable causes from multifactorial etiologies. Speculations made by local pediatric dentists regarding the reasons underlying the increase in dental emergencies managed by DD-BCCH were accurate, although incomplete. Financial hardships, limited access to a dental provider and positive perceptions of hospital care were contributors to the problem. Other noteworthy factors included parental limited knowledge about dental disease. It would be beneficial to advise the dental community of these findings in an informative way to encourage participation in resolving some of these issues that remain within their control. Many of the emergency visits may have been avoided if the children in the study had been receiving regular care by a trusted and skilled community dentist. It would also be helpful to families if they could have assurances that their dentist was available to them outside of business hours, even if only for direction or advice as to what to do in case of emergency. A joint effort to implement changes by family units, health professionals and public

health workers will improve the oral health and reduce the number of dental emergencies experienced by BC children.

5.4 Knowledge Transfer

The findings from this research have been/will be disseminated in a variety of formats and in a number of ways, including oral and poster presentations at various institutional, local, provincial and national forums for dental professionals, physicians and researchers.

This research has been presented at BC Children's Hospital Department of Surgery "OPSEI Academic Rounds", Child and Family Research Institute (CFRI) Annual Trainee Research Day, UBC Dentistry Research Day and the Canadian Public Health 2015 conference. A presentation at the Canadian Association of Pediatric Dentists AGM in Halifax, Canada is also planned. Dr. Park was awarded first place in the Master's category at the 2014 CFRI Trainee Research Poster Competition.

As per the terms of the Telethon award agreement, the BC Children's Hospital Telethon Award Committee received a mid-term progress report in 2014, and a final synopsis was submitted to the Committee at the conclusion of the project, reviewing the objectives and summarizing the results, conclusions, challenges and recommendations. An executive summary will be submitted to the BCDA in response to the "2011 Children's Dentistry Report" which initially raised concern over the increase in dental emergencies managed by DD-BCCH.

This research will be prepared as a manuscript, with submission for publication to one of the peer-reviewed national or international dentistry journals such as Dental Traumatology, Journal of the Canadian Dental Association or Pediatric Dentistry.

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Appendix A



UBC DENTISTRY



PARTICIPANT INFORMATION AND CONSENT FORM

Study Title: "An analysis of dental emergency cases managed at BC Children's Hospital"

Principal Investigator:

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Sponsor: This research is supported by BC Children's Hospital 2012 Telethon Projects Award

1. YOUR PARTICIPATION IS VOLUNTARY

You are being invited to take part in this research study because we want to gather information about the emergency cases managed at the Dental Department at BC Children's Hospital (DD-BCCH) and require participants who will be honest during the focus group interviews. Because of your child's recent dental emergency visit, we have invited you to participate in this study.

Your participation is voluntary. For participating, you will receive a \$10 gift card, along with an entry into a larger gift card draw. You have the right to refuse to participate in this study. If you decide to participate, you may still choose to withdraw from the study at any time without any negative consequences.

If you wish to participate in this study, you will be asked to sign this form. Please take time to read the following information carefully and discuss it with your family before you decide.

2. WHO IS CONDUCTING THE STUDY?

This research is being conducted as part of Dr. Park's Masters thesis requirement in Craniofacial Science at UBC Faculty of Dentistry Graduate Pediatric Dentistry program.

3. BACKGROUND

Over the past six years, there has been a four-fold increase in the number of dental emergency cases managed by the Department of Dentistry at BC Children's Hospital (DD-BCCH). The growing demand for emergency care has placed a heavy burden on hospital resources. It has lengthened the time our other patients have to wait for dental care; these longer wait-times have the largest effect on children with special health care needs. In order to find a solution to this problem, we need to know why we are treating so many emergency patients.

4. WHAT IS THE PURPOSE OF THE STUDY?

The purpose of this study is to identify the potential factors contributing to this increased demand for emergency dental care. We would like to ask parents of children treated for a recent dental emergency at DD-BCCH to take part in focus groups, to share their experience and describe the reason they came here to seek treatment.

5. WHO CAN PARTICIPATE IN THIS STUDY?

You may participate in this study if your child has been treated for a dental emergency at DD-BCCH between November 2012 and August 2013, and if you are able to communicate in English or are willing to provide a translator.

6. WHAT DOES THE STUDY INVOLVE?

The study involves taking part in an approximate 2 hour focus group interview with a small group of other parents whose children have had a recent dental emergency at DD-BCCH. You will be asked to share your experiences and describe the reason you chose to come to DD-BCCH. The focus group session will be facilitated by an experienced researcher. It will be audio recorded for later analysis.

7. WHAT ARE MY RESPONSIBILITIES?

Your responsibility is to attend the focus group meeting to which you are assigned, and to participate openly in the discussion to the best of your ability.

8. WHAT ARE THE POSSIBLE HARMS AND DISCOMFORTS?

We do not think there is anything in this study that could harm you or be bad for you. Some of the questions we ask may seem sensitive or personal. You do not have to answer any question if you do not want to.

9. WHAT ARE THE POTENTIAL BENEFITS OF PARTICIPATING?

No one knows whether or not you will directly benefit from this study. We hope that the information learned from this study can be used in the future to benefit patients requiring emergency dental care at BC Children's Hospital.

10. WHAT ARE THE ALTERNATIVES TO THE STUDY TREATMENT?

If you would prefer to participate in a one-on-one interview, we would be happy to arrange this alternative to participation in the focus group.

11. WHAT HAPPENS IF I DECIDE TO WITHDRAW MY CONSENT TO PARTICIPATE?

You may withdraw from this study at any time without giving reasons.

12. WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

Your confidentiality will be respected. No information or records that disclose your identity will be published without your consent, nor will any information or records that disclose your identity be removed or released without your consent unless required by law.

You will be assigned a unique study number as a subject in this study. Only this number will be used on any research-related information collected about you during the course of this study, so that your identity [i.e., your name or any other information that could identify you] as a subject in this study will be kept confidential. Information that contains your identity will remain only with the Principal Investigator and/or designate. The list that matches your name to the unique study number that is used on your research-related information will not be removed or released without your consent unless required by law.

All audio recording will be transcribed by the Principal Investigator and/or designate and remain only with the Principal Investigator and/or designate in a locked filing cabinet for five years after publication.

We strongly encourage focus group participants not to discuss the content of the focus group to people outside the group; however, we can't control what participants do with the information disclosed.

13. WHAT WILL THE STUDY COST ME?

Reimbursement: We will not pay you for the time you take to be in this study. However, we will pay the cost of your parking or public transportation, if receipts are provided.

Incentives: As a thank-you for your participation in the focus group, you will receive a \$10 gift card. Also, your name will also be entered into a larger gift card draw. Refreshments and on-site childcare will also be provided for the duration of the focus group session.

14. WHO DO I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY DURING MY PARTICIPATION?

If you have any questions or desire further information about this study before or during participation, you can contact Dr. Park at ***-***-**** or Dr. Campbell at ***-***-****.

15. WHO DO I CONTACT IF I HAVE ANY QUESTIONS OR CONCERNS ABOUT MY RIGHTS AS A SUBJECT?

If you have any concerns or complaints about your rights as a research subject and/or your experiences while participating in this study, contact the Research Subject Information Line in the University of British Columbia Office of Research Services by e-mail at RSIL@ors.ubc.ca or by phone at 604-822-8598 (Toll Free: 1-877-822-8598).

16. SUBJECT CONSENT TO PARTICIPATE

Title of the study: **"An Analysis of Dental Emergency Cases Managed at BC Children's Hospital"**

Subject Consent

My signature on this consent form means:

- I have read and understood the subject information and consent form
- I have had sufficient time to consider the information provided and to ask for advice if necessary.
- I have had the opportunity to ask questions and have had satisfactory responses to my questions.
- I understand that all of the information collected will be kept confidential and that the results will only be used for scientific objectives.
- I understand that my participation in this study is voluntary and that I am completely free to refuse to participate or to withdraw from this study at any time without changing in any way the quality of care that I receive.
- I understand that I am not waiving any of my legal rights as a result of signing this consent form.
- I understand that there is no guarantee that this study will provide any benefits to *me*

I consent to participate in this study.

Subject's Signature

Printed name

Date

Signature of
Person Obtaining Consent

Printed name

Study Role

Date

If you wish to be informed of the study results, please provide your **email address**

Appendix B



Dear Parent/Caregiver,

You are being given this form to read because your child has visited us for emergency care.

Over the next year we would like to study our dental emergency cases to see to what types of emergencies are more common and to review how we handle these cases.

We would like your permission to contact you in the future to see if you could help us by participating in research about your child's dental emergency.

If you are willing to be contacted, you will receive more detailed information regarding the research at that time. Please give us your permission to contact us by signing below with your signature.

Even though you agree to be contacted you still may choose NOT to participate in the research and this will have NO impact on the care that your child will receive in future.

I hereby give my permission to be contacted by a member of Dr. Karen Campbell's research team in the Department of Dentistry at BC Children's Hospital:

Dr. Jennifer Park, a UBC Pediatric Dentistry Graduate Student
Dr. Jocelyn Shih, a UBC Undergraduate Dental Student

Print your name: _____

Sign your name: _____

I would prefer to be contacted by: (choose all that are preferred):

Email _____
Email address

Phone _____
Cell or home phone number

Letter _____
Mailing address (incl. Postal Code)

Appendix C



UBC DENTISTRY



Focus Group Guide

1. Tell us why you brought your child to the BC Children's Hospital?
 - a) Have you come here before with this child or any of your other children?
 - b) How did you find out about this service?
 - c) Did you contact any other health workers prior to coming to BCCH-DD?

*Rationale: To understand why parents chose to bring their child **specifically** to DD-BCCH vs. private dental office.*

2. Tell us about the circumstances that prompted the visit.
 - a) How serious was the problem?
 - b) Was this visit unexpected or anticipated?
 - c) Were you aware of any other dental problems in your child's mouth?

Rationale: To compare parental vs. BCCH-DD views on what problem justified an emergency.

3. Tell us about your experience at the emergency visit?
 - a) What treatment was performed at the emergency visit?
 - b) What was the follow-up like?

Rationale: Were parental expectations of hospital dental care met.

4. Describe your child's past experiences with dental care?
 - a) Has your child had previous dental visits?
 - b) Does your child attend regularly scheduled dental care?

Rationale: To determine whether there are confounding variables (i.e., uncooperative behavior) that have contributed to this emergency dental visit.

5. Tell us of any difficulties you faced in attending the dental emergency visit?
 - a) What are some reasons that may have kept you from coming to BCCH-DD (prompts: for example: finances, language, childcare, transportation)

Rationale: To discover what the main barriers parents are facing in receiving dental care for their children.

6. Tell us of any other alternatives you think you might have had?

Rationale: We want to know if parents are aware that private practice family dentists/pediatric dentists are on-call, have emergency services, etc.

7. Is there anything else you would like to add?

Appendix D

Table D.1 - Participant and Patient Characteristics for Dentoalveolar Trauma

Participant	Mode of Communication	Ethnicity*	Relation to Patient	Time Elapsed since Emergency	Chief Concern	Age of Patient (years)	Gender	Past dental care for patient
1	Direct	Caucasian	Mother	3-6mos	“a barstool fell on him and knocked his teeth”	2	Male	First visit
2	Telephone	Asian	Mother	<1mos	“he fell in my kitchen”	2	Male	First visit
3	Telephone	Asian	Father	<1mos	“fell at waterslide...broke two-thirds of front tooth”	8	Male	Regular care with a general dentist
4	Direct	Middle Eastern	Mother	1-3mos	“fell on sidewalk”	8	Male	Regular care with general dentist
5	Telephone	Indian	Mother	<1mos	“she tripped on her toe and had a fall”	2	Female	First visit
6	Telephone	Caucasian	Mother	3-6mos	“he fell and landed face first into coffee table”	1.5	Male	First visit
7	Telephone	Asian	Mother	1-3mos	“he fell off bike”	7	Male	Regular care with a general dentist
8	Telephone	Indian	Mother	3-6mos	“she was jumping on the bed and sister knocked her off”	2	Female	First visit

* Ethnicity as determined by physical appearance, accent on telephone or revelation through conversation

Table D.2 - Parent and Patient Characteristics for Caries-Related Dental Emergencies

Participant	Mode of Communication	Ethnicity*	Relation to Patient	Time Elapsed Since Emergency	Chief Concern	Age of Patient (years)	Gender	Past dental care for patient
1	Telephone	Asian	Father	3-6mos	"He's got some dental issues and he was having some pain"	4	Male	Irregular care
2	Direct	Caucasian	Mother	<1mos	"I thought she was in pain because she fell but they said she had cavities also"	1.5	Female	First visit
3	Telephone	Hispanic	Mother	3-6mos	"She had so much pain from her tooth"	6	Female	Seen annually at a community clinic
4	Telephone	Asian	Mother	3-6mos	"He felt toothache for three days and I gave him Tylenol for that"	7	Male	First visit
5	Telephone	Asian	Mother	3-6mos	"My child really can't sleep and the tooth is aching that's when I brought her"	5	Female	Irregular dental care
6	Telephone	Caucasian	Mother	1-3mos	"She was crying and complaining of a toothache for the last week and we couldn't sleep"	5	Female	Uncooperative for dental treatment with family dentist
7	Telephone	Caucasian	Mother	1-3mos	"He has so many cavities and I was concerned that he wasn't eating"	3	Male	Waiting for treatment at pediatric dental office
8	Telephone	Hispanic	Father	<1mos	"He had an abscess on one of his molars"	4	Male	First visit

Participant	Mode of Communication	Ethnicity*	Relation to Patient	Time Elapsed Since Emergency	Chief Concern	Age of Patient (years)	Gender	Past dental care for patient
9	Telephone	Caucasian	Mother	1-3mos	"His molar cracked"	4	Male	Irregular dental care
10	Telephone	Caucasian	Mother	3-6mos	"His face was very swollen"	4	Male	Regular care with a general dentist
11	Telephone	Asian	Mother	1-3mos	"Her left cheek was red and swollen when she woke up"	5	Female	Uncooperative for dental treatment with family dentist
12	Telephone	Asian	Mother	3-6mos	"He wouldn't eat or sleep because of his bad teeth"	3	Male	First visit
13	Telephone	Caucasian	Mother	<1mos	"His face started to swell and we were worried"	6	Male	Regular care with a general dentist

* Ethnicity as determined by physical appearance, accent on telephone or revelation through conversation

Table D.3 - Parent and Patient Characteristics for ‘Other’ Dental Emergencies

Participant	Mode of Communication	Ethnicity*	Relation to Patient	Time Elapsed Since Emergency	Chief Concern	Age of Patient (years)	Gender	Past dental care for patient
1	Direct	Indian	Mother	3-6mos	“There was a swelling and this one looks like its so big”	6mos	Male	First visit
2	Telephone	Caucasian	Mother	3-6mos	“His gums were swollen and he was very irritable”	2	Male	First visit
3	Telephone	Asian	Mother	3-6mos	“I thought I had somehow broken his adult tooth”	8	Male	Irregular dental care
4	Telephone	Asian	Mother	3-6mos	“She was complaining that the spacer was poking her”	6	Female	Regular care with a dentist

Appendix E

Thematic Analysis of Financial Issues Domain

Codes	<i>“expensive”</i> <i>“too much money”</i> <i>“main problem is the money”</i> <i>“so expensive”</i> <i>“cost much”</i> <i>“I have paid lots”</i> <i>“it was \$6700”</i> <i>“we have to pay but don’t have that much”</i> <i>“high cost”</i>	“we don’t have a dental plan” “no insurance” “not enough coverage” “still need to pay on top” “Blue Cross doesn’t cover all” “already used up all the insurance” “I must self pay” “I have a little insurance through work”	“bill through MSP” “use our care card” “free treatment” “financially it was better” “government pays”
Themes	<u>High cost of dental treatment</u>	<u>Lack of dental insurance</u>	<u>False perception of free dental treatment in a hospital</u>
Domain	Financial Issues		

Appendix F

Distribution of study sample by year, month and day

