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Oral Health Behaviours and Attitudes among Japanese Immigrants in Greater Vancouver,  
British Columbia, Canada

by  
Keiko Ogami

A thesis  
submitted in partial fulfillment  
of the requirements for the degree of  
Master of Science in Dental Hygiene  
Idaho State University  
Spring 2016

## **Committee Approval**

To the Graduate Faculty:

The members of the committee appointed to examine the thesis proposal of Keiko Ogami finds it satisfactory and recommends that it be accepted.

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May 6th, 2015

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RE: regarding study number IRB-FY2015-84 : Oral hygiene behaviours and attitudes

Dear Ms. Ogami:

I have reviewed your request for expedited approval of the new study listed above. This is to confirm that I have approved your application.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

Submit progress reports on your project in six months. You should report how many subjects have participated in the project and verify that you are following the methods and procedures outlined in your approved protocol. Then, report to the Human Subjects Committee when your project has been completed. Reporting forms are available on-line.

You may conduct your study as described in your application effective immediately. The study is subject to renewal on or before Tue, 3 May 2016, unless closed before that date.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; [emailhumsubj@isu.edu](mailto:emailhumsubj@isu.edu)) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP  
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### **List of Abbreviations**

CALD	Culturally and Linguistically Diverse
BC	British Columbia
BMI	Body Mass Index
BP	Blood Pressure
CDHA	Canadian Dental Hygienists Association
CIHR	Canadian Institute of Health Research
DFS	Decayed and Filled Surface
DMFS	Decayed, Missing, and Filled Surface
DMFT	Decayed, Missing, and Filled Teeth
DS	Decayed Surface
EAAM	East Asian Acculturation Measure
EAAM-C	East Asian Acculturation Measure-Chinese Version
FTUs	Functional Tooth Units
HSC	Human Subjects Committee
HU-DBI	Hiroshima University Dental Behavioural Inventory
IRBs	Institutional Review Boards
ISU	Idaho State University
JPHC	Japan Public-Health Center-Based
MS	Missing Tooth Surface
NPHS	National Population Health Survey
NT	Natural Teeth
OHSI	Oral Hygiene Status Index
P-BAS	Psychological Behavioral Acculturation Scale



PCR	Plaque Control Record
SALSA	Sacramento Area Latino Study on Aging
STOFHLA	Short Test of Functional Health Literacy in Adults
TCM	Traditional Chinese Medicine
US	United States
WHO	World Health Organization

## **Abstract**

The purpose of this study was to examine relationships between acculturation and oral health behaviours and attitudes among Japanese immigrants in Greater Vancouver, British Columbia, Canada. This cross-sectional study used three questionnaires: demographic/socioeconomic questionnaire, the East Asian Acculturation Measure to measure acculturation dimensions of East Asian immigrants, and a modification of the Hiroshima University-Dental Behavioural Inventory to evaluate oral health behaviours and attitudes. Data were analyzed using descriptive statistics, Spearman and Pearson correlations, independent t-tests, and multiple linear regression analysis. Forty-eight eligible Japanese immigrants participated. There was an inverse association between age and assimilation ( $r=-.392$ ,  $p=0.01$ ). Income was significantly associated with oral health behaviors/attitudes ( $r_s=.287$ ). Marginalization ( $p=0.02$ ) was the only significant predictor of HU-DBI. Separation was suggestive of a prediction ( $p=0.05$ ). In conclusion, improvement in oral health behaviours and attitudes in Japanese immigrants is needed. A relationship exists between acculturation and oral behaviours/attitudes.

## **Chapter I: Introduction**

### **Introduction**

Acculturation is one of the major factors that influence general and oral health when people move from their home countries to other countries, especially from less developed to more developed countries (Lassetter & Callister, 2009; Gao & McGrath, 2011). Although there has been extensive research in acculturation and general health for over 40 years, there are limited studies published regarding acculturation and oral health. Nonetheless, the influence of acculturation on oral health has received attention in recent years (Gao & McGrath, 2011).

When people migrate from their native countries to other countries, they are exposed to new and sometimes unfamiliar cultures. The term *acculturation* refers to the “phenomena when groups of individuals having different cultures come into continuous first hand contact, with subsequent changes in the original culture patterns of either or both groups” (Redfield, Linton, & Herskovits, 1936, p. 149). Berry (2003) observed that people experience four possible acculturation outcomes after they reside in new countries for a period of time: assimilation (adoption of the dominant culture), separation (reconfirmation of the traditional culture), integration (combination of the two cultures), or marginalization (detachment from both cultures). Based on these constructs, Barry (2001) developed the East Asian Acculturation Measure (EAAM) as a useful tool for researchers and clinicians to investigate the acculturation patterns of East Asian immigrants. These different outcomes and levels of acculturation are important indicators in assessing health-related knowledge, attitudes, beliefs and practices that possibly influence health status, the utilization of the healthcare system, and clinical

outcomes. Mariño, Stuart, Wright, Minas, and Klimidis (2001) found that focusing on cultural factors might be more important than focusing on immigrants' socioeconomic status (educational level, employment status, or language) when developing public health programs or treatment approaches.

Oral health disparities exist in subpopulation groups including, First Nation populations (indigenous people), the elderly, and new Canadians (landed immigrants) in Canada (Asadoorian, 2009). These disparities often are observed as differences in dental caries rates, periodontal disease, tooth loss, edentulism, oral cancer, and tobacco use. Although strategies for improving general and oral health outcomes have been identified and implemented, these disparities continue (Charbonneau, Neufeld, Craig, & Donnelly, 2009). Based on findings from two recent studies, certain ethnic groups in the United States, for example, had higher levels of oral disease without regard to income level (Kreps, 2006; Vazquez & Swan, 2003). Charbonneau et al. (2009) stated that addressing level of income and access to care might only be part of health disparity problems. Researchers have explored differences in cultural values, how different ethnic groups view dental professionals in oral care settings and access to oral care (Dong, Loignon, Levine, & Bedos, 2007; Lai & Chau, 2007).

The literature indicates that different levels of acculturation have affected immigrants' oral health. For example, one study found that immigrant students in Canada had less frequent dental visits and poorer oral health status, including gingivitis and caries, than Canadian-born students. However, immigrants who had been in Canada more than six years had better oral health than those who migrated less than two years prior to the study (Locker, Clarke, & Murray, 1998). Mariño et al. (2001) studied

acculturation and oral health in depth. They observed that immigrants with a medium level of acculturation had significantly higher decayed, missing, and filled surfaces (DMFS) scores than those with low or high acculturation as both original and mainstream cultures may have protective effects on oral diseases.

### **Statement of the Problem**

To date, there have been insufficient studies published regarding acculturation and its impact on oral health care behaviours and attitudes. An investigation of a relationship between different acculturation patterns and oral health care behaviours and attitudes, therefore, is needed to identify potential factors that may ultimately clarify the complex relationship between acculturation and oral health.

### **Purpose(s) of the Study**

The purpose of this study was to examine relationships between different acculturation patterns and oral health behaviours and attitudes among Japanese immigrant populations in Greater Vancouver, British Columbia (BC), Canada.

### **Significance of the Work**

As mentioned, immigrants in Canada have exhibited oral health disparities. Dental hygienists should be able to positively impact these disparities through advocating for policy changes, performing preventive interventions, providing oral health education, including cancer screenings or tobacco cessations, and providing oral health education for other health professionals who deliver their services to underserved populations.

Because dental hygienists are responsible for reducing barriers to care for ethnic minorities by providing culturally appropriate care, knowledge of psychological and behavioural acculturation may provide essential information for public health programs

and practitioners. Researchers and dental professionals may be able to identify factors that influence different patterns of acculturation and are linked to specific oral health behaviours and attitudes, leading to an improvement in culturally-related oral health behaviours and attitudes of ethnic minority groups.

This study addressed one of the pillars of the Canadian Institute of Health Research (CIHR): Social, Cultural, Environmental and Population Health (Canadian Dental Hygienists Association [CDHA], 2003). As examples of research areas associated with this pillar, the CDHA (2003) indicated social and economic impact of oral health and disease on populations, barriers and opportunities for oral care for all populations, and cultural and linguistic relevance of dental hygiene services. This study addressed one aspect of these research areas that focus on social, cultural environmental and population health rather than traditional biomedical and clinical research. Focusing on this pillar followed a trend of oral health research in Canada away from the cellular level and towards a focus on individual/population health (CDHA, 2003).

As a result of dissemination of the findings of this study, awareness of patterns of acculturation and oral hygiene behaviours and attitudes of immigrants may increase among dental hygienists. Ultimately, dental hygienists may utilize the findings from this study in their patient care and education.

### **Research Question(s)**

- Are patterns of acculturation in Japanese adult immigrant populations in Greater Vancouver, BC, Canada related to self-reported oral hygiene behaviours and attitudes scores?

### **Research Hypothesis**

- There will be a relationship between patterns of acculturation as measure by the EAAM and oral hygiene behaviours and attitudes as measured by a modified version of the Hiroshima University-Dental Behavioural Inventory (HU-DBI) in Canadian immigrants of Japanese origin.

## **Definitions**

***Acculturation.*** Phenomena when groups of individuals having different cultures come into continuous first hand contact, with subsequent changes in the original culture patterns of either or both groups (Redfield et al., 1936, p. 149).

***Patterns of acculturation.*** Framework of acculturation that consisted of assimilation (adoption of the dominant culture), rejection (reconfirmation of the traditional culture), integration (combination of the two cultures), or marginalization (detachment from both cultures; Berry 2003). This variable was measured by the East Asian Acculturation Measure (EAAM) to explore patterns of acculturation in this study.

***East Asian adult immigrant populations.*** East Asian countries include People's Republic of China, Hong Kong, Japan, North Korea, South Korea, Macau, Mongolia, and Taiwan (Statistics Canada, 2010). The study focused on adult populations who are over 18 years of age and Japanese immigrants in Canada.

***Self-reported oral hygiene behaviors and attitudes.*** A quantitative survey evaluation of one's dental health attitudes, perceptions, and behaviours (Kawamura, 1988). These variables were measured by a questionnaire developed by Makoto Kawamura the HU-DBI which contains 20 items related to tooth-brushing behaviours and perception about one's oral health (Kawamura, 1988). The researcher, however, modified the HU-DBI using five-point Likert-type scale (5=strongly agree, 4=agree,

3=no opinion or uncertain, 2=disagree, 1=strongly disagree) rather than categorical responses of yes and no for this study in order to measure different degrees in response for each question.

***Greater Vancouver.*** Greater Vancouver includes many cities in the province of British Columbia of Canada. The name of these cities are West Vancouver, District of North Vancouver, North Vancouver city, University Endowment Lands (UEL), Vancouver, Burnaby, Bel Carra, Anmore, Port Moody, Coquitlam, Port Coquitlam, New Westminster, Pitt Meadows, Maple Ridge, Richmond, Delta, Surrey, City of Langley, White Rock, and Township of Langley (Canada Immigration Lawyers and Corporate Intra Company Transfer Services, n.d.).



## **Chapter II: Literature Review**

This literature review provides a discussion regarding the importance of oral health behaviours and attitudes of adult immigrants. Subtopics include: (a) acculturation related to general health, (b) acculturation related to oral health, (c) oral health status and dental care utilization in Canada: native vs. immigrant populations, (d) oral health care behaviours, attitudes, and health beliefs in East Asian populations. Databases searched for this literature review included MEDLINE through PubMed and CINAHL using combinations of the following search terms: acculturation, Asian ethnicity, oral health, oral disease, behaviours and attitudes, health disparities, oral health disparities, and Canada.

### **Acculturation Related to General Health**

International immigration to Canada has accelerated during the last century. In 2012, Canadian immigration accepted 257,887 new permanent residents and this number was greater than the average number of immigrants for the five-year period from 2008 to 2012: 257,000 (Government of Canada, 2013). According to the World Bank (2013), more than 215 million people live outside their birth countries. As a result, ethnic and racial diversifications exist in many different countries (Martin & Midgley, 2006). Immigrants normally encounter new cultures when moving from countries of origin to other countries.

Lassetter and Callister (2013) conducted a systematic review to identify the impact of migration on the general health of immigrants in Western societies. Fifty-eight research studies, six literature reviews, one unpublished doctoral dissertation, and one meta-analysis were selected. The review revealed that some migrants were categorized

as being in good health based on mortality rates and life expectancy, birth outcomes, and risk of illness; however, other migrants experienced poor health as evidenced by patterns of deteriorating health, coronary heart disease, elevated body mass index (BMI), elevated blood pressure (BP), and depression. The authors identified factors that were either positively or negatively associated with migrants' health as follows:

- Length of residence and acculturation;
- Disease exposure;
- Lifestyle and living conditions;
- Risky behaviour (drinking and smoking);
- Health habits;
- Social support networks;
- Cultural and language barriers;
- Experiences with racism; and
- Lack of awareness of cultural health beliefs and practices among health care providers (Lassetter & Callister, 2013, p. 99).

In their recommendation for practice, the authors suggested that health care providers should engage in breaking barriers through a systematic approach such as policy making, establishment of equal health care access of migrants, and promotion of culturally adapted health habits (Lassetter & Callister, 2013).

Another systematic literature review (N=72) by O'Driscoll, Banting, Borkoles, Eime, & Polman (2013) examined the relationship between sport and physical activity participation and acculturation in culturally and linguistically diverse (CALD) migrant populations. Among the 72 studies, six were interventions, 18 were qualitative and 48

quantitative studies since 1990. The purpose of this study was to summarize recent research of relationships between sport and physical activity participation and CALD migration populations. The review revealed that high acculturation was associated with increased sport and physical activity by females. Moreover, O'Driscoll et al. found that psychosocial correlates (self-efficacy, social support, and one's attitudes) were consistently associated with higher levels of physical activity across the literature. Environmental and organizational factors such as accessibility to information and facilities, time issues, safety, geographic isolation, weather, and cost also affected sports participation and physical activity rates. O'Driscoll et al. made recommendations for future research. They pointed out that a lack of research on sport participation exists as well as a lack of "a clear understanding and approach to researching CALD migrant groups" (p. 6). They also asserted that the concept of acculturation was not comprehended well in the research field, and it was difficult and complex to develop a valid instrument to measure acculturation.

Delavari, Sønderlund, Swinburn, Mellor, and Renzaho (2013) conducted a systematic literature review regarding acculturation and obesity in immigrants. The focus of the study was to identify the relationship between acculturation and overweight/obesity in adult immigrant populations from low/middle to high income countries. The authors reviewed only the literature that used a standardized acculturation scale (unidirectional or bidirectional models). Nine papers were selected; eight studies were cross-sectional, while one study was longitudinal. Six studies identified that there was a positive association between acculturation and body mass index (BMI) in adult immigrants who migrated from low/middle to high income countries. Conversely, three

studies included in this systematic review indicated that highly acculturated immigrants experienced unhealthy weight gain particularly in men. The relationship between acculturation and obesity seemed to be more complex in women than men as both positive and negative relationships were observed among women (Delavari et al., 2013).

In conclusion, the authors emphasized that the use of standardized acculturation scales was important because consistent findings were not observed through using a proxy measure of acculturation. Future research should include analysis of gender, socioeconomic status, diet, physical activity, or body size perception in order to enhance understanding interaction of obesity and acculturation, and interventions for weight management. Also, a study of protective factors of enculturation that includes positive parts of both traditional and host culture should be included in the future research (Delavari et al., 2013).

A longitudinal cohort study involving a Latino population assessed the association between immigrant generation and diabetes risk (Afable-Munsuz, Mayeda, Pérez-Stable, & Hann, 2013). The purpose of this study was to examine whether there was a significant association between aging Mexican-origin generations including first to third generations and diabetes risk by using data collected from the Sacramento Area Latino Study on Aging (SALSA). Subjects of this study were participants of the SALSA cohort study between 1997 and 2008. Subjects (N=1789) who were over 60 years old had a single two-hour interview about their lifestyle, acculturation, and medical diagnoses. The interviewers also collected anthropometric measurements and blood samples to measure lipids, antioxidants, glucose, and insulin levels. To measure acculturation, the authors

used the Acculturation Rating Scale for Mexican-Americans II scale (Afable-Munsuz et al., 2013).

The authors found that when socioeconomic status and lifestyle were not adjusted, diabetes risk was significantly higher in US-born third generation immigrants (OR=2.09) than in first generation immigrants (OR=1.00). However, there was an opposite association between acculturation and diabetes risk in the adjusted model of socioeconomic status and lifestyle. The subjects with higher US acculturation displayed somewhat lower diabetes rates (OR=0.88). After adjusting for socioeconomic status and lifestyle, a significant association was still observed between generation and diabetes risk (OR=2.00 for third generation), but the association between acculturation and diabetes risk was no longer significant (OR=0.95; Afable-Munsuz et al., 2013). This finding suggested that there was a contraindication between more generations in the US and higher acculturation in risk of diabetes. Acculturation of migrants might play an important role in risk of diabetes rather than generation in the US.

In order to assess immigration in depth, the authors recommended family intergenerational studies, prospective cohort studies of new immigrants, and binational studies of migrants and their non-immigrant counterparts. In addition, acculturation was measured through a short adaptation of a previously validated scale. However, it is vague whether using an extensive scale would be practical (Afable-Munsuz et al., 2013).

As a summary of the findings of acculturation and general health, researchers need to continue further investigations of the relationship between acculturation and general health in immigrants because acculturation positively and negatively influences general health and its behaviours. Findings indicated that demographic and

socioeconomic factors, lifestyle, and acculturation including length of residency were influential factors in general health, diabetes rates, and sport and physical activity participations. However, there was a disagreement in the findings regarding associations between acculturation and BMI and acculturation and diabetes rates in immigrants with gender, socioeconomic status and lifestyle being potential influencing variables. Therefore, researchers need to continue to explore the relationship between acculturation and general health of immigrants.

### **Acculturation Related to Oral Health**

Several researchers identified that acculturation impacts oral health. Gao and McGrath (2011) conducted a systematic review on the oral health impacts of acculturation. They evaluated the quality of published studies of oral health impacts of acculturation through five electric databases (PubMed, Medline, Web of Science, Cochrane Library, and PsycINFO) from 1980 to 2009 and summarized those findings. The authors selected 27 studies conducted among Hispanics, other immigrants or ethnic group in the United States, and in other countries. The age of participants was from two to 70 years old. All these studies included cross-sectional, longitudinal studies, qualitative, and quantitative studies. Random and convenience sampling were utilized in those studies. Acculturation measures included single indicator (language, country of birth, age at immigration, and length of residence), combination of these indicators, and acculturation scales.

The authors found that there was “a positive association between at least one acculturation indicator and utilization of dental services” in 16 of 27 studies included in the review (Gao & McGrath, 2011, p. 204). The indicators included dental insurance

coverage, English proficiency, and length of residence in the US. The subjects who had dental insurance coverage, were English-speakers, and resided longer in the US, used dental services more than the subjects who did not. Furthermore, the authors determined that 15 of the 27 studies regarding the association between acculturation and oral diseases (caries and/or periodontitis) indicated positive impacts of acculturation on oral health. Acculturation as measured by language, country of birth, age at immigration, and length of residence was positively associated with caries and periodontitis (Gao & McGrath, 2011). In other words, high English language proficiency, being born in the US, younger age at immigration, and longer residence in the US were positively associated with oral health. People with a medium level of psychological acculturation, however, were most susceptible to oral disease (Mariño et al., 2001).

The authors stated that adjustment of other confounders or risk factors should be considered in future studies of use of dental services. They also mentioned that other oral conditions such as oro-facial pain or oral cancer should be incorporated in the analysis to better understand the impact of acculturation on oral health. The authors identified limitations of current evidence. They stated that multidimensional scales have not been used in dental studies and identified a lack of study of impacts of acculturation on oral health self-care behaviours and oral diseases and conditions. Further, they recommended that future research include qualitative studies, studies of oral health behaviours and diseases, and use of multidimensional acculturation scales and multivariate analytical approaches (Gao & McGrath, 2011).

Spolsky, Marcus, Coulter, De-Martirosian, and Atchison (2000) conducted a study of a Hispanic population in Los Angeles in order to validate the Oral Health Status

Index (OHSI) in a minority population. The primary purpose of this study was to investigate the relationship between the OHSI and factors associated with oral health as well as epidemiologic, demographic, and behaviour variables. The study population included Hispanics living in Los Angeles who were over 12 years old and immigrated originally from Mexico and Central and South America. The participants were recruited through flyers in English and Spanish at low-income medical and dental offices. In total, 279 participants received an extra-intra-oral examination (Decayed, Missing, and Filled Tooth Index [DMFT] and periodontal exam), completed demographic and behavioural questionnaires, and had OHSI score recorded (Spolsky, Marcus, Coulter, De-Martirosian, & Atchison, 2000).

Through bivariate analysis, the authors found that four of the five demographic variables were statistically significant ( $p < 0.05$ ). Increasing age was associated with lower OHSI. Increasing level of education and income were associated with higher OHSI. Central/South America born Hispanics had significantly lower OHSI score than the Mexican-born participants. Three of four behavioural variables were statistically significant ( $p < 0.05$ ) indicating better status among the participants who drank alcohol, flossed, and were highly acculturated.

Of three multiple regression models, only the epidemiologic predictors were used in the first regression model. It revealed that percentage of Decayed Teeth/Decayed, Filled Teeth, number of replaced teeth/missing teeth, and millimeters of mesial attachment loss were statistically significant ( $p < 0.001$ ). These disease indicators explained 47.48% of variance in the regression. The demographic variables were added to the epidemic predictors, and the results indicated that age ( $p < 0.04$ ), gender ( $p < 0.0133$ ),



and place of birth ( $p < 0.0016$ ) were statistically significant, findings that explained 51.61% of variance in the OHSI. Lastly, the behavioural variables were added to the third regression model. None of the behavioural variables (alcohol use, tobacco use, and flossing/brushing) were statistically significant (Spolsky et al., 2000). Spolsky et al. concluded that the OHSI was validated in this study through epidemiologic and demographic variables.

Mariño et al. (2001) conducted research regarding acculturation and dental health of the Vietnamese in Australia. The purpose of this study was to investigate the role of two major acculturation factors (behavioural and psychological) that might have influenced oral health status and oral health knowledge and behaviours of members of the Vietnamese population. Vietnamese-born subjects ( $N=147$ ) who were at least 18 years old and lived in suburbs of Melbourne, Australia participated in the study. Behavioural acculturation included social skills, language usage, life styles, and the ability to accommodate oneself to new culture. Psychological acculturation, however, was made up of a more complex process that was related to “the degree of consensus with defined norms, basic values, ideologies, beliefs, attitudes and preference of the majority of the group” (Mariño et al., 2001, p. 108). The study consisted of three parts: two surveys and an oral examination. The authors used the Psychological Behavioural Acculturation Scale (P-BAS) and self-assessed oral health status, the use of dental services, oral hygiene practices and oral health knowledge. The oral examination consisted of an evaluation of dental (decayed, missing, filled surface [DMFS] index) and periodontal status.

The range of scores for behavioural acculturation was from one to five. The mean score of this category of Vietnamese immigrants was 2.36 and its distribution was skewed toward higher acculturation scores. With 0.00 being the average psychological acculturation score of an imaginary Anglo-Celtic sample, the average score of Vietnamese sample was -1.52. In the dental caries history section, the subjects who were older than 54, and did not work outside home had the highest DMFS score ( $p<0.001$ , DMFS=61.54). On the other hand, the subjects who were acculturated behaviourally at medium to high levels, were younger than 35 and did not work outside home had the lowest DMFS score ( $p<0.001$ , DMFS=7.64). In the oral health knowledge section, the subjects who were younger than 25 and highly psychologically acculturated had the highest oral health knowledge ( $p<0.001$ , Know=2.03). The participants who were psychologically acculturated at a medium level had the lowest oral health knowledge ( $p<0.001$ , Know=0.73). In regards to dental visits, the participants who (a) were older than 35 and lived less than 21% of life in Australia ( $p<0.001$ , Visit=70.4%), and (b) were older than 35, lived more than 20% of life in Australia, and were highly psychologically acculturated ( $p<0.001$ , Visit=72.7%) visited dental offices most often. The subjects who were older than 35, lived over 20% of life in Australia, and had low level of psychologically acculturation visited dental offices the least ( $p<0.001$ , Visit=18.2%).

Mariño et al. (2001) found that acculturation was related to occupation, age, level of education and immigration variables. Acculturation also was related to all three oral health outcomes: oral health knowledge, dental visits, and dental caries history. Additionally, acculturation is a primary factor in analyzing immigrants' oral health because it may reveal variations in socio-economic indices especially for oral health

knowledge and dental visits. The influence of acculturation was less obvious in evaluation of dental status. These researchers identified that the moderately psychologically acculturated group tended to have higher DMFS indices than lower or higher acculturated groups who had better oral health status. Those immigrants who were in moderately acculturated also had less dental knowledge than other immigrants. The authors mentioned acculturation as a predictor of high risk for general and dental health. They also considered that analyzing acculturation, especially in less psychologically and behavioural acculturated groups, as a predictor may help identify which cultural aspects are accountable for which outcomes. Limitations included that the subjects were from a relatively homogenous social group in Melbourne, were able to access oral health services and were eligible for free health and dental care. These limitations may have positively influenced the outcome of the study. Mariño et al. (2001) concluded that focusing on socio-economic/demographic aspects of immigrants and immigration variables might not be enough to change oral health status of immigrants.

Cruz, Chen Salazar and Le Geros (2009) investigated the association of immigration and acculturation related to oral health in immigrants.

The purpose of this study was to assess whether oral health is affected by country of origin, length of stay, language preference, and age at immigration. Subjects between 18 and 65 years old who were born outside the United States were recruited for participation in this study. Recruitment occurred at community-based organizations, churches, and other social and political groups of immigrant people in New York City. The 1,318 participants completed a self-administered questionnaire that included information of socio-demographics, access and use of dental services, oral health

practices, self-perceived oral health, self-perceived oral health care need, immigration status, oral health knowledge, and attitudes towards oral health. Researchers conducted oral health examinations for caries and periodontal status based on the National Institute of Dental and Craniofacial Research examination criteria. The clinical indices included “one set of caries experience” (decayed, missing, and filled surface [DMFS], missing tooth surface [MS], and ratio of decayed surfaces to decayed and filled surface [DS:DFS]; Cruz et al., 2009, p. S475) and “one set of periodontal experience” (the percentage of sites with periodontal pockets deeper than four millimeters and the percentage of sites with attachment loss of more than four millimeters; Cruz et al., 2009, p. S475).

The followings statements summarize findings:

- 1) Immigrants’ country of birth seemed to play an important role in oral health experience.
- 2) There was a negative association between length of stay in the United States and dental treatment need as measured by DS:DFS (OR=0.34).
- 3) Age at immigration was positively associated with having a higher level of caries and need of dental treatment (OR=2.64), more severe periodontal disease scores (OR=1.78 for % of sites with pocket depth  $\geq 4\text{mm}$ , OR=2.08 for % of sites with attachment loss  $\geq 4\text{mm}$ ).
- 4) There was no correlation between preferred languages spoken and caries indices or periodontal indices.

Findings imply that immigrants' country of birth, length of stay in the US, and age at immigration are related to oral health including caries and periodontal conditions of immigrants; however, language use was not associated with immigrants' oral health.

As limitations, Cruz et al. (2009) pointed out that the subjects were not representative of immigrants as measured by the US Census Bureau in terms of socioeconomic characteristics. Also, since the survey gathered self-reported information, there may be recall bias and interviewers might influence the participants' answers. As a recommendation for future research, Cruz et al. (2009) indicated that quantitative and qualitative studies will be needed to clarify relationships of ethnicity, income, education, biology, and culturally associated behaviours which affect immigrants' oral health (Cruz et al., 2009).

Geltman et al. (2013) conducted a cross-sectional survey using a convenience sample of Somali refugees in Massachusetts. They investigated the impact of health literacy and acculturation on participants' oral health conditions. The researchers hypothesized: Participants with high health literacy would have (1) less history of decay, untreated decay, and periodontal disease, (2) a higher rate of traditional or Western personal hygiene practices and behaviors and as a result, they have better oral health conditions, and (3) more use of professional dental preventive services. They also evaluated other factors related to functional and mental health outcomes, social and cultural determinants, acculturation, and oral health conditions and practice (Geltman et al., 2013).

Geltman et al. (2013) collected information regarding the health literacy of 439 Somali refugees 18 years or older who had lived in the US less than ten years. Data were

collected using extended qualitative interviews and the Short Test of Functional Health Literacy in Adults (STOFHLA), Oral Health Quality of Life Instrument, a revised Haitian Acculturation Scale, and other health related questionnaires. They also examined participants' oral health status (caries assessment and periodontal assessment).

The results showed that participants with lower health literacy, as measured by STOFHLA, were more likely to be less acculturated, female, and older, Bantu (a minority ethnic group), had no education or, Medicaid. They were also less likely to brush more than once a day and more likely to use traditional stick brush. Oral diseases were more prevalent in the participants with no education, Somali ethnicity, and lower income levels. Higher DMFT scores were observed in women and periodontal diseases were prominent in men. In the bivariate analysis, higher DMFT scores were seen in the low-literacy group ( $p=0.085$ ). In the adjusted analysis, in the participants who lived in the US less than five years, lower health literacy was associated with lower DMFT ( $p=0.02$ ).

On the other hand, among the participants who lived in the US more than five years and less than ten years, lower health literacy was correlated with higher DMFT ( $p=0.01$ ). In the unadjusted analysis, there was no association between health literacy and untreated decay. The participants with low acculturation had untreated decay 2.75 times more than those with high acculturation ( $p=0.01$ ). The participants with medium acculturation were not significantly different from those with high acculturation. Bivariate analysis did not indicate significant association between health literacy and periodontal disease (Geltman et al., 2013).

Findings indicated that overall, Somali refugees' oral health, including DMFT and periodontal disease was better than the general US adult population. The subjects who

lived in the US less than five years and with low health literacy displayed better oral health conditions (lower DMFT). Geltman et al. (2013) stated that this finding may be due to less exposure to and/or active avoidance of refined sugar by Somali immigrants in the US. However, the participants who lived in the US more than five years and less than ten years indicated that lower health literacy was associated with increased mean DMFT scores as the authors predicted in the hypothesis. The results of qualitative interviews supported the hypothesis of a relationship between untreated decayed teeth and health literacy level.

Finally, Geltman et al. (2013) stated that the oral health condition of the subjects was very good. Somali participants with low STOFHLA demonstrated low DMFT initially, but the DMFT increased after those people lived in the US more than five years. They also emphasized oral health promotion and prevention for Somali refugees that focus on the importance of limiting refined sugar intake, frequent brushing, and dental visit, and continuing traditional practices such as stick brush, cleanliness rituals before prayer (Geltman et al., 2013).

In summary, the findings of studies regarding acculturation and oral health indicate a need for further exploration, as the findings were ambiguous. Findings demonstrated that length of residency and proportion of life in host countries, age at immigration, languages, countries of birth, socioeconomic status, cultures, traditional health beliefs, and ethnic differences between the patients and service providers were important factors in acculturation. There was a disagreement in the findings of levels of acculturation and DMFS, the length of stay in the US and dental treatment needs, and English proficiency and oral health status. Future research should include a study of the

impacts of patterns of acculturation on oral health and self-care behaviours, and a variety of oral diseases and conditions in order to provide better information for effective delivery of oral health interventions and reducing oral health disparities. There have been several acculturation studies in Western countries: Australia, Canada and the US; however, there are limited or no studies published based on the East Asian immigrant populations in Canada. Therefore, a study of acculturation and oral health self-care behaviours of immigrants in Vancouver, BC may reveal new findings and add information to the existing body of knowledge.

### **Oral Health Status and Dental Care Utilization in Canada: Native versus Immigrant Populations**

This section describes the general/oral health status and dental care utilization of foreign-born East Asian immigrants in Canada as well as foreign-born in their home countries and Canadian-born populations in Canada. The findings of previous studies regarding the oral health status and dental care utilization in Canada and in original countries of immigrants are inconclusive. The oral health status and utilization of dental services by Canadian and immigrant populations may be attributed to not only socioeconomic status, but also other factors such as duration of residence in Canada, the place of birth, use of dental public programs, availability of dental insurance, fear, language barriers, cost of dental care, or cultural competency of service providers. In addition, oral health status and dental care utilization seem to interact with each other. Therefore, it is difficult to draw definite conclusions from previous studies describing oral health status and dental care utilization.



Dunn and Dyck (2000) investigated social determinants of health among immigrants in Canada by using data from the 1994-95 National Population Health Survey (NPHS) which consisted of information from telephone interviews. These researchers conducted a cross-sectional study to “(a) examine differences in health status and health care utilization between immigrants and non-immigrants, immigrants of European and non-European origin, and immigrants of less than 10 years and more than 10 years residence in Canada, (b) examine the social determinants of health care utilization and health status in immigrants and non-immigrants, and (c) evaluate the utility of large-scale, national databases for these purposes” (Dunn & Dyck, 2000, p. 1574). Their survey questions included four self-reported variables: health status, presence of chronic conditions, overnight hospitalization, and unmet need for care. The NPHS samples were limited to 2,297 immigrants and 13,482 Canadian-born residents, all aged 20 years or more. The analysis of the immigrants and Canadian-born samples consisted of (a) a description of the socio-economic characteristics; (b) differences in three different sub-groups: immigrants versus Canadian-born; country of origin; and duration of residency in Canada; finally, (c) a logistic regression analysis to investigate concurrent influence of a variety of socio-economic characteristics, coping and stress indicators, and immigration characteristics on health outcomes.

Results of this study by Dunn & Dyck (2000), based on the logistic regression analysis revealed that socio-economic factors were possibly more important to health status and health care access for immigrants than non-immigrants. Being in the highest income bracket, single, a single parent, and well-educated were especially associated with better self-rated health status. Among immigrants, the respondents who were from Asia,

Africa, or South America were less likely to state that their health status was excellent or very good, while those from Europe, Australia, the United States, and Mexico reported their health status oppositely. Older immigrants were more likely to report chronic health conditions than older non-immigrants. Among immigrants, well-established immigrants (immigrants who lived in Canada more than 10 years) reported more chronic conditions than less well-established immigrants. This finding may be attributed to the older age of well-established immigrants. Dunn and Dyck (2000) concluded that the logistic regression models, which measured four outcome variables of immigrants and non-immigrants, demonstrated that socio-economic factors were more important for health status of immigrants than non-immigrants.

Dunn and Dyck (2000) recommended a longitudinal study design that will allow evaluation of socio-economic aspects of pre- and post-immigration health care. Furthermore, larger samples of people from different places and social circumstances were recommended for studies to draw meaningful conclusions about immigration and social determinants of health. Most researchers acknowledged that social gradient was not about income levels; however, in order to investigate other factors in addition to income per se, Dunn and Dyck believed that more theoretical research was needed.

Locker et al. (1998) conducted a study regarding the oral health status of Canadian-born and immigrant adolescents in Ontario, Canada. The purpose of this study was to compare the oral health status of Canadian-born and immigrant adolescents based on length of residence in Canada and dental visiting pattern. Although the study was conducted more than 15 years ago, it is included this literature review as a part of past

findings because of its direct relationship to Canadian immigrants and oral hygiene, the topic of this review.

The subjects of this study were 13- to 14-year-old students (Grade 8) who lived in the City of North York, Ontario. The response rate to the survey was 87.5% (N=721). The collected data consisted of two parts: a self-completed questionnaire and a clinical examination conducted by two dental hygienists. The length of residence of immigrants in Canada was divided into three timeframes: “i) students who immigrated to Canada six or more years ago, ii) students who immigrated between three and five years ago, and iii) those who immigrated within the preceding two years” (Locker et al., 1998, p. 178). As the clinical examination was conducted, the dental hygienists reported the oral health status as measured by indices for debris and calculus, gingivitis using the Gingival Index of Loe & Silness, and caries using decayed, missing and filled teeth (DMFT).

Locker et al. (1998) found that more immigrant students had poor oral hygiene, gingivitis, and caries than Canadian-born students. While 15% of the immigrant subjects had dental decay, only 4% of the non-immigrant subjects had dental decay ( $p < 0.001$ ). Additionally, students who immigrated less than two years ago (28%) used dental services less than students who immigrated over six years ago (55%;  $p < 0.001$ ; Locker et al., 1998). Although Canadian-born students showed similar oral health status to those immigrant students who had been in Canada for six years or more, there was a significant difference in the oral health status between Canadian-born and those who had been in Canada less than two years. This finding implied that the longer the immigrant students resided in Canada, the better their oral health status became. The authors attributed

immigrant students' oral health status differences to the use of dental public programs and school preventive services after arrival in Canada (Locker et al., 1998).

Newbold and Patel (2006) conducted a study about use of dental service by immigrant Canadians. The purpose of this study was to compare utilization of dental services in immigrants and in Canadian-born populations and to analyze factors that were related to dental visits. The authors used data from Statistic Canada's National Population Health Survey (NPHS) for this study. The target subjects of the NPHS were 12-year-old or older residents across Canada except people who lived on reserves, on Canadian Forces bases, and in remote areas. Ninety-five percent of interviews were conducted through telephone and the other 5% were conducted in person. The NPHS gathered information regarding socio-demographic and socioeconomic characteristics, lifestyle, and health care utilization from each household. Newbold and Patel (2006) focused on utilization of dental services and reasons for the visits. Descriptive and multivariate statistics were used to analyze collected data.

The study revealed that without adjusting other factors such as age, sex, and the presence of dental insurance, similar rates of the use of dental services in the past year existed among immigrants and native-born Canadians (58.4% versus 57.0% for immigrants and native-born respectively,  $p=0.09$ ). However, more immigrants visited a dentist than Canadian-born populations ( $OR=1.18$ ) when logistic regression was used to determine the probability of dental service utilization, controlling for all other factors such as age, sex, and education. In addition, significant difference existed in the use of dental services within the immigrant groups based upon length of time since immigration. Only 40.9% of immigrants who lived in Canada for less than five years visited a dentist

in the previous year although more than 60% of immigrants who resided in Canada for more than 10 years visited a dentist. Also, more native-born Canadians sought preventive care than immigrants (37.5% versus 33.4%). Furthermore, new immigrants (lived in Canada for less than four years) were less likely to visit a dentist than immigrants who lived in Canada five years or more. Possible reasons for this difference were social acceptability, adaptation, increasing awareness of dental resources, income, and insurance. This finding agreed with the finding of Locker et al. (1998) based on the same NPHS data. Regarding ethnicity differences, Asian immigrants tended to visit a dentist less than European immigrants. The finding agreed with the finding from Dunn and Dyck (2000).

Calvasina, Muntaner, and Quiñonez (2014) conducted a study about unmet dental care needs of Canadian immigrants. Researchers investigated factors associated with unmet dental care needs of recent immigrants to Canada over a three-and-one-half year period. Calvasina et al. (2014) used three waves of Statistics Canada's Longitudinal Survey of Immigrants to Canada (LSIC) in order to explore immigrants' unmet dental care needs. Data were collected at six months (wave 1), two years (wave 2), and four years (wave 3) after immigration (p. 146). The survey included questions regarding socio-economic status, housing, language skills, values and social attitudes, social support, health status, access, and utilization in more than 15 languages. The study sample (N=2,216) included immigrants who were aged between 18 and 60, had never lived in Canada nor in a third country, did not have refugee status, and reported dental problems. Independent variables were socio-demographic (age, sex, marital status, and ethnicity), socio-economic (education, history of social assistance, dental insurance

coverage, employment status, and average household income), and official language proficiency (self-reported proficiency in writing, reading, and speaking English or French).

The bivariate analysis showed that immigrants with less than high school education, an average household income of less than \$20,000, a history of social assistance, experience of unemployment, and no dental insurance were more likely to have an unmet dental care need when compared to their counterparts. In addition, immigrants who were older than 40 years of age and were African/Arabic/Middle Eastern, South Asian, or Chinese tended to have an unmet dental care need. Also, very good and good language proficiency was negatively associated with unmet dental care needs over time. However, sex and marital status were not associated with an unmet dental care need. The first model of multiple logistic regression analysis revealed that “average household income, educational level, ethnicity and age remained statistically significant after controlling for all covariates” (p. 149). On the other hand, when the dental insurance was included as a variable in the second model, age groups became no longer significantly associated with unmet dental care needs and other variables (ethnicity, education levels, and average household income) as they had been in the first model. Not having dental insurance was significantly associated with unmet dental care needs. The findings from this study were consistent with Newbold and Patel that having dental insurance was an important factor of immigrants’ dental service use.

As limitations, Calvasina et al. stated that they performed a cross-sectional analysis instead of a longitudinal analysis because there were no information of unmet dental care in the first multiple regression analysis and no significant changes “in the

proportion of immigrants who reported unmet dental care needs between wave 2 and 3” (p. 152). Additionally, the study was self-reported of unmet dental care needs rather than clinical oral examinations. Therefore, it may lead underestimation of clinically determined dental care needs. Lastly, the survey results were derived from the participants who migrated in 2001 although Calvasina et al. believed that the study results indicated the most recent and accurate information of unmet dental care needs among immigrants in Canada. Calvasina et al. concluded that immigrants who have no dental insurance and low annual household income were more likely to report unmet dental care needs than those with dental insurance and higher income. Moreover, Chinese and South Asian immigrants had more unmet dental care needs than Europeans.

Dong, Levine, Loignon, and Bedos (2011) interviewed Chinese immigrants in Montreal, Canada regarding use of dental services to identify how Chinese immigrants accessed dental care services and what kind of difficulties they encountered when they sought dental treatment. This study included 12 participants who were members of the Montreal Chinese community. They were Chinese people who were born in China, lived in Montreal, and were over 20-years of age.

Semi-structured qualitative interviews were utilized during in one-on-one sessions from January to June in 2005. The contents of the interviews were directed toward Chinese immigrants’ experiences and management of dental disease (Dong, Levine, Loignon, & Bedos, 2011).

The results of Dong et al.’s (2011) study showed that none of the subjects had sought advice from Canadian dentists for check-ups; however, almost all subjects had consulted with dentists when they had acute symptoms. They used dental services for

acute symptoms rather than preventive care. The participants were concerned that the cost of dental treatment was higher than it was in China, were uncertain about where to find experienced dentists, and were worried about limitations in communicating with dentists and cultural competency of dentists. When the subjects needed to find dentists, they asked their friends or relatives or referred to a local Chinese newspaper. They preferred dentists who had Chinese backgrounds for ease of communication and sense of shared culture. Some of the participants traveled back to China to seek advice from dentists because they believed that they could find experienced dentists easily in China. Although government welfare programs were available for immigrants, these Chinese immigrants hesitated to apply for the programs due to the humiliation of being labeled as low-income people. As a result, they avoided seeking dental care services (Dong et al., 2011).

Dong et al. pointed out limitations of the study. They stated that the sample size was small. Their samples were very specific: educated and low- or no-income first-generation Chinese immigrants who lived in Montreal. Therefore, the results may not be representative of all Chinese immigrants in Canada. The authors suggested universal dental insurance for low-income populations, dental health services provided in Chinese language, and development of cultural competency in academic dental programs or dentistry.

Although Dong et al. (2011) studied Chinese immigrants in only one Canadian city, MacEntee et al. (2012) explored oral health care of elderly Chinese immigrants in two places: Vancouver, Canada and Melbourne, Australia. The purpose of this study was to investigate how those Chinese immigrants acculturate to their host countries in terms



of oral health and subsequent service use. MacEntee et al. used audiotapes of focus groups to analyze how Chinese immigrants perceive oral health and the importance of oral care and dentistry. The researchers displayed posters in Chinese and English at community centers and were able to recruited 28 participants (four focus groups) in Vancouver and 23 participants (five focus groups) in Melbourne. The participants were aged 65 years or older and moved from China or Hong Kong to either Vancouver or Melbourne in the previous 15 years.

Although the findings addressed three categories (i.e., health and illness, dentistry, and accessing care), the author of this literature review will highlight the accessing care findings as the other two categories were about behaviours and perceptions of Chinese immigrants rather than use of dental services. In regards to financial aspects in accessing care, the cost of dental treatment was an issue for those immigrants in both locations (Vancouver and Melbourne). The participants in Vancouver were especially aware of the cost of dental care since treatment fee in Canada are 20 to 30% higher than in Hong Kong. Some participants suggested that seniors should be covered for the expense of cleaning, check-ups, and fillings. They also stated that the government should cover some expenses of making dentures based on seniors' income. Vancouver participants also argued that the government should reimburse seniors for the cost of dental treatment because oral and general health are linked each other. Participants in both locations addressed that they do not want to be burdens to their children for their dental expenses. As a result, many participants in both locations went back to their countries of origin to receive dental treatments because the cost of treatments was less expensive in China; there were no language barriers in China; and they perceived the quality of dental work in

their home countries was good. However, two participants who went back to China to treat dental problems had to be retreated in Canada. One participant completed all dental treatments before coming to Canada as he/she expected expensive treatments in Canada (MacEntee et al., 2012).

As limitations, the principle of theoretical sampling in recruiting was successful to a limited extent since the participants were moderately wealthy, well educated, and well acculturated to lifestyles and health systems in Canada and Australia. MacEntee et al. (2012) was not able to recruit immigrants who had low incomes, were less educated, and were socially isolated because they did not require information about income when they recruited the participants. In conclusion, the authors stated that the similarity of the findings in immigrants of two locations implied that distribution of information and availability of services was important in regards to experiences and perceptions of oral health of immigrants. Oral health knowledge and practices of those immigrants will be impacted by traditional Chinese culture, life, and oral health services in the host countries (MacEntee et al., 2012).

Data regarding oral health status of Japanese immigrants in Canada is scarce. The 80/20 promotion foundation, which promotes people to keep 20 or more their own teeth by the time they reach the age of 80, reported on the state of Japanese dental health in Japan (80/20 Suishin-Zaidan, n. d.) . Findings from the survey of the Actual Status of Dental Diseases that was conducted by the Ministry of Health, Labour and Welfare in Japan in 1999 indicated that the number of treated permanent teeth in 1999 had increased since the previous survey in 1993; however, females had more treated teeth than males. Although the mean number of DMF had increased from the previous survey, DMF of the

participants who were under 40-years-old had declined. Females had more missing teeth than males. More participants completed treatment than previous survey, and the percentage of persons with untreated decayed teeth decreased since last survey. Older participants (aged 80-84) had less remaining teeth than younger participants (aged 75-79), and proportion of having 20 or more their own teeth was less in older participants (aged 80-84) than in young participants (aged 74-79). The oral health status was different among the participants who were different in age and sex (80/20 Suishin-Zaidan, n. d.).

In the past, dental health initiatives in Japan emphasized decayed teeth and young children; however, in more recent years, dental health measures have focused on periodontal diseases for adults and seniors (80/20 Suishin-Zaidan, n. d.). In order to promote dental health among adults, certain municipalities and some local agents have launched oral health promotion services. Moreover, dental health guidance was added to the Dental Hygienists Law in June, 1989 to promote better dental health for those adult populations. To promote an awareness of dental hygiene among Japanese people, some projects were implemented. The examples included in the 80/20 Movement were, promotion of home dentist functions, Dental Hygiene Week, healthy teeth contests for mother and their children, and the National Dental Health Congress (80/20 Suishin-Zaidan, n. d.). Although this report was about the oral health status of Japanese in Japan, not immigrants', it may provide information regarding the oral health status of Japanese people pre-immigration to Canada or researchers may be able to compare the findings in Japan and Canada.

Oshikohji et al. (2011) conducted a more recent study of the employed Japanese adult populations in Japan. Oshikohji et al. (2011) analyzed the relationship between

workplace oral health examination including oral hygiene instruction and oral health status through an annual oral health examination that was provided to employees in Japan. This study included 4,484 subjects (3,449 males and 1,035 females) aged between 35 and 74 years old who completed both oral health examination and a questionnaire survey in 2008. Oral health examinations included dental exams (DMFT), periodontal exams (data from the Third National Health and Nutrition Examination Survey), and oral hygiene status (the Simplified Debris Index). The subjects also received oral hygiene instruction after the examination. Additionally, the subjects completed a questionnaire survey regarding examination in the previous year, frequency of dental visits for maintenance, and current smoking and tooth brushing habits. More than half of the subjects were between the ages of 35 and 44 years (Oshikohji et al., 2011).

In Oshikohji et al.'s (2011) multivariate analysis of the relationship between the proportion of teeth with  $PD \geq 4\text{mm}$  and other variables, the older subjects, male, smokers, the subjects with more missing teeth, and the subjects with poor oral hygiene status had significantly higher odd ratios (ORs) for having teeth with  $PD \geq 4\text{mm}$ . The subjects whose company provided a workplace oral health examination every year and the subjects who brushed their teeth more than three times per day had significantly lower ORs for having  $\geq 10\%$  of teeth with  $PD \geq 4\text{mm}$ . The subjects who visited a dental office more than twice a year had higher ORs for having  $\geq 10\%$  of teeth with  $PD \geq 4\text{mm}$  (Oshikohji et al., 2011).

Further, in the multivariate analysis of the relationship between the DMFT and other variables, Oshikohji et al. (2011) found the subjects who smoked and the subjects with poor oral hygiene status had significantly higher ORs for having more than two

decayed teeth. On the other hand, the subjects who brushed more than three times a day and the subjects who visited a dentist more than twice a year had significantly lower ORs for having decayed teeth. However, there was no significant association between receipt of a workplace oral health examination and the number of caries. A workplace examination, therefore, might have a positive effect on periodontal health (Oshikohji et al., 2011).

The results indicated that the subjects who received a workplace oral health examination every year had lower risk for having teeth with more than four millimeters periodontal pockets than the subjects who received an examination for the first time (Oshikohji et al., 2011). Workplace oral health examination was correlated with regular tooth brushing and good oral health status. Annual oral health examinations were recommended along with oral health instruction, in order to improve periodontal health condition. According to this study, the subjects who were smokers had a significantly higher risk for having deep periodontal pockets as well as caries more over non-smokers. This study showed that tooth brushing habits and oral hygiene status were significantly associated with periodontal disease and caries. Thus, it would be important to perform workplace oral health examination to improve oral health status for employees (Oshikohji et al., 2011).

Since this study only examined oral health status of participants who received an oral health examination at the workplace, oral health status of those who did not receive such an examination was undetermined. Most of the subjects of this study were male. Furthermore, since the periodontal health status of the subjects was based on a partial periodontal examination, periodontal health status may have been underestimated. As

summary, a workplace oral health examination with oral health instruction might have good influence on periodontal health status. Therefore, it is important to increase public awareness of the importance of oral health examination and oral health instruction in the adult populations in order for them to maintain optimal oral health (Oshikohji et al., 2011).

Moreover, Ueno, Ohara, Inoue, Tsugane, and Kawaguchi (2012) explored a relationship between education levels and oral health status in Japanese adults in Japan. The aim of this study was to examine whether there was an educational gradient in dentition status and oral health-related behaviours among Japanese adults who were under the universal public health insurance system. Participants were a subsample from those who had participated in both the Japan Public Health Center-Based (JPHC) Study Cohort I in 1990 and the dental survey in 2005 in the Yokote health center jurisdiction. A total of 1201 subjects completed a self-administered dental questionnaire and had a clinical oral examination between July 2005 and January 2006. The self-completed questionnaire included demographics (date of birth and gender) and final education levels as well as health behaviours such as intake of sweet snacks or drinks, dental check-ups, and smoking status. Dentition and oral hygiene status were determined through clinical oral examination (Ueno, Ohara, Inoue, Tsugane, & Kawaguchi, 2012).

Age was negatively associated with education levels both in men ( $p < 0.01$ ) and women ( $p < 0.001$ ). Intake of sweet drinks was significantly associated with education level in men. There were more subjects who drank sweet drinks everyday among the lower education levels ( $p = 0.001$ ). Furthermore, intake of sweet snacks, dental check-ups in the previous year, smoking status, and oral hygiene were not significantly related to

education levels. After adjusting for demographic and oral health related variables, there was no association between edentulousness and education level. On the other hand, the proportion of subjects with 20 or more their own teeth ( $p<0.001$ ), number of teeth present ( $p=0.037$ ), filled teeth ( $p=0.016$ ), natural teeth ( $p<0.001$ ), and a combination of natural and artificial teeth ( $p<0.001$ ) were significantly related to education levels (Ueno et al., 2012).

As limitations, the subjects were not representative of the general populations in Japan. Also, only the education levels were analyzed as an indication of socioeconomic status in this study. Ueno et al. concluded that dental health education in early age in school health programs is important to enhance health literacy and decrease the inequalities of dental health.

Murakami, Aida, Ohkubo, and Hashimoto (2014) conducted a study of income-related dental care use in Japan. A hypothesis of this study was that there is an income gap in dental service use in preventive dental treatment, but not in insured curative dental treatment. Murakami et al. (2014) used the data from the Japanese Study of Stratification Health, Income, and Neighborhood (J-SHINE). The J-SHINE was conducted from October 2010 to February 2011 in four municipalities in Tokyo metropolitan area. The participants were aged 25-50 years and they were randomly chosen from the residential registry. The sample was 3083 individuals who completed a computer- and self-assisted survey that included questions about curative and preventive dental care use, annual household income, educational attainment, and self-assessed oral health.

The results indicated that almost the same percentage of men and women used curative dental care in the past (40.0% for men and 41.5% for women) and there was no

significant difference in income levels in curative care use between men and women ( $p=0.234$  for men and  $p=0.270$  for women). Also, none of the variables of age, marital status, educational attainment, work status, and place of residence was significantly related to curative care. Curative care use was higher in subjects who evaluated their own oral health as worse than those who assessed as better. On the other hand, regarding preventive dental care use, there was a significant difference between men and women (24.1% for men and 34.1% for women). In addition, among men, there was a significant income-related difference in use of preventive care, even after adjusting for covariates ( $p=0.001$ ). Men who were in the highest income bracket were more likely to use preventive care than those with the lowest income level ( $p=0.003$ ). Likewise, women with the highest income level tended to use more preventive care than those with the lowest income level ( $p=0.003$ ). However, after adjusting for other covariates, the income-related gradient was no longer significant in women ( $p=0.126$ ). There was a significant correlation between educational attainment and prevent care use in women, not in men. Preventive care use was higher among subjects who assessed their own oral health as better than those who assessed as worse.

Murakami et al. discussed limitations of the study. First, the response rate was low. As several previous studies indicated that non-respondents had low socioeconomic status (as cited in Murakami et al., 2014), socioeconomic inequalities in the present study may have occurred although the subjects were fairly equal to the target populations in terms of age, sex, and educational attainment. Second, because city of residency of the samples were urban areas, results may be different from the present study if those were from rural areas. Other limitations included limited measurement of quality of dental



care use due to data limitations and under- or over-reporting of income because the surveys were self-reported. Murakami et al. concluded that the preventive care use was lower than that of curative care use among men and women in urban areas. Income-related inequality in preventive care use was significant in men although no income-related difference in curative care use in both men and women. Also, educational attainment was positively associated with preventive care use only in women.

In summary, the findings of oral health status and dental care utilization of native versus immigrant populations indicated that socioeconomic factors, the region of origin, seemed to influence oral health status of immigrants and people who live in their countries. In addition, the duration of residence in Canada influenced dental care utilization and oral health status of immigrants. On the other hand, in addition to the aforementioned factors, the cost of dental treatment, availability of dental insurance and dental public programs, language barriers, and cultural competency of the service providers may affect the utilization of dental services. Altogether, it seemed that most of the previous findings were consistent; however, further studies are needed to further investigate the relationship between extent of acculturation and oral health behaviours, oral health status, and use of dental care.

### **Oral Health Care Behaviours, Attitudes, and Health Beliefs in East Asian populations**

This section will describe the oral health care behaviours, attitudes, and health beliefs of East Asian populations. Those behaviours, attitudes, and beliefs are affected by many different factors; however, socioeconomic characteristics, cultural background and cultural beliefs seem to be main factors. Several studies have assessed socioeconomic

status and how it influences oral health behaviours, attitudes, and beliefs. Some other studies investigated how behaviours, attitudes, and beliefs are important for oral health status. In addition, other literature has addressed how cultural beliefs are related to one's behaviours, attitudes, and health beliefs.

Kawamura and Iwamoto (1999) conducted a survey of Japanese employees in regards to dental health knowledge, attitudes/behaviours and perceived oral health. The aim of this study was to evaluate a wide range of oral self-care activity among Japanese employees. Kawamura and Iwamoto (1999) used a 60-item questionnaire called the Dental Checker (KAITEC Co., Tokyo). This instrument included assessment of dental health knowledge, attitudes, behaviours, and perceived oral conditions. The information was collected at 29 large companies "which had joined the Health Insurance Union over a one-year period in 1992" (Kawamura & Iwamoto, 1999, p. 174). Data were gathered from 77,845 Japanese employees (males: 52,345, female: 25,500) and the mean age of the male was 40.9 years, while the mean age of the female was 37.1 years.

According to the results of the survey of dental knowledge, 34% of the respondents considered that tooth decay often appears in poor quality teeth. Almost 50% of the respondents thought that using fluoridated toothpaste is effective in preventing periodontal disease. More than one quarter of the respondents believed that periodontitis was attributed to eating too many sweets. Almost 30% of the respondents agreed that they should stop brushing for a while when they have periodontal diseases.

Approximately 70% of the respondents thought that tooth brushing alone could not prevent gum diseases (Kawamura & Iwamoto, 1999). Next, the results of the attitude section indicated that 75% of the respondents agreed that they postpone seeing a dentist

until they have a toothache. More than 50% of the respondents did not think that caries is a disease, while over 90% of the respondents believed that periodontitis is a serious disease. Nearly 45% of the respondents indicated that they would like to learn how to clean their teeth. Almost 45% of the respondents stated that they were too busy to see a dentist (Kawamura & Iwamoto, 1999). Regarding health-related behaviours, surprisingly over 80% of the respondents did not floss at all and only 15% of the respondents visited a dentist regularly. More than half of the respondents stated that they have never been taught how to brush by dental professionals. Less than one quarter of the respondents agreed that they took too much time to brush their teeth. Healthier behaviours such as brushing carefully around the gum line or back of the teeth were practiced by 70 to 80% of the respondents (Kawamura & Iwamoto, 1999). Finally, the results of perceived oral conditions were analyzed. Over 70% of the respondents agreed that their gums tend to bleed when they brush their teeth. Almost 70% of the respondents stated that food frequently get caught between the teeth. Approximately 30% of the respondents stated that they had sensitivity to cold/hot water and had difficulty chewing tough food year after year. More than half of the respondents believed that they would lose their teeth when they get old and their teeth would get worse in spite of daily brushing. The results also indicated that age significantly affected perception oral conditions such as space between teeth, deposits, and chewing problems (Kawamura & Iwamoto, 1999).

Kawamura and Iwamoto (1999) pointed out limitations of the study. Random sampling was not used as the information of the subjects was collected through approval of health personnel. Those companies included in the study were likely to have positive attitudes towards occupational health services. Moreover, large companies usually might

have had more concern about the health care of their employees than small companies. Last, only 60% of the employees responded to the questionnaire. The employees who had a negative attitude towards dental care might have been unlikely to participate in the survey. Therefore, generalization of the results must be considered carefully. Oral self-care of general Japanese employees is possibly worse than indicated by the findings of this study. Kawamura and Iwamoto (1999) stated that both employers and employees have to recognize the importance of preventive dentistry. Dental professionals also have to provide systemic oral health promotion to the employees at the workplace (Kawamura & Iwamoto, 1999).

Saito et al. (2009) conducted a study to assess oral health behaviours and perceptions about oral health of periodontal patients. The purpose of this cross-sectional study was to assess the oral self-care and perceptions of the clients in a dental school clinic in Japan who had periodontal diseases using a short questionnaire survey that was based on two oral health conceptual models. Sixty-five patients (23 males and 42 females) between the age of 23 and 77 years were recruited from Suidobashi Hospital, Tokyo Dental College, Tokyo, as subjects for initial assessment and periodontal treatments. The study was limited to subjects who had a clinical and radiographic diagnosis of mild to moderate periodontitis, more than 20 teeth with a minimum of four molars, no extensive dental hygiene treatments in the last six months, and good general health. Data regarding oral health status and behaviours and perceptions related to oral self-care were collected through a clinical oral examination and a questionnaire. The questionnaire with a total of 19 questions had three different categories: oral hygiene, dietary habits, and perception of oral condition (Saito et al., 2009).

Saito et al. (2009) found a positive correlation between plaque scores and frequency of tooth-brushing ( $p=0.035$ ) & interproximal cleaning ( $p=0.023$ ). The habits of brushing three times or more a day and interproximal cleaning were associated with better Plaque Control Record (PCR) scores. However, when Saito et al. analyzed dietary habits, they found that there was no association between dietary habits (frequency of meals, self-evaluation of diet, and frequency of between-meal snacks) and plaque scores. Regarding subjects' perceptions of their oral conditions, Saito et al. found that regular dental check-ups ( $p=0.0407$ ) and acceptance of professional advice ( $p=0.0101$ ) were significantly associated with the PCR scores. In other words, the subjects who had regular dental check-ups or accepted dental professionals' advice had better PCR scores. In order to improve periodontal patients' self-care, Saito et al. planned to formulate strategies based on the conceptual models.

Saito et al. (2009) stated that they were in the process of investigating the correlation between "identified health care behaviours and periodontal parameters in larger patient populations" (p.33), and they wanted to clarify the long-term relationship among patients' health beliefs, their behaviours, and oral health status.

Saito et al. (2009) indicated one limitation. Because the sample size was small, the sample may not represent the whole populations with chronic periodontitis in Japan. These authors recommended future research using a larger sample size and a survey that would "evaluate the effect of age and gender differences" (p. 33) on one's oral self-care as age and gender. Validity and reliability of the questionnaires also needed further testing.

Tada and Hanada (2004) conducted a study of differences in oral health behaviours and related factors among Japanese young adults. The purpose of this study was to describe a sample's oral health behaviours and compare determinants of each oral health behaviour items (tooth brushing frequency, using dental floss, and having dental check-ups) and make comparisons between genders. The sample was 527 dental patients (245 males and 282 females) adults aged 20-29 living in Chiba City, Japan. Tada and Hanada (2004) identified three measurable variables: dental health knowledge, oral health behaviours, and socioeconomic characteristics that were measured through a questionnaire. The questions of dental health knowledge were about dental plaque, dental calculus, periodontal diseases, fluoridation, sealants, sugarless snacks, and xylitol. Oral health behaviour was assessed using two self-care items (frequency of tooth brushing and flossing) and one professional care item (frequency of dental check-ups). The questions about socioeconomic variables addressed the age group (20-24 years or 25-29 years), employment status (full-time, part-time, or unemployed), and family composition (live alone or live with family; Tada & Hanada, 2004).

The results of the dental health knowledge section demonstrated that more women than men knew the meaning of each dental health knowledge item. There was a significant difference in dental health knowledge between women and men in five items (dental calculus [ $p=0.001$ ], periodontal disease [ $p=0.001$ ], sealants [ $p=0.001$ ], fluoridation [ $p=0.001$ ], and sugarless dietary choices [ $p=0.027$ ]). In the oral health behaviour section, women also showed significantly higher rates of good oral health behaviours than men. Interestingly, although differences existed between genders, both women and men exhibited high percentages in frequency of tooth brushing (80% and

60 % respectively,  $p=0.001$ ); however, less than half of each group indicated regular flossing behaviours (38% for women and 30% for men,  $p=0.042$ ). Only 17% of women and less than 5% of men had received a dental check-up once or more per year ( $p=0.001$ ). Regarding other factors associated with oral health behaviours, family composition was associated with tooth brushing frequency in women. Moreover, there was a significant association between women's dental health knowledge and employment status with using dental floss. Full-time employed women used dental floss more than unemployed women. Age classification was a significant factor in men who used dental floss and in women who had dental check-ups. However, there was no significant age group variable associated with frequency of tooth brushing and dental check-ups in men (Tada & Hanada, 2004).

According to Tada and Hanada (2004), men aged between 20 and 29 need to improve oral health knowledge and oral health behaviours. After women gained health knowledge, they are more likely to demonstrate good health behaviours than men. In other words, oral health behaviours of women were easily affected by different factors than that of men. Thus, health promotion would potentially be more effective for women than men. Tada and Hanada (2004) also stated that health behaviours of men were more ambiguous than that of women. There may be some other factors that were not examined in this study that influenced the oral health behaviours of men. Therefore, searching other factors that were not used in this study and may be relate to oral health behaviours in young men was recommended. Sexual differences that may have been related to oral health behaviours of 20- to 29- year-old participants were observed in this study. This

finding may not apply to other age groups. Further study of different age groups would be useful for oral health promotion (Tada & Hanada, 2004).

Morita et al. (2006) also found gender differences in his retrospective study. The objective of this research study was to determine the relationship of oral health behaviours, symptoms of oral diseases, and number of retained teeth in a Japanese community. Since Tobishima was a typical medium sized village, subjects in this village were selected. All residents in Tobishima were contacted and 390 men and 387 women (response rate was 21.5%) participated in the study in 1998. The age distribution of the participants was 30 to 60 years which was similar to the distribution of all residents. Data collection instruments consisted of a questionnaire and dental examinations. The questionnaire contained 40 questions; however, only 15 questions that explored lifestyle and symptoms related to the teeth and mouth were analyzed in this study. The 15 questions included preference of sweets and frequency of snacks between meals, smoking and drinking habits, the presence of symptoms related to teeth and mouth, and attitudes towards dental visits. The participants were also asked about their behaviours in each different life stage such as in elementary school, junior high school, 20s, 30s, 40s, and 50s. Dentists performed dental examinations at the health center of Tobishima. The number of retained teeth excluding wisdom teeth was counted for each participant based on modified World Health Organization (WHO) criteria (Morita et al., 2006).

The results of the study by Morita et al. (2006) showed that men retained fewer teeth than women as they aged, and one third of all participants (133 men and 132 women) had fewer teeth than the average for their individual groups. The results also demonstrated that frequency of tooth brushing (OR=3.98), having own toothbrush



(OR=2.11), smoking (OR=2.71), and bleeding gums (OR=2.03) were significantly associated with number of retained teeth in males. The significant relationship with number of retained teeth in females was observed in relation to frequency of between-meal snacks which had a very strong association in 60 to 69 year old females (OR=4.67). Moreover, having some hobbies (OR=2.97), having a family dentist (OR=2.34), and visiting a dentist as soon as symptoms appear (OR=1.74) were significantly related to number of retained teeth in females. Factors associated with tooth loss in both genders were alcohol consumption (OR=11.96 for male group and OR=3.83 for female group), swollen gums (OR=1.93 for male group and OR=3.04 for female group) and toothache (OR=3.39 for male group and OR=3.52 for female group; Morita et al., 2006). In summary, tooth retention in males was associated with oral health behaviours, lifestyle, and symptoms, while retention of teeth in females was more related to lifestyle. For both genders, tooth retention was associated with lifestyle and symptoms. Therefore, there were different factors associated with tooth retention in males and females.

Morita et al. (2006) concluded that frequency of between-meal snacks, alcohol consumption, smoking, frequency of tooth brushing, having some hobbies, having a family dentist, and consulting a dentist when symptoms occur were significantly associated with number of retained teeth. They stated that the findings from this study can be used to develop guidelines for older people for retaining sufficient functional teeth (Morita et al., 2006).

Furthermore, Nakayama and Mori (2012) studied oral health behaviours in adult Japanese populations. The aim of this study was to analyze the association between number of retained natural teeth and oral health behaviours of Japanese adult people in

Japan (Nakayama & Mori, 2012). The survey was conducted from June 2010 to March 2011 in the city of Obihiro and the town of Honbetsu in the Tokachi area in the eastern part of Hokkaido. The sample included 750 subjects (331 males and 419 females) who were aged over 50 and had at least five teeth. Dental hygienists of a dental clinic in Obihiro and public health nurses in Honbetsu interviewed the subjects using a structured questionnaire when the subjects had dental check-ups. The survey questionnaire included age, sex, smoking status (current, former, and non-smokers), complaint of oral condition, frequency of tooth brushing, using an interdental brush and dental floss, having routine dental check-ups, and having a family dentist. Oral health status of the subjects was measured using the DMFT dental caries index (Nakayama & Mori, 2012).

A multivariate unconditional logistic regression model was analyzed according to sex. In male subjects, current smoking was significantly associated with the risk of having fewer teeth than 20. In female subjects, being at an age between 60 and 69 years, 70 or older, having a complaint of oral condition, less than or equal to once a day brushing, no use of an interdental brush, no use of dental floss, and current smoking were significantly associated with the risk of having fewer teeth than 20. In summary, less frequent tooth brushing and no usage of an interdental brush and dental floss were significantly associated with fewer teeth in females, while current smoking was significantly associated with having fewer teeth in both males and females (Nakayama & Mori, 2012).

Nakayama and Mori (2012) indicated limitations of the study. First, due to the cross-sectional study, the researchers could not identify the cause of tooth loss. A future cohort study would have been necessary in order to find the relationship between tooth

loss and oral hygiene behaviours. Second, socioeconomic status of the subjects was not investigated in this study, although other studies indicated the impact of socioeconomic status on tooth loss (as cited in Nakayama & Mori, 2012). Third, since relatively healthy people participated in a dental examination, self-selection bias might have been possible in this study. Furthermore, the study was conducted in only the Hokkaido prefecture in Japan. Therefore, the results may not be representative of the general Japanese populations. In conclusion, Nakayama and Mori (2012) stated that there was a significant association between having fewer teeth and oral health behaviours (frequency of tooth brushing, utilization of an interdental brush and dental floss, and smoking status). Thus, good oral health behaviours and no smoking are important factors for tooth loss prevention (Nakayama & Mori, 2012).

Other researchers conducted studies in Chinese populations. Petersen, Jiang, Peng, Tai, and Bian (2008) explored oral and general health behaviours among Chinese urban adolescents. The purpose of this study was to analyze the relationship between general and oral health-related behaviours of Chinese juvenile and their school performance, peer relationships, and parents' education levels and incomes.

The study by Petersen et al. (2008) was a cross-sectional survey conducted from February to March 2003. The subjects were selected through multistage cluster sampling and were divided into three age groups: 11, 13, and 15 years. Eight cities (Beijing, Wuhan, Xi'an, Guangzhou, Shanghai, Lanzhou, Kunming, and Shenyang) in China were chosen for the study. The final sampling included 2,662 students (948 students aged 11 years, 902 students aged 13 years, and 812 students aged 15 years) and the response rate was 92%. The survey designed by the WHO, Global Oral Health Programme, in Geneva,

Switzerland included the following variables: self-assessment of general and oral health status, self-reported oral hygiene practices, oral health knowledge and attitudes, general hygiene status, dietary habits, lifestyles (smoking, use of alcohol and physical activity), dentist and physician visits, school performance, leisure activities, relationship with friends, family status, lifestyle of parents and their education and income levels (Petersen et al., 2008). Under teachers' supervision, the students completed the survey. The validity and reliability of the survey were established previously. The survey originally was formulated in English and translated into Chinese. Then it was translated back to English after the students completed the questionnaires for analysis (Petersen et al., 2008).

A multivariate analysis revealed that the level of parents' education was positively associated with seven factors of health behaviours of the subjects: dental visits, oral hygiene practices, general hygiene practices, healthy dietary habits, physical activity, alcohol consumption, playing computer games, and sugary foods and drinks intake. However, it was negatively associated with watching television. Oral hygiene practices were not significantly performed among students with "negative attitudes towards dental care and low knowledge of the prevention of dental disease" when other factors were equal (Petersen et al., 2008, p. 79). Furthermore, students who were poor performers in school had higher risks of tobacco and alcohol use, watched television more frequently, played computer games more often, eat more sugary foods/drinks than those with good performance in school. Other factors being equal, tobacco and alcohol consumption and frequency of playing computer games were observed more often among boys than girls. Also, dental visiting was relatively lower among boys than girls (Petersen et al., 2008). In summary, good oral health-related behaviours such as regular dental visits, oral

hygiene practices, and healthy dietary habits were performed among students with good academic performance and active peer relationships whose parents had high educational levels. However, there was a gender difference; boys visited a dentist less than girls.

Petersen et al. (2008) indicated limitations of this study. The participants were chosen through cluster sampling rather than as individuals. Those participants may have possibly had similar behaviours, attitudes, or views. Moreover, the questionnaires that were used in the study may have had some limitations. The authors stated that individual perceptions about oral health care and lifestyles may have been overestimated, while risk behaviours such as sugary foods and drinks intake may have been underestimated. Through this study, Petersen et al. (2008) concluded that oral health-related behaviours of adolescents were related to living conditions, academic performance, peer relationships and attitudes, and oral health care knowledge. The participants who had good oral health behaviours also demonstrated good general health behaviours. Lastly, the study showed the multidimensionality of health behaviours. Since changing single health behaviour did not affect other health behaviours, comprehensive health education for Chinese adolescents was recommended.

Furthermore, Dong et al. (2007) investigated perceptions of oral diseases in Chinese populations. The aim of this qualitative study was to “explore the representation of oral health and illness among Chinese immigrants now residing in Canada” (Dong et al., 2007, p. 1340). Researchers conducted in-depth, one-on-one, semi-structured interviews between April and June 2005 on adult Chinese immigrants in Montreal. This study was a qualitative research. The researchers recruited Chinese immigrants who were “1) born in China; 2) first-generation immigrants; 3) current residents of Montreal;

4) economic immigrants (an economic immigrant is a skilled worker or spouse of a skilled worker who did not come as a refugee); and 5) aged twenty and over” (Dong et al., 2007, p. 1341). The researchers interviewed 12 immigrants. Participants were from urban areas of different provinces in Mainland China. Although the participants had high levels of education when they entered to Canada, all of them had low family incomes in Canada as they were unemployed or had short-term employment (Dong et al., 2007).

The interview consisted of four sections. The introductory part was about participants’ immigration pathway such as their experience and reasons of immigration, and social and family network in Canada. The second section focused on general health: “perception of health, perception of illness, and management of illness” (Dong et al., 2007, p. 1342). The third section was a main section of the interview. This section included perceptions of oral diseases, experience of oral diseases and dental consultation, and oral hygiene practice. The last section concentrated on the socioeconomic status of the participants such as “their age, family status, region of origin in China, education level, primary language spoken, and family income in Canada” (p. 1342). The interview lasted about one and a half hours for each participant and was recorded in audiotape (Dong et al., 2007).

The results showed that all participants considered that oral health was very important for them. They identified dental caries, gum swelling, and gum bleeding as dental diseases. Most participants knew both biomedical (caries or decayed tooth) and traditional terms (tooth worm) to name dental caries. They also regarded a black spot as a sign of early dental caries. They perceived that caries was “a continuous and irreversible process that leads to a cavity, toothache, and ultimately, the destruction of the

tooth” (p. 1342). Additionally, the participants thought that caries was related to diet such as acidic or sweet food, bad oral hygiene, and genetics. They believed that maintaining good oral hygiene as well as rinsing with cold boiled water and salt water as a traditional method was an important practice to prevent dental caries. They also considered that early dental caries treatment would allow them to retain their teeth longer.

Regarding gum swelling, the participants used both scientific (gum swelling) and traditional terms (tooth bed swelling) to identify gingival inflammation. They also mentioned that food did not cause pain or was an irritant. They considered that gum swelling was a reversible disease that was caused by local factors (bad oral hygiene) as well as systemic factors (internal fire). For preventions of gum swelling, the participants believed that maintaining good oral hygiene (brushing and rinsing with salted water), reducing stress, getting a rest, improving mood, eating balanced diet, and drinking traditional herb tea were helpful. They sought remedies from both traditional and Western medicine. If internal fire was a main causal factor, the participants would rely on Chinese traditional medicine. When bad oral hygiene was a main cause, antibiotics from China and consultation with a dentist could be remedies (Dong et al., 2007).

Lastly, gingival bleeding was not considered to be an oral disease by the majority of participants. It was rather perceived as a common and almost normal phenomenon due to its reversibility. Most participants believed that gingival bleeding was caused by insufficient intake of Vitamin C. Thus, increasing the intake of Vitamin C would be preventions or treatments of gum bleeding for the participants. In summary, the participants had a good understanding of caries lesions in process, etiology, and

prevention. However, the participants demonstrated strong traditional beliefs about gingival swelling and bleeding.

The researchers concluded that the subjects seemed to value both traditional Chinese and Western medicine. This observation referred to one of the acculturation outcomes: integration “which is associated with low acculturative stress, as research shows, is the preferred form of acculturation in different cultural communities in Canada” (p. 1346). The researchers suggested that further studies should include Chinese immigrants with a lower education level because their knowledge and openness to Western medicine might be different from the present study.

Additionally, Hsu, Yen, Lan, Wu, and Lee (2013) studied oral health behaviours and oral habits of older Taiwanese people. The purpose of their study was to explore the relationship between oral health behaviours/oral habits and oral health conditions in terms of age, sex, educational levels, and self-reported general health status. Researchers hypothesized that people with at least 20 natural teeth (NT) and eight functional tooth units (FTUs) have better oral health practice than those who do not (Hsu, Yen, Lan, Wu, & Lee, 2013).

The study was conducted in Taiwan with the aid of the Taiwan Dental Association between March and December 2006. Two-thousand-seventy-one subjects (1013 males and 1058 females; mean age  $60.0 \pm 9.9$  years) completed questionnaires and dental examinations. The subjects voluntarily participated in the study. The questionnaires consisted of demographic characteristics including gender, age, and educational level, and assessment of oral health behaviours (tooth brushing frequency, dental floss use, and dental hygiene visits) and oral habits (smoking and betel-nut



chewing). It also contained questions of self-perceived dental and general health. Additionally, the subjects received clinical dental examinations from dentists according to the WHO format. The clinical dental examinations included “the locations, numbers and types of natural and prosthetic teeth” (Hsu et al., 2013, p. 122). Teeth that were sound, decayed, filled or filled but decayed were regarded as NT. Intact dentition indicated 28 NT with exclusion of third molars. FTUs were “pairs of occluding posterior natural teeth or fixed artificial teeth, including abutment teeth, pontics and implant supported prostheses” (p. 122). As the FTUs included one unit for premolar and two units for molars (third molars were excluded), intact dentition indicated 12 FTUs (Hsu et al., 2013).

A logistic regression analysis was used to investigate the true impact of oral health behaviours, oral habits, and self-perceived health status on dentition status. After controlling for covariates, the low dentition group included the subjects who were older, had lower education level, infrequently used dental floss, current smoked, had poor self-perceived dental health, and were former betel-nut chewers. However, regular dental hygiene visits and self-perceived general health were not associated with low dentition status. Interestingly, current betel-nut chewers were less likely to belong to the low dentition group compared to never betel-nut chewers.

Hsu et al. (2013) concluded that educational levels, utilization of dental floss, current betel-nut chewing, and self-perceived dental health were positively associated with good oral health status. Current smokers, former betel-nut chewers, and older participants exhibited low dentition status. The authors indicated limitations of the study. First, the results cannot be generalized since the participants were senior clinic patients

who may have maintained good dental health. Second, this study was a cross-sectional, not a longitudinal study. Thus, the study cannot be used to conclude cause-effect relationships. Lastly, the study did not control for other tooth retention-related factors such as the patients' and clinicians' preference for treatment options and motivations of the patients to look for dental services in the past. The authors suggested that it is important to understand how age and sex influence oral health behaviours and oral habits in retention of teeth. Hsu et al. (2013) recommended that in order to retain 20 or more NT and at least eight FTUs, use of dental floss, and cessation of tobacco and betel-nut chewing should be encouraged (Hsu et al., 2013).

Smith et al. (2013) conducted a meta-analysis to identify the influence of culture on the oral health-related beliefs and behaviours of elderly Chinese immigrants in Western countries. The analysis also included literature about culture, acculturation, and traditional Chinese medicine (TCM). In the first phase, researchers used databases such as Ovid-MEDLINE, Science Citation Index, EMBASE, and CINAHL to collect literature about "aging, disablement, health-related beliefs and behaviours, and ethnic consideration applicable to oral health among Chinese elders" between January 1, 1950 and June 25, 2010 (Smith et al., 2013, p.29). The researchers obtained 40 papers, reports, chapters, and theses which focused on elderly Chinese. In the second phase, the researchers carefully assessed literature according to the criteria: "1) the study was conducted using accepted research methods; 2) the findings were supported by the evidence; and 3) the findings applied to the phenomena investigated" (Smith et al., 2013, p. 29). In the third phase, the researchers organized the findings based on themes: "nature and influence of

culture and oral health-related beliefs on oral-health behaviours among both immigrant and non-immigrant populations” (p. 32).

In the results section, Smith et al. (2013) presented Chinese concepts of health and how their concepts may affect the oral health-related beliefs and behaviours among elderly Chinese immigrants. First, Chinese tradition and oral health were discussed. Religion and culture play an important role in how health problems were identified and treated by health care providers and patients. About oral health, Chinese people regard dental caries and teeth losses are genetic and unavoidable in old age (as cited in Smith et al., 2013). Next, oral health-related beliefs were discussed. Socio-economic status, education, and urban versus rural residence were relevant factors for oral health beliefs in elderly Chinese immigrants. The researchers discovered the persistence of traditional oral health-related beliefs among elderly Chinese immigrants even after many years of immigration. Chinese health beliefs were stronger in the older and less educated Chinese immigrants. In addition, a survey in rural areas of southern China revealed that people believed that *tooth worms* cause dental caries and hot food and *internal heat* causes periodontal diseases (as cited in Smith et al., 2013). Lastly, oral health-related behaviours were analyzed. Chinese cultural health beliefs were characterized through help-seeking and self-care behaviours. Chinese people generally prefer TCM because it gives a culturally sensitive explanation of disease treatment to those people. The cost of dental treatment was another factor related to choose TCM over Western dentistry (as cited in Smith et al., 2013). However, younger, educated, and wealthy Chinese people generally preferred Western dental treatment. One study in Hong Kong indicated that TCM was utilized in chronic problems such as periodontal diseases, and Western

dentistry was used in acute conditions such as endodontic treatment and oral trauma. The use of TCM combined with Western dentistry was also observed in some studies in England, the US, and Canada (as cited in Smith et al., 2013). Several cross-sectional studies showed that Chinese immigrants usually improved their oral hygiene and used more dental services over time, along with TCM (as cited in Smith et al., 2013). Furthermore, second- and third- generation immigrants tended to accept Western dentistry and favour TCM less. On the other hand, older Chinese immigrants hesitated to seek Western dental treatment due to cultural barriers which included language barriers, unfamiliarity with services, and inconsideration of dental professionals to the cultural norms and expectations of elderly Chinese (as cited in Smith et al., 2013). Chinese elders in England, Canada, and the US normally prefer to consult with Chinese speaking dentists who are sensitive to Chinese culture to prevent misunderstanding about patients' history and treatment options (Smith et al., 2013).

As limitations of the study, Smith et al. (2013) focused on elderly Chinese immigrants; therefore, “the transferability of the findings to other ethnic group” was limited (p. 43). The authors also stated that the quality of studies were generally low and merely described the beliefs and behaviours of the immigrants without random selections or tests for differences among specific elderly groups. In summary, the authors mentioned that there were limited findings regarding how traditional beliefs change over time when immigrants were acculturated to Western dental system. The influence of socio-economic status, education, place of origin, and culture of Chinese immigrants were also analyzed insufficiently (Smith et al., 2013).

In conclusion, oral health behaviours, attitudes, and health beliefs in East Asian populations are influenced by socioeconomic status, especially age and sex, and cultural background and cultural beliefs. At the same time, oral health behaviours, attitudes and health beliefs also affect oral health status. Nonetheless, there are insufficient studies about Japanese immigrants in Western countries and how East Asian immigrants change their oral health behaviours, attitudes, and health beliefs over time in the host countries. Researchers should explore this lack of information in immigrants in order to deepen the existing knowledge and improve dental services for those immigrant people.

## **Summary of Chapter II**

Chapter two reviewed studies examining (a) acculturation related to general health, (b) acculturation related to dental health, (c) oral health status and dental care utilization of native and immigrants populations in Canada, and (d) oral health care behaviours, attitudes, and health beliefs of East Asian populations. The findings of acculturation related to general and oral health were inconclusive. Acculturation positively and negatively influences general health and its behaviours. Acculturation was an important factor in health behaviours and diseases; however, demographic and socioeconomic factors were also involved with health activity, diabetes risk, and obesity. In addition, gender seemed to play an important role in acculturation and obesity. The relationship between acculturation and oral health may be complex as there was disagreement between primary research on Vietnamese immigrants in Australia and a study of Somalis in the US. The findings from several studies demonstrated that acculturation influences general and oral health as well as the use of dental services. Those studies also revealed several influential factors that impact general and oral health

and utilization of dental services. Most of the previous findings about oral health status and use of dental care in natives and immigrants were consistent across the literature. However, the extent of acculturation of immigrants in relation to oral health status and their use of dental services need to be investigated to deepen understanding of acculturation. Overall, acculturation, regions of origin, the duration of residence in host countries, socioeconomic characteristics, especially gender and sex, cultural background and beliefs are major influential factors for immigrants' oral health status, dental service use, and oral health behaviours and attitudes.

Authors also recommended future research. As many studies were cross-sectional studies, researchers suggested prospective cohort studies, qualitative and quantitative research, and longitudinal studies. They also recommended using larger and/or random sample from different place and social circumstances. Using valid, multidimensional and standardized acculturation scales was recommended. Therefore, the present study used validated instruments and multivariate analysis approaches to explore its area of focus, which was a study of impact of acculturation on oral self-care behaviours and oral health conditions.

### **Chapter III: Methodology**

This study was designed to evaluate the relationship between different acculturation patterns and oral health behaviours and attitudes of Japanese immigrants in Greater Vancouver, BC, Canada. This chapter presents an overview of the research design, research context, research participants (inclusion/exclusion criteria and human subjects protection), data collection instruments and methods (instruments, validity and reliability, and procedures and protocols), limitations, proposed statistical analysis, and manuscript submission.

#### **Research Design**

The study was designed to test the following research hypothesis:

- There will be a relationship between patterns of acculturation as measured by the East Asian Acculturation Measure (EAAM) and oral hygiene behaviours and attitudes as measured by a modified version of the Hiroshima University-Dental Behavioural Inventory (HU-DBI) in Canadian immigrants of Japanese origin.

This cross-sectional study employed a self-reporting approach to questionnaire administration with volunteer adult participants from Vancouver's population of Japanese immigrants. A cross-sectional survey was chosen due to a limited time and the budget. In addition, cross-sectional surveys may be able to assess population characteristic and provide baseline data for longitudinal studies. Demographic and socioeconomic status, acculturation, and oral health behaviours and attitudes were the variables measured.

#### **Research Context**

The surveys and informed consent were distributed through the postal service, personal delivery, and e-mail attachment. Unlike client-care intervention, the

questionnaire was the one of the easiest research tools because it did not require a particular site to conduct study.

### **Research Participants**

**Inclusion criteria.** The sample was a non-probability, convenience sample of volunteers because it allowed for convenient and feasible recruitment of an adequate number of participants as volunteers. The size of the sample was 48 participants.

Inclusion criteria for participants were:

- First generation Japanese immigrants residing in Greater Vancouver, BC.
- At least 18 years of age.
- Self-reported average or fluent English.
- Native language is not English.

**Exclusion criteria.** Individuals with experience in the dental profession or industry were excluded from the study due to the potential impact on oral health attitudes and behaviours. Non-English speaking individuals also were excluded because the surveys to be used were in English, and this population would be vulnerable.

**Human subjects protection.** An application for expedited review of this study was submitted to the Idaho State University (ISU&) Institutional Review Board's Human Subjects Committee (HSC), and approval was obtained before subject recruitment and enrollment. All policies and procedures designed to protect human subjects were strictly followed. All subjects had the opportunity to ask questions about the informed consent form (Appendix A) and the study itself. As the informed consent form indicated, participants read and signed both copies of the consent form before initiating the



subsequent surveys. One copy of the signed informed consent was returned in the self-addressed, stamped envelope provided or personal delivery.

The study had minimal risk because it involved use of a questionnaire as a survey instrument. The risk of breach of confidentiality was discussed with the participants, and the PI and all members of the research team kept information obtained strictly confidential. The informed consent asked for the participants' name, and either e-mail and/or phone number to be used for entry into the drawing for the gift card, and contacting the winner. Questionnaires were given a code alphabet and data entry and analysis used only the codes, not name of the participants. A separate file with participants' name and code alphabets were kept in a locked computer file at the PI's office. All documents, including informed consent forms, questionnaires, and other research-related documents were kept in a locked cabinet by the PI throughout the conduct of the study. Following data collection and analysis, the informed consents and surveys were sent to Dr. Tara Johnson and will be stored in a locked file in her office for seven years after the thesis is defended, at which time they will be shredded.

### **Data Collection Instruments and Methods**

**Instruments.** This cross-sectional, quantitative study used three survey instruments to assess demographic and socioeconomic characteristics of the sample, acculturation, and oral health attitudes and behaviours. The instruments were self-administered. It took 10~15 minutes to complete all three surveys (each survey took approximately 3-5 minutes). Participants began with a demographic and socioeconomic questionnaire (Appendix B) and moved on to complete two other questionnaires: the East Asian Acculturation Measure (EAAM; Appendix C) and a modified version of the

Hiroshima University-Dental Behavioral Inventory (HU-DBI; Appendix D). All responded surveys were in printed form exclusively. Both instruments were valid and reliable in their original forms. Permissions to use the EAAM and the HU-DBI from each researcher are included in Appendix E and F. The demographic and socioeconomic questionnaire included ten questions asking gender, age, language spoken on a daily basis, self-reported English language proficiency, duration of residency in Canada, age at immigration, education, and household income levels. The EAAM contained 29 questions related to status of acculturation: assimilation, separation (rejection), integration and marginalization to Canadian culture (Barry, 2001). The EAAM used a seven-point Likert-type scale (strongly disagree, disagree, disagree somewhat, neutral, agree somewhat, agree, strongly agree) and questions addressed whether individuals perceived themselves as Asians and/or Canadians. The original HU-DBI included 20 items with dichotomous response options of agree or disagree (Kawamura, 1988; Kawabata, Kawamura, Miyagi, Aoyama, & Iwamoto, 1990); however, Kawamura's original HU-DBI scale includes only 12 of those items for scoring (Appendix D). Kawamura chose these 12 items based on their statistically significant correlation with oral hygiene-related conditions (i.e., plaque, calculus, gingival condition, probing depth) as measured by the Oral Rating Index. When calculating HU-DBI scores, one point was given for each agree response to items 4, 9, 11, 12, 16 and 19 and one point was scored for disagree responses to items 2, 6, 8, 10, 14 and 15. The only modification made was to expand the response options to a 5-point Likert scale (strongly disagree, disagree, no opinion, agree, or strongly agree) to allow for more varied responses and provide continuous data for statistical analysis. The results of these two surveys revealed the

relationship between the one's oral health behaviours and attitudes and different status of acculturation of Japanese immigrants.

***Validity and reliability.*** Barry (2001) previously established validity and reliability of the EAAM. Barry's study included 150 East Asian immigrants in the United States (50 Chinese, 50 Japanese, and 50 Korean) who had average or fluent English and native language levels. The mean age of the participants was 28.7 and they had lived in the US for 7.4 years on average. Barry (2001) calculated internal consistency for the EAAM using a Cronbach's alpha and showed coefficients of 0.77 (assimilation), 0.76 (separation), 0.74 (integration), and 0.85 (marginalization). This result indicated internal validity of the EAAM as a Cronbach's alpha of 0.70 is normally regarded as acceptable (George & Mallery, 2003). Regarding validation, negative significance was observed between assimilation and separation ( $r=-.39$ ,  $p=0.000$ ), and integration and marginalization ( $r=-.40$ ,  $p=0.000$ ; Barry 2001). These findings were consistent with Barry's model (assimilation, separation, integration, and marginalization); therefore, the EAAM was considered valid.

Kawamura (1988) tested validity and reliability of the HU-DBI. Validity and reliability was demonstrated by criterion concurrent validity ( $N=51$ ) with oral health/hygiene status (Oral Rating Index [ORI],  $r=.565$ ) and internal consistency was established by Cohen's alpha ( $N=753$ ,  $\alpha=0.76$ ). Additionally, Kawabata et al. (1990) tested reliability by using a test-retest method on university students. The results indicated that the HU-DBI was reliable because there was a positive correlation between first and second tests ( $r=.730$ ,  $p<0.001$ ).

**Procedure and protocols.** The participants were recruited initially through networking and word of mouth (phase I). Networking was through the PI's friends or acquaintances, and by word of mouth, those participants introduced their friends or acquaintances to information about the study for potential participation. As phase II, although the PI posted a flyer (Appendix G) at an English language school and Japanese community center (Tonarigumi) and placed an ad (Appendix H) at Japanese local newspaper (Vancouver Shinpo) and Japanese web-site (JP Canada), no one responded to the study through these means of recruitment. People who agreed to participate in the study completed surveys in printed form and returned them in a self-addressed, stamped envelope provided or by personal delivery.

### **Limitations**

With the nature of a cross-sectional study, the results do not reveal long-term relationships between acculturation and oral health behaviours and attitudes over time. Because the non-probability sample was recruited from Greater Vancouver, BC, which was a limited area of Canada although Japanese immigrants reside in diverse geographical locations, results were not representative of the entire Japanese immigrant populations in BC or Canada. In addition, the non-probability convenience sampling may have resulted in ascertainment bias, which can often lead to a sample different from the target population. In other words, study populations may not be representative of the entire populations of Japanese immigrants in Greater Vancouver, BC, Canada. The size of the sample (N=48) may not have been large enough to fully represent characteristics of the population. Furthermore, because the study included only first generation Japanese immigrants who were able to speak English, the result may not reflect findings from

people who did not speak English, but may have contributed valuable information to the study.

### **Statistical Analysis**

Data were analyzed using descriptive statistics, Spearman rank correlation coefficient ( $r_s$ ) for ordinal data and Pearson correlation coefficient ( $r$ ) for continuous data to assess the relationships between demographic/socioeconomic variables, acculturation, and oral health behaviours and attitudes. The independent sample t-test was used to analyze differences in EAAM and HU-DBI scores based on of gender, language spoken at home, and place of education. Multiple linear regression was used to observe the effects of four potential predictor variables, the acculturation dimensions measured by the EAAM, on the dependent variable, the HU-DBI. All analyses were performed using IBM SPSS Version 23. The alpha level set for statistical significance was  $\leq 0.05$ .

### **Manuscript Submission**

Following the thesis defense, a manuscript will be submitted for publication in the Canadian Journal of Dental Hygiene (CJDH), published by the Canadian Dental Hygienist Association, to share newly obtained knowledge with other scholars regarding immigrants' oral health behaviours and attitudes in Canada. The manuscript follows this chapter in lieu of the traditional thesis Chapters IV, Results, and V, Discussion and Conclusions. It meets the requirement outlined in the CJDH author guidelines presented in Appendix I.

### **Summary of Chapter III**

The purpose of this study was to examine relationships between different acculturation patterns and oral health behaviours and attitudes among Japanese adult

immigrant populations in Greater Vancouver, British Columbia (BC), Canada. This cross-sectional, quantitative study used two questionnaires along with a demographic and socioeconomic questionnaire. The relationship between these variables were measured by the EAAM, which uses ordinal variables (seven-point Likert-type scale), measures different acculturation patterns of East Asian immigrants after those Asians migrate to North America, and a modified version of the HU-DBI, which uses a five point Likert sale to evaluate oral health behaviours and attitudes. The convenience sample included 48 first generation Japanese immigrant volunteers recruited through networking. Data analysis used descriptive statistics, Spearman ( $r_s$ ) and Pearson ( $r$ ) correlation coefficients, an independent sample t-test, and multiple linear regression analysis. As limitations of this study, long-term effects of acculturation and oral health behavioural and attitude changes were not revealed due to the nature of cross-sectional surveys. The results also may not be representative of Japanese immigrants in Canada because of the limited area of study, non-probability convenience sampling, small sample size, and exclusion of non-English speakers.

## References

- Afable-Munsuz, A., Mayeda, E. R., Pérez-Stable, E. J., & Haan, M. N. (2013). Immigrant generation and diabetes risk among Mexican Americans: The Sacramento Area Latino Study on Aging. *American Journal of Public Health*, e1-e8.
- Asadoorian, J. (2009). Inequity and disparity in oral health – Part II. Socio-economic status and deprivation: can dental hygiene diminish the impact? *Canadian Journal of Dental Hygiene*, 43(2), 53-59.
- Barry, D. T. (2001). Development of a new scale for measuring acculturation: The East Asian acculturation measure (EAAM). *Journal of Immigrant Health*, 3(4), 193-197.
- Berry, J. W. (1980). Acculturation as varieties of adaptation. In: Padilla. A. (Eds.), *Acculturation: theory, models and some new findings* (pp. 9-25). Boulder, CO: Westview.
- Berry, J. W. (2003). Conceptual approaches to acculturation. In: Chun K. M., Organista P. B., & Mañin G. (Eds.), *Acculturation: advances in theory, measurement, and applied research* (pp. 17-37). Washington, DC: American Psychological Association. doi: 10.1037/10472-004
- Calvasina, P., Muntaner, C., & Quiñonez, C. (2014). Factors associated with unmet dental care needs in Canadian immigrants: an analysis of the longitudinal survey of immigrants to Canada. *BMC Oral Health*, 14, 145.
- Canada Immigration Lawyers and Corporate Intra Company Transfer Services. (n.d.). *Greater Vancouver Regional District Map*. Retrieved from

<http://www.canadalegal.info/img--site/BC/greater-vancouver-map/GVRD-map.html>.

- Canadian Dental Hygienists Association. (2003). *Canadian Dental Hygienists Association: Dental Hygiene Research Agenda*. Retrieved from [http://www.cdha.ca/pdfs/Profession/Policy/research\\_agenda\\_102603.pdf](http://www.cdha.ca/pdfs/Profession/Policy/research_agenda_102603.pdf)
- Charbonneau, C. J., Neufeld, M. J., Craig, B. J., & Donnelly, L. R. (2009). Increasing cultural competence in the dental hygiene profession. *Canadian Journal of Dental Hygiene*, 43(6), 297-305.
- Cruz, G. D., Chen, Y., Salazar, C. R., & Le Geros, R. Z. (2009). The Association of immigration and acculturation attributes with oral health among immigrants in New York City. *American Journal of Public Health*, 99(52), S474-S480.
- Delavaril, M., S nderlund, A. L., Swinburnl, B., Mellor, D., & Renzaho, A. (2013). Acculturation and obesity among migrant populations in high income countries – a systematic review. *BMC Public Health*, 13, 458.
- Dong, M., Levine, A., Loignon, C., & Bedos, C. (2011). Chinese immigrants' dental care pathways in Montreal, Canada. *Journal of Canadian Dental Association*, 77, b131.
- Dong, M., Loignon, C., Levine, A., & Bedos, C. (2007). Perceptions of oral illness among Chinese immigrants in Montreal: A qualitative study. *Journal of Dental Education*, 71(10), 1340-1347.
- Dunn, J. R., & Dyck, I. (2000). Social determinants of health in Canada's immigrant population: results from the National Population Health Survey. *Social Science & Medicine*, 51(11), 1573-1593.



- Gao, S., & McGrath, C. (2011). A review on the oral health impacts of acculturation. *Journal of Immigrant Minority Health, 13*, 202-213.
- Geltman, P. L., Adams, J. H., Cochran, J., Doros, G., Rybin, D., Henshaw, M. Barnes, L. L., & Paasche-Orlow, M. (2013). The impact of functional health literacy and acculturation on the oral health status of Somali refugees living in Massachusetts. *American Journal of Public Health, 103*(8), 1516-1523.
- George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4<sup>th</sup> ed.). Boston, MA: Allyn & Bacon.
- Government of Canada (2013). *Section 2: Managing permanent immigration and temporary migration*. Retrieved from <http://www.cic.gc.ca/english/resources/publications/annual-report-2013/section2.asp>.
- Hsu, K. J., Yen, Y. Y., Lan, S. J., Wu, Y. M., & Lee, H. E. (2013). Impact of oral health behaviours and oral habits on the number of remaining teeth in older Taiwanese dentate adults. *Oral Health Preventive Dentistry, 11*(2), 121-130. doi: 10.3290/j.ohpd.a29360.
- Kawabata, K., Kawamura, M., Miyagi, M., Aoyama, H., & Iwamoto, Y. (1990). The dental health behavior of university students and test-retest reliability of the HU-DBI. *Journal of Dental Health, 40*, 474-475.
- Kawamura, M. (1988). Dental behavioral science: the relationship between perceptions of oral health and oral status in adults. *Journal of Hiroshima University Dental Society, 20*, 273-86.

- Kawamura, M., & Iwamoto, Y. (1999). Present state of dental health knowledge, attitudes/behaviour and perceived oral health of Japanese employees. *International Dental Journal*, 49, 173-181.
- Kreps, G. L. (2006). Communication and racial inequities in health care. *American behavioral scientist*, 49(6), 760-74.
- Lai, D. W. L., & Chau, S. B. Y. (2007). Predictors of health service barriers for older Chinese immigrants in Canada. *Health & Social Work*, 32(1), 57-65.
- Lassetter, J. H., & Callister, L. C. (2009). The impact of migration on the health of voluntary migrants in western societies. *Journal of Transcultural Nursing*, 20(1), 93-104.
- Locker, D., Clarke, M., & Murray, H. (1998). Oral health status of Canadian-born and immigrant adolescents in North York, Ontario. *Community Dentistry and Oral Epidemiology*, 26(3), 177-181.
- MacEntee, M. I., Mariño, R., Wong, S., Kiyak, A., Minichiello, V., Chi, I. Lo, E. C. M., Huancai, L. (2012). Discussion on oral health care among elderly Chinese immigrants in Melbourne and Vancouver. *Gerodontology*, 29, e822-e832.
- Mariño, R., Stuart, G. W., Wright, F. A. C., Minas, I. H., & Klimidis, S. (2001). Acculturation and dental health among Vietnamese living in Melbourne, Australia. *Community Dentistry and Oral Epidemiology*, 29, 107-19.
- Martin, F., & Midgley, E. (2006). Immigration: shaping and reshaping America. *Population Bulletin*, 61.
- Morita, I., Nakagaki, H., Toyama, A., Hayashi, M., Shimozaoto, M., Watanabe, T., Tohmatsu, S., Igo, J., & Sheiham, A. (2006). Behavioral factors to include in

- guidelines for lifelong oral healthiness: an observational study in Japanese adults. *BMC Oral Health*, 6, 15.
- Murakami, K., Aida, J., Ohkubo, T., Hashimoto, H. (2014). Income-related inequalities in preventive and curative dental care use among working-age Japanese adults in urban areas: a cross-sectional study. *BMC Oral Health*, 14, 117.
- Nakayama, Y., & Mori, M. (2012). The relationship between number of natural teeth and oral health behavior in adult Japanese people. *Journal of the National of Public Health*, 61(4), 366-373.
- Newbold, K. B., & Patel, A. (2006). Use of dental services by immigrant Canadians. *Journal of Canadian Dental Association*, 72(3), 143-143f.
- O'Driscoll, T., Banting, L. K., Borkoles, E., Eime, R., & Polman, R. (2013). A systematic literature review of sport and physical activity participation in culturally and linguistically diverse (CALD) migrant populations. *Journal of Immigrant Minority Health*. doi: 10.1007/s10903-013-9857-x
- Oshikohji, T., Shimazaki, Y., Shinagawa, T., Fukui, N., Akifusa, S., Hirata, Y., & Yamashita, Y. (2011). Relationship between receiving a workplace oral health examination including oral health instruction and oral health status in the Japanese adult population. *Journal of Occupational Health*, 53, 222-229.
- Petersen, P. E., Jiang, H., Peng, B., Tai, B. J., & Bian, Z. (2008). Oral and general health behaviours among Chinese urban adolescents. *Community Dentistry and Oral Epidemiology*, 36, 76-84.
- Redfield, R., Linton, R., & Herskovits, M. J. (1936). Memorandum for the study of acculturation. *American Anthropologist*, 38, 149-152.

- Saito, A., Kikuchi, M., Ueshima, F., Matsumoto, S., Hayakawa, H., Masuda, H., & Makiishi, T. (2009). Assessment of oral self-care in patients with periodontitis: a pilot study in a dental school clinic in Japan. *BMC Oral Health*, 9, 27.
- Smith, A., MacEntee, M. I., Beattie, B. L., Brondani, M., Bryant, R., Graf, P., Hornby, K., Kobayashi, K., & Wong, S. T. (2013). The influence of culture on the oral health-related beliefs and behaviours of elderly Chinese immigrants: A meta-synthesis of the literature. *Journal of Cross-Cultural Gerontology*, 28, 27-47.
- Spolsky, V. W., Marcus, M., Coulter, I. D., Der-Martirosian, C., & Atchison, K. A. (2000). An empirical test of the validity of the oral health status index (OHSI) on a minority population. *Journal of Dental Research*, 79, 1983-8.
- Statistics Canada (2010). *Classification of place of origin, outside Canada*. Retrieved from <http://www.statcan.gc.ca/concepts/definitions/origin01-origne01-eng.htm>
- Statistics Canada. (2012). *Focus on geography series, 2011 census: Census metropolitan area of Vancouver, British Columbia*. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-cma-eng.cfm?Lang=Eng&TAB=1&GK=CMA&GC=933>
- Tada, A., & Hanada, N. (2004). Sexual differences in oral health behaviour and factors associated with oral health behaviour in Japanese young adults. *Journal of the Royal Institute of Public Health*, 118, 104-109.
- Ueno, M., Ohara, S., Inoue, M., Tsugane, S., & Kawaguchi, Y. (2012). Association between education level and dentition status in Japanese adults: Japan public health center-based oral health study. *Community Dentistry and Oral Epidemiology*, 40, 481-487.

Vazquez, L., & Swan, J. H. (2003). Access and attitudes toward oral health care among Hispanics in Wichita, Kansas. *Journal of Dental Hygiene*, 77(2), 85-96.

World Bank. (2013). Topics in development: Migration, remittances, and diaspora.

Retrieved from

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/0,,contentMDK:21924020~pagePK:5105988~piPK:360975~theSitePK:214971,00.html>.

8020 Suishin-Zaidan. (n. d.). *Dental health in Japan*. Retrieved from

<http://www.8020zaidan.or.jp/newtest3/english/dhj.html#2>

## Appendix A: Informed Consent Form

Dear Participant:

We are asking you to participate in research study. You will complete three surveys being given to first generation Japanese immigrants who live in the Greater Vancouver, B.C. area. The purposes of these surveys are to gain insight into Japanese immigrants' lifestyle adaptation to Canadian culture as they relate to oral hygiene behaviours and attitudes. The surveys will ask questions about demographics, oral hygiene behaviors and attitudes, and your level of agreement with statements about your integration into the Canadian culture. It is our hope that information from these surveys will contribute to a better understanding of the relationship between culture and oral health behaviours.

Your responses to the surveys will be anonymous. Your name will not be collected or appear anywhere on the survey and complete privacy will be guaranteed.

Participation is completely voluntary and you may withdraw at any time. There is no reward for participating or consequence for not participating. However, by returning your signed consent and surveys, your name will be entered into a drawing for a C\$100 Costco gift card. You will only be contacted if you win the gift card.

For further information regarding this research please contact, Idaho State University, Principal Investigator (PI), Keiko Ogami at (778) 231-2445 or e-mail: keiko312@hotmail.com.

If you have any questions about your rights as a research participant, you may contact the Idaho State University Institutional Review Board at 001-(208) 282-2179.

There are two copies of this letter. After signing them, keep one copy for your records and return the other one with your completed surveys in the self-addressed, stamped envelope provided. Thank you in advance for your cooperation and support.

Please indicate your agreement to participate by signing below.

I am 18 years or older, a first generation Japanese immigrant with self-reported average to fluent English, and my native language is not English. I am not a dental professional nor work in dental industry. Also, I am not a non-English speaker. I have read and understood this consent form and agree to participate.

Signature: \_\_\_\_\_

Name: \_\_\_\_\_ (please print)

Date: \_\_\_\_\_

Should I win the gift card, please contact me:

Phone: \_\_\_\_\_ email: \_\_\_\_\_

## Appendix B: Demographic and Socioeconomic Questionnaires

Items		Answers
1	Gender	1. Male 2. Female
2	Date of birth and age	_____
3	What language do you speak most often at home?	1. English 2. Japanese 3. Other- specify _____
4	Do you speak any other language on a regular basis at home?	1. No 2. Yes, English 3. Yes, Japanese 4. Other- specify _____
5	How would you assess your English proficiency in general?	1. Poor 2. Fair 3. Good 4. Excellent
6	How long have you been living in Canada?	1. Less than 5 years 2. Between 5 and 9 years 3. Between 10 and 14 years 4. Over 14 years
7	Which age did you move to Canada?	1. Less than 25 years old 2. Between 25 and 34 years old 3. Between 35 and 44 years old 4. Over 44 years old
8	What is the highest education you have completed?	1. Elementary school 2. High school, but not diploma 3. High school diploma 4. Trade certificate 5. College diploma 6. University certificate or diploma, not a bachelor's degree 7. University bachelor's degree 8. University master's degree or above
9	Where was your education?	1. Japan 2. Canada 3. Both Japan and Canada 4. Other – specify _____
10	What is your annual household income?	1. Less than \$20,000 2. Between \$20,000 and \$50,000 3. Between \$50,000 and \$80,000 4. Above \$80,000 5. I would not rather answer

### Appendix C: East Asian Acculturation Measure (EAAM) Items

Below are listed a number of statements. For each statement, write the appropriate number (1-7) listed below to indicate your level of agreement or disagreement. Some of the statements are worded positively and others are worded negatively.

1 = STRONGLY DISAGREE  
2 = DISAGREE  
3 = SOMEWHAT DISAGREE

4 = DON'T AGREE OR  
DISAGREE

5 = AGREE SOMEWHAT  
6 = AGREE  
7 = STRONGLY AGREE

	Items	1 Strongly Disagree	2 Disagree	3 Disagree Somewhat	4 Neutral	5 Agree Somewhat	6 Agree	7 Strongly Agree
1.	I write better in English than in Japanese.							
2.	Most of the music I listen to is Asian.							
3.	I tell jokes both in English and in Japanese.							
4.	Generally, I find it difficult to socialize with anybody, Asian or Canadian.							
5.	When I am in my apartment/house, I typically speak English.							
6.	My closest friends are Asian.							
7.	I think as well in English as I do in Japanese.							
8.	I sometimes feel that neither Canadians nor Asians like me.							
9.	If I were asked to write poetry, I would prefer to write it in English.							
10.	I prefer going to social gatherings where most of the people are Asian.							
11.	I have both Canadian and Asian friends.							
12.	There are times when I think no one							



	understands me.							
13.	I get along better with Canadians than Asians.							
14.	I feel that Asians treat me as an equal more so than Canadians do.							
15.	I feel that both Asians and Canadians value me.							
16.	I sometimes find it hard to communicate with people.							
17.	I feel that Canadians understand me better than Asians do.							
18.	I would prefer to go out on a date with an Asian than with a Canadian.							
19.	I feel very comfortable around both Canadians and Asians.							
20.	I sometimes find it hard to make friends.							
21.	I find it easier to communicate my feelings to Canadians than to Asians.							
22.	I feel more relaxed when I am with an Asian than when I am with a Canadian.							
23.	Sometimes I feel that Asians and Canadians do not accept me.							
24.	I feel more comfortable socializing with Canadians than I do with Asians.							
25.	Asians should not date non-Asians.							
26.	Sometimes I find it hard to trust both Canadians and Asians.							
27.	Most of my friends at work/school are Canadians.							
28.	I find that both Asians and Canadians often have difficulty understanding me.							
29.	I find that I do not feel comfortable							

when I am with other people.							
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## Appendix D: Modified Version of Hiroshima University-Dental Behavioral Inventory (HU-DBI)

Please answer to each question based on your level of agreement or disagreement to each item.

Items		1 Strongly Disagree	2 Disagree	3 No Opinion or Uncertain	4 Agree	5 Strongly Agree
1.	I don't worry much about visiting the dentist.					
2.	My gums tend to bleed when I brush my teeth.*					
3.	I worry about the color of my teeth.					
4.	I have noticed some white sticky deposits on my teeth.*					
5.	I use a child-sized toothbrush.					
6.	I think that I cannot help having false teeth when I am old.*					
7.	I am bothered by the color of my gums.					
8.	I think my teeth are getting worse despite my daily brushing.*					
9.	I brush each of my teeth carefully.*					
10.	I have never been taught professionally how to brush.*					
11.	I think I can clean my teeth well without using toothpaste.*					
12.	I often check my teeth in a mirror after brushing.*					
13.	I worry about having bad breath.					
14.	It is impossible to prevent gum disease with tooth brushing alone.*					
15.	I put off going to the dentist until I have toothache.*					
16.	I have used a dye to see how clean my teeth are.*					
17.	I use a toothbrush with hard bristles.					
18.	I don't feel I've brushed well unless I brush with strong strokes.					
19.	I feel I sometimes take too much time to brush my teeth.*					
20.	I have had my dentist tell me that I brush very well.					

\*Questions for scoring

## Appendix E: Permission to Use EAAM Instrument for Research

Outlook.com Print Message

<https://snt148.mail.live.com/ol/mail.mvc/PrintMessages?mkt=en-ca>

[Print](#)

[Close](#)

### RE: Permission to use EAAM instrument for research

From: **Barry, Declan** (declan.barry@yale.edu)  
Sent: January-07-15 1:24:47 PM  
To: Denise Bowen (bowedeni@gmail.com)  
Cc: Keiko Ogami (keiko312@hotmail.com); Tara Johnson (johntara@isu.edu)  
3 attachments  
East Asian Acculturation Measure Instructions.doc (27.2 KB) , Perception of discrimination.pdf (64.3 KB) , Willingness to seek psychological services.pdf (69.3 KB)

Dear Denise: Sure. Feel free to use it. To my knowledge, it has not been translated into non-English languages. I have attached a copy of the instrument, scoring instructions, and some representative papers, which may be of interest to you. Good luck with your research.

Regards,  
Declan

--  
Declan T. Barry, Ph.D.  
Assistant Professor of Psychiatry  
Yale University School of Medicine  
Director, APT Pain Treatment Services  
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34 Park Street  
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The information contained in this message may be privileged and confidential.  
If you are NOT the intended recipient, please notify the sender immediately  
with a copy to [hipaa.security@yale.edu](mailto:hipaa.security@yale.edu) and destroy this message

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**From:** Denise Bowen [bowedeni@gmail.com]  
**Sent:** Wednesday, January 07, 2015 4:08 PM  
**To:** Barry, Declan  
**Cc:** Keiko Ogami; Tara Johnson  
**Subject:** Permission to use EAAM instrument for research

Dear Dr. Declan:

My graduate student, Keiko Ogami, contacted you recently to request permission to use the EAAM instrument you developed in our research project entitled, Oral Health Behaviours and Attitudes among East Asian Immigrants in Vancouver, British Columbia, Canada. I am writing to follow up on this request

as we are preparing to meet with our statistician and begin data collection soon. We are studying Japanese and Chinese immigrants and would appreciate it if you would send us a copy of the instrument with your permission for use. If it is available in languages other than English, we would also request the Japanese and Chinese versions. If not, the English version would be appreciated. Of course, appropriate credit will be given in dissemination and publication of results.

We anxiously await your reply in anticipation of your support for our project. Thank you for your many contributions to the literature and scholarship, as well as your time and attention to this request.

Best regards,  
Denise Bowen

--  
Denise M. Bowen, RDH, MS  
6929 Running Iron Lane  
Pocatello, ID 83204  
[bowedeni@gmail.com](mailto:bowedeni@gmail.com)

Denise M. Bowen, RDH, MS  
Assistant Professor of Psychology  
Yale University School of Medicine  
Director, APT Post-Testament Services  
CHC/CHC Room 5250  
360 Yale Street  
New Haven, CT 06510-3150

Phone: (203) 785-5500  
Fax: (203) 785-4581  
E-mail: [denise.bowen@yale.edu](mailto:denise.bowen@yale.edu)

[http://med.yale.edu/psychology/people/denise\\_bowen](http://med.yale.edu/psychology/people/denise_bowen)  
The information contained in this message may be privileged and confidential.  
If you are not the intended recipient, please notify the sender immediately  
with a copy to [denise.bowen@yale.edu](mailto:denise.bowen@yale.edu) and delete this message.

From: Denise Bowen ([bowedeni@gmail.com](mailto:bowedeni@gmail.com))  
Sent: Wednesday, January 03, 2012 4:01 PM  
To: Barry, Denise

Re: Keiko Ogami, PhD  
Subject: Permission to use the EAM instrument for research

Dear Dr. Bowen:

My graduate student, Keiko Ogami, contacted you recently to request permission to use the EAM instrument you developed in our research project entitled, "Oral Health Behaviors and Attitudes among East Asian Immigrants in Vancouver, British Columbia, Canada." I am writing to follow up on this request.

The followings are attachments from Dr. B. Declan.

January 7, 2015

Dear Colleague:

Thank you for your inquiry about my research. Please feel free to use the East Asian Acculturation Measure (EAAM) in your research. If possible, please forward me a copy of your findings for my files. If you are interested in doing collaborative research, please let me know. For details of the scale development and for citation purposes, the following articles may be useful:

**Barry, D. T. (2001). Development of a new scale for measuring acculturation: the East Asian Acculturation Measure (EAAM). Journal of Immigrant Health, 3, 193-197.**

**Barry, D. T., & Garner, D. M. (2001). Eating concerns in East Asian immigrants: Relationships between acculturation, self-construal, ethnic identity, gender, psychological functioning and eating concerns. Eating and Weight Disorders, 6, 90-98.**

**Barry, D. T., & Grilo, C. M. (2002). Cultural, psychological, and demographic correlates of willingness to use psychological services among East Asian immigrants. Journal of Nervous and Mental Disease, 190, 32-39.**

To score each scale, add the participant's scores (1 to 7) for the relevant items.

Overall EAAM (add the scores for the 29 items)

*Assimilation* (#s 1, 5, 9, 13, 17, 21, 24, 27)

*Separation* (#s 2, 6, 10, 14, 18, 22, 25)

*Integration* (#s 3, 7, 11, 15, 19)

*Marginalization* (#s 4, 8, 12, 16, 20, 23, 26, 28, 29)

If you translate the scale into another language, I would appreciate a copy of the translation.

If you have any questions, please feel free to e-mail me: declan.barry@yale.edu

**Thank you again for your interest in the EAAM**

**Declan Barry, Ph.D.  
Yale University School of Medicine**

## Appendix F: Permission to Use HU-DBI Instrument for Research

Outlook.com Print Message <https://snt149.mail.live.com/ol/mail.mvc/PrintMessages?mkt=en-ca>

[Print](#) [Close](#)

**RE: 河村誠先生の連絡先**

---

From: **Keiko Ogami** (keioga00@hotmail.com)  
Sent: February-06-14 11:27:08 PM  
To: 病院総務・人事・職員研修担当 (byo-soumu@office.hiroshima-u.ac.jp)

今井さま

お忙しいところどうも有難うございました。

大神恵子

---

From: byo-soumu@office.hiroshima-u.ac.jp  
To: keioga00@hotmail.com  
Date: Fri, 7 Feb 2014 15:52:29 +0900  
Subject: RE: 河村誠先生の連絡先

大神恵子 様

WEB検索すると、

歯科における行動科学的研究：

第9報 歯科保健行動目録(HU-DBI)の日本語版・英語版の等価性に関する研究

が出てきますので、河村 誠 先生が作成に携わったのは間違いだと思います。

〒734-8551広島市南区霞1-2-3

広島大学病院総務グループ 担当: 今井 康晴

TEL:082-257-5015 FAX:082-257-5087

E-mail: byo-soumu@office.hiroshima-u.ac.jp



+++++

広島大学の先生様へ

**From:** Keiko Ogami [mailto:keioga00@hotmail.com]**Sent:** Friday, February 07, 2014 3:35 PM**To:** 病院総務・人事・職員研修担当**Subject:** RE: 河村誠先生の連絡先

今井さま

早速のお返事どうも有難うございます。確認までですが、河村先生が作成されたもので、私が使いたいと思っているアンケートの名前はHU-DBIと言います。先生がこのひとつだけ作成されたのであれば間違いはないと思いますが、確認のほうよろしく願いできますか？ お忙しいところすみません。

大神恵子

> From: [byo-soumu@office.hiroshima-u.ac.jp](mailto:byo-soumu@office.hiroshima-u.ac.jp)> To: [keioga00@hotmail.com](mailto:keioga00@hotmail.com)

&gt; Date: Fri, 7 Feb 2014 10:07:06 +0900

&gt; Subject: 河村誠先生の連絡先

&gt;

&gt; 大神恵子 様

&gt;

&gt; 広島大学病院総務グループの今井と申します。

&gt; お問い合わせいただきありがとうございました。

&gt;

&gt; 河村 誠 先生へ連絡したところ、

&gt; アンケートを使用して構わない、とのことでした。

&gt;

&gt; 河村先生から、対応が難しいので代わりに連絡

&gt; してほしいと依頼を受けましたので、

&gt; 私が回答させていただいた次第です。

&gt; どうぞよろしくお願いいたします。

&gt;

&gt; ++++++

&gt; 〒734-8551 広島市南区霞1-2-3

&gt; 広島大学病院総務グループ 担当: 今井 康晴

&gt; TEL: 082-257-5015 FAX: 082-257-5087

> E-mail: [byo-soumu@office.hiroshima-u.ac.jp](mailto:byo-soumu@office.hiroshima-u.ac.jp)

&gt; ++++++

&gt;

&gt;

&gt; From: Keiko Ogami [mailto:keioga00@hotmail.com]

&gt; Sent: Friday, February 07, 2014 4:28 AM



> To: International Affairs([inquiry@office.hiroshima-u.ac.jp](mailto:inquiry@office.hiroshima-u.ac.jp))  
> Subject: 河村誠先生の連絡先  
>  
> 事務局様  
>  
> 私は日本で歯科衛生士をして、現在カナダのバンクーバーで、  
> 衛生士として働いております。  
> 大学院の勉強の一部で、論文を書いております。  
> 歯学部河村誠先生が作成されたアンケートを使って、研究を  
> 進めたいと思っています。  
> 河村先生の連絡先を調べておりますが、なかなか見つかりません。  
> もし事務局のほうで連絡先がわかれば教えて頂きたいと思い、  
> メールをさせていただきました。  
> ご連絡お待ちしております。  
>  
> 大神恵子

**From:** byo-soumu@office.hiroshima-u.ac.jp

**To:** keioga00@hotmail.com

**Date:** Fri, 7 Feb 2014 15:52:29 +0900

**Subject: RE: 河村誠先生の連絡先**

大神恵子 様

**WEB 検索すると、歯科における行動科学的研究：**

**第 9 報 歯科保健行動目録(HU-DBI)の日本語版・英語版の等価性に関する研究**  
が出てきますので、河村 誠 先生が作成に携わったのは間違いないと思いま  
す。

**〒734-8551 広島市南区霞 1 - 2 - 3**

**広島大学病院総務グループ 担当：今井 康晴**

**TEL : 082-257-5015 FAX : 082-257-5087**

Dear Ms. Keiko Ogami,

I assure that Dr. Kawamura was involved with a research of the HU-DBI (Japanese and English version) as I was able to observe the information on the Web.

Sincerely yours,

Yasuharu Imai

---

---

**E-mail : byo-soumu@office.hiroshima-u.ac.jp**

**From: Keiko Ogami [mailto:keioga00@hotmail.com]**

**Sent: Friday, February 07, 2014 3:35 PM**

**To: 病院総務・人事・職員研修担当**

**Subject: RE: 河村誠先生の連絡先**

今井さま

早速のお返事どうも有難うございます。 確認までですが、河村先生が作成されたもので、私が使いたいと思っているアンケートの名前は **HU-DBI** と言います。 先生がこのひとつだけ作成されたのであれば間違いはないと思いますが、確認のほうよろしく願いできますか？ お忙しいところすみません。

Dear Mr. Imai,

Thank you very much for your quick response. I want to confirm that the name of the instrument I want to use is the HU-DBI. If Dr. Kawamura invented this instrument only, there would not be any mistakes. Can you confirm it and please let me know?

Sincerely,

---

---

Keiko Ogami

---

**From:** byo-soumu@office.hiroshima-u.ac.jp  
**To:** keioga00@hotmail.com  
**Date:** Fri, 7 Feb 2014 10:07:06 +0900  
**Subject:** 河村誠先生の連絡先

大神恵子 様

広島大学病院総務グループの今井と申します。  
お問い合わせいただきありがとうございました。  
河村 誠 先生へ連絡したところ、アンケートを使用して構わない、とのことでした。河村先生から、対応が難しいので代わりに連絡してほしいと依頼を受けましたので、私が回答させていただいた次第です。  
どうぞよろしくお願いいたします。

〒734-8551 広島市南区霞 1 - 2 - 3  
広島大学病院総務グループ 担当：今井 康晴  
TEL : 082-257-5015 FAX : 082-257-5087  
E-mail : byo-soumu@office.hiroshima-u.ac.jp

Dear Keiko Ogami,

Thank you for your inquiry. My name is Imai at the general affairs department of Hiroshima University. I was able to contact with Dr. Kawamura and he gave you a permission to use his instrument for your research. Unfortunately, Dr. Kawamura is not able to contact you directly; therefore, I am replying to your inquiry. Thank you for your understanding.

Regards,

Yasuharu Imai

---

From: Keiko Ogami [mailto:keioga00@hotmail.com]  
Sent: Friday, February 07, 2014 4:28 AM  
To: International Affairs(inquiry@office.hiroshima-u.ac.jp)  
Subject: 河村誠先生の連絡先

事務局様

私は日本で歯科衛生士をして、現在カナダのバンクーバーで、衛生士として働いております。大学院の勉強の一部で、論文を書いております。歯学部の河村誠先生が作成されたアンケートを使って、研究を進めたいと思っています。河

村先生の連絡先を調べておりますが、なかなか見つかりません。もし事務局のほうで連絡先がわかれば教えて頂きたいと思い、メールをさせていただきました。

ご連絡お待ちしております。

大神恵子

Subject: Dr. Kawamura's contact information

Dear Personnel,

I used to practice as a dental hygienist in Japan and currently I am working as a hygienist in Vancouver, Canada. I am writing thesis as a part of my graduate study at Idaho State University. I want to use Dr. Kawamura's instrument to conduct my research. I have been looking for Dr. Kawamura's contact information, but I have not found it yet. If you have his contact information, can you let me know so that I can ask his permission to use his instrument?

Sincerely,

Keiko Ogami

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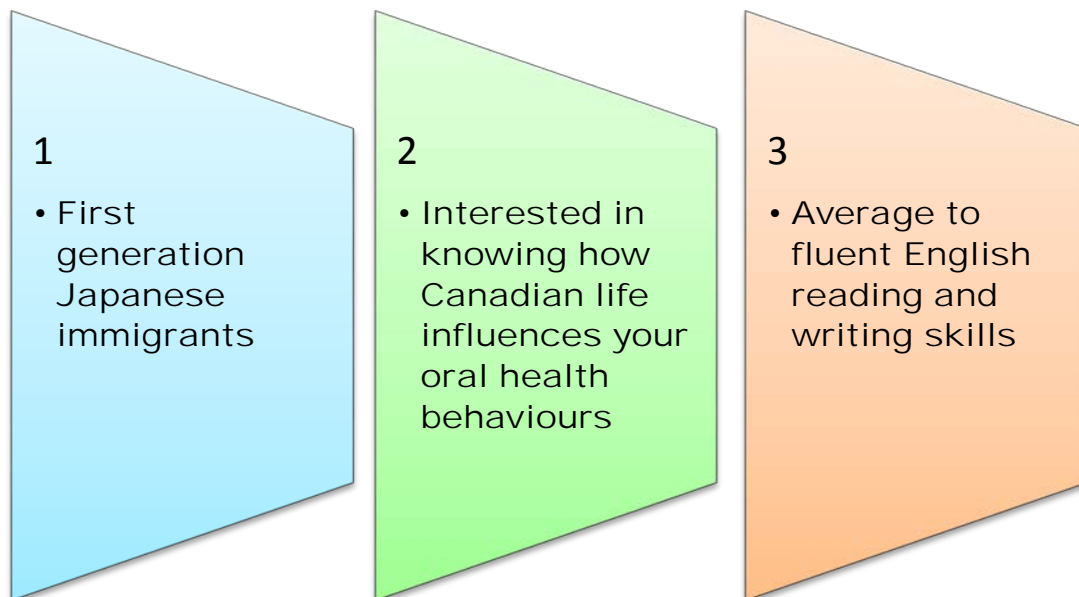
## Appendix G: Flyer to Recruit Subjects



# Japanese Immigrants' Oral Health Behaviour Research Study

*Be part of an immigrants' oral health behaviour research study*

If you are or have:



If you say yes to all three questions, you may be eligible to participate in oral health behaviour study.

The purpose of this study is to examine relationships between different acculturation patterns and oral health behaviours and attitudes among Japanese adult immigrant populations in Greater Vancouver, British Columbia (BC), Canada. You will be asked to complete three hard-copy surveys that will take approximately 10-15 minutes to complete. Upon return of the surveys in the self-addressed, stamped envelope provided, you will be entered into a drawing for a C\$100 Costco gift card. You will only be notified if you win the drawing

Contact Keiko Ogami at 778-231-2445 or by e-mail ([keiko312@hotmail.com](mailto:keiko312@hotmail.com)) for more information.

## **Appendix H: Advertisement to Recruit Subjects**

If you are a first generation Japanese immigrant and your English reading and writing skills are moderate to good, you may be eligible to participate in a research study. The study is about your adaptation to Canadian lifestyles and your oral health/hygiene behaviours and attitudes. You will be asked to respond to three short surveys that take approximately 10-15 minutes to complete. Upon return of the surveys in the self-addressed, stamped envelope provided, you will be entered into a drawing for a C\$100 Costco gift card. If you are interested in participating in the study, please contact Keiko Ogami at keiko312@hotmail.com or 778-231-2445.

## Appendix I: Canadian Journal of Dental Hygiene: Guideline for Authors

### GUIDELINES FOR AUTHORS

The *Canadian Journal of Dental Hygiene* (CJDH) is a quarterly peer-reviewed publication of the Canadian Dental Hygienists Association. It invites manuscript submissions in English and French on topics relevant to dental hygiene practice, theory, education, and policy. Manuscripts should deal with current issues, make a significant contribution to the body of knowledge of dental hygiene, and advance the scientific basis of practice. All pre-submission enquiries and submissions should be directed to [journal@cdha.ca](mailto:journal@cdha.ca)

#### Manuscript categories

1. Original research articles: maximum 6000 words, no more than 150 references, and an abstract within 250 words.
2. Literature reviews: between 3000 and 4000 words, no more than 150 references, and an abstract within 250 words.
3. Short communications/Case reports: maximum 2000 words, as many references as required, and an abstract within 150 words.
4. Position papers: maximum 4000 words, no more than 100 references, and an abstract within 250 words. This category includes position papers developed by CDHA.
5. Letters to the editor: maximum 500 words, no more than 5 references and 3 authors. No abstract.
6. Editorials: by invitation only.

Details on the required components of each manuscript category may be found under "Manuscript Preparation" at [www.cdha.ca/cjdh](http://www.cdha.ca/cjdh).

#### Manuscript topics

CJDH welcomes your original submissions on

- **Professionalism:** ethics, social responsibility, legal issues, entrepreneurship, business aspects, continuing competence, quality assurance, and other topics within the general parameters of professional practice.
- **Clinical practice:** interceptive, therapeutic, preventive, and ongoing care procedures to support oral health.
- **Oral health sciences:** knowledge related to the sciences that underpin dental hygiene practice.
- **Theory:** dental hygiene concepts or processes.
- **Health promotion:** public policy and elements integral to building the capacity of individuals, groups, and society at large, such as the creation of supportive learning environments, developing abilities, strengthening community action, and reorienting oral health services.
- **Education and evaluation:** teaching and learning at an individual, group or community level (includes education related to clients, oral health professionals, as well as program assessment, planning, implementation and evaluation).

Please note that manuscripts submitted to CJDH should be the original work of the author(s) and should not be under review or previously published by another body in any written or electronic form. This does not include abstracts prepared for and presented at a scientific meeting and subsequently published in the proceedings. The journal's full [Ethics Policy](#) governing authorship, conflict of interest, research ethics, and academic misconduct is available online at [www.cdha.ca/cjdh](http://www.cdha.ca/cjdh). Please consult this document prior to submitting your manuscript.

**Peer review:** All papers undergo initial screening by the Scientific Editor to ensure that they fall within the journal's mandate and meet our submission requirements. Suitable papers are then sent for peer review by two or more referees. This process also applies to position papers generated by CDHA, given that they involve an analysis of literature. Additional specialist advice (e.g., from a statistician) may be sought for peer review if necessary.

**Revision:** When a manuscript is returned to the corresponding author for revision, the revised version should be submitted within 6 weeks of the author's receipt of the referee reports. The author(s) should explain in a covering letter how the requested revisions were addressed or why they were discounted. If a revised manuscript is resubmitted after the 6-week period, it may be considered as a new submission. Additional time for revision may be granted upon request, at the managing editor's discretion.

#### Manuscript submission checklist

Check	Cover Letter
	Originality of the work and any conflicts of interest declared.
	Contact information for corresponding author provided.
Check	Manuscript
	Text is presented in a clear font, such as Arial or Times New Roman, double-spaced, and in 12-point size.
	All margins are 1 inch (2.5 cm).
	Pages are numbered consecutively, starting with title page.
	Authors' full names, academic degrees, and affiliations are listed on the title page.
	Corresponding author's contact information is provided on the title page.
	Key words from the Medical Subject Headings (MeSH) database at <a href="http://www.nlm.nih.gov/mesh/meshhome.html">www.nlm.nih.gov/mesh/meshhome.html</a> are listed after the abstract.
	Abbreviations and units conform to the Système international d'unités (SI). SI symbols may be used without definition in the body of the paper. Abbreviations are defined in parentheses after their first mention in the text.
	Figures and tables are numbered consecutively, cited in the text, and inserted at the end of the manuscript.
	Previously published tables or figures are accompanied by written consent from the copyright holder (usually the publisher) to reproduce the material in the print and online versions of CJDH.



Check	Manuscript
	Any information (text or images) identifying clients or research subjects is accompanied by written consent from the individual(s) to publish the information in CJDH.
	References in the text are numbered and listed in order of appearance.
	References are formatted according to the Vancouver style ( <a href="http://www.nlm.nih.gov/bsd/uniform_requirements.html">www.nlm.nih.gov/bsd/uniform_requirements.html</a> ), using abbreviated journal titles.
	Personal communications are not included in the reference list but are cited in parentheses in the text. Confirmation of permission to print the quotation is included in the Acknowledgements section.

Artwork includes any illustrations, graphs, figures, photographs, and any other graphics that clearly support and enhance the text. This artwork must be supplied in its original file format (as source files). Acceptable file formats include .eps, .pdf, .tif, .jpg, .ai, .cdr in high resolution, suited for print reproduction:

- minimum of 300 dpi for grayscale or colour halftones
- 600 dpi for line art
- 1000 dpi minimum for bitmap (b/w) artwork
- colour artwork submitted in CMYK (not RGB) colour mode

The author(s) must provide proof of permission to reproduce previously produced artwork from the original source and acknowledge the source in the caption. The editorial office reserves the right to reschedule publication of an accepted manuscript should there be delays in obtaining permissions or artwork of suitable print quality.

Data or tables may be submitted in Excel or Word formats.

#### Supplementary information

Supplementary information is peer-reviewed material directly relevant to the conclusions of an article that cannot be included in the printed version owing to space or format constraints. It is posted on the journal's web site and linked to the article when the article is published and may consist of additional text, figures, video, extensive tables or appendices. Sources of supplementary information should be acknowledged in the text, and permission for using them sent to the editorial office at the time of submission. All supplementary information should be in its final format because it will not be copy-edited and will appear online as originally submitted.

#### SAMPLES OF REFERENCES AND CITATIONS

CJDH, like most biomedical and scientific journals, uses the Vancouver citation style for references, which was established by the International Committee of Medical Journal Editors

in 1978. References should be numbered consecutively in the order in which they are first mentioned in the text. Use the previously assigned number for subsequent references to a citation (i.e., no "op cit" or "ibid"). Use superscript Arabic numerals to identify the reference within the text (e.g.,<sup>1,2</sup> or <sup>3-6</sup>). For more information on this style and the uniform requirements for manuscript preparation and submission, please visit [www.nlm.nih.gov/bsd/uniform\\_requirements.html](http://www.nlm.nih.gov/bsd/uniform_requirements.html). Examples of how to cite some common research resources appear below.

#### JOURNAL ARTICLES

##### Standard article

Orban B, Manella VB. A macroscopic and microscopic study of instruments designed for root planing. *J Periodontol*. 1956;27:120-35.

##### Volume with supplement

Orban B, Manella VB. A macroscopic and microscopic study of instruments designed for root planing. *J Periodontol*. 1956;27 Suppl 7:S6-12.

##### Conference proceedings – abstract

Austin C, Hamilton JC, Austin TL. Factors affecting the efficacy of air abrasion [abstract]. *J Dent Res*. 2001;80(Special issue):37.

##### No author

What is your role in the profession? [editorial] *J Dent Topics*. 1999;43:16-17.

##### Organization as author

Canadian Dental Hygienists Association. Policy framework for dental hygiene education in Canada. *Probe*. 1998;32(3):105-7.

#### BOOKS AND OTHER MONOGRAPHS

##### Personal authors

Hooyman NR, Kiyak HA. *Social gerontology: A multidisciplinary perspective*. 6th ed. Boston: Allyn & Bacon; 2002.

##### Editors as authors

Cairns J Jr, Niederlehner BR, Orvosm DR, editors. *Predicting ecosystem risk*. Princeton (NJ): Princeton Scientific Publications; 1992.

##### Chapter in book

Weinstein L, Swartz MN. Pathological properties of invading organisms. In: Soderman WA Jr, Soderman WA, editors. *Pathological physiology: mechanisms of disease*. Philadelphia: WB Saunders; 1974. p. 457-72.

##### Conference paper

Calder BL, Sawatzky J. A team approach: Providing off-campus baccalaureate programs for nurses. In: Doe AA, Smith BB, editors. *Proceedings of the 9th Annual Conference on Distance Teaching and Learning*; 1993 Sep 13-15, Ann Arbor, MI. Madison (WI): Ann Arbor Publishers; 1993. p. 23-26.



Scientific or technical report

Murray J, Zelmer M, Antia Z. *International financial crises and flexible exchange rates*. Ottawa: Bank of Canada; 2000 Apr. Technical Report No. 88.

OTHER PUBLICATIONS

Newspaper article

Rensberger B, Specter B. CFCs may be destroyed by natural process. *The Globe and Mail*. 1989 Aug 7;Sect B:24.

Audiovisual

Wood RM, editor. *New horizons in esthetic dentistry* [videocassette]. Chicago: Chicago Dental Society; 1989.

Unpublished material

Smith A, Jones B. The whitening phenomenon. *J Nat Dent*. (Forthcoming 2004)

ELECTRONIC MATERIAL

Monograph on Internet

National Library of Canada. *Canadiana quick reference* [monograph on the Internet]. Ottawa: The Library; 2000 [cited 2003 Nov 30]. Available from: [www.nlc-bnc.ca/8/11/index-e.html](http://www.nlc-bnc.ca/8/11/index-e.html)

Journal on Internet

Walsh MM. Improving health and saving lives. *Dimens Dent Hyg* [serial on Internet] 2003 Nov/Dec [cited 2004 Jan 12]. Available from: [www.dimensionsofdentalhygiene.com/nov\\_dec/saving\\_lives.htm](http://www.dimensionsofdentalhygiene.com/nov_dec/saving_lives.htm)

Homepage/website

Canadian Dental Hygienists Association [homepage on the Internet]. Ottawa: CDHA; 1995 [cited 2003 Nov 20]. Available from: [www.cdha.ca](http://www.cdha.ca)

## **Manuscript**

Oral Health Behaviours and Attitudes among Japanese Immigrants in Greater Vancouver,  
British Columbia, Canada

Keiko Ogami, RDH, BS, MSDH Candidate, Department of Dental Hygiene, Idaho State  
University

Tara Johnson, RDH, PhD, Associate Professor, Department of Dental Hygiene, Idaho  
State University

Denise Bowen, RDH, MS, Professor Emeritus, Department of Dental Hygiene, Idaho  
State University

## Abstract

**Background:** The purpose of this study was to examine relationships between acculturation patterns and oral health behaviours and attitudes among Japanese immigrants in Greater Vancouver, British Columbia, Canada. **Methods:** This cross-sectional study used three questionnaires: a self-designed demographic/socioeconomic questionnaire, the East Asian Acculturation Measure (EAAM) to identify acculturation patterns of East Asian immigrants after migration to North America, and a modification of the Hiroshima University Dental Behavioural Inventory (HU-DBI) to evaluate oral health behaviours and attitudes. The convenience sample (N=48) was recruited by networking. Data were analyzed using descriptive statistics, Spearman ( $r_s$ ) and Pearson ( $r$ ) correlations, independent sample t-test, and multiple linear regression analysis.

**Results:** Mean HU-DBI scores were 37.92 of 60.0 total. Mean EAAM scores were: assimilation, 2.86; separation, 3.71, integration, 4.41; and marginalization, 3.08 of 7.0 total. Pearson correlation analysis indicated an inverse association between age and assimilation ( $r=-.392$ ,  $p=0.01$ ). Income was significantly associated with oral health behaviors and attitudes ( $r_s=.287$ ). Marginalization ( $p=0.02$ ), or detachment from both cultures, was the only significant predictor of HU-DBI scores; the higher the marginalization, the lower the HU-DBI. Separation, or the reconfirmation of traditional culture, was suggestive of a prediction ( $p=0.05$ ). **Conclusion:** Improvement in oral health behaviours and attitudes in Japanese immigrants is needed. A relationship exists between acculturation and oral behaviours/attitudes. Oral health education in dental hygiene practice and public health program should target Japanese immigrants, with special consideration for less acculturated individuals and those in lower socioeconomic

levels. Further study of relationship between acculturation and oral health behaviours is indicated.

**Key Words:** acculturation, oral health, health behaviour

Oral Health Behaviours among Japanese Immigrants in Greater Vancouver,  
British Columbia, Canada

**Introduction**

Acculturation is the phenomenon that occurs when migrants change their cultural pattern over time in the host countries as a result of exposing themselves to new a culture.<sup>1</sup> It is one of the major factors influencing general and oral health when people relocate from their home countries to other countries, especially from less developed to more developed countries.<sup>2,3</sup> For decades, research has identified a relationship between acculturation and general health.<sup>4-6</sup> Evidence also supports a relationship between acculturation and oral diseases (dental caries and periodontal disease). Limited information is available regarding acculturation and oral health behaviours.<sup>3</sup>

When people migrate from their native countries to other countries, they are exposed to new and sometimes unfamiliar cultures. Berry observed that people experience four possible acculturation outcomes after they reside in a new country for a period of time: assimilation (adoption of the dominant culture), separation (reconfirmation of the traditional culture), integration (combination of the two cultures), or marginalization (detachment from both cultures).<sup>7</sup> Based on these constructs, Barry developed the East Asian Acculturation Measure (EAAM) as a useful tool for researchers and clinicians to investigate the acculturation patterns of East Asian immigrants.<sup>8</sup> These different dimensions of acculturation are important indicators in assessing health-related knowledge, attitudes, beliefs and practices; utilization of the healthcare system; and, clinical outcomes. Mariño, Stuart, Wright, Minas, and Klimidis suggested that cultural factors might be more important than immigrants' socioeconomic status (educational

level, employment status, or language) when developing public health programs or treatment approaches.<sup>9</sup>

## **Literature Review**

Several studies have assessed the relationship between demographic/socioeconomic characteristics, especially gender and age, with oral health status and/or behaviours, attitudes, and beliefs in Japan. Differences in oral health status, oral health behaviours and related factors have been identified between sexes among Japanese adults.<sup>10-12</sup> In general, women have been found to have better oral health status, oral health behaviours and more knowledge about dental health than men.<sup>10, 11</sup> Factors associated with oral health status such as frequency of toothbrushing, interdental cleaning or smoking status, have been shown to differ in men and women.<sup>11, 12</sup> However, Kawamura and Iwamoto discovered that gender was not a major factor, whereas age significantly affected perceptions about oral health and disease in employed adults in Japan.<sup>13</sup> Hsu et al. found age and education level were associated with low dentition and oral health status.<sup>14</sup> Likewise, Ueno et al. found an association between various measures of oral health and the education level of Japanese adults.<sup>15</sup>

Studies of factors affecting oral health status of immigrants to North America have identified an association between acculturation attributes and oral disease. Cruz et al. identified immigrants' country birth, length of stay in the host country, and age at immigration as factors that played important roles in their oral disease prevalence, independently of most known risk factors for oral disease.<sup>16</sup> Calvasina et al. concluded immigrants who have no dental insurance and low annual household income were more

likely to report unmet dental care needs than those with dental insurance and higher income.<sup>17</sup>

Oral health behaviours, attitudes, and beliefs are known variables related to oral health status. Studies of these factors in individuals residing in East Asia indicate less than ideal oral health behaviours and habits in these countries of origin. Frequent toothbrushing, interproximal cleaning, regular dental check-ups, and acceptance of professional advice were associated with good oral health status in a population of dental school clinic patients in Japan, although plaque control was generally inadequate.<sup>18</sup> Oral health behaviours and habits of older Taiwanese were found to be associated with number of remaining teeth.<sup>14</sup> Low dentition was greater in individuals who were older, had less education, were infrequent floss users, had current smoking habits, had poor self-perceived dental health, and were former betel-nut chewers.<sup>14</sup> Research findings also have identified relationships between acculturation or cultural beliefs and one's behaviour, attitudes and health beliefs in East Asian immigrants residing in countries with western cultures. Mariño et al. found that acculturation was related to occupation, age, level of education and immigration in Vietnamese living in Australia.<sup>9</sup> Acculturation also was related to three oral health outcomes: oral health knowledge, dental visits, and dental caries history.

Immigrants have demonstrated poorer oral health status than native born-populations, and lack of dental insurance, low income and ethnicities have been found to predict unmet dental care needs in Canadian immigrants.<sup>17</sup> Gao and McGrath completed a literature review to determine the oral health implications of acculturation.<sup>3</sup> Fifteen studies included in the review suggested better oral health among acculturated

immigrants; however, this association could not be attributed to more frequent dental visits. Therefore, these authors recommended studies of oral health behaviours and diseases using refined acculturation scales to improve the understanding of the course of immigrants' oral health along the acculturation continuum. A study of perceptions of oral diseases in Chinese populations in Canada revealed that most participants possessed scientific knowledge about dental caries such as the basic etiology and progression of carious lesions.<sup>19</sup> The participants used both western and traditional beliefs and behaviours in prevention and remedies for gingival swelling, but held traditional beliefs regarding causes and prevention of gingival bleeding. Results of this study implied that cultural beliefs influenced oral health behaviours. Similarly, a meta-synthesis of the literature regarding elderly Chinese immigrants in Western countries found religion and culture played an important role in identification and treatment of health problems and Chinese health beliefs were stronger in older and less educated Chinese immigrants.<sup>20</sup> This meta-synthesis also indicated traditional cultural beliefs were related to oral health behaviours and attitudes. Thus, the present study investigated whether demographic and socioeconomic variables and different patterns of acculturation including one's cultural beliefs and adoption of Canadian culture were associated with oral health behaviours and attitudes.

In summary, health beliefs, and oral health behaviours and attitudes in East Asian populations and immigrants are influenced by demographic/socioeconomic factors, especially age, education, and sex, and cultural background and cultural beliefs. These health beliefs and oral health behaviours and attitudes also affect oral health status.



To date, there have been few studies published regarding acculturation and its impact on oral health care behaviours and attitudes, especially regarding Japanese immigrants residing in Canada. An investigation of the relationship between different acculturation patterns and oral health care behaviours and attitudes is needed to identify potential factors that may ultimately clarify the complex relationship between acculturation and oral health. The purpose of this study was to examine relationships between acculturation and oral health behaviours and attitudes among Japanese immigrant populations in Greater Vancouver, British Columbia (BC), Canada.

### **Significance of the Work**

Immigrants in Canada have exhibited oral health disparities.<sup>21</sup> Dental hygienists are responsible for reducing barriers to care for ethnic minorities by providing culturally appropriate care; therefore, knowledge of psychological and behavioural acculturation may provide essential information for public health programs and practitioners. Researchers and dental professionals may be able to identify factors that influence different patterns of acculturation and are linked to specific oral health behaviours and attitudes, leading to an improvement in culturally-related oral health behaviours and attitudes of ethnic minority groups.

This study addressed one of the pillars of the Canadian Institute of Health Research (CIHR): Social, Cultural, Environmental and Population Health.<sup>22</sup> As examples of associated research areas within this pillar, the Canadian Dental Hygienists Association (CDHA) has identified several areas: social and economic impact of oral health and disease on populations, barriers and opportunities for oral care for all populations, and cultural and linguistic relevance of dental hygiene services.

Through dissemination of the findings of this study, awareness of patterns of acculturation and oral hygiene behaviours and attitudes of immigrants may increase among dental hygienists. Ultimately, dental hygienists may utilize the findings from this study in their patient care and education. The study was designed to answer the following research question:

- Is acculturation in the Japanese adult immigrant populations in Greater Vancouver, BC, Canada related to self-reported oral hygiene behaviours and attitudes scores?

The research hypothesis tested was:

- There will be a relationship between acculturation as measured by the EAAM and oral hygiene behaviours and attitudes as measured by a modified version of the Hiroshima University-Dental Behavioural Inventory (HU-DBI) in Canadian immigrants of Japanese origin.

## **Methods**

An application for expedited review of this study was submitted to the Idaho State University (ISU) Institutional Review Board's, Human Subjects Committee (HSC) and approval was obtained before subject recruitment and enrollment began (IRB-FY2015-84). This cross-sectional, quantitative study used three short questionnaires: a self-designed demographic and socioeconomic questionnaire, the EAAM, and the HU-DBI. The EAAM contains 29 questions related to the four dimensions of acculturation as described by Berry: assimilation (8 items), separation (7 items), integration (5 items) and marginalization (9 items) with a 7-point Likert scale (strongly disagree, disagree, disagree somewhat, neutral, agree somewhat, agree, strongly agree) to score for each item. The EAAM instrument was shown to be valid and reliable at the time of its development.<sup>8</sup> The original HU-DBI, developed and validated by Kawamura, included

20 items with dichotomous response options of agree or disagree; however, Kawamura's original HU-DBI scale includes only 12 of those items for scoring (Figure 1).<sup>23-25</sup>

Kawamura chose these 12 items based on their statistically significant correlation with oral hygiene-related conditions (i.e., plaque, calculus, gingival condition, probing depth) as measured by the Oral Rating Index. When calculating HU-DBI scores, one point was given for each agree response to items 4, 9, 11, 12, 16 and 19 and one point was scored for disagree responses to items 2, 6, 8, 10, 14 and 15. The only modification made was to expand the response options to a 5-point Likert scale (strongly disagree, disagree, no opinion, agree, or strongly disagree) to allow for more varied responses and provide continuous data for statistical analysis.

A convenience sample of 48 first generation Japanese immigrant volunteers in Vancouver, Canada was recruited through networking. Inclusion criteria were first generation Japanese immigrants residing in Greater Vancouver, BC, at least 18 years of age, self-reported average or fluent English, and English not spoken as their native language. Individuals with experience in the dental profession or industry were excluded from the study due to the potential impact on oral health attitudes and behaviours. To control for confounding variables, volunteers who only spoke or read Japanese were also excluded and the questionnaire was administered in English. The surveys were delivered personally, through the postal service or as an e-mail attachment; however, to maintain confidentiality, only hard copies of respondents' surveys enclosed in a sealed envelope were accepted.

Data were analyzed using descriptive statistics, Spearman rank correlation coefficient ( $r_s$ ) for ordinal data and Pearson correlation coefficient ( $r$ ) for continuous data

to assess the relationships between demographic/socioeconomic variables, acculturation, and oral health behaviours and attitudes. The independent sample t-test was used to analyse differences in EAAM and HU-DBI scores based on gender, language spoken at home, and place of education. Multiple linear regression was used to observe the effects of four potential predictor variables, the acculturation dimensions measured by the EAAM, on the dependent variable, the HU-DBI. All analyses were performed using IBM SPSS Version 23. The alpha level set for statistical significance was  $\leq 0.05$ .

## **Results**

Forty-eight eligible participants responded to the surveys. The majority of the participants were females (72.9%). The average age of the participants was 39 years. Two-thirds of the participants reported speaking Japanese at home, and 58.3% of the participants spoke only one language at home. Most of the participants (91.7%) identified their English skills as fair to good. Table 1 summarizes all demographic and socioeconomic data.

The EAAM scores, based on a 7-point Likert scale and a maximum total of 7.0 points, are presented in Table 2. Mean scores for the EAAM subscales were: assimilation, 2.86; separation, 3.71; integration, 4.41; and marginalization, 3.08. The HU-DBI scores were based on a 5-point Likert scale with 12 items for a maximum total of 60.0 points. The mean HU-DBI score was 37.92. Pearson correlation analysis indicated that there were no significant associations ( $p > 0.05$ ) between the HU-DBI and the four EAAM subscale scores representing assimilation, separation, integration, and marginalization (Table 3).

The independent samples t-test analysis identified no significant difference in the HU-DBI scores based on gender ( $p=0.56$ ) and no significant difference in the EAAM acculturation dimension subscales (assimilation, 0.14; separation, 0.69; integration, 0.59; marginalization, 0.85) based on gender. Likewise, no statistically significant differences were found in the HU-DBI scores based on language spoken at home ( $p=0.68$ ) or place of education, Japan vs. Japan and Canada ( $p=0.71$ ). However, there were significant differences in EAAM subscale scores for assimilation ( $p=0.01$ ), separation ( $p=0.002$ ), and integration ( $p=0.02$ ) between those who reported speaking either English or Japanese at home. In regards to place of education, there were statistically significant differences in separation ( $p=0.02$ ) and integration ( $p=0.01$ ) between participants who completed their education in Japan versus both Japan and Canada (Table 4).

Analysis of the relationship between the EAAM scores with demographic and socioeconomic ordinal variables, (Table 5), revealed that educational level was significantly associated with assimilation ( $r_s=.302$ ,  $p=0.04$ ), integration ( $r_s=.314$ ,  $p=0.04$ ), and marginalization ( $r_s=.360$ ,  $p=0.01$ ). Self-reported English proficiency was negatively associated with separation ( $r_s=-.291$ ,  $p=0.045$ ) and positively associated with integration ( $r_s=.557$ ,  $p=0.001$ ). Pearson correlational analyses indicated that age was the only other demographic variable found to be significantly associated with any of the EAAM dimension scales (Table 5). A significant negative correlation was identified between age and assimilation ( $r_s=-.392$ ,  $p=0.01$ ). No significant relationships were identified between EAAM scores and years in Canada or age at immigration.

Spearman correlational analyses of the relationship between demographic and socioeconomic variables with the HU-DBI indicated income was the only ordinal

variable significantly associated with the HU-DBI ( $r_s=.287$ ,  $p=0.046$ ). Pearson correlational analyses identified no significant associations between age, years in Canada, or age at immigration and the HU-DBI (Table 6).

Previous studies have suggested using multivariate analysis of acculturation outcomes and oral health measures.<sup>3</sup> Multiple linear regression analysis included the four EAAM dimension scores as predictor variables, and the HU-DBI score was the dependent variable. Marginalization ( $p=0.02$ ) was the only significant predictor of HU-DBI, with a negative Beta, or regression weight; however, separation ( $p=0.05$ ) was suggestive of being a predictor of HU-DBI with a positive Beta, or regression weight (Table 7).

## **Discussion**

Gao and McGrath recommended studies of oral health behaviour and diseases using refined acculturation scales to improve the understanding of the course of immigrants' oral health along the acculturation continuum.<sup>3</sup> The present study addressed that recommendation.

Analysis identified significant differences in acculturation between those who reported speaking English or Japanese at home and place of education. As one might expect, the data showed that assimilated and integrated Japanese immigrants reported speaking English at home. Japanese immigrants who spoke Japanese at home scored higher in separation, indicating a reconfirmation of traditional culture. Likewise, the separation dimension was more predominant with Japanese immigrants who completed their education only in Japan. However, Japanese immigrants who finished their

education both in Japan and Canada integrated themselves into both Canadian and Japanese cultures.

An analysis of the relationship of EAAM with demographic and socioeconomic variables identified self-reported English proficiency as negatively associated with separation and positively associated with integration. However, the positive correlation between English proficiency and integration ( $\leq 0.01$  level) was stronger than the negative correlation between English proficiency and separation ( $\leq 0.05$  level). This finding suggests although participants with higher English proficiency were integrated into both Canadian and Japanese cultures, those Japanese immigrants with lower English skills remained separated (reconfirmation of traditional culture) as an outcome. Significant relationships were also found regarding education level and acculturation. Participants who were more educated were assimilated to Canadian culture and integrated into both Canadian and Japanese cultures. Surprisingly, participants who completed higher education were correspondingly marginalized and isolated from both cultures. This finding supports previous findings from Mariño et al. that acculturation was related to level of education.<sup>9</sup> While income was not significantly associated with any of the acculturation dimensions, it was significantly associated with oral health behaviours and attitudes. Accordingly, Calvasina et al. reported that immigrants who have no dental insurance and low annual household income were more likely to report unmet dental care needs than those with dental insurance and higher income.<sup>17</sup>

Age was inversely related to assimilation into Canadian culture. Those participants who were younger were more assimilated indicating younger immigrants may more easily assimilate themselves into Canadian culture than older immigrants.

Previously, Mariño et al. identified that acculturation as measured by language, country of birth, age at immigration, and length of residence was positively associated with oral health, yet surprisingly, our findings denote that time in Canada and age at the time of immigration were not significantly associated with any of the acculturation dimensions.<sup>9</sup> This finding is contradictory to Barry's results, which indicated that length of stay in the host country to be positively associated with assimilation and integration and negatively associated with marginalization.<sup>8</sup> Differences in findings related to demographics may be due to the smaller sample size used for this study. Further, the independent sample t-test analyses demonstrated no significant differences in levels of acculturation or oral hygiene behaviours and attitudes based on gender. These results support Barry's findings indicating no association between gender and the four acculturation scales. However, several previous studies have shown that women had better dental knowledge and better oral health behaviours than men.<sup>10-12, 26</sup>

Multiple regression analysis revealed that marginalization was a significant predictor of the HU-DBI while holding other variables constant. The higher the marginalization, the lower the HU-DBI, indicating participants who experienced no attachment to either culture had poorer oral hygiene attitudes and behaviours. The same is likely true for those who rejected the new culture, as separation was suggestive as a predictor. Given the small sample size, there was probably not adequate power to confirm this variable as statistically significant at the  $\leq 0.05$  level. These multivariate analysis findings suggest an inter-relationship between acculturation and oral health behaviours and attitudes, despite no significant association found using correlational analyses. These findings also support the recommendation by Gao and McGrath to



incorporate a multidimensional acculturation scale (bidirectional model of acculturation rather than unidirectional model), and to utilize multivariate analytical approaches to study the complex relationship between acculturation and oral health behaviours.<sup>3</sup> Based on these findings the hypothesis stating that there would be a relationship between acculturation and oral health behaviours and attitudes was supported.

Understanding the limitations of this study is necessary to accurately interpret and apply the results. This cross-sectional study did not examine long-term relationships between acculturation and oral health behaviours and attitudes over time. The non-probability sample recruited from Greater Vancouver, BC was not representative of the entire Japanese immigrant populations in BC or Canada. The distribution of gender in this sample might have influenced the results. In addition, the non-probability convenience sample may result in ascertainment bias, which can often lead to a sample different from the target populations. The size of the sample (N=48) may not have been large enough to fully represent characteristics of the population, although the size was adequate for statistical power. Furthermore, because the study included only first generation Japanese immigrants who were able to speak/understand English, the results may not reflect findings from people who did not speak/understand English, but may have contributed valuable information to the study.

### **Conclusion**

Dental hygienists may positively impact oral health disparities through advocating for policy changes, performing preventive interventions, providing oral health education, and providing oral health education for other health care professionals who deliver their services to underserved populations. Based on the results of this study, it appears that

particular attention may be needed for groups of Japanese immigrants who are less assimilated into Canadian culture, or for economically disadvantaged Japanese immigrants. Additional research evaluating the potential factors that might influence a relationship between acculturation and oral health status is needed. Oral health education in dental hygiene practice and public health program should target Japanese immigrants, with special consideration given to those who are less acculturated and have lower income.

**Figure 1: Modified Version of Hiroshima University-Dental Behavioral Inventory (HU-DBI)**

Please answer to each question based on your level of agreement or disagreement to each item.

Items	1 Strongly Disagree	2 Disagree	3 No Opinion or Uncertain	4 Agree	5 Strongly Agree
1. I don't worry much about visiting the dentist.					
2. My gums tend to bleed when I brush my teeth.*					
3. I worry about the color of my teeth.					
4. I have noticed some white sticky deposits on my teeth.*					
5. I use a child-sized toothbrush.					
6. I think that I cannot help having false teeth when I am old.*					
7. I am bothered by the color of my gums.					
8. I think my teeth are getting worse despite my daily brushing.*					
9. I brush each of my teeth carefully.*					
10. I have never been taught professionally how to brush.*					
11. I think I can clean my teeth well without using toothpaste.*					
12. I often check my teeth in a mirror after brushing.*					
13. I worry about having bad breath.					
14. It is impossible to prevent gum disease with tooth brushing alone.*					
15. I put off going to the dentist until I have toothache.*					
16. I have used a dye to see how clean my teeth are.*					
17. I use a toothbrush with hard bristles.					
18. I don't feel I've brushed well unless I brush with strong strokes.					
19. I feel I sometimes take too much time to brush my teeth.*					
20. I have had my dentist tell me that I brush very well.					

\*Questions for scoring

**Table 1. Participant Demographic and Socioeconomic Responses**

<b>Variables</b>	<b>Level / Category</b>	<b>N(48)</b>	<b>%</b>
<b>Gender</b>	Male	13	27.1
	Female	35	72.9
<b>Age</b>	Mean age 39 years, SD=8.4, range 19-58 years		
<b>Language at Home</b>	English	15	31.3
	Japanese	32	66.7
	Missing	1	2.1
<b>Other Language Spoken at Home</b>	No	28	58.3
	Yes, English	12	25.0
	Yes, Japanese	7	14.6
	Other	1	2.1
<b>Self-Reported English Proficiency</b>	Fair	21	43.8
	Good	23	47.9
	Excellent	4	8.3
<b>Years in Canada</b>	Less than 5 years	11	22.9
	Between 5 and 9 years	13	27.1
	Between 10 and 14 years	8	16.7
	Over 15 years	16	33.3
<b>Age immigrated</b>	Less than 25 years old	16	33.3
	Between 25 and 34 years old	30	62.5
	Between 35 and 44 years old	1	2.1
	Over 45 years old	1	2.1
<b>Highest Education</b>	High school, but no diploma	1	2.1
	High school diploma	9	18.8
	Trade certificate	4	8.3
	Some college or university courses but no degree	11	22.9
	College or university certificate or diploma not bachelor's degree	3	6.3
	University bachelor's degree	18	37.5
	University master's degree or above	2	4.2
<b>Place of Education Completed</b>	Japan	34	70.8
	Canada	1	2.1
	Both Japan and Canada	12	25.0
	Other	1	2.1
<b>Annual Income</b>	Less than \$20,000	3	6.3
	Between \$20,000 and \$50,000	13	27.1
	Between \$50,000 and \$80,000	7	14.6
	Above \$80,000	10	20.8
	I would not rather answer	14	29.2
	Missing	1	2.1

**Table 2. Summary of EAAM and HU-DBI Score**

<b>Instrument</b>	<b>Total Points</b>	<b>N</b>	<b>Mean</b>	<b>Median</b>	<b>SD</b>
Assimilation	7.0	46	2.86	2.94	0.82
Separation	7.0	48	3.71	3.71	0.92
Integration	7.0	45	4.41	4.20	1.14
Marginalization	7.0	47	3.08	3.11	0.99
HU-DBI	60.00	48	37.92	37.56	4.20

**Table 3. Relationships between EAAM and HU-DBI Scores**

<b>Variable</b>	<b>by Variable</b>	<b>Correlation</b>	<b>N</b>	<b><i>p</i> value</b>
HU-DBI	Assimilation	.074	46	0.63
HU-DBI	Separation	.087	48	0.55
HU-DBI	Integration	.045	45	0.77
HU-DBI	Marginalization	-.219	47	0.14

**Table 4. Differences in EAAM and HU-DBI Scores based on Gender, Language spoken at Home, and Place of Education**

<b>Gender</b>							
	<b>Male</b>		<b>Female</b>				
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b><i>p</i></b>	<b><i>t</i></b>	<b><i>df</i></b>
Assimilation	2.58	0.89	2.98	0.77	0.14	1.51	44
Separation	3.80	0.93	3.68	0.92	0.69	0.40	46
Integration	4.26	1.07	4.47	1.18	0.59	-0.55	43
Marginalization	3.03	1.23	3.09	0.91	0.85	-0.19	45
HU-DBI	37.32	3.12	38.16	4.56	0.56	-0.60	46
<b>Language Spoken at Home</b>							
	<b>English</b>		<b>Japanese</b>				
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b><i>p</i></b>	<b><i>t</i></b>	<b><i>df</i></b>
Assimilation	3.33	0.68	2.63	0.80	0.01**	2.89	43
Separation	3.12	0.82	3.99	0.86	0.002**	-3.28	45
Integration	5.00	1.27	4.13	1.00	0.02*	2.40	42
Marginalization	2.95	1.04	3.12	0.99	0.59	-0.54	44
HU-DBI	38.16	5.4	37.56	3.36	0.68	0.42	45
<b>Place of Education</b>							
	<b>Japan</b>		<b>Japan &amp; Canada</b>				
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b><i>p</i></b>	<b><i>t</i></b>	<b><i>df</i></b>
Assimilation	2.78	0.83	3.01	0.80	0.42	-0.82	43
Separation	3.89	0.80	3.17	1.13	0.02*	2.42	44
Integration	4.14	1.08	5.22	0.99	0.01**	-2.92	42
Marginalization	3.04	1.02	3.04	0.97	1.00	-0.00	43
HU-DBI	37.68	4.32	38.28	3.96	0.71	-0.38	44

\* significant at 0.05 level

\*\* significant at 0.01 level

**Table 5. Relationship of EAAM with demographic variables**

Score	Demographic Variable	Correlation Coefficient	N	<i>p</i> value
<b>Spearman (<math>R_s</math>)</b>				
Assimilation	Education Level	.302*	46	0.04*
Assimilation	Income	.129	45	0.40
Assimilation	English Proficiency	.125	46	0.41
Separation	Education Level	-.236	48	0.11
Separation	Income	.169	47	0.26
Separation	English Proficiency	-.291*	48	0.045*
Integration	Education Level	.314*	45	0.04*
Integration	Income	-.051	44	0.74
Integration	English Proficiency	.557**	45	0.001**
Marginalization	Education Level	.360*	47	0.01*
Marginalization	Income	.035	46	0.82
Marginalization	English Proficiency	-.120	47	0.42
<b>Pearson (<math>R</math>)</b>				
Assimilation	Age	-.392*	40	0.01*
Assimilation	Time in Canada	-.243	46	0.10
Assimilation	Age at Immigration	-.094	46	0.53
Separation	Age	.006	40	0.97
Separation	Time in Canada	.129	48	0.38
Separation	Age at Immigration	.222	48	0.13
Integration	Age	-.152	38	0.36
Integration	Time in Canada	-.163	45	0.29
Integration	Age at Immigration	-.152	45	0.32
Marginalization	Age	.010	39	0.95
Marginalization	Time in Canada	-.082	47	0.59
Marginalization	Age at Immigration	.178	47	0.23

\*Correlation is significant at the 0.05 level (2-tailed)

\*\*Correlation is significant at the 0.01 level (2-tailed)



**Table 6. Relationship HU-DBI Demographic Variables**

<b>Variable</b>	<b>By Variable</b>	<b>Correlation Coefficient</b>	<b>N</b>	<b><i>p</i></b>
<b>Spearman (<math>R_s</math>)</b>				
HU-DBI	Education Level	-.135	48	0.36
HU-DBI	Income	.287*	47	0.046*
HU-DBI	English Proficiency	.069	48	0.64
HU-DBI	Assimilation	.082	46	0.59
HU-DBI	Separation	.093	48	0.53
HU-DBI	Integration	.084	45	0.58
HU-DBI	Marginalization	-.213	47	0.15
<b>Pearson (<math>R</math>)</b>				
HU-DBI	Age	-.159	40	0.33
HU-DBI	Time in Canada	-.030	48	0.84
HU-DBI	Age at Immigration	-.062	48	0.68

\*Correlation is significant at the 0.05 level (2-tailed)

**Table 7. Linear Regression Analysis**

<b>Model</b>	<b>Beta Coefficient</b>	<b><i>t</i></b>	<b><i>p</i></b>
Constant		4.60	.001
Assimilation	.157	0.89	.38
Separation	.465	2.01	.05*
Integration	.217	0.95	.35
Marginalization	-.432	-2.40	.02*

Dependent Variable: HU-DBI

## References

1. Redfield R, Linton R, Herskovits MJ. Memorandum for the study of acculturation. *Am Anthropol.* 1936;38:149-152.
2. Lassetter JH, Callister LC. The impact of migration on the health of voluntary migrants in western societies. *J Transcult Nurs.* 2009 Jan; 20(1): 93-104.
3. Gao S, McGrath C. A review on the oral health impacts of acculturation. *J Immigr Minor Health.* 2011;13:202-213.
4. O'Driscoll T, Banting LK, Borkoles E, Eime R, Polman R. A systematic literature review of sport and physical activity participation in culturally and linguistically diverse (CALD) migrant populations. *J Immigr Minor Health.* 2013 June; doi: 10.1007/s10903-013-9857-x
5. Delavaril M, S nderlund AL, Swinburnl B, Mellor D, Renzaho A. Acculturation and obesity among migrant populations in high income countries – a systematic review. *BMC Public Health.* 2013; 13: 458.
6. Afable-Munsuz A, Mayeda ER, P rez-Stable EJ, Haan MN. Immigrant generation and diabetes risk among Mexican Americans: The Sacramento Area Latino Study on Aging. *Am J Public Health.* 2013 March; e1-e8
7. Berry JW. Conceptual approaches to acculturation. In: Chun KM, Organista PB, Ma in G, Editors. *Acculturation: advances in theory, measurement, and applied research.* Washington, DC: American Psychological Association; 2003. p.17-37. doi: 10.1037/10472-004
8. Barry DT. Development of a new scale for measuring acculturation: The East Asian acculturation measure (EAAM). *J Immigr Health.* 2001;3(4):193-197.

9. Mariño R, Stuart GW, Wright FAC, Minas IH, Klimidis S. Acculturation and dental health among Vietnamese living in Melbourne, Australia. *Community Dent Oral Epidemiol.* 2001;29:107–19.
10. Tada A, Hanada N. Sexual differences in oral health behaviour and factors associated with oral health behaviour in Japanese young adults. *Journal of the Royal Institute of Public Health.* 2004;118:104-109.
11. Morita I, Nakagaki H, Toyama A, Hayashi M, Shimozaoto M, Watanabe T, et al. Behavioral factors to include in guidelines for lifelong oral healthiness: an observational study in Japanese adults. *BMC Oral Health.* 2006 Dec; 6: 15. doi: 10.1186/1472-6831-6-15
12. Nakayama Y, Mori M. The relationship between number of natural teeth and oral health behavior in adult Japanese people. *Journal of the National of Public Health.* 2012;61(4):366-373.
13. Kawamura M, Iwamoto Y. Present state of dental health knowledge, attitudes/behaviour and perceived oral health of Japanese employees. *International Dental Journal.* 1999;49:173-181.
14. Hsu KJ, Yen YY, Lan SJ, Wu YM, Lee HE. Impact of oral health behaviours and oral habits on the number of remaining teeth in older Taiwanese dentate adults. *Oral Health Prev Dent.* 2013;11(2):121-130. doi: 10.3290/j.ohpd.a29360.
15. Ueno M, Ohara S, Inoue M, Tsugane S, Kawaguchi Y. Association between education level and dentition status in Japanese adults: Japan public health center-based oral health study. *Community Dent Oral Epidemiol.* 2012;40:481-487.

16. Cruz GD, Chen Y, Salazar CR, Le Geros RZ. The Association of immigration and acculturation attributes with oral health among immigrants in New York City. *Am J Public Health*. 2009;99(52):S474-S480.
17. Calvasina P, Muntaner C, Quiñonez C. Factors associated with unmet dental care needs in Canadian immigrants: an analysis of the longitudinal survey of immigrants to Canada. *BMC Oral Health*. 2014;14:145.
18. Saito A, Kikuchi M, Ueshima F, Matsumoto S, Hayakawa H, Masuda H, et al. Assessment of oral self-care in patients with periodontitis: a pilot study in a dental school clinic in Japan. *BMC Oral Health*. 2009;Oct:9:27.
19. Dong M, Loignon C, Levine A, Bedos C. Perceptions of oral illness among Chinese immigrants in Montreal: A qualitative study. *J Dent Edu*. 2007;71(10):1340-1347.
20. Smith A, MacEntee MI, Beattie BL, Brondani M, Bryant R, Graf P, et al. The influence of culture on the oral health-related beliefs and behaviours of elderly Chinese immigrants: A meta-synthesis of the literature. *J Cross Cult Gerontol*. 2013 Feb;28:27-47.
21. Asadoorian J. Inequity and disparity in oral health – Part II. Socio-economic status and deprivation: can dental hygiene diminish the impact? *J Dent Hyg*. 2009; 43(2):53-59.
22. Canadian Dental Hygienists Association. *Dental Hygiene Research Agenda*. Ottawa: Canadian Dental Hygienists Association; 2003. Available from [http://www.cdha.ca/pdfs/Profession/Policy/research\\_agenda\\_102603.pdf](http://www.cdha.ca/pdfs/Profession/Policy/research_agenda_102603.pdf)

23. Kawamura M. Dental behavioral science: the relationship between perceptions of oral health and oral status in adults. *Journal of Hiroshima University Dental Society*. 1988;20:273-86.
24. Kawabata, K., Kawamura, M., Miyagi, M., Aoyama, H., & Iwamoto, Y. (1990). The dental health behavior of university students and test-retest reliability of the HU-DBI. *Journal of Dental Health*, 40, 474-475.
25. Yildiz S, Dogan B. Self-Reported Dental Health Attitudes and Behaviour of Dental Students in Turkey. *Eur J Dent*. 2011;5:253-259.
26. Petersen PE, Jiang H, Peng B, Tai BJ, Bian Z. Oral and general health behaviours among Chinese urban adolescents.. *Community Dent Oral Epidemiol*. 2008;36:76-84.