

**SELF-REPORTED ORAL HEALTH AND DENTAL SERVICE UTILIZATION OF
VULNERABLE PREGNANT WOMEN REGISTERING FOR THE PRENATAL PUBLIC
HEALTH PROGRAM IN FRASER HEALTH, BC, CANADA.**

by

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Abstract

Objective: To determine the baseline self-reported oral health and dental service utilization of pregnant women from diverse ethno cultural backgrounds within the geographical are of the Fraser Health Authority in British Columbia, Canada.

Method: A prospective 34-item cross-sectional survey was administered to all the women enrolling for a prenatal registration program between October 2012 and January 2013. For data analysis, a two-sample t-test was used, and categorical variables were tested using a chi-square test. Multivariable logistic regressions were used to estimate the odds ratio.

Results: A total of 740 pregnant women filled out the questionnaire. The majority (84%) of the respondents rated their oral health as good or excellent. Fifty two percent of the women had visited dental professional during last year. Almost 1/3 of those reporting symptoms of depression rated their oral health as fair or poor. Forty-one percent reported having bleeding gums, 22% experienced tooth sensitivity, and 13% had persistent dry mouth since the beginning of their pregnancy. When asked about the beliefs associated with pregnancy, 37% of the respondents expected bleeding gums, and 34% expected tooth sensitivity. Women born in India had visited a dental professional 2.8 times more often than women who had been born elsewhere. Those with dental insurance were 6.6 times more likely to visit a dentist than those without insurance.

Conclusion: The majority of pregnant women considered dental care during pregnancy to be very important and had previously visited a dental professional within the last year. However, more than 1/3 had experienced one or more oral problems while more than half held false beliefs about the effects of pregnancy upon oral health. These reported oral beliefs and problems could be addressed with patient education during routine pre-natal care and subsequent referral to a dentist if needed.

Preface

This study was approved by the University of British Columbia, Office of Behavioral Research Ethics Board (Certificate Number: H12-01049) and Fraser Health Research Ethics Board.

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List of Abbreviations

BB	Best Beginning (Prenatal registration form in Fraser health authority)
BC	British Columbia
CHMS	Canadian Health Measure Survey
CHW	Community Health Worker
DND	Department of National Defense
ECC	Early Childhood Caries
FHA	Fraser Health Authority
FoD	Faculty of Dentistry
GDM	Gestational Diabetes Mellitus
Ig	Immunoglobulin
IL	Interleukin
LBW	Low Birth Weight
OCDO	Office of Chief Dental Officer
PGs	Prostaglandins
PHN	Public Health Nursing
PTB	Pre-Term Birth
TNF	Tissue Necrotic Factor
UBC	University of British Columbia
VCH	Vancouver Coastal Health
WHO	World Health Organization

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Dedication

I would like to dedicate this work to my beloved parents, Naseem and Abdullah. I can't thank you enough for all the hardships you have endured to provide me with the best education and for making me a good human being. *Thank you for being the best parents in the world!*

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Chapter 1: Introduction

1.1 Oral Health and the Canadian Health Measure Survey

Oral health is an integral part of the general well-being of an individual. The condition of our mouth affects the way we eat, speak, smile and develop social relations.(1) Unfortunately, the publically funded Canadian health care system does not cover any substantial provision of dental health care. Communities, such as aboriginal and refugee, seniors living in long-term care facilities and children with special needs, receive some basic coverage for dental care but for the most part, dental services are provided by the private sector on the basis of ‘fee for service’.

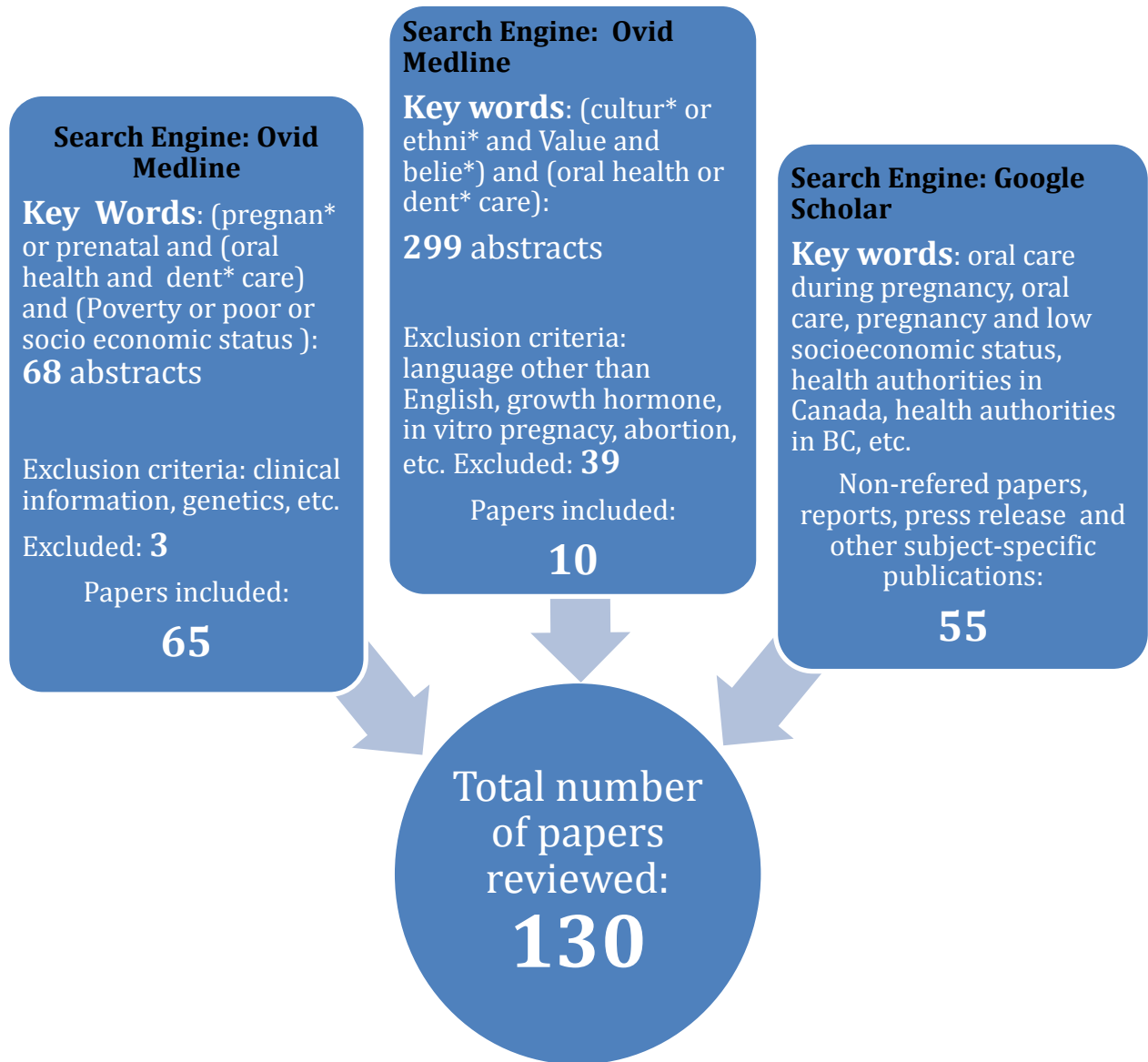
According to Timmreck et al, 2003, there is no or little information available at the population level regarding the oral health needs of the Canadian population. Needs assessment is therefore of primary importance when designing a public health intervention catering to the widespread needs of Canadians.(2) Released in 2011, the Oral Health component of the Canadian Health Measure Survey (CHMS) provided valuable information about the baseline of oral health of Canadians. According to the CHMS, although three out of four Canadians visit a dental professional every year, one forth still does not have any kind of insurance and have to pay for dental expenses out-of-pocket. In fact, the high cost of dental treatment is the most common barrier preventing full access to dental care.(3) As a result, almost 20% of Canadians are unable to get proper oral and dental care. Twice as many lower income Canadians, including pregnant women, experience oral diseases such as dental decay compared to Canadians from the higher socioeconomic strata.(3) Therefore, it is important for us to identify the oral needs of low-income pregnant women who might be at elevated risk for oral disease. This will enable us to set our priorities for the effective delivery of resources to meet the specific dental needs of this

particular stratum of the population. There is no population-wide data available from the CHMS or any other public health organization regarding the oral health status of women during pregnancy in Canada.

1.2 Oral Health and Pregnancy

Oral health care and oral disease prevention before, during and after pregnancy is one of the most important aspects of general health for mother and newborn.(3) More often than not, however, pregnant women and their health professionals are unaware of the potential risks of oral diseases during this natural life event.(3) Poor maternal oral health has consequences to the pregnancy itself as it can be related to, or the cause of, miscarriages, preterm birth (PTB) or low birth weight (LTW). (4) Moreover, poor maternal oral health is believed to be associated with early childhood caries and long-term systemic disorders after birth for the newborn. However, the current literature does not offer indisputable evidence or a full understanding of the mechanisms of how poor oral health affects pregnant women and their infants. In order to better understand the associations of the above pregnancy-related conditions with poor oral health, a detailed yet non-systematic literature review was conducted as depicted in Figure 1. Appendix 1 shows the list of the 130 publications gathered from this review that I used to develop my research (proposal) which included peer reviewed papers, reports, letters to the editor, thesis and books. Other publications were also used throughout the thesis to support or refute my findings.

Figure 1 - Key words and database used for the systematic literature search.



1.2.1 Hormonal Changes During Pregnancy

Complex physiological and hormonal changes are normally expected during pregnancy. Some of these changes can, however, adversely affect the oral cavity.(5) For example, hormonal fluctuations, particularly of progesterone and estrogen, can alter collagen production at the gingival level and affect the immune system by altering an acute neutrophilic response.(6) Such alteration can potentially lead to lower levels of antioxidants and may induce xerostomia in up to 50% of pregnant women.(3, 4) As a result from the altered immune response and disturbance in saliva production, the oral cavity may become more susceptible to various diseases including dental caries, gingivitis, periodontitis and oral tumours (7) discussed ahead.

1.2.2 Dental Decay (caries)

Dental decay is the most common oral infection worldwide contributing to tooth loss, and can also affect pregnancy. The major risk factors associated with the high prevalence of dental caries in pregnancy are lack of readily available fluoride, a diet high in sugar and frequent snacking (especially in pregnancy), changes in oral hygiene habits (including frequency and efficacy), and lower socioeconomic status.(3, 8) These risk factors can further increase the susceptibility to, and prevalence of, dental caries during pregnancy, especially when associated with frequent erosion of the dental enamel due to gastric reflux (e.g., increased acid in the mouth) and infrequent or nonexistent dental checkups.(8) In turn, the cariogenic bacteria associated with tooth decay can be transmitted to the newborn, which can be a risk factor for early childhood caries (ECC).(3, 9)

1.2.3 Early Childhood Caries

Mothers with a high prevalence of dental caries have a greater tendency to vertically transmit cariogenic bacteria to their infants through saliva, for example while kissing or sharing food using the same spoon.(9, 10) The most common and active transmissible organisms

involved in early childhood caries are *Streptococcus mutans* and *Streptococcus sobrinus*, and *Lactobacillus* species, with *mutans* being associated with the early colonizing bacteria of ECC.

(10, 11) Other risk factors associated with ECC include improper child brushing habits, substitution of sugary beverages for breast milk and allowing the infant to fall asleep while being breast or bottle-fed.(12-14)

ECC seems to be a risk factor for problems with growth and development, eating and phonetic alterations, low self-esteem and poor school attendance.(6) The associated costs of treating ECC are extremely high. According to the Association of Dental Surgeons of British Columbia (1999), more than 5,000 children under the age of four are treated annually under general anesthesia for ECC with an annual estimated cost of 10 million dollars.(6) Dental diseases and their treatment, including ECC, are the greatest contributors to hours lost from school or work in total: 40.36 million hours lost per year in Canada, and 2.26 million hours lost per year in British Columbia, respectively.(6)

1.2.4 Gingivitis

Gingivitis is a reversible inflammation of the gingival tissue that affects 60% to 75% of pregnant women. (15, 16) Although gingival inflammation is most commonly caused by the accumulation of plaque around the tooth, the decreased immune response and alterations in the hormonal milieu during pregnancy can also contribute to its development. In fact, half of pregnant women are likely to experience a significant exacerbation of gingivitis, albeit mostly transient.(15) If followed up with proper oral hygiene measures, it is most likely to subside after childbirth.(5) If left untreated, however, this inflammation may lead to periodontitis and destruction of the periodontal tissues around teeth.(5)

1.2.5 Periodontitis and Associated Complications

The bacterial infiltration caused by gingivitis can further spread below the gum line and stimulate a chronic inflammatory reaction. This can result in subsequent bone loss and breakdown of the surrounding periodontal tissue. The American Academy of Periodontology suggest that, like tooth decay, this condition can culminate in tooth loss if left untreated.(5)

According to the New York State Department of Health in 2006, almost half of women of reproductive age suffer from periodontitis and of those who are pregnant, 30% develop periodontal disease.(17) This chronic inflammation has been linked with preterm birth and low birth weight, with preeclampsia and gestational diabetes.

1.2.5.1 Preterm Birth and Low Birth Weight Babies

A baby born at less than 37 weeks of gestation and weighing less than 2500 grams is considered as a preterm birth (PTB) and to be of low birth weight (LBW), respectively. (17) According to some research, periodontal disease could be considered an independent risk factor for PTB and LBW.(17) This can be due to the increased levels of inflammatory mediators that are produced in response the periodontal inflammation and toxins. This inflammation can lead to the increased production of circulating cytokines (e.g., tumour necrosis factor, interleukin 8, interleukin).

Furthermore, it can increase the uterine stimulating factors such prostaglandins, which can have an effect on the placental function that can induce early labour. (18)

The key factors involved in PTB and LBW include: IgG antibodies, periodontal pathogens (mainly *Tannerella forsythia*, *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, *Treponema denticola*, *Fusobacterium nucleatum* and *Campylobacter rectus*) and increased levels of cytokines. (18) The presence of higher levels of fetus IgM in the fetal blood cord samples of the pregnant women with the chronic periodontal disease suggests an

association of periodontal disease with the PTB and LBW.(19, 20) The other known risk factors for PTB and LBW include substance abuse, very low or very high maternal age, alcohol consumption, multiple births, low socioeconomic status, previous history of PTB, and urinary tract infections.(21, 22) However, studies have also correlated PTB and LBW with periodontitis although not without controversy.(19, 23) In fact, some researchers have refuted this association by highlighting potential biases in such findings in terms of differences in study design, sample size, population involved (e.g., socioeconomic status, race), outcome measures (e.g., definition of preterm or low birth weight or fetal loss), exclusion and inclusion criteria and the clinical indices used to measure the level of disease.(23) Nonetheless, research also suggests that taking proper care of the mother's periodontal health during pregnancy can contribute towards a healthy pregnancy and a healthy newborn.(24, 25)

1.2.5.2 Periodontitis Related Preeclampsia

Periodontitis has been also associated with preeclampsia, pregnancy-induced hypertension, which usually presents after 20 weeks of gestation and affects approximately 5% of pregnant women.(26) However, the exact pathophysiology of the mechanism is not known. Another theory suggest that the inflammatory mediators of periodontal infection can damage the endothelial lining of placental vasculature by increasing the placenta's vascular permeability. Thereby, active periodontitis-related bacteria and their metabolites are subsequently able to enter the placenta, which can culminate in sepsis and abortion.(5, 26, 27)

1.2.6 Gestational Diabetes Mellitus

According to the American College of Obstetricians and Gynecologists, Gestational Diabetes Mellitus (GDM) is presented as carbohydrate intolerance with onset during pregnancy.(28) Periodontal disease can cause or complicate GDM. Some evidence suggests that periodontal

inflammation can elicit a transient bacteremia caused by the pathogens in subgingival plaque. This bacteremia can further cause a sustainable systemic inflammatory response involving periodontal inflammatory mediators and cytokines such as TNF- α , IL-1 β , IL-6, IL-8 and C-reactive protein by entering the blood circulation. This systemic inflammation (caused by chronic periodontitis) can increase the insulin resistance, causing the destruction of pancreatic B-cells. This may increase the glucose tolerance level hence manifesting the symptoms of GDM.(29, 30) Studies suggest that GDM can significantly increase the risks of maternal and infant morbidity.(31) Although early detection and management of periodontal disease can improve insulin resistance and glycemic levels, untreated periodontal disease can further lead to long-term health complications for both mother and infant.(31)

1.2.7 Systemic Complications for the Expectant Mother and Fetus

Research suggests that the by-product of periodontal inflammation in the form of a C-reactive protein can contribute to cardiovascular disease, stroke and diabetes mellitus.(18) Some studies also suggest that the risk of cardiovascular diseases may increase in pregnant women with poor periodontal health.(18) These complications can also be extended to infants born preterm or with low birth weight. As adults, these infants might be at additional risk for developing diabetes and cardiovascular disorders.(32, 33) The exact pathophysiology of this mechanism is still unknown but it has been hypothesized that it is the formation of atheromas in the form of plaques in the inner lining of arteries that lead to atherosclerosis and other CVS disorders.(33)

Furthermore, the presence of bacteria in the placenta can also be associated with poor neurologic outcomes during fetal development such as cerebral palsy, a group of chronic conditions affecting body movements and muscle coordination; periventricular leukomalacia, a major form of brain white matter injury associated with the subsequent development of cerebral palsy,

intellectual impairment and visual disturbances; and Alzheimer's Dementia, a neurodegenerative disorder that leads to selective memory impairment.(34, 35) Although the exact pathophysiology of the above conditions has not yet been fully understood, it has been theorized that the inflammatory mediators from periodontitis during pregnancy can alter the internal cellular environment and affect the genomic machinery of the fetus.(35)

1.2.8 Oral Tumours

Although not common, another variety of oral pathology that can affect pregnant women is a benign neoplasm. It is estimated that up to 5% of pregnant women may experience these benign growths that clinically and histopathologically resemble a pyogenic granuloma (a benign tumour-like condition of the skin and mucus membrane) that grows on the gingival surface particularly after the first trimester.(36) This condition is most likely to occur due to the increased levels of progesterone, in association with bacteria from plaque and calculus, subsequently contributing to the development of this condition. (36) Unlike gingival inflammation, this condition is not believed to be associated with adverse pregnancy outcomes and usually subsides after pregnancy. However, this transient pathology can affect the normal masticatory function and can limit the nutritional intake of both the mother and consequently, the fetus during pregnancy.(37)

1.2.9 Socioeconomic, Cultural and Need Factors

Oral health during pregnancy can be further affected by a number of social, economic and cultural factors that prevent pregnant women from attaining basic and essential oral health care either because of financial constraints or beliefs. Studies worldwide have indicated that oral care might not be a priority for pregnant women and their health care professionals due to a variety of factors mostly related to ethno-cultural health values and beliefs.(38)

There seems to exist a direct correlation between poverty, lower socioeconomic and educational status and acquiring oral health care during pregnancy, which places pregnant women at greater risk for the health complications discussed above.(38) In fact, some ethno-cultural groups believe that oral problems can be quite expected during pregnancy. For example, there is a Chinese belief that the fetus can ‘utilize’ the mother’s calcium and as a result, the pregnant woman could expect quite normally to lose teeth, to have tooth decay or to have existing fillings falling out.(39, 40)

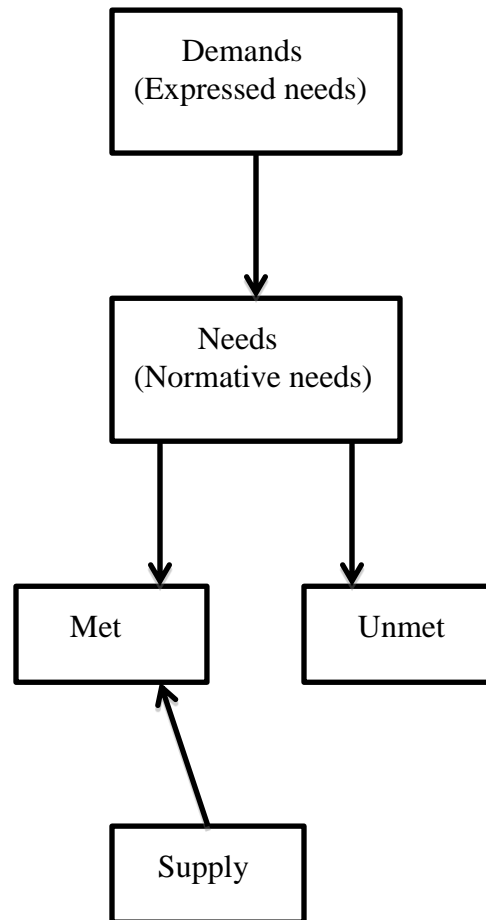
A mother’s health education also plays a key role in shaping the oral health of her children. A mother with bad dietary and oral hygiene habits can encourage the same eating and hygiene behaviours in her children. As a result, children may demonstrate lack of, or improper care, for their oral health during their childhood and adult life.(40)

Financial affordability, lack of dental insurance and high rates of dental needs also play a great role in shaping care-seeking behaviour.(41, 42) Therefore, the population in general including pregnant women can be deprived of getting basic dental care when needed. According to the American Pregnancy Risk Assessment Monitoring System, not more than 50% of pregnant women receive oral care.(41)

Predisposing factors for this insufficient dental service utilization include low socioeconomic status, immigrant or refugee status, lack of cultural adaptation, lack of physical access to a dental office, misconceived values and beliefs about oral health, alcohol consumption, tobacco abuse or simply lack of awareness about oral health care during pregnancy.(43, 44) It has also been shown that women who do not receive relevant oral health care information or who do not have prior dental knowledge are unable to engage in preventive health care behaviour. (42)

Although publicly funded educational and preventive oral health initiatives exist, they might not be enough to address the extensive dental needs of Canadians.(45) Moreover, there is no comprehensive data on the oral health needs of pregnant women in Canada. Due to financial unaffordability and lack of resources for meeting the unknown dental care needs of the population, Wright et al used the following illustration to distinguish the differences between health care needs, supply and demand in a general population.(46)

Figure 2: Different aspects of needs (Adopted from Wright *et al.* 1998 and Ramraj *et al.* 2012)



According to Wright *et al.*, need is defined as a “capacity to benefit”. He further elaborates that resources should be available for the population, once the needs have been identified. Demand is “what patients ask for” and supply is the final outcome or resource, which is provided by the health care system, private or public.(46) It is an undeniable fact that the rising cost of dental services restricts people from obtaining even the most very basic dental care. As a result, more efforts are needed at the population level to address the oral health needs of Canadians in general, and pregnant women in particular.(46) One way of doing this would be by focusing more on the prevention and early clinical intervention which could lead to a substantial cost

benefit for both the population and the health care system. This could be accomplished by strengthening the dental public health programs and initiatives on local and provincial levels.(46)

1.3 Dental Public Health in Canada Health Authorities in British Columbia

The field of dental public health is dynamic and has been evolving over time in Canada. It mainly involves dental health needs assessments, surveillance, disease and injury prevention, health promotion and protection and aids for improving the dental health of populations.(30, 47)

The Canadian Association of Public Health Dentistry (CAPHD) has defined specific tasks for the improvement of the oral health of the population.

The CAPHD has been leading the development of the core tasks for dental public health professionals with the ongoing support from Public Health Agency of Canada as part of the larger Pan-Canadian Public Health Core Competencies initiative (See Appendix 2).

In summary, it is essential to strengthen and standardize the practices within organizations as well as complex public health strategies. As the public health systems and services vary between and within provinces and territories across Canada, so does the usage of discipline competencies. As a result, the adoption of dental public health task requires acceptance and commitment from a variety of groups including federal and provincial/territorial governments and regional health care authorities. Within this context, there are seven major health care authorities in British Columbia that have preventive dental public health programs catering to the needs of their regional populations.

In B.C., the seven major health authorities are: Vancouver Coastal Health (VCH), Fraser Health (FH), Northern Health, Vancouver Island Health Authority, Interior Health, Provincial Health Service Authority and First Nation Health Authority. Like in other Canadian provinces, most of the prenatal dental programs in B.C focus on educating pregnant women in maintaining their oral

health during pregnancy. (45) Fraser Health is the largest health authority in BC, and it is described ahead.

1.3.1 Fraser Health Authority

Fraser Health (FH) works to improve the health and quality of life of the people associated with it.(48) It is divided into three major zones: North, South and East. Each zone has its own infrastructure of local public health units, which are designed to meet the health care needs of their target populations. FH serves more than 1.6 million people, which include a large Asian population consisting of Indo-Canadians, Korean and Filipino descent. It has an annual operating budget of 2.6 billion dollars, and includes 12 acute care hospitals and 7760 residential care beds, and houses 1,547 residents in public mental health homes and community centers.(48) FH current oral health promotion initiatives include fluoride varnish application for children up to the age of 4-yrs old, oral health education in elementary schools, preschool dental resource kit for children at age three that includes oral health education material and oral health care program for the adults with developmental disabilities. Fraser Health also has been involved with research in Public Health Dentistry, one of which in collaboration with Simon Fraser University that highlighted the appalling oral care treatment needs of the government-assisted refugees.(49) FH also runs a prenatal program called ‘Best Beginnings’, which is similar to programs offered by other provincial health authorities reaching pregnant women and their new born(s).

1.3.1.1 Best Beginnings Prenatal Program

The Best Beginnings (BB) *“is a direct public health resource to promote the health and wellness of the pregnant women, new mothers, babies two years of age and families using a population health approach that seek to raise the health status of those most in need”*.(50) The

program has been designed to provide universal health services to all pregnant women, as well as enhanced services for those who are vulnerable, their children and families. It aims to use the best available public health evidence to minimize adverse outcomes while enhancing protective factors during pregnancy. It collaborates with maternity care providers to facilitate seamless care across prenatal services. (50)

All pregnant women under the umbrella of FH are encouraged to register in the BB program within 18 to 20 weeks of pregnancy (Appendix 7 shows the BB form). This permits access to all prenatal health services to promote a healthy prenatal experience for mothers and their future babies. According to the FH, the BB registration form serves as a pre-screening tool on the existing social, economic and health care problems associated with the pregnant women. It supports woman's health rights from the time that she conceives, throughout the prenatal period and after delivery. The primary goal of BB registration is to provide health and community resource information about all pregnant women while identifying vulnerability factors during pregnancy and providing evidence based public health interventions to the pregnant women.

In terms of vulnerability, the BB form identifies pregnant women which may be at health risks if they report tobacco use, symptoms of depression, financial difficulties, earlier or advanced age, food insecurity, aboriginal status, lower educational level, among other concerning factors. Once the pregnant woman is identified as having possible risk factor(s), she is placed into a vulnerability category as per the pathways below:

- Pathway A Selected population**
- Pathway B Symptoms of depression**
- Pathway C Vulnerability**

Pathway D Tobacco use

Pathway E Mail Environmental Tobacco Smoke (ETS) pamphlet

Pathway F No Follow-up

Pathway A: FH recognizes the importance of improving the health status of the indigenous residents due to their historical health disparities and social economic inequalities.

Approximately 40,000 First Nations people from 32 different bands are provided with essential health care through FH. All the aboriginal women are eligible for Public Health Nursing (PHN) assessment, care and education.

Pathways B and D: Pathways B and D include women who present with any positive responses to depression or tobacco smoking, respectively. Women identified within these pathways are also eligible for PHN.

Pathway C: This pathway overlaps with pathway A, and includes those aboriginal women who also have at least one of the following risk factors: young/old maternal age at pregnancy, insufficient income, symptoms of depression, tobacco smoking and a lower level of education. Women identified with this pathway remain eligible for PHN assessment.

Pathway E: This pathway includes women who answer yes to the second-hand smoke question on the registration form and who do not meet the criteria for A, B, C or D pathways. Women identified in this pathway receive information that is mailed out only.

Pathway F: This pathway represents those pregnant women who do not meet the criteria for the pathways A, B, C, D or E. They will not receive prenatal PHN follow up.

Other risk factors including the experience of violence from an intimate partner are also identified and addressed accordingly. Based on the initial prenatal registration and the pathway identification, contact with the pregnant woman is established within the next seven calendar

days for further vulnerability assessment. For pathways B, C or D these assessments are completed over the telephone. For pathway A, the vulnerability assessment is completed over the phone or in person. If the contact number is not available, three visit attempts over a period of three weeks are made. The pathways identify women with health risks who are offered various services and referrals ranging from nutritional counselling, alcohol and smoking cessation programs, sexual health, to immunization. Likewise, the same pregnant woman can be assigned to more than one pathway and receive the follow up based on their self-reported vulnerable factor(s). (50)

Although comprehensive, the BB form does not have any question regarding oral health, access to dental care or attitudes or the values and beliefs of pregnant women towards their oral care. These were important issues that I have identified and discussed earlier. FH then took an initiative to include dental question(s) in the registration form that lead to the partnership for my research. Also, no designated pathway exists to identify pregnant women vulnerable to the consequence of oral diseases.

Different oral health questionnaires exist in the dental literature to assess respondents' knowledge, attitudes and behaviours on topics ranging from their own health, satisfaction with services, treatment needs, health values and beliefs and so on. These questions are mostly self-completing and vary in length (e.g., number of questions) and answering format (e.g., frequency of events, level of agreement or satisfaction, etc.). Below I present and discuss some of these existing questions, including the Canadian Health Measure Survey and others.

1.3.2 Canadian Health Measure Survey and Prenatal Dental Questionnaires

Before 2007, when the Office of Chief Dental Officer (OCDO) and the Department of National Defense (DND) started the data collection for the oral component of CHMS, there was

no nationwide data available on the clinical status of Canadians. Dentists from the DND traveled across Canada to examine almost 6,000 participants in 15 communities randomly selected from all over Canada from March 2007 to February 2009. This sample size is a representation of the 97% of the Canadians aged 6 to 79 years old. Although CHMS includes data on self-reported general and oral health followed by the clinical examination, it does not seem to have been developed under a particular framework or supporting theory to base its questions. The validation process used to evaluate the questions is also unknown (See Appendix 2 as I elaborate on my understanding of validity and its relevance to questionnaire development). Moreover, the results of the CHMS do not specify any particular findings regarding oral care and pregnancy, but the questions posed could be used for surveying pregnant women.

My literature review (Figure 1) also directed me to existing prenatal dental questionnaires. Most of them focus on parental knowledge, beliefs and behaviours for oral health of toddlers,(51) parental influence on adolescents oral health behaviour,(52) knowledge, attitude and behaviour of partners or care takers regarding transmissibility of caries,(53) parental risk attitudes and caries-related behaviours,(54) and the parental beliefs and attitudes towards child caries prevention.(55) Some examples of the questions include ‘*has your child ever had dental caries?*’ (Yes, No, Don’t know), ‘*can dental caries be transmitted from person to person?*’ (Yes, No, Don’t know), ‘*if our child uses fluoride toothpaste, it will prevent tooth decay?*’ (1=strongly disagree, 5=strongly agree), ‘*it is not worth to battle with our child to brush his/her teeth twice daily*’ (1=strongly disagree, 5=strongly agree). These questions do not necessarily target the oral health attitudes, knowledge and beliefs of pregnant women.

A recent study from the UBC Faculty of Dentistry entitled ‘*Can prenatal dental public health program can make a difference?*’ presents a questionnaire designed to explore the

knowledge, attitude and behaviour about oral health care practices of pregnant women and to identify the most common oral problems experienced by them.(45) Given the current evidence on the links between the lack of oral health and the risks to pregnancy, Fraser Health partnered with the UBC Faculty of Dentistry to design oral health-related question(s) to the BB form. The literature review I have conducted enabled me to develop new, and modify existing, oral health questions in the light of my research questions and objectives:

1.4 Research Question

What is the baseline self-reported oral health status and dental service utilization of pregnant women from diverse ethno-cultural backgrounds in Fraser Health Authority in BC

1.5 Objectives:

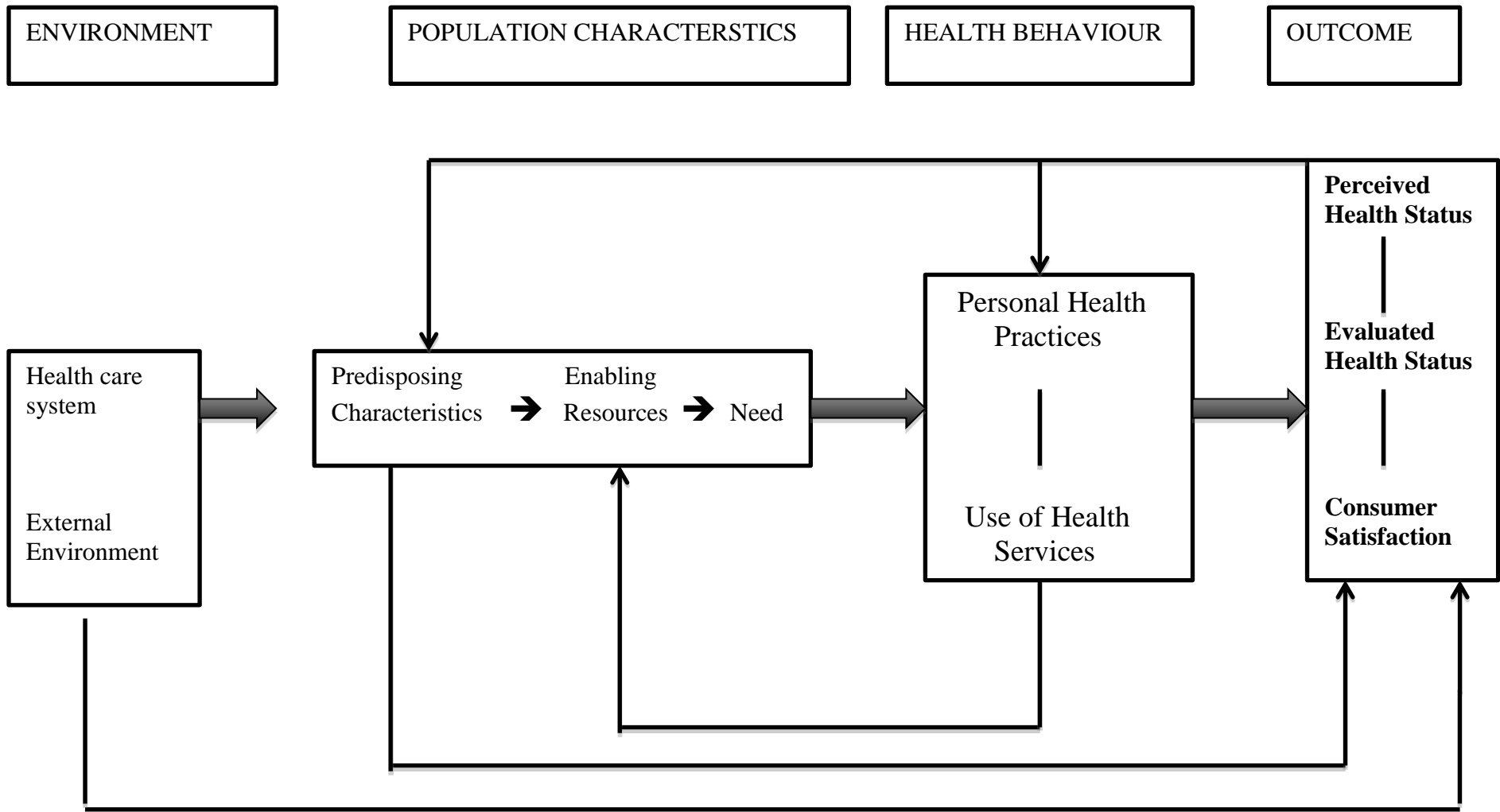
- 1) *To design and test question(s) to identify the baseline of self-reported oral health status and dental service utilization during pregnancy.*
- 2) *To identify the baseline self-reported oral health and dental service utilizations of pregnant women in Fraser Health Authority.*
- 3) *To examine how independent variables (e.g., educational levels, dental insurance availability, perceived oral health status) correlate with self-reported oral health status and dental service utilization.*

Chapter 2: Material and Methods

2.1 Proposed Framework for this Study

Given the nature of my research and in the context of the BB form and development of a dental questionnaire (discussed below), Andersen and Newman model of Health Services (1995) (Figure 3) appears to fit quite well with my research question and objectives.(56) This model was first developed in 1960 to examine the use of health services and to foster the even-handed promotion and access of health services. After a series of modifications, the latest form presented in 1995 determines the role of different societal and individual factors that may influence one's utilization of health care services. As shown in Figure 3, the model comprises three major factors: predisposing (demographics), enabling (ability to pay or difficult living conditions) and needs factors (health status or perceived needs). The model has been used in various researches to predict the most important factors that could influence health service utilization. According to Babitsch, Figure 3 has been widely used in various studies as a theoretical framework and adapted to different areas of health care research.(57, 58) The main predisposing variables examined in most of the studies using this model are age, gender/sex, education and ethnicity. The main enabling factors are income and financial affordability, financial condition, health insurance and having a usual source of care or a family doctor.(58, 59)

Figure 3: Andersen's Emerging Model (taken from Andersen1995)



2.2 Proposed Survey Questions

Based on the above literature review and framework to address my research question and objectives, I suggested the following seven self-reported questions. These questions enabled me to determine the overall oral health status (including self-perceived oral health conditions) and dental service utilization of pregnant women.

Question 1

1.A Please rate the health of your mouth: (choose one)

- Excellent
- Good
- Fair
- Poor

Rationale: This question has been widely utilized (41, 59, 60), and was also part of the CHMS. It is very likely that those who answer ‘excellent’ or ‘poor’ are telling us that their mouths are in fact clinically good or bad, respectively, as found by Pitiphat and colleagues and others.(60, 61) It can then serve as surrogate measure for the oral health status while providing an economical alternative to clinical examination.(62)

1.B How important do you think the health of your mouth is during pregnancy?

- Very important
- Moderate important
- Somewhat important
- Not important
- I don’t know

Rationale: Adapted from the CHMS, this question helped me to gauge the level of importance of oral care as perceived by the respondents during pregnancy.

Question 2

2.A Do you have an insurance or government program that covers all or part of your dental expenses?

- Yes
- No
- Don't know
- I was refused coverage

2.B If yes, then is it:

- An employer sponsored plan?
- A private plan?
- A government program for social service?
- A government program for First Nations and Inuit?

Question 3

In the past 12 months, have you avoided having some or all the dental treatment that was recommended because of the cost?

- Yes
- No

Rationale: The above questions # 2 and 3 were used to identify the status and type of dental coverage of my study population, as employed by others (41). It also helped me to determine if financial affordability can be an influencing factor to seek the recommended dental treatment.

Question 4

When was the last time you saw a dental professional (dentist, dental hygienist, denturist) (choose one)?

- Less than 1 year ago
- 1 year to less than 2 years ago
- 2 years to less than 3 years ago
- 3 years to less than 4 years ago
- 4 years to less than 5 years ago
- 5 or more years ago

Question 5

Do you usually see a dental professional (dentist, dental hygienist, denturist) (choose one)?

- ... more than once a year for checkups or treatment
- ... about once a year for checkup or treatment
- ... less than once a year for checkup and treatment
- ... only for emergency care
- ... never

Rationale: Questions 4 and 5 focus on the pattern of dental care attendance, which I used to identify the respondents' seeking oral care behaviour during or before pregnancy. In fact, the given choices of answers may or may not be correlated with the independent variables such as low income, smoking, refugee status, and so on.(59)

Question 6

Since the beginning of your pregnancy to today, have you had any one or more of the following conditions:

- | | |
|---|--|
| Toothache | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Pain in your teeth when consuming hot or cold foods or drinks | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Severe tooth or mouth pain at night | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Pain around your jaw joints | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Bleeding gums while brushing your teeth | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Persistent dry mouth | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Persistent bad breath | <input type="checkbox"/> Yes <input type="checkbox"/> No |

Rationale: Also modified from the CHMS, this question about self-perceived knowledge of one's own oral health enabled me to identify the most prevalent self-reported oral problems experienced by pregnant women. There have been studies indicating that this type of question can be used as a surrogate measure for the actual oral health status where clinical examination cannot be conducted.(63)

Question 7:

During your pregnancy, what do you think is most likely to happen in your mouth? (You may choose more than one answer)

- I may lose a tooth or teeth
- My teeth may become loose
- My teeth and gums may become sensitive
- I may lose calcium from my mouth/body because of my baby
- I may have a cavity or cavities in my teeth
- I may have one or more dental fillings falling out/lose a filling(s)
- I may avoid brushing and/or flossing
- My gums may bleed
- I may develop an oral tumour(s)/cancer
- I should avoid seeing a dentist/dental professional because_____
- None of the above
- Other _____

Rationale: This question was developed based on my literature review. It asks for the held beliefs regarding oral care during pregnancy, which may or may not be influenced by the respondents' ethnic backgrounds or education levels. I was also interested in finding any potential correlation between the most prevalent self-reported oral conditions and self-reported oral health related beliefs. Moreover, the answers given to this question could be very helpful for health authorities and policy makers for designing the educational material that could target the false beliefs and misconceptions identified by this study.

2.3 Study Design and Protocol

As mentioned above, one of my objectives was to identify the baseline of self-reported oral health and dental service utilization as reported by pregnant women affiliated with the FHA. In order to accomplish this objective, I attached the above seven questions to the BB registration form for easy reading, together with the consent to participate in the study (Appendix E).

This study was carried out in two phases over four months. In phase 1, I conducted a brief pilot study for about a week to test the proposed questions. Phase 2 comprised of the main study in which data was collected via the BB form and the attached dental survey distributed to all the women attending prenatal registration at the Surrey Memorial Hospital, the largest hospital in FH enrolling more than 4000 pregnant women/year, all of which are encouraged to register into the BB program.

2.4 Phase 1 – Pilot

After obtaining ethics approval from FHA (Appendix 5) and UBC Ethical Research Board (UBC BREB # H12-01049), the proposed dental questions were piloted within a sample of seventeen individuals including pregnant women and their husbands, and hospital staff at the Surrey Memorial Hospital family planning and birthing unit who came from various ethno-cultural background. This diversity and size of the target population offered me the opportunity to carry out my data collection at the Surrey Memorial Hospital. The pilot entailed a brief face-to-face interview to get general ideas about the questions as volunteer participants answered them. I was interested in respondents' ideas about questions' comprehension, clarity and syntax coherence. Although the questions were based on existing questions of the CHMS, the general feedback helped me to make necessary changes. In order to proper elicit information about the questionnaire, I asked participants the following:

- a) Are there any difficult words to understand?*
- b) Is there clarity in the words?*
- c) Is there any redundancy with the questions or their options?*
- d) If you were told to rewrite this question, how would you do that?*
- e) Are the given options enough? Or would you like to include any other option? Why?*

f) *Would you like to exclude any option? Why?*

g) *Is there any redundancy with the options? Which ones?*

Thirteen out of seventeen respondents did not raise any concerns with the questions. Others gave the following comments/suggestions about question # 7:

Respondent 1 reported that she did not find this question important because her doctor mentioned that her gums would bleed during pregnancy anyways. She further said that she has been advised by her family doctor not to visit a dentist during pregnancy.

Respondent 2 and 9 suggested adding the option ‘**None of the above**’ in case respondents did not believe that any of the listed conditions would happen while **Respondent 9** further suggested to replace the word ‘**mobile**’ with ‘**loose**’ to make it more reader friendly.

Respondent 3 suggested including other questions(s) about smoking and/or other tobacco consumption to compare with the other dental questions. She was probably unaware that the BB form already asks the questions regarding smoking and tobacco consumption.

All the necessary changes were made after discussing them with my thesis supervisor and committee members.

2.5 Phase 2 – Main Study:

Upon agreement with FH, I chose a full birth cycle from October /12 to February/13 to collect my data. Just like the pilot, this phase was carried out in the family planning and birth unit at Surrey Memorial Hospital on the volunteer basis.

If agreeing to participate in my study, participants were advised to detach the consent form for their records while filling out the BB form and the dental survey. The BB forms were kept in the reception area where a public health nurse collected them twice a week (mostly on Tuesdays and Fridays). In order to collect as much BB forms and survey as possible, I went to Surry Memorial

Hospital twice every week, on Mondays and Thursdays, before the public health nurse. I separated all the dental survey and made copies of the BB registration form while leaving the original to the nurse. I gave each respondent an ID code (to match the respective survey with the BB form) while de-identifying the forms by blacking out all the personal information such as name, address, postal code, care card number, date of birth, telephone number and other contact information. As requested by FH, all the data was numerically coded and entered into Microsoft Excel spreadsheet for statistical analysis (see ahead). However, if participants wanted to fill out only one of the documents (either the BB form or the survey), they could well do so even though I could not use this data for analysis purposes.

This second phase of my study reached 835 registrants in the 4-month birth cycle. From these, 740 (87%) responded fully to the survey and the BB form registration. This number held enough statistical power to tease out the potential relationships and correlations between the different variables presented above. Given that the Prenatal Registration Program is also voluntary, the actual number of pregnant women that were seen at Surrey Memorial Hospital during that time was probably larger.

2.6 Data Variables:

Given the content of the survey questions and BB form, I have identified the following variables to focus my data analysis based on Anderson and Newman's model.

2.6.1 Selection and Construction of Outcome Variables

The dependent/outcome variables in my study are the self-reported oral health (from Question # 1) and dental service utilization during pregnancy (from Question # 4), which helped me to determine the overall behaviour of the participants to pursue dental services during pregnancy.

The first outcome variable was derived by asking pregnant women to rate the health of their

mouth (“excellent,” “good,” “fair” and “poor”). The answers were dichotomized, and the first of these two options indicated that the respondents were satisfied with the health of their mouth while the last two options indicated those that were not satisfied with the health of their mouth. The second outcome variable, which was dental service utilization, was derived from a question asking about their last dental visit (“less than one year”, “more than one year”, “more than five years”, “never”).

2.6.2 Selection and Construction of Independent Variables

The independent variables were grouped as per Anderson and Newman’s model constructs, including predisposing, enabling, and needs.

2.6.2.1 Predisposing Variables

Predisposing variables were understood as those factors associating with unmet dental needs. They included demographic factors such as sex (in this study it was just focused on females), age, education (having minimum of high school education in this study), immigration status (born in Canada or outside Canada and number of years living in Canada) and smoking status (smoker or non smoker).

2.6.2.2 Enabling Variables

Enabling variables were understood as those factors associating with the acquisition of dental care. The main variables in this category were income adequacy and dental insurance. The respondents who had dental insurance were further asked about the type of insurance they had (e.g., private, employer sponsored, government, etc). Although there was no question regarding the total household income and professions of the respondents, the BB form asked if these

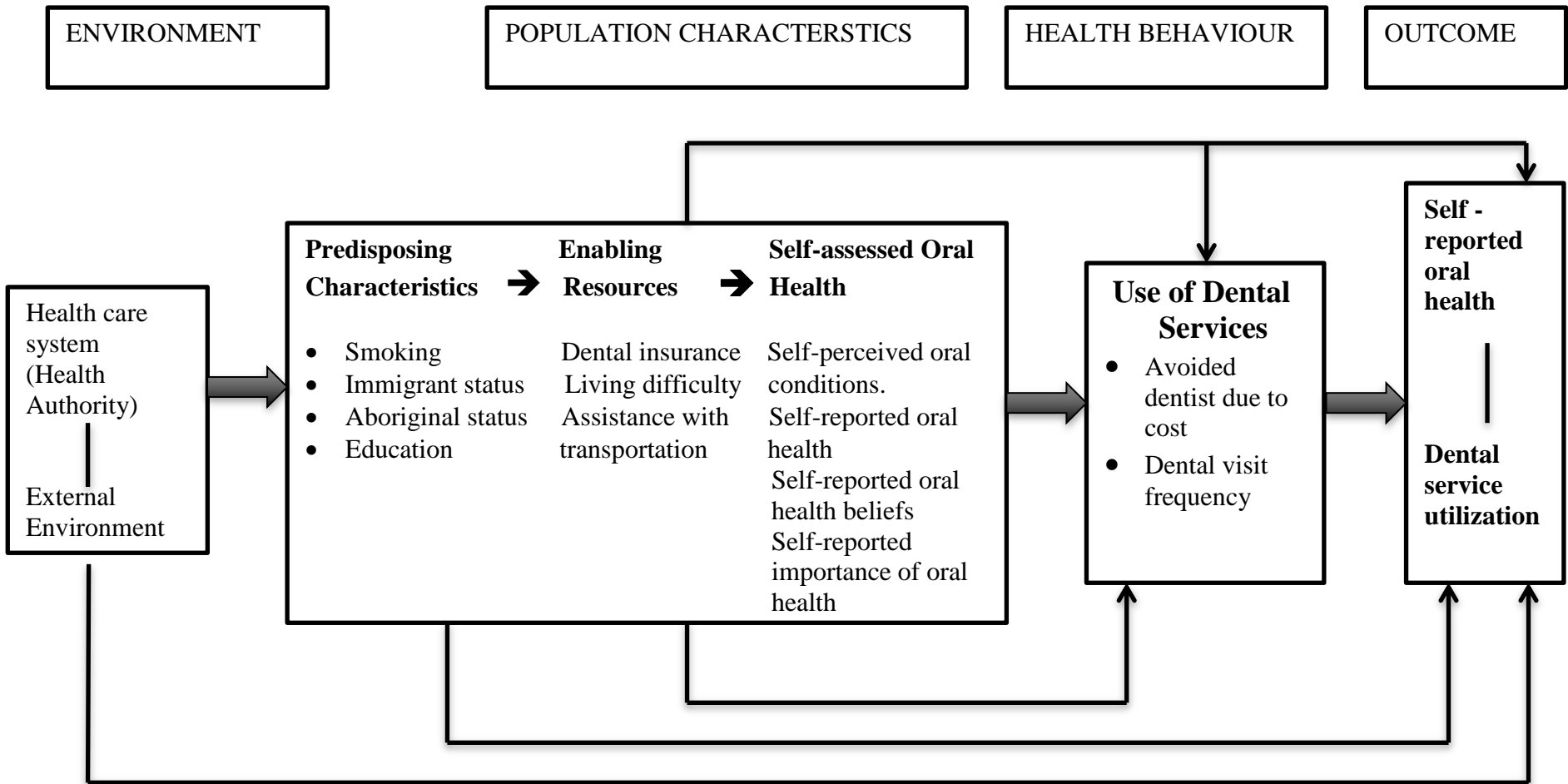
women were having trouble living within their total household income (“yes” or “no”). This question acted as a surrogate to determine the income adequacy in this population.

2.6.2.3 Needs Variables (Self-assessed Oral Health)

Health needs were self-assessed as per question # 1.B on the importance of oral health during pregnancy (“very important,” “moderate important,” “somewhat important,” and “not at all important”), self-reported oral conditions # 7 (oral pain, dry mouth, bleeding gums, etc.) and oral beliefs during pregnancy (bleeding gums, dry mouth, etc.). These questions on self-assessed oral health (status and beliefs) helped me to determine the self-perceived oral care needs of this group of population.

The above outcome and independent variables lead to the modification on the Newman and Anderson model (Figure 3). Under enabling, predisposing and needs factors (now as self-assessed oral health), I was able to outline the important characteristics of my study population that were influential to the outcome variables of self-reported oral health and of dental service utilization which let me to produce Figure 4.

Figure 4: Functional model – Modification of Andersen's Emerging Model (adapted from Andersen's 1995)



2.7 Data Analysis

All the important variables were transferred to the Statistical Package for the Social Sciences (SPSS Institute Inc. version 9.3) using Microsoft Excel for MAC (Version 14.2) spreadsheet. Continuous variables were summarized using descriptive statistics (n, mean \pm SD). Categorical variables were summarized using frequencies and percentages to examine the sample characteristics and to identify the overall needs and patterns of dental visits in the population. Continuous variables were compared by using two sample t-tests, and categorical variables were tested using the chi-square test of association. Multivariable logistic regressions were used to estimate the odds ratio and 95% confidence interval for self-reported oral health, symptoms, and dental beliefs. Significance was considered at p-values < 0.05 .

Given that my two outcome variables were self reported oral health and dental service utilization, both seemed to be influenced by the same predisposing, enabling and self-assessed oral health factors. Moreover, due to the nature of my study and to tease out the strongest correlations of different psychosocial factors, both outcome variables also served as independent variables. For this reason, I have chosen to discuss both of my outcome variables together with the most significant predisposing and enabling factors and self-assessed oral health factors in the light of existing literature, ahead (page 57).

Chapter 3: Results

3.1 Descriptive Analysis

3.1.1 General Characteristics of the Study Population

The demographic characteristics of the study population are presented in table 1. The mean age of the women was 30.2 (SD \pm 4.8) years. The majority (79%) had a prenatal consultation with their obstetrician or midwife during the first trimester, as expected. Eighty five percent had completed high school. Five percent reported that they are currently smoking while 13% reported to be subjected to second hand smoking on daily or weekly basis (Table 1). Five percent had aboriginal status, and 5% had refugee status. Thirteen percent reported the symptoms of depression, while 14% had difficulty living within their total household income (Table 1).

The women were from twenty different countries, but most were either born in Canada (36%) or India (34%). Eighty-nine percent reported speaking English and 16% reported the need for an interpreter in order to complete the survey (data not shown). Eighty-eight percent of the respondents reported that they plan to breast feed their baby (data not shown).

3.1.2 Descriptive Oral Health Characteristics of the Study Population:

Seventy one percent of the women valued their oral health as important during pregnancy (Data not shown). Most of the respondents regarded their oral health as excellent (55%) or good (29%), while 14% rated their oral health as fair and 2% as poor (Figure 5). Amongst the women who rated their oral health as fair or poor, 19% were from Asian countries other than India, 18% were from India, and 17% were from Canada (Figure 6). More than half (56%) of all the respondents visited a dental professional in the last year for regular care, while 23% saw a dental professional for emergency only. Nine percent of the respondents had never visited a dental professional (Figure 7).

Table 1 - General characteristics of the study population

Population Characteristics	Total Participants N (%)
First Pregnancy	
<i>Yes</i>	293 (41.3%)
<i>No</i>	415 (58.5%)
Refugee Status	
<i>Yes</i>	40 (5.5%)
<i>No</i>	681 (94.5%)
Years living in Canada	
<i>Born in Canada</i>	252 (34.6%)
<i>Less than 5 yrs</i>	197 (27.0%)
<i>5-10 years</i>	149 (20.4%)
<i>More than 10 yrs</i>	131 (18.0%)
Aboriginal Status	
<i>Yes</i>	37 (5.5%)
<i>No</i>	632 (94.5%)
Completed high school	
<i>Yes</i>	617 (85.2%)
<i>No</i>	107 (14.8%)
Someone to talk	
<i>Yes</i>	667 (91.9%)
<i>No</i>	59 (8.1%)
Assistance with transportation*	
<i>Yes</i>	650 (89.8%)
<i>No</i>	74 (10.2%)
Difficult to live on income†	
<i>Yes</i>	101 (14.2%)
<i>No</i>	611 (85.8%)
Depressed during the past month	
<i>Yes</i>	67 (9.3%)
<i>No</i>	653 (90.7%)
Little interest during the past month	
<i>Yes</i>	91 (12.7%)
<i>No</i>	627 (87.2%)

* Women reported needing assistance with childcare, housing and transportation.

† Women reported having difficulty living within their household income.

Population Characteristics	Total Participants N (%)
Tobacco	
<i>Never smoked</i>	567 (81.0%)
<i>Currently smoking</i>	39 (5.6%)
<i>Quit smoking less than 1 yrs ago</i>	37 (5.3%)
<i>Quit smoking more than 1 yr ago</i>	56 (8.0%)
People smoke around you	
<i>Daily</i>	59 (8.6%)
<i>Weekly</i>	31 (4.5%)
<i>Monthly</i>	13 (1.9%)
<i>Less than monthly</i>	53 (7.7%)
<i>Never</i>	530 (77.3%)

Note: The sample size for each question varies with respect to the number of participants who provided responses. The percentages shown in this table represent row percentages.

Figure 5: Self-reported oral health of the study population
Women from the surveyed population reporting the health of their mouth as excellent, good, fair or poor. (N=717)

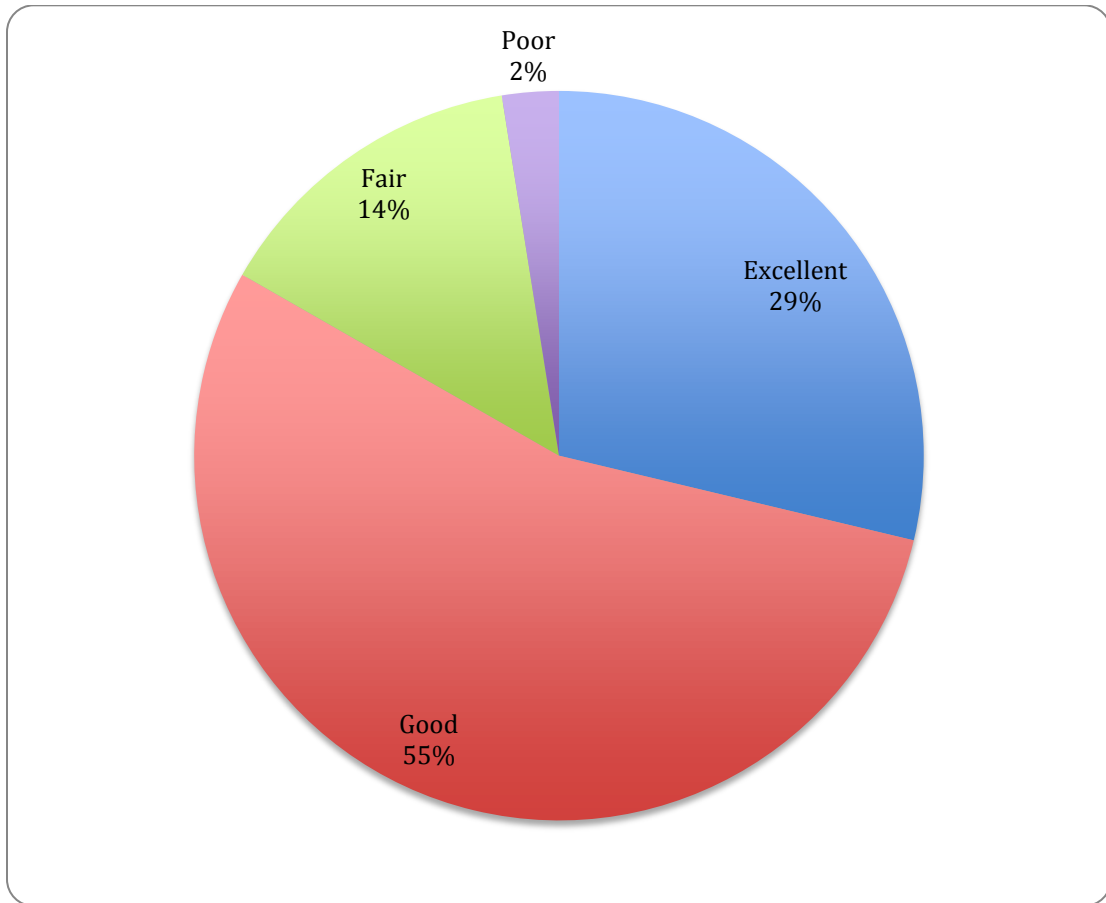


Figure 6: Self-reported oral health status (fair or poor) according to their region of birth
Women from Asia, Canada and India were more likely to rate the health of their mouth as fair/poor than other parts of the world. (N=707)

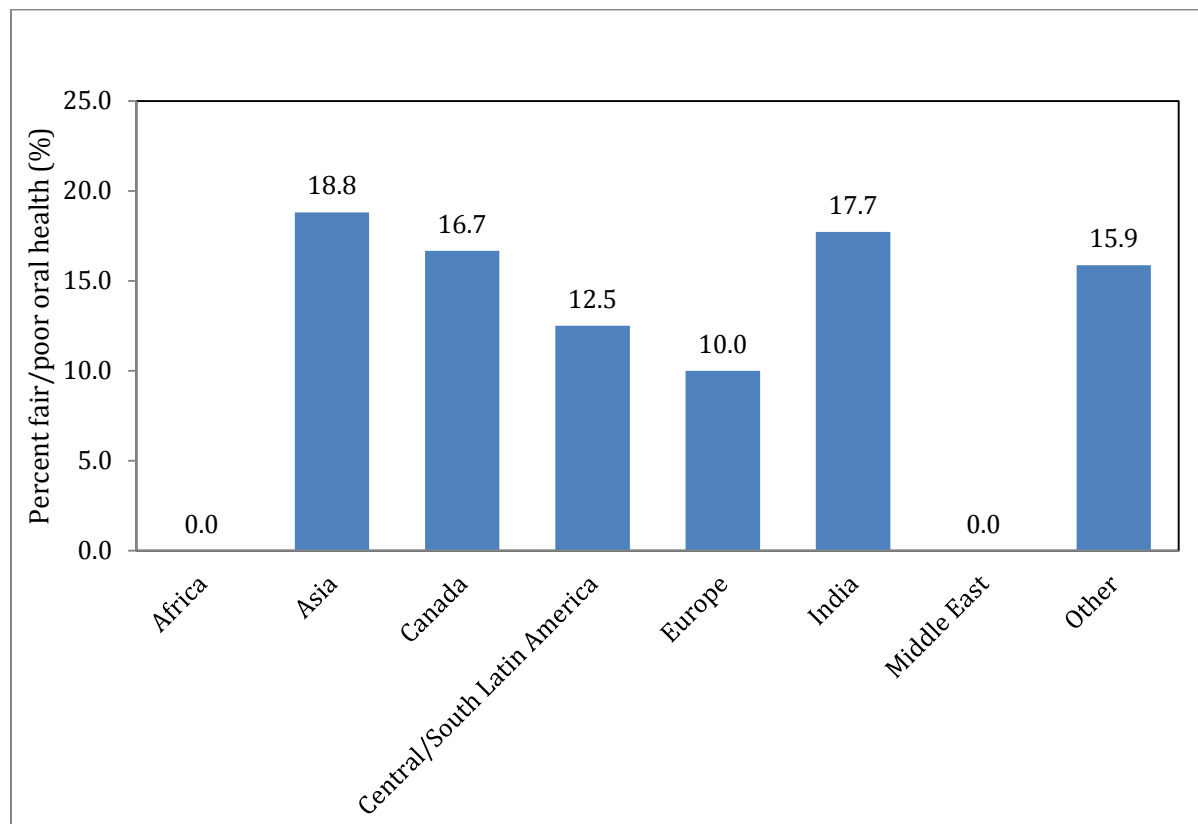
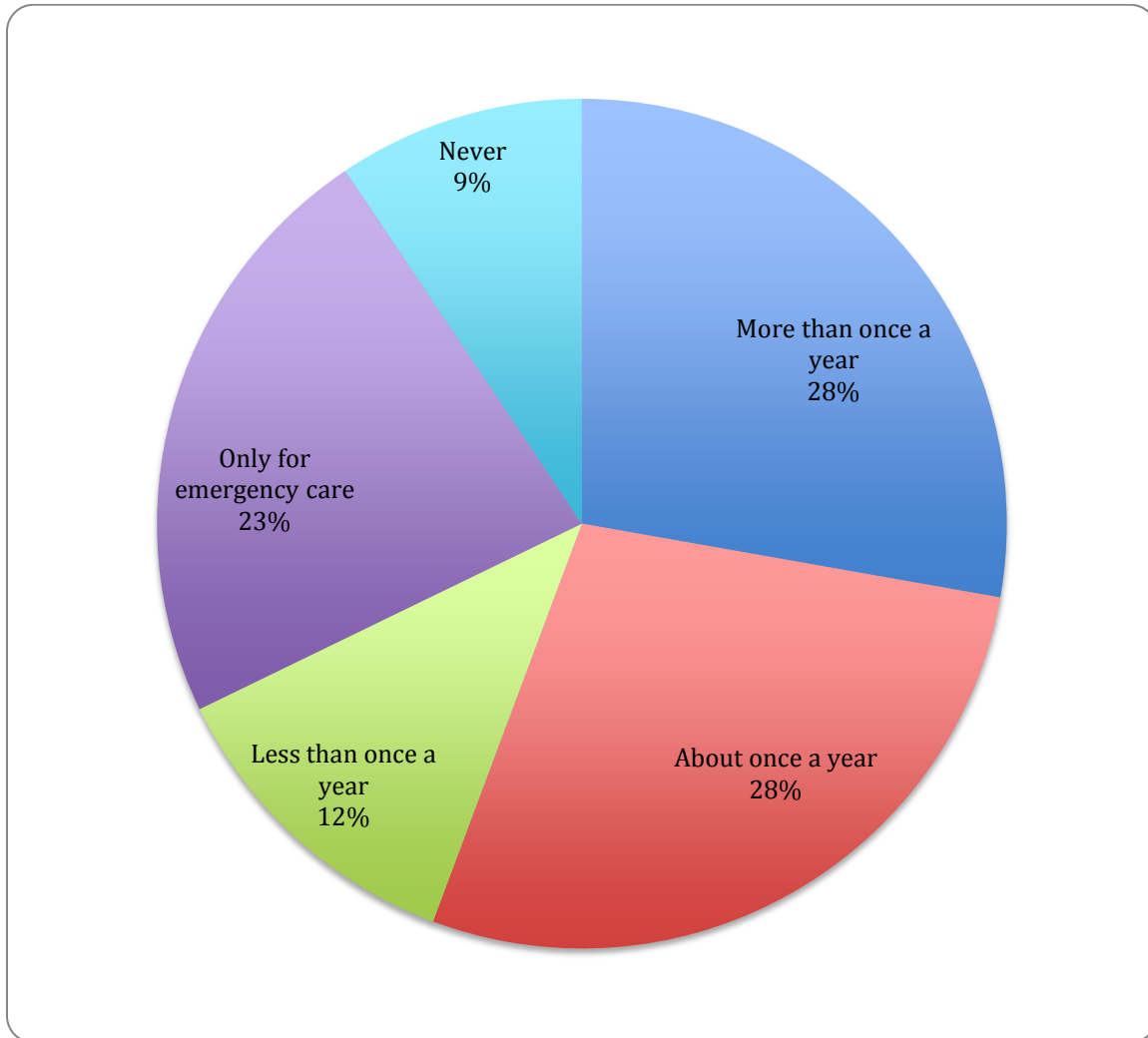


Figure 7: Self-reported dental service utilization of the study population
Women from the surveyed population reporting their last dental visit (within the last year, more than one year, for emergency care or never). (N=702)



According to figure 8(a), the most common self-reported oral problems during pregnancy were bleeding gums (42%), tooth sensitivity (22%) and dry mouth (13%). Almost 37% self-reported they had none of the listed problems. The most common self-reported dental beliefs regarding pregnancy acquired oral conditions were bleeding gums (38%), tooth sensitivity (36%) and depletion of calcium from the teeth (28%) (Figure 8b). According to figure 9, women who visited a dental professional within the last year were likely to rate their oral health as excellent/good than the women who hadn't consulted a dental professional in more than two years. Different beliefs were more prevalent depending upon the woman's ethnicity. Pregnant women from India (22%), Africa (11%), Canada (36%) and Middle East (9%) all shared the beliefs that tooth sensitivity, bleeding gums, and calcium loss were to be expected during pregnancy (data not shown). Women from Asian countries other than India expected to have bleeding gums during pregnancy (data not shown).

Figure 8(a): Self-reported dental conditions of the study population
Women reported having one or more dental conditions during pregnancy. Tooth sensitivity, bleeding gums and tooth ache were the most common self-reported dental conditions by this surveyed population. (N=740)

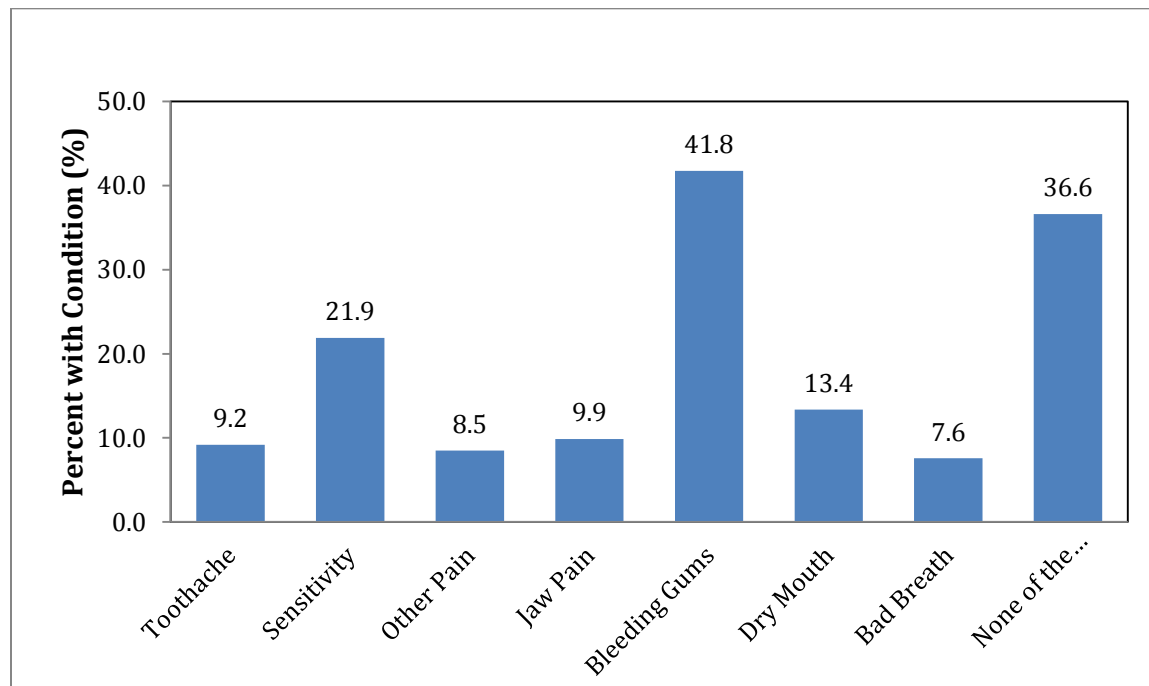


Figure 8(b): Self reported pregnancy related oral health beliefs of the study population

Women reported having one or more oral health related beliefs due to pregnancy. Tooth sensitivity, bleeding gums and losing calcium were the most commonly held dental beliefs by this surveyed population. (N=740)

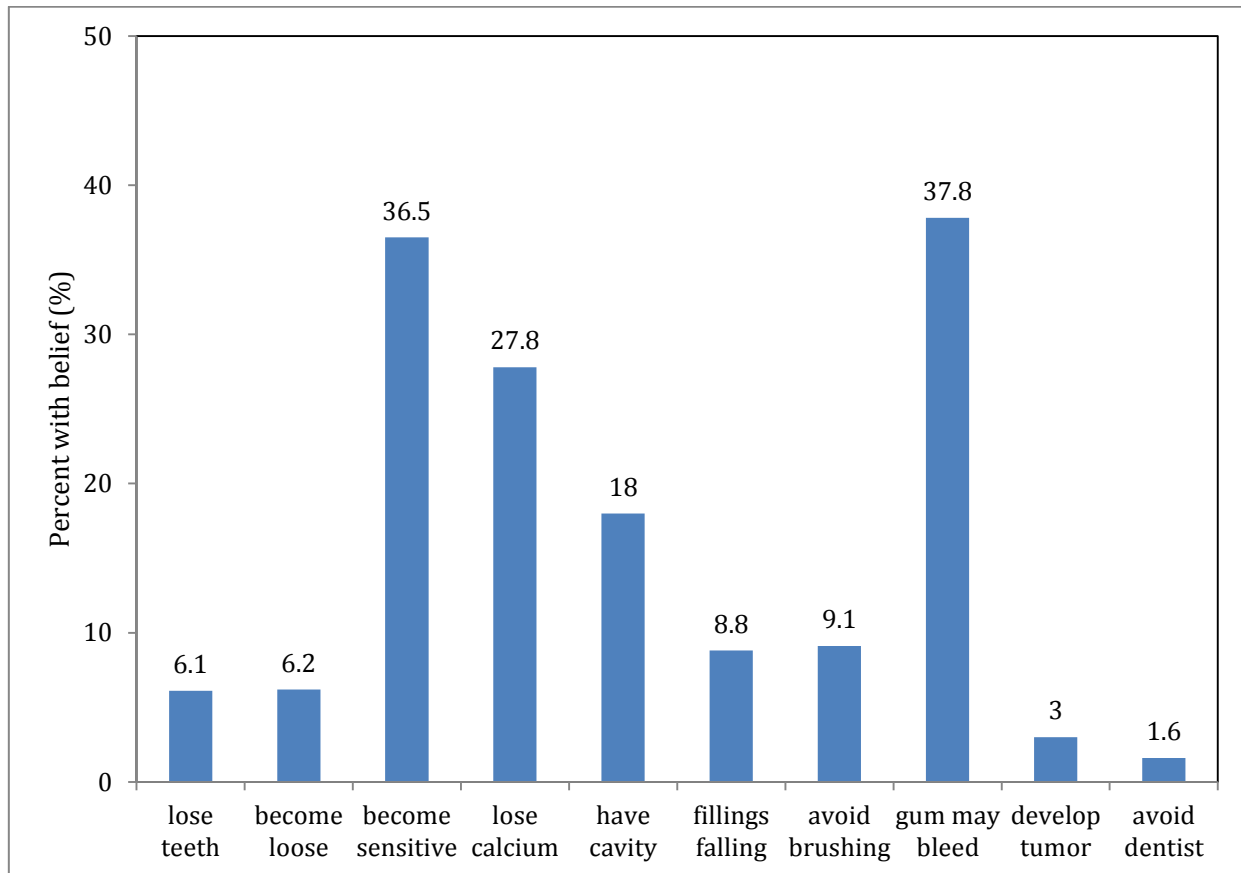
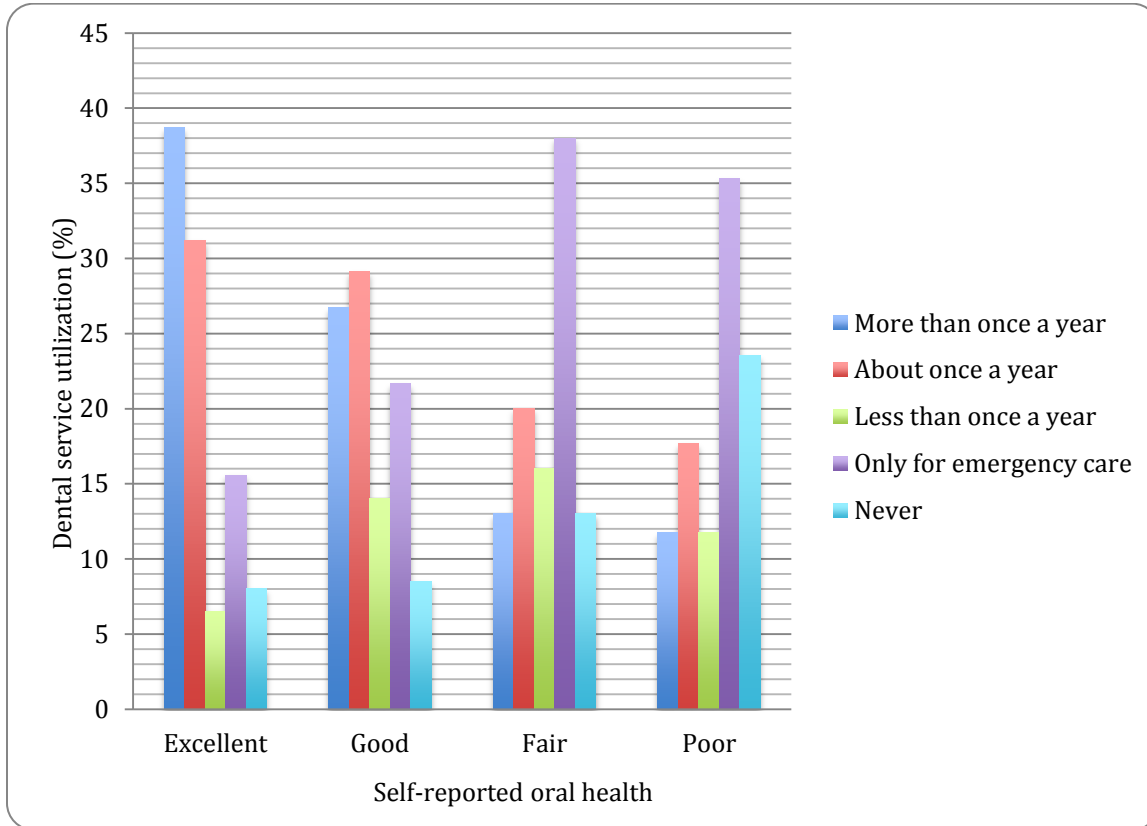


Figure 9: Dental service utilization vs. self-reported oral health of the study population

Bivariate comparison of self-reported oral health with dental service utilization. Women reporting the health of their mouth as excellent or good were more likely to visit a dental professional within the last year than the women who rated the health of their mouth as fair or poor. (N=703)



3.2. Bivariate Analysis

3.2.1 Self-reported Oral Health with Psychosocial (pre-disposing and enabling) Variables:

The enabling characteristics of the study population with self-reported oral health are presented in table 2. There were no significant differences between how women rated their oral health and mean age, country of birth, aboriginal or refugee status, years living in Canada, and a high school education. Almost 81% of women reported no history of smoking. A greater proportion of never smokers and women who had quit smoking more than one year prior to completing the survey rated their oral health as excellent or good. Similarly women who were subjected to daily second hand smoke were less likely to report their oral health as excellent than women who were exposed to second hand smoke less frequently.

Women with dental insurance (53%) were more likely to report the health of their mouth as excellent (35%) as compared to those without dental insurance (47%) (excellent 22%) while women without dental insurance (47%) had a higher proportion of women who rated their oral health as fair (20%) or poor (4%) ($P < 0.001$) (Table 3). Of the women with insurance, those with employer sponsored insurance rated their oral health higher than women using government or First Nations sponsored dental insurance ($P < 0.001$).

Although not significant more women reporting symptoms of depression rated their oral health as fair or poor than women reporting no symptoms of depression. There was no significant difference in the self-reported oral health found for women who had difficulty living within their total household income compared to women who did not have difficulty living within their income. There was a trend for women who already had children to report their oral health as

worse than those without children ($P=0.057$). Hence, no statistical significance was found in self-reported oral health with depression and living difficulties (Table 3). Women who reported visiting a dental professional in last 2 years (46%) were more likely to rate the health of their mouth higher (excellent 37%) than the women who hadn't visited a dental professional in more than 5 years (13%) (excellent 20%) ($P<0.001$) (Table 3).

Table 2: Predisposing (demographic) characteristics of the study population with self-reported oral health

	Total Participants N (%)	Excellent N (%)	Good N (%)	Fair N (%)	Poor N (%)	P-value
Age						
<i>Mean (± SD)</i>	30.2 (4.8)	30.4 (4.7)	30.5 (4.7)	28.7 (5.7)	31.7 (4.7)	0.130
<i>Median (min, max)</i>	30 (16, 48)	30 (19, 43)	30 (17, 48)	29 (16, 45)	33 (23, 42)	
Country of Birth						
						0.695
<i>Canada</i>	258 (36.0%)	83 (32.2%)	132 (51.2%)	38 (14.7%)	5 (1.9%)	
<i>Indian</i>	237 (33.1%)	63 (26.6%)	132 (55.7%)	36 (15.2%)	6 (2.5%)	
<i>Others[‡]</i>	222 (31.0%)	60 (27.0%)	127 (57.2%)	28 (12.6%)	7 (3.2%)	
Aboriginal						
						0.454
<i>Yes</i>	36 (5.5%)	8 (22.2%)	21 (58.3%)	7 (19.4%)	0 (0.0%)	
<i>No</i>	617 (94.5%)	187 (30.3%)	334 (54.1%)	82 (13.3%)	14 (2.3%)	
Refugee						
						0.679
<i>Yes</i>	37 (5.3%)	10 (27.0%)	23 (62.2%)	3 (8.1%)	1 (2.7%)	
<i>No</i>	663 (94.7%)	191 (28.8%)	358 (54.0%)	97 (14.6%)	17 (2.6%)	
Years of living in Canada						
<i>(Mean, ± SD)</i>	1.2 (1.1)	1.0 (1.1)	1.3 (1.1)	1.4 (1.2)	1.3 (1.0)	
High school education						
						0.150
<i>Yes</i>	601 (85.2%)	182 (30.3%)	321 (53.4%)	82 (13.6%)	16 (2.7%)	
<i>No</i>	104 (14.8%)	23 (22.1%)	60 (57.7%)	20 (19.2%)	1 (1.0%)	
Smoking status						
						0.027
<i>Never smoked</i>	552 (80.9%)	159 (28.8%)	304 (55.1%)	76 (13.8%)	13 (2.4%)	
<i>Currently smoking</i>	38 (5.6%)	7 (18.4%)	22 (57.9%)	5 (13.2%)	4 (10.5%)	
<i>Quit > 1 yr ago</i>	37 (5.4%)	8 (21.6%)	20 (54.1%)	9 (24.3%)	0 (0.0%)	
<i>Quit < 1 yr ago</i>	55 (8.1%)	22 (40.0%)	24 (43.6%)	8 (14.5%)	1 (1.8%)	
Passive smoking						
						0.001
<i>Daily</i>	59 (8.8%)	10 (16.9%)	31 (52.5%)	16 (27.1%)	2 (3.4%)	
<i>Weekly</i>	31 (4.6%)	9 (29.0%)	11 (35.5%)	7 (22.6%)	4 (12.9%)	
<i>Monthly</i>	13 (1.9%)	5 (38.5%)	6 (46.2%)	2 (15.4%)	0 (0.0%)	
<i>Less than monthly</i>	53 (7.9%)	19 (35.8%)	27 (50.9%)	6 (11.3%)	1 (1.9%)	
<i>Never</i>	513 (76.7%)	150 (29.2%)	290 (56.5%)	64 (12.5%)	9 (1.8%)	

Note: The sample size for each question varies with respect to the number of participants who provided responses. The percentages shown in this table represent row percentages.

[‡] Other countries were grouped as African, Central and South American, European and Middle Eastern countries.

Table 3: Enabling characteristics of the study population with self-reported oral health

	Total Participants N (%)	Excellent N (%)	Good N (%)	Fair N (%)	Poor N (%)	P- value
Living difficulty[§]						0.095
<i>Yes</i>	101 (14.5%)	24 (23.8%)	52 (51.5%)	21 (20.8%)	4 (4.0%)	
<i>No</i>	594 (85.5%)	178 (30.0%)	327 (55.1%)	75 (12.6%)	14 (2.4%)	
Dental insurance						<0.001
<i>Yes</i>	351 (52.7%)	124 (35.3%)	193 (55.0%)	29 (8.3%)	5 (1.4%)	
<i>No</i>	315 (47.3%)	68 (21.6%)	171 (54.3%)	63 (20.0%)	13 (4.1%)	
Type of insurance*	(N=349)					<0.001
<i>Employer sponsored</i>	326 (93.4%)	117 (35.9%)	181 (55.5%)	25 (7.7%)	3 (0.9%)	
<i>Government program for social services</i>	16 (4.6%)	2 (12.5%)	9 (56.3%)	3 (18.8%)	2 (12.5%)	
<i>First nations/Inuit</i>	7 (2.0%)	0 (0.0%)	4 (57.1%)	3 (42.9%)	0 (0.0%)	
Have children						0.057
<i>Yes</i>	400 (56.5%)	104 (26.0%)	234 (58.5%)	51 (12.8%)	11 (2.8%)	
<i>No</i>	308 (43.5%)	100 (32.5%)	150 (48.7%)	51 (16.6%)	7 (2.3%)	
Assistance with transportation**						0.956
<i>Yes</i>	634 (90.1%)	183 (28.9%)	346 (54.6%)	90 (14.2%)	15 (2.4%)	
<i>No</i>	70 (9.9%)	22 (31.4%)	36 (51.4%)	10 (14.3%)	2 (2.9%)	
Depressed/hopeless						0.385
<i>Yes</i>	64 (9.1%)	15 (23.4%)	34 (53.1%)	12 (18.8%)	3 (4.7%)	
<i>No</i>	638 (90.9%)	187 (29.3%)	349 (54.7%)	87 (13.6%)	15 (2.4%)	
Dental utilization						<0.001
<i>last 2 years ago</i>	325 (46.2%)	120 (36.9%)	172 (52.9%)	29 (8.9%)	4 (1.2%)	
<i>2 to 5 years ago</i>	285 (40.5%)	60 (21.1%)	164 (57.5%)	55 (19.3%)	6 (2.1%)	
<i>< 5 years ago</i>	93 (13.2%)	19 (20.4%)	49 (52.7%)	18 (19.4%)	7 (7.5%)	

Note: The sample size for each question varies with respect to the number of participants who provided responses. The percentages shown in this table represent row percentages.

*Participants were asked to identify an insurance type if they answer, “Yes” to the question “Do you have an insurance or government program that covers all or part of your dental expenses.

[§] Women reported having difficulty living within their household income.

** Women reported needing assistance with childcare, housing and transportation.

3.2.2 Dental Service Utilization with Psychosocial (pre disposing and enabling)

Variables:

Women who were older at the time of the survey were more apt to have visited a dental professional within the last year than younger pregnant women ($P=0.015$) (Table 4). Women who were born in Canada were more likely to have visited a dental professional within the past year (56%) than the women born in India (29%) and other countries (53%) ($P<0.001$) (Table 4). Former smokers who had quit less than one year prior to the survey were more likely to have visited a dental professional within the last year than never smokers and those who had quit more than one year ago ($P=0.039$). Time of last visit with a dental professional was not associated with aboriginal or refugee status, years living in Canada, high school education or exposure to second hand smoke.

Table 5 displays the enabling characteristics of the study population with self-reported dental service utilization. Women with dental insurance were more likely to have visited a dental professional within the past year (69%) than women who did not have dental insurance (23%) ($P<0.001$). Women who had a more recent dental professional visit were more likely to rate their oral health higher than those women who had not visited a dental professional in more than 5 years ($P<0.001$). Amongst those who visited a dental professional within the past year, 60% rated the health of their mouth as excellent and 45% good compared to those who visited a dental professional in more than five years (10% and 13%, respectively) ($P<0.001$). Women who reported symptoms of depression (9%) were less likely to visit a dental professional (32%) in less than a year than the ones who were not depressed (48%). Already having children and type of insurance was not associated with date of last dental professional visit.

Table 4: Predisposing (demographic) characteristics of the study population with self-reported dental service utilization

	Total Participants N (%)	Less than 1 year ago N (%)	1 to 5 years ago N (%)	≥5 years ago N (%)	P-value
Age					
<i>Mean (± SD)</i>	30.2 (4.8)	30.7 (4.9)	30.1 (4.9)	28.8 (4.3)	0.015
<i>Median (min, max)</i>	30 (16, 48)	31 (17, 48)	30 (16, 45)	29 (17, 38)	
Country of Birth					
<i>Canada</i>	253 (35.4%)	141 (55.7%)	87 (34.4%)	25 (9.9%)	<0.001
<i>Indian</i>	238 (33.3%)	68 (28.6%)	120 (50.4%)	50 (21.0%)	
<i>Others</i>	223 (31.2%)	119 (53.4%)	84 (37.7%)	20 (9.0%)	
Aboriginal					
<i>Yes</i>	36 (5.6%)	18 (50.0%)	13 (36.1%)	5 (13.9%)	0.844
<i>No</i>	612 (94.4%)	296 (48.4%)	246 (40.2%)	70 (11.4%)	
Refugee					
<i>Yes</i>	39 (5.6%)	17 (43.6%)	18 (46.2%)	4 (10.3%)	0.721
<i>No</i>	658 (94.4%)	307 (46.7%)	264 (40.1%)	87 (13.2%)	
Years of living in Canada (Mean, ± SD)					
	1.2 (1.1)	1.2 (1.2)	1.3 (1.1)	1.3 (0.9)	
High school education					
<i>Yes</i>	597 (85.3%)	285 (47.7%)	239 (40.0%)	73 (12.2%)	0.201
<i>No</i>	103 (14.7%)	41 (39.8%)	44 (42.7%)	18 (17.5%)	
Smoking status					
<i>Never smoked</i>	548 (81.2%)	247 (45.1%)	226 (41.2%)	75 (13.7%)	0.039
<i>Currently smoking</i>	37 (5.5%)	19 (51.4%)	12 (32.4%)	6 (16.2%)	
<i>Quit > 1 yrs ago</i>	37 (5.5%)	15 (40.5%)	18 (48.6%)	4 (10.8%)	
<i>Quit < 1 yr ago</i>	53 (7.9%)	36 (67.9%)	15 (28.3%)	2 (3.8%)	
Passive smoking					
<i>Daily</i>	57 (8.6%)	21 (36.8%)	27 (47.4%)	9 (15.8%)	0.246
<i>Weekly</i>	31 (4.7%)	14 (45.2%)	12 (38.7%)	5 (16.1%)	
<i>Monthly</i>	13 (2.0%)	7 (53.8%)	2 (15.4%)	4 (30.8%)	
<i>Less than monthly</i>	52 (7.8%)	29 (55.8%)	19 (36.5%)	4 (7.7%)	
<i>Never</i>	511 (77.0%)	241 (47.2%)	207 (40.5%)	63 (12.3%)	

Note: The sample size for each question varies with respect to the number of participants who provided responses. The percentages shown in this table represent row percentages.

Table 5: Enabling characteristics of the study population with self-reported dental service utilization

	Total Participants N (%)	Less than 1 year N (%)	1 to 5 years ago N (%)	≥5 years ago N (%)	P-value
Living difficulty^{††}					0.069
<i>Yes</i>	101 (14.6%)	41 (40.6%)	40 (39.6%)	20 (19.8%)	
<i>No</i>	589 (85.4%)	281 (47.7%)	239 (40.6%)	69 (11.7%)	
Dental insurance					<.001
<i>Yes</i>	349 (52.2%)	241 (69.1%)	96 (27.5%)	12 (3.4%)	
<i>No</i>	319 (47.8%)	74 (23.2%)	175 (54.9%)	70 (21.9%)	
Type of insurance*					0.290
<i>Employer sponsored</i>	325 (93.4%)	223 (68.6%)	92 (28.3%)	10 (3.1%)	
<i>Government program</i>	16 (4.6%)	9 (56.3%)	7 (43.8%)	0 (0.0%)	
<i>First nations and Inuit</i>	7 (2.0%)	4 (57.1%)	2 (28.6%)	1 (14.3%)	
Have children					0.899
<i>Yes</i>	398 (56.4%)	185 (46.5%)	162 (40.7%)	51 (12.8%)	
<i>No</i>	308 (43.6%)	140 (45.5%)	125 (40.6%)	43 (14.0%)	
Assistance with transportation^{††}					0.038
<i>Yes</i>	630 (89.9%)	299 (47.5%)	252 (40.0%)	79 (12.5%)	
<i>No</i>	71 (10.1%)	24 (33.8%)	32 (45.1%)	15 (21.1%)	
Down and depressed					0.018
<i>Yes</i>	66 (9.5%)	21 (31.8%)	37 (56.1%)	8 (12.1%)	
<i>No</i>	632 (90.5%)	304 (48.1%)	244 (38.6%)	84 (13.3%)	
Self-reported oral health					<.001
<i>Excellent</i>	199 (28.3%)	120 (60.3%)	60 (30.2%)	19 (9.5%)	
<i>Good</i>	385 (54.8%)	172 (44.7%)	164 (42.6%)	49 (12.7%)	
<i>Fair</i>	102 (14.5%)	29 (28.4%)	55 (53.9%)	18 (17.6%)	
<i>Poor</i>	17 (2.4%)	4 (23.5%)	6 (35.3%)	7 (41.2%)	

Note: The sample size for each question varies with respect to the number of participants who provided responses. The percentages shown in this table represent row percentages.

*Participants were asked to identify an insurance type if they answer, “Yes” to the question “Do you have an insurance or government program that covers all or part of your dental expenses?”

^{††} Women reported having difficulty living within their household income

^{††} Women reported needing assistance with the childcare, housing and transportation.

3.2.3 Self-reported Oral Health Status with Self-Assessed Dental Conditions and Beliefs

Table 6 shows the self-reported oral health in regards to self-perceived oral conditions and beliefs. Amongst the women who reported having toothache during pregnancy, 7% rated their oral health as excellent and 40% as good while 43% rated the health of their mouth as fair and 9% as poor ($P<0.001$) (Table 6). Amongst the women who reported having a dry mouth during pregnancy, 19% rated their oral health as excellent and 55% as good while 24% rated their oral health as fair and 24% as poor respectively ($P<0.001$) (Table 6). Amongst the women who believed they would lose calcium during pregnancy, 11% of them rated their oral health as excellent and 53% as good while 19% rated their oral health as fair and 4% as poor ($P=0.008$). Amongst the women who believed that their teeth might become sensitive during pregnancy, 27% of them rated their oral health as excellent and 53% as good while 15% rated their oral health as fair and 3% as poor (Table 6). Amongst the women who believed in avoiding tooth brushing during pregnancy, 12% of them rated their oral health as excellent and 47% as good while 30% rated their oral health as fair and 19% as poor ($P<0.001$) (Table 6).

Table 6: Self-reported oral health with self-perceived oral conditions and beliefs

	Total Participants N (%)	Excellent N (%)	Good N (%)	Fair N (%)	Poor N (%)	P-value
Importance of oral health during pregnancy						<0.001
<i>Very/Moderate/Somewhat Important</i>	643 (91.7%)	195 (96.5%)	353 (92.7%)	81 (80.2%)	14 (82.4%)	
<i>Not Important/Don't know</i>	58 (8.3%)	7 (3.5%)	28 (7.3%)	20 (19.8%)	3 (17.6%)	
Self-perceived oral conditions^{§§}						
<i>Toothache</i>	67 (9.3%)	5 (7.4%)	27 (40.2%)	29 (43.3%)	6 (9.0%)	<0.001
<i>Sensitivity</i>	160 (22.3%)	31 (15.0%)	76 (19.4%)	43 (42.2%)	10 (55.6%)	<0.001
<i>Other pain</i>	62 (8.6%)	5 (2.4%)	25 (6.4%)	27 (26.5%)	5 (27.8%)	<0.001
<i>Jaw pain</i>	71 (9.9%)	9 (4.4%)	32 (8.2%)	22 (21.6%)	8 (44.4%)	<0.001
<i>Bleeding gums</i>	306 (42.7%)	59 (28.6%)	178 (45.5%)	59 (57.8%)	10 (55.6%)	<0.001
<i>Dry mouth</i>	99 (13.8%)	16 (19.1%)	55 (55.0%)	24 (24.2%)	4 (4.0%)	0.014
<i>Bad breath</i>	56 (7.8%)	8 (3.9%)	27 (6.9%)	17 (16.7%)	4 (22.2%)	<0.001
<i>Others</i>	262 (36.5%)	103 (50.0%)	141 (36.1%)	16 (15.7%)	2 (11.1%)	<0.001
Self-reported oral health beliefs^{§§}						
<i>Lose teeth</i>	45 (6.3%)	6 (2.9%)	17 (4.3%)	18 (17.6%)	4 (22.2%)	<0.001
<i>Tooth become loose</i>	46 (6.4%)	9 (4.4%)	21 (5.4%)	15 (14.7%)	1 (5.6%)	0.003
<i>Tooth become sensitive</i>	269 (37.5%)	74 (27.5%)	145 (53.1%)	41 (15.2%)	9 (3.5%)	0.622
<i>Lose calcium</i>	204 (28.5%)	48 (11.2%)	108 (52.9%)	39 (19.1%)	9 (4.4%)	0.008
<i>Have cavity</i>	132 (18.4%)	26 (12.6%)	60 (15.3%)	35 (34.3%)	11 (61.1%)	<0.001
<i>Fillings fall out</i>	63 (8.8%)	5 (2.4%)	35 (9.0%)	20 (19.6%)	3 (16.7%)	<0.001
<i>Avoid brushing</i>	66 (9.2%)	8 (12.1%)	31 (46.9%)	20 (30.3%)	7 (10.6%)	<0.001
<i>Gum may bleed</i>	276 (38.5%)	77 (37.4%)	145 (37.1%)	45 (44.1%)	9 (50.0%)	0.422
<i>Develop tumour</i>	22 (3.1%)	3 (1.5%)	8 (2.0%)	11 (10.8%)	0 (0.0%)	<0.001
<i>Avoid dentist</i>	12 (1.7%)	2 (1.0%)	3 (0.8%)	6 (5.9%)	1 (5.6%)	0.001

^{§§} Respondents were able to choose more than one answer.

3.2.4 Dental Service Utilization with Self-Assessed Dental Conditions and Beliefs

The women who took part in this study overwhelmingly reported that oral health was important to some degree. Almost 92% of the women felt their oral health was very/moderate or somewhat important. Women who considered that the health of their mouth as very/moderate to somewhat important were more likely to see a dental professional (48%) in the past year than the women who considered the health of their mouth was not important/don't know (25%) ($P=0.004$). Women who had not seen a dental professional in more than 5 years were more likely to experience jaw pain than women who had more recent visits ($P=0.013$). There were no significant differences amongst date of last dental visit and women who experienced toothache, sensitivity, bleeding gums, dry mouth or bad breath. Although not significant it is interesting to report that women who had visited a dental professional within the last year reported more tooth sensitivity (47%) than women who hadn't been to a dental office in more than 5 years (15%). Similarly, women who had been to a dental professional within the last year reported experiencing bleeding gums (47%) more frequently than women who hadn't seen a dental professional in more than 5 years (15%). Interestingly, there was no difference in the women who experience no oral conditions during their pregnancy and year of last visit ($P=0.206$).

Examining the women's self-reported oral health beliefs and last dental visit was also shown in table 7. Women who had a dental visit within the last year were more likely to believe that their teeth would become sensitive ($P<0.001$), they would lose calcium while they were pregnant ($P=0.016$), and their gums would bleed ($P=0.012$). Women who hadn't had a visit within the last 5 years were more likely to believe they would lose teeth ($P=0.045$), develop a cavity ($P=0.016$), have a filling fall out ($P=0.045$), and develop a tumour ($P=0.015$). there was a

trend for women who hadn't been to a dental professional in more than 5 years to avoid brushing as compared to women who visited the dental professional more recently ($P=0.06$). Those who visited a dental professional within the past year were more likely to believe that their gums and teeth might become sensitive during pregnancy (44%) than those who did not visit a dental professional in the last year (49%) ($P<.0001$) (Data not shown). Of interest, women who had visited a dental professional within the last year were more likely to report their oral health as excellent versus women who hadn't been to a dental professional in more than 1 year, while rated their oral health as poor ($P<0.001$).

Table 7: Self -assessed oral health of the study population with dental service utilization

	Total Participants N (%)	Less than 1 year ago N (%)	1 to 5 years ago N (%)	≥5 years ago N (%)	p-value
Importance of oral health during pregnancy					0.004
<i>Very/Moderate/Somewhat Important</i>	638 (91.8%)	306 (48%)	256 (40%)	76 (12%)	
<i>Not Important/Don't know</i>	57 (8.2%)	14 (25%)	28 (49%)	15 (26%)	
Self-perceived oral conditions §§					
<i>Toothache</i>	68 (9.5%)	31 (9.5%)	31 (10.7%)	6 (6.3%)	0.238
<i>Sensitivity</i>	162 (22.7%)	76 (46.9%)	61 (37.6%)	25 (15.4%)	0.810
<i>Other pain</i>	63 (8.8%)	23 (7.0%)	26 (8.9%)	14 (14.7%)	0.261
<i>Jaw pain</i>	73 (10.2%)	22 (6.7%)	33 (11.3%)	18 (18.9%)	0.013
<i>Bleeding gums</i>	308 (43.1%)	141 (46.7%)	120 (38.9%)	47 (15.2%)	0.184
<i>Dry mouth</i>	99 (13.9%)	41 (12.5%)	43 (14.8%)	15 (15.8%)	0.605
<i>Bad breath</i>	56 (7.8%)	23 (7.0%)	26 (8.9%)	7 (7.4%)	0.746
<i>None of the above</i>	262 (36.7%)	120 (36.6%)	114 (39.2%)	28 (29.5%)	0.206
Self-reported oral health beliefs ***					
<i>Lose teeth</i>	45 (6.3%)	13 (4.0%)	22 (7.6%)	10 (10.5%)	0.045
<i>Tooth become loose</i>	46 (6.4%)	15 (4.6%)	22 (7.6%)	9 (9.5%)	0.162
<i>Tooth become sensitive</i>	270 (37.8%)	146 (44.5%)	108 (37.1%)	16 (16.8%)	<0.001
<i>Lose calcium</i>	204 (28.6%)	96 (47.0%)	96 (33.0%)	12 (12.6%)	0.016
<i>Have cavity</i>	132 (18.5%)	53 (16.2%)	60 (20.6%)	19 (20.0%)	0.016
<i>Fillings falling</i>	64 (9.0%)	20 (6.1%)	30 (10.3%)	14 (14.7%)	0.045
<i>Avoid brushing</i>	67 (9.4%)	22 (6.7%)	28 (9.6%)	17 (17.9%)	0.062
<i>Gum may bleed</i>	277 (38.8%)	143 (43.6%)	109 (37.5%)	25 (26.3%)	0.012
<i>Develop tumour</i>	22 (3.1%)	4 (1.2%)	11 (3.8%)	7 (7.4%)	0.015
<i>Avoid dentist</i>	12 (1.7%)	8 (2.4%)	3 (1.0%)	1 (1.1%)	0.313
Self reported oral health					<0.001
<i>Excellent</i>	199 (28.3%)	120 (36.9%)	60 (21.1%)	19 (20.4%)	
<i>Good</i>	385 (54.8%)	172 (52.9%)	164 (57.5%)	49 (52.7%)	
<i>Fair</i>	102 (14.5%)	29 (8.9%)	55 (19.3%)	18 (19.4%)	
<i>Poor</i>	17 (2.4%)	4 (1.2%)	6 (2.1%)	7 (7.5%)	

§§ Respondents were able to choose more than one answer.

3.2.5 Country of Birth with Self-Assessed Dental Conditions and Beliefs

Next we compared self-perceived oral conditions and oral health beliefs amongst women by country of birth (Table 8). Almost all women, regardless of where they were born, reported that oral health while they were pregnant was important to some degree. A greater proportion of non-aboriginal Canadian women reported having bleeding gums (39%) more often than Indian women (26%), aboriginal women (16%) and women born elsewhere (4%) (P=0.001). Similarly, more non-aboriginal Canadian women experienced sensitivity than women born in countries other than India and Canada (33%), Indian women (19%) and aboriginal Canadian women (1%) (P=0.015). More aboriginal Canadian women experienced a toothache (24%) than the other women but the result was not significant.

Upon comparison of country of origin and oral health beliefs (Table 8), non-Aboriginal Canadians (38%) and 'other' women (38%) were more likely to believe they would lose calcium during pregnancy than Indian women (22%) and Aboriginal women (3%) (P=0.003). More Canadian women believed their teeth would become sensitive than women from 'other' (39%), India (20%), and aboriginal Canadians (18%) (P<0.001). Similar results were found for the belief that their gums would bleed with 52% of Canadian born women, compared to 37% of women from other countries, 25% of women from India and 18% of aboriginal women (P<0.001). Women from Asian countries other than India expected to have bleeding gums during pregnancy (data not shown)

Table 8: Self -assessed oral health of the study population with the country of birth

	Total Participants N (%)	Aboriginal Canadian N (%)	Non-aboriginal Canadian N (%)	Indian N (%)	Others⁺⁺⁺ N (%)	P-value
Importance of oral health during pregnancy						0.061
<i>Very/Moderate/Somewhat Important</i>	648 (91.7%)	17 (100.0%)	220 (92.4%)	206 (88.0%)	205 (94.0%)	
<i>Not Important/Don't know</i>	59 (8.3%)	0 (0.0%)	18 (7.6%)	28 (12.0%)	13 (6.0%)	
Self-perceived oral conditions⁺⁺⁺						
<i>Toothache</i>	68 (9.2%)	4 (23.5%)	25 (10.2%)	20 (8.0%)	19 (8.4%)	0.166
<i>Sensitivity</i>	162 (21.9%)	6 (1.0%)	66 (47.7%)	40 (18.5%)	50 (32.5%)	0.015
<i>Other pain</i>	63 (8.5%)	1 (5.9%)	23 (9.3%)	21 (8.4%)	18 (7.9%)	0.924
<i>Jaw pain</i>	73 (9.9%)	1 (5.9%)	23 (9.3%)	24 (9.6%)	25 (11.0%)	0.865
<i>Bleeding gums</i>	309 (41.8%)	7 (16%)	121 (39%)	81 (26%)	100 (4.2%)	0.001
<i>Dry mouth</i>	99 (13.4%)	2 (11.8%)	36 (14.6%)	33 (13.2%)	28 (12.3%)	0.898
<i>Bad breath</i>	56 (7.6%)	2 (11.8%)	21 (8.5%)	17 (6.8%)	16 (7.0%)	0.787
<i>Others</i>	271 (36.6%)	7 (41.2%)	81 (32.9%)	106 (42.4%)	77 (33.9%)	0.116
Self-reported oral health beliefs						
<i>Lose teeth</i>	45 (6.1%)	1 (5.9%)	15 (6.1%)	14 (5.6%)	15 (6.6%)	0.975
<i>Tooth become loose</i>	46 (6.2%)	1 (5.9%)	16 (6.5%)	16 (6.4%)	13 (5.7%)	0.985
<i>Tooth become sensitive</i>	270 (36.5%)	3 (17.6%)	129 (52.4%)	50 (20.0%)	88 (38.8%)	<0.001
<i>Lose calcium</i>	206 (27.8%)	6 (3%)	76 (38%)	45 (22%)	79 (38.3%)	0.003
<i>Have cavity</i>	133 (18.0%)	2 (11.8%)	50 (20.3%)	36 (14.4%)	45 (19.8%)	0.255
<i>Fillings falling</i>	65 (8.8%)	1 (5.9%)	19 (7.7%)	20 (8.0%)	25 (11.0%)	0.547
<i>Avoid brushing</i>	67 (9.1%)	1 (5.9%)	25 (10.2%)	21 (8.4%)	20 (8.8%)	0.868
<i>Gum may bleed</i>	280 (37.8%)	3 (17.6%)	129 (52.4%)	63 (25.2%)	85 (37.4%)	<0.001
<i>Develop tumour</i>	22 (3.0%)	1 (5.9%)	10 (4.1%)	6 (2.4%)	5 (2.2%)	0.518
<i>Avoid dentist</i>	12 (1.6%)	0 (0.0%)	6 (2.4%)	2 (0.8%)	4 (1.8%)	0.494
Self-reported oral health						0.373
<i>Excellent</i>	206 (28.7%)	2 (11.8%)	81 (33.6%)	63 (26.6%)	60 (27.0%)	
<i>Good</i>	391 (54.5%)	10 (58.8%)	122 (50.6%)	132 (55.7%)	127 (57.2%)	
<i>Fair</i>	102 (14.2%)	5 (29.4%)	33 (13.7%)	36 (15.2%)	28 (12.6%)	
<i>Poor</i>	18 (2.5%)	0 (0.0%)	5 (2.1%)	6 (2.5%)	7 (3.2%)	

⁺⁺⁺ Other countries were grouped as African, Central and South American, European and Middle Eastern countries

⁺⁺⁺ Respondents were able to choose more than one answer.

3.3 Multivariate Analysis

3.3.1 Self-Reported Oral Health Status and Dental service utilization

Upon multivariate analysis, the following variables remained significant: birth place, dental insurance, and depression (Table 9). The only psychosocial variable to remain significant in multivariate analysis is the place of birth. Women born in India were less likely to self-report any oral conditions than women born in other countries (OR=0.34). As shown in Table 9, the odds of visiting a dental professional in the past year were 2.86 times greater for the women born in India than women born elsewhere, while other variables in the model were held constant. Women with dental insurance were 6.61 times more likely to have visited a dental professional within the past year than women without dental insurance. The odds of visiting a dental professional in the past year were 0.59 times lower for those who are not depressed than for those who are depressed, while other variables in the model were held constant.

Table 9: Multivariate analysis of self-reported oral health and dental service utilization

	Odds ratio (OR)	95% Confidence Interval (CI)	
Psychosocial variables with self-reported oral health ^Y			
<i>Birth Place (Indian vs Others)</i>	0.339	0.120	0.954
<i>Birth Place (Canada vs Others)</i>	0.727	0.215	2.457
<i>Depressed (No vs Yes)</i>	0.750	0.284	1.981
<i>Living Difficulty (No^m vs Yes)</i>	1.900	0.763	4.733
<i>Smoking (No vs Yes)</i>	1.171	0.425	3.226
<i>High School (No vs Yes)</i>	0.915	0.219	1.229
<i>Insurance (No vs Yes)</i>	0.519	0.219	1.229
Psychosocial variables^{§§§} with Dental service utilization ^Y			
<i>Insurance (No vs Yes)</i>	6.614	4.620	9.468
<i>Birth Place (Indian vs Others)</i>	2.861	1.881	4.351
<i>Depressed (No vs Yes)</i>	0.592	0.386	0.906
<i>Living Difficulty (No vs Yes)</i>	1.086	0.697	1.694
<i>Smoking (No vs Yes)</i>	0.928	0.610	1.413
<i>High School (No vs Yes)</i>	1.166	0.715	1.900
<i>Birth Place (Canada vs Others)</i>	1.456	0.944	2.247

^Y The reference for the independent variables is the category level after "vs".

^{§§§} Predisposing and enabling variables by Newman and Andersen that included: birthplace, dental insurance, education, smoking status and difficulty living within the total household income.

3.3.2 Self-Assessed Dental Conditions and Beliefs

The results of multivariate analysis of psychosocial variables and the belief that the women's teeth would become sensitive are in table 10. The only variable to remain significant is country of birth. The odds of believing that the teeth may become sensitive during pregnancy were 0.40 times lower for Indians than for women born in other countries keeping all the other variables in the model held constant. Similarly, women born in Canada were 1.88 times more likely to believe they would have bleeding gums during their pregnancy than women born in other countries. Hence it is not surprising that women born in India were less likely to believe they would have bleeding gums.

Women without dental insurance were less likely to believe they would suffer from bleeding gums (OR=0.71). The odds of having any self-reported oral health conditions were 0.34 times lower for Indians than for all the other races, while other variables in the model are held constant.

Table 10: Multivariate analysis of self-perceived oral conditions and beliefs

	Odds ratio (OR)	95% Confidence Interval (CI)	
Psychosocial variables**** with Self-reported oral conditions[†]			
<i>Birth Place (Indian vs Others)</i>	0.339	0.120	0.954
<i>Birth Place (Canada vs Others)</i>	0.727	0.215	2.457
<i>Depressed (No vs Yes)</i>	0.750	0.284	1.981
<i>Living Difficulty (No vs Yes)</i>	1.900	0.763	4.733
<i>Smoking (No vs Yes)</i>	1.172	0.425	3.226
<i>High School (No vs Yes)</i>	0.915	0.320	2.620
<i>Insurance (No vs Yes)</i>	0.519	0.219	1.229
Psychosocial variables with belief of teeth becoming sensitive			
<i>Birth Place (Indian vs Others)</i>	0.397	0.256	0.615
<i>Birth Place (Canada vs Others)</i>	1.370	0.917	2.046
<i>Depressed (No vs Yes)</i>	0.892	0.574	1.388
<i>Living Difficulty (No vs Yes)</i>	1.172	0.737	1.864
<i>Smoking (No vs Yes)</i>	0.847	0.563	1.272
<i>High School (No vs Yes)</i>	0.688	0.407	1.161
<i>Insurance (No vs Yes)</i>	0.711	0.502	1.006
Psychosocial variables with belief of getting bleeding gum[†]			
<i>Birth Place (Canada vs Others)</i>	1.878	1.250	2.822
<i>Birth Place (Indian vs Others)</i>	0.614	0.402	0.939
<i>Insurance (No vs Yes)</i>	0.710	0.504	1.000
<i>Depressed (No vs Yes)</i>	0.802	0.521	1.235
<i>Living Difficulty (No vs Yes)</i>	1.009	0.642	1.585
<i>Smoking (No vs Yes)</i>	1.370	0.907	2.071
<i>High School (No vs Yes)</i>	0.747	0.449	1.244

**** Predisposing and enabling variables by Newman and Andersen that included: birthplace, dental insurance, education, smoking status and difficulty living within the total household income.

[†] The reference for the independent variables is the category level after "vs".

Chapter 4: Discussion

To the best of my knowledge, this was the first study done at the sub-population level in British Columbia and perhaps in Canada to identify the baseline of self-reported oral health and dental service utilization amongst a diverse population of pregnant women. Although the CHMS represents the baseline of oral health for the Canadian population, it did not include high-risk groups such as pregnant women. Given that oral conditions such as periodontitis and gingivitis may be related to adverse pregnancy outcomes, and that such conditions can be highly prevalent during this life event, pregnant women might be considered a high risk group for the adverse effects of oral conditions.(15)

The majority of my results confirmed the findings from the CHMS 2011. The proportion of pregnant women in this study who rated their oral health as excellent/good was almost identical to the results of the CHMS (83% vs. 84%, respectively). Fewer of the pregnant women had dental insurance than those who took part in CHMS (53% vs. 62%) and only slightly more pregnant women reported avoiding dental treatment due to cost (19% vs. 16, respectively). This disparity may be due to the fact that my surveyed population had more financial barriers than other Canadians. This could be because of various psychosocial factors such as being at the lower socio economic strata of the population as per the composition of the area reached by Fraser Health.(48) It is for this reason that the results of this study can be useful for health care agencies, including the Fraser Health Authority and policy makers to develop evidence-based educational and clinical programs catering to the oral care needs of this previously untouched population. The main objectives met in this study were:

- 1) *To design and test question(s) to identify the baseline of self-reported oral health status and dental service utilization during pregnancy.*

A combination of questions adapted from the CHMS along with new questions were tested and attached to the BB prenatal registration form. This enabled the development of a standardized tool to compare the results of my research with the existing data on the oral health of Canadians.

2) *To identify the baseline self-reported oral health and dental service utilization of pregnant women in Fraser Health Authority.*

The two-outcome variables of this study, self-reported oral health and dental service utilization were explored in this population. In regards to self-reported oral health, a high proportion of women (84%) rated the health of their mouth as excellent/good while 16% reported their oral health as fair/poor (Figure 5). In terms of dental service utilization, more than half (56%) had visited a dental professional within the last year for regular care, while 23% had seen a dental professional for emergency care only. Nine percent of the respondents had never visited a dental professional including during their current pregnancy (Figure 6).

3) *To examine how independent variables (e.g., educational levels, dental insurance availability, perceived oral health status) in Andersen and Newman's predisposing, enabling factors and perceived oral health assessment (need) factors are correlated to influence the overall self-reported oral health status and dental service utilization.*

According to my bivariate analysis, the main predisposing and enabling factors that influenced the overall *self-reported oral health* were: 1) a minimum of high school education; 2) having dental insurance; and 3) visiting a dental professional within the past two years. For *dental service utilization*, the main predisposing and enabling factors included: 1) dental insurance; 2) self-reported oral health status; and 3) country of origin. The most significant self-perceived need factors (self-reported oral conditions and oral health related beliefs) that influenced the two outcome variables were: bleeding gums, tooth sensitivity, toothache, and dry mouth. Regarding

oral health related beliefs during pregnancy, more than two-thirds of women expected to lose calcium and to have bleeding gums and/or expected to have tooth sensitivity due to their pregnancy.

4.1 Key Findings:

4.1.1 Pre-Disposing and Enabling Factors with Dental Service Utilization and Self-Reported Oral Health

As recommended in the guidelines of both the American Dental Association and the American Association of Periodontology, all pregnant women should receive a comprehensive dental and periodontal checkup during pregnancy.(64) However, according to the findings, psychosocial barriers, financial barriers and belonging to certain ethnic groups seem to be major risk factors for women not receiving basic dental care. These factors have been also identified under Andersen and Newman's model (Figure 3) as having influence on overall oral health status and dental service utilization.(56)

According to this study, almost half of the surveyed population, which included both Aboriginal and non Aboriginal Canadians, reported consulting a dental professional within the last year. Studies by Gaffield *et al.* and Lyndon-Rochelle *et al.* also suggested similar patterns of dental service utilization during pregnancy in the state of Arkansas, Illinois, Louisiana and North Dakota ranging from 43 to 49 percent.(3, 41) According to the findings reported by Roger *et al.* 30 to 50% of the women they surveyed sought dental care during pregnancy and consulted a dental professional more frequently during pregnancy than at other times.(65) This is a positive care seeking behaviour that should be promoted by allied health care providers to avoid the common misunderstanding that dental care cannot occur during pregnancy.(66) Such positive behaviour may be also due to the fact that the majority of my participants considered having

good oral health as very important during pregnancy.(66) However, those who felt that oral health during pregnancy was important tend to have higher levels of education, also discussed by Gaffield *et al.*(41) Perhaps the time of pregnancy could be used to educate this population regarding efficient oral health practices and to introduce oral health related behavioural modifications.(66)

In this study population, the most important enabling factors that seemed to influence the overall dental service utilization was having dental insurance and the financial means to afford dental care, as a well-known finding across similar and different populations.(3, 67) However, it remains almost a privilege to have dental coverage in North America, where the provision of dental care is not publicly funded. Having dental insurance also implies that the individual or the sponsor has a job with fringe benefits and probably has minimal difficulty living within the total household income. On the contrary, 12% of my participants reported difficulty living within their total household income and almost half of them reported not having any form of dental insurance. Not surprisingly, more than one third of those reporting income difficulties had never consulted a dental professional or have done so for emergency purposes only. Dinas *et al.* had also identified similar pattern of dental visits in Greece, where having free dental treatment was a predictive factor of dental service utilization.(67) This may imply that like other marginalized groups, pregnant women from the lower socio economic strata face difficulties in accessing the care they need.(45) The other financial limitation for accessing dental care despite having dental insurance could be having only limited dental coverage that may not cover all the aspects of dental treatment. This could be of serious concern as oral health problems may lead to adverse pregnancy outcomes.(17) For this reason, there should be publicly funded programs offering coverage for basic dental treatment for pregnant women including dental and periodontal

assessments. This would have a beneficial effect by preventing any dental related adverse outcomes that may harm both the mother and the fetus.

Attempts have been made to examine the association of various psychosocial factors with dental service utilization.(68) Their findings suggest that a woman's level of education and awareness of good oral health can influence the overall oral health status and dental service utilization during pregnancy.(37, 41) One of the most influential predisposing factors that seem to influence the overall dental service utilization in my study population was having a minimum of a high school education and being Canadian born.(3) This may be due to the fact that women born in Canada have more awareness regarding their oral care as a result of the different oral health programs and available information as compared to women who were born in other regions of the world with lower levels of education. Additionally, with participants from this study being born in more than 20 different countries, there is a high possibility that these women held certain oral health related beliefs and practices that could have explained some of the findings, including the belief that calcium is lost from the teeth to the fetus and that tooth decay is common(69) Such beliefs and others that I found may have been influenced by various social, cultural and religious norms with a negative impact upon dental service utilization.(69) Conversely, the odds of consulting a dental professional were almost three times higher for the women born in India than for those born in other parts of the world according to my findings. This demonstrates that an individual's ethnic background can be a strong independent factor affecting the overall dental service utilization in this population. However, due to the lack of research there are no conclusive results on this subject.(70)

Another factor that seems to affect the dental care utilization in the general population, including pregnant women, are their health care providers.(42) During the pilot of the survey at

Surrey Memorial Hospital, one of the respondents raised a concern that her physician advised her not to seek dental care during pregnancy. I am not certain why she was advised to do so and although this was not the part of my questionnaire, research does suggest that there is widespread misconception about the use of dental services during pregnancy held by health care professionals including dentists.(42) This is a setback in the light of the current evidence that dental appointments during pregnancy are not only safe, but highly recommended.(71) It is also important to bear in mind that the vast majority of my participants consulted with their midwives and family doctors during the first trimester of their pregnancy, although I am not certain whether these women had received any information on the importance of oral health by their health care providers during their first antenatal visit. According to Gunay *et al.* and Honkala *et al.* up to 71% of the women did not receive any oral care instruction from their family doctors or health care providers during their pregnancy.(72, 73) Although some studies suggest that obstetricians have acknowledged the importance of dental care during pregnancy, only a small portion of obstetricians actually encourage pregnant women to seek dental care. Both pregnant women and their healthcare professionals seem to have doubts in regards to the safety of dental treatment during pregnancy, although dental treatment including periodontal treatment is safe throughout the course of pregnancy.(42, 74)

Nonetheless, dental professionals should consider their pregnant patients' current health status such as existing medical conditions (e.g. gestational diabetes mellitus, preeclampsia), gestational age of the fetus and the general health of the woman before providing any dental treatment. In fact, some considerations for a dental visit during pregnancy include: shorter appointments, avoiding morning scheduling when the patient is experiencing morning sickness, limit the procedures to those judged routine and essential while avoiding extensive and multiple

surgical treatments and use of antibiotics and local anesthesia should be administered with caution.(69)

The predisposing and enabling factors mentioned above (e.g., having dental insurance) seemed to also influence the overall self-reported oral health of this surveyed population positively given that almost two thirds of the respondents who rated their oral health as fair/poor did not have dental insurance. As they have financial barriers and no dental insurance, participants may have felt reluctant to pursue necessary dental treatment, which could impact their overall self-esteem and quality of life. In fact, the multivariate analysis confirmed that the odds of reporting the oral health status as fair/poor were two times higher in the population who had difficulty living within their total household income when all the other psychosocial variables in the model were held constant. This implies that having dental coverage and financial means to afford dental care not only affected the overall oral health status but was also one of the most important driving forces for the dental service utilization.(42) Another important factor that seemed to affect the oral health of this population was their pattern of dental visit. According to the results, women who had visited a dental professional within the last year for regular checkup were more likely to rate the health of their mouth as excellent/good as compared to their counterparts. This could be due to the fact that the women who visited dental professional within the last year for regular checkup were more concerned about their oral health hence, took care of their oral health and rated their oral health as excellent/good.(75)

4.1.2 Self-Assessed Oral Health (Need Variables) with Dental Service

Utilization and Self-Reported Oral Health

A significant proportion of women reported to have one or more dental conditions and they believed were due to their pregnancy. Unfortunately, their self-reported oral conditions were not

confirmed by any clinical examination, which is one of the limitations of this study. However, it has been reported in various studies that fluctuations in the sex hormones during pregnancy can increase a woman's susceptibility to oral conditions such as gingivitis and periodontitis.(17) According to my study, almost two thirds of the respondents reported having bleeding gums which confirmed the findings by Gaffield *et al.*, Christensen *et al.*, and Lyndon-Rochelle *et al.*(3, 41, 75) However, it remains unknown as to whether or not these women considered these oral health related conditions to be a problem or a normal occurrence. According to Gilbert and Nuttall, self-reported gingival health can underestimate its clinical status.(71) This is of a concern given that pregnancy-induced gingivitis and periodontitis may lead to adverse pregnancy outcomes such as PTB or LBW.(17) Given the frequent self-reported gingival inflammation, participants might have considered it normal during pregnancy and not necessarily as a problem per se. This can be further supported by some previous studies that suggest that many people do not perceive gingival bleeding as a sign of gingival inflammation.(75) Although pregnancy gingivitis is a transient condition that may subside after childbirth, it can be associated with potential adverse pregnancy outcomes if left untreated.(4) The other most prevalent self-reported oral conditions were tooth sensitivity, dry mouth and toothache, which were also found by Shashidhar in 2009.(76) Just like bleeding gums, more than one-third of my participants expected to get tooth sensitivity during pregnancy and may not have considered it as a problem.

Due to the anonymity of participation and the time frame of my study, I was not able to conduct a qualitative research to tease out the roots of the self-reported oral health beliefs and oral health-related practices, or the reasons why they believed that certain oral conditions would be expected to occur during pregnancy.

Nonetheless, beliefs of getting certain oral conditions during pregnancy were widespread in

my surveyed population. More than half of the respondents expected one or more dental conditions during pregnancy (Tables 6, 7 and 8). The most common held beliefs during pregnancy were: bleeding gums, loss of a tooth and loosening of a tooth due to pregnancy. However, I do not know if such beliefs were held before the onset of pregnancy. For instance, although almost one third of the respondents reported avoiding tooth brushing during pregnancy, it remains unknown if this avoidance was also prior to the pregnancy. Another belief held by my participants was ‘losing calcium’ or a tooth during pregnancy. Such an expectation has been often reported Chinese belief that the fetus can ‘utilize’ the mother’s calcium and as a result, the pregnant woman should expect to lose teeth, to have tooth decay or to lose dental fillings.(39, 77) In fact, a 2005 survey in the United States also found that the old wives tale “one tooth for a baby” was very much alive.(69)

In this study, most of the beliefs related to oral health during pregnancy were prevalent regardless of the country of origin, which asks the question: Where did these beliefs originate? According to Glover, “*beliefs have to be considered holistically and that no belief exists in isolation in the mind of the believer*”.(78) In the context of my study, this may imply that the oral health beliefs identified by this population could be due to the co-existing oral health related changes due to normal hormonal fluctuations, which would make them believe that certain oral conditions would be indeed ‘attributed’ to pregnancy. In fact, this could lead to a ‘normalization’ of a belief, which could explain why participants who expected tooth sensitivity and calcium depletion were also more likely to rate their oral health as excellent/good. Unfortunately, there is a lack of evidence in the literature that attempts to unfold the roots and origins of oral health related beliefs in this important phase of a women’s life.

In total, more than half of the participants consulted a dental professional within the last year.

However, almost 50% of the women reporting one or more dental beliefs and oral conditions did not consult a dental professional within the last year, while those who did visit a dental office did so for emergency care. This is of concern given that the literature suggests that health professionals, including dental professionals, are unsure about providing dental treatment during pregnancy.(42)(17)

4.1.3 Aboriginal Community:

According to my surveyed population, two-thirds of the Aboriginal pregnant women rated their oral health as excellent/good, which was an equal percentage compared to the non-Aboriginal population. More than half reported not visiting a dental professional within the last year. Despite the fact that aboriginal communities have extended dental coverage as the Non-Insured Health Benefits from Health Canada.(79) However, due to a long history of discrimination and neglect, this ethnic group seems to have more psychosocial deprivations as compared to other Canadians.(31, 79, 80) According to CHMS 2011, the aboriginal community in Canada has a greater need for medical and dental care in comparison to other Canadians. This may imply that aboriginal pregnant women are also at risk for not receiving proper dental care. It is for this reason that Fraser Health, as well as other health authorities, pay special attention to the care provided to aboriginal pregnant women and has designated a vulnerability pathway solely for aboriginal pregnant women. The inclusion of dental education, oral health related counselling and basic dental care in this pathway might be beneficial in providing a more holistic approach to healthcare amongst these women. In fact, BC was just introduced to the First Nations Health Authority via the BC Tripartite Framework Agreement on First Nation Health Governance to set out its operational start-up plans, goals, priorities, program plans and services, evaluation process and use of funding provided by Canada and BC.(79)

4.2 Summary:

In summary, there is a need to provide evidence-based education and awareness to this population of pregnant women. It is suggested that more focus be placed on the education, prevention and early clinical intervention regarding dental care so that health and financial complications can be addressed beforehand. Also, more research is needed to explore the roots of the beliefs on restricting dental care during pregnancy.(81)

Chapter 5: Conclusions, Recommendations and Limitations

5.1 Conclusion

Given the findings from this study, pregnant women not only need education but also proper care for their higher levels of unmet needs. The key findings suggested that dental service utilization is related to ability to pay (e.g., having dental insurance), the woman's country of origin, and self-reported oral conditions including bleeding gums, tooth sensitivity, tooth ache and dry mouth. The most common oral-health related beliefs held by pregnant women were the expectation of bleeding gums, tooth sensitivity and losing calcium due to pregnancy. These beliefs associated with the related oral conditions may put women at risk for the adverse effects to herself and the fetus.

Overall, this study provided a baseline of self-reported oral health status, conditions, beliefs and dental service utilization by pregnant women from the largest BC health authority. With the help of the modified Andersen Newman model, it highlighted the predisposing and enabling psychosocial factors that may influence the overall oral health and dental service utilization by pregnant women.(56) This data can be used by the Health Authority to identify the existing need for oral care and education that could be provided to this population. However, more work is needed to explore the roots of the most commonly held dental beliefs during pregnancy.

5.2 Recommendations for Dental Public Health Organization and Professionals

The aim of dental public health organizations and professionals is to improve the overall oral health quality of life of communities and populations. During the past decade there has been some progress in preventing the most common dental diseases, however, more attention is needed for those groups with specific needs such as pregnant women. Based on the findings of my study,

policy makers, public health professionals and organizations could develop programs that could increase the awareness of oral health during pregnancy and involve the pregnant women and their health care providers with a positive impact on the overall dental services utilization. For example, services and educational programs could be developed which focus on educating pregnant woman, midwives, family doctors, obstetricians as well as dental professionals. Educational material on importance of oral care during pregnancy could also be developed and made available to the pregnant women in various prenatal clinics and could be given along with the other health related educational material routinely provided to them. Due to the lack of awareness and lack of public information, the New York Department of Health (2006) released a set of guidelines regarding oral health practices during pregnancy. According to this document, all pregnant women should consult their dental professionals during pregnancy. The document further emphasized that delay in dental care during pregnancy can raise some serious risks to mother and fetus.

Although financial affordability and availability of dental services are major drivers of dental service utilization, limited public health dollars and publically funded programs hinder the provision of dental care.(81) Alternatively, midwives who are closely involved with the pregnant women or the public health nurses, could be trained to conduct basic dental examinations and refer for proper care, or at least discuss issues that can be prevented while dispelling wrong beliefs about oral health and pregnancy.(81)

The seven oral health questions that I have used could be permanently attached to the BB prenatal registration form. Also, within the context of the BB program, there could be an assigned pathway that could highlight the vulnerability due to oral health. Like other designated pathways, the ‘oral health’ pathway would identify those women at risk for oral diseases who would be

properly followed up by the public health nurse and referred for education and/or dental treatment if needed.

5.2.1 Future Directions

There should be some follow up studies to explore the roots of oral-health related beliefs during pregnancy. This research could be done in the form of focus groups or one-on-one individual interviews that could explore some of the roots of these oral health-related misconceptions during pregnancy. This should be done both on pregnant women and their health professionals so that awareness and educational programs could be designed accordingly. Clinical examinations and studies could be performed to identify the magnitude and severity of the self-reported oral conditions.

5.3 Limitations

1. All the questions in the dental survey were self-reported and I was unable to identify the severity of the reported conditions.
2. I do not know why some of the women had not visited a dental professional within the last year. I do not know if they avoided the dental visit due to anxiety or any cultural or ethnic beliefs, which may have influenced the dental service utilization.
3. Sixteen percent of the respondents highlighted the need for an interpreter. As a result, it remains unknown as to whether or not they fully understood the survey questions. I was also unsure if spouses, family members or accompanying persons had translated the survey for respondents.

Despite of the limitations, this study provided comprehensive self-reported data on the overall oral health of pregnant women at the sub-population level of a diverse ethnic community, which has not been done before in Canada. It is the first study of its kind to provide insights regarding

the widespread beliefs about oral health during pregnancy that might affect the overall oral health and dental service utilization by these women.

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Appendices

Appendix A - Citations from the Systematic Literature Search on Oral Health and Pregnancy.

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Appendix B - Core Competencies for Oral Health Promotion Outlined by The Canadian Association for Public Health Dentistry.

1. Oral Public Health Sciences

This involves appropriate knowledge as well as useful critical thinking skills and competency in the fields of behavioural and social sciences, biostatistics, epidemiology, environmental public health, demography, workplace health, and the prevention of chronic diseases, infectious diseases, psychosocial problems and injuries.

2. Oral Health Assessment and Analysis

This category describes competencies needed to collect, assess, analyze and apply information to make evidence-based decisions, prepare budgets, and make recommendations for policy and program development.

3. Oral Health Program Planning, Implementation and Evaluation

This category illustrates the competencies essential to effectively choose options, and to plan, implement and evaluate programs in dental public health. This also includes the management of stressful incidents such as outbreaks and emergencies.

4. Oral Health Policy Planning, Implementation and Evaluation

This is needed for effective planning, implementation and evaluation of policies in dental public health for the improvement and protection of oral and general health.

5. Partnerships, Collaboration and Advocacy

This involves judicious usage of partnerships and collaborative efforts for the common goal of improving the health and well-being of the public.

6. Diversity and Inclusiveness

This category identifies the socio-cultural competencies required to interact effectively with diverse individuals, groups and communities. It is the combination of attitudes and practices that result in inclusive behaviors, practices, programs and policies.

7. Communication

This refers to the internal and external exchange of ideas and information, whether written or verbal, the provision of appropriate and adequate information to different audiences, computer literacy, and the ability to work with the media and use social marketing techniques.

8. Leadership

Leadership plays a pivotal role in improving performance of the individuals comprising an organization and enhancing the quality of the working environment. This also enables organizations and communities to create, propagate and apply shared visions, missions and values.¹⁵

In summary, it is essential to strengthen and standardize practices within organizations as well as the complex public health strategies of a wider scale. As public health systems and services vary between and within provinces and territories across Canada, so do the usage of discipline competencies. As a result, the adoption of dental public health strategies requires acceptance and commitment from a variety of groups including the federal and provincial/territorial governments, as well as regional health care authorities. Within this context, there are six major health care authorities in British Columbia that have preventive dental public health programs catering to the needs of their regional populations

Appendix C - Concepts of Validity

In order to cater the relevant responses from a designed survey, researchers have always relied upon the process of validation in respect to the target population. The test of validity has been designed to address the issues of the forms and study conditions that might affect the interpretation of the results.* In order to determine the validity of the CHMS questions, I would like to discuss the types and attributes of the validity and correlate it with my proposed questions. I will base this discussion on a theoretical ground only given the unavailability of information about the validation process used by the CHMS. As a result, I offer my personal understanding and interpretation of the validity literature in relation to the CHMS.

Trinitarian Concept vs. Unitarian Concept of Validity:

In the Trinitarian concept of validity, the concept of construct, criterion and content validity goes as:

1. Content Validity: It is known as a fixed property of a questionnaire that is based on the expert judges' which determines the relevance of the content of the questions to what it intends to measure. Also known as logical validity, it refers to the clarity, comprehension, relevance and precision of the questions in a survey.
2. Criterion Validity: It refers as a correlation of a questionnaire's score with some other measure, usually a 'gold standard' that has been used and accepted in the field. This type of validity does not provide any theoretical basis of the test score with what it was intend to measure. Hence, there is an uncertainty if what has been measured, was the true aim of the designed construct. It is divided in to two types:

Concurrent Validity: it refers to the association of the questionnaire's results with the defined criteria.

Predictive Validity: It can be viewed as the extent to which the questionnaire's results predict a given criteria in the future

3. Construct Validity: refers to underline theory or construct, which forms the basis of the questionnaire in order to capture a particular observation or behaviour in a population. Many of the underlying constructs are based on the larger theories or clinical observations. In most of the psychological instruments, the measurements or scores are derived with the help of a hypothetical construct. In the case of the third proposed question from CHMS above, one could hypothetically signify that a women who reports to have bleeding gums would need to be provided with the provisions for an immediate dental care. Construct validity can be further divided in to two types

Convergent Validity: “It refers to the similar response to like-questions, either within the same instruments or between instruments with the same theoretical framework”.

Discriminant Validity: It refers to the ability of an instrument to discriminate between respondents who experience the same phenomenon in different ways or between similar questions in an instrument with different theoretical frameworks. The Unitarian concept of validity relies upon the criterion related evidence, combined with the professional judgment (content validity) in order to accurately reflect the construct, integrated in the theoretical framework in a questionnaire.

Appendix D - Ethics Approval Certificate from Fraser Health Authority



LETTER OF AUTHORIZATION TO CONDUCT RESEARCH

Date: 2012 July 24 **PI Name:** BRONDANI, Mario
Address: 2199 Westbrook Mall
City/Province: Vancouver, BC **Postal Code:** V6T 1Z3

FHREB File #: 2012-068 **Study Protocol #:**
Study Title: Best Beginnings: Exploring The Oral Health Related Behaviours Of Pregnant Women In Fraser Health, BC

The following required applicable approvals have been received and are in order:

FH REB Certificate of Initial Approval
 Dated: 2012 July 20
 Consent not required
 Reason: Implied Consent - Questionnaires
 Consent Waived
 Reason:

Consent Required and approved:
The signed signature page of the consent form for a specific study must be submitted to Health Records/Health and Business Analytics for the release of any of that subject's personal information.

Department Agreement for Providing Research-related Services Authorization Services (DAR Form)
 Not Applicable
 Privacy Impact Assessment (PIA)
 Not Applicable

Health Canada Letter of No Objection TCPS Certificate
 Not Applicable

Clinical Trial Registration No. Registered at: www.ClinicalTrials.gov
 Not Applicable www.Controlled-trials.com

Funding: **Cost-Centre Not Required**
 Unfunded
 Industry: REB fee received
 Grant-in-aid
 Grant awarded to non-Fraser Health Institution

Cost-Centre Required
 Grant/grant-in aid award to Fraser Health
 Grant awarded by Fraser Health
 Grant funds transferred to Fraser Health by academic sponsor
 External grant fund reimburses Fraser Health

Agreements:
 Executed Clinical Trial Agreement for Industry Sponsored Trials
 Affiliated Researchers: Executed "Research Collaboration Agreement" dated:
 Executed "Sub-Agreement" dated:
 Research Grant Contribution Agreement dated:
 Name of Granting Agency:

This letter authorizes the principal investigator to begin research-related procedures in compliance with all FH research-related policies at http://fhpulse/policies_guidelines/org_policies/pages/default.aspx.

Please note that the ethical approval for this study must be renewed before the one year expiry date of the certificate of initial approval if the study will be ongoing at that time.

Authorized by:
 Susan Churick
 Director, FH Evaluation and Research Services

Susan Churick

Digitally signed by Susan Churick
 DN: cn=Susan Churick, o=Fraser Health
 Authority, ou=CEIS, email=susan.
 churick@fraserhealth.ca, c=CA
 Date: 2012.07.23 10:52:25 -0700

Fraser Health Authority Medicine Evaluation and Research Services http://research.fraserhealth.ca/	400 - 13450 102nd Avenue Surrey, BC V3T 0H1	Tel (604) 587-4436 Fax (604) 930-5425
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Appendix E - Consent For Participation



UBC DENTISTRY



Oral Health Care Needs and Behaviour of Pregnant Women

Master of Science Student: Dr. Abbas Jessani
Supervisor: Dr. Mario Brondani

Oral health care and oral disease prevention before, during and after your pregnancy are very important aspects of your general health and of your babe. For this reason, Fraser Health (FH) and the University Of British Columbia Faculty Of Dentistry (UBC-FoD) have included general questions about your oral health in this Best Beginnings prenatal registration form. Your answers to these important questions will help us to identify the existing oral health care needs of pregnant women like yourself.

This questionnaire is **voluntary**, and will not affect the provision of any service you have or will have. It will take approximately 2 minutes of your time to complete, and is associated with minimal risk as the questionnaires will remain **anonymous** and **confidential**.

By completing this questionnaire, it will be assumed that you give consent for the use and possible publication of the anonymous data and information provided. Please keep this cover page for your records.

For further information, contact:

Dr. Mario Brondani,

Assistant Professor, University of British Columbia

JBM 122/2199 Wesbrook Mall

Vancouver, BC, V6T 1Z3

P: 604 8226562.

Dr. Abbas Jessani at 778 928 3767 or via email: abbas.jessani@gmail.com

Thank you very much for your time and participation!

Appendix F - Best Beginning Prenatal Registration Form



Best for a healthy future
BEGINNINGS
 • A Public Health Program •



PRENATAL REGISTRATION FORM
 (Please Print)

Your completed registration form will be returned to the Public Health Nurse at your local health unit. The information you provide on this form becomes part of your confidential individual health record.

INFORMATION ABOUT YOU									
Today's Date (y/m/d)			Care Card Number				Birth Date (y/m/d)		
Last Name			First Name				Age		
Street Address									
City						Postal Code			
Name of Doctor or Midwife						Phone # of Doctor or Midwife			
City of Doctor or Midwife						Name of Obstetrician			
What is your due date? (y/m/d)					Is this your first pregnancy?		<input type="checkbox"/> Yes		<input type="checkbox"/> No
How many months pregnant were you at your first prenatal doctor or midwife visit?					<input type="checkbox"/> 1-3 months		<input type="checkbox"/> 4-6 months		<input type="checkbox"/> 7-9 months
Do you have other children?		<input type="checkbox"/> Yes		<input type="checkbox"/> No					
What country were you born in?		<input type="checkbox"/> Canada		<input type="checkbox"/> Other (name of country)					
Did you come to Canada as a refugee?		<input type="checkbox"/> Yes		<input type="checkbox"/> No					
How long have you lived in Canada?		<input type="checkbox"/> Born in Canada		<input type="checkbox"/> Less than 5 years		<input type="checkbox"/> 5-10 years		<input type="checkbox"/> More than 10 years	
Do you speak English?		<input type="checkbox"/> Yes		<input type="checkbox"/> No					
What language do you speak most?		<input type="checkbox"/> English		<input type="checkbox"/> Punjabi		<input type="checkbox"/> Mandarin		<input type="checkbox"/> Cantonese	
		<input type="checkbox"/> Farsi		<input type="checkbox"/> French		<input type="checkbox"/> Vietnamese		<input type="checkbox"/> Other (name of language)	
Do you need an interpreter?		<input type="checkbox"/> Yes		<input type="checkbox"/> No					
Do you identify as having Aboriginal heritage?		<input type="checkbox"/> Yes		<input type="checkbox"/> No					
Have you completed high school?		<input type="checkbox"/> Yes		<input type="checkbox"/> No					
Are you attending a pregnancy support program such as Pregnancy Outreach Program or Healthiest Babies Possible?							<input type="checkbox"/> Yes		<input type="checkbox"/> No
Do you have someone you can talk to when you are upset or worried or just need to talk?							<input type="checkbox"/> Yes		<input type="checkbox"/> No
Do you have someone who can help you out with transportation, housing, childcare or other personal needs?							<input type="checkbox"/> Yes		<input type="checkbox"/> No
Are you finding it very difficult to live on your total household income?							<input type="checkbox"/> Yes		<input type="checkbox"/> No
During the past month have you often been bothered by feeling down, depressed or hopeless?							<input type="checkbox"/> Yes		<input type="checkbox"/> No
During the past month have you often been bothered by little interest or pleasure in doing things?							<input type="checkbox"/> Yes		<input type="checkbox"/> No
Please tick ONE of the check boxes about tobacco				<input type="checkbox"/> I have never smoked cigarettes			<input type="checkbox"/> I currently smoke cigarettes		
				<input type="checkbox"/> I quit smoking less than 1 year ago			<input type="checkbox"/> I quit smoking more than 1 year ago		
How often do people smoke around you?			<input type="checkbox"/> Daily		<input type="checkbox"/> Weekly		<input type="checkbox"/> Monthly		<input type="checkbox"/> Less than Monthly
			<input type="checkbox"/> Never						
Are you planning to breastfeed your baby?			<input type="checkbox"/> Yes		<input type="checkbox"/> No		<input type="checkbox"/> Not decided yet		
YOUR CONTACT INFORMATION									
Your Phone Number			Home:			Work:			Cell:
If you do not have a phone - how can we reach you?									
Is it okay to leave a message at home?			<input type="checkbox"/> Yes		<input type="checkbox"/> No		Which phone number is best to reach you at?		
			<input type="checkbox"/> Home		<input type="checkbox"/> Work		<input type="checkbox"/> Cell		
When is the best time to call during the day?			<input type="checkbox"/> Anytime		<input type="checkbox"/> Morning		<input type="checkbox"/> Afternoon		<input type="checkbox"/> I am not available by phone during the day
PUBLIC HEALTH NURSE COMPLETES SECTION BELOW									
Name of PHN						Health Unit		Eligibility Pathway	
Signature of PHN						Date			

Appendix G - Dental Questionnaire



UBC DENTISTRY



<p>1. Please rate the health of your mouth: (choose one) <input type="checkbox"/> Excellent <input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor</p> <p>1.2 How important do you think is the health of your mouth during pregnancy? <input type="checkbox"/> Very important <input type="checkbox"/> Important <input type="checkbox"/> Somewhat important <input type="checkbox"/> Not important <input type="checkbox"/> I don't know</p> <hr/> <p>2. Do you have an insurance or government program that covers all or part of your dental expenses? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> I was refused coverage</p> <p>2.1. If yes, then is it: <input type="checkbox"/> An employer sponsored plan? <input type="checkbox"/> A private plan? <input type="checkbox"/> A government program for social service? <input type="checkbox"/> A government program for First Nations and Inuit?</p> <hr/> <p>3. In the past 12 months, have you avoided having some or all the dental treatment that was recommended because of the cost? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <hr/> <p>4. When was the last time you saw a dental professional (dentist, dental hygienist, and denturist)? (choose one) <input type="checkbox"/> Less than 1 year ago <input type="checkbox"/> 1 year to less than 2 years ago <input type="checkbox"/> 2 years to less than 3 years ago <input type="checkbox"/> 3 years to less than 4 years ago <input type="checkbox"/> 4 years to less than 5 years ago <input type="checkbox"/> 5 or more years ago <input type="checkbox"/> never</p> <hr/> <p>5. How often do you see a Dental professional (dentist, dental hygienist, and denturist)? (choose one) <input type="checkbox"/> More than once a year for checkups or treatment <input type="checkbox"/> About once a year for checkup or treatment <input type="checkbox"/> Less than once a year for checkup or treatment <input type="checkbox"/> Only for emergency care <input type="checkbox"/> Never</p>	<p>6. Since the beginning of your pregnancy to today, have you had any one or more of the following conditions:</p> <p>a) Toothache <input type="checkbox"/> Yes <input type="checkbox"/> No b) Sensitivity in your teeth when consuming hot or cold foods or drinks <input type="checkbox"/> Yes <input type="checkbox"/> No c) Other pain in your mouth <input type="checkbox"/> Yes <input type="checkbox"/> No d) Pain around your jaw joints <input type="checkbox"/> Yes <input type="checkbox"/> No e) Bleeding gums while brushing your teeth <input type="checkbox"/> Yes <input type="checkbox"/> No f) Persistent dry mouth <input type="checkbox"/> Yes <input type="checkbox"/> No g) Persistent bad breath <input type="checkbox"/> Yes <input type="checkbox"/> No h) Others _____</p> <hr/> <p>7. During your pregnancy, what do you think is most likely to happen in your mouth? (You may choose more than one answer)</p> <p><input type="checkbox"/> I may lose a tooth or teeth <input type="checkbox"/> My teeth may become loose <input type="checkbox"/> My teeth and gums may become sensitive <input type="checkbox"/> I may lose calcium from my mouth/body because of my baby <input type="checkbox"/> I may have cavity or cavities in my teeth <input type="checkbox"/> I may have one or more dental fillings falling out/lose a filling(s) <input type="checkbox"/> I may avoid brushing and/or flossing <input type="checkbox"/> My gums may bleed <input type="checkbox"/> I may develop oral tumor/cancer <input type="checkbox"/> I should avoid seeing a dentist/dental professional because _____</p> <p>_____</p> <p><input type="checkbox"/> I don't know <input type="checkbox"/> None of the above <input type="checkbox"/> Other _____</p>
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