Dental Health and Dental Care Utilization Among

Childbearing Age Asian Women Immigrants in Canada

by

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Abstract

This study examines the dentistry care utilization, self-reported dental health status, and oral health issues of Asian immigrants and Asian women immigrants of childbearing age, using the combined Canadian Community Health Survey from 2012-2014 and 2011-2014 data. Reports show that amongst Asian immigrants and Asian women immigrants of childbearing age, there are significantly lower frequency of dental care utilization compared to non-immigrant counterparts. Furthermore, the difference in dentist visiting behavior between native-born Canadians and Asian immigrants mitigated with increase in length of residence in Canada. Socioeconomic status, lifestyle factors, dental health and dental insurance coverage cannot fully explain the behavioral differences in visiting the dentist between Asian immigrants and Asian women immigrants of childbearing age compared to the native-born citizens. For both Asian immigrants and Asian women immigrants of childbearing age, the primary reason for not visiting the dentist in the last three years is that the "Respondent did not think necessary." This response is much different than reasons for not visiting the dentist provided by other groups which such as the "cost" and "haven't gotten around to it." Asian immigrants, as well as Asian women of childbearing age, had a significantly greater risk of tooth extracted due to tooth decay than other ethnicities. Asian immigrants also had a higher prevalence of having fair or poor self-reported dental health than Canadian born residences. Surprisingly, the prevalence of dental health problems for Asian immigrants is like that of a native-born Canadians, with Asian women immigrants of childbearing age showing the least prevalence of dental symptoms among the three population groups. Our results suggest that oral health beliefs

in the lack of necessity in dental services exist among recent Asian immigrants and Asian women immigrants of childbearing age, with their oral health gradually changing over time throughout their stay in Canada. Early symptoms of dental problems that lead to decay may most likely result from the lack of visits to the dentist in Asian immigrants. Finally, the study findings do not appear to support the 'Healthy Immigrant Effect' for dental health and teeth issues.

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General Summary

This research examines dentist visiting behavior, dental health status, and oral health problems of Asian immigrants and Asian women immigrants of childbearing age. Results show that both Asian immigrants and Asian women immigrants of childbearing age are less likely to visit dentists compared to corresponding native-born Canadians. Moreover, Asian immigrants are more likely to visiting dentists with increasing launching time in Canada. The primary reason for not visiting the dentist in the last three years of both Asian immigrants and Asian women immigrants is that the "Respondent did not think necessary.". On the contrary, "cost" and "haven't gotten around to it." are the main reasons for not visiting the dentist provided by other groups. Both Asian immigrants and Asian women of childbearing age are more likely to have tooth extracted due to tooth decay than other ethnicities. Our results indicate that oral health beliefs in the lack of necessity in visiting dentist exist among recent Asian immigrants and Asian women immigrants of childbearing age. Therefore, Asian immigrants' oral health gradually changes over time throughout their stay in Canada. Early stage of dental problems that lead to decay may most likely result from the lack of dentist visit among Asian immigrants.

Co-Authorship Statements

Qianqian Li conceived the study and was in charge of overall direction and planning. Qianqian Li developed the theory, gained the acquisition of CCHS data set, planned and performed all data analysis in SAS software. Qianqian Li verified the analytical methods. Dr. Peter Wang encouraged Qianqian Li to investigate the grouping of lifestyle characteristics to meet with CCHS confidential requirements. Dr. Peter Wang supervised the findings of this work.

Qianqian Li took the lead in writing the manuscript and the thesis. Dr. Yanqing Yi, Dr. John C Knight and Dr. Peter Wang contributed to the drafting of the manuscript, and the interpretation of the results. Dr. Yanqing Yi assisted with interpretation logistic regression results, pointed out the requirement of COVID-19 statement, clarified subgroup analysis of immigrant status, condensed the analysis method in Chapter 3 and Chapter 4. Dr. John C Knight pointed out update of references, provided comments in introduction and literature reviews, reorganized the discussion and conclusion in Chapter 3 and Chapter 4.

This manuscript will be used as a publication which is on the stage of preparation. All authors provided critical feedback, checked grammar error, and helped shape the research, analysis, and manuscript.

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Abbreviations

AFICBA	Asian female immigrants of childbearing age
CAPI	Computer Assisted Personal Interview
CCDSS	Canadian Chronic Disease Surveillance System
CCHS	Canadian Community Health Survey
CHMS	Canadian Health Measures Survey
CI	Confidence Interval
CIHI	Canadian Institute for Health Information
COV	Coefficient of Variation
FNOHS	First Nations Oral Health Survey
LSIC	Longitudinal Survey of Immigrants to Canada
NHS	National Household Survey
OR	Odds Ratio
RDC	Research Data Center

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CHAPTER 1: INTRODUCTION

1.1 Background

Canada is an immigrant welcoming country, receiving a significant number of immigrants each year. From 2011 to 2016, about 21.9% of the total population (7.5 million) were immigrants, with recent (<10 years) immigrants representing 3.5% of the Canadian population (1). From 2017 to 2019, more than half of new immigrants come from Asian and Pacific Rim countries (63.5%) (2). Chinese and South Asian immigrants constitute the fastest growing ethnic minority in Canada, with Chinese becoming one of the top three largest subgroups (1.8 million). In January 2022, Asian immigrants are more likely to be occupied in the health care and patient services than other immigrants, with many working on the front line in the health care sector during the pandemic(2, 3).

Literature suggests that recent immigrants on average tend to be healthier than the general Canadian population, with this often being referred to as the Healthy Immigrant Effect (4-7). However, the health advantages of immigrants gradually diminish over time during their stay in Canada(5, 8). Canadian immigrants have been reported to underuse the health care system (8-10). Acculturation, language barriers, lack of knowledge of the system, low income, and lack of medical insurance may discourage immigrants from health care utilization (11-17).

Surprisingly very few studies have examined the oral health and dentist visiting behaviors of immigrants residing in Canada. Most Canadian researchers focused on the oral health of children/adolescents (18-22), the elderly (23, 24), and the whole grouped

foreign-born Canadians (25-29). Recently few studies have focused on the oral health behaviors of Canadian Asian immigrants, particularly the Japanese immigrants (30) and the Chinese population, with the qualitative interviews conducted in 2005 and the Longitudinal Survey of Immigrants to Canada (LSIC) from 2001 to 2005 respectively (31, 32). Calvasina et al. conducted a study comparing the access to dental care and unmet dental care needs of Asian immigrants and European immigrants by using LSIC data from 2001 to 2005(33). They found that the lack of dental insurance, low income, and ethnicity contributed to the unmet dental care needs for recent immigrants. There are three studies on oral health status and clinically determined need for dental care among foreign-born citizens compared with the Canadian average in specific provinces in Canada. One of the studies focused on refugees and immigrants in Nova Scotia (34), and found that they rated their oral health as good as Canadian born citizens. However, data showed that the refugee group had higher oral disease and less exposure to dental care than the Canadian average. The second study focused on Chinese immigrants in Montreal (35), targeting the cultural components on Chinese immigrants' attitudes toward professional dental care services. This study found that Chinese immigrants still hold strong traditional beliefs concerning gingival swelling and bleeding, which had an influence on their attitudes toward dental care and professional services. The third study conducted in 2019, which specifically target to the relationship between triclosan exposure with toothpaste usage newcomer Canadian Asian women of reproductive age in Canada. This study found that South Asian Canadian women had elevated urinary triclosan compared to East Asian born women(36).

Compared with their male counterparts, immigrant women are more vulnerable to dental health problems as they are less likely to access to dental care due to lower wages, less job security, and decreased market participation in the Canadian labor market (29, 37). Some studies reported that female immigrants were found to be more likely to report dental problems, and to use transnational dental care services over time. The transnational dental care services is dental care services across national borders (31, 38). Furthermore, women will face more oral health problems during pregnancy. Research suggests that some prenatal oral symptoms may have adverse health consequences during the pregnancy. Periodontitis is positively associated with preterm birth and low birth weight, and high levels of cariogenic bacteria in mothers can lead to increasing dental caries in the infant(39-42). However, patients, physicians, and dentists are cautious and often avoid treatment during pregnancy(39). Moreover, the effect of treating periodontal disease during pregnancy remains still under investigation (43, 44). Therefore, the preconception period has been proposed as a more optimal time for treatment. Nonetheless, there are only a few studies that have looked at women's oral health problems, oral health behaviors, and dental care utilization in the preconception period (45). More studies are needed on oral health status and dental service utilization behavior among female Asian immigrants at child bearing age. This is the first study target towards the oral health and dental service utilization of Asian preconception women immigrants in Canada.

1.2 Research Objectives

Considering immigrant women are more vulnerable than men to dental health problems, and preconception period has been proposed as a more optimal time for treatment than during pregnancy. The overarching goal of this thesis is to describe dental health, dental health issues, and dental care utilization among Asian immigrants (childbearing age women in particular) in comparison with corresponding Canadian-born citizens and non-Asian immigrants. For observed inter-group differences, we further examined factors explaining those differences. Finally, this study explored barriers to dental care services.

Specific objectives:

In Chapter 3, this study examined the self-reported oral health status, dental problems, and dentist utilization of Asian immigrants in contrast to Canadian born citizens and non-Asian immigrants:

- To describe the oral health status and dentist visiting of Asian immigrants.
- To compare the oral health status and dentist visiting of Asian immigrants with Canadian born citizens and non-Asian immigrants.
- To explore factors that are associated with disparities in dental health and dental service utilization between Asian immigrants and other Canadians.

In Chapter 4, this study examined the self-reported oral health status, dental problems, and dentist utilization of Asian potential mothers in contrast to Canadian potential mothers and non-Asian female childbearing age immigrants:

- To describe the oral health status and dentist visiting of Asian women immigrants at

child baring age.

- To compare the oral health status and dentist visiting of Asian immigrants with corresponding Canadian born female citizens and non-Asian female childbearing age immigrants.

- To explore factors that are associated with disparities in dental health and service utilization between Asian female childbearing age immigrants and other Canadian potential mothers.

1.3 Rationale of Study

People from Asian countries are now becoming the leading visible minority group of Canadian immigrants. This creates a challenge for health care professionals, as immigrants' experiences and perspectives on health issues may differ from those of the non-immigrant medical culture(46). The "Healthy Immigrant Effect," as consistently suggested in the literature, largely refers to major chronic health conditions(4-7, 47). But there is a dearth of information on oral health and dental healthcare utilization among Asian immigrants in Canada. Results drawn from this study can be used to inform future policies and facilitate targeted programming aimed at improving immigrants' oral health and access to dental care, while improving oral health inequalities in Canada.

Compared with their male counterparts, newly immigrated women are more vulnerable to health issues (31, 38, 48). When female immigrants become new mothers, they often

face additional pressures and physical changes that have a direct impact on their health (49-51). Furthermore, women will encounter more oral health problems during pregnancy, and some prenatal oral conditions may have adverse consequences for the child (52-55). There has been limited research on oral health and dental care utilization of Asian women immigrants of childbearing age, also referred to as preconception women or potential mothers in this study. The findings of this study are expected to shed light on how to improve the health of Asian women immigrants prior to their first or subsequent pregnancy. The recommendations provided in this thesis may be used to suggest improvements regarding preconception health care for Asian immigrants in Canada.

1.4 Thesis Outline

This thesis is organized as follows: Chapter 1 is an overall introduction to this study. Chapter 2 includes literature review of prior research on Canadian immigrants, Canadian dental health system, dental health problems, dental health problems during pregnancy, demographic, socioeconomic and lifestyle factors related to dental health problems. Chapter 3 addresses the first objective which examines the oral health status and dental visits of Asian immigrants in Canada. Chapter 4 addresses the second objective regarding the oral health status and dental visits of Asian preconception women immigrants. Finally, Chapter 5 summarizes the main findings and conclusions of this study and describes any possible policy implications and further research directions. There are some overlaps in the

methods and statistical analysis sections across chapters 3 and 4, due to a manuscript format

was being used for this thesis.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Canadian Immigrants

Canada needs newcomers to maintain and grow its population and economy, that receives a significant number of immigrants each year. Since 1867, Canada has received more than 17 million immigrants, with the number of immigrants admitted annually expanded after World War II with the economic recovery. Since the 1950s, the number of immigrants entering Canada has gradually increased over time, with an average of 235,000 new immigrants coming into the country each year (56). The National Household Survey (NHS) 2011 showed that about 20.6% of the total population was born in foreign countries. The composition of immigrants coming into Canada has drastically changed between 1871 and 2011. In 1871, immigrants mainly came from European countries, with the main sources of immigration were the British Isles (83.6%), the United States (10.9%) and Germany (4.1%) (56). Based on the 1971 Canada Census, 28.3% of immigrants were from the United Kingdom and 51.4% were from other European countries. However, starting in 1960s, the number of immigrants from Asia and other regions of the world began to grow (56).

In 2016, 7.5 million of the total population were immigrants in Canada, from those recent immigrants composed of up to one-fifth of the total population. The proportion immigrants could reach between 24.5% and 30.0% by 2036 (1). Currently, most immigrants come from Asian and Pacific Rim countries. Based on the 2017 to 2019 Census data, about 63.5% of immigrants were from Asia; of these, Chinese and East Indians were

the two largest ethnic groups. Immigrants born in Asia **are predicted to** represent between

55.7% and 57.9% of all immigrants by 2036 (57, 58). According to the 2020 Immigration,

Refugees and Citizenship Canada (IRCC) data, people from Asian countries have become

the main immigrant population, with those from mainland China surpassing the European

population as the main foreign-born Canadians. Chinese immigrants have constituted the

fastest growing ethnic minority in Canada, with immigrants from mainland China

becoming one of the top three largest subgroups (9%) (59).

As immigrants compose significant portion of the Canadian population, this presents

health-care workers with unique issues. This is because immigrants' health, experiences,

and perceptions on illness may differ from Canadian born residents' medical cultures.

Therefore, the difference in ideas pose new issues to the health system.

2.2 Immigrants Health Status

The "Healthy Immigrant Effect" states that Canadian immigrants are typically much

healthier than native-born citizens at the time of arrival. This phenomenon has been well-

documented in the literature(4-7, 47, 60). Because only the healthiest candidates who pass

medical screening can become Canadian immigrants, the "Healthy Immigrant Effect" is

most likely related to the selection effect of immigrants.

However, during 10 to 20 years of immigration, immigrants' health advantages

gradually diminish (60, 61), and their health status becomes equal or worse than of

Canadian-born people (62-64). The reasons for immigrants to experience a decrease in

their health status over time still remains unclear. According to several studies, it is caused by a wide variety of reasons, including changes in dietary habits, lifestyle factors, socioeconomic status inequalities, environmental changes, and underuse of health services (65-67).

Unexpectedly, very few studies have examined the oral health of immigrants in Canada. Most of the research are concentrated towards the oral health of children and adolescents (18, 22), the elderly (23, 24, 68, 69), and foreign-born Canadians as a whole (25, 31, 70, 71). Recently, some studies have focused on the oral health behaviors of Canadian Asian immigrants, specifically Japanese (30) and Chinese immigrants (32). One study compared the access to dental care and unmet dental care needs of Asian and European immigrants by using Canadian Health Measures Survey (CHMS) data from 2007 to 2009 (72). There are three studies for specific city or provinces in Canada; one targeted at refugees and immigrants in Nova Scotia (34) , another one on Chinese immigrants in Montreal of Quebec (35), and the third one on immigrants in Ontario(36).

Available literature indicates that Canadian immigrants have poorer oral health than native-born populations and that immigrants have a higher risk of underusing dental care. Cost barriers, a lack of dental insurance, as well as language and cultural barriers are potential predictors of limited access to dental care among immigrants. Ogami and colleagues demonstrated that acculturation patterns, attitude, and belief are three of the major factors influencing the oral health and oral health behavior of Japanese immigrants in Canada (30). Mei Dong and colleagues suggested that Chinese immigrants use dental services based on the occurrence of symptoms rather than on preventive care(32). Financial

problems, language barriers, and cultural barriers were the main factors that affected their access to dental care services in Canada. By using foreign-born Canadians as a whole, both studies show immigrants have higher unmet dental care needs and are more likely to report dental problems than Canadians (31, 73).

Applying the "Healthy Immigrant Effect" on oral health, inconsistent findings have been reported in past literature. Some of the studies have revealed that immigrants have a higher rate of oral disease when compared to native-born population, with patterns that improve with the length of time residing in Canada (18, 74). However, other studies have showed an increased likelihood of immigrants reporting dental problems over time after settling (31, 70).

Due to the scarce and inconsistent literature on Asian immigrants' oral health and access to dental care, more research is needed to examine Asian immigrants' oral health status and dental seeking behavior along with other associated factors.

2.3 Dental Health Problems

The most common and well-known form of gum disease is gingivitis, which affects 75% of adults in the United States (75). Data from CHMS from 2007 to 2009 revealed that 96% of adults have had a history of cavities, and 32% of Canadian adults aged 20 years and over have moderate to severe inflammation of gingivitis (72). Gingivitis is caused by plaque developing around the gums and causing inflammation in the surrounding teeth. Symptoms include redness, gum swelling, and gum bleeding, which

can be easily identified on the daily toothbrush or by a dental exam. Gingivitis can be easily treated or prevented by regularly visiting a dentist or a dental hygienist for cleaning twice a year. Nevertheless, periodontitis can occur if gingivitis is left untreated (49, 75-78). Periodontitis is the second-most common periodontal disease, with moderate periodontitis affecting approximately 30% and advanced periodontitis affecting 10% of the adult population in the United States (79). Data of Canadian Health Measures Survey from 2007 to 2009 revealed that about 21% of Canadian adults have or have had a moderate or a severe periodontal problem (72).

2.4 Pregnant Women's Dental Problem

Periodontal diseases are considered to have a cause-and effect relationship with adverse pregnancy outcomes such as preterm birth, low birth weight and fetal growth restriction, because infection could be cause by translocation of periodontal pathogens from infected periodontium to fetus (45, 52, 53, 80). Moreover, considering the fetus is connected by the umbilical cord to the mother's placenta, it is prudent to keep the pregnant patient's periodontal system as free of diseases as possible. However, because pregnant mothers have a heightened sensitivity to taste, smell, and environmental temperature, this can cause severe nausea, gagging and vomiting during the routine dental treatment process. Additionally, health professionals tend to be conservative in treating pregnant women, especially during the first trimester (81, 82). Furthermore, treatment of periodontal disease during pregnancy has been revealed to be ineffective in improving pregnancy outcomes

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(43, 83, 84). For example, Michalowicz et al, Offenbacher et al. and Newnham et al. have demonstrated that periodontal therapy during pregnancy has no effect on rates of preterm delivery (42, 85, 86). Therefore, pre-pregnancy stage (childbearing age) has been understood as the more optimal time for treating periodontal disease.

Due to estrogen and progesterone hormones increasing during pregnancy, maternal anatomy, physiology, and metabolism changes, pregnant women's oral cavities and gums are more sensitive to irritants and oral infections. Furthermore, vomiting from morning sickness also changes the balance of oral hygiene. Many common oral problems can occur in pregnant women. Some of the non-severe oral problems include bleeding gums, erosion of tooth enamel, pyogenic granuloma, ptyalism, enamel erosion, tooth mobility, xerostomia, and pregnancy gingivitis. Some of the severe oral problems include periodontitis and tooth loss (87, 88).

To maintain oral hygiene, it is recommended to brush teeth at least twice a day with a soft toothbrush along with fluoride toothpaste, rinse mouth with water after vomiting, and floss when gum symptoms show up. Visiting a dentist for checkup is also recommended, which is effective in preventing oral problems that can turn into severe issues later on in life (89).

2.5 The Canadian Dental Care System

Canadian universal health insurance (Medicare) refers to Canada's publicly funded health care system. Medicare comprises thirteen provincial and territorial health care insurance plans instead of one national plan.

Medicare in Canada is handled by individual provinces and territories, and all residents are required to be accepted for health coverage under the Canada Health Act. Even though certain provinces (such as British Columbia, Alberta, and Ontario) require health care premiums for services, health services cannot be denied due to premium payment, personal income, living standards, or medical history. Residents traveling between territories and provinces within Canada can continue to use their original health care insurance for up to 3 months until they register for the new plan (90).

Canadian universal health insurance covers basic services, for example, primary care physicians and hospitals. But dental services, prescription glasses, optometrists, physiotherapy, home care, long-term care, ambulance services, and prescription medications are not covered by the public health care system. To supplement primary health coverage, private health insurance plans offered by employers often cover vision and dental care. Insurance packages can also be purchased from private insurance providers. Based on World Health Organization Global Health Expenditure database in 2019, 70% of total Canadian health expenditures come from public health care insurance, and the remaining 30% comes from private health expenditure (91, 92). Private dental insurance covers 95% of the total dental care expenses, but only 5% of total spending on dental care comes from public health insurance (91).

It is a controversy for the existence of the private dental insurances. On the one hand, it complements the public dental health care system, while on the other hand it will favor to those with higher incomes. Currently, there are about 2.8 primary care doctor for every 1000 Canadians (93), and there were about 1 dentists per 1622 inhabitants in 2016(94). Therefore, the wait times depends largely on the availability of doctors and the current demand for medical services. Compared to the public dental health care system, private dental clinics typically offer services with reduced waiting time.

The Canadian Health Measures Survey measured oral health insurance cover, which showed that 62% of Canadians have private dental insurance, along with 32% of the citizens not having any sort of dental insurance(95). Thompson's study suggests that 22.7% of Canadians reported a barrier to going to a dentist due to financial costs. This includes lack of access to dentists or not getting full treatment due to monetary constraints (96). The Canadian Dental Association report in 2017 showed that 50% of Canadians in lower-income brackets had no dental insurance. Among the lower-income Canadians, 47% of them had unmet dental care needs, compared to only 26% in the higher-income groups(97). The vulnerable population with unmet dental care needs are usually people of low-income populations, elderly, disable persons, children, non-Indigenous people, and new immigrants.

Furthermore, many studies show that people who do not have access to regular dental care have poorer oral health when compared to the average Canadian population (31, 33, 73, 98). Therefore, Canada faces great challenges in providing the vulnerable population with the required oral health services.

2.6 Factors Associated With Dental Health

2.6.1 Lifestyle Factors

Smoking with dental health problems:

In the oral cavity, greater accumulations of plaque and calculus have been reported in smokers when compared with nonsmokers. The impacts of smoking on oral cavity include not only aesthetic changes, such as stained teeth, restorations, and dentures but also more serious complications. Such as an increased prevalence of periodontitis leading to tooth loss, increased bone loss, impaired wound healing(99-101). Studies concluded that smokers have shown significantly higher levels of gingivitis, such as periodontal disease, teeth decay, and teeth loss when compared with nonsmokers (99, 102-104).

The current smoking prevalence in Canada (12 and older) has significantly reduced from 17.7 % in 2013 to 14.8% in 2019, which includes people who smoke daily or occasionally. The rates for men and women both dropped during this period, with men ranging from 20.4% to 17.3% and women ranging from 15.0% to 12.3% (105). In Canada, non-European immigrants were less likely than other Canadians to be daily smokers (106). A study of CCHS survey revealed that Asian immigrants exhibited significantly lower smoking prevalence than non-immigrants(107). Another study indicated that smoking behavior change was correlated positively with duration of residence in Canada (108, 109). Some of the studies reveal that smoking prevalence for all female immigrants were generally lower

than those of male immigrants (110). One study using CCHS 2000-2005 data showed the smoking prevalence of Canadian-born female population (24.3%) is higher than the prevalence in foreign-born female respondents (11.6%). And certain groups of Asian women being extremely unlikely to smoke compared with Canadian-born women. For an example smoking OR for Chinese females immigrants is (95% CI: 0.05–0.08) and for Indian-born females immigrants is (95% CI: 0.04–0.08)(111).

Smoking has been identified as the second greatest risk factor for global death and disability(112). Several studies have determined that smoking has a causal relationship with numerous disorders. Smoking increases the risk of mental disorders (113, 114); chronic diseases such as chronic lung disease, asthma, myocardial infarction, and cardiovascular diseases (115); and is the primary cause of cancer of the lungs, larynx, esophagus, bladder, and mouth (116).

Some studies also found links between smoking status and self-reported oral health and dental attendance (117-119). The results revealed that the self-reported oral health and dental attendance of smokers differed from non-smokers. Compared with smokers, non-smokers were more likely to report "good oral health", along with smokers being twice as likely to attend the dentist symptomatically.

Alcohol consumption with dental health:

Drinking alcohol already constituted a part of Canadian culture. Alcohol is a commonplace item in Canadian celebrations and social events, and it is the third most consumed beverage in Canada, after water and coffee (120). Alcohol was also the most widely used psychoactive drug next to caffeine (121).

Based on 2019 survey summaries, 23.7 million Canadians (76%) reported consuming alcoholic beverages, which has slightly decreased since 2017 (78% 23.3 million). Men (78% or 12 million) tend to report higher alcohol consumption compared to women (75% or 11.7 million). The prevalence of alcohol use is mainly among young adults aged 20 to 24 (84%) and adults aged 25 years and older (78%) than youth aged 15 to 19 (46%) (122). More than 4.3 million (20%) Canadians drink enough to be at risk for chronic health effects along with 3.3 million (12%) at risk for immediate injury and harm. It is recognized worldwide that alcohol is related to many diseases, such as neuropsychiatric disorders, cardiovascular diseases, hypertension, hepatitis, cirrhosis, fertility, skin and muscles issues, immune system dysfunctions, oral, pharyngeal, and esophageal cancers (123). Based on statistics Canada definition, heavy drinkers are defined as persons aged 12 or older who consumed 12 or more times for consuming 5 or more drinks on one occasion over the past year (124).

Referring to the oral health, literature indicates that alcohol consumption is a potential risk factor for dental health diseases. Studies show that high alcohol consumption showed more decayed surface and apical lesions on teeth, which may negatively influence dental health (125). Moreover, heavy alcohol consumption was found to be associated with high prevalence of tooth loss (126, 127), increased clinical attachment loss (128), increased change of gingival inflammation and plaque accumulation (129), and deeper periodontal pockets (130). Moreover, two recent systemic reviews in 2016 and 2020 indicated that alcohol consumption is an indicator for periodontitis (131, 132).

Diabetes with dental health problems:

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia due to dysfunction of insulin secretion (133). There are three major types of diabetes: type 1 diabetes, type 2 diabetes, and gestational diabetes. High levels of blood glucose can damage the blood vessels in various kinds of tissues and organs in the body, which can eventually cause many diseases, such as, heart disease, stroke, kidney disease, blindness, and nerve damages. Periodontitis is referred to as one of the complications of diabetes. There is noteworthy evidence from clinical research showing a strong relationship between diabetes and periodontal disease (134-137).

Diabetics have a higher risk of developing periodontal diseases. The prevalence of periodontal diseases in non-diabetic individuals is 39%, when compared to diabetic individuals is 59.6% (138). High glucose levels make it easier for bacteria to flourish in the oral region, making people who are diabetic more vulnerable to have bacterial infection (138, 139). The relationship between diabetes with periodontitis is bidirectional. Having diabetes not only makes the infection harder to fight, but serious gum disease may also make diabetes much harder to control (140).

According to the Canadian Chronic Disease Surveillance System (CCDSS) in the 2016 to 2018 results, roughly 3.4 million Canadians aged 20 and older were living with diagnosed diabetes. Although people with diagnosed diabetes are more common in older age groups, more than 50% of the affected Canadian population (1.2 million) was between 25 and 64 years. Prevalence of diagnosed diabetes has consistently increased over the years in Canada, there were about 3.3% annual rise in the number of those living with diabetes (141, 142).

Immigrants from non-European countries are known to have higher rates of diabetes. An Ontario population-based study showed that immigrants from non-European countries, such as South Asia, had an increased risk of diabetes compared to immigrants from Western Europe and North America. Another study showed that recent immigrants are more vulnerable to risk factors for diabetes. There is evidence that recent immigrants tend to have higher food insecurity, less access to health education programs (143), lower incomes, and reduced access to health services (144). Therefore, immigrants are at higher risks of periodontal disease.

2.6.2 Demographic and socioeconomic factors

Numerous studies have demonstrated that demographic and socio-economic factors have a fundamental impact on oral health. Demographic factors included sex, age, and ethnicity. Socio-economic variables included education, history of social assistance, dental insurance coverage, employment status, average household income, marriage status, official language proficiency, and employment status (74, 145-149).

Social-economic factors:

Numerous researches already found that high levels of education, greater income adequacy, and dental insurance coverage were associated with greater access to dental service (150-152). On the contrary, increasing age was associated with lower dental service use (96.3). One study showed that those who had a post-secondary education or higher were more likely to have visited the dentist compared to all other educational levels. The

use of dental services increases with higher household income. Furthermore, people with married status also showed a higher rate of use for dental services (25, 153), which may also due to married people have higher household income and dental insurance coverage. Another study regarding the financial barriers to dental care showed a similar result. Participants with post-secondary education had more dental insurance coverage than those with only high school or less, and those with lower income and without dental insurance coverage were the most likely to report financial barriers to dental care (152).

Gender differences:

Men and women's health inequalities in major health outcomes have been well documented. Self-reported health, life expectancy, and mortality are only a few examples (154-157). Gender differences in various oral health-related outcomes were also discovered, such as in the use of dental service, oral hygiene practices, and oral health status. A study conducted in England demonstrated that female immigrants who were white, Indian, Chinese, and Caribbean were more likely to report oral and facial pain symptoms than male respondents (158).

In Canada, there are significant gender differences when it comes to oral health, oral hygiene behavior, oral health care utilization. According to Bhatti et al., Canadian women had lower insurance coverage and utilization of dental services than men (98). One study done on Japanese immigrants showed that females had better oral health, oral health behaviors, and more knowledge about dental health than male Japanese immigrants in Canada (30). Another study found that Canadian immigrant women were also more likely to report dental problems and to use transnational dental care services over time(31).

Asian immigrants have low-income, less dental insurance coverage (25), and increased risk of diabetes with longer duration of living in Canada (159, 160), but Asian immigrants have less heavy alcohol consumption (161) and less smoking prevalence (114), and immigrants are much healthier on arrival in Canada compared to native-born Canadians (162, 163). Moreover, Women immigrants have lower-income, are less likely to have job security, and less dental insurance coverage than men counterparts (37, 164), and women will face various oral health problems especially during pregnancy (174, 175). But women have more regular dental visiting patterns and engage in more dental care-seeking behaviors, and they have lower smoking prevalence (111), and women use alcohol at lower rates than men (165, 166). It is interesting to investigate the role of lifestyle, demographic, and socio-economic factors in dental health and dentist utilization among Asian immigrants, especially Asian female immigrants.

CHAPTER 3: DENTAL HEALTH STATUS, DENTIST VISITING, AND DENTAL INSURANCE OF ASAIN IMMIGRANTS IN CANADA

3.1 Introduction

Canada is an immigrant nation that welcomes a significant number of newcomers each year. In 2016, 21.9% of the total population (7.5 million) were immigrants, with new immigrants who came between 2011 and 2016 representing 3.5% of the total population (1, 167, 168). Currently, more than half of new immigrants come from Asian and Pacific Rim countries (63.5%) (2). Chinese immigrants and South Asian immigrants constitute the fastest growing ethnic minority in Canada, with immigrants from mainland China have become one of the top three largest subgroups (1.8 million) (2, 3, 169).

Recent literature has stated that the health and health-seeking behavior of Canadian immigrants differed from those of the native-born population. Recent immigrants are found to be on average healthier than the general Canadian population, however, studies indicate that their health appears to deteriorate over time after immigration which is known as the 'Healthy Immigrant Effect' (4-7). Canadian immigrants are typically considered to under use the health care system (8-10). Acculturation, language barriers, lack of knowledge of the health care system, low income, and lack of medical insurance can all play into discouraging immigrants from health care utilization (11-17).

Surprisingly, very few studies have examined the oral health of immigrants in Canada. Most researchers focused on the oral health of children and adolescents (18-21), the elderly

(23, 24), and the whole grouped Canadian immigrants (25-29). Recently few studies have focused on the oral health behaviors of Canadian Asian immigrants, with the study targeting specific Asian populations, such as the Japanese immigrants (30) and the Chinese immigrants (32). A quantitative study compared the access to dental care and unmet dental care needs of Asian immigrants and European immigrants by using CHMS data from 2007 to 2009 (72). There are three studies for specific provinces in Canada; one targeted at refugees and immigrants in Nova Scotia (34) , another one on Chinese immigrants in Montreal (35), and the third one on immigrants in Ontario (36).

Most studies indicate that Canadian immigrants have poor oral health than native-born populations, and that immigrants are at higher risk to under use dental care systems. Cost barriers, lack of dental insurance, language, and cultural barriers are potential predictors of limited access to dental care among immigrants. Ogami et al. showed that acculturation patterns, attitude, and belief are three of the major factors influencing the oral health and oral health behavior of Japanese immigrants in Canada (30). Dong et al. suggested that Chinese immigrants use dental services based on the occurrence of symptoms rather than preventive care (32). Financial problems, language and cultural barriers were the main factors that affected their access to dental care services in Canada. By using the Canadian immigrants as a whole group, both studies show immigrants have higher unmet dental care needs and more likely to report dental problems than Canadians (31, 73).

In previous studies on the "Healthy Immigrant Effect" on oral health, contradictory data were found, with some revealing that immigrants had a greater risk of oral disease than native-born people, a pattern that improves as more time spent in Canada (11, 38). However,

another study has revealed that immigrants reported increased likelihood of dental problems sometime after immigration (31).

Due to scarce and inconsistent literature of information on Asian immigrants' oral health and access to dental care, more research is required to identify reasons for Asian immigrants' oral health status and dental seeking behavior.

This study aims to achieve the following three objectives. First, it described the oral health status and dentist visiting of Asian immigrants. Second, it compared the oral health status and dentist visiting of Asian immigrants with Canadian born citizens and non-Asian immigrants. Third, it explored factors that are associated with disparities in dental health and dental service utilization between Asian immigrants and other Canadians.

3.2 Methods

Data source

Canadian Community Health Survey (CCHS) is a cross-sectional survey conducted by Statistics Canada, which contains detailed information on health care utilization, health status, and health risk factors for Canadian population. CCHS interviews a sample of approximately 130,000 respondents and produces an annual microdata file combining two years of data. The target population of CCHS conducted in 2012, 2013 and 2014 covers 12 years of age and over, who lived in any province or territory. The survey excluded 3% of the Canadian citizens aged 12 and over, who lived on reserves and other Aboriginal settlements, on Canadian Force bases, in institutions, in the Quebec health regions of Région du Nunavik and Région des Terres-Cries-de-la-Baie-James. Households were

randomly selected, with the eligible respondents having one to one interview with a computer assisted personal interview (CAPI). The CCHS used a stratified three-stage sample in each geographic area in 10 provinces. In order to be representative of the covered population, survey weights provided by Statistics Canada was used in calculations and statistical analysis(170). The questionnaires are initially offered in either English or French. To remove language barrier, recruited interviewers in each of the Statistics Canada Regional Offices were provided with a wide range of language competencies. The final questionnaires were translated into different languages when it was necessary(170). In this study, the CCHS 2012-2014 Master data file data were analyzed through Statistics Canada's Research Data Centers (RDC) Program at Memorial university.

Based on the CCHS 2012-2014 questionnaires, Asian immigrants were defined as anyone who was born outside of Canada; not born as Canadian citizen; who were immigrants; their racial origin was Asian, which included Korean, Filipino, Japanese, Chinese, South Asian (East Indian, Pakistani or Sri Lankan), South East Asian (Cambodian or Indonesian), Laotian, Vietnamese, Arab, or West Asian (Afghani or Iranian).

Outcome variables

Dental health status was used as an outcome variable. We explored it using three different approaches: First, self-reported dental health status. Second, any dental symptoms during the last one month. Third, teeth removed due to decay in the past 12-months. We used the following three questions from CCHS:

Questionnaire from CCHS	Answers	Categorized outcomes
"In general, would you say the health of your teeth and mouth?"	"Excellent" or "Very good" or "Good"	good oral health status
	"Fair" or "Poor"	poor oral health status
"In the past month, have you had: a toothache?" or "In the past month, were your teeth: sensitive to hot or cold food or drinks? " or "In the past month, have you had: pain in or around the jaw joints?" or "In the past month, have you had: other pain in the mouth or face?" or "In the past month, have you had: bleeding gums?"	Either question was answered "yes" by a respondent	Had dental symptoms during past one month
	All questions were answered "No" by a respondent	Do not had dental symptoms during past one month
"In the past 12 months, have you had any teeth removed by a dentist?"	"Yes"	Had teeth removed due to decay in past one year
	"No"	Did not have teeth removed due to decay in past one year

Dental care utilization was used as the second outcome variable. We explored it using two different approaches: First, time since last visit to the dentist. Second, frequency of visiting dentist. We used the following two questions from the CCHS:

Questionnaire from CCHS	Answers	Categorized outcomes
"When was the last time that you went to a dentist?"	"Less than 1 year ago" or "1 year to less than 2 years ago" or "1 year to less than 3 years ago"	Visiting dentist within the last 3 years (Yes)
	"3 year to less than 4 years ago" or "4 year to less than 5 years ago" or "5 or more years ago"	Visiting dentist within the last 3 years (No)
"Do you usually visit dentist"	"More than once a year for check-ups" or "about once a year for check-ups"	Visiting dentist more than once per year (Yes)
	"Less than once a year for check-ups" or "only for emergency care"	Visiting dentist more than once per year (No)

Independent variables

The main independent variable of interest in this study was immigrant status. Immigrant status was categorized as 'Canadian born residences', 'non-Asian immigrants', 'Asian long-term immigrant', and 'Asian recent immigrants'. Canadian born residents were considered to be people who were born in Canada; Asian immigrants as people who were born outside of Canada, and were not born as Canadian citizens, that held an immigration status in Canada during the time of the study. Ethnic origins were from the following categories: Korean, Filipino, Japanese, Chinese, East Indian, Pakistani, Sri Lankan, Cambodian, Indonesian, Laotian, Vietnamese, Arab, Afghani, or Iranian. The Asian immigrant status was further divided into two categories: recent Asian immigrant and long-

term Asian immigrant. The long-term Asian immigrants were those who have lived in Canada for over 10 years, with recent Asian immigrants as those who lived in Canada for less than 10 years (60, 171-174).

Other independent variables included demographic and socioeconomic status, health status, and lifestyle factors. The socioeconomic variables included education level, household income, employment status, dental insurance, and type. Level of education was collected as the highest level of education that was coded into three categories: less than secondary school graduation, secondary school graduation/some postsecondary, and postsecondary school graduation. Dental insurance coverage was formatted as yes or no, which indicated if the participate either had or lacked dental insurance. Dental insurance was further divided into three categories: government sponsored, employer-sponsored, and private (yes or no). Total annual household income was divided into three groups: Less than $40000, $40000 to $79999, and $80000 or more.

The sociodemographic variables included age, gender, marital status, and official language. Age was grouped in the following ranges: 12-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, and 60 years or over. Gender was divided into male and female. Information on marital status was collected as three categories, married or common-law, divorced /separated/widowed, and single or never married. Knowledge of official language was grouped as ability to converse in English/French or not.

Diabetes status (diabetes, non-diabetes) was used as a health status co-variate. Diabetes was categorized as either type 1, type 2, or gestational diabetes, otherwise persons were not diabetic.

The lifestyle variables included smoking status (non-smoker, current smoker), alcohol consumption (non-heavy drinker/heavy drinker), frequency of brushing teeth (≥ 2 per day, <2 per day). Non-smoker was defined as former smoker or never smoked, current smoker was defined as occasional smoker or daily smoker. Non-heavy drinkers reported having to binge drink on one occasion and no more per month in the past 12 months, with heavy drinkers reported having to binge drink on more than one occasion per month in the past 12 months.

Statistical analysis

Simple descriptive analyses were performed to describe and compare the socioeconomic characteristics, demographic characteristics, lifestyle characteristics, and prevalence of diabetes among the preconception Canadian-born residences, non-Asian preconception female immigrants, and Asian preconception female immigrants. And also, between native-born Canadians and subgroups of longtime Asian immigrants and recent Asian immigrants. Sample weights were applied in statistical analysis to represent the target population. The Chi square test was used to compare the percentages of people with different characteristics between Canadian-born residences and non-Asian immigrants and subgroups of recent and long-term Asian immigrants. The rescaled weights were used in the descriptive analyses to address the unequal probabilities of selection. Rescaled weights were calculated by dividing the original weight by the mean original weights, which is described by Statistics Canada (175). Furthermore, a series of multivariate logistic regression model analyses were conducted to compare the dental health status and dentist visiting frequency of Asian immigrants as a whole group, as well as subgroups, with native-

born Canadians after adjusting for demographic variables, socioeconomic variables, and lifestyle factors.

The CCHS used a complex sampling design with stratification and multiple stages of sample selection, which led to unequal probabilities of selection of survey respondents. To address underestimation or overestimation of variability in estimate analysis, the bootstrap resampling method was used in the CCHS to estimate coefficients of variation, p-values, and significance tests. Statistics Canada provided the Bootstrap weights, which are used to estimate the variance by generating a random sample with the replacement 500 times from the CCHS sample and estimating the variance from these estimates (176). The Bootstrap method was used by using survey logistic var method=BRR procedure and the survey frequency procedure in SAS 9.4 software (177). Based on Statistics Canada's CCHS guidelines, when the number of a sample size was less than 30, the estimate was suppressed by Statistics Canada in order to ensure the reliability of the estimate. When the coefficient of variation (COV) was between 16.6% and 33.3%, the point estimate and confidence intervals were interpreted with caution because the estimated variance might not be reliable (178-180). When COV was greater than 33.3%, the estimated variance was suppressed due to extreme sampling variability (178-180). Statistical significance was measured at the 95% confidence interval level. The statistical analyses were performed using SAS software package version 9.4 (SAS Institute Inc., Cary NC) through Statistics Canada's Research Data Centers (RDC) at Memorial university.

3.3 Results

The population in this study consist of 26,099 Canadian born, 6,767 non-Asian, and 5,069 Asian immigrant participants aged 12 years and older. Of Asian immigrants, 1,937 were recent Asian immigrants and 3,131 were long-term Asian immigrants (Table 1). The study sample consisted of similar weighted proportions of men and women. Table 1 illustrates differences in the population profiles of Canadian born residents, non-Asian immigrants, and Asian immigrants with further categorization as either a recent or long-term Asian immigrant. The Canadian born population was evenly distributed among different age groups, while the majority of non-Asian immigrants were more concentrated in the senior age bracket. Asian immigrants were typically much younger than the Canadian born residents. The age distribution of Asian immigrants differed with length of residence in Canada. Recent Asian immigrants were mainly composed of persons aged 20-49 years, but most of long-term Asian immigrants were over 40 years of age. Although the three groups had similar patterns of marital status, educational attainment, and knowledge of official languages, slight differences emerged within socio-economic status. Asian Immigrants had slightly higher levels of education attainment and higher marriage rate. Many immigrants were familiar with Canadian official language but had a lower level of household income compared with native born counterparts.

In addition to socio-economic status, personal lifestyle differences were observed in this study (Table 1). Compared with Canadian born groups (20.32%) and non-Asian immigrants (13.9%), Asian immigrants (8.97%) had a lower prevalence of current smokers. Among Asian immigrants, 10.04% of recent Asian immigrants and 8.31% of long-term

immigrants were current smokers. With respect to alcohol consumption, 15.18% of Canadian born residences were heavy drinkers and very few of the respondents in the immigrant population were heavy drinkers, including only 2.64% in Asian immigrants and 6.54% in the non-Asian immigrants. The prevalence of diabetes in long-term Asian immigrants (10.66%) surpassed that of non-Asian immigrants (7.56%) and native-born Canadian population (5.35%), even though only 3.06% of recent Asian immigrants had diabetes. All respondents kept good oral hygiene routines and there were no apparent differences among the three population groups. More than 79% of respondents from all the three of the groups brushed their teeth equal amounts of time or more than twice per day.

Table 1: Distribution of selected demographic, socio-economic characteristics and lifestyle in household population aged 12 or older, by immigrant status.

Characteristic	Canadian born residences (n=26099) (%) #	Non-Asian immigrants (n=6767) (%)#	Asian immigrants (n=5069) (%)#	Recent Asian immigrants (n=1937) (%)#	Long-term Asian immigrants (n=3131) (%)#
Age					
12-19	13.09	4.44	8.02	13.68	4.52^E
20-29	19.45	9.27	16.46	24.47	11.50
30-39	15.07	15.50	20.21	29.77	14.30
40-49	16.11	17.33	24.67	21.11	26.87
50-59	17.75	19.53	15.89	5.63^F	22.23
60-high	18.54	33.93	14.76	5.35^F	20.58
Sex					
Male	48.86	49.67	48.94	47.62	49.75
Female	51.14	50.32	51.06	52.38	50.25
Marital status					
Married/Common-law	53.95	66.87	69.53	64.53	72.62
Divorced/separate/widow	10.35	15.49	5.73	2.73^E	7.58

Single /Never married	35.70	17.64	24.74	32.74	19.80
Education(household)					
Less than secondary	17.37	16.53	14.36	15.51	13.64
Secondary/ Some secondary	26.64	25.29	22.72	23.20	22.42
Post-secondary	55.99	58.18	62.92	61.29	63.93
Household income					
No income-39,999	18.68	27.05	25.78	31.81	22.05
$40,000-79,999	30.47	32.66	39.26	41.96	37.59
$80,000 or more	50.86	40.30	34.96	26.23	40.36
Smoking status					
Current smoker	20.32	13.90	8.97	10.04	8.31
Non-smoker	79.68	86.10	91.03	89.96	91.69
Diabetes					
yes	5.35	7.56	7.76	3.06[E]	10.66
no	94.65	92.44	92.24	96.94	89.34
Heavy drinker					
yes	15.18	6.54	2.64[E]	2.36[F]	2.81[E]
no	84.82	93.46	97.36	97.64	97.19
Knowledge of official languages					
Either English/ French	NA	95.62	93.62	91.25	95.09
Neither English/French	NA	4.38	6.38[E]	8.75[E]	4.91[E]
Frequency of brush teeth					
≥ 2/day	79.39	82.20	86.64	83.35	88.68
<2/day	20.54	17.59	13.36	16.65	11.32
Others‡	0.07[E]	0.21[F]	0	0	0

Data source: Canadian Community Healthy Survey annual data 2012,2013,2014

(%) #All percentages are probability weighted

n=weighted sample size

Abbreviations: NA, not applicable

E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.

F, Coefficient of variation greater than 33.3%, estimate suppressed

‡Others included don't know/ refusal/not stated

Table 2 shows dental insurance coverage by immigrant status. Canadian born residents had significantly higher dental insurance coverage than immigrants. Dental insurance coverage among Canadian-born population was 72.91%, compared with 60.66% in non-Asian immigrants, and 59.51% in Asian immigrants. The percentage of dental insurance coverage for immigrants rose with increased length of residence in Canada, from 52.98% in recent Asian immigrants to 63.55% in long-term Asian immigrants. Employer sponsored dental insurance accounted for most of the dental insurance coverage. More than 82% of all study participants who had dental insurance was sponsored by an employer. However, there was no significant difference in dental insurance types between Canadian born residents and immigrants.

Table 2: Rates of dental insurance coverage in household population aged 12 or older, by immigrants Status

	Canadian born residences (n=26099) (%)#†	Non-Asian immigrants (n=6767) (%)#	Asian immigrants (n=5069) (%)#	Recent Asian immigrants (n=1937) (%)#	Long-term Asian immigrants (n=3131) (%)#
Dental insurance coverage					
	P<0.01 **	P<0.01 **	P<0.01 **	P<0.01 **	
yes	72.91	60.66	59.51	52.98	63.55
no	27.09	39.34	40.49	47.02	36.45
Persons who have dental insurance coverage	Canadian born residences (n= 19029) (%)*†	Non-Asian immigrants (n=4105) (%)*	Asian immigrants (n=3017) (%)*	Recent Asian immigrants (n= 1026) (%)*	Long-term Asian immigrants (n=1990) (%)*
Employer sponsored dental insurance					
yes	82.17	82.53	85.16	82.13	86.72
no	15.44	16.38	13.64	15.00[E]	12.93[E]
Other‡	2.39	1.10[E]	1.21	2.87[F]	0.35[F]

Data source: Canadian Community Healthy Survey annual data 2012,2013,2014
(%) #All percentages are probability weighted
n=weighted sample size
†Reference group
** Chi-square test was used to evaluate statistical differences based on immigrant status. Highly significant different from Canadian born residences (p<0.01)
‡Included don't know/ refusal/not stated
E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.
F, Coefficient of variation greater than 33.3%, estimate suppressed

With respect to dental health care utilization, results in Table 3 show that there was a

significant difference between Canadian born population and immigrant population.

Canadian born citizens were more likely to have visited the dentist at least once in the past

12-months (79.03%), compared to 72.17% of non-Asian immigrants and 63.52% of all

Asian immigrants. After considering the length of residence in Canada, long-term Asian

immigrants (69.83%) were more likely to consult a dentist once per year than recent Asian

immigrants (53.33%). Results were similar for dentist-visiting behavior within the last 3

years (Table 3) with 90.89% of native-born Canadians visiting the dentist within the last

three years, compared to 88.80% of non-Asian immigrants and 84.31% of all Asian

immigrants.

Table 3: Rate of last time visiting dentist and dentist visiting behavior per year in household population aged 12 or older, by immigrant status.

	Canadian born residences (n=26099) (%)#†	Non-Asian immigrants (n=6767) (%)#	Asian immigrants (n=5069) (%)#	Recent Asian immigrants (n=1937) (%)#	Long-term Asian immigrants (n=3131) (%)#
Visiting dentist within the last 3 years					
		P<0.01 **	P<0.01 **	P<0.01**	P<0.01**
yes	90.89	88.80	84.31	81.58	85.99
no and others‡	9.11	11.20	15.69	18.42	14.01
Visiting dentist more than once per year					
		P<0.01 **	P<0.01 **	P<0.01**	P<0.01**
yes	79.03	72.17	63.52	53.33	69.83
no	20.97	27.83	36.48	46.67	30.17

Data source: Canadian Community Healthy Survey annual data 2012,2013,2014
(%)#All percentages are probability weighted
n=weighted sample size
†Reference group
**Highly significant different from Canadian born residences (p<0.01)
‡Others included don't know/ refusal/not stated

With respect of the dental health care utilization, logistic regression analyses demonstrated significant differences between Asian immigrants and Canadian born residents after adjustment for demographic, socioeconomic status, health status and lifestyle factors (Table 4). While taking account for these factors, Asian immigrants as whole (OR=0.59; 95% CI 0.49-0.71) along with recent Asian immigrants (OR=0.44; 95% CI 0.32-0.59) were less likely than Canadian born residents to visit the dentist more than once per year. Asian immigrants as whole (OR=0.68; 95% CI 0.54-0.86) and recent Asian immigrants (OR=0.61; 95% CI 0.43-0.87) were less likely to visit the dentist in the past three years compared to Canadian born residents. However, when looking at dental visits in the past three years, there was no statistical differences between non-Asian immigrants and Canadian born participants.

Table 4: Odds ratios last time visiting dentist and dentist visiting behavior per year, household age 12 and older, by immigrant status.

	Unadjusted OR	Age-adjusted OR	Adjusted OR‡	Adjusted OR§
Visiting dentist within the last 3 years (yes)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	0.79(0.67-0.94)**	0.83(0.69-0.98)*	0.91(0.76-1.09)	0.98(0.82-1.17)
Asian immigrants	0.53(0.43-0.64)**	0.54(0.45-0.66)**	0.59(0.48-0.73)**	0.68(0.54-0.86)**
Recent Asian immigrants	0.43(0.32-0.59)**	0.46(0.33-0.62)**	0.52(0.37-0.72)**	0.61(0.43-0.87)**
Long-term Asian immigrants	0.60(0.47-0.76)**	0.61(0.48-0.78)**	0.65(0.50-0.84)**	0.73(0.55-0.97)*
Visiting dentist more than once per year (yes)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	0.69(0.61-0.77)**	0.69(0.61-0.77)**	0.78(0.68-0.89)**	0.84(0.73-0.96)*
Asian immigrants	0.46(0.40-0.54)**	0.46(0.40-0.54)**	0.51(0.43-0.61)**	0.59(0.49-0.71)**
Recent Asian immigrants	0.30(0.23-0.39)**	0.31(0.24-0.40)**	0.37(0.28-0.49)**	0.44(0.32-0.59)**
Long-term Asian immigrants	0.61(0.51-0.74)**	0.60(0.50-0.73)**	0.64(0.52-0.78)**	0.73(0.58-0.93)**

Data source: Combined Canadian Community Healthy Survey annual data of 2012, 2013, and 2014
†Reference group.
*Significantly different from Canadian born residences (P<0.05), using bootstrap.
**Highly significant different from Canadian born residences (P<0.01), using bootstrap
Abbreviations: OR, odds ratio.
‡ Adjusted for age, sex, marital status, education, household income, diabetes status, smoking status, alcohol consumption and knowledge of official language.
§ Adjusted for all factors which include age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, self-reported dental status, dental symptoms, and dental insurance coverage.

Stratified multivariate logistic regression analysis were performed to predict the odds of visiting dentist more than once per year by immigrant status and to explore whether different risk factors exist between native Canadians, non-Asian immigrants, and Asian

immigrant (Table 5). In general, females with higher education attainment and dental insurance were more likely to visit a dentist more than once per year. After adjusting for other factors, people with dental insurance were four times more likely to visit the dentist compared with those without dental insurance. This is true across groups: Canadian born residents OR=0.29, Asian immigrants OR=0.24, other immigrants OR=0.24. Females were more likely to visit the dentist than males, for non-immigrants OR=1.41, Asian immigrants OR=1.51, other immigrants OR=1.57. Compared to the 20–29-year-old age groups, adolescents (12-19) and senior citizens (60-high) visited the dentist more frequently than other age groups within all population groups. Household income showed a significant association with dentist visiting behaviors as well, with people in the higher income ranges more likely to visit the dentist several times a year.

Interactions of frequency of dentist visiting were found with socioeconomic and lifestyle factors among Canadian born groups and non-Asian immigrants (Table 5). First, household income showed a significant association with dentist visiting behaviors among Canadian-born population and non-Asian immigrants. With the income increase, people were more likely to visit the dentist more than once per year. Second, people in Canadian-born groups and non-Asian immigrants who claimed an excellent/very good/good self-reported dental health usually visited the dentist more than once per year than those in the same groups that claimed a poor/fair self-reported dental health. However, self-reported dental health did not show significant association with dentist visiting behaviors among Asian immigrants. Third, smoking habit was only associated with dentist-visisting behaviour of Canadian-born residents' dentist visiting behavior and not other ethnic groups.

Canadian-born smokers tend to consult with a dentist more often than corresponding nonsmokers. However, diabetes status was only associated with a dentist visiting behavior in Asian immigrants. Asian immigrants living with diabetes were almost twice as likely (OR=1.87; 95% CI 1.03-3.41) to visit the dentist than non-diabetic Asian immigrants. In addition, language did not affect the behavior of dentist visiting among all immigrant population. Finally, time since immigration was significantly associated with Asian immigrant's dentist visiting within one year (OR=1.75; 95% CI 1.17-2.61). Long-term Asian immigrants were more likely to consult a dentist within a year than recent Asian immigrants living in Canada.

Table 5: Stratified logistic regression of dentist visiting behavior, household population aged 12 or older, by immigrant status.

Characteristic	Odds Ratio 95% (Confidential interval) ‡		
	Visiting dentist more than once per year (yes)		
	Canadian born residences	Non-Asian immigrants	Asian immigrants
Education			
Secondary/ Some secondary†	1.00	1.00	1.00
Less than secondary	0.71(0.60-0.85)**	1.13(0.77-1.65)	0.42(0.22-0.82)**
Post-secondary degree	1.36(1.19-1.55)**	1.63(1.14-2.32)**	1.18(0.79-1.75)
Age			
20-29†	1.00	1.00	1.00
12-19	3.61(2.82-4.63)**	4.25(1.95-9.24)**	3.19(1.48-6.87)**
30-39	1.06(0.88-1.28)	1.01(0.60-1.72)	0.96(0.56-1.67)
40-49	1.22(0.99-1.52)	1.71(0.98-2.98)	1.93(1.00-3.71)*
50-59	1.73(1.41-2.12)**	2.67(1.56-4.56)**	1.42(0.67-3.03)
60-high	2.16(1.75-2.65)**	3.88(2.32-6.48)**	1.97(1.01-3.85)*
Sex			
Male†	1.00	1.00	1.00
Female	1.41(1.26-1.58)**	1.57(1.21-2.06)**	1.51(1.06-2.16)*
Household income			
40000-79999†	1.00	1.00	1.00
80000-more	1.80(1.59-2.05)**	1.61(1.12-2.31)**	1.60(1.07-2.39)*
no income-39999	0.67(0.58-0.77)**	0.54(0.40-0.72)**	0.68(0.45-1.02)
Marital status			
Married/Common-law†	1.00	1.00	1.00
Single /Never married	1.19(1.00-1.40)*	0.75(0.49-1.14)	1.06(0.63-1.76)
Widowed/ Separated/	1.08(0.91-1.27)	0.76(0.51-1.15)	0.88(0.51-1.51)
Smoking status			
Smoker†	1.00	1.00	1.00
No smoker	1.60(1.40-1.83)**	0.77(0.54-1.10)	1.31(0.71-2.43)
Alcohol drinker			
Non-heavy drink†	1.00	1.00	1.00
Heavy drink	0.94(0.80-1.10)	1.02(0.58-1.82)	1.07(0.46-2.48)

Diabetes status			
yes†	1.00	1.00	1.00
no	1.17(0.96-1.43)	1.07(0.73-1.57)	1.87(1.03-3.41)*
Dental insurance			
yes†	1.00	1.00	1.00
No	0.29(0.26-0.33)**	0.21(0.16-0.28)**	0.24(0.17-0.33)**
Dental symptoms			
yes†	1.00	1.00	1.00
no	0.94(0.84-1.05)	1.06(0.81-1.39)	1.05(0.74-1.50)
Self-reported dental health			
Fair & poor†	1.00	1.00	1.00
Excellent/very good/good	3.59(3.14-4.10)**	2.90(2.16-3.89)**	1.33 (0.87-2.03)
Language			
English/French†	NA	1.00	1.00
Neither English nor French	NA	0.61(0.32-1.15)	0.55(0.21-1.42)
Immigration length			
0-10 years†	NA	NA	1.00
11-high years	NA	NA	1.75(1.17-2.61)**

Data source: Combined Canadian Community Healthy Survey annual data of 2012, 2013, and 2014

*Significantly different from Canadian born residences (P<0.05), using bootstrap

**Highly significant different from Canadian born residences (P<0.01), using bootstrap

†Reference category

‡ Adjusted for age, marital status, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, immigration length, self-reported dental health, dental symptoms, and dental insurance coverage

The main reason for not visiting the dentist within the last three years were asked in the survey. There were significant differences in response between Canadian born residents and Asian immigrants (Table 6). There were four main reasons identified. One being the 'cost' as the biggest reasons for native born Canadians (37.07%) and non-Asian immigrants (34.80%). The next two reasons were that 'respondent did not think it was necessary' and with the final reason being 'other'. But the main reasons for Asian immigrants were

different from other populations, such that 64.47% of Asian immigrants agreeing with 'respondent did not think it was necessary'. The cost was the reason for only 20.21% of the Asian participants. In the subgroup of Asian immigrants, 71.01% of recent arrivals did not think it was necessary to visit a dentist. With increased length of stay in Canada, the proportion of immigrants agreeing with being necessary to visit dentist decreased to 59.13%.

Table 6: Reasons for not visiting dentist within the last 3 years of household population aged 12 or older, by immigrant status

	Canadian born residences (n=2378) (%)#†	Non-Asian immigrants (n=757) (%)#	Asian immigrants (n=794) (%)#	Recent Asian immigrants (n=357) (%)#	Long-term Asian immigrants (n=438) (%)#
			P<0.01 **	P<0.01 **	P<0.01 **
Cost§	37.07	34.80	20.21^E	16.69^E	23.07^E
Resp. did not think necessary§	25.41	35.40	64.47	71.01	59.13
Other reasons‡§	21.08	16.59	11.79^E	6.78^F	15.88^E
Haven't got around it§	16.44	13.22^E	3.53^F	5.52^F	1.92^F

†, Reference group
(%) # All percentages are probability weighted
* Chi-square test was used to evaluate statistical differences based on immigrant status. Significantly different from Canadian born residences (p<0.05), using bootstrap
** Chi-square test was used to evaluate statistical differences based on immigrant status. Highly significant different from Canadian born residences (p<0.01), using bootstrap
E Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.
F Coefficient of variation greater than 33.3%, estimate suppressed
§ Responses are not mutually exclusive
‡ Included Haven't got around to it, dentist did not think necessary, personal/family responsibilities, not available when request dentist, not available in area, transportation problems, did not know where to go, fear, not specified, other (not specified)

Table 7 shows prevalence of self-reported dental health, dental symptoms and teeth lost by immigrant status. Most participants rated their dental health as excellent/very good/good. with 86.84% of non-immigrants were more likely than immigrants to report their dental health status as good, compared to 83.65% of non-Asian immigrants and 80.52% of Asian immigrants reported having a good/excellent dental health. Both recent and long-term Asian immigrants were more likely to report their health status as either fair or poor than non-immigrants. After controlling for length of residence in Canada, 82.09% of recent Asian immigrants were more likely to rate grade their dental health status as good or excellent than 79.54% of long-term Asian immigrants.

The prevalence of any dental symptoms during the past month was similar between Asian immigrants and Canadian born residents, even when controlling for length of residence in Canada. Both recent and long-term Asian immigrants reported similar rates of any dental symptoms to Canadian born residents. Non-Asian immigrants had a lower prevalence (40.61%) of dental symptoms compared with Canadian born residents (44.66%). However, regarding tooth removal due to decay, Asian immigrants' prevalence of teeth lost (5.79%) surpassed both the non-Asian immigrants (5.18%) and the native-born population (3.08%). In addition, long-term Asian immigrants had a higher prevalence of teeth lost than Canadian born residents (6.10% vs. 3.08% respectively).

Table 7: Prevalence of self-reported dental health, dental symptoms and teeth loss in household population aged 12 or older, by immigrant status

Characteristic	Canadian born residences (n=26099) (%)#†	Non-Asian immigrants (n=6767) (%)#	Asian immigrants (n=5069) (%)#	Recent Asian immigrants (n=1937) (%)#	Long-term Asian immigrants (n=3131) (%)#
Self-reported health					
		P<0.01**	P<0.01**	P<0.05*	P<0.01**
Excellent/very good/good	86.84	83.65	80.52	82.09	79.54
Fair/poor/ Other‡	13.16	16.35	19.48	17.91	20.46
Teeth removed due to decay in past 1 year					
		P<0.01**	P<0.01**		P<0.01**
Yes	3.08	5.18	6.01	5.28	6.10
No/not visit dentist/ Other‡	96.92	94.82	93.99	94.72	93.90
Dental symptoms past 1 month					
		P<0.05*			
Yes&	44.66	40.61	44.53	45.13	44.16
No/ Other‡	55.34	59.39	55.47	54.87	55.84

Data source: Combined Canadian Community Healthy Survey annual data of 2012, 2013, and 2014
(%) # All percentages are probability weighted
† Reference group.
* Chi-square test was used to evaluate statistical differences based on immigrant status. Significantly different from Canadian born residences (p<0.05), using bootstrap
** Chi-square test was used to evaluate statistical differences based on immigrant status. Highly significant different from Canadian born residences (p<0.01), using bootstrap
‡ Others included don't know/ refusal/not stated
& Include had a toothache, teeth sensitive to hot or cold, pain in jaw joints, pain in mouth or face, bleeding gum. Responses are not mutually exclusive

Results of multivariate logistic regression analyses showed that the differences in self-reported dental health and teeth removed due to decay between immigrants and Canadian born residents persisted, after adjustment for age, sex, socioeconomic status, and lifestyle

factors (Table 8). Results from both age-adjusted and socioeconomic status-adjusted logistic regression showed that Asian immigrants and other immigrants were more likely to rate their oral health as fair or poor than Canadian born residents. After adjustment for all socioeconomic and life-style factors, the most significant differences in self-reported dental health remained except for recent Asian immigrants (OR=1.23; 95% CI 0.86-1.75). Differences of teeth removed due to decay between immigrants and Canadian born residents were also observed in multivariate logistic regression analyses (Table 8). In adjusted and unadjusted models, both Asian immigrants and other immigrants were more likely to report teeth lost compared with Canadian born residents. Especially Asian immigrants as whole (OR=2.03; 95% 1.51-2.73) and recent Asian immigrants (OR=2.45; 95% CI 1.30-4.63) who had more than twice the risk in reporting teeth lost compared to Canadian born residents. However, referring to the dental symptoms during the past month, there was no significant difference in acute dental symptoms between immigrants and Canadian born residents in adjusted or unadjusted models.

Table 8: Odds ratios for selected health status indicators of household population aged 12 or older, by immigrant status.

	Unadjusted OR	Age-adjusted OR	Adjusted OR‡	Adjusted OR§
Self-reported teeth health (Fair/Poor)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	1.30(1.12-1.49)**	1.20(1.04-1.38)*	1.13(0.97-1.32)	1.13(0.96-1.32)
Asian immigrants	1.61(1.32-1.95)**	1.63(1.34-1.98)**	1.59(1.30-1.94)**	1.50(1.22-1.84)**
Recent Asian immigrants	1.45(1.06-1.99)*	1.62(1.18-2.24)**	1.47(1.04-2.08)*	1.23(0.86-1.75)
Long-term Asian immigrants	1.70(1.35-2.15)**	1.63(1.29-2.07)**	1.66(1.30-2.11)**	1.67(1.29-2.17)**
Dental symptoms in the past 1 month (Yes)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	0.85(0.76-0.94)**	0.96(0.86-1.08)	0.96(0.86-1.08)	0.97(0.86-1.09)
Asian immigrants	1.00(0.86-1.15)	0.98(0.85-1.14)	0.98(0.85-1.14)	0.99(0.85-1.15)
Recent Asian immigrants	1.02(0.81-1.28)	0.92(0.72-1.16)	0.89(0.70-1.13)	0.88(0.69-1.13)
Long-term Asian immigrants	0.98(0.83-1.16)	1.03(0.87-1.22)	1.04(0.88-1.23)	1.06(0.89-1.25)
Teeth removed due to decay in past 1 year (Yes)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	1.69(1.32-2.16)**	1.37(1.07-1.77)*	1.33(1.02-1.73)*	1.36(1.05-1.77)*
Asian immigrants	1.93(1.45-2.58)**	1.94(1.45-2.60)**	1.90(1.42-2.55)**	2.03(1.51-2.73)**
Recent Asian immigrants	1.75(0.96-3.21)**	2.32(1.24-4.34)**	2.24(1.20-4.18)*	2.45(1.30-4.63)**
Long-term Asian immigrants	2.04(1.49-2.81)**	1.78(1.28-2.47)**	1.77(1.27-2.46)**	1.88(1.35-2.60)**

Data source: Combined Canadian Community Healthy Survey annual data of 2012, 2013, and 2014

Abbreviations: OR = odds ratio
†Reference group
*Significantly different from Canadian born residences (p<0.05), using bootstrap
**Highly significant different from Canadian born residences (p<0.01), using bootstrap
‡ Adjusted for age, sex, marital status, education, household income, diabetes status, smoking status, alcohol consumption, immigration length, and knowledge of official language.
§ Adjusted for all factors which include age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, teeth brush, visiting dentist more than once per year, and dental insurance coverage

Stratified by socio-economic factors multivariate logistic regression analyses were performed separately for non-immigrant, non-Asian immigrants, and Asian immigrants to explore factors associated with self-reported dental health, teeth removed due to decay, and occurance of dental symptoms during the last month (Table 9). For both Canadian born residents and non-Asian immigrants, lower educational achievement, smoking, lower income, diabetes, and brushing teeth less than twice each day were associated with poorer dental health (Fair/Poor) reports. Moreover, senior women who belonged to the native-born group graded their dental health also as fair or poor. However, none of the above factors were significantly associated with self-reported dental health in Asian immigrants. After controlling for all other independent variables, the association between teeth removal and educational attainment, age, household income, smoke status, drinking habits, and teeth brushed remained statistically significant in Canadian-born citizens. People with some post-secondary educations were more likely to report teeth lost due to decay than those with secondary /some secondary degree. Furthermore, elderly born within Canada (more than 50 years old) were also more likely to have their teeth lost. On the contrary, people with higher household income, who were nonsmoker, brushed their teeth more than

twice per day, had lower risk of teeth lost due to decay. In other immigrants, there were associations between teeth removal and smoking habits and dentist visits. Non-Asian immigrants who were nonsmokers were less likely to lose their teeth than smokers. Interestingly, non-Asian immigrants who visited the dentist less than once a year were less likely to report teeth lost compared to non-Asian immigrants who visited ing the dentist frequently. However, none of the above factors were significantly associated with teeth lost in Asian immigrants.

Table 9 demonstrates the unadjusted and adjusted association of individual socio demographic and physical health factors with dental symptoms. Results suggested that risk factors are different between Asian immigrant, non-Asian immigrants, and Canadian born residents for experiencing dental symptoms within the last month. In general, the factors examined in this study affected both non-Asian immigrants and Canadian born residents in similar manners for having dental symptoms. Factors such as being a female, a smoker, and within a younger age category were significantly and independently significant with high rates of acute dental symptoms in Canadian born residences and non-Asian immigrants. Moreover, Table 9 also shows that lower household income, brushing teeth less than twice per day, and lower dental visit frequency correlated with occurrence of acute dental symptoms in Canadian born residents. Nevertheless, this study showed that only age, marital status, and alcohol consumption associated with having dental symptoms in Asian immigrants. For example, Asian immigrants who were single or widowed, fell in the age category of 30-49, and were heavy drinkers were more likely to have dental symptoms during the last month. Regarding the official language ability, it was not an

independent predictor for dental issues or self-reported dental status for either non-Asian

or Asian immigrants.

Table 9: Stratified logistic regression of select dental status and dental issues by immigrant status, of household population age 12 and older, Canada.

Characteristic	OR 95% (Confidential interval) §								
	Self-reported dental health (Fair/Poor)			Dental symptoms during past one month(yes)			Teeth removed due to decay(yes)		
	Canadian born residences	Non-Asian immigrants	Asian immigrants	Canadian born residences	Non-Asian immigrants	Asian immigrants	Canadian born residences	Non-Asian immigrants	Asian immigrants
Education									
sec/some secondary†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
less than secondary	1.18(0.99-1.42)	1.62(1.11-2.34) *	0.57(0.27-1.19)	1.06(0.93-1.21)	0.82(0.59-1.15)	1.31(0.75-2.29)	1.18(0.88-1.57)	1.47(0.74-2.92)	1.99(0.62-6.38)
post-secondary degree	0.73(0.62-0.85) **	1.22(0.86-1.73)	0.65(0.40-1.06)	1.04(0.95-1.15)	1.00(0.77-1.30)	1.09(0.75-1.57)	0.67(0.51-0.88) **	0.99(0.55-1.76)	1.24(0.58-2.69)
Sex									
male†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
female	0.75(0.66-0.86) **	1.21(0.91-1.60)	1.00(0.65-1.55)	1.41(1.29-1.53) **	1.61(1.30-1.98) **	1.17(0.86-1.59)	0.835(0.67-1.04)	0.88(0.55-1.38)	1.26(0.73-2.16)
Age									
20-29†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12-19	0.53(0.39-0.71) **	1.25(0.57-2.76)	0.81(0.29-2.22)	0.91(0.75-1.11)	2.36(1.34-4.15) **	0.95(0.50-1.80)	0.15(0.07-0.32) **	0.19(<0.001 - >999.99)	0.64(0.01-61.30)
30-39	0.99(0.77-1.28)	0.95(0.48-1.87)	0.96(0.48-1.92)	0.80(0.68-0.95) **	0.84(0.52-1.36)	1.90(1.10-3.29) *	1.00(0.57-1.75)	0.805(0.23-2.84)	1.50(0.17-13.44)
40-49	0.97(0.75-1.25)	1.49(0.81-2.73)	1.58(0.76-3.28)	0.81(0.67-0.96) *	0.74(0.44-1.24)	1.81(1.04-3.14) *	1.39(0.78-2.49)	2.53(0.80-7.94)	1.78(0.20-15.90)

50-59	1.72(1.37-2.16) **	1.53(0.90-2.61)	1.96(0.88-4.35)	0.70(0.60-0.83) **	0.81(0.50-1.28)	1.87(0.89-3.94)	2.36(1.38-4.05) **	1.75(0.55-5.58)	3.12(0.35-28.27)
60-high	1.10(0.88-1.38)	1.59(0.92-52.74)	1.81(0.86-3.85)	0.33(0.28-0.39) **	0.53(0.33-0.84) **	1.23(0.65-2.32)	2.21(1.27-3.86) **	1.99(0.70-5.65)	3.96(0.46-34.35)
Household income									
40000-79999†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80000-more	0.63(0.52-0.75) **	1.04(0.70-1.54)	1.02(0.68-1.54)	0.87(0.78-0.96) **	1.16(0.89-1.51)	0.99(0.71-1.38)	0.65(0.47-0.90) **	0.81(0.46-1.44)	0.74(0.38-1.44)
no income-39999	1.32(1.12-1.55) **	1.44(1.04-1.99) *	1.32(0.76-2.27)	1.26(1.12-1.42) **	1.32(0.98-1.78)	0.86(0.58-1.28)	1.71(1.34-2.18) **	1.26(0.81-1.96)	1.28(0.57-2.85)
Marital status									
married/common-law†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
single/never married	1.19(0.99-1.43)	0.99(0.64-1.54)	0.84(0.47-1.52)	0.96(0.85-1.08)	0.82(0.56-1.20)	1.85(1.19-2.87) **	0.89(0.60-1.31)	0.86(0.37-1.95)	0.79(0.19-3.39)
widowed/ Separated/ Divorced	1.06(0.89-1.26)	1.05(0.74-1.51)	1.08(0.61-1.91)	0.90(0.79-1.03)	1.03(0.77-1.39)	2.08(1.28-3.36) **	0.92(0.71-1.18)	0.93(0.57-1.52)	0.91(0.41-2.04)
Smoking status									

smoker†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
no smoker	0.42(0.36-0.49) **	0.53(0.38-0.74) **	1.06(0.49-2.30)	0.84(0.76-0.93) **	0.69(0.50-0.95) *	0.93(0.57-1.51)	0.44(0.35-0.56) **	0.507(0.28-0.91) **	0.45(0.17-1.22)
Alcohol drinker									
non heavy drinker†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
heavy drinker	0.85(0.70-1.03)	1.40(0.80-2.43)	1.19(0.41-3.48)	0.98(0.87-1.12)	1.06(0.68-1.67)	3.03(1.30-7.08) *	0.58(0.42-0.80) **	0.692(0.238-2.02)	0.19(<0.001->999.999)
Diabetes									
yes†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
no	0.75(0.58-0.96) *	0.44(0.31-0.64) **	0.81(0.43-1.53)	1.013(0.86-1.20)	0.80(0.56-1.15)	0.84(0.50-1.39)	0.74(0.54-1.02)	0.89(0.49-1.62)	0.53(0.22-1.27)
Teeth brush									
<2 a day†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
≥2 a day	0.54(0.48-0.62) **	0.59(0.42-0.82) **	0.88(0.54-1.42)	0.761(0.69-0.84) **	0.77(0.58-1.017)	0.99(0.63-1.54)	0.74(0.58-0.95) *	1.07(0.62-1.83)	0.81(0.40-1.66)
Dental insurance coverage	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
yes†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
no	1.09(0.95-1.24)	1.09(0.79-1.49)	1.52(0.99-2.32)	0.96(0.87-1.05)	1.00(0.77-1.29)	0.83(0.61-1.13)	0.81(0.63-1.026)	1.26(0.81-1.97)	0.65(0.30-1.44)

Visiting dentist more than once per year									
yes †	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
no	3.34(2.92-3.83) **	2.83(2.15-3.72) **	1.35(0.90-2.03)	1.13(1.01-1.26) **	1.27(0.99-1.64)	1.12(0.81-1.57)	0.89(0.68-1.17)	0.47(0.31-0.73) **	0.86(0.43-1.73)
language									
either English or French†	NA	1.00	1.00	NA	1.00	1.00	NA	1.00	1.00
neither English nor French	NA	1.56(0.78-3.12)	2.24(0.93-5.42)	NA	0.55(0.32-0.95) *	1.68(0.75-3.77)	NA	1.27(0.51-3.18)	0.96(0.25-3.72)
Immigrants' years									
0-10 years†	NA	NA	1.00	NA	NA	1.00	NA	NA	1.00
11-high years	NA	NA	1.04(0.66-1.63)	NA	NA	0.93(0.67-1.29)	NA	NA	0.69(0.30-1.57)

Data source: Combined Canadian Community Healthy Survey annual data of 2012, 2013, and 2014

†Reference group

Abbreviations: OR, odds ratio, NA: not applicable

*Significantly different from Canadian born residences (P<0.05), using bootstrap

**Highly significant different from Canadian born residences (P<0.01), using bootstrap

OR: Odds ratio.

§ Adjusted for all factors which include immigrant status, age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, self-reported dental status, light dental issue, teeth brush frequency, visiting dentist more than once per year, and dental insurance coverage.

3.4 Discussion

In response to the oral health status and unmet dental care needs, very few studies have examined specifically on Asian immigrants in Canada. Most research focused on the oral health of children and adolescents (19, 22), the elderly (23, 24, 68), the Canadian immigrants (25, 31, 70, 71), refugees, and specific groups of immigrants in specific provinces and territories of Canada (30, 34-36), and brief descriptive summary of Asian immigrants and European immigrants (95). This is the first study on oral health and unmet dental care needs by using large survey data of the whole Asian immigrant population in Canada. It is also one of the preliminary studies focusing on Asian immigrants' attitude and misconception that leads to unmet dental care needs.

This study results are consistent with most studies' findings, which demonstrated that socio-economic status, dental insurance coverage, self-reported oral health, and general health behaviors are all associated with the Canadian population's receiving recommended dental care (96, 145, 152, 181, 182). With these well studied risk factors, this study also revealed that ethnicity was significantly associated with unmet dental care needs and poor dental health among Canadian population. This study showed that Asian immigrants hold a quite high risk of having teeth removed due to decay and Asian immigrants do not visit dentist as frequently as their native Canadian counterparts. These findings were similar to those reported in previous literature(33, 183, 184).

Our study demonstrates the improvement of immigrants' conception related to dental care usage through various channels and methods. On one hand, as our study

showed having lived in Canada for a longer period was associated with increased dental service use. This phenomenon of immigrant period effect on dental health practices was also observed in a previous study (23). On the other hand, by using the latest consensus data, we did not find that a language barrier acted as a key barrier to dental services usage. But a language barrier generally has been found to be a key barrier in preventing Asian immigrants from receiving recommended dental care in previous studies in the 1980s, 1990s (23). Recent studies also show that language proficiency made using oral health services difficult for older migrants in Canada (69) .

This study displayed that majority of Asian immigrant participants had been accustomed to professional dental care usage. As more than 84% of Asian immigrants visited a dentist within 3 years and 63.53% participants have dentist visiting frequency more than once per year among Asian immigrants.

Although our results demonstrated Asian immigrants made good use of dental care, apparent unmet dental care needs still exist in Asian immigrants compared with the rest of the Canadian population. With respect to whether a relationship exists between acculturation and oral behaviors, some literature reveals that a relationship exists between acculturation and oral behaviors or attitudes in Asian immigration to Canada (30). Similarly, on one hand, based on an adjusted multivariate logistic regression model, this study found that well-known socio-economic and general health factors could not fully explain significant unmet dental care needs differences between Asian immigrants and the Canadian population. On the other hand, when participants were asked about reasons for not visiting a dentist within the last 3 years. The majority of Asian immigrants (64.47%)

stated that they did not believe dental visits were necessary, whereas Canadian-born residents cited cost as the primary reason. These indicate that a misconception about dental care usage still exists among Asian immigrants. Consistent with our finding, previous studies have noted Asian immigrants had inadequate dental health practices, which were influenced by culture. Asian immigrants may only intend to access dental care in the presence of symptoms rather than preventive oral hygiene practices, when prevention may be too late and treatment is delayed (182, 185).

When it comes to dental health status, this study showed that Asian immigrants hold a quite high risk (OR= 1.90, P<0.01) of having teeth removed due to decay, under the circumstances of self-reported dental health and dental symptoms, which are quite similar among three groups of residences. Theories from other studies may offer explanations for our results. Asian immigrants' inadequate dental health practices may lead to treatment delays (182). Previous literature also revealed that elderly Chinese immigrants still hold misconceptions about tooth loss, they still consider tooth loss 'normal' and 'inevitable' (23, 182, 186), and they doubt that dental advice and treatments can prevent dental diseases (107). One study shows that Asian immigrants utilize dental services in Canada based on the occurrence of symptoms rather than preventive care similar to what we found. They prefer to do self-examination or ask friends or relatives to check their teeth when symptoms show up, instead of seeking Canadian professional dental care (32). Their results support our explanation of Asian immigrants' dental health status, because of a lack of a professional way to effectively identify dental symptoms which may eventually turn into decay. This shows that Asian immigrants were more likely to report having teeth removed

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due to decay. Moreover, our results indicate socio-economical and other risk factors could not fully explain the high risk of tooth loss in Asian immigrants.

Our study confirmed a similar hypothesis that oral health beliefs and cultural values may affect care-seeking behaviors, and therefore indirectly lead to the consequence of a high risk of tooth loss in Asian immigrants. Future community health education strategies should be developed taking into account the cultural health beliefs of the Asian immigrants who are probably less likely to have knowledge about the value, function, and availability of existing professional dental care services.

Furthermore, female respondents were more likely to visit a dentist frequently within the past year. This result is consistent with other studies (25, 187). Such gender differences in dentist visits can be explained by women's positive attitudes towards dental visits, their better knowledge of maintaining oral health, and more likely to consult a dentist for a preventive visit (187, 188). Considering our results find gender differences in dentist visits, chapter 4 further investigates dental service utilization and dental health in female Asian immigrants.

These findings may help governments encompass understanding of the holistic concept of oral health, identifying and supporting the unique needs of Asian immigrants' population.

3.5 Conclusion

This research found differences between Asian immigrants and native-born Canadians regarding dental visiting behavior and oral health aspects.

Referring to the dentist visiting behavior. Results show that Asian immigrants do not visit dentist as frequently as their native Canadian counterparts. There are significant differences in professional dental care usage between Asian immigrant and non-immigrant women, even after considering the adjustments for demographic factors, socioeconomic status, health status and lifestyle factors.

This study explored the potential factors that may explain the differences in dental care utilization among participant groups. Apart from pervasive socioeconomic, demographic, and health factors, this study revealed that the lack of attention of visiting dentists in Asian immigrants had to do with culture, which seemed to have a particular important reason in distinguishing Asian immigrants from non-immigrants' dental care utilization. Fortunately, our results indicate that the cultural barrier that plays a role in lower dentist visit frequency in Asian immigrants were mitigated with the duration of stay in Canada. It is crucial to identify effective interventions that enhance dentist visits in Asian immigrants as this is an important public health research question to investigate in future studies.

Furthermore, in this study we selected three dental health indicators, which were self-reported dental health, dental symptoms, and teeth removal due to decay. Results for these health indicators were not consistent. On the one hand, Asian immigrants had lower self-reported dental health than Canadian born residents, they rated their health poorly compared to Canadian born residents. However, Asian immigrants were less likely to be aware of recent dental symptoms compare to their non-immigrant counterparts. On the other hand, Asian immigrants were more likely than Canadian born residents to report teeth

removal due to decay. These results indicated that Asian immigrants might have been more aware of the lower rates of their dental health, but they do not possess an effective way in detecting dental symptoms, ultimately leading to teeth removal due to decay.

CHAPTER 4: THE ORAL HEALTH STATUS, DENTIST VISITING AND DENTAL INSURANCE OF FEMALE ASIAN IMMIGRANTS OF CHILDBEARING AGE IN CANADA

4.1 Introduction

Compared with their male counterparts, immigrant women are more vulnerable to dental health issues due to lower wages, less job security, and decreased market participation in the Canadian labor market (37, 38, 48). Some studies reported that female immigrants were more likely to report dental problems and to use transnational dental care services over time (31, 38). Furthermore, women will face more oral health problems during pregnancy. Research suggests that some prenatal oral symptoms may have adverse consequences for pregnancy outcomes. For example, periodontitis is positively associated with preterm birth and low birth weight, and high levels of cariogenic bacteria in mothers can lead to increasing dental caries in the infant(40, 42, 45, 86, 189, 190). However, patients, physicians, and dentists are cautious and often avoid treatment during pregnancy. Moreover, treatment for periodontal disease during pregnancy was ineffective in improving pregnancy outcomes(43, 83, 84). Therefore, the preconception period has been

understood as a more optimal time for treating prenatal periodontal disease. However, very few studies have reported the oral health problems among Asian potentials mothers in Canada. This is the first quantitative study in Canada to look at the oral health status and dental health issues of Asian women immigrants of childbearing age. Pregnant status was not collected in questionnaires of dental health or dentist visiting part, and therefore pregnant women are not excluded (191). Women of childbearing age are here referred as "preconception women" or "potential mothers."

The objectives of the present study contained three aspects. First, it described the oral health status and dentist utilization of Asian women immigrants at child baring age. Second, it compared the oral health status and dentist visiting of Asian immigrants with corresponding Canadian born female citizens and non-Asian female childbearing age immigrants. Third, it explored factors that are associated with disparities in dental health and service utilization between Asian female childbearing age immigrants and other Canadian potential mothers.

4.2 Methods (Note to Readers: This Section Mostly Duplicates 3.2)

This section mostly duplicates 3.2, the only difference is the target population. In the previous chapter 3, the target population of CCHS conducted in 2012, 2013 and 2014 covers 12 years of age and over. Chapter 4 used the combination of CCHS data conducted in 2011, 2012, 2013 and 2014, and the target population of females whose age is between 20 and 39 years (192-194). Childbearing age interval covers from 15 –

45 years old (195, 196), however, this study chose 20 to 39 years for two reasons: First. Based on Canadian vital statistics births database 2001 to 2016, the total fertility rate is about 1.6 which represent that each woman had one or two children, and the average age at maternity at first birth is around 29 years old(197). The 2016 database also summarized the 20 - 39 years old women own very high fertility rate (20 - 24 years old: 37.6, 25 - 29 years old: 87.6, 30 - 34 years old: 107.6, 35 - 39 years: 56.0), compared with 15 - 19 year (8.4) and 40 - 44 years old women (11.5). Second. Demographic characteristics of Asian immigrants (Table 1 in Chapter 3) show that 20 - 49 years old persons (61.34%) constitute the majority Asian population. Especially 20 - 39 years old (36.67%) Asian immigrants are more than 40 - 49 years old (24.67%) Asian immigrants (197). Considering both two aspects, 20 - 39 years old women were chosen as target population who are represent potential mothers of Canadian Asian women.

CCHS data combination method of SAS analysis

First, variables in CCHS 2011-2012 with inconsistent names in CCHS 2013-2014 are recoded (edcgcb12=sdcgcb13) before the combination, which makes the variable name order consistent. Second, append all necessary variables in CCHS 2011-2012 with CCHS 2013-2014 data by using SAS proc append syntax. Third, for each observation, create a new variable, standard weight: standard weight=wts_m/mean(wts_m). Exclude the missing survey data on age, marriage, income, education, smoking status, alcohol drinking status, immigrant status, dental insurance coverage, and diabetes status.

4.3 Results

The study population are respondents with non-proxy interview and all participants had their natural teeth. Table 10 describes the study participants' characteristics of Canadian born residents, non-Asian immigrants, and Asian immigrants. The analysis is limited to women of child-bearing age. The number of respondents aged between the ages of 20 and 39 years was made up of 4066 Canadian-born women, 763 other immigrant women, and 908 Asian immigrant women in Canada. Among Asian immigrants, 522 were recent Asian immigrants, and 386 were long-term Asian immigrants (Table 10). This study shows the socioeconomic and lifestyle differences between three groups of women aged 20-39 (Table 10). In general, compared with native-born women, a higher percentage of immigrant women were married or living in common-law. Asian immigrants or non-Asian female childbearing age immigrants had lower household income compared with their native-born counterparts, but income differences shrunk with the length of immigration increase in Canada. Asian immigrant women have a lower proportion of people who are either smoker, heavy drinker, or diabetic, which suggests that immigrants are not only healthier than native-born women, but they also maintain a healthy daily lifestyle. Due to the confidentiality of CCHS data, this result, which contains a low number of people who are not familiar with the official language, was not released from RDC. People are almost half and half distributed and among Canadian born citizens in the 20–29-year-old (53.39%) and the 30–39-year-old (46.6%) groups, while results showed a slightly higher proportion of immigrants in the 30–39-year-old (63.99% and 59.63%) group than those in the 20–29-year-old(36.01% and 40.37%) group. Moreover, immigrants (66.12% and 62.00%) showed

a higher proportion of people who were getting married or living in common-law than native Canadians. There were no apparent differences in the highest education attainment among the three female population groups, with about 70% of the female population having a secondary or higher educational attainment (Table 10). Female population kept good oral hygiene routines with more than 86% of the female study population reporting brushing teeth no less than twice each day. Even though most of the socioeconomic profiles were similar among the three population groups, household income showed differences. Both non-Asian immigrants and Asian immigrant families had a higher percentage of low-income status than Canadian-born citizens. However, the longer the length of residence （>10 years）in Canada, the disparity of household income tend to shrink between Asian long-term immigrants and native-born Canadians. Most immigrants have a healthy lifestyle, 90.3% of Asian immigrants and 83.32% non-Asian immigrants were nonsmokers, without diabetes, and non-heavy drinkers, while the proportion were lower in Canadian-born residences (66.38%).

Table 11 shows dental insurance coverage by immigrant status for women aged 20-39 years old. Canadian-born residents had significantly higher dental insurance coverage than immigrants. Dental insurance coverage was present in 73.77% of the Canadian born population, compared with 62.94% of the non-Asian population and 58.62% of the Asian immigrants. With an increase in length of residence in Canada, the population proportion of dental insurance coverage increased from 51.45% in recent Asian immigrants to 68.33% in long-term Asian immigrants.

Employer-sponsored dental insurance accounted for the majority (more than 80%) of dental insurance coverage, and there were no significant differences in dental insurance type between non-immigrants and immigrants. Within subgroup of Asian immigrants, long-term Asian immigrants (90.47%) showed a higher proportion than recent Asian immigrants (77.26%) in terms of employer-sponsored dental insurance.

Table 10: Distribution of selected demographic, socio-economic, and lifestyle characteristics, by immigrant status, women aged 20-39 years, Canada.

Characteristic	Canadian born residences (n=4066) (%)#	Non-Asian immigrants (n=763) (%)#	Asian immigrants (n=908) (%)#	Recent Asian immigrant (n=522) (%)#	Long-term Asian immigrants (n=386) (%)#
Age					
20-29	53.39	36.01	40.37	43.52	36.11
30-39	46.61	63.99	59.63	56.48	63.89
Marital status					
Married/Common-law	47.78	62.00	66.12	69.08	62.11
Divorced/separate/widow/ Single /Never married	52.22	38.00	33.88	30.92	37.89
Education					
Less than secondary	30.08	29.49	31.54	34.35^E	27.74
Secondary and Post-secondary	69.92	70.51	68.46	65.65	72.26
Household income					
no income-39,999	20.19	30.70	33.43	42.88	20.66^E
$40,000-79,999	29.90	32.91	33.32	33.12	33.59
$80,000 or more	49.91	36.39	33.25	24.01	45.75
Smoking/Diabetes/ Heavy drinker status					
No	66.38	83.32	90.30	91.19	89.09
Yes	33.63	16.68	9.70 ^{E}	8.81	10.91 ^{E}
Frequency of brush teeth					
≥ 2/day	88.02	92.53	88.65	90.17	86.59
< 2/day or others‡	11.98	7.47^E	11.35 ^{E}	9.83 ^{E}	13.41^E

Data source: Canadian Community Healthy Survey annual data 2011, 2012, 2013, 2014
(%) # All percentages are probability weighted
n=weighted sample size
E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.
‡Others included don't know/ refusal/not stated

Table 11: Rates of dental insurance coverage in women aged 20-39 years, by immigrant status.

	Canadian born residences (n= 4066) (%)#†	Non-Asian immigrants (n= 763) (%)#	Asian immigrants (n= 908) (%)#	Recent Asian immigrants (n= 522) (%)#	Long-term Asian immigrants (n= 386) (%)#
Dental insurance coverage					
		P<0.01 **	P<0.01 **	P<0.01 **	
Yes	73.77	62.94	58.62	51.45	68.33
no	26.23	37.02	41.38	48.55	31.67
Persons who have dental insurance	Canadian born residences (n= 3000) (%)#†	Non-Asian immigrants (n= 480) (%)#	Asian immigrants (n=532) (%)#	Recent Asian immigrants (n=268) (%)#	Long term Asian immigrants (n= 264) (%)#
Employer-sponsored dental insurance					
					P<0.05 *
Yes	83.45	80.66	83.81	77.26	90.47
No/ Other‡	16.55	19.34	16.19	21.96 E	9.19 E

Data source: Canadian Community Healthy Survey annual data 2011, 2012, 2013, 2014
(%) # All percentages are probability weighted
n=weighted sample size
* Chi-square test was used to evaluate statistical differences based on immigrant status. Significant different from Canadian born residences (p<0.05), using bootstrap
** Chi-square test was used to evaluate statistical differences based on immigrant status. Highly significant different from Canadian born residences (p<0.01), using bootstrap
E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.
‡Others included don't know/ refusal/not stated

With respect to access to dental health care, results in table 12 show that there was a significant difference between Canadian-born women and the female foreign-born population at their child-bearing age. Canadian-born female citizens were more likely to have visited a dentist within the past year; 77.67% of them visited dentists at least once per year, compared with 66.31% of non-Asian female immigrants and 59.38% of female Asian

immigrants. After considering the length of immigration in Canada, long-term Asian immigrants (70.46%) were more likely to consult a dentist within one year than recent Asian immigrants (51.19%), and eventually there was no significant difference between long-term Asian with native-born Canadians. Similar results showed that 91.87% of native-born Canadians visited a dentist at least three years ago, compared with 86.69% of non-Asian immigrants and 86.16% on average of Asian immigrants (Table 12).

Table 12: Rate of last time visiting dentist and dentist visiting behavior per year in women aged 20-39, by immigrant status.

	Canadian born female residences (n= 4066) (%)#†	Non-Asian female immigrants (n=763) (%)#	Asian female immigrant (n=908) (%)#	Recent Asian female immigrant (n=522) (%)#	Long-term Asian female immigrant (n=386) (%)#
Visiting dentist within the last 3 years					
		P<0.01**	P<0.01**	P<0.05*	
Yes	91.87	86.49	86.16	85.16	87.51
No and others‡	8.13	13.51^E	13.84^E	14.84^E	12.49^F
Visiting dentist more than once per year					
		P<0.01**	P<0.01**	P<0.01**	
Yes	77.67	66.31	59.38	51.19	70.46
No	22.33	33.69	40.62	48.81	29.54^E

Data source: Canadian Community Healthy Survey annual data 2011,2012,2013,2014
(%) # All percentages are probability weighted
n=weighted sample size
†Reference group
* Chi-square test was used to evaluate statistical differences based on immigrant status. Significant different from Canadian born residences (p<0.05), using bootstrap
** Chi-square test was used to evaluate statistical differences based on immigrant status. Highly significant different from Canadian born residences (p<0.01), using bootstrap
E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.
F, Coefficient of variation greater than 33.3%, estimate suppressed
‡Included don't know/ refusal/not stated

Referring to the frequency of visiting the dentist, in both adjusted and unadjusted models, other immigrant women, Asian immigrant women as whole, and recent Asian immigrant women were less likely to visit a dentist compared to non-immigrants (Table 13). After controlling for co-variates, a similar difference still existed in Asian immigrant women as whole (OR= 0.53; 95% CI 0.37-0.76) and recent Asian immigrant women (OR= 0.43; 95% CI 0.28-0.68), but not for non-Asian immigrants or long-term Asian immigrants. After controlling for all risk factors, no significant difference in the last time immigrants visited a dentist relative to native-born Canadians was found.

Table 13: Odds ratios of last time visiting the dentist visiting behavior per year of women aged 20-39 years, with immigrant status.

	Unadjusted OR	Age-adjusted OR	Adjusted OR‡	Adjusted OR§
Visiting dentist within the last 3 years (Yes)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	0.56(0.38-0.83)**	0.55(0.37-0.82)**	0.67(0.43-1.03)	0.79(0.49-1.26)
Asian immigrants	0.54(0.34-0.85)**	0.53(0.34-0.84)**	0.69(0.42-1.14)	0.80(0.48-1.34)
Recent Asian immigrants	0.50(0.28-0.87)*	0.49(0.28-0.86)*	0.73(0.38-1.42)	0.86(0.43-1.73)
Long-term Asian immigrants	0.61(0.27-1.35)	0.59(0.27-1.31)	0.62(0.28-1.41)	0.72(0.32-1.60)
Visiting dentist more than once per year (Yes)				
Canadian born residences†	1.00	1.00	1.00	1.00
Non-Asian immigrants	0.56(0.42-0.77)**	0.54(0.40-0.73)**	0.62(0.45-0.84)**	0.71(0.50-1.00)
Asian immigrants	0.42(0.30-0.59)**	0.40(0.29-0.57)**	0.46(0.33-0.65)**	0.53(0.37-0.76)**
Recent Asian immigrants	0.30(0.20-0.45)**	0.29(0.19-0.44)**	0.38(0.25-0.58)**	0.43(0.28-0.68)**
Long-term Asian immigrants	0.68(0.41-1.13)	0.66(0.39-1.09)	0.62(0.37-1.06)	0.71(0.42-1.19)

Data source: Combined Canadian Community Healthy Survey annual data of 2011,2012, 2013, and 2014
†Reference group
*Significantly different from Canadian born residences (P<0.05), using bootstrap
**Highly significant different from Canadian born residences (P<0.01), using bootstrap
Abbreviations: OR, odds ratio
‡Adjusted for age, sex, marital status, education, household income, and diabetes status/smoking status/alcohol consumption.
§ Adjusted for all factors which include age, sex, marital status, education, household income, diabetes status/smoking status/alcohol consumption, self-reported dental status, dental symptoms, and dental insurance coverage

Stratified multivariate logistic regression analysis were performed to predict the odds of visiting dentist more than once per year by immigrant status and to explore whether different risk factors exist between native Canadians women aged 20-39 years, female non-Asian immigrants aged 20-39 years,, and female Asian immigrant aged 20-39 years (table 14). In general, various socioeconomic factors are significantly correlated with dentist-visiting behaviors in Canadian-born and non-Asian female childbearing age immigrants, but only a few factors show a significant correlation with dentist-visiting behaviors in immigrant mothers. Canadian-born women and non-Asian immigrant women with post-secondary education, who do not smoke or drink heavily, do not have dental insurance, and who have self-reported dental health as excellent, very good, good are more likely to visit the dentist at least once per year. While none of the above factors, except for dental insurance coverage and household income, are significantly correlated with dentist-visiting behaviors in Asian immigrant women.

Moreover, among all the factors, dental insurance coverage and household income are common factors determining women's dentist-visiting behavior in all populations. Women with dental insurance coverage are more than twice as likely to visit a dentist at least once per year, especially Asian immigrant women, who are almost three times more likely to visit a dentist more than once per year than women without dental insurance coverage (OR= 0.33; 95% CI 0.17-0.67). Women who do not live-in low-income families are more likely to consult with a dentist frequently. Compared with women with less than $39999 household income, Asian immigrant women who come from families with 40000-79999

income are almost four times more likely to visit a dentist per year (OR= 0.26; 95% CI

0.12-0.59).

Table 14: Stratified logistic regression of dentist visiting behavior per year with immigrant status of women aged 20-39 years living in Canada.

Characteristic	OR 95% confidential interval‡		
	Visiting dentist more than once per year (Yes)		
	Canadian-born residences	Non-Asian immigrants	Asian immigrants
Education			
Less than secondary†	1.00	1.00	1.00
Post-secondary degree	1.56(1.21-2.02)**	2.38(1.23-4.62)*	1.90(0.87-4.14)
Age			
30-40†	1.00	1.00	1.00
20-29	1.02(0.78-1.32)	0.977(0.50-1.89)	0.99(0.42-2.40)
Household income			
40000-79999†	1.00	1.00	1.00
80000-more	2.16(1.58-2.94)**	1.20(0.56-2.55)	0.89(0.41-1.93)
no income-39999	0.56(0.41-0.77)**	0.32(0.15-0.70)**	0.26(0.12-0.59)**
Marital status			
Married/Common-law†	1.00	1.00	1.00
Single /Never married/ Widowed/ Separated/ Divorced	1.23(0.94-1.61)	0.81(0.39-1.66)	1.87(0.77-4.55)
Smoker/diabetes /heavy drinker			
Yes†	1.00	1.00	1.00
No	1.34(1.07-1.67)*	1.297(0.57-2.94)	0.83(0.24-2.91)
Dental insurance			
Yes†	1.00	1.00	1.00
no	0.31(0.24-0.40)**	0.48(0.25-0.89)*	0.33(0.17-0.67)**
Dental symptoms			
Yes†	1.00	1.00	1.00
No	1.08(0.85-1.37)	0.97(0.51-1.87)	0.74(0.39-1.39)
Self-reported dental health			
Fair & poor†	1.00	1.00	1.00
Excellent,very good,good	4.02(2.81-5.76)**	3.25(1.37-7.71)**	2.30(0.77-6.89)
Immigrants years			
0-10 years†	NA	NA	1.00
11-high years	NA	NA	1.56(0.83-2.94)

Data source: Combined Canadian Community Healthy Survey annual data of 2011,2012, 2013, and 2014
†Reference group.
*Significantly different from Canadian born residences (P<0.05), using bootstrap
**Highly significant different from Canadian born residences (P<0.01), using bootstrap
‡ Adjusted for all factors which include age, marital status, education, household income, diabetes status/smoking status/alcohol consumption, immigration length, self-reported dental health, dental symptoms, and dental insurance coverage

Next, the main reason for not visiting the dentist within the last three years were indicated by female respondents. There were clear differences between native-born Canadians and Asian immigrants (table 15). Four main reasons were identified, "other reasons" were the leading cause of not visiting the dentist for native born Canadians (48.84%) with "haven't get around to it" followed as the second most common reason (20.76%). Whereas the biggest reason for non-Asian immigrants was "Did not think it is necessary" (34.23%). However, the main reason for Asian immigrants was thoroughly different from other groups. "Did not think it is necessary" (67.80%) was the biggest reason for Asian immigrants followed by "cost" as the other reason (3.97%).

Table 15: Reasons for not visiting dentist within the last 3 years, women aged 20-39, by immigrantion status.

	Canadian born residences (n=330) (%)#†	Non-Asian immigrants (n=103) (%)#	Asian immigrants (n=126) (%)#
Haven't get around to it§	20.76	16.91[F]	9.59[F]
Respondents did not think necessary§	13.96[E]	34.23[E]	67.80
Cost§	16.43 [E]	15.62 [F]	3.97[F]
Other reasons‡§	48.84	33.24 [E]	18.65[F]

Data source: Combined Canadian Community Healthy Survey annual data of 2011,2012, 2013, and 2014

†Reference group, Chi-square test was used to evaluate statistical differences based on immigrant status.

(%)#All percentages are probability weighted

E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.

F, Coefficient of variation greater than 33.3%, estimate suppressed

§ Responses are not mutually exclusive

‡ Included Haven't got around to it, dentist did not think necessary, personal/family responsibilities, not available when request dentist, not available in area, transportation problems, did not know where to go, fear, not specified, other (not specified)

Table 16 shows the prevalence of self-reported dental health, dental symptoms, and teeth lost for women aged 20-39 by immigrant status. More than 85% of the female population tend to rate their dental health as "excellent, very good, good," and there is no significant difference between the three population groups, whether they are recent or long-term immigrants.

Referring to the prevalence of any dental symptoms and teeth lost due to decay, a significant difference showed up between non-immigrant women and immigrant women at 20-39 years old. Asian female immigrants of childbearing age had a lower prevalence

(42.96%) of any tooth symptoms compared with Canadian born residents (53.42%). After controlling for length of residence in Canada, both recent (42.78%) and long-term Asian female immigrants (43.20%) reported lower rates of any tooth symptoms than native-born women. There were no significant differences between non-Asian female immigrants and native-born Canadian women. Interestingly, when it comes to teeth removed due to decay, Asian female immigrants of childbearing age had more teeth loss (6.08%) than the non-Asian women (3.40%) and native-born women (2.12%) in Canada.

Table 16: Prevalence of self-reported dental health, dental symptoms, and teeth loss of women aged 20-39, by immigrant status.

	Canadian born residences† (n= 4066) (%)#†	Non-Asian immigrants (n= 763) (%)#	Asian immigrants (n= 908) (%)#	Recent Asian immigrants (n=522) (%)#	Long-term Asian immigrants (n=386) (%)#
Self-reported health					
Excellent/very good/good	89.41	85.43	86.54	86.55	86.53
Fair & poor	10.59	14.57[E]	13.46 [E]	13.45 [E]	13.47 [E]
Teeth removed due to decay in past one year					
			P<0.01**		
Yes	2.12	3.40	6.08 [E]	-	-
No/not visit dentist	97.88	96.60	93.92	-	-
Dental symptoms in past month					
			P<0.01**	P<0.05*	P<0.05*
Yes[&]	53.42	49.21	42.96	42.78	43.20
No/ Other‡	46.58	50.79	57.04	57.22	56.80

Data source: Combined Canadian Community Healthy Survey annual data of 2011, 2012, 2013, and 2014.
(%) #All percentages are probability weighted.
†Reference group.
*Significantly different from Canadian born residences (p<0.05), using bootstrap
**Highly significant different from Canadian born residences (p<0.01), using bootstrap
- Sample size of one cell is smaller than 5
E, Coefficient of variation between 16.6% and 33.3%. Estimates are considered marginal and associated with high sampling variability.
& Include had a toothache, teeth sensitive to hot or cold, pain in jaw joints, pain in mouth or face, bleeding gum. Responses are not mutually exclusive.

Results of multivariate logistic regression analyses showed that the differences in self-reported teeth health and teeth removed due to decay between immigrants and Canadian born residents persisted, after adjustment for age, sex, socioeconomic status, and lifestyle factors (table 17). Results from both age-adjusted and socioeconomic status-adjusted logistic regression showed that non-Asian immigrant women were more likely to rate their

oral health as fair or poor than Canadian born women (table 17). After adjustment for all factors, significant differences in self-reported teeth health disappeared. There were no significant differences in self-reported dental health between Asian immigrant women and native-born women in adjustment and unadjusted models. The significant difference in having dental symptoms within the past one month disappeared between non-immigrant and Asian immigrant women with or without taking account other factors (table 17). In both adjusted and unadjusted models, Asian immigrants reported having lower risk of experiencing dental symptoms (OR= 0.67; 95% CI 0.49-0.91) compared to non-immigrants. After considering subgroups in Asian immigrants, recent and long-term immigrants did not show significant differences compared with native-born Canadian women after controlling all socio-economic and lifestyle factors and non-Asian immigrant women did not show differences compared with native-born Canadian women.

Table 17: Odds ratios for selected dental health status indicators of women aged 20-39 years, by immigration status.

	Unadjusted OR	Age-adjusted OR	Adjusted OR‡	Adjusted OR§
Self-reported teeth health (Fair/Poor)				
Canadian born residences	1.00	1.00	1.00	1.00
Non-Asian immigrants	1.44(0.97-2.14)	1.51(1.01-2.25)*	1.53(1.02-2.29)*	1.48(0.96-2.27)
Asian immigrants	1.31(0.81-2.13)	1.36(0.84-2.20)	1.409(0.83-2.39)	1.21(0.69-2.11)
Recent Asian immigrants	1.31(0.66-2.62)	1.35(0.68-2.69)	1.277(0.61-2.67)	1.07(0.50-2.29)
Long-term Asian immigrants	1.32(0.70-2.48)	1.38(0.73-2.61)	1.615(0.83-3.20)	1.45(0.71-2.95)
Acute teeth issue (Yes)				
Canadian born residences	1.00	1.00	1.00	1.00
Non-Asian immigrants	0.85(0.66-1.09)	0.858(0.66-1.11)	0.87(0.66-1.13)	0.88(0.67-1.14)
Asian immigrants	0.66(0.49-0.90)**	0.664(0.49-0.90)**	0.67(0.50-0.91)**	0.67(0.49-0.91)**
Recent Asian immigrants	0.65(0.42-1.00)*	0.657(0.43-1.02)	0.66(0.43-1.01)	0.66(0.43-1.01)
Long-term Asian immigrants	0.66(0.46-0.95)*	0.673(0.47-0.97)*	0.69(0.48-1.01)	0.68(0.46-1.01)
Teeth removed due to decay in past 1 year (Yes)				
Canadian born residences	1.00	1.00	1.00	1.00
Non-Asian immigrants	1.62(0.65-4.06)	1.55(0.62-3.88)	1.70(0.66-4.39)	1.72(0.65-4.50)
Asian immigrants	2.99(1.51-5.91)**	2.89(1.48-5.64)**	3.31(1.65-6.66)**	3.31(1.64-6.70)**

Data source: Combined Canadian Community Healthy Survey annual data of 2011, 2012, 2013, and 2014

Abbreviations: OR= odds ratio

†Reference group.

*Significantly different from Canadian born residences (p<0.05), using bootstrap

**Highly significant different from Canadian born residences (p<0.01), using bootstrap

‡Adjusted for immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status

§ Adjusted for all factors which include immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status, teeth brush, visiting dentist more than once per year, and dental insurance

Stratified multivariate logistic regression analyses were performed separately for Canadian-born female participants, non-Asian immigrant women, and Asian immigrant women to predict the odds and identify the risk factors for self-reported dental health, teeth removed due to decay, and experiences with dental health symptoms (Table 18). Education level, household income, lifestyle, oral hygiene habits, and the frequency of visiting the dentist were significantly related to native-born Canadian potential mothers' self-reported dental health. Native-born women with a post-secondary degree (OR= 0.62; 95% CI 0.45-0.85), who did not live in low income families (OR=1.46; 95% CI 1.02-2.11), who kept a healthy lifestyle (did not smoke, heavy drink, and no diabetes) (OR= 0.47; 95% CI 0.34-0.66), and who brushed their teeth two or more times per day (OR= 0.49; 95% CI 0.34-0.70) were less likely to report their dental health as fair/poor. While none of the above factors were significantly associated with self-reported dental health status in Asian immigrant or other immigrant women, except for dentist visiting frequency for non-Asian immigrant women. Non-Asian immigrant women who visit the dentist less than once per year were more likely to report their dental health as fair/poor (OR= 3.16;95% CI 1.44-6.92).

Referring to teeth removal due to decay, similar associations were found in all three groups of women. Education level, household income, and lifestyle factors were significantly related to teeth loss prevalence in native-born potential mothers. Native-born women who had higher than a post-secondary degree (OR= 0.33;95% CI 0.15-0.75), who did not live in low-income families (OR= 2.38 ;95% CI 1.01-5.62), and did not smoke or drink heavily, and did not have diabetes (OR=0.44;95% CI 0.20-0.95), were less likely to

report teeth lost due to decay. However, none of the above factors were significantly associated with teeth removed due to decay in Asian immigrant and other immigrant women.

The occurrence of dental symptoms did not show significant associations with socioeconomic or lifestyle factors. Among the introduced factors, only the habit of brushing teeth and the frequency of dental visits were significantly associated with the occurrence of dental symptoms in Canadian-born women. Only teeth brushing habits showed an association with the occurrence of dental symptoms in non-Asian immigrant women. Both Canadian-born women (OR= 0.62; 95% CI 0.47-0.81) and non-Asian immigrant women (OR= 0.34; 95% CI 0.12-1.00) who brushed their teeth more than once per day were less likely to report any dental symptoms during the past month. Canadian-born women who did not frequently visit the dentist were more likely to report dental symptoms (OR= 1.33; 95% CI 1.06-1.68). None of the above factors were significantly associated with teeth removed due to decay in Asian immigrant and other immigrant women.

Table 18: Stratified logistic regression of select dental status and dental issues by immigrant status, of women aged 20-39 years, Canada.

Characteristic	OR 95% (confidential interval) ‡								
	Self-reported dental health (Fair/Poor)			Dental symptoms within past one month(yes)			Teeth removed due to decay(yes)		
	Canadian born residences	Non-Asian immigrants	Asian immigrants	Canadian born residences	Non-Asian immigrants	Asian immigrants	Canadian born residences	Non-Asian immigrants	Asian immigrants
Education									
Less than post-secondary†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Post-secondary degree	0.62(0.45-0.85) **	1.63(0.67-3.94)	0.35(0.10-1.22)	0.81(0.645-1.01)	1.06(0.59-1.88)	0.61(0.29-1.29)	0.33(0.15-0.75) **	1.89(0.07-49.81)	0.40(0.06-2.53)
Age									
30-40†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20-29	1.04(0.74-1.45)	1.34(0.58-3.09)	0.52(0.15-1.79)	1.19(0.96-1.48)	0.94(0.53-1.65)	0.557(0.25-1.25)	0.60(0.30-1.21)	0.97(0.13-7.42)	--
Household income									
40000-79999†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
80000-more	0.77(0.49-1.21)	0.60(0.12-2.94)	0.67(0.26-1.75)	0.93(0.75-1.15)	1.09(0.57-2.07)	1.22(0.65-2.31)	0.69(0.22-2.16)	--	1.39(0.10-19.04)
no income-39999	1.46(1.02-2.11) *	2.24(0.82-6.12)	0.33(0.10-1.06)	1.09(0.84-1.41)	0.52(0.24-1.14)	0.93(0.44-1.95)	2.38(1.01-5.62) *	4.55(0.30-68.05)	0.55(0.01-66.84)
Marital status									
Married/Common-law†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other status than marriage/ common-law	1.00(0.71-1.42)	0.54(0.23-1.26)	1.35(0.40-4.57)	0.95(0.76-1.18)	0.81(0.44-1.48)	1.21(0.59-2.49)	0.83(0.40-1.70)	0.93(0.09-9.69)	0.63(0.001-364.46)
Smoke diabetes drink status									
yes†	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

no	0.47(0.34-0.66) **	0.45(0.17-1.19)	2.27(<0.001->999)	0.85(0.70-1.03)	1.19(0.61-2.32)	0.60(0.20-1.80)	0.44(0.20-0.95) *	0.25(0.02-3.39)	--
Teeth brush									
<2 a day	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
>=2 a day	0.49(0.34-0.70) **	0.28(0.08-1.00)	0.45(0.10-1.95)	0.62(0.47-0.81) **	0.34(0.12-1.00) *	1.82(0.49-6.79)	1.01(0.49-2.11)	--	--
Dental insurance coverage									
yes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
no	1.17(0.80-1.72)	0.87(0.35-2.21)	0.69(0.28-1.72)	0.86(0.70-1.06)	1.28(0.72-2.30)	0.91(0.48-1.74)	1.09(0.53-2.25)	1.55(0.12-20.77)	0.39(0.02-10.19)
Frequency of visiting dentist									
>= 1/year	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
<1/years and never	3.97(2.78-5.66) **	3.16(1.44-6.92) **	1.69(0.54-5.29)	1.33(1.06-1.68) *	1.18(0.65-2.13)	1.00(0.53-1.88)	1.20(0.54-2.68)	1.037(0.20-5.37)	1.67(0.20-14.01)
Immigrants' years									
0-10 years	NA	NA	1.00	NA	NA	1.00	NA	NA	--
11-high years	NA	NA	0.90(0.36-2.25)	NA	NA	0.93(0.52-1.69)	NA	NA	--

Data source: Combined Canadian Community Healthy Survey annual data of 2011, 2012, 2013, and 2014

Abbreviations: OR= odds ratio

-- Not applicable due to low subject number

†Reference group.

*Significantly different from Canadian born residences (p<0.05), using bootstrap

**Highly significant different from Canadian born residences (p<0.01), using bootstrap

§ Adjusted for all factors which include immigrant status, age, education, marriage, smoking status/alcohol consumption/diabetes status, visiting dentist more than once per year, teeth brush frequency, dental insurance coverage. and dental insurance coverage

4.4 Discussion

This study examined the dental health status, dental issues, and dental care utilization of Asian female childbearing age immigrants and compared it with that of corresponding non-immigrant Canadian women. This study furthered the understanding of barriers to dental care utilization for Asian female childbearing age immigrants.

In the preceding study (chapter 3), table 9 has already shown that among numerous risk factors which affected dental health status, marital status and age were two factors that significantly correlated with Asian immigrants' prevalence of dental symptoms. However, the results in this study did not show any such factors correlating with prevalence of dental symptoms in female Asian immigrants of child-bearing age.

The results indicate that there are unmet dental health needs that exist among Asian female immigrants at their childbearing age. The cause for unmet dental health needs may be due to perceived lack of necessity, lower household income, and a lack of dental insurance coverage. Asian female immigrants might be conscious of a lower rate of their dental health, but they do not possess an effective way of detecting dental symptoms. Consequently, these potential dental symptoms may further deteriorate into tooth removal due to decay.

It is well known that women are more susceptible than men to various oral health problems (gingival, periodontal), especially during pregnancy (198, 199). Maternal oral periodontal disease and dental caries not only affect a pregnant woman's own oral health status, but may also increase her risk of other diseases, result in adverse birth outcomes, as

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well as transmit infection to the offspring (41, 190, 200-202). Despite the high prevalence of caries in pregnant women, pregnant women still lack the knowledge about the importance of dental visits during pregnancy (203). This disease is readily preventable or manageable with early and regular dental checkups (204, 205). Furthermore, not only do Canadian government agencies lack authoritative guidance on dental care for pregnant women (206, 207), but dentists and midwives also have a deficiency in oral health knowledge and beliefs during the prenatal period (208, 209). It is surprising that the topic of oral health and dentist visiting behavior for women at their childbearing age is noticeably silent, despite extensive literatures focused on pregnancy women's dental health and their dental seeking behaviors.

This study's results are consistent with most studies' findings in pregnant women, which demonstrate that both periodontal disease and caries are highly prevalent, particularly among low-income women and members of racial and ethnic minority groups (190). In particular, dental insurance coverage is an important predictor of dental care utilization, with publicly insured adults experiencing higher levels of oral diseases but less likely to access dental services. According to one study, because the public dental health programs for adults are limited in availability and accessibility, low-income pregnant women still face great difficulty in obtaining dental services (210).

Numerous studies have already demonstrated that dental care is necessary and dental coverage is available during pregnancy because of concern about possible risks (211, 212). Besides pregnant women deferring dental treatment until after giving birth, both obstetricians and dentists are reluctant to recommend a dental examination or provide care

to pregnant women. They are all concerned about any risks associated with performing dental treatments while pregnant (208, 211, 213, 214). Therefore, women at their childbearing age will draw special attention for the purpose of preventing dental health issues in advance. This study revealed unoptimistic results among female Asian immigrants at their childbearing age. With respect to dental care usage, our study shows that apparent unmet dental care needs still exist in female Asian immigrants compared with the rest of Canadian population.

This study demonstrates some optimistic aspects of dental health status among female Asian immigrants at childbearing age. This study's results revealed that Asian immigrant women possessed equivalently good self-reported health and a significantly lower prevalence of dental symptoms among the three groups. This phenomenon may be due to the fact that Asian women are more concerned about their body and appearance, including oral appearance, than Asian men (199, 215, 216). But our concern is that although our results demonstrated Asian female immigrants hold certain good dental health status (lower prevalence of dental symptoms), they show a significantly higher rate of teeth removed due to decay compared to the rest of the groups. This higher rate of teeth removed could be explained by the Asian concept of teeth lost and periodontal disease. Previous studies show that Chinese believed that total tooth loss was "normal" and that tooth loss was seen as inevitable. Chinese women believed that tooth loss was caused by frequent childbirth. Some Chinese perceived tooth loss as an opportunity to avoid pain (217).

Another explanation for the higher rate of teeth removed may be insufficient dental care usage. Our study shows that apparent unmet dental care needs still exist in female Asian

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immigrants compared with the rest of Canadian population. This is consistent with previous studies that found female immigrants were more likely to have visited the dentist (25, 31, 214). Research already identified the progression of periodontal disease and gingival to tooth decay and dental plaque, from the beginning of swelling of tissues, pain, and tenderness to the late events in the pathogenesis of decay. The early stage of subsurface demineralization can only be detected microscopically (218, 219). However, Asian immigrants would only intend to access dental care in the presence of symptoms rather than preventive oral hygiene practices (182, 188). As a consequence, treatment was delayed, making prevention too late.

In summary, our study confirmed a similar hypothesis that oral health beliefs and cultural values may affect care-seeking behaviors, and therefore indirectly lead to consequence of high risk of teeth loss in Asian female immigrants. Future community health education strategies should fit with the cultural health beliefs of Asian immigrants, who are probably less likely to have knowledge about the value, function, and availability of existing professional dental care services.

This is the first comprehensive study on the dental health status, attitudes, and misconceptions related to dentist-seeking behaviors in the Asian female population at their childbearing age in Canada. These findings may help governments incorporate an understanding of the holistic concept of oral health by identifying and supporting the unique needs of female Asian immigrant population.

4.5 Conclusion

First, the study looked at the dentist visiting behaviors of the participants. Even though the study (chapter 4) already demonstrated that female respondents as a whole were more likely to visit the dentist compared to their male counterparts, Asian immigrant women still showed a significantly lower frequency of booking appointments with the dentist than non-immigrant women. This trend still exists after adjusting for confounders in logistic regression model.

Secondly, this study further explored the potential factors that may explain the differences in professional dental care utilization. A perceived lack of necessity, lower household income, and dental insurance coverage are major barriers to professional dental usage for most Asian immigrants of childbearing age.

Thirdly, an anecdotal observation shows dental health and oral issues between Asian immigrant women and native-born women of childbearing age. Based on both adjusted and unadjusted multivariate logistic regression models, this study showed that Asian immigrant women possessed equivalently good self-reported health and a significant lower prevalence of dental symptoms among three population groups. Surprisingly, Asian immigrant women as a whole showed a significantly higher rate of teeth removed due to decay than other groups.

CHAPTER 5: CONCLUSION

5.1 Dental Health Status, Dental Health Care Utilization

This study compared the utilization of dental care, self-reported dental health status, and oral health issues of Asian immigrants with those of other Canadian immigrants and Canadian born residents. Furthermore, this thesis compared dental health utilization of Asian immigrant females of childbearing age with those of corresponding other immigrant women and non-immigrant women.

Results for Asian immigrants and Asian female childbearing age immigrants were not consistent. Both Asian immigrants and Asian female immigrants of childbearing age showed a significantly lower frequency of dental care utilization than the corresponding Canadian born residents and other immigrants. This study revealed that a perceived lack of necessity is a major barrier to professional dental usage for many Asian immigrants, more specifically female Asian immigrants of childbearing age. Moreover, dental care utilization for both Asian immigrants and Asian female childbearing age immigrants seems to be influenced by the length of residence in Canada. As the length of residence in Canada increased, the proportion of Asian immigrants frequently visiting the dentist also increased. However, the frequently visiting dentist proportion of long-term Asian immigrants was still lower than Canadian born residents.

Referring to dental health status, this study found that Asian immigrants were more likely to report being "fair & poor", and they also had a higher prevalence of teeth removed

due to decay than Canadian-born residents. However, there were no differences in dental symptoms between Asian immigrants and Canadian-born residents. For Asian female immigrants at childbearing age, their self-reported health was as good as the other two population groups. Furthermore, Asian immigrant women showed a significantly lower prevalence of dental symptoms than the other two population groups, and surprisingly a significantly higher rate of teeth removed due to decay than the other groups. The result showed that Asian immigrant women were three times more likely to report having teeth lost due to decay. Moreover, the duration of residence in Canada may not completely explain the "Healthy Immigrant Effect" in dental health. Compared with recent Asian immigrants, long-term Asian immigrants showed lower odds ratio of having teeth removed due to decay with higher odds ratio of poor self-reported dental health. Our study suggests that Asian female immigrants hold good dental health status, but they still have a higher rate of teeth removed. This result suggests that slight tooth symptoms may turn into decay maybe because they have not frequently visited a dentist. Therefore, the early stage of dental symptoms may result in teeth lost due to decay without appropriate treatment.

Also explored in this study were potential factors that may explain the differences in dental care utilization, self-reported dental health status, and oral health issues among Asian immigrants compared to other immigrants and non-immigrants. Even though gender, education attainment, age, household income, and dental insurance coverage are important determinants of the frequency of visiting the dentist, self-reported dental health status and oral health issue persist among Asian immigrants in Canada after controlling for the above factors. Our study suggests that oral health beliefs and perceived the lack of necessity for

dental services and problems with accessibility to dental services exist among recent Asian immigrants and Asian potential mothers, which could further affect Asian immigrants' future dental health.

5.2 Implications of The Study

The findings in this study provide several scientific contributions to the Asian immigrant health literature. Firstly, the study used the national representative sample of the 2011-2014 CCHS database, with the results having generality and reliability. Therefore, this study can be an important contributing source of information on the health of Asian immigrants for future health research and health policy decisions. Second, this is the first study to assess the dental health and dentist utilization of Asian immigrants in Canada. More specifically, this is the first study targeting Asian female immigrants of childbearing age. Thirdly, this study demonstrates in a quantitative study that cultural differences may play an important role in Asian immigrants' opinion of dental visits. Oral health beliefs and the lack of perceived necessity for dental visits may lead to a high risk of tooth loss in Asian potential mothers. Future studies are warranted in delineating relationships between how culture influences the dental health decisions of Asian potential mothers. Identifying effective interventions to increase dentist check-up rates and emphasize the importance of dental visits in Asian women is an important public health research area for future studies. Furthermore, this thesis has included health practice and policy implications. There is a great need to develop culturally sensitive educational programs regarding the risk factors

related to dental check-ups. It is also crucial to have preventive health screening for Asian immigrant women, especially for recent Asian immigrant women.

5.3 Limitations of The Study

There were several limitations in our research. First, the CCHS is a population-based survey, which allows us to analyze the health status of Asian immigrants at a national level. However, the CCHS is also a cross-sectional survey, and it does not allow us to assess changes in health status over time in Asian immigrants. Even though this study used combined 2012-2014 data to obtain a sufficient sample size, the two-year study is still not long enough for true longitudinal research. Another limitation would be that the latest version of the CCHS data was not used. This is due to the strict confidentiality of the CCHS data along with the COVID-19 break out in the year 2020. The author was out of Canada, extracting the latest data for further investigation was difficult for the research team. Due to time restriction and obstacle of gaining data, this study only did comparison between Canadian with Asian immigrants and Canadian with non-Asian immigrants. But statistical comparison was not done directly between Asian immigrants with non-Asian immigrants. Therefore, future studies should conduct analysis between Asian immigrants and non-Asian immigrants. Thirdly, due to sample size constraints, this study was unable to conduct analyses for specific Asian immigrant women subgroups in terms of long-term and recent immigrant status in female Asian immigrants of child-bearing age. Future studies could include more subgroups. Moreover, refers to independent variables' manipulation. future

study will consider using narrower groups in household income. One 2021 economy report summarized median annual family income in Canada from 2012, 2013, and 2014 is $74540 , $76550, and $78870 respectively(220). Therefore, household income above $80000 could be separated into more narrower groups in the future study, to avoid anyone above $80000 could be statistically treated the same. Refers to data analysis, the arbitrary encoding (yes/no) were used for dependent variables to fit the multinominal logistic regression in this study. Because self-reported dental status (excellent, very good, good, fair, poor) has intrinsic ordering, dependent variables could be encoded as ordinal variables, and ordered logistic regression will be more optimal to predict interaction of self-reported dental status with risk factors. Fourth of all, we only identify people who did not use proxy interviews. Certain questions about tooth sensitivity, tooth pain, and dentist visits were only asked of people who did not use proxy interviews. Therefore, the survey subjects do not represent the entire population of Asian immigrants in Canada. Another limitation of survey female subjects of childbearing age is pregnant persons were not excluded. Because pregnant status information is not included in CCHS oral health and dentist visiting questioners, so this study population is not specifically pre-conception women. Future study could be conducted with excluding pregnant women of childbearing age. Furthermore, this study show that language barrier is not corelated with dentist visiting behaviors, the results may be considered bias. Because it is likely that people who were willing to participate in the survey may have had better English skills and no language barrier. Future studies need more general interviewees. Another limitation is that self-reported dental health data is based on self-reported information and misclassification

errors may occur. Due to great variability in the meaning of self-reported oral health, results not only reflect individuals' cultural and subjective views but also reflect oral health or oral health self-awareness. The sixth limitation refers to language barrier. CCHS only provides data for knowledge of official languages instead of language grade (good/fair/poor). Therefore, "language problem" factor was not fully identified. For example, in our study, more than 90% of Asian immigrants spoke English and/or French, but other studies using Longitudinal Survey of Immigrants to Canada (LSIC 2001-2005) identified that about 55% of adult immigrants rated their speaking skills as moderate/good/very good (31). Besides the language issue, other factors could also be considered. For example, sweet foods, sugary drinks, brushing teeth, dental floss usage are all well-known factors affecting dental health, however, CCHS lacks this information. To more accurately determine the true association, future studies should perform analyses between dental health and immigration adjusting for these other factors.

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APPENDIX

Questionnaire of the Canadian Community Health Survey Annual Component - 2014 (Relevant part only) Dentist visits

Dental visits (DEN)

Optional content	Northwest Territories, Ontario
DEN_BEG	Optional Content (See Appendix 2)
DEN_C130A	If (DODEN block = 1), go to DEN_C130B. Otherwise, go to DEN_END.
DEN_C130B	If proxy interview, go to DEN_END. Otherwise, go to DEN_R130.
DEN_R130	**The following questions are about dental visits.** INTERVIEWER: Press <1> to continue.
DEN_C130C	If CHP_Q14 = 1, go to DEN_Q130. Otherwise, go to DEN_Q132.

DEN_Q130
DEN_130

It was reported earlier that you have "seen" or "talked to" a dentist in the past 12 months. Did you actually visit one?

1	Yes	(Go to DEN_END)
2	No	(Go to DEN_Q132)
DK, RF		(Go to DEN_END)

DEN_Q132
DEN_132

When was the last time that you went to a dentist?

1	Less than 1 year ago	
2	1 year to less than 2 years ago	(Go to DEN_END)
3	2 years to less than 3 years ago	(Go to DEN_END)
4	3 years to less than 4 years ago	(Go to DEN_Q136)
5	4 years to less than 5 years ago	(Go to DEN_Q136)
6	5 or more years ago	(Go to DEN_Q136)
7	Never	(Go to DEN_Q136)
DK, RF		(Go to DEN_END)

Processing:	*In processing, if a respondent answered DEN_Q130 = 1, the variable DEN_Q132 is given the value of 1.*
DEN_E132	Inconsistent answers have been entered. The respondent went to a dentist less than 1 year ago but previously reported that he/she had not "seen" or "talked" to a dentist in the past 12 months. Please confirm.
Rule :	*Trigger soft edit if DEN_Q132 = 1 and CHP_Q14 = 2.*
DEN_C133	If DEN_Q132 = 1, go to DEN_END. Otherwise, go to DEN_Q136.

DEN_Q136 **What are the reasons that you have not been to a dentist in the past 3 years?**

INTERVIEWER: Mark all that apply.

DEN_36A   01   Have not gotten around to it

DEN_36B   02   Respondent - did not think it was necessary

DEN_36C   03   Doctor - did not think it was necessary

DEN_36D   04   Personal or family responsibilities

DEN_36E   05   Not available - at time required

DEN_36F   06   Not available - at all in the area

DEN_36G   07   Waiting time was too long

DEN_36H   08   Transportation - problems

DEN_36I   09   Language - problem

DEN_36J   10   Cost

DEN_36K   11   Did not know where to go / uninformed

DEN_36L   12   Fear (e.g., painful, embarrassing, find something wrong)

DEN_36M   13   Wears dentures

DEN_36O   14   Unable to leave the house because of a health problem

DEN_36N   15   Other

         DK, RF

DEN_END

Teeth and dental health

Oral health 1 (OH1)

Optional content	Ontario, Nunavut
OH1_BEG	Optional Content (See Appendix 2)
OH1_C20A	If (DOOH1 block = 1), go to OH1_C20B. Otherwise, go to OH1_END.
OH1_C20B	If proxy interview, go to OH1_END. Otherwise, go to OH1_R20.
OH1_R20	**Next, some questions about the health of your teeth and mouth.** INTERVIEWER: Press <1> to continue.
OH1_Q20 OH1_20	**In general, would you say the health of your teeth and mouth is:** INTERVIEWER: Read categories to respondent. 1 **Excellent** 2 **Very good** 3 **Good** 4 **Fair** 5 **Poor** DK, RF

Oral health 2 (OH2)

Optional content   Nunavut, Ontario, Saskatchewan, Manitoba

OH2_BEG   Optional Content (See Appendix 2)

OH2_C10A   If (DOOH2 block = 1), go to OH2_C10B.
Otherwise, go to OH2_END.

OH2_C10B   If proxy interview, go to OH2_END.
Otherwise, go to OH2_C10C.

OH2_C10C   If DEN_Q132 = 7 (never goes to dentist), go to OH2_Q11.
Otherwise, go to OH2_Q10.

OH2_Q10
OH2_10   **Do you <u>usually</u> visit the dentist...?**

<u>INTERVIEWER</u>: Read categories to respondent.

1   **more than once a year for check-ups**
2   **about once a year for check-ups**
3   **less than once a year for check-ups**
4   **only for emergency care**
DK, RF   (Go to OH2_END)

OH2_Q11
OH2_11   **Do you have insurance that covers all or part of your dental expenses?**

1   Yes
2   No   (Go to OH2_C12)
DK, RF   (Go to OH2_C12)

OH2_Q11A   **Is it...?**

<u>INTERVIEWER</u>: Read categories to respondent. Mark all that apply.

OH2_11A   1   **a government-sponsored plan**
OH2_11B   2   **an employer-sponsored plan**
OH2_11C   3   **a private plan**
      DK, RF

OH2_C12   If DEN_Q130 = 2 and DEN_Q132 = 2,3,4,5,6,7 (did not go to the dentist in the past year), go to OH2_Q20.
Otherwise, go to OH2_Q12.

OH2_Q12
OH2_12   **In the past 12 months, have you had any teeth removed by a dentist?**

1   Yes
2   No   (Go to OH2_Q20)
DK, RF   (Go to OH2_Q20)

OH2_Q13
OH2_13

(In the past 12 months,) were any teeth removed because of decay or gum disease?

1 Yes
2 No
DK, RF

OH2_Q20
OH2_20

Do you have one or more of your own teeth?

1 Yes
2 No
DK, RF

OH2_C21

If DEN_Q136 = 13, go to OH2_D22.
Otherwise, go to OH2_Q21.

OH2_Q25A
OH2_25A

In the past <u>month</u>, have you had:

a toothache?

1 Yes
2 No
DK, RF

OH2_Q25B
OH2_25B

In the past <u>month</u>, were your teeth:

sensitive to hot or cold food or drinks?

1 Yes
2 No
DK, RF

OH2_Q25C
OH2_25C

In the past <u>month</u>, have you had:

pain in or around the jaw joints?

1 Yes
2 No
DK, RF

OH2_Q25D
OH2_25D

(In the past month, have you had:)

other pain in the mouth or face?

1 Yes
2 No
DK, RF

OH2_Q25E OH2_25E	**(In the past month, have you had:)** **bleeding gums?** 1 Yes 2 No DK, RF
OH2_Q25F OH2_25F	**(In the past month, have you had:)** **dry mouth?** <u>INTERVIEWER</u>: Do not include thirst caused by exercise. 1 Yes 2 No DK, RF
OH2_Q25G OH2_25G	**(In the past month, have you had:)** **bad breath?** 1 Yes 2 No DK, RF
OH2_C30	If OH2_Q20 = 1, go to OH2_Q30. Otherwise, go to OH2_END.
OH2_Q30 OH2_30	**How often do you brush your teeth?** 1 More than twice a day 2 Twice a day 3 Once a day 4 Less than once a day but more than once a week 5 Once a week 6 Less than once a week DK, RF

Socioeconomic status:

INC_C5A	If INC_Q3 <=0, go to INC_END. Otherwise, go to INC_C6A.
INC_Q5A INC_5A	Can you estimate in which of the following groups your household income falls? Was the total household income in the past 12 months...?

INTERVIEWER: Read categories to respondent.

1   Less than $50,000 including income loss
2   $50,000 and more   (Go to INC_Q5C)
DK, RF   (Go to INC_END)

INC_Q5B INC_5B	Please stop me when I have read the category which applies to ^YOUR1 household. Was it...?

INTERVIEWER: Read categories to respondent.

1   Less than $5,000
2   $5,000 to less than $10,000
3   $10,000 to less than $15,000
4   $15,000 to less than $20,000
5   $20,000 to less than $30,000
6   $30,000 to less than $40,000
7   $40,000 to less than $50,000
DK, RF

Go to INC_C6A

INC_Q5C INC_5C	Please stop me when I have read the category which applies to ^YOUR1 household. Was it...?

INTERVIEWER: Read categories to respondent.

1   $50,000 to less than less than $60,000
2   $60,000 to less than less than $70,000
3   $70,000 to less than less than $80,000
4   $80,000 to less than less than $90,000
5   $90,000 to less than less than $100,000
6   $100,000 to less than less than $150,000
7   $150,000 and over
DK, RF

INC_C6A	If HHLDSZ > 1, go to INC_C6B. Otherwise, go to INC_END.
INC_C6B	If AGE > 17, go to INC_D6. Otherwise, go to INC_END.

Educational Attainment (EHG2)
EHG2_BEG

EHG2_Q01
EDU_1

What is the highest grade of elementary or high school [respondent name] has ever completed?

1   Grade 8 or lower (Québec: Secondary II or lower)   (Go to EHG2_Q03)
2   Grade 9 - 10 (Québec: Secondary III or IV,
     Newfoundland and Labrador: 1st year secondary)   (Go to EHG2_Q03)
3.   Grade 11 - 13 (Québec: Secondary V,
     Newfoundland and Labrador: 2nd to 3rd year
     of secondary)

EHG2_Q02
EDU_2

Did [respondent name] complete a high school diploma or its equivalent?

1   Yes
2   No

EHG2_Q03
EDU_3

Has [respondent name] received any other education that could be counted towards a certificate, diploma or degree from an educational institution?

1   Yes   (Go to EHG2_Q04)
2   No

EHG2_Q04
EDU_1

What is the <u>highest</u> certificate, diploma or degree that [respondent name] has completed?

1   Less than high school diploma or its equivalent
2   High school diploma or a high school
     equivalency certificate
3.   Trade certificate or diploma
4.   College, CEGEP or other non-university certificate or diploma (other than trades
     certificates or diplomas)
5.   University certificate or diploma below the
     bachelor's level
6.   Bachelor's degree (e.g. B.A., B.Sc., LL.B.)
7.   University certificate, diploma, degree above the
     bachelor's level

EHG2_END

SDC_Q4C

^YOU2_C may belong to one or more racial or cultural groups on the following list.

^ARE_C ^YOU1?

<u>INTERVIEWER</u>: Read categories to respondent and mark up to 4 responses that apply.

If respondent answers "mixed" or "bi-racial", or "multi-racial", etc probe for specific groups and mark each one separately (e.g. White, Black, Chinese).

Aboriginal people or First Nations are not included in the list of response categories because the Employment Equity Act defines visible minorities as "persons, other than Aboriginal persons, who are non-Caucasian in race or non-white in "colour". Guidelines state that "Due to their status as First Nation people, Aboriginal peoples are specifically excluded from the definition".

Under the Employment Equity Act, Aboriginal Peoples are considered to be a separate designated group.

SDC_43A	01	**White**
SDC_43C	02	**South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)**
SDC_43B	03	**Chinese**
SDC_43D	04	**Black**
SDC_43E	05	**Filipino**
SDC_43F	06	**Latin American**
SDC_43H	07	**Arab**
SDC_43G	08	**Southeast Asian (e.g., Vietnamese, Cambodian, Malaysian, Laotian, etc.)**
SDC_43I	09	**West Asian (e.g., Iranian, Afghan, etc.)**
SDC_43K	10	**Korean**
SDC_43J	11	**Japanese**
SDC_43M	12	Other - Specify (Go to SDC_S4C)
	DK, RF	

Go to SDC_Q5A_1

SDC_Q5A_1
SDC_5A_1

Of English or French, which language(s) ^DOVERB ^YOU1 speak well enough to conduct a conversation? Is it...?

INTERVIEWER: Read categories to respondent.

1   **English only**
2   **French only**
3   **Both English and French**
4   Neither English nor French
DK, RF

SDC_B5B

Call LanguageLookUp block (LLU) a maximum of three times. Always call it the first time;
call subsequent items if the previous instances SDC_B5B.LangCode is a response other than 90000000 (No more languages).

SDC_Q2
SDC_2

^WERE_C ^YOU1 born a Canadian citizen?

1   Yes   (Go to SDC_D4)
2   No
DK, RF   (Go to SDC_D4)

SDC_Q3
SDC_3

In what year did ^YOU1 first come to Canada to live?

INTERVIEWER: The respondent may have first come to live in Canada on a work or study permit or by claiming refugee status. If the respondent moved to Canada more than once, enter the first year they arrived in Canada (excluding holiday time spent in Canada).

If the respondent cannot give the exact year of arrival in Canada, ask for a best estimate of the year.

|_|_|_|_| Year
(MIN: 1,890)
(MAX: 2,030)

DK, RF

SDC_E3

Year must be between ^YEAROFBIRTH and ^CURRENTYEAR. Please return and correct.

Rule :

Trigger hard edit if SDC_Q3 < ^YEAROFBIRTH or SDC_Q3 > ^CURRENTYEAR.

SDC_D4

Not Applicable

Lifestyle status

SMK_Q202
SMK_202

At the present time, ^DOVERB ^YOU2 smoke cigarettes daily, occasionally or not at all?

1	Daily	
2	Occasionally	(Go to SMK_Q205B)
3	Not at all	(Go to SMK_C205D)
DK, RF		(Go to SMK_END)

Universe: *Daily smoker (current)*

ALC_Q3
ALC_3

How often in the past 12 months ^HAVE ^YOU1 had ^DT_BINGEDRINK or more drinks on one occasion?

1   Never
2   Less than once a month
3   Once a month
4   2 to 3 times a month
5   Once a week
6   More than once a week
DK, RF

CCC_Q101
CCC_101

(Remember, we're interested in conditions diagnosed by a health professional and that are expected to last or have already lasted 6 months or more.)

^DOVERB_C ^YOU2 have diabetes?

INTERVIEWER: Exclude respondents who have been told they have prediabetes. Only respondents with type 1, type 2 or gestational diabetes should answer yes to this question.

1	Yes	
2	No	(Go to CCC_Q121)
DK, RF		(Go to CCC_Q121)

Regression results:

Results of Table 4. Odds ratios last time visiting dentist household age 12 and older, by immigrant status. Adjusted for age, sex, marital status, education, household income, diabetes status, smoking status, alcohol consumption and knowledge of official language.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.9523	0.1968	4.84	<.0001
immigrant_status	Asian immigrants	-0.5280	0.1104	-4.78	<.0001
immigrant_status	Non Asian immigrants	-0.0943	0.0901	-1.05	0.2960
immigrant_status	Canada born	0	.	.	.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.590	0.475	0.733
immigrant_status Non Asian immigrants vs Canada born	0.910	0.762	1.086

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.2986
immigrant_status	long term Asian immigrant >10 years				0.0012
immigrant_status	recent Asian immigrant <10 years				0.0001
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.910	0.762	1.087
immigrant_status long term Asian immigrant >10 years vs Canada born	0.645	0.495	0.840
immigrant_status recent Asian immigrant <10 years vs Canada born	0.517	0.369	0.724

Results of Table 4. Odds ratios last time visiting dentist household age 12 and older, by immigrant status. Adjusted for all factors which include age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, self-reported dental status, dental symptoms, and dental insurance coverage.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.9317	0.2062	4.52	<.0001
immigrant_status	Asian immigrants	-0.3882	0.1183	-3.28	0.0011
immigrant_status	Non Asian immigrants	-0.0226	0.0898	-0.25	0.8019

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.678	0.538	0.856
immigrant_status Non Asian immigrants vs Canada born	0.978	0.820	1.166

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.8031
immigrant_status	long term Asian immigrant >10 years				0.0276
immigrant_status	recent Asian immigrant <10 years				0.0073
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.978	0.820	1.167
immigrant_status long term Asian immigrant >10 years vs Canada born	0.731	0.554	0.966
immigrant_status recent Asian immigrant <10 years vs Canada born	0.609	0.425	0.874

Results of Table 4. Odds ratios dentist visiting behavior per year household age 12 and older, by immigrant status. Adjusted for age, sex, marital status, education, household income, diabetes status, smoking status, alcohol consumption and knowledge of official language.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.4162
immigrant_status	Non Asian immigrants				0.0002
immigrant_status	long term Asian immigrant >10 years				<.0001
immigrant_status	recent Asian immigrant <10 years				<.0001
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.779	0.683	0.888
immigrant_status long term Asian immigrant >10 years vs Canada born	0.636	0.516	0.784
immigrant_status recent Asian immigrant <10 years vs Canada born	0.367	0.277	0.486

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.3739
immigrant_status	Asian immigrants				<.0001
immigrant_status	Non Asian immigrants				0.0002
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.511	0.430	0.606
immigrant_status Non Asian immigrants vs Canada born	0.776	0.681	0.885

Results of Table 4. Odds ratios dentist visiting behavior per year household age 12 and older, by immigrant status. Adjusted for all factors which include age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, self-reported dental status, dental symptoms, and dental insurance coverage.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.0087
immigrant_status	Non Asian immigrants				0.0134
immigrant_status	long term Asian immigrant >10 years				0.0093
immigrant_status	recent Asian immigrant <10 years				<.0001

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.841	0.733	0.965
immigrant_status long term Asian immigrant >10 years vs Canada born	0.732	0.578	0.926
immigrant_status recent Asian immigrant <10 years vs Canada born	0.435	0.322	0.588

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.0078
immigrant_status	Asian immigrants				<.0001
immigrant_status	Non Asian immigrants				0.0124
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.591	0.491	0.713
immigrant_status Non Asian immigrants vs Canada born	0.839	0.732	0.963

Results of Table 8. Odds ratios Self-perceived teeth health household age 12 and older, by immigrant status. Adjusted for age, sex, marital status, education, household income, diabetes status, smoking status, alcohol consumption, immigration length, and knowledge of official language.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.0003
immigrant_status	Non Asian immigrants				0.1310
immigrant_status	long term Asian immigrant >10 years				<.0001
immigrant_status	recent Asian immigrant <10 years				0.0308

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	1.128	0.965	1.319
immigrant_status long term Asian immigrant >10 years vs Canada born	1.658	1.300	2.114
immigrant_status recent Asian immigrant <10 years vs Canada born	1.469	1.036	2.083

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.0003
immigrant_status	Asian immigrants				<.0001
immigrant_status	Non Asian immigrants				0.1309

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	1.588	1.301	1.939
immigrant_status Non Asian immigrants vs Canada born	1.128	0.965	1.319

Results of Table 8. Odds ratios Self-perceived teeth health household age 12 and older, by immigrant status. Adjusted for all factors which include age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, teeth brush, visiting dentist more than once per year, and dental insurance coverage.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.1470
immigrant_status	long term Asian immigrant >10 years				0.0001
immigrant_status	recent Asian immigrant <10 years				0.2500

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	1.126	0.959	1.321
immigrant_status long term Asian immigrant >10 years vs Canada born	1.673	1.293	2.166
immigrant_status recent Asian immigrant <10 years vs Canada born	1.231	0.864	1.754

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.0002
immigrant_status	Non Asian immigrants				0.1449

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	1.496	1.216	1.842
immigrant_status Non Asian immigrants vs Canada born	1.126	0.960	1.321

Results of Table 8. Odds ratios Dental symptoms in the past 1 month household age 12 and older, by immigrant status. Adjusted for age, sex, marital status, education, household income, diabetes status, smoking status, alcohol consumption, immigration length, and knowledge of official language.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.1825
immigrant_status	Non Asian immigrants				0.5064
immigrant_status	long term Asain immigrant >10 years				0.6409
immigrant_status	recent Asain immigrant <10 years				0.3421

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.962	0.859	1.078
immigrant_status long term Asain immigrant >10 years vs Canada born	1.041	0.879	1.232
immigrant_status recent Asain immigrant <10 years vs Canada born	0.888	0.696	1.134

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.1923
immigrant_status	Asian immigrants				0.7991
immigrant_status	Non Asian immigrants				0.5017

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.981	0.845	1.138
immigrant_status Non Asian immigrants vs Canada born	0.962	0.859	1.077

Results of Table 8. Odds ratios Dental symptoms in the past 1 month household age 12 and older, by immigrant status. Adjusted for all factors which include age, sex, marital status, official language, education, household income, diabetes status, smoking status, alcohol consumption, knowledge of official language, teeth brush, visiting dentist more than once per year, and dental insurance coverage.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.0652
immigrant_status	Non Asian immigrants				0.5915
immigrant_status	long term Asain immigrant >10 years				0.5101
immigrant_status	recent Asain immigrant <10 years				0.3035

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.969	0.864	1.087
immigrant_status long term Asain immigrant >10 years vs Canada born	1.058	0.894	1.254
immigrant_status recent Asain immigrant <10 years vs Canada born	0.878	0.685	1.125

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					0.0687
immigrant_status	Asian immigrants				0.8674
immigrant_status	Non Asian immigrants				0.5879

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.987	0.850	1.147
immigrant_status Non Asian immigrants vs Canada born	0.969	0.864	1.086

Results of Table 13. Odds ratios last time visiting dentist women aged 20-39 years, by immigrant status. Adjusted for age, sex, marital status, education, household income, and diabetes status/smokingstatus/alcohol consumption

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.0696
immigrant_status	long term Asian immigrant >10 years				0.2537
immigrant_status	recent Asain immigrant <10 years				0.3561
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.666	0.429	1.033
immigrant_status long term Asian immigrant >10 years vs Canada born	0.624	0.277	1.405
immigrant_status recent Asain immigrant <10 years vs Canada born	0.731	0.375	1.424

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.1433
immigrant_status	Non Asian immigrants				0.0677
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.687	0.415	1.136
immigrant_status Non Asian immigrants vs Canada born	0.665	0.429	1.030

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Results of Table 13. Odds ratios last time visiting dentist women aged 20-39 years, by immigrant status. Adjusted for all factors which include age, sex, marital status, education, household income,diabetes status/smoking status/alcohol consumption, self-perceived dental status, dental symptoms, and dental insurance coverage

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.3300
immigrant_status	long term Asian immigrant >10 years				0.4130
immigrant_status	recent Asain immigrant <10 years				0.6707
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.791	0.493	1.269
immigrant_status long term Asian immigrant >10 years vs Canada born	0.716	0.322	1.595
immigrant_status recent Asain immigrant <10 years vs Canada born	0.860	0.428	1.726

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.4010
immigrant_status	Non Asian immigrants				0.3232
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.802	0.478	1.344
immigrant_status Non Asian immigrants vs Canada born	0.790	0.494	1.262

Results of Table 13. Odds ratios dentist visiting behavior per year women aged 20-39 years, by immigrant status. Adjusted for age, sex, marital status, education, household income, and diabetes status/smokingstatus/alcohol consumption

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.4786	0.1606	2.98	0.0030
immigrant_status	Non Asian immigrants	-0.4865	0.1572	-3.10	0.0021
immigrant_status	long term Asian immigrant >10 years	-0.4718	0.2687	-1.76	0.0798
immigrant_status	recent Asain immigrant <10 years	-0.9781	0.2158	-4.53	<.0001
immigrant_status	Canada born	0	.	.	.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.615	0.451	0.837
immigrant_status long term Asian immigrant >10 years vs Canada born	0.624	0.368	1.058
immigrant_status recent Asain immigrant <10 years vs Canada born	0.376	0.246	0.575

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		0.4827	0.1607	3.00	0.0028
immigrant_status	Asian immigrants	-0.7734	0.1772	-4.36	<.0001
immigrant_status	Non Asian immigrants	-0.4832	0.1574	-3.07	0.0023
immigrant_status	Canada born	0	.	.	.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.461	0.326	0.654
immigrant_status Non Asian immigrants vs Canada born	0.617	0.453	0.840

Results of Table 13. Odds ratios dentist visiting behavior per year women aged 20-39 years, by immigrant status. Adjusted for all factors which include age, sex, marital status, education, household income,diabetes status/smoking status/alcohol consumption, self-perceived dental status, dental symptoms, and dental insurance coverage

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		-0.0779	0.2014	-0.39	0.6993
immigrant_status	Non Asian immigrants	-0.3470	0.1744	-1.99	0.0472
immigrant_status	long term Asian immigrant >10 years	-0.3465	0.2638	-1.31	0.1897
immigrant_status	recent Asain immigrant <10 years	-0.8336	0.2281	-3.66	0.0003
immigrant_status	Canada born	0	.	.	.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.707	0.502	0.996
immigrant_status long term Asian immigrant >10 years vs Canada born	0.707	0.421	1.188
immigrant_status recent Asain immigrant <10 years vs Canada born	0.434	0.278	0.680

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept		-0.0664	0.2019	-0.33	0.7425
immigrant_status	Asian immigrants	-0.6415	0.1838	-3.49	0.0005
immigrant_status	Non Asian immigrants	-0.3434	0.1748	-1.96	0.0501
immigrant_status	Canada born	0	.	.	.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.527	0.367	0.756
immigrant_status Non Asian immigrants vs Canada born	0.709	0.503	1.000

Results of Table 17. Odds ratios Self-perceived teeth health women aged 20-39, by immigrant status. Adjusted for immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.0403
immigrant_status	long term Asian immigrant >10 years				0.1689
immigrant_status	recent Asain immigrant <10 years				0.5155
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	1.528	1.019	2.292
immigrant_status long term Asian immigrant >10 years vs Canada born	1.615	0.815	3.202
immigrant_status recent Asain immigrant <10 years vs Canada born	1.277	0.610	2.672

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.2044
immigrant_status	Non Asian immigrants				0.0396
immigrant_status	Canada born				.

NOTE: The degrees of freedom for the t tests is 500.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	1.409	0.829	2.394
immigrant_status Non Asian immigrants vs Canada born	1.532	1.021	2.299

Results of Table 17. Odds ratios Self-perceived teeth health women aged 20-39, by immigrant status. Adjusted for all factors which include immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status, teeth brush, visiting dentist more than once per year, and dental insurance

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.0785
immigrant_status	long term Asian immigrant >10 years				0.3086
immigrant_status	recent Asain immigrant <10 years				0.8715
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	1.470	0.957	2.257
immigrant_status long term Asian immigrant >10 years vs Canada born	1.448	0.710	2.954
immigrant_status recent Asain immigrant <10 years vs Canada born	1.065	0.495	2.293

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.5022
immigrant_status	Non Asian immigrants				0.0754
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	1.209	0.694	2.107
immigrant_status Non Asian immigrants vs Canada born	1.476	0.961	2.267

Results of Table 17. Odds ratios Dental symptoms in the past 1 month women aged 20-39, by immigrant status. Adjusted for immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.2818
immigrant_status	long term Asian immigrant >10 years				0.0547
immigrant_status	recent Asain immigrant <10 years				0.0534
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.865	0.663	1.127
immigrant_status long term Asian immigrant >10 years vs Canada born	0.692	0.475	1.008
immigrant_status recent Asain immigrant <10 years vs Canada born	0.658	0.431	1.006

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.0098
immigrant_status	Non Asian immigrants				0.2836
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.673	0.498	0.908
immigrant_status Non Asian immigrants vs Canada born	0.865	0.664	1.128

Results of Table 17. Odds ratios Dental symptoms in the past 1 month women aged 20-39, by immigrant status. Adjusted for all factors which include immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status, teeth brush, visiting dentist more than once per year, and dental insurance

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Non Asian immigrants				0.3269
immigrant_status	long term Asian immigrant >10 years				0.0544
immigrant_status	recent Asain immigrant <10 years				0.0567
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Non Asian immigrants vs Canada born	0.875	0.670	1.143
immigrant_status long term Asian immigrant >10 years vs Canada born	0.680	0.459	1.007
immigrant_status recent Asain immigrant <10 years vs Canada born	0.656	0.425	1.012

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.0102
immigrant_status	Non Asian immigrants				0.3293
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	0.667	0.490	0.908
immigrant_status Non Asian immigrants vs Canada born	0.875	0.670	1.144

Results of Table 17. Odds ratios Teeth removed due to decay in past 1 year women aged 20-39, by immigrant status. Adjusted for immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
immigrant_status	Asian immigrants				0.0008
immigrant_status	Non Asian immigrants				0.2748
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	3.314	1.650	6.658
immigrant_status Non Asian immigrants vs Canada born	1.697	0.656	4.389

Results of Table 17. Odds ratios Teeth removed due to decay in past 1 year women aged 20-39, by immigrant status. Adjusted for all factors which include immigrant status, age, education, marriage, household income, smoking status/alcohol consumption/diabetes status, teeth brush, visiting dentist more than once per year, and dental insurance

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	t Value	Pr > |t|
Intercept					<.0001
immigrant_status	Asian immigrants				0.0009
immigrant_status	Non Asian immigrants				0.2720
immigrant_status	Canada born				.

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence Limits	
immigrant_status Asian immigrants vs Canada born	3.310	1.641	6.675
immigrant_status Non Asian immigrants vs Canada born	1.715	0.654	4.496