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Dental utilization among aging immigrants in Canada

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Abstract
Objective: To compare the dental-care utilization of elderly immigrants to that of non-immigrants in Canada.
Materials and Methods: This is a secondary data analysis of publicly available data from the 2008/09 Canadian Community Health Survey: Healthy Aging (CCHS-HA) component. The target population consisted of 30,865 people aged 45 years and above. A modified Andersen's health-service utilization model was used as the framework for analysis, grouping predisposing (age, sex, marital status, immigrant status, time since immigration, smoking, alcohol use), enabling (Education, household income, dental insurance, social support), need (Self-reported health and self-reported oral health) and behavioural factors (Brushing and physician visit), to compare the dental care utilization between elderly immigrants and non-immigrants. Descriptive statistics and binary and multivariable logistic regressions were performed.
Results: Results for the entire population indicate age, sex, marital status, level of education and income, dental insurance, physician visit, smoking and self-reported oral health as significant predictors of dental visits. Predictors for utilization among immigrant seniors were: age, sex, marital status, social interaction, and level of education. Predictors for non-immigrant seniors included: age, level of education, household income, dental insurance, smoking, and self-reported oral health.
Conclusion: By comparing elderly immigrants and non-immigrants, this study draws attention to what influences dental care utilization in each group. Implications for oral health policy include integrating oral health insurance into Canada's universal healthcare system, changes in legislation that improve the availability and access to dental insurance, and better utilization of existing dental public-health resources by including targeted services to elderly immigrants.

Keywords: dental utilization, aging, immigrants, Canada

Introduction

Aging and migration are important socio-demographic phenomena, with implications for public-health policies. This has significance in the Canadian context, as older immigrants are an ever-growing segment of the population [1]. In general, seniors make up a more significant share of Canada's population than do children, with the 2016 census showing that seniors in Canada now outnumber children [2]. The census also showed that immigrants represent a considerably large group among seniors [3]. Thus, combined with dropping rates of edentulism across the population, where more people keep their teeth into old age than ever before, this has led to seniors' needs receiving increasing attention in dental-care policy [4]. Further, based on multiple factors including their life experiences, immigrant seniors' oral-health needs and characteristics may be different from those of Canadian-born, meaning this group will likely feature more prominently in future dental-care policy as well. Thus, there is a need to understand and compare the oral health-care utilization of immigrant seniors and their Canadian-born counterparts.

While the literature on immigrants' general health is available [5-10], few studies have examined the oral health of immigrants to Canada, with most of these studies focusing on children or adolescents and very few on seniors [11-14]. these studies propose that immigrants have a higher rate of dental disease, a pattern that can improve with an extended residency in Canada [9]. Recent studies have also shown that immigrants have better oral-health status upon arrival, which (like general health) can deteriorate post-migration [9, 16].

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they are also reported to have a higher prevalence of untreated dental conditions, and a lower prevalence of dental insurance coverage [14, 15].

Studies on the use of dental services by immigrants in Canada have been limited and have reported mixed results as well. Some point to limited access, a lower rate of utilization, and more self-reported cost barriers to dental-care by immigrants compared to Canadian-born [11,19,20]. while another study has demonstrated that immigrants have a higher rate of dental-care utilization, even though they have significantly less dental-insurance coverage [10]. The features of the Canadian dental-care system also have an important impact on utilization of care, given that almost all Canadian oral-health care is privately financed and delivered; thus it tends to exclude low-income and uninsured individuals [17]. Ultimately, public dental insurance only accounts for about 5.5% of all dental-care expenditures in the country and very little, if any, is targeted to immigrants [18].

As identified by previous literature, some of the major determinants that hinder seniors' use of dental services include old age, economic disadvantage, low levels of education, lack of dental insurance, living in rural areas, being edentulous, and having to incur out-of-pocket expenses [10, 22, 23]. Seniors with good oral-health status have also been shown not to use dental services because they perceive their mouths as healthy and do not perceive any oral-health problems [22]. A study using the Anderson model of health-service utilization reported that, unlike physician visits (which were largely explained by need), dental visits were better predicted by predisposing factors such as age, sex, and race [24]. Further, while studies on immigrant seniors in North America have shown that their use of dental services increased with length of residence [25]. studies from Europe indicate a disproportionate concentration of ready access to treatment among wealthy elderly populations and reduced use of dental services among elderly immigrants compared to native populations [26, 27]. Conversely, an American study revealed that older immigrants tended to use dental services more than the native-born, and a study on elderly immigrants in Canada produced similar results [22, 10].

In summary, an increase in the aging population means that seniors will feature more prominently in future dental-care policy. In the Canadian context, the senior immigrant population also represents a large and growing share of Canadians, and, given that immigrant seniors may have unique needs, such needs will have to be considered in the context of dental-care policy as well. Unfortunately though, relatively little is known about dental care use among senior immigrants in Canada. As a result, this study investigates the differences between immigrant and non-immigrant seniors' dental-care utilization and various potential predictors of this outcome. This study's findings have implications for dental-care policies designed to improve access to dental care among the elderly in general, and immigrant elderly in particular.

Materials and Methods
Conceptual framework
The study uses a modified version of Andersen's model of health-service utilization (Figure 1). According to the model, dental utilization can be thought of as a conditional function of predisposing (demographics and immigration), enabling (household income, dental insurance, education), need (Self-reported oral health) and behavioural factors (tooth brushing, doctor visits) [22, 28, 29].

Data source
This was a secondary data analysis of the Canadian Community Health Survey, a cross-sectional survey administered by Statistics Canada that collects self-reported health-related data. We used data obtained during the 2008/09 cycle, with a focus on the Healthy Aging component (Cycle 4.2) (CCHS-HA), composed of people aged 45 and above, who live in private dwellings in the 10 provinces. This analysis of the immigrant population excludes non-permanent residents (Those in Canada on employment or student visas, and refugee claimants). This analysis also excludes residents of the three territories, Aboriginal reserves, Crown lands and some remote regions, as well as people living in institutions and full-time members of the Canadian Armed Forces. This study was conducted on anonymous and unlinked data and was thus exempt from ethical review. As per the Tri-Council Policy Statement on the ethical conduct in research involving humans, "REB review is not required for research that relies exclusively on secondary use of anonymous information, or anonymous human biological materials, so long as the process of data linkage or recording or dissemination of results does not generate identifiable information [30].

Study variables
Outcome variable
Dental-care utilization was based on each individual's response to the question "When was the last time you saw a dental professional? The coding for measurement ranged from "less than one year to "never. For this study, the coding used was: 1 = "less than one year" (Reference) and 2 = more than one year.

Exposure Variable
One exposure variable was used in this study, namely, immigrant status." This was coded as 0 = no (Reference), 1 = yes.

Other predisposing variables
These included age, gender, and marital status, time in Canada since immigration, smoking, and alcohol frequency. Marital status had four categories: 1 = "married (Reference), 2 = widowed, 3 = divorced/separated, and 4 = single. Sex was coded as 1 = male and 2 = female (Reference). Age was measured as 1 = 45 to 54 years (reference), 2 = 55 to 64 years, 3 = 65 to 74 years, 4 = 75 to 84 years, and 5 = 85 years and above. Smoking status was defined by at the present time, do you smoke cigarettes daily, occasionally or not at all? and the variables were dichotomised into yes (Daily/occasional/always occasional) and "no (Former daily/former occasional) (Reference). During the past 12 months, how often did you drink alcoholic beverages? was used to evaluate the frequency of drinking alcohol and is categorized into regular, occasional, and non-drinker (reference). Finally, time in Canada since immigration, was coded as, 1 = 0 to 19 years, 2 = 20 to 29 years, 3 = 30 to 39 years, 4 = 40 to 49 years, and 5 = 50 years and above.

Enabling Variables
Enabling variables in the study included "dental insurance, education, household income, and social support. Dental insurance was assessed using the question "Do you have insurance or a government program that covers all or part of your dental expenses? and was coded as: 1 = "yes and 2 = no. Education was coded as: 1 = "less than secondary, 2 = "secondary education," 3 = "other post-secondary," and 4 =

"post-secondary graduate degree." Income was coded as 1 = "less than \$20,000/year," 2 = "\$20,000 to \$39, 999," 3 = "\$40,000 to \$59, 999," 4 = "\$60,000 to \$79, 999," and 5 = "\$80,000 and above." In the study, the Medical Outcomes Survey Social Support Scale (MOS-SSS) was used to evaluate individual perceptions of the amount of social support that is available [31, 32]. The MOS-SSS includes 19 items that measure five dimensions of social support: tangible support (minimum= 0, maximum =16), emotional support (minimum=0, maximum=32), informational support (minimum= 0, maximum =32), affectional support (minimum=0, maximum =12), and positive social interaction (minimum=0, maximum =16). In the CCHS data, emotional and informational support were combined into one component.

Need variables
One variable used to evaluate need is self-reported health (SRH). In the CCHS, SRH was operationalized as: In general, would you say your health is.? This was measured using a five-point Likert scale ranging from excellent to poor. The other need variable used is self-reported oral health (SROH) [33]. In the CCHS, SROH is operationalized as: In general, would you say the health of your mouth is.? This was measured using a five-point Likert scale and dichotomized into "excellent ∕very good ∕good" and "fair ∕poor" oral-health conditions.

Lifestyle (Behavioural) variables
The variable, "Daily brushing" is coded as 1 = "more than twice/day" (reference), 2 = "twice/day," 3 = "once/day," 4 = "< once/day," 5 = "once/week," and 6 = "never." Health-care utilization is coded as: 1 = "yes" and 2 = "no" and is based on the response to the question: "[Not counting when you were an overnight patient], in the past 12 months, have you seen or talked to any of the following health professionals about your physical, emotional or mental health? A family doctor or general practitioner?

Statistical Analyses
For estimates produced from the CCHS-HA to represent the population covered (Not merely the sample itself), survey weights were used in all statistical calculations. After weighting, the original sample represents close to 14 million people. We performed descriptive statistics and binary logistic regression on weighted data using IBM SPSS Statistics 23.0. Simple descriptive analyses were conducted to describe the characteristics of the sample. A Chi-square test was then performed to explore the association between categorical independent variables and the categorical dependent variable. Significant variables were tested using binary logistic regression to assess the independent association between the variables and the main outcome. Unless otherwise noted, differences between comparison groups are statistically significant below the five per cent level. A full population model and a model stratified by immigration status (Immigrant/non-immigrant) were utilized for analysis as well.

Results
Table 1 presents sample characteristics for the population covered by CCHS-HA (Aged 45 and above) in 2008–09. The majority (38.5%) of the participants were 45 to 54 years of age. Women represented 51.9% of the total population and 73.7% of the total population were married. About half (52.6%) of the respondents had post-secondary education and

55.6% had dental insurance. The majority (87.9%) reported excellent to good oral health and had visited a dentist in the last year (67.2%).
Among the immigrant population, the highest percentage was in the oldest age group. Most immigrants (76.6%) reported being married (Table 1). Almost half (49.1%) reported being uninsured for dental care. About half (55%) reported having post-secondary graduate degrees. "Fair to poor" self-rated oral health was more common among immigrants (16.9%) compared to non-immigrants (10.5%), although most immigrants (71.2%) reported seeing a dentist in the previous year.

Bivariate analysis
An inverse association was seen between age and dental-care utilization among the full population in the unadjusted model, with higher age corresponding to higher odds of not having seen a dentist in more than a year (data not shown). Also, respondents who self-reported fair to poor oral-health status had 87% higher odds (OR = 1.87; CI: 1.86-1.88) of not having seen a dentist in more than one year compared to those who answered excellent/very good/good. Elderly males had 13% higher odds (OR = 1.13; CI: 1.13-1.14) of not having seen a dentist in more than one year. A negative relationship was seen between education and dental-care utilization, with those who had less than secondary education were four times more likely (OR = 3.94; CI: 3.93-3.95) of not having seen a dentist in more than one year compared to those with post-secondary education. Household income was also associated with dental-care utilization, with respondents who had a household income of less than \$20,000/year were almost seven time more likely (OR = 6.90; CI: 6.87-6.93) of not having seen a dentist in more than one year. A lack of dental insurance also showed a significant association with dental-care utilization; people without dental insurance were more likely (OR = 3.52; CI: 3.51–3.53) of not having seen a dentist in more than one year.
Our unadjusted results (Table 2) showed that age, sex, marital status, education, household income, dental insurance, smoking, physician visit, and self-reported oral health were common significant predictors of dental visits among both elderly immigrants and non-immigrants. For elderly immigrants, "no" to physician visit (OR = 2.34; CI: 2.33–2.36) and "low" positive social interaction (OR = 1.25; CI: 1.25–1.25) were significant predictors of reduced dental visits. For elderly non-immigrants, annual household income "<\$20,000" (OR = 8.16; CI: 8.12–8.21), "no" dental insurance (OR = 3.69; CI: 3.68–3.70), "low" emotional and informational support (OR = 1.27; CI: 1.26–1.28), smoking (OR = 1.90; CI: 1.89–1.90), and "fair or poor" self-reported oral-health status (OR = 2.19; CI: 2.18–2.20) were significant predictors of reduced dental visits.
Among the shared predictors for the stratified population, age, marital status and education were significant predictors—in different categories-for both immigrant as well as non-immigrant seniors (Table 2). Elderly immigrants aged 85 years and above had the highest likelihood (OR = 4.25; CI: 4.47-4.58) of not having seen a dentist in more than a year compared to elderly non-immigrants (OR = 3.73; CI: 3.69-3.74). Elderly non-immigrants showed a higher likelihood of not having seen a dentist in more than a year among the 65 to 74 (OR = 2.06; CI: 2.05-2.07) and 75 to 84 (OR = 2.80; CI: 2.79-2.81) age groups. "Widowed" elderly immigrants had a higher likelihood (OR = 2.02; CI: 1.99–2.04) of not having seen a dentist in more than a year among the two cohorts,

while divorced or separated" elderly non-immigrants had a higher likelihood (OR = 1.26; 1.25-1.27) among the two cohorts. Elderly immigrants with secondary education had a higher likelihood of not having seen a dentist in more than a year (OR = 1.89; CI: 1.87-1.90) among the two cohorts. Elderly non-immigrants with "less than secondary education" had a higher likelihood (OR = 4.23; CI: 4.22-4.25) of not having seen a dentist in more than a year among the two cohorts, as did those with "other post-secondary education (OR = 1.61; CI: 1.60-1.62).

Multivariable analysis
In the adjusted full-population model (data not shown), seniors aged 85 years and above had a 37% higher likelihood (AOR = 1.37; CI: 1.36-1.38) of not having seen a dentist in more than a year compared to the reference group. Men had a 23% higher likelihood of not having seen a dentist in the previous year compared to women. Education also predicted dental-care utilization among seniors, with people who had less than secondary education showing a higher likelihood (AOR = 1.98; CI: 1.96-2.00) of not having seen a dentist in more than a year compared to the reference group. Higher income, like higher levels of education, showed a strong association with dental-care utilization. Seniors with an annual household income of less than $20,000 had a 187% per cent higher likelihood (AOR = 2.87; CI: 2.86-2.89) of not having seen a dentist in more than a year; this likelihood reduced as income increased. Respondents who self-reported "fair to poor" oral health had 28% higher odds of not having seen a dentist in more than a year compared to those who answered "excellent/very good/good, and smokers had a 62% (AOR = 1.62; CI: 1.62-1.63) higher likelihood of not having seen a dentist in more than a year compared to non-smokers.

In the adjusted stratified model (Table 3), significant predictors of dental visits among elderly immigrants were sex, marital status, affectional support, positive social interaction, and physician visits. Elderly immigrant men showed a higher likelihood (AOR = 1.24; CI: 1.24-1.25) of not having seen a dentist in the previous year compared to the reference group. Marital status was a significant variable, and elderly immigrants were seen to have a higher likelihood of not visiting a dentist in more than a year irrespective of whether they were married, divorced or widowed. Elderly immigrants who were widowed (AOR = 2.11; CI: 2.07-2.15) had the highest odds of not having visited a dentist, followed by those who reported being married (AOR: 2.05; CI: 2.01-2.08). Elderly immigrants showed a higher likelihood of not having seen a dentist in more than a year among two social support variables: affectional support and positive social interaction. While elderly immigrants reporting low affectional support showed a 10% higher likelihood (AOR = 1.10; CI: 1.09-1.11) of not having visited a dentist in over a year, elderly immigrants reporting low positive social interaction showed a 32% higher likelihood (AOR = 1.32; CI: 1.31-1.34) of not having seen a dentist in more than a year. Interestingly, while in the bivariate results both non-immigrants and immigrants reported a higher likelihood, after adjusting, non-immigrants had a higher likelihood of visiting a dentist. Elderly immigrants who responded no to visiting a physician had a higher likelihood (AOR = 2.67; CI: 2.64-2.69) of not having seen a dentist in more than a year. Significant predictors among elderly non-immigrants that increased the likelihood of not having seen a dentist in more than a year included, "no" dental insurance (AOR = 2.44; CI: 2.43-2.45), "fair or poor self-reported oral health (AOR = 1.46; CI: 1.45-1.47)

and smoking (AOR = 1.69; CI: 1.68-1.70).
Significant variables common to both cohorts included old age, education, and household income. Elderly immigrants aged 85 years and above showed the highest likelihood of not having seen a dentist in more than a year, at 68% (AOR= 1.68; CI: 1.65-1.71), while immigrants aged 65 to 74 years showed the highest likelihood of having seen a dentist in the previous year (AOR= 0.68; CI: 0.67-0.69). Comparatively, elderly non-immigrants aged 75 to 84 years had higher odds (AOR=1.07; CI: 1.06-1.07) of not having seen a dentist in more than a year compared to elderly immigrants (AOR=1.03; CI: 1.02–1.04). Also, although elderly non-immigrants aged 85 years and above had the highest likelihood of not having seen a dentist in more than a year (AOR=1.30; CI: 1.29-1.31), this likelihood was 38% lower than that of elderly immigrant.

Education was a significant predictor for both cohorts. Elderly immigrants with "secondary education" had a 71% higher likelihood (AOR = 1.71; CI: 1.69-1.72) of not having seen a dentist in more than a year (34% higher odds than their non-immigrant counterparts). Elderly non-immigrants having less than secondary education showed the highest likelihood (AOR = 2.05; CI: 2.04-2.06), of not having seen a dentist in more than a year, compared to elderly immigrants with the same education level. Income, like education, was also a predictor of dental utilization among elderly immigrants and non-immigrants. Elderly immigrants with an annual household income of $40,000 to $59,999 had a higher likelihood (AOR = 1.67, CI: 1.66-1.69) of not having seen a dentist in more than a year compared to non-immigrants. Elderly non-immigrants had a higher likelihood of not having seen a dentist for more than one year compared to immigrants, given annual household incomes of $<20,000 (AOR = 3.07; CI: 3.05-3.09), $20,000 to $39,999 (AOR = 2.63; CI: 2.61-2.64), and $60,000 to $79,999 (AOR = 1.51; CI: 1.50- 1.52).

To summarize: age, sex, marital status, level of education and household income, dental insurance, physician visit, smoking, and self-reported oral health were significant predictors for dental care utilization for all Canadian seniors. After stratification, we noticed differing predictors for lower dental-care utilization among immigrant and non-immigrant seniors. Old age, being male, their marital status, having lower education, affectional support and positive social interaction, and reduced physician visit predicted lower dental care utilization among immigrant seniors. Also, old age, lower levels of education, low annual household income, lack of dental insurance, smoking, and fair to poor self-reported oral health predicted lower dental care utilization among non-immigrant seniors.

Discussion
In this study, we compared the utilization of dental care by elderly immigrants to that of non-immigrants, in order to identify differences in their dental-care use, as well as significant predictors that influenced this utilization. The study identified old age, sex, marital status, level of education and household income, dental insurance, physician visit, smoking, and self-reported oral health as significant predictors for all seniors in Canada. The data show that different predictors influenced reduced dentist visits. Significant predictors for immigrant and non-immigrant seniors influenced how dental-care utilization was reported. Old age, being male, their marital status, low levels of education, affectional support and positive social interaction

along with reduced physician visits predicted lower dental utilization among elderly immigrants. For elderly non-immigrants, being male, older age, low levels of education, low annual household income, lack of dental insurance, smoking, and fair to poor self-reported oral health determined the pattern for dental visits. Certain factors-such as old age, and education and household income-appeared to play equally significant roles in different categories for both groups. Marital status, being a male, low positive social interaction and affectional support, and reduced physician visit were seen as more significant to immigrant seniors, while lack of dental insurance, smoking, and fair or poor self-reported oral-health status were more significant factors among non-immigrant seniors.

Marital status was seen to be a significant predictor of dental utilization among elderly immigrants in our study. While previous studies have shown that being divorced or widowed resulted in lower dental utilization [34]. The higher likelihood of not visiting a dentist among married elderly immigrants in our study could be due to lower income and a lack of dental insurance. Sex is a widely studied determinant of health-care utilization and was found to be a significant predictor of dental utilization among immigrant seniors. In our study, elderly immigrant men showed a lower likelihood of visiting a dentist, compared to women. This was in line with previous studies finding that immigrant women show higher rates of dental utilization than immigrant men [10].

A significant association among elderly immigrants between dental visits and positive social interaction was seen, indicating that immigrant seniors were more affected by a lack of positive interaction than Canadian-born seniors; positive social interaction is described as the availability of people for positive interaction, based on four questions about whether the respondent has someone with whom to have a good time, to relax, to get his or her mind off things, or to do something enjoyable [28].

Our results show that seniors with low levels of education used dental care less, a finding that is consistent with previous research [35] and studies that have shown that elderly immigrants with higher education were more likely to have seen a dentist compared to elderly immigrants with lower educational levels [36]. Elderly immigrants and non-immigrants also showed different risk profiles in this study in terms of education. Elderly immigrants with secondary education had higher odds of not having seen a dentist in more than a year compared to the non-immigrants. Non-immigrants in the less than secondary (And other post-secondary education categories) had a lower frequency of having been to a dentist in more than a year. This study also corroborates prior studies demonstrating that seniors with lower incomes report lower rates of dental-care utilization.[21] Lower-income elderly immigrants were shown to have used dental care more often in the previous year than elderly non-immigrant. Additionally, elderly immigrants in the mid-income category ($40,000 to $59,999) showed lower rates of utilization when compared to the Canadian-born cohort which could possibly be due to a lack of dental insurance.

Our results show that a variable pattern of risk can be seen in each age group. Immigrant adults 55 to 64 years of age, and seniors 85 years and above, had the fewest dental visits. This could indicate barriers such as lack of dental insurance or limited oral health knowledge [10, 37]. Studies show that a lack of perceived need for dental care is one of the strongest predictors of low dental-care utilization among older adults, when compared to adults younger than 50, and this may be particularly true for immigrants and ethnic minorities [37]. Contrary to these findings, our study also showed that elderly immigrants between the ages of 65 and 74 were found to have an increased likelihood of dental visits in the previous year compared to seniors among all age groups which could be an effect of acculturation by length of residence in Canada as demonstrated in a previous study [26].

The availability of dental insurance has been found to be a significant predictor of utilization [23]. yet, despite a lack of dental insurance, immigrant seniors in our study were more likely to have visited a dentist in the previous year than non-immigrant seniors. Also, self-perceived reports of overall and oral health have been shown to be independent predictors of access and utilization of health care [37]. among seniors who self-reported fair or poor oral health, immigrants reported having visited a dentist in the previous year more often than elderly non-immigrants. A possible explanation could be a lack of adequate service in their region of origin or a lack of prior dental education have resulted in more dental problems in this cohort [10].

In terms of policy, although the principles of the Canada Health Act embrace the values of universality, comprehensiveness, and equitable access to care for all citizens, oral-health care has not been covered. The implementation of universal coverage for oral-health care would help all Canadians to access basic dental care, regardless of their ability to pay. Additionally, it will be necessary to target vulnerable populations-including elderly immigrants, who may experience a more significant burden of disease-by creating programs and/or dental plans that are focused on this group. In this way, more complex dental interventions may be subsidized and made accessible to this growing group of seniors. Additionally, implementing programs to correct perceptions about oral health and improve oral health behaviours among elderly immigrants would further help in improving the utilization of dental services and oral health outcomes in this group.

The cross-sectional nature of the CCHS-HA survey limits our study as no causal relationships can be inferred. Also, marginalized groups are under-represented in population surveys, and the rate of poor oral health among people experiencing significant socio-economic disadvantages and vulnerabilities may be much higher than has been presumed. Another limitation the authors faced was an inability to use the variable "time of immigration that would have allowed us to explore changes in senior immigrants' oral-health status based on their arrival in Canada. The coding of this variable in the CCHS-HA started at 0 to 19 years, yet important changes in immigrants' oral health would begin during their initial years after arrival [10]. and the lack of information limits our understanding of the changes occurring in these intervening years. Also, age acted as a confounder with the time of immigration variable in the regression models which prevented the authors from using this variable.

Table 1: A snapshot of characteristics of CCHS-HA population (aged 45+) in 2008–09 (N= 13,635,506)

Determinant	Total Population N weighted (13, 635, 506)	%	Non-Immigrant N weighted (10, 145770)	%	Immigrant N weighted (3, 307, 606)	%
Age						
45 to 54 years	5,247,633	38.5	4,049,546	39.9	1,121,243	33.9
55 to 64 years	4,020,434	29.5	2,965,143	29.2	1,005,103	30.4
65 to 74 years	2,40,7389	17.7	1,723,279	17.0	657,757	19.9
75 to 84 years	1,468,364	10.8	1,065,527	10.5	387,327	11.7
85 and older	491,687	3.6	342,275	3.4	136,176	4.1
Sex						
Male	6,557,587	48.1	4,826,718	47.6	1,633,832	49.4
Female	7,077,919	51.9	5,319,052	52.4	1,673,774	50.6
Marital status						
Married / Common-law	10,051,901	73.7	7,379,669	72.7	2,532,936	76.6
Widowed	1,353,035	9.9	975,696	9.6	354,849	10.7
Divorced / Separated	1,356,906	10.0	1,055,229	10.4	287,417	8.7
Single	872,413	6.4	734,241	7.2	132,258	4.0
Education						
< Secondary	3,038,332	22.6	2,298,551	23.0	698,002	21.3
Secondary	2,664,487	19.8	1,982,278	19.8	646,606	19.8
Other post-secondary	670,114	5.0	538,498	5.4	128,511	3.9
Post-secondary graduate	7,082,043	52.6	5,189,619	51.8	1,799,618	55.0
Income						
< $20,000	1,111,197	9.8	834,949	9.7	271,080	10.4
$20,000–39,999	2,308,986	20.5	1,719,146	19.9	581,405	22.2
$40,000–59,999	2,078,532	18.4	1,541,883	17.9	529,259	20.2
$60,000–79,999	1,827,910	16.2	1,465,958	17.0	357,553	13.7
> $80,000	3,956,494	35.1	3,064,959	35.5	876,134	33.5
Dental insurance						
Yes	7,575,743	55.6	5,792,983	57.2	1,681,832	50.9
No	6,037,789	44.4	4,337,937	42.8	1,620,896	49.1
Self-reported oral health						
Excellent / Very good / Good	11,982,784	87.9	9,070,851	89.5	2,748,754	83.1
Fair / Poor	1,644,917	12.1	1,069,134	10.5	558,052	16.9
Dentist visit						
Less than 1 year	9,145,729	67.2	6,665,827	65.8	2,353,501	71.2
More than 1 year	4,461,589	32.8	3,459,489	34.2	949,725	28.8

Table 2: Unadjusted relationship of predisposing, enabling, need and behavioral factors by dentist visit (more than one year) - CCHS-HA population (aged 45+) in 2008-09 (N= 13,635,506)

Determinants	Non-Immigrant % Dental visit -more than one year ago	p	OR	95% C.I. for OR	P value	Immigrant % Dental visit -more than one year ago	p	OR	95% C.I. for OR	P value
Age (Ref:45 to 54 years)										
45 to 55	26.5					23.0				
55 to 64	31.4		1.27	(1.26,1.27)	<.001	25.3		1.13	(1.12,1.14)	<.001
65 to 74	42.6	<.001	2.06	(2.05,2.07)	<.001	29.4	<.001	1.39	(1.38,1.40)	<.001
75 to 84	50.2		2.80	(2.79,2.81)	<.001	43.3		2.55	(2.53,2.57)	<.001
85 and above	57.2		3.72	(3.69,3.74)	<.001	57.5		4.52	(4.47,4.58)	<.001
Sex (Ref: Female)										
Male	35.8		1.15	(1.14,1.15)	<.001	30.2		1.15	(1.14,1.15)	<.001
Female	32.7	<.001				27.3	<.001			
Education (Ref: Post-secondary graduate)										
<Secondary	57.5		4.23	(4.22, 4.25)	<.001	45.3		3.09		<.001
Secondary	32.8		1.52		<.001	33.6		1.89	(3.07,3.10)	<.001
Other post-secondary	34.0		1.61	(1.51, 1.53)	<.001	21.5		1.02	(1.87,1.90)	.002
Post-secondary graduate	24.2	<.001		(1.60, 1.62)		21.1	<.001		(1.01, 1.04)	
Income (Ref 80,000 and above)										
<$20,000	62.6		8.16	(8.12, 8.21)	<.001	47.8		4.26	(4.22, 4.30)	<.001
$20000 to 39,000	53.7		5.64		<.001	41.1		3.25		<.001
$40,000 to 59,000	35.5		2.68	(5.62, 5.67)	<.001	32.0		2.19	(3.23, 3.28)	<.001
$60,000 to 79,000	29.0	<.001	1.99	(2.67, 2.69) (1.98, 2.00)	<.001	24.5	<.001	1.51	(2.18, 2.21) (1.50, 1.52)	<.001

$80,000 and above	17.0					17.7				
Dental Insurance (Ref: yes)										
Yes	21.8	<.001				17.0	<.001			
No	50.6		3.69	(3.68,3.70)	<.001	40.8		3.36	(3.34,3.38)	<.001
SS positive social interaction (Ref: High)										
Low	36.9	<.001	1.22	(1.21,1.23)	<.001	30.7	<.001	1.25	(1.24,1.25)	<.001
High	32.4					26.2				
Visit doctor (Ref: Yes)										
Yes	32.7	<.001				27.0	<.001			
No	43.6		1.59	(1.59,1.60)	<.001	46.4		2.34	(2.33,2.36)	<.001
SROH (Ref: Excellent/very good/good)										
Excellent/very good/good	32.2	<.001				27.3	<.001			
Fair/poor	51.0		2.19	(2.18,2.20)	<.001	35.7		1.48	(1.47,1.49)	<.001
Time since immigration (Ref: 50 years and above)										
0 to 19 years						31.0		0.94	(0.93,0.94)	<.001
20 to 29 years						28.7		0.84	(0.83,0.85)	<.001
30 to 39 years						24.2	<.001	0.66	(0.66,0.67)	<.001
40 to 49 years						25.6		0.72	(0.71,0.73)	<.001
50 years and above						32.3				

Table 3: Adjusted relationship of predisposing, enabling, need and behavioural factors to dental visit (more than one year)- CCHS-HA population (aged 45[+]) in 2008-09 (N= 13,635,506)

| Determinants	Non-Immigrant				Immigrant			
	AOR	95% C.I. for OR		P value	AOR	95% C.I. for OR		P value
		Lower	Upper			Lower	Upper	
Age (Ref:45 to 54)								
55 to 64	1.01	1.00	1.01	<.001	1.08	1.07	1.09	<.001
65 to 74	0.98	0.97	0.99	<.001	0.68	0.67	0.69	<.001
75 to 84	1.07	1.06	1.07	<.001	1.03	1.02	1.04	<.001
85 and above	1.30	1.29	1.31	<.001	1.68	1.65	1.71	<.001
Sex Male (Ref: Female)	1.22	1.21	1.23	<.001	1.24	1.24	1.25	<.001
Marital Status (Ref: Single)								
Married	1.40	1.39	1.40	<.001	2.05	2.01	2.08	<.001
Widowed	1.40	1.39	1.40	<.001	2.11	2.07	2.15	<.001
Divorced/Separated	1.38	1.37	1.39	<.001	1.56	1.53	1.59	<.001
Education (Ref: Post-secondary)								
<Secondary	2.05	2.04	2.06	<.001	1.98	1.96	2.00	<.001
Secondary	1.37	1.36	1.37	<.001	1.71	1.69	1.72	<.001
Other post-secondary	1.32	1.31	1.33	<.001	0.89	0.88	0.91	<.001
Income (Ref: $80,000 and above)								
<$20,000	3.07	3.05	3.09	<.001	2.46	2.42	2.49	<.001
$20000 to 39,000	2.63	2.61	2.64	<.001	2.06	2.04	2.08	<.001
$40,000 to 59,000	1.65	1.64	1.65	<.001	1.67	1.66	1.69	<.001
$60,000 to 79,000	1.51	1.50	1.52	<.001	1.46	1.44	1.47	<.001
Dental Insurance No (Ref: yes)	2.44	2.43	2.45	<.001	2.37	2.35	2.38	<.001
SS Low affectional support (Ref: High)	0.85	0.84	0.85	<.001	1.10	1.09	1.11	<.001
SS positive social interaction Low (Ref: High)	0.83	0.82	0.83	<.001	1.32	1.31	1.34	<.001
Health (Ref: Excellent)								
Very good	1.06	1.05	1.07	<.001	1.11	1.09	1.12	<.001
Good	1.21	1.20	1.21	<.001	1.13	1.12	1.14	<.001
Fair	1.07	1.06	1.08	<.001	1.41	1.39	1.43	<.001
Poor	1.34	1.33	1.36	<.001	1.21	1.19	1.23	<.001
Visit doctor No (Ref: Yes)	1.69	1.68	1.69	<.001	2.67	2.64	2.69	<.001
SROH (Fair / poor) (Ref: Excellent / very good / good)	1.46	1.45	1.47	<.001	0.98	0.98	0.99	<.001
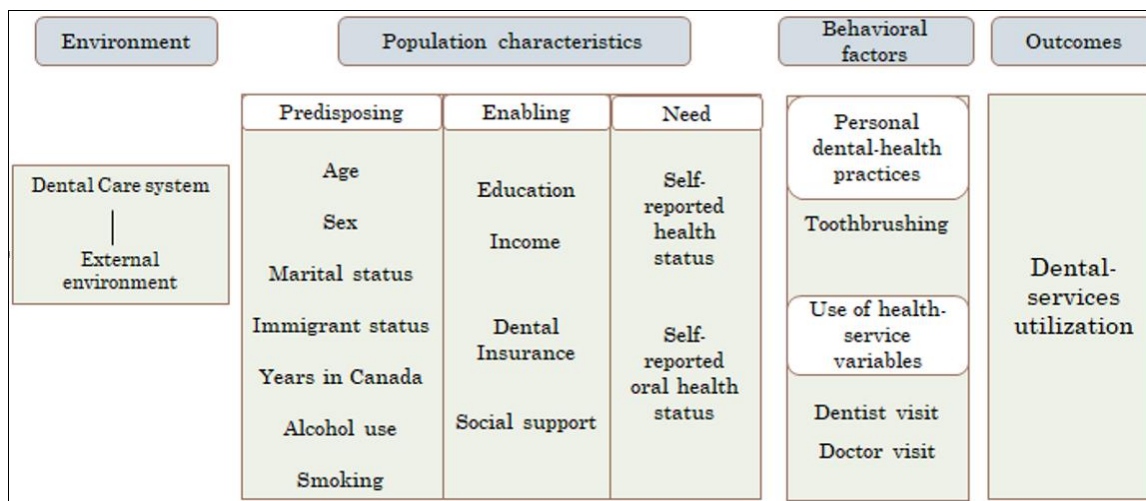
Fig 1: Conceptual Framework of the Study, Andersen RM. Andersen and Newman Framework of Health Services Utilization. *J Health Soc Behav*. 1995; 36(December):1-10. Doi:10.1111/pme.12756.

Conclusion

Policy-makers will soon be tasked with meeting the needs of an aging population, including an aging immigrant subgroup, who will likely present greater treatment demands. By comparing elderly immigrants and non-immigrants, this study highlights some significant predictors that influence each group's dental-care utilization. The data reinforce the challenges of understanding the complex relationships between dental-care utilization, demographic variables, immigration, and aging. Given current aging and demographic trends, future research and longitudinal studies are required to improve our understanding of the characteristics that influence aging immigrants' specific needs and their use of dental services. Development of this knowledge base can assist policy-makers in preparing programs that meet the specific needs of the older immigrant Population.

References

1. Statistics Canada. Census Profile 2016 Census Stat Canada Cat no 98-316-X2016001. 2017; Ottawa (Released May 3, 2017): http://www12.statcan.gc.ca/census-recensement/2016. Doi: Catalogue no. 98-316-X2016001
2. Statistics Canada. Age and sex, and type of dwelling data: Key results from the 2016 Census. *Stat Canada* cat no 11-001-X. 2017:1-17. http://www.statcan.gc.ca/daily-quotidien/170503/dq170503a-eng.pdf. Accessed April 26, 2018.
3. Statistics Canada. Immigration and ethnocultural diversity in Canada. *Stat Canada* cat no 99-010-X. 2013:1-23. http://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-010-x/99-010-x2011001-eng.cfm. Accessed April 26, 2018.
4. Harford J. Population ageing and dental care. Community Dent Oral Epidemiol. 2009;37(2):97-103. Doi:10.1111/j.1600-0528.2008.00441.x
5. Kennedy S, Kidd MP, McDonald JT, Biddle N. The healthy immigrant effect: Patterns and evidence from four countries. J Int. Migr. Integr. 2015;16(2):317-322. https://Doi.org/10.1007/s12134-014-0340-x.
6. Kennedy S, McDonald JT, Biddle N. The healthy immigrant effect and immigrant selection: Evidence from four countries. Social and Economic Dimensions of an Aging Population Research Papers 164. Hamilton, ON: McMaster University; c2006. https://ideas.repec.org/p/mcm/sedapp/164.html. Accessed April 26, 2018.
7. McDonald JT, Kennedy S. Insights into the "Healthy Immigrant Effect": Health status and health service use of immigrants to Canada. Soc Sci Med. 2004;59(3):1613-1627. https://Doi.org/10.1016/j.socscimed.2004.02.004.
8. De Maio FG, Kemp E. The deterioration of health status among immigrants to Canada. Glob Public Health. 2010;32(5):462-478. https://Doi.org/10.1080/17441690902942480.
9. Calvasina P, Muntaner C, Quiñonez C. The deterioration of Canadian immigrants' oral health: Analysis of the Longitudinal Survey of Immigrants to Canada. Community Dent Oral Epidemiol. 2015;43(5):424-432. Doi:10.1111/cdoe.12165.9.
10. Newbold B. The short-term health of Canada's new immigrant arrivals: Evidence from LSIC. Ethn. Health. 2009;14(3):315-336. https://Doi.org/10.1080/13557850802609956.
11. Newbold KB, Patel A. Use of dental services by immigrant Canadians. J Can Dent Assoc (Tor). 2006;72(2):143.
12. Reza M, Amin M, Sgro A, Abdelaziz A, Ito D, Main P. Oral health status of immigrant and refugee children in North America: A scoping review. J Can Dent. 2016;82:g3. http://www.cda-adc.ca/_images/jcdatempimages/g3/g3.pdf. Accessed April 26, 2018.
13. MacEntee MI, Mariño R, Wong S, *et al*. Discussions on oral health care among elderly Chinese immigrants in Melbourne and Vancouver. Gerodontology. 2012;29(2):822-832. Doi:10.1111/j.1741-2358.2011.00568.x.
14. MacEntee MI, Wong ST, Smith A, *et al*. Oral healthcare challenges for older Punjabi-speaking immigrants. Can J Aging. 2014;33(2):196-207. Doi:10.1017/S0714980814000087.
15. 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(1):145. Doi:10.1186/1472-6831-14-145.

16. Health Canada. Report on the Findings of the Oral Health Component of the Canadian Health Measures Survey 2007-2009. Ottawa, ON: Health Canada; 2010. http://publications.gc.ca/collections/collection_2010/sc-hc/H34-221-2010-eng.pdf. Accessed April 24, 2018.

17. Zini A, Vered Y, Sgan-Cohen HD. Are immigrant populations aware about their oral health status? A study among immigrants from Ethiopia. BMC Public Health. 2009;9:205. Doi:10.1186/1471-2458-9-205.

18. McNally M, Lyons R. The silent epidemic of oral disease: Evaluating continuity of care and policies for the oral health care of seniors. Ottawa, ON: Canadian Health Services Research Foundation / Fondation canadienne de la recherche; 2004. http://www.cfhi-fcass.ca/Migrated/PDF/ResearchReports/OGC/lyons_final.pdf. Accessed April 26, 2018.

19. Neumann DG, Quiñonez C. A comparative analysis of oral health care systems in the United States, United Kingdom, France, Canada, and Brazil. Network for Canadian Oral Health Research Working Papers Series. 2014:1-18. http://ncohr-rcrsb.ca/knowledge-sharing/working-paper-series/content/garbinneumann.pdf. Accessed April 26, 2018.

20. Bedos C, Brodeur JM, Benigeri M, Olivier M. Utilization of preventive dental services by recent immigrants. Can J Public Health. 2004;95(3):219-223.

21. Ramraj C, Azarpazhooh A, Dempster L, Ravaghi V, Quiñonez C. Dental treatment needs in the Canadian population: Analysis of a nationwide cross-sectional survey. BMC Oral Health. 2012;12:46. Doi:10.1186/1472-6831- 12-46.

22. Thompson B, Cooney P, Lawrence H, Ravaghi V, Quiñonez C. The potential oral health impact of cost barriers to dental care: Findings from a Canadian population-based study. BMC Oral Health. 2014;14:78. Doi:10.1186/1472-6831-14-78.

23. Anderson CN, Kim H. An examination of older immigrants' use of dental services in the United States. J Aging Soc Policy. 2010;22(1):18-32. Doi:10.1080/08959420903385593.

24. Kiyak HA, Reichmuth MS. Barriers to and Enablers of Older Adults' Use of Dental Services. J Dent Educ; c2005. http://www.jdentaled.org/content/jde/69/9/975.full.pdf. Accessed April 21, 2018.

25. Brothwell DJ, Jay M, Schönwetter DJ. Dental Service Utilization by Independently Dwelling Older Adults in Manitoba, Canada. 2008, 74(2). http://cda-adc.ca/jcda//vol-74/issue-2/161.pdf. Accessed April 22, 2018.

26. Gao XL, McGrath. C. A review on the oral health impacts of acculturation. J Immigr. Minor Health. 2011;13(2):202-213. Doi:10.1007/s10903-010-9414-9.

27. Listl S. Income-related inequalities in dental service utilization by Europeans aged 50+. J Dent Res. 2011;90(6):717-723. Doi:10.1177/0022034511399907.

28. Olerud E, Hagman-Gustavsson ML, Gabre P. Oral health status in older immigrants in a medium-sized Swedish city. Spec Care Dent. 2016;36(6):328-334. Doi:10.1111/scd.12195.

29. Andersen RM. Andersen and Newman Framework of Health Services Utilization. J Health Soc Behav. 1995;36(December):1-10. Doi:10.1111/pme.12756

30. Andersen RM, Davidson PL. Ethnicity, aging, and oral health outcomes: a conceptual framework. Adv Dent Res. 1997;11(2):203-209. Doi:10.1177/08959374970110020201.

31. Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada and Social Sciences and Humanities Research Council of Canada. Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans; c2014. http://www.pre.ethics.gc.ca/pdf/eng/tcps2-2014/TCPS_2_FINAL_Web.pdf

32. Sherbourne CD, Stewart AL. The MOS social support survey. Soc Sci Med. 1991;32(6):705-714. Doi:10.1016/0277-9536(91)90150-B.

33. Gilmour H. Social participation and the health and well-being of Canadian seniors. Stat Canada Health Reports. 2012;23(82):1-12. https://www.statcan.gc.ca/pub/82-003-x/2012004/article/11720-eng.pdf. Accessed April 26, 2018.

34. Liu Y. Differentiation of self-rated oral health between American non-citizens and citizens. Int. Dent J. 2016;66(6):350-355. Doi:10.1111/idj.12248.

35. Tsakos G, Sabbah W, Chandola T, *et al*. Social Relationships and Oral Health among Adults Aged 60 Years or Older. Psychosom Med. 2013;75(2):178-186. Doi:10.1097/PSY.0b013e31827d221b

36. Kim JK, Baker LA, Seirawan H, Crimmins EM. Prevalence of oral health problems in U.S. adults, NHANES 1999-2004: Exploring differences by age, education, and race/ethnicity. Spec Care Dent. 2012;32(6):234-241. doi:10.1111/j.1754-4505.2012.00280.x.

37. Wu B, Tran TV, Khatutsky G, Wu M, Tran B. Comparison of Utilization of Dental Care Services Among Chinese- and Russian-Speaking Immigrant Elders. J Public Health Dent. 2005;65(2):97-103. https://libres.uncg.edu/ir/uncg/f/B_Wu_Comparison_2005.pdf. Accessed May 16, 2018.

38. Shelley D, Russell S, Parikh NS, Fahs M. Ethnic disparities in self-reported oral health status and access to care among older adults in NYC. J Urban Heal. 2011;88(4):651-662. doi:10.1007/s11524-011-9555-8