EXAMINING SELF-RATED ORAL HEALTH AND SELF-RATED ORAL NEED AMONG ADULTS AGED 55+ IN ONTARIO

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Abstract

There is a paucity of research on self-rated oral health (SROH) and self-rated oral needs (SRON) within aging populations. As such, the research objectives of this study were to assess factors associated with SROH and assess how SRON indicators correlate with SROH among Ontarian adults aged 55 years and greater. Data from the 2017-2018 Annual Component of the Canadian Community Health Survey were used. Linear regression estimated the associations between a range of biopsychosocial factors and SROH. Pearson's correlation estimated associations between SRON and SROH. Smoking, poor general health rating, and never visiting the dentist were associated with an increased likelihood of poorer SROH. Satisfaction with teeth/denture appearance was correlated with better SROH. This study is first to consider both SROH and SRON in Ontarian older adults. More research is needed to inform applied practice and policy that aim to improve services and promote oral health with aging.

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

Thesis Overview

Oral health is an essential component of overall health. However, oral health is often not considered within health management in many populations, including older adults. Older adults' perceptions towards their oral health are pivotal to understand how oral health interacts with many factors including socio-demographic, health behaviour, health and healthcare, dental and dental care, and self-perceived oral need factors. Little is known about how older adults' perceptions towards their oral health are associated with such factors. As a result, this thesis examined self-rated oral health (SROH) and self-rated oral need (SRON) among adults aged 55 years and greater in Ontario.

Six chapters will be used to present this thesis research. Chapter one provides background information to introduce this field of research and to briefly outline the objectives of the current study. Chapter two more exhaustively reviews the extant literature while situating the thesis research objectives within past studies. Chapter three uses the information provided in the first two chapters to explain the methodology and methods used to achieve the current research objectives. Chapter four presents the results of the analyses performed. Chapter five discusses the findings of this study to explain significant statistical associations and patterns found between the predictor and outcome variables as well as to demonstrate how this study contributes to filling some research gaps in the literature. Chapter six concludes the study and this thesis by providing an overview of the importance of this research and the implications of the findings on future research, policy, and practice.

Background

Older adults are the fastest-growing segment of the population in Ontario, and the number of older adults in the province is expected to double by 2046 (Government of Ontario, 2021). Many older adults experience limited access to oral health services and care despite reporting higher rates of poor oral health than any other age group (Grignon et al., 2010). The Canadian Dental Association (CDA) (2022) defines oral health as a state of oral tissues that "contribute positively to your physical, mental, and social well-being by allowing you to speak, eat and socialize unhindered by pain, discomfort, or embarrassment." Represented by this CDA definition, studies have demonstrated that poor oral health is associated with a decreased quality of life, increased healthcare costs, and a barrier to overall healthy aging (Kiyak, 1981; Ortiz-Barrios et al., 2019).

Currently, many older adults are not accessing oral health services as much as needed for various reasons (Gilbert et al., 2003), which creates an urgent need for health system stakeholders and policy makers to have timely information on the oral health needs of the older population (Mariño et al., 2008). Additionally, it is unclear whether there are age or gender differences within the older adult population in regard to self-ratings of oral and general health (Locker et al., 2005). Population-based evidence regarding oral health needs, normative needs, healthcare utilization in the older population may be helpful in addressing known gaps in dental care utilization and reducing oral health disparities (Adunola et al., 2019). More information is required for policymakers as well as health care professionals and practitioners to respond and provide appropriate levels and types of oral health care (Bonner, 2017).

As such, a study using population-based data exploring the predictors of *self-rated oral health* (SROH) and *self-rated oral needs* (SRON) among older adults, as well as the correlations

between SROH and SRON, provides information to help address this current knowledge gap that may inform future oral health services and applied oral health promotion strategies.

Oral health needs are conceptualized in two ways – subjective needs and objective needs (Peterson & Pedersen, 1984). Individuals express subjective needs through perceptions of their own oral health state (i.e., SROH) and their needs for oral care, services, or treatment (i.e., SRON). These subjective needs are dependent on personal experiences and the appraisals of those experiences. Conversely, objective needs which are sometimes referred to as 'normative needs,' represent measures of individuals' physical oral health status. Dental professionals use clinical measures of objective needs for treatment when diagnosing oral diseases and recommending oral health services. It has been noted in the extant literature that considerations of objective needs alone does not completely represent older adults' oral health status, especially in terms of dental care treatment and service use (Heft et al., 2003). To illustrate, specific normative oral disease symptoms (i.e., objective) may be perceived to be minor according to some individuals but significant to others (i.e., subjective).

To explain the interplay between objective and subjective oral health and oral need indicators, it is noted that, although normative need measures are valid and reliable indicators of oral conditions, these problems only become apparent over time and as a result are more commonly expressed later in life (Koistinen et al., 2020). Individuals who are unaware of their oral health conditions will progress to manifest signs and symptoms. Also, an individual's subjective need for treatment may be absent in the initial stages of the disease and as a result, treatment is not sought leading to the condition remaining undetected until diagnosed by a dental professional under more urgent conditions (Matthias et al., 1993). Further, individuals may feel symptoms of oral disease that have no apparent signs (Reisine & Bailit, 1980; Smith & Sheiham,

1979). As a result, viewing oral health and oral needs as related to both physical symptoms and psychosocial factors, rather than only focusing on normative needs, is essential in the comprehensive assessment of the oral health status and oral need for dental care (Reisine & Locker, 1995). This consideration is especially true for populations with high unmet needs such as the older adult population (Robinson et al., 1998). These multidisciplinary considerations are represented by the biopsychosocial model of health which can be used as a framework to understand complex experiences of health and health-related behaviour (Engel, 1981), such as oral health, oral need, and dental health service use.

In the existing research on oral health, there is an emphasis on normative clinical diagnoses and the biopsychosocial factors associated with these objective oral health outcome measures. This emphasis is likely due to the dominant biomedical approach in health care that often disregards subjective appraisals of oral health (Koistinen et al., 2020). The few studies that have examined subjective oral health measures typically relate SROH and SRON—as predictor variables, representing psychological factors— to dentists' objective clinical diagnoses (Atchison et al., 1993; Drake et al., 1990; Jones et al., 2001). However, studies do not as often consider the biopsychosocial factors associated with SROH and SRON—as the outcome variables of main interest. Furthermore, in terms of older adults in research, the current body of research either considers adults ages 18-60 years (Gallego et al., 2017), considers only specific ages such as '40-55' (Zaitsu et al., 2011) or '35-54' (Kim et al., 2018). Some research homogenizes the older adult population as '60+' (Adunola et al., 2019; Matthias et al., 1995; Ortíz-Barrios et al., 2019), which generalizes the older population by including older adults whose ages are decades apart into one group. Generalizing the older adult population is not representative of this population as age-group differences likely exist in later life that warrant consideration.

Exploring the biopsychosocial factors that are associated with SROH and SRON as outcome variables among older groups of adults is an important and practical endeavour. Not only would it fill in current research gaps, as outlined previously, but it would also be useful for developing evidence-informed strategies to promote oral health and dental service use among older adults. It is already known that older adults experience the poorest oral health of all age groups across the lifespan (Robinson et al., 1998), which in turn increases the risk of multiple systemic diseases, such as heart attacks and strokes in later life (Health Canada, 2021). Fortunately, these diseases are preventable and oral literacy, oral hygiene, and dental service use are modifiable factors that determine oral health status in the older population (Baskaradoss et al., 2018). Therefore, by identifying the associations of SROH and correlations to SRON, new or existing oral health interventions can be developed or improved. For example, rather than taking a one-size-fits-all approach, oral health programs and policies can be tailored not only based on age but also based on the biopsychosocial profiles of older adults.

Research Objectives and Questions

This research aimed to assess the factors associated with SROH and SRON as key oral health outcomes among adults aged 55+. This research was the first to consider both SROH and SRON in Ontarian older adults. As such, it makes an original contribution to existing gaps in the literature on oral health in an aging population. Based on the relevant literature, it was hypothesized that a range of factors would be significantly and robustly associated with SROH and SRON, including predictor variables that range across socio-demographic, health behaviour, health and healthcare factors, and dental health and dental care factors. More specifically, this research answered the following two primary research questions: 1. What factors are associated

with SROH in the Ontarian 55+ population? and 2. How is SROH correlated to SRON in the Ontarian 55+ population?

Chapter Summary

Chapter one introduced the concept of oral health using the CDA's definition to connect oral health to the experiences of older adults in different populations. Oral health was further divided into subjective and objective oral health and respective measures were explained to help provide information to address current gaps in the literature that may inform future oral health services and applied oral health promotion strategies. Rather than the current focus on a biomedical model of oral health, including psychosocial measures was hypothesized to help examine the factors associated with SROH and how SROH is related to SRON. To fully examine SROH and SRON, a deeper understanding of the concepts pertaining to this field of research is provided in Chapter two.

Chapter 2: Literature Review

Chapter Introduction

To understand the importance and implications of oral health in older adults in Ontario, the previous literature is presented in this chapter to create a frame of reference for this study. The previous literature is conceptualized into general concepts that become more specifically related to this study to create an understanding of the factors included in the study. Aging and oral health is explained using biomedical and biopsychosocial considerations that affect how oral health and dental care recommendations change as an individual ages. To date, research on oral health changes associated with age use a predominantly clinical approach to assessing oral health status within the older population. However, a more holistic approach of using self-rated measures is emerging within the field of oral health research in older adults. Nevertheless, there remains a lack of this holistic approach in Canadian populations. Organizing this field of research into themes presented below help identify gaps in the previous literature, which the current study aims to address.

Aging and Oral Health: Biopsychosocial Considerations

Throughout the human lifespan, teeth undergo morphological and histological changes to the enamel and pulp of the tooth (Carvalho, 2016). There are many 'natural' changes that occur with the enamel of teeth, such as decreasing thickness over time, especially after the age of 50 years (Atsu et al., 2005). One study estimated that one-third of the thickness of the enamel is lost in adults older than 65 years compared to new teeth in children (Kidd et al., 1984). Further, there is an increase in gingival recession due to the loss of periodontal attachment with age, which can increase the risk of cavities occurring in the roots of the teeth (Carvalho, 2016; Griffin et al., 2004). Additionally, age is associated with a decrease in nerve branches around the pulp of teeth

leading to weaker and delayed responses to stimuli (Farac et al., 2012; Jafarzadeh & Abbott, 2010; Jespersen et al., 2014). Older adults are more likely to have cracked, stained, worn teeth, and gingival recession (Hartmann & Müller, 2004).

It is stated that these biological changes need to correspond with increasing age to be considered part of 'normal' aging (Carvalho, 2016). However, these changes also need to be carefully distinguished from pathological alterations to the teeth. For example, changes need to be based on the prediction of whether the tooth's function will be lost and whether the tooth will last the normal rate of wear and tear respective to age (Smith & Knight, 1984). Further, teeth are exposed to many conditions that lead to the wear and tear of the teeth, gums, and tongue causing a change in the anatomy of the mouth over time that may correlate with age but not be caused by it. Recent trends show that older adults are retaining more of their natural teeth longer, causing dental professionals to expect to observe age-related oral changes more frequently in the adult population (Mckenna & Burke, 2010). Therefore, it is practically impossible to specifically determine how much wear will be considered physiological or pathological without considering other factors that can affect the health of the mouth (Carvalho, 2016).

It is vital to note that aging is more than inevitable anatomical and physical changes over time — it is also a psychosocial construct (Levy, 2009). Although aging is an inescapable process, it is usually depicted as a negative experience, mainly viewed as the deterioration of the body and mind (Meisner & Levy, 2016). Stereotypes associated with aging such as a decrease in appearance (e.g., loss of teeth and unappealing smile), the loss of physical functioning (e.g., losing chewing and swallowing efficiency), and the onset of oral diseases contribute to the negative view of aging (Clark & Korotchenko, 2011). Older adults in general regard younger people as healthier than they are because older adults are more likely to accept certain disabilities

and pains as inevitable (Drake et al.,1990). Our beliefs and attitudes towards aging are influenced by societal views on aging experienced throughout our lives. For example, many adults and older adults accept less-than-optimal oral health because they expect to experience oral pain, oral disease, and loss of teeth as they age and accept it as a normal part of aging (Raphael, 2017). These age-related stereotypes influence the psychosocial well-being of individuals, thereby increasing the risk for poor biopsychosocial health outcomes in later life (Levy et al., 2012; Levy et al., 2014; Meisner & Levy, 2016). This inaccurate and ageist perspective can be a barrier to accessing oral care in the older adult population. They are less likely to seek care if they do not perceive pain or discomfort as abnormal. Therefore, in addition to biological considerations of oral health, it is of utmost importance to consider the psychosocial and behavioural factors associated with oral health of the older adult population to understand this issue holistically.

Aging and Oral Care

Globally, the World Health Organisation (WHO) (2017) has developed a strategy and action plan on aging and health, including integrating and focusing on oral care as a part of overall health. Oral health is an essential part of overall health. Many oral diseases are associated with and indicative of underlying issues throughout the body. Many oral diseases and conditions have similar modifiable risk factors to the leading non-communicable diseases such as cancer, diabetes, and cardiovascular diseases (WHO, 2017). Despite the importance of oral health in older adults, very little research is done regarding preventing oral diseases (Greene & Adelman, 2003; Kishore et al., 2013). Throughout the literature, there is a focus on treatments using a biomedical approach rather than a holistic approach.

The current biomedical approach to oral diseases often disregards the aging perspective by focusing on a general adult population while attributing oral disease to aging (Wade & Halligan, 2004). Poor oral hygiene is viewed as inevitable because aging is seen as a gradual decline in eyesight, hearing, and mobility; all are essential prerequisites for good oral self-care (Ghezzi & Ship, 2000; Heyden, 1990). Older adults are commonly excluded from clinical trials, while some dental clinics limit the number of older adults they provide care to (Chang et al., 2020). When having a dental check-up, it is not uncommon for older adults to experience missed diagnosis due to attributing pathology as a normal part of aging causing under-treatment (Gonsalves et al., 2008; Schroyen et al., 2018). Many clinicians use clinical practice guidelines developed on younger adults and generalize them towards the older population, despite having no research to support the generalisability of the findings to older adults (Mutasingwa et al., 2011). Generalizing findings from different populations to older adults discriminate against the specific needs of older adults by not providing patient-centred care.

Each stage of life experiences different resources and opportunities that can influence one's health and perceptions of health (Braveman & Barclay, 2009). Therefore, it is safe to assume that people in different age groups will be influenced by different factors, especially when age is a consistent predictor of oral disease. As a person ages, they are likely to accumulate oral disease and its consequences over time and become more susceptible to oral disease as time goes by (McNally et al., 2014). Therefore, prevention that accounts for a biopsychosocial approach where life experiences are considered to improve older adults' oral health is needed. Studies have shown that good oral health in the older population can be maintained with individualized oral care, even in patients with chronic oral diseases (Blinkhorn, 1993; Kiyak, 2000; MacEntee et al., 1997).

Use of Clinical Measures

The biomedical approach to oral health is prevalent throughout clinical practice and research. Previous research uses measures of SROH to find associations with clinically defined oral needs in many different populations (Judith et al., 2001; Nascimento et al., 2021). The relationship between perceptions of oral health is affected by the awareness of the clinical oral status (Schützhold et al., 2014). Studies have assessed SROH using single-item questions in recent years and found associations with many clinical factors (Schützhold et al., 2014). Some of the clinical factors used were the dentition status, which is the amount of decayed, filled, missing, and treated teeth, bleeding gums, dry mouth, chewing ability, presence of pain, and satisfaction with dental appearance (Atchison & Dolan, 1990; Cushing et al., 1986; Matthias et al., 1995). Including clinical measures to better understand SROH is important because clinical factors can influence how older adults perceive their oral health. For example, toothache and loss of teeth are mainly caused by cavities (Chestnutt et al., 2000; McCaul et al., 2001), and the dentition status affects the chewing ability and appearance of the mouth which is shown to negatively affect SROH in older populations (Afonso-Sonza et al., 2007).

The previous literature focused extensively on the associations between SROH and clinical measures done by dental professionals. Although this is important, emphasis is given to the association between SROH and dental care utilization in older adults (Afonso-Sonza et al., 2007) or to compare the SROH of older adults to dentists' evaluations of their patients' oral health status (Atchison et al., 1993). Self-reported oral pain and diseases are associated with an increased likelihood of seeking oral care (Muirhead et al., 2009). Visiting the dentist is usually expensive and access to dentists is limited to some older adults. Therefore, relying on clinical measures to understand better how older adults rate their oral health is sometimes impossible. Clinically determined oral need is also associated with a lower likelihood of seeking oral care in

the future (Gilbert et al., 2003). Clinical diagnoses are associated with an increase in dental anxiety with adults, which may lead to adults postponing their dental visits (Dou et al., 2018). In some cases, relying on clinically determined oral need may create barriers for older adults needing to visit their dental professional.

Using self-rated data can help bridge the gap between SROH and clinical measures as questionnaires were found to be of possible value in assessing the oral health needs in older adult populations (Robinson et al., 1998). Self-rated measures in an aging population have a strong predictive power for a wide array of health outcomes (Kim et al., 2018; Levy et al., 2004; Sargent-Cox et al., 2012; Wu et al., 2011). Therefore, using self-rated measures to assess older adults' perceptions of their oral health and needs will help in understanding this population's oral health disparities.

Use of Self-Rated Oral Health and Self-Rated Oral Needs

SROH ratings are subjective and individualized perspectives of oral health status used in diverse populations (Atchison, 1997). Subjective measures are easy to collect and knowledge about SROH can lead to a better understanding of SRON (Wu et al., 2011). Subjective oral health measures provide accurate and comprehensive information on people's perceptions of their oral health and predict the social, psychological, and functional impacts on peoples' lives (Fagundes, 2021). Individuals being asked to rate their oral health on a scale of poor to excellent has become a standard practice when performing population-based health surveys and evaluations (Kaplan & Baron-Epel, 2003). Self-ratings of health can provide subjective and objective measures to be used in more complex multi-scales and indexes in health assessments (Rowan, 1994).

Several studies have showcased that using SROH as a health assessment tool is associated with clinical outcomes and can be reliably used to determine the needs of older adults (Atchison & Gift, 1997; Costa et al., 2019; Kim et al., 2018; Matthias et al., 1995; Nascimento et al., 2021; Robinson et al., 1998). For example, self-rated health measures were shown to be strong predictors of morbidity and mortality (DeSalvo, 2005; Idler & Benyamini, 1997). In the review done by Idler and Benyamini (1997), possible interpretations to explain this association are 1) self-rated health is a more accurate and inclusive measure of health status and health risks than other covariates; 2) self-rated health is a dynamic evaluation that includes the trajectory of health as well as current health; 3) self-rated health influences behaviours that subsequently affect health status and 4) self-rated health can reflect the absence or presence of resources that can improve health. Also, SROH was shown to be correlated with many dental diagnoses such as coronal cavities and mobile teeth (Atchison et al., 1993; Jones et al., 2001; Matthias et al., 1995). However, these previous studies focused solely on comparing SROH with the health and survival outcomes as well as clinical diagnoses of dental professionals.

One study done in the United Kingdom found that oral health *self*-assessment (i.e., SROH) has predictive value in assessing the oral needs of adult communities (Robinson et al., 1998). SROH's is valuable in assessing the oral needs of populations as it can be used to predict the oral needs of populations before programs or policies are implemented. Another study on older adults in the United States found that self-reported broken filling, broken dentures, cavities, loose teeth, teeth that look bad, and toothache were strongly associated with the self-rated need to visit the dentist (Heft et al., 2003). On the other hand, other studies found that dentists and patients may have differing opinions on oral health status (Kim et al., 2018); however, these studies analysed a general adult population rather than focusing on an older adult population.

While clinically-defined disease statuses are one factor in assessing oral health status, individuals' perspectives of their oral health needs can account for functional, behavioural, and social factors (Adunola et al., 2019). SROH assessments are multidimensional constructs that account for the individual's physical and mental well-being based on their subjective understanding of their health, personal experiences, environment, and other factors (Fagundes et al., 2021). Therefore, assessing the relationship between an individuals' reports of SROH and their SRON may help address known barriers to healthy aging in older adults. Additionally, further understanding of the relationships between SROH and SRON can help professionals and policy makers in the dental field predict and support the need for oral care.

Due to SROH being a holistic assessment many studies focused on the relationship of SROH with OHRQOL (Gallego et al., 2017; Koistinen et al., 2020; Mariño et al., 2008; Ortíz-Barrios et al., 2019). Standardized questionnaires such as the Oral Health Impact Profile (OHIP-14) and Geriatric Oral Health Assessment Index (GOHAI) were used to measure SROH and OHRQOL (Atchison et al., 1993; Jones et al., 2001; Matthias et al., 1995; Wu et al., 2011; Zaitsu et al., 2012). These standardized questionnaires predominantly measure associations between SROH and OHRQOL with factors such as socio-demographic, health behaviour, and health status. SROH is also measured using questionnaires that do not include the OHIP-14 or the GOHAI. Similar results were found between studies that utilized standardized questionnaires and those that did not. However, both types of studies are neither in a Canadian context nor focused on an older adult population (Adunola et al., 2019; Afonso-Souza et al., 2007; Drake et al.,1990; Lundegren et al., 2012; Peterson, 1983; Schützhold et al., 2014). Thus, using subjective measures without the GOHAI or OHIP-14 may provide more information on this study's population.

SRON is an important factor in understanding the older population's oral health. Earlier research has found that one reason older adults do not utilize dental services is because of an incorrect perception that underestimates their dental treatment needs (Tervonen et al., 1988). Despite this, previous research focused on the association between SROH and clinical diagnosis (Drake et al., 1990). Focusing on the association between SROH and clinical diagnosis may not be always practical. Many older adults do not visit the dentist as much as they need to (Gilbert et al., 2003), partly due to underestimating their own dental needs (Tervonen et al., 1988). Therefore, more information is needed regarding the association between SROH and SRON.

SRON is often conceptualized based on the World Health Organisation's International Classification of Impairments, Disabilities, and Handicaps (1980), which was later modified by Locker (1988) to focus on oral health more specifically which resulted in the Oral Impacts on Daily Performances (OIDP). The OIDP modified by Locker (1988) was distinguished into three levels: oral status, intermediate impacts, and ultimate impacts. The first level is the oral status which includes any oral impairments that are predominantly clinically measured. The second level is the intermediate impacts which are usually the earliest impacts caused by poor oral status. These intermediate impacts consist of discomfort, pain, functional limitations, and dissatisfaction with appearance was later added because studies found it to be a major dimension of oral health outcomes (Cushing et al., 1986; Leao & Sheiham, 1995; Linn, 1966). Also, the intermediate impacts can cause one another to occur. For example, pain may cause dissatisfaction with appearance or discomfort and vice versa. The third level is the ultimate impacts that represent the impacts on daily activities that can be physical, social, and psychological performances. This study used the OIDP by Locker (1988) and adds the fourth level called 'oral health measures' (figure 1) because all three levels can be measured by

objective and subjective measures. An objective approach can be taken by a dental professional to assess the oral impacts' severity and frequency. On the other hand, a subjective appraisal can be done to measure the severity and frequency of the different levels on the perceived oral impacts of individuals.

The OIDP is useful in indicating the dental treatment need (i.e., SRON) planning in populations and is useful in assessing the outcomes of treatment in some populations (Adulyanon & Sheiham, 1997; Robinson et al., 1996). Additionally, the OIDP has acceptable psychometric properties, has a sound theoretical basis, was successfully implemented in older adult populations (Abegg et al., 2015) and provides a reliable, valid, and concise measurement for SRON and SROH factors (Adulyanon & Sheiham, 1997). The OIDP is used as a framework to situate the variables measured in this study in the older adult population in Ontario.

Many cross-sectional studies have been conducted to find the associations between SROH and clinically-determined intermediate oral impacts as outlined in the OIDP framework (Adunola et al., 2019; Bonner et al., 2017; Kim et al., 2018; Reisine et al., 1980). However, none of these studies focused on SROH and these oral impacts as subjective measures (i.e., SRON). Moreover, studies have examined SROH without quality-of-life measurements and found significant associations between SROH and self-rated aesthetics, mouth dryness, oral pain, and dentition status (Atchison et al., 1993; Wu et al., 2011; Zaitsu et al., 2011). These previous findings support the use of self-reported variables in research on oral health using the OIDP.

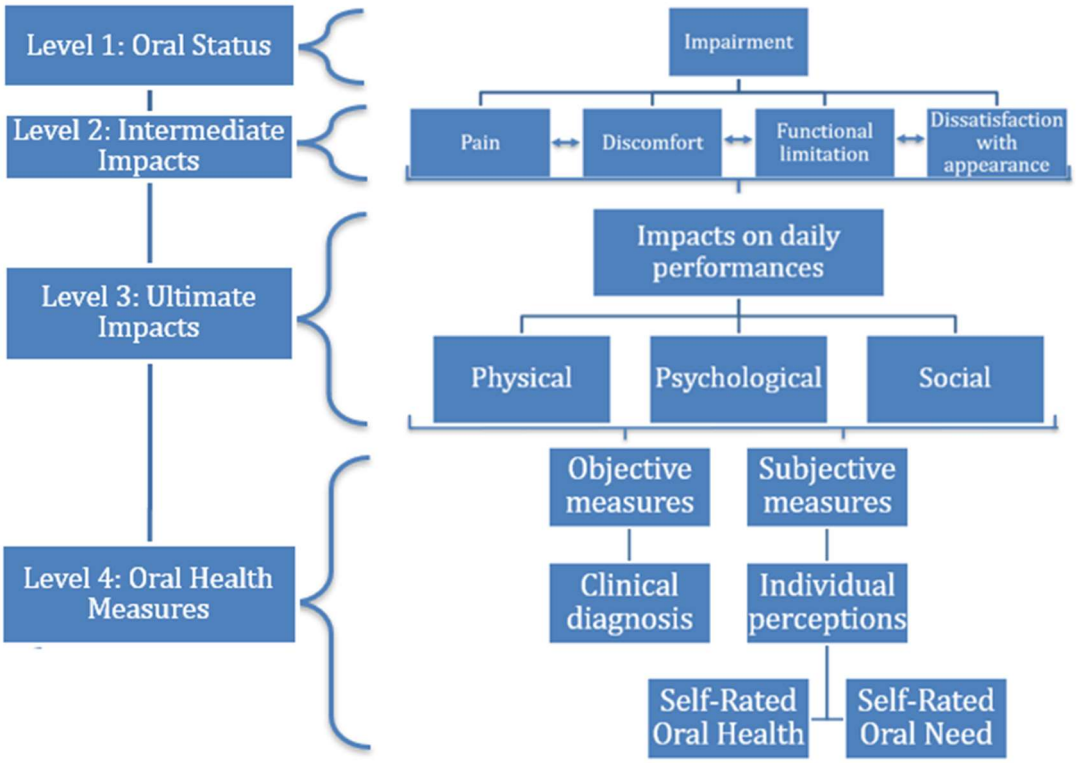

Figure 1. Oral Impacts on Daily Performances (OIDP) Framework (Modified from Locker, 1988)

Canadian Research

The SROH and SRON of older adults is still an under-researched field in general and is further evident when focusing on a Canadian context. Prior studies were conducted outside Canada (Adunola et al., 2019; Arcury et al., 2012; Jang et al., 2014), focused on a general adult population (Adunola et al., 2019), or assessed SROH and other factors' influence on dental care utilization (Afonso-Souza et al., 2007; Arcury et al., 2012; Muirhead et al., 2009; Schützhold et al., 2014; Zangiabadi et al., 2017). There have been population-based cross-sectional studies on oral health of the older adult population using the OIDP in Sweden (Ostberg et al., 2008), Norway (Astrom et al., 2006), Bosnia (Eric et al., 2012), and other countries. Currently, there are no available studies that use a nationally or provincially representative sample of older adults that have simultaneously assessed the influence of both SRON and SROH in Canada.

Chapter Summary

The different themes regarding the oral health in older adult populations were discussed to position this study within the literature and to use the concepts from past studies as the framework for the current study. The biological changes associated with the oral health of the aging population was explained to provide a foundation for any psychological and social changes that can occur to the aging population's oral health. The earlier research that focused on biological changes in older adults' oral health provided a foundation for research to be based mostly on biological factors and to exclusively use clinical oral measures. The reliance on clinical measures of oral health has led to a gap in the field that is currently being filled by studies on self-rated measures, such as SROH and SRON. An enhanced understanding of the relationship between biopsychosocial predictors and SROH outcome variables is needed to ensure that evidence on the increasing demand for dental care in older adults is adequately supplied. There is a lack of research regarding the association of socio-demographic, health and health behaviour, and dental health and care factors on the SROH of an age-specific older adult population. Additionally, there is a lack of research regarding SROH and SRON in a Canadian population and a lack of research using the OIDP framework within a Canadian population. Therefore, this study explores the relative contributions of socio-demographic, health, health behaviour, and dental health and care factors on SROH and the correlation of SRON factors with SROH among older adults in Ontario. The methodology used to achieve the research objectives will be explained in the next chapter.

Chapter 3: Methods

Chapter Introduction

This chapter provides a methodological framework that successfully achieves the research objectives. The research design, the source of the data, the sampling and data collection, and the sample size are all presented. The predictor and outcomes variables are explained in detail, including the way the variables were measured, coded, and analysed to generate statistical results that represent the associations between a range of biopsychosocial factors and SROH as well as correlations between SROH and SRON.

Research Design and Data Source

This epidemiological study used the Canadian Community Health Survey (CCHS), which is administered by Statistics Canada. The CCHS is a validated and reliable cross-sectional survey that offers nationally representative data on health status, health determinants, and health care use for the Canadian population aged 12 years and greater (Statistics Canada, 2019). The CCHS was conducted every two years from the start of the survey in 2001 to 2007, where the survey was modified to be conducted annually in both official languages of Canada. Specialists developed the CCHS questionnaire from Statistics Canada with other federal, provincial, and territorial government departments. The CCHS includes both core and optional content. The core content is mandatory across Canada whereas each province or territory selects optional content depending on the identified priorities of the region. Canadians living in private households, on reserves or Indigenous settlements, Canadian Armed Forces, children in foster homes, and those living within institutions are not included. These groups represent approximately 3% of the Canadian population (Statistics Canada, 2019). Data used for the current study were from the

CCHS 2017-2018 Annual Component, which was the most recent component to include the SROH and SRON optional content in the CCHS.

Sampling and Data Collection

The CCHS uses random-sampling strategies to identify participants from all ten provinces and three territories of Canada. Two styles of computer-assisted interviewing are used to collect data. One for personal interviews and one for telephone interviews. These two styles allow for the customization of the questionnaire for each participant and facilitates the data management of the survey such that questions that are not applicable are skipped automatically. Any inconsistent or out-of-range responses are flagged. The average length of the CCHS interview is estimated to be between 40 and 45 minutes per interview. More detailed information regarding the sampling procedures of the CCHS can be found on the Statistics Canada website (see Statistics Canada, 2019). Recruitment sampling and data collection for this Annual Component started in January 2017 and finished in December 2018.

Sample and Participants

The overall CCHS 2017-2018 component included a total sample of 113,290 participants aged 12 and greater across all provinces and territories. However, data used for the current study had to be restricted to the province of Ontario because Ontario was the only province to select the SROH and SRON optional content. All other measures that were included in the current study were core content. Further, analyses were restricted to Ontario participants aged 55 years and greater. This age group was selected to focus on an older population as captured by the CCHS and as represented by previous research (Zangiabadi, Costanian & Tamim, 2017). After excluding participants who reside outside of Ontario (n = 79,779) and who are less than 55 years old (n = 17,606), a total of 15,905 participants were included in the study. Participants responses

were weighted using the CCHS population weights to represent a population of 4,261,422 people living in Ontario aged 55 years and greater. Any missing values that interfered with the analyses were removed to ensure all participants had valid responses in the analysis.

Outcome Variables

Self-Rated Oral Health (SROH)

The following item of the CCHS 2017-2018 Annual Component measured SROH: In general, would you say the health of your mouth is…. Response options were provided using the following five-point Likert scale: Excellent (Code = 4), very good (3), good (2), fair (1), or poor (0). Higher scores represented better SROH. This item has been used in previous research to measure SROH (Adunola et al., 2019; Gallego et al., 2017; Matthias et al., 1995; Nascimento et al., 2021).

Self-Rated Oral Needs (SRON)

There was a total of seven items in the CCHS 2017-2018 Annual Component that represented SRON. More specifically, each participant was asked to report how much, in the past 12 months, they: a) found it uncomfortable to eat any food because of problems with their mouth; b) avoided eating particular foods because of problems with their mouth; c) had any persistent or on-going pain anywhere in their mouth; d) had bleeding gums, including while brushing or flossing their teeth; e) had persistent dry mouth; and f) had persistent bad breath. For items that related to problems with the mouth, participants were instructed to consider their teeth, dentures, tongue, gums, lips, and jaw joints in their response. These items have been used in previous research to measure SRON (Atchison & Dolan, 1990; Kabisch et al., 2022; Kotha et al., 2017; Ouanounou, 2016; Schertel et al., 2020; Wolff et al., 1990). Responses options for each of these six questions were provided using the following four-point Likert scale: Often (0),

sometimes (1), rarely (2), or never (3). Higher scores on these six items represented better SRON (i.e., lower levels of need).

The seventh measure used to measure SRON was the CCHS item that asked the following question of participants: How satisfied are you with the appearance of your teeth and/or dentures? Response options for this question were provided using the following five-point Likert scale: Very dissatisfied (0), dissatisfied (1), neither satisfied nor dissatisfied (2), satisfied (3), or very satisfied (4). Higher scores on this seventh item also represented better SRON (i.e., lower levels of need). This item has also been used in previous research to represent SRON (Matthias et al., 1995).

Predictor Variables

As noted previously, the CCHS includes a wide range of questions in the general core and optional content that pertain to participants' socio-demographic characteristics and the many factors that affect people's health-related behaviours, health status, and health care use. Representing the biopsychosocial model of health (see Chapters 1 and 2), the current study included a selection of potential factors that may be associated with SROH and/or SRON from the items available in the CCHS 2017-2018 Annual Component. This selection was evidence-based according to a review of research studies pertaining to SROH and SRON (as noted below, in parenthesis, for each predictor). Similar variables were used to enable a direct comparison of the current results to studies done in different samples and populations. The factors included in the study were organized thematically into the following theme categories: Socio-demographic factors, health behaviour factors, health and health care factors, and dental health and dental care factors.

Socio-demographic Factors

Socio-economic status was captured by: annual household income (less than $20,000; $20,000 to $39,999; $40,000 to $59,999; $60,000 to $79,999; or $80,000 or more) (Adunola et al., 2019; Gallego et al., 2017; Afonso-souza et al., 2007); highest level of personal educational attainment (less than secondary school graduation, secondary school graduation, or post-secondary education) (Adunola et al., 2019; Pattusi et al., 2010); and employment status in the past 12 months (yes or no/retired) (Adunola et al., 2019; Ortíz-Barrios et al., 2019; Zangiabadi et al., 2017). The CCHS collected data on age in five-year age groups, which ranged from 55 to 59 years to 80+ years (Adunola et al., 2019; Afonso-Souza et al., 2007; Ekbäck et al., 2010; Petersen, 1983). Gender was collected based on those who identified as male or female (Adunola et al., 2019; Afonso-Souza et al., 2007; Ekbäck et al., 2010; Petersen, 1983). Ethnicity was collected as those identifying as White or as a visible minority (Adunola et al., 2019; Afonso-Souza et al., 2007; Matthias et al., 1995; Peterson, 1983). Knowledge of the official Canadian languages was reported as English and/or French or neither English nor French (Calvasina et al., 2015; Jang et al., 2021). Relationship status was measured as those who had a partner (married and common-law) or those that did not (widowed, divorced, separated, and single) (Adunola et al., 2019; Campo & Yon, 2014; Gallego et al., 2017).

Health Behaviour Factors

Health behaviours were captured by current smoking status (yes or no) (Zangiabadi et al., 2017), alcohol consumption (never, less than once a month, at least once a month, or at least once a week) (Zangiabadi et al., 2017), and physical activity (those who met Canadian Physical Activity Guidelines of 150 minutes of moderate-to-vigorous intensity levels of activity per week or those who did not meet the guidelines) (Massie et al., 2021; Pohjola et al., 2020).

Health and Health Care Factors

Health and health care factors are represented by participants' self-rated general health (excellent, very good, good, fair, or poor) (Zangiabadi et al., 2017); if they had a regular healthcare provider available to them (yes or no) (Andersson et al., 2007) and self-rated life stress (not at all stressful, not very stressful, a bit stressful, quite a bit stressful, or extremely stressful) (Vasiliou et al., 2016). Self-reported clinical diagnoses that were previously made by a health care professional included: diabetes status (yes or no) (Zangiabadi et al., 2017); mood disorders (e.g., depression, bipolar, mania, dysthymia) (yes or no) (Ouanounou & Ng, 2019); anxiety disorders (e.g., phobia, OCD, panic) (yes or no) (Ouanounou & Ng, 2019); heart disease status (yes or no) (Morrison et al., 1999), and high blood pressure status (yes or no) (Morrison et al., 1999).

Dental Health and Dental Care Factors

Dental health and dental care factors included were: if participants had dental insurance (no insurance, employer-sponsored/private insurance, or government-sponsored insurance) (Adunola et al., 2019; Afonso-Souza et al., 2007; Gallego et al., 2017; Peterson, 1983); their dentate status (wears dentures or does not wear dentures) (Gift et al., 1998; Matthias et al., 1995); their daily toothbrushing frequency (twice or more per day or once or less per day) (Zangiabadi et al., 2017); as well as the frequency and reason for their dental visits (visits twice or more a year for check-ups or treatments, visits once or less a year for check-ups or treatments, visits only for emergency care, or never visits (Afonso-Souza et al., 1993; Zangiabadi et al., 2017).

For further clarifications on the transformations, coding, and organization of the variables, refer to Table 1 in Appendix A.

Data Analyses

To characterize the sample of participants, descriptive statistics for all outcome and predictor variables were conducted. SROH and SRON variables were treated as continuous variables in the analyses. The Kolmogorov-Smirnov test was used to assess the distribution of the outcome SROH variable (skewness = 0.53; kurtosis = -0.16), which is normally distributed and allowed for linear regression to be used in the follow-up analysis. Predictor variables were included in the analyses as either continuous or categorical variables depending on their mode of measurement as noted in the results and Table 1.

To address the research objectives, first, a simple linear regression model with only one individual predictor variable and SROH as the outcome variable was estimated to represent associations between each factor and SROH independent of the other predictor variables. The full and final model included all socio-demographic, health behaviour, health, and healthcare, as well as dental health and dental care factors together. Unstandardized β coefficients and due to the large sample size, 99% confidence intervals were used to represent the magnitude and significance of the associations between the factors and SROH (Samuels, 2014). Multicollinearity was assessed using a variance inflation factor and tolerance levels to ensure any interactions between the predictor variables was addressed.

To address the second research objective, Pearson's correlation coefficients were estimated for each SRON variable with SROH. Bootstrapping, population weights, and normalized weights created and provided by Statistics Canada were applied to the analyses. Statistical significance for a two-tailed test was set as a critical alpha equal to or lesser than 0.01 or lower. A critical alpha of 0.01 was chosen to reduce the chances of a false positive and to provide strong evidence to support the associations made (Samuels, 2014). All analyses were conducted using IBM SPSS version 28.

Chapter Summary

The methodology and methods used is based on past studies such that this study can provide findings that can be compared to the previous literature. This study uses the CCHS, which is public data accessed through the York University's database. All data were collected by Statistics Canada and was filtered, organized, recoded, and analysed to answer the current research objectives. The predictor and outcome variables and the analyses of these variables were explained. The statistical tests used to assess the association between the predictor variables and SROH was linear regression and Pearson's correlation was used to assess the correlations between SRON variables and SROH. The results of these methods are presented in the next chapter.

Chapter 4: Results

Chapter Introduction

The results of the study are presented in this chapter. The descriptive statistics are stated to provide an overview of the data that were collected from participants and to assess the distribution of the variables within their respective coding. The results that address the research objectives are presented under the research objective headings. Additionally, tables are provided to present the results of the transformations, descriptive statistics, simple and multiple linear regression, and Pearson's correlation tests in the appendices.

Descriptive Statistics

Self-Rated Oral Health

A total of 15,119 participants had valid responses to the SROH variable weighted to represent a population of 4,050,830. Of the weighted population, 854,725 (21.1%) rated their oral health as 'excellent', 1,454,248 (35.9%) rated their oral health as 'very good', 1,227,402 (30.3%) rated their oral health as 'good', 344,321 (8.5%) rated their oral health as 'fair', and 170,135 (4.2%) rated their oral health as 'poor'. Further detail regarding the descriptive statistics of the sample can be found in Table 2.

Self-Rated Oral Need

The SRON variables were mostly reported by participants as 'never' experiencing the oral need condition. More specifically, a total of 2,640,713 (66.5%) reported 'never' being uncomfortable when eating food, while 207,465 (5.2%) reported they were 'often' uncomfortable when eating food because of a problem with their mouths. Additionally, 2,936,050 (73.9%) participants reported 'never' avoiding particular foods, and 192,554 (4.8%) reported avoiding particular food 'often,' because of a problem with their mouths. A total of

2,986,154 (75.1%) participants reported ‘never’ having persistent mouth pain, while 103,327 (2.6%) reported having persistent pain ‘often’ due to a problem in their mouths. Persistent bad breath was reported as ‘often’ by 130,241 (3.4%) participants, while 2,607,889 (67.6%) reported ‘never’ having persistent bad breath. A total of 2,274,619 (57.4%) reported ‘never’ having a dry mouth, while 444,411 (11.2%) reported ‘often’ having a dry mouth. The second most prevalent oral need factor was bleeding gums. A total of 2,136,686 (59.2%) participants reported ‘never’ having bleeding gums, while 141,104 (3.9%), 440,115 (12.2%), 889,510 (24.7%) reported ‘often,’ ‘sometimes,’ and ‘rarely’ having bleeding gums, respectively. Finally, 2,161,412 (54.5%) participants reported being ‘satisfied’ and 1,074,583 (27.1%) reported being ‘very satisfied’ with their teeth/denture appearance. However, 273,733 (6.9%) reported being ‘dissatisfied’ and 78,862 (2.0%) reported being ‘very dissatisfied’ with their teeth/denture appearance.

Socio-Demographic Factors

All 15,905 participants were weighted to represent a population of 4,261,422 older adults living in Ontario. Of the weighted population, 997,706 (25.1%) were between ages 55 and 59 years; 884,493 (22.2%) were between ages 60 and 64 years; 756,058 (19.0%) were between ages 65 and 69 years; 567,612 (14.3%) were between ages 70 and 74 years; 365,738 (9.2%) were ages 75-79 years; and 407,147 (10.2%) were greater than 80 years of age. Regarding the socio-economic factors, 1,975,099 (49.7%) had a total household income greater than $80,000; 2,334,343 (60.3%) had a post-secondary diploma or degree; and 2,527,064 (64.6%) were not working or are retired. Additionally, participants were 53.0% female, 80.7% White, 98.4% spoke English or French, and 69.3% had a partner.

Health Behaviour Factors

A total of 544,206 (13.7%) participants reported currently smoking cigarettes; 1,003,609 (25.4%) never drank alcohol, while 1,705,519 (13.2%) drink alcohol at least once per week; and 2,071,668 (53.5%) reported engaging in physical activity levels below the Canadian Physical Activity Guidelines.

Health and Healthcare Factors

A total of 1,345,638 (33.9%) participants rated their general health as 'very good' and an additional 1,283,105 (32.3%) rated it as 'good.' A regular healthcare provider was available to 3,737,159 (94.9%) participants; and 1,488,701 (37.6%), 395,183 (10.0%), and 614,482 (15.5%) had high blood pressure, heart disease, and diabetes, respectively. In terms of mental health factors, life was rated as 'not very stressful' by 1,112,748 (28.5%) participants, 1,384,119 (35.1%) rated life to be 'a bit stressful,' and 114,899 (2.9%) rated life as 'extremely stressful.' Mood disorders and anxiety disorders were reported by 342,527 (8.6%) and 265,117 (6.7%) participants, respectively.

Dental Health and Dental Care Factors

A total of 1,800,802 (45.9%) participants had no dental insurance, while 1,962,153 (50.0%) had employer insurance or a private plan, and 161,701 (4.1%) had government-sponsored insurance. Dentures or prosthetic teeth were worn by 1,287,727 (32.4%) participants. A total of 2,901,106 (80.5%) reported brushing their teeth twice or more per day; and 2,146,176 (54.1%) reported visiting the dentist twice or more per year for check-ups or treatments, while 1,109,670 (28.0%) visited the dentist once or less per year for check-ups or treatments. Additionally, 530,672 (13.4%) visited the dentist only for emergency care, and 181,793 (4.6%) reported never visiting the dentist.

Research Objective 1: Associations Between Factors and SROH

Simple and Multiple Linear Regression

The unadjusted simple linear regression analyses indicated that all predictor variables were statistically associated with SROH at the 0.01 critical alpha level. However, in the fully adjusted multiple linear regression model, all predictor variables were statistically associated with SROH at the 0.01 critical alpha level except for three factors: having a regular healthcare provider (β = .005, 99% CI [-.001, .011], p = .039); diabetes status (β = -.002, 99% CI [-.002, .006], p = .115); and heart disease status (β = -.003, 99% CI [-.007, .002], p =.146). The R^2 of the multiple linear regression model was 0.42. The statistically significant variables in the fully adjusted multivariate model results are presented below. Further detail regarding the linear regression models and analyses can be found in Table 3. The multiple linear regression model included an analytical sample of 12,150 participants (i.e., 76.4% of eligible sample size) was weighted to represent a population of 3,313,483 people aged 55 years and greater in Ontario. A total of 3,840 (23.6%) participants were excluded in a listwise fashion by SPSS due to having missing values for one or more of the variables. When considering multicollinearity, all variables had a variance inflation factor of under 2.0 and a tolerance greater than 0.5.

Socio-Demographic Variables

All socio-demographic variables were significantly associated with SROH. Increasing age groups was associated with increased SROH (β = .043, 99% CI [.042, .044], p = .000); decreasing total household income was associated with decreased SROH (β = -.048, 99% CI [-.05, .047], p = .000); having less than a high school diploma was associated with decreased SROH compared to having a post-secondary degree (β = -.169, 99% CI [-.173, -.164], p = .000).

Further, people who belonged to one or more visible minority ethnoracial group had decreased SROH compared to those who were White (β = -.138, 99% CI [-.142, -.135], p = .000).

Health Behaviour Factors

Smoking cigarettes was associated with decreased SROH (β = -.353, 99% CI [-.357, -.349], p = .000); drinking alcohol at least once per month was associated with decreased SROH (β = -.097, 99% CI [-.101, -.93], p = .000) compared to those who never drink alcohol.

Health and Healthcare Factors

Self-rated general health was associated with decreased SROH (β = -.258, 99% CI [-.260, -.257], p = .000). Having a mood disorder was associated with decreased SROH (β = -.148, 99% CI [-.153, -.142], p = .000), and having anxiety disorder was also associated with a decreased SROH (β = -.088, 99% CI [-.094, -.082], p = .000) when compared to not being diagnosed with a mood or anxiety disorder respectively.

Dental Health and Dental Care Factors

Having dental insurance was associated with SROH in comparison to having no dental insurance. Specifically, having employer or private insurance was associated with an increased SROH (β = .068, 99% CI [.065, .071], p = .000), having a government-sponsored insurance plan was associated with an increased SROH (β = .08, 99% CI [.073, .088], p = .000). Wearing dentures or any prosthetic in the mouth was associated with a decreased SROH (β = -.353, 99% CI [-.356, -.350], p = .000) compared to having no dentures or prosthetics in the mouth. Brushing one's teeth once or less per day was associated with a decreased SROH (β = -.117, 99% CI [-.120, -.113], p = .000) when compared to brushing twice or more per day. Never visiting a dentist was associated with a decreased SROH (β = -.673, 99% CI [-.683, -.664], p = .000). Only visiting a dentist for emergency care was also associated with a decrease in SROH (β = -.481,

99% CI [-.485, -.476], p = .000) and visiting once or less per year for check-ups or treatments was associated with a decreased SROH (β = -.079, 99% CI [-.082, -.076], p = .000). All dental visit variables are in comparison to visiting the dentist twice or more per year for check-ups or treatments.

Research Objective 2: Associations Between SROH and SRON

Pearson's Correlation

For the Pearson's correlations, cases were excluded through pairwise deletion which resulted in different numbers of cases included in each statistical test representing the SRON variables and their correlation with SROH. As such, the analytical sample size for each test is reported below. Increased SROH was correlated with an increased satisfaction with teeth and/or denture appearance (r =.531, p = <.01, N = 3,963,425); the frequency of bad breath (r = .220, p = <.01, N = 3,855,383); frequency of dry mouth (r = .232, p = <.01, N = 3,966,192); frequency of bleeding gums (r = .204, p = .000, N = 3,607,413); persistent pain in the mouth (r = .366, p = <.01, N = 3,974,502); avoiding particular food (r = .397, p = <.01, N = 3,975,657); and being uncomfortable eating food (r = .410, p = <.01, N = 3,973,898). All correlations were significant at the 0.01 critical alpha level using two-tailed tests. Further detail regarding the Pearson's correlation can be found in Table 4.

Chapter Summary

This chapter provided information on the results that answered the current research questions. The descriptive statistics were used to assess the characteristics of the participants' data, the linear regression analyses provided information on the associations of the predictor variables and SROH outcome variable, and the Pearson's correlations provided information on

the correlations between SROH and SRON. The results will be discussed in the next chapter to interpret the results and more fully address the research objectives of the current study.

Chapter 5: Discussion

Chapter Introduction

The aim of this study was to explore the associates of SROH and to assess the correlations between SRON and SROH in an Ontarian older adult population. This chapter evaluates the major findings of this study in the context of past research. To address both research objectives, the predictor variables associated with SROH and the SRON variables correlated with SROH are discussed, compared, and contrasted with existing evidence in terms of statistical significance and the potential health impacts of the population (i.e., ecological or clinical significance). The novel contributions of the findings are presented while also considering the study limitations. The implications of the findings on future research, policy, and practice are discussed throughout as results pertain to oral health promotion for the older adult population. The factors discussed are pertinent to the relevance of findings to oral health promotion, and the order of the factors presented correspond to the potential level of population impact that is discussed in further detail. The highest level of impact on the population comes from socioeconomic factors; then on an individual level, such as health behaviour factors; then factors that provide long-lasting prevention; then clinical factors; and then in terms of education factors.

Socioeconomic Factors

The socioeconomic factors in this study were total annual household income and the highest level of education attained by the participants. Increasing the income bracket was

associated with higher SROH and having less than a post-secondary diploma/degree was associated with lower SROH compared to having a post-secondary diploma/degree. These findings are consistent with the previous literature that demonstrates similar results. For example, lower levels of household income and education have been associated with lower oral health status and oral functioning in different previous studies (Guarnizo-Herreño et al., 2014; Kim et al., 2018; Locker, 2000; Watt & Sheiham, 1999). Income and education are often strongly correlated with one another. Generally, people with lower levels of education make less income in comparison to people with higher levels of education. As such, one explanation to these findings may be a result of having low financial security, associated with lower levels of education, which is a known major reason for low dental care utilization (Chattopadhyay, 2008; Guo et al., 2014). Having lower dental care utilization is associated with poorer SROH in this study and in previous studies as well (Zangiabadi et al., 2017). Additionally, Pattussi et al. (2010) found that older adults with low educational attainment/income are at an increased risk for poor SROH.

Socioeconomic status has the greatest impact on health at a population level (Frieden, 2010). Improving the population's socioeconomic determinants of health, through poverty reduction and improved education, can have a significant positive effect on the oral health of the population. Oral health conditions and SROH can be improved through the promotion of policies and initiatives that prioritise the improvement of socioeconomic determinants of health and developing health enabling and affordable physical and social environments (Tellez et al., 2014). These policies and systems changes are essential in creating opportunities, supports, and services for improving oral health and reducing oral health disparities generally but also in regards to age. Policy initiatives rooted in serving the older adult population is of utmost importance for

improving the oral health status for an aging population (Schaff et al., 2013). Most models of health improvement focus on various aspects of clinical intervention and health services (Frieden, 2010); however, a focus on regulatory, fiscal, and legislative policies can also be implemented as a complementary way to promote and maintain good oral health.

Improving Health Behaviours

Changing the local physical and social environments to foster good oral health can start with improving not only oral health behaviours, but health behaviours of the older adult population more broadly. To illustrate, some behaviours found to be associated with a lower SROH in this study were smoking and drinking alcohol. The association between smoking and lower SROH is consistent with previous literature as smoking has been linked to many oral conditions, such as periodontitis and edentulism, and associated with a decrease in oral health-related quality of life among older adults (Calzada et al., 2021). Smoking may be associated with poorer SROH partly because smoking is often recognized to be the most important risk factor in oral cancer (Shah & El Haddad, 2015). Smoking increases oral needs, causes poorer responses to dental treatment, and increases susceptibility to infections (Palmer et al., 2005). Past research also demonstrates an increase in perception of oral conditions among those who smoke on a regular basis (Shah & El Haddad, 2015). Further, irrespective of good oral hygiene, such as brushing and flossing regularly, frequent smokers perceive more oral health problems than non-smokers (Shah & El Haddad, 2015). Therefore, if older adults who smoke perceive to have more oral conditions present, they are more likely to rate their oral health as poor.

Drinking alcohol was also associated with a lower SROH compared to never drinking alcohol in the current study. Drinking alcohol at least once a month but less than once a week was the most associated with poor SROH. Interestingly, different frequencies of alcohol

consumption were seen to have different significant associations to SROH. Drinking at least once a week or more and less than once a month were less associated with lower SROH than drinking alcohol at least once a month but less than once a week. The literature has been inconsistent with alcohol consumption and SROH. Many studies stated frequent alcohol use to be associated with poor oral health (Arcury et al., 2012; Friedlander et al., 2003; Hede, 1996; Meurman, 2000; Morita et al., 2006). Other studies have illustrated the opposite effect, where frequent alcohol consumption was associated with less tooth loss among older adults compared to those who did not drink (Okamoto et al., 2006; Yoshida et al., 2001). Further, a study by Copeland et al. (2004) found alcohol consumption to be a risk factor for poor oral health while also having a protective effect on tooth loss. Given these inconsistent findings, further research needs to be done to establish the connections between alcohol consumption and SROH.

Together, these findings show that health behavioural aspects play a role in preventing oral disease and increasing SROH. Fostering environments that promote healthy behaviours can also improve, not only general health, but the oral health of older adults as well. Many older adults are not aware of the specific relationships between smoking and oral diseases, especially periodontitis (Lung et al., 2005). Thus, it is important to make it easier for older adults to practice good oral health behaviour, and overall health behaviour, as part of their daily routines to comprehensively prevent oral diseases (Widström, 2004). More specifically, strategies to create healthier environments can include designing communities that emphasize the promotion and engagement in physical activity as well as the lowering consumption of tobacco and alcohol (Frieden, 2010).

Teeth Brushing

Promoting long-lasting primary prevention of oral diseases among individuals can improve SROH in many populations (Frieden, 2010). One example of a long-lasting prevention factor is regular teeth brushing. This study found that irregular teeth brushing, which is brushing one's teeth once or less per day, was strongly associated with poor SROH. This finding is consistent with the previous literature (Dumitrescu et al., 2009; Gallego et al., 2017). Regular teeth brushing is essential for maintaining excellent oral health as regular teeth brushing is an effective method for plaque and calculus removal and for controlling oral diseases (Agostini et al., 2014). Good teeth brushing can decrease the number of cavities and decrease the amount of decayed, missing, filled, treated teeth at all ages (Schützhold et al., 2014).

Pertaining to older adults, decreasing the number of missing teeth will lower the use of dentures and other dental prosthetics (Heft et al., 2003). As such, the current study findings are consistent with the previous literature in that wearing any dentures or dental prosthetics was strongly associated with lower SROH (Heft et al., 2003; Schützhold et al., 2014). However, despite being an effective way to prevent oral diseases, many older adults are not aware of how or how much to practice good oral hygiene, such as proper dental care, replacing toothbrushes at recommended times, and the causes and consequences of dental caries (Shah & El Haddad, 2015). This lack of knowledge and education, as well as the lack of good oral hygiene practices in a notable segment of the older adult population, has been described by the World Health Organization as one of the challenges to improve oral health in the 21st century (Peterson, 2004).

General Health

Oral health and general health are strongly interrelated (Kim et al., 2021). Any perceived decline or harm to physical, mental, or oral well being can have detrimental and reciprocal effect on the others (Bassim et al., 2020). The current study found that better perceptions of one's general health was associated with better perceptions of one's oral health. Due to the robust relationship between general health oral health, it has been argued that oral health can be used an indicator for the general health of individuals and populations (Wu et al., 2010). As such, SROH appears to be an important indicator of health that is even associated with mortality and functional decline in later life (Lee, 2000; Winter et al., 2007). Further, it has been shown in previous research that having a high multimorbidity score (i.e., the diagnosis of multiple chronic conditions) is associated with poor SROH in older adults (Jones et al., 2001; Schützhold et al., 2014). The more self-reported medical diseases older adults have, the higher likelihood that they will also report lower oral health (Schützhold et al., 2014). Therefore, the use of a cost-effective measure such as SROH may provide an easier and clearer picture of oral and general health needs of aging populations.

Mental Health

In the current study, lower SROH was strongly associated with both self-reported diagnosed mood and anxiety disorders. These findings support previous studies that show associations between oral health and psychological distress (Ouanounou & Ng, 2019) as well as an increased risk of oral health impairments among older adults with depressive and anxious symptoms (Anttila et al., 2001; Anttila et al., 2006; Okoro et al., 2012). Having an anxiety disorder has been associated with skipping preventive dental care even among groups with dental insurance benefits (Sohn & Ismail, 2005). Likewise, depressive symptoms are also associated

with negative perceptions towards preserving one's teeth, increased sugar consumption, and a decreased likelihood of attending dental check-ups compared to those without depressive symptoms (Dahl et al., 2018). In another study, depressive symptoms were associated with edentulousness among non-smoking men, and anxiety symptoms were associated with lower tooth brushing frequencies (Anttila et al., 2001). These findings can help explain why older adults with an anxiety disorder or depressive disorder in this study were more likely to report lower SROH.

Further, taking medications for chronic conditions such as mental illnesses can also have an impact on the oral health of older adults through decreasing salivary flow (Timo & Anna-Maija, 2017) that may, in turn, influence SROH. Another study found that physicians prescribe medications that have adverse side effects on the oral health of older patients while having little or no awareness of the oral health of their older patients (Andersson et al., 2007). These studies also support the current study's findings that a decreased salivary flow (i.e., dry mouth) as an indicator of SRON was correlated with a poorer SROH. Unfortunately, the prevalence of psychological distress is expected to increase in the future, posing a challenge to health care systems, which includes dental care (Ekbäck et al., 2009; Samson et al., 2008).

Overall, the findings pertaining to health showcase the importance for medical professionals and other allied health stakeholders to be aware of the associations between older adults' general and mental health, as they may inadvertently negatively influence the oral health of this population. Further, dental professionals may consider screening or becoming in contact with the patient's primary healthcare provider to understand the patient's oral health more holistically. The patient's general and mental health needs to be emphasized by dental professionals and other health care stakeholders to reduce the likelihood of poor oral health in

the older adult population. According to the World Health Organization, to improve oral health promotion and oral disease prevention, both general and mental health programs should be incorporated into oral health promotion programs (Peterson & Kwan, 2004). Such programs can be implemented at national to local levels to improve oral, mental, and general health outcomes of the Ontarian older adult population.

Clinical Interventions

Clinical interventions are individual-level interventions that are an important part of oral health promotion and oral disease prevention in older adults and have the greatest potential health impact among patients (Frieden, 2010). A primary example of ongoing clinical interventions in this study was visiting the dentist on a regular interval of two or more times a year, which was the strongest factor associated with better SROH. Further, never visiting a dentist or only visiting a dentist for emergency care were strongly associated with poorer SROH compared to visiting the dentist in regular intervals. These findings are consistent with previous research that demonstrate regular dental check-ups are essential to bettering the natural course of oral diseases (Adunola et al., 2015; Afonso-Souza et al., 2007; Jones et al., 2001). More specifically, routine dental visits can lead to earlier detection and treatments of dental caries and periodontal disease as well as improve in dental restorations, which all decrease prospective or progressive oral disease risk (Afonso-Souza et al., 2007; Luzzi & Spencer, 2008). Moreover, regular dental check-ups can have an educational effect among patients, making them feel more positive and confident towards managing their dental hygiene and oral health (Afonso-Souza et al., 2007).

In the current study, 46% of the participants did not visit the dentist as per the Canadian Dental Association recommendation of two or more times a year. There are many possible

reasons why almost half of the participants did not adhere to this recommendation. For example, there may be a perceived or an actual lack of control or ability to visit a dentist among older adults that can be a barrier to routine dental care utilization. Some potential reasons for this lack of control may be having mental health conditions (i.e., previously discussed) or a general lack of confidence (i.e., self-efficacy) or ability (i.e., transportation) to physically attend the dentist (Luzzi & Spencer, 2008). Therefore, assessing patient's intentions, past dental attendance, self-efficacy, as well as social and physical environments within health care systems would increase dental care utilization (Luzzi & Spencer, 2008). Designing age-friendly communities to address the reduction in transportation and mobility associated with older age would help alleviate some of the challenges experienced by this population in accessing oral care (Dolan et al., 2005). Past studies have also demonstrated a difference in patient dental care attitudes who visit publicly funded dental clinics in comparison to private dental clinics. Patients visiting a public dental care dentist held greater positive attitudes towards visiting the dentist, perceived positive social pressures to visit the dentist, and generally felt in control of the visit to the dentist (Luzzi & Spencer, 2008).

Costs to accessing dental care is another significant barrier for older adults, especially those who live on a fixed and/or limited income. Oral diseases are found to remain untreated largely due to the cost of the treatments needed for disease prevention (Peres et al., 2019). The increasing costs of dental care affect older adult populations greater than other populations because of the increase in teeth retention in older ages has led to an increase in the complexity of restorative care for many older adults, which often makes treatments more expensive (Sachdev et al., 2021). Also, there is a lack of public funding or full-coverage insurance programs for older

adults, causing costs to be a large barrier to access dental care in comparison to the funding available for children and young adults (Canadian Dental Association, 2017).

The results from these barriers tend to lower dental care utilization in the older adult population, leading to an increase of untreated oral diseases, late-stage disease diagnoses, and thus, poor prognoses (Peres et al., 2019). Barriers to accessing dental care need to be addressed to increase older adults' adherence to regular dental care utilization as recommended by the Canadian Dental Association (2021). Implementing strategies to address barriers and promote regular dental care utilization within the older adult population, while examining its associations with SROH and SRON, would be helpful in addressing the known gaps in dental care utilization and oral health inequities while exploring potential unknown gaps as well. With the possible introduction of the public dental health sector in Ontario (Tunney, 2022), more research is needed to establish the impact of public dental care utilization on SROH and SRON in this population.

Oral Health and Aging Education

Education for older adults on oral health and dental care services can have a significant effect on the overall health of this population. Additionally, older adults may benefit from further education regarding aging, pertaining to oral health and to aging more generally so that negative views regarding aging are addressed. Older adults' beliefs or expectations for aging have been shown to influence health-related behaviour and health outcomes over time (Levy et al., 2009; Meisner & Levy, 2016). To illustrate, if an older adult believes aging to be a process of inevitable and universal deterioration, their overall health is more likely to decline (Levy et al., 2004; Meisner & Levy, 2016). Indeed, studies have found that some older adults believe oral pain is a so-called 'normal' part of the aging process (Schützhold et al., 2014) and perceive their

oral health as ‘good’ even when it is objectively poor due to expectations of these negative outcomes with the aging process (Drake et al., 1990; Koistinen et al., 2020). Therefore, older adults may appraise minor or even severe oral diseases as less disrupting and thus report higher satisfaction with their oral health (Andrade et al., 2019; McNally et al., 2014).

For these reasons, older adults can experience a ‘paradox of need’ due to negative perceptions on aging such that those who need dental treatments the most are also the least likely to receive dental care. Therefore, to fully meet the needs and provide oral health planning supports for this age group, it is essential to understand the factors that are associated with how older adults perceive their oral health (i.e., SROH) and oral needs (i.e., SRON) in terms of their perceptions of the aging process. It is important to educate older adults on normative and realistic expectations of aging while providing affirming experiences and supportive interactions for older patients within the dental care system. The complexity of aging, in addition to the diversity in individual’s beliefs, values, norms, and ways of living need to be considered when educating older adults about their oral health (Mallman et al., 2015).

Education is also beneficial within the healthcare sector to improve the oral health of older adults. More specifically, it is important to bolster education for dental professionals on oral health and aging, as well as on how to better promote oral health holistically that would involve inter-professional approaches. Given the connections between general and mental health with SROH, dental and medical professionals must build a closer and more collaborative relationship to increase their older patients’ comprehensive health and wellbeing. To illustrate, physicians can help prevent oral diseases before they occur in older adults as they are usually the primary point of contact. Physicians can also refer patients to a dental professional before signs and symptoms of the oral disease occur.

However, there are many barriers that divide the dental and medical fields. For example, research has noted that little is known about the physician's concept of the importance of oral health within the overall wellbeing of the older population (Andersson et al., 2007). Further, some physicians have indicated that they do not feel it is necessary to consult with dental professionals concerning their older adult patients; however, are more likely to cooperate with dental professionals concerning their shared paediatric patients (Andersson et al., 2007). Although there is an increase in gerontological education in medical and dental professional training, the amount of education and collaborative experience necessary to overcome these separated and ageist perspectives in the healthcare field is unclear.

The lack of education and inter-professional experience to integrate the medical and dental fields can be overcome with collaborative and mutual dialogue between or among dentists, dental hygienists, physicians, nurses, etc. (Andersson et al., 2007). Connecting across these professions will bridge the gap between the medical and dental fields, develop a better understanding of each other's professions, and offer more comprehensive health care services that focuses on more holistic health outcomes. To cultivate collaborative care provisions between the dental and medical fields, increasing the interactions between dental and medical students may be an effective strategy to improve overall health of older adults. Emphasizing inter-professional education and providing experiential education opportunities to dental and medical students that highlight the impact of oral health on overall health (and vice versa) can create an open team approach to promoting health and wellbeing for the aging population (Frenkel & Lurie, 2002; Isman, 1993; Shuman, 1990). Given these findings, the statistically non-significant association in this study between having a regular healthcare practitioner and SROH may be due to the disconnect between primary healthcare practitioners and oral health practitioners. Further

research is required to understand the relationship between oral health and primary health care providers for the older adult population.

Satisfaction with Teeth and/or Denture Appearance

This study demonstrated that SROH was the most strongly correlated with participants' satisfaction with their teeth and/or denture appearance as an indicator of SRON. This finding is similar to previous studies that show SROH is associated with personal appraisals of the physical appearance of teeth and dentures (Schützhold et al., 2014; Jokovic & Locker, 1997). Although the other SRON factors have clinical outcomes, such as bleeding gums (Matthias et al., 1995), mouth dryness (Dahl et al., 2018), and oral pain (Gilbert et al., 1998), dental appearance is still an important SRON factor to consider given the robust magnitude of its association with SROH. To illustrate, dental appearance has been shown to be intrinsically related to one's self-esteem, to influence social interactions, and to motivate some individuals to seek dental care (Meng et al., 2007). Further, research has suggested that adults' satisfaction with their dental appearance may outweigh other health needs and concerns (Alkhatib et al., 2005) and that maintaining dental aesthetics is one way that some older adults define 'successful aging' (Nitschke & Muller, 2004). As a result, an emphasis on dental aesthetics, in addition to functional dental ability or clinical measures of SRON, is important to consider in the future of the dental field. However, it is also important to note that in many high-income countries, the dental field is not meeting the oral health demands of their citizens partly due to the emphasis on aesthetic treatments that are largely driven by profit motives and consumerism (Holden, 2018). Therefore, a balanced approach between clinical treatment needs and aesthetic SRON is needed to improve oral health outcomes by addressing SRON the aging population.

Future Research

Future research needs to examine the associates of SROH as a longitudinal study to gather temporal data to help guide evidence-based intervention programs and public policies. Studies have found age-specific differences in SROH and SRON using longitudinal surveys in different countries. As such, future research can use the Canadian Longitudinal Study on Aging now that follow-up data are available, to examine associations between SROH, SRON, and other factors over time. Prospective studies should consider the sociodemographic, health behaviour, health and healthcare, dental and dental care factors, and their associations with SROH as well as dental clinical conditions to further establish the relationship between SROH and SRON with objective measures. Previous studies have focused on the relationship between clinical and subjective measures of oral health in different countries but not yet in Canada. Using studies such as the Canadian Health Measures Survey, although cross-sectionally designed, may help establish the association between SROH and clinical diagnoses in a Canadian context. Additionally, population-based surveys regarding the perceptions of older adults on SROH, SRON, and on aging would help inform programs and policies designed to address specific oral health and dental service needs of older adults in Canada.

Strengths and Limitations

This study has numerous strengths, for example, being the first provincially-representative study to examine the relationship between various sociodemographic, health and healthcare, health behaviour, and dental and dental care factors with SROH. It was also the first study to assess the correlations between SROH and SRON in a heterogenized age group-based population of adults aged 55 years and greater in Ontario. Further, this study had a weighted sample size that represented approximately 4.3 million older adults living in Ontario, which

provided ample statistical power. However, some limitations are present as well. For example, it is a secondary data analysis and thus information regarding additional oral health variables, such as the number of decayed, filled, and missing teeth as well as periodontal considerations, were not available. The secondary use of data causes a lack of control over the variables available and how they are measured. The selection of factors was based on previous secondary research. Also, due to the cross-sectional nature of the survey design, it is not possible to infer causation or directionality between variables. For example, reverse causality between oral health, general health, and psychological health and how they influence the SROH of the older adult population cannot be assessed with these data. Lastly, all predictor and outcome variables were self-reported, thus responses were subject to recall bias. As previously mentioned, longitudinal studies that link SROH, SRON, and other oral factors to the health and wellness of the aging population are needed to build a better understanding of SROH and SRON. Regardless of these limitations, this study provides meaningful findings that contribute to the understanding of SROH and SRON among older adults in Ontario.

Chapter Summary

Chapter 5 presented a discussion of the study findings and placed the results within the existing literature. Overall, findings support previous research and shows that the most robust associate of SROH is irregular dental visits in terms of the Canadian Dental Association guidelines. Irregular dental visits are associated with compounded health problems, accumulated over time with aging, which can increase healthcare costs for older individuals and for the healthcare system. Oral health promotion needs to be planned and invested into to reach older adults better. Further programs and policies need to consider strategies to increase dental care utilization in the older adult population of Ontario. Further, SROH was found to be highly

correlated with SRON variables, especially how older adults perceived their teeth and/or denture appearance, and other need factors such as bleeding gums and dry mouth. Therefore, SROH is associated with SRON, with clinical dental health services and the estimated costs to provide dental care for the older adult population. Future research should examine how interventions based on sociodemographic factors, encouraging health behaviours, establishing long-lasting preventive interventions, and educating older adults as well as dental and medical professionals can improve the SROH and SRON for this population. The findings from this study can inform recommendations on how SROH and SRON can be used in oral health promotion for older adults in Ontario. For example, considering dental care utilization and satisfaction of teeth and/or denture appearance may be the most important in developing policies, programs, or tailoring messages regarding the oral health of older adults because those factors were the most robustly associated with better SROH. Furthermore, these findings have practical implications for promoting better oral health as the current study demonstrates what factors may constrain and what factors may enable higher levels of SROH among older adults.

Chapter 6: Conclusion

This thesis research investigated the associations between SROH and socio-demographic, health and healthcare, health behaviour, and dental and dental care factors in Ontarian older adults, as well as the associations between SRON factors and SROH. The first research question was answered using simple and multiple linear regression that demonstrated many factors were associated with SROH. The second research question was answered using Pearson's correlation that showed all SRON indicators were correlated with SROH. Future research is needed to validate these findings further, to bridge the gap between the medical and dental fields, to improve oral health behaviours and outcomes, and to prevent oral diseases among older adults and with aging. Further, the findings of this thesis research suggest that dental care utilization, wearing dentures, and smoking are the strongest associates of SROH in Ontarian older adults. As such, SROH can be directly impacted by programs and policies that focus on oral health promotion and dental service provision for an aging population, and that SROH would be indirectly impacted by improvements in health-related behaviours more generally. This research adds additional rationale and evidence for the importance of holistic health promotion in an aging population as vital for policymakers to consider and employ to alleviate the negative effects of these factors on SROH and other more comprehensive health outcomes. In the context of public health, preventive and behavioural interventions are needed to reduce the disparities in SROH among older adults in Ontario. Although a universal healthcare system exists, it does not (yet) include dental health care. As a result, inequities in oral health are present and persist among older adults in terms of how this group perceives their oral health and their oral needs. More research is needed regarding SROH within current and future cohorts of older adults in Canada to appropriately respond to the needs of the Canadian aging population.

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Appendices

Appendix A: Transformations

Table 1. Variable Transformations Performed in SPSS

SPSS Variable Label	Question asked by the CCHS	Values	Transformed Variable Label	Values
Self-Rated Oral Need				
Perceived Oral Health	In general, would you say the health of your mouth is...?		Self-Rated Oral Health (SROH)**	
	1	Excellent	0	Poor
	2	Very good	1	Fair
	3	Good	2	Good
	4	Fair	3	Very good
	5	Poor	4	Excellent
Problems with mouth - uncomfortable to eat food - freq - 12 mo	In the past 12 months, how often have you found it uncomfortable to eat any food because of problems with your mouth?		PWM - uncomfortable to eat food**	
	1	Often	0	Often
	2	Sometimes	1	Sometimes
	3	Rarely	2	Rarely
	4	Never	3	Never
Problems with mouth - avoid particular foods - freq - 12 mo	In the past 12 months, how often have you avoided eating particular foods because of problems with your mouth?		PWM - avoids particular foods**	
	1	Often	0	Often
	2	Sometimes	1	Sometimes
	3	Rarely	2	Rarely
	4	Never	3	Never
Problems with mouth - other persistent pain - freq - 12 mo	Remember, by mouth we mean teeth, dentures, tongue, gums, lips, and jaw joints...In the past 12 months, how often have you had any other persistent or ongoing pain anywhere in your mouth?		PWM - other persistent pain**	
	1	Often	0	Often
	2	Sometimes	1	Sometimes
	3	Rarely	2	Rarely
	4	Never	3	Never
Had bleeding gums - frequency - 12 mo	In the past 12 months, how often have you had bleeding gums, including while brushing or flossing your teeth?		Had bleeding gums**	
	1	Often	0	Often
	2	Sometimes	1	Sometimes

	3	Rarely	2	Rarely
	4	Never	3	Never
Had dry mouth - frequency - 12 mo	In the past 12 months, how often have you had persistent dry mouth?		Had dry mouth**	
	1	Often	0	Often
	2	Sometimes	1	Sometimes
	3	Rarely	2	Rarely
	4	Never	3	Never
Had persistent bad breath - frequency- 12 mo	In the past 12 months, how often have you had persistent bad breath?		Had persistent bad breath**	
	1	Often	0	Often
	2	Sometimes	1	Sometimes
	3	Rarely	2	Rarely
	4	Never	3	Never
Satisfaction with teeth/denture appearance	How satisfied are you with the appearance of your teeth and/or dentures?		Satisfaction with teeth/denture appearance**	
	1	Very satisfied	0	Very dissatisfied
	2	Satisfied	1	Dissatisfied
	3	Neither satisfied nor dissatisfied	2	Neither satisfied nor dissatisfied
	4	Dissatisfied	3	Satisfied
	5	Very dissatisfied	4	Very satisfied
Socio-Demographic Factors	What is your age?			
Age			Age**	
	11	Age between 55 and 59	0	55-59
	12	Age between 60 and 64	1	60-64
	13	Age between 65 and 69	2	65-69
	14	Age between 70 and 74	3	70-74
	15	Age between 75 and 79	4	75-79
	16	Age 80 and older	5	80+
Total household income - all sources - (D)	What was the total household income?		Total household income**	
	1	No income or less than $20,000	0	$80,000 or more
	2	$20,000 to $39,999	1	$60,000 to $79,999
	3	$40,000 to $59,999	2	$40,000 to $59,999
	4	$60,000 to $79,999	3	$20,000 to $39,999
	5	$80,000 or more	4	No income or less than $20,000

Highest level of education - participant, three levels - (D)	What is your highest level of educational attainment?		Education	
	1	Less than secondary school graduation	0	Post-secondary certificate diploma or univ degree
	2	Secondary school graduation, no post-secondary education	1	Only Graduated Highschool
	3	Post-secondary certificate diploma or univ degree	2	Less than secondary school graduation
Main activity - last week	Last week, was your main activity working at a paid job or business, looking for paid work, going to school, caring for children, household work, retired or something else?		Working Status	
	1	Working or vacation (from paid work)	0	No/Retired
	2	Looking for paid work	1	Yes
	3	Going to school (including vacation from school)		
	4	Retired		
	5	Long-term illness		
Sex	Is [participant name] male or female?		Gender	
	1	Male	0	Male
	2	Female	1	Female
Cultural / racial background - (D)			Race	
	1	White	0	White
	2	Non-white (Aboriginal or Other Visible Minority)	1	Non-White (Indigenous or Other Visible Minority)

Knowledge of official languages			Knowledge of Official Languages	
	1	English only	0	English and/or French
	2	French only	1	Neither English and/or French
	3	Both English and French		
	4	Neither English nor French		

Marital status	What is your marital status? Are you...?		Relationship Status	
	1	Married	0	No Partner
	2	Common-law	1	Partner
	3	Widowed/Divorced/Separated		
	4	Single		
Health Behaviour Factors				
Type of smoker (daily / occasionally / not at all) - presently	At the present time, do you smoke cigarettes every day, occasionally or not at all?		Smoking Status	
	1	Daily	0	No
	2	Occasionally	1	Yes
	3	Not at all		
Drank alcohol - frequency - 12 mo	During the past 12 months, how often did you drink alcoholic beverages?		Alcohol Frequency	
	1	Less than once a month	0	Did not drink this month
	2	Once a month	1	Less than once a month
	3	2 to 3 times a month	2	At least once a month
	4	Once a week	3	At least once a week
	5	2 to 3 times a week		
	6	4 to 6 times a week		
	7	Every day		
	8	Did not drink		
Physical activity indicator - (D)	In the last 7 days, how much time in total did you spend doing these activities that made you sweat at least a little and breathe harder?		Physical Activity Indicator (CPAG)	
	1	Physically active at/above the recommended level from CPAG	0	Below CPAG Guidelines
	2	Physically active below the recommended level from CPAG	1	Above CPAG Guidelines
	3	No physical activity minutes reported		
Health and Healthcare Factors				
Perceived health	In general, would you say your health is...?		Self-Rated General Health (SRGH)**	
	1	Excellent	0	Excellent
	2	Very good	1	Very good
	3	Good	2	Good
	4	Fair	3	Fair
	5	Poor	4	Poor
Has a regular health care provider	Do you have a regular health care provider? By this, we mean one health professional that you regularly see or		Has a Regular Healthcare Provider	

	talk to when you need care or advice for your health.			
	1	Yes	0	Yes
	2	No	1	No
Perceived life stress	Thinking about the amount of stress in your life, would you say that most of your days are...?		Self-rated Life Stress (SRLS)**	
	1	Not at all stressful	0	Not at all stressful
	2	Not very stressful	1	Not very stressful
	3	A bit stressful	2	A bit stressful
	4	Quite a bit stressful	3	Quite a bit stressful
	5	Extremely stressful	4	Extremely stressful
Has high blood pressure	Do you have high blood pressure?		High Blood Pressure Status	
	1	Yes	0	No
	2	No	1	Yes
Has heart disease	Do you have heart disease?		Heart Disease Status	
	1	Yes	0	No
	2	No	1	Yes
Has diabetes	Do you have diabetes?		Diabetes Status	
	1	Yes	0	No
	2	No	1	Yes
Has a mood disorder (depression, bipolar, mania, dysthymia)	Do you have a mood disorder such as depression, bipolar disorder, mania, or dysthymia?		Mood Disorder Status	
	1	Yes	0	No
	2	No	1	Yes
Has an anxiety disorder (phobia, OCD, panic)	Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?		Anxiety Disorder Status	
	1	Yes	0	No
	2	No	1	Yes
Dental Health and Dental Care Factors				
Insurance - dental expenses - all / part cost coverage	Do you have insurance or a government program that covers all or part of your dental expenses?		Insurance Status	
	1	Yes	0	No Insurance
	2	No	1	Employer/Private plan
			2	Government-sponsored Insurance

Type of insurance - dental - employer	Is it...? - An employer-sponsored plan			
	1	Yes		
	2	No		
Type of insurance - dental - govt (children / seniors)	Is it...? - A provincial or territorial government program for children or seniors			
	1	Yes		
	2	No		
Type of insurance - dental - private plan	Is it...? - A private plan			
	1	Yes		
	2	No		
Type of insurance - dental - govt (social service clients)	Is it...? - A government program for social service (welfare) clients			
	1	Yes		
	2	No		
Type of insurance - dental - govt (First Nations and Inuit)	Is it...? - A government program for First Nations and Inuit			
	1	Yes		
	2	No		
Wears dentures / dental prosthesis / false teeth	Do you wear dentures, dental prosthesis or false teeth?		Binary Wears Dentures / Dental Prosthetics / False Teeth	
	1	Yes	0	No
	2	No	1	Yes
Brushing teeth - frequency	How many times do you brush your teeth on a daily basis?		Binary Teeth brushing Frequency	
	Mean	2.11	0	Twice or more per day
	Median	2	1	Once or less per day
Visit dental professionals - frequency	How often do you usually see a dental professional, such as a dentist, a dental hygienist or a denturologist?		Categorical Reason for Dental Professional Visit	
	1	More than once a year for check-ups or treatment	0	Visits twice or more a year for check-ups or treatments
	2	About once a year (for check-ups or treatment)	1	Visits once or less than once a year for check-ups or treatment
	3	Less than once a year (for check-ups or treatment)	2	Only for emergency care
	4	Only for emergency care	3	Never
	5	Never		

**** Variable treated as a continuous variable.**

Appendix B: Descriptive Statistics

Table 2. Descriptive Statistics of Sample

Variables	Responses	Total	Excellent	Very Good	Good	Fair	Poor
		N[a] (%)	N[b] (%)	N[b] (%)	N[b] (%)	N[b] (%)	N[b] (%)
Socio-Demographic Factors							
Age	55-59	997,706 (25.1)	207,510 (24.5)	358,236 (25.3)	297,144 (24.4)	86,423 (26.7)	48,393 (27.7)
	60-64	884,493 (22.2)	182,632 (21.6)	295,715 (20.9)	280,125 (23)	75,103 (23.2)	50,918 (29.2)
	65-69	756,058 (19)	168,263 (19.9)	266,765 (18.9)	226,191 (18.5)	65,541 (20.2)	29,298 (16.8)
	70-74	567,612 (14.3)	116,462 (13.8)	226,973 (16)	167,835 (13.8)	37,345 (11.5)	18,997 (10.9)
	75-79	365,738 (9.2)	78,291 (9.3)	127,146 (9)	115,420 (9.5)	27,653 (8.5)	17,228 (9.9)
	80+	407,147 (10.2)	92,904 (11)	139,555 (9.9)	133,215 (10.9)	31,852 (9.8)	9,621 (5.5)
Total household income							
	No income or less than $20,000	242,413 (6.1)	32,497 (3.8)	55,833 (3.9)	75,626 (6.2)	51,323 (15.9)	27,134 (15.6)
	$20,000 to $39,999	579,246 (14.6)	102,684 (12.1)	179,346 (12.7)	195,605 (16)	64,536 (19.9)	37,075 (21.3)
	$40,000 to $59,999	650,703 (16.4)	114,965 (13.6)	229,807 (16.3)	206,316 (16.9)	59,764 (18.5)	39,851 (22.9)
	$60,000 to $79,999	529,898 (13.3)	100,043 (11.8)	194,981 (13.8)	178,166 (14.6)	34,558 (10.7)	22,150 (12.7)
	$80,000 or more	1,975,099 (49.7)	495,437 (58.6)	753,918 (53.3)	564,151 (46.2)	113,458 (35.1)	48,135 (27.6)
Education							
	Less than a Highschool Diploma	612,421 (15.8)	84,075 (10.2)	191,996 (13.9)	224,534 (18.9)	67,084 (21.8)	44,732 (26.5)
	Only Graduated Highschool	922,002 (23.8)	167,962 (20.3)	335,273 (24.3)	287,930 (24.2)	82,104 (26.7)	48,733 (28.9)
	Post-secondary diploma/degree	2,334,343 (60.3)	575,024 (69.5)	850,667 (61.7)	675,486 (56.9)	157,857 (51.4)	75,309 (44.6)
Working Status							
	No/Retired	2,527,064 (64.6)	533,446 (64.2)	869,739 (62.7)	787,673 (65.3)	215,033 (67.3)	121,173 (72)
	Yes	1,385,872 (35.4)	297,717 (35.8)	518,418 (37.8)	418,224 (34.7)	104,415 (32.7)	47,098 (28)
Gender							
	Male	1,870,016 (47)	362,532 (42.8)	661,989 (46.8)	592,721 (48.6)	167,720 (51.8)	85,054 (48.8)
	Female	2,108,738 (53)	483,530 (57.2)	752,401 (53.2)	627,209 (51.4)	156,197 (48.2)	89,401 (51.2)
Race							
	White	3,060,532 (80.7)	681,877 (84.2)	1,119,393 (83.1)	898,500 (76.8)	229,857 (76.2)	130,905 (79.5)

	Non-White (Indigenous or Other Visible Minority)	732,363 (19.3)	128,209 (15.8)	227,771 (16.9)	270,769 (23.2)	71,862 (23.8)	33,752 (20.5)
Knowledge of Official Languages							
	English and/or French	3,849,195 (98.4)	821,940 (99.4)	1378,735 (98.8)	1,173,115 (97.3)	305,433 (97.6)	169,972 (98.4)
	Neither English and/or French	64,424 (1.6)	4,623 (0.6)	17,216 (1.2)	31,962 (2.7)	7,548 (2.4)	64,424 (1.6)
Relationship Status							
	No Partner	1,220,990 (30.7)	235,242 (27.8)	410,358 (29.61)	372,196 (30.6)	129,829 (40.2)	73,365 (42.2)
	Partner	2,750,451 (69.3)	609,790 (72.2)	1,001,912 (70.9)	844,901 (69.4)	193,263 (59.8)	100,585 (57.8)
Health Behaviour Factors							
Smoking Status							
	No	3,431,727 (86.3)	773,270 (91.5)	1,267,177 (89.6)	1,037,150 (85.1)	249,452 (77.1)	104,678 (60)
	Yes	544,206 (13.7)	72,154 (8.5)	146,486 (10.4)	181,506 (14.9)	74,284 (22.9)	69,776 (40)
Alcohol Frequency							
	Did not drink this month	1,003,609 (25.4)	192,342 (22.8)	328,293 (23.3)	338,074 (28)	86,916 (27.2)	57,984 (33.4)
	Less than once a month	664,075 (16.8)	122,510 (14.5)	230,482 (16.4)	204,323 (16.9)	65,328 (20.5)	41,432 (23.8)
	At least once a month	578,037 (14.6)	108,878 (12.9)	220,839 (15.7)	172,839 (14.3)	54,992 (17.2)	20,489 (11.8)
	At least once a week	1,705,519 (43.2)	418,652 (49.7)	629,763 (44.7)	491,354 (40.7)	111,847 (35.1)	53,903 (31)
Physical Activity Indicator CPAG							
	Below CPAG Guidelines	2,071,668 (53.5)	385,344 (46.5)	726,345 (52.6)	675,002 (56.7)	178,866 (58.9)	106,111 (62.8)
	Above CPAG Guidelines	1,798,740 (46.5)	443,381 (53.5)	653,326 (47.4)	514,465 (43.3)	124,775 (41.1)	62,793 (37.2)
Health and Healthcare factors							
Self-Rated General Health							
	Poor	203,439 (5.1)	19,453 (2.3)	32,958 (2.3)	67,971 (5.6)	38,281 (11.8)	44,776 (25.7)
	Fair	419,708 (10.6)	46,758 (5.5)	101,126 (7.2)	158,936 (13.1)	74,194 (22.9)	38,694 (22.2)
	Good	1,283,105 (32.3)	179,802 (21.3)	407,132 (28.8)	523,139 (43)	111,415 (34.4)	61,617 (35.3)
	Very Good	1,345,638 (33.9)	287,138 (34)	624,773 (44.3)	344,525 (28.4)	69,886 (21.6)	19,316 (11.1)
	Excellent	717,716 (18.1)	311,142 (36.9)	245,875 (17.4)	120,670 (9.9)	30,121 (9.3)	9,908 (5.7)
Healthcare Provider							

	No	201,811 (5.1)	35,720 (4.3)	62,572 (4.5)	71,916 (5.9)	18,173 (5.8)	13,430 (7.7)
	Yes	3,737,159 (94.9)	800,238 (95.7)	1,339,336 (95.5)	1,141,328 (94.1)	295,689 (94.2)	160,568 (92.3)
Self-rated Life Stress							
	Not at all stressful	770,958 (19.6)	231,138 (27.5)	273,489 (19.5)	201,155 (16.7)	39,445 (12.4)	25,731 (14.8)
	Not very stressful	1,122,748 (28.5)	244,495 (29.1)	444,591 (31.7)	327,728 (27.2)	77,000 (24.1)	28934 (16.7)
	A bit stressful	1,384,119 (35.1)	259,636 (30.9)	471,735 (34.3)	461,062 (38.3)	130,719 (41)	50,967 (29.4)
	Quite a bit stressful	549,276 (13.9)	81,573 (9.7)	179,459 (12.8)	187,059 (15.5)	63,511 (19.9)	37,674 (21.7)
	Extremely stressful	114,899 (2.9)	24,484 (2.9)	24,628 (1.8)	27,372 (2.3)	8,377 (2.6)	30,038 (17.3)
High Blood Pressure Status							
	No	2,475,866 (62.4)	575,419 (68.3)	900,635 (63.8)	723,212 (59.5)	182,068 (56.4)	94,532 (54.8)
	Yes	1,488,701 (37.6)	266,827 (31.7)	511,216 (36.2)	491,990 (40.5)	140,607 (43.6)	78,061 (45.2)
Heart Disease Status							
	No	3,560,280 (90)	778,696 (92.7)	1,288,096 (91.5)	1,070,198 (88.3)	280,887 (87.5)	142,403 (81.9)
	Yes	395,183 (10)	61,735 (7.3)	119,757 (8.5)	141,989 (11.7)	40,238 (12.5)	31,464 (18.1)
Diabetes Status							
	No	3,355,448 (84.5)	749,574 (88.7)	1,220,869 (86.4)	992,876 (81.6)	251,425 (78.3)	140,704 (80.7)
	Yes	614,482 (15.5)	95,848 (11.3)	192,018 (13.6)	223,388 (18.4)	69,627 (21.7)	33,601 (19.3)
Mood Disorder Status							
	No	3,632,076 (91.4)	789,046 (93.4)	1,324,119 (93.7)	1,124,268 (92.2)	275,518 (85.3)	119,125 (68.4)
	Yes	342,527 (8.6)	56,103 (6.6)	89,441 (6.3)	94,562 (7.8)	47,508 (14.7)	54,913 (31.6)
Anxiety Disorder Status							
	No	3,705,543 (93.3)	806,638 (95.5)	1,338,854 (94.7)	1,140,743 (93.8)	284,770 (88.2)	134,538 (77.7)
	Yes	265,117 (6.7)	38,064 (4.5)	74,379 (5.3)	76,023 (6.2)	38,093 (11.8)	38,558 (22.3)
Dental Health and Dental Care							
Insurance Status							
	No Insurance	1,800,802 (45.9)	346,651 (41.5)	590,265 (42.2)	600,166 (50)	162,960 (50.8)	100,759 (59.1)
	Employer/private plan insurance	1,962,153 (50)	461,951 (55.4)	766,578 (54.8)	548,099 (45.7)	125,353 (39.1)	60,172 (35.3)

	Government-sponsored insurance	161,701 (4.1)	25,901 (3.1)	41,903 (3)	51,926 (4.3)	32,296 (10.1)	9,675 (5.7)
Wears Dentures / Dental Prosthetics / False Teeth							
	No	2,682,703 (67.6)	661,207 (78.2)	1,016,485 (72)	736,997 (60.6)	170,745 (52.9)	97,269 (56)
	Yes	1,287,727 (32.4)	184,260 (21.8)	395,543 (28)	479,671 (39.4)	151,774 (47.1)	76,479 (44)
Teeth brushing Frequency							
	Once or less per day	704,273 (19.5)	103,977 (13.6)	232,265 (17.9)	241,562 (22.2)	72,246 (24.5)	54,223 (33.5)
	Twice or more per day	2,901,106 (80.5)	661,420 (86.4)	1,064,714 (82.1)	844,474 (77.8)	2,222,905 (75.5)	107,593 (66.5)
Reason For Dental Professional Visit							
	Never	181,793 (4.6)	31,321 (3.7)	44,036 (3.1)	63,759 (5.2)	20,056 (6.2)	22,621 (13)
	Only for emergency care	530,672 (13.4)	54,606 (6.5)	143,998 (10.2)	192,724 (15.9)	76,156 (23.5)	63,188 (36.3)
	Visits once or less than once a year for check-ups or treatment	1,109,670 (28)	226,525 (26.9)	385,828 (27.3)	369,406 (30.4)	85,872 (26.6)	42,039 (24.1)
	Visits twice or more a year for check-ups or treatments	2,146,176 (54.1)	530,860 (62.9)	838,111 (59.4)	589,546 (48.5)	14,1328 (43.7)	46,331 (26.6)
Self-Rated Oral Need							
PWM - uncomfortable eating food							
	Often	207,465 (5.2)	8,044 (1)	24,315 (1.7)	66,525 (5.5)	41,979 (13)	66,602 (38.2)
	Sometimes	485,522 (12.2)	31,950 (3.8)	106,940 (7.6)	209,848 (17.2)	88,213 (27.2)	48,571 (27.9)
	Rarely	640,199 (16.1)	67,739 (8)	245,609 (17.4)	242,271 (19.9)	64,042 (19.8)	20,538 (11.8)
	Never	2,640,713 (66.5)	737,788 (87.3)	1,034,720 (73.3)	700,149 (57.4)	129,583 (40)	38,473 (22.1)
PWM - avoids particular foods							
	Often	192,554 (4.8)	10,901 (1.3)	19,469 (1.4)	57,433 (4.7)	39,079 (12.1)	65,672 (37.7)
	Sometimes	392,798 (9.9)	24,484 (2.9)	82,905 (5.9)	165,783 (13.6)	69,970 (21.6)	49,656 (28.5)
	Rarely	454,257 (11.4)	48,778 (5.8)	153,251 (10.8)	177,825 (14.6)	58,729 (18.1)	15,674 (9)
	Never	2,936,050 (73.9)	761,664 (90)	1,157,550 (81.9)	817,735 (67.1)	156,031 (48.2)	43,070 (24.7)
PWM - other persistent pain							
	Often	103,327 (2.6)	4,945 (0.6)	7,642 (0.5)	34,403 (2.8)	21,076 (6.5)	35,261 (20.2)
	Sometimes	342,396 (8.6)	11,148 (1.3)	74,419 (5.3)	143,425 (11.8)	69,142 (21.4)	44,262 (25.4)
	Rarely	542,625 (13.7)	48,545 (5.7)	181,670 (12.8)	209,137 (17.2)	72,083 (22.4)	31,190 (17.9)

	Never	2,986,154 (75.1)	781,316 (92.4)	1,150,302 (81.3)	830,869 (68.2)	160,107 (49.7)	63,560 (36.5)
Had bleeding gums							
	Often	141,104 (3.9)	11,979 (1.6)	27,371 (2.1)	57,838 (5.3)	16,955 (5.7)	26,961 (16.7)
	Sometimes	440,115 (12.2)	50,008 (6.5)	128,742 (9.9)	170,472 (15.7)	56,982 (19.2)	33,911 (21)
	Rarely	889,510 (24.7)	152,102 (19.9)	360,058 (27.8)	278,094 (25.6)	74,312 (25)	24,944 (15.5)
	Never	2,136,686 (59.2)	551,452 (72)	781,079 (60.2)	579,813 (53.4)	14,8832 (50.1)	75,510 (46.8)
Had dry mouth							
	Often	444,411 (11.2)	55,436 (6.6)	116,921 (8.3)	147,161 (12.1)	72,082 (22.6)	52,811 (30.3)
	Sometimes	615,827 (15.5)	86,760 (10.3)	217,592 (15.4)	203,235 (16.7)	60,595 (19)	47,645 (27.3)
	Rarely	631,336 (15.9)	89,733 (10.6)	243,148 (17.2)	220,970 (18.1)	50,174 (15.7)	27,311 (15.7)
	Never	2,274,619 (57.4)	612,927 (72.5)	833,143 (59.1)	646,274 (53.1)	13,576 (42.6)	46,513 (26.7)
Had persistent bad breath							
	Often	130,241 (3.4)	12,397 (1.5)	27,357 (2)	45,219 (3.8)	18,847 (6.1)	26,421 (16.5)
	Sometimes	439,953 (11.4)	45,470 (5.5)	140,864 (10.2)	176,658 (15)	44,044 (14.2)	32,917 (20.6)
	Rarely	677,300 (17.6)	89,601 (10.8)	259,033 (18.8)	227,616 (19.3)	68,807 (22.2)	32,243 (20.2)
	Never	2,607,889 (67.6)	682,522 (82.2)	947,295 (68.9)	731,490 (61.9)	178,313 (57.5)	68,269 (42.7)
Satisfaction with teeth/denture appearance							
	Very dissatisfied	78,862 (2)	1,504 (0.2)	3,117 (0.2)	7,601 (0.6)	12,078 (3.8)	54,562 (31.5)
	Dissatisfied	273,733 (6.9)	11,978 (1.4)	38,738 (2.7)	93,662 (7.7)	73,369 (23)	55,986 (32.3)
	Neither satisfied nor dissatisfied	374,835 (9.5)	17,594 (2.1)	90,555 (6.4)	179,929 (14.8)	64,925 (20.3)	21,832 (12.6)
	Satisfied	2,161,412 (54.5)	317,008 (37.5)	868,870 (61.6)	800,520 (65.9)	138,908 (43.5)	36,106 (20.8)
	Very satisfied	1,074,583 (27.1)	497,083 (58.8)	408,769 (29)	133,850 (11)	29,945 (9.4)	4,936 (2.8)
Self-Rated Oral Health							
	Poor	170,135 (4.2)					
	Fair	344,321 (8.5)					
	Good	1,227,402 (30.3)					
	Very Good	1,454,248 (35.9)					
	Excellent	854,725 (21.1)					

[a] Sample size is estimated using normalized weights done by the CCHS.

[b] Frequencies are row percentages estimated using normalized weights in SPSS.

Appendix C: Data Analyses

Table 3. Simple and Multiple Linear Regression Results

Variables	Responses	SROH Unadjusted β Coefficient	CI (99% CI) Upper, Lower	P-Value = 0.01	SROH Adjusted β Coefficient	CI (99% CI) Upper, Lower	P-Value = 0.01
Socio-Demographic Factors							
Age		.02	.019, .02	.000	.043	.042, .044	.000
Total household income		.145	.144, .146	.000	-.048	-.05, -.047	.000
Education							
	Post-secondary diploma/degree	Referent					
	Only Graduated Highschool	-.102	-.105, -.01	.000	-.071	-.074, -.068	.000
	Less than a Highschool Diploma	-.33	-.334, -.326	.000	-.169	-.173, -.164	.000
Working Status							
	No/Retired	Referent					
	Yes	.075	.072, .078	.000	-.007	-.01, -.004	<.001
Gender							
	Male	Referent					
	Female	.095	.093, .098	.000	.088	.086, .091	.000
Race							
	White	Referent					
	Non-white (Indigenous or other minority)	-.18	-.183, -.176	.000	-.138	-.142, -.135	.000
Knowledge of Official Languages							
	English and/or French	Referent					
	Neither English and/or French	-.419	-.43, -.41	.000	-.018	-.028, -.007	<.001
Relationship Status							
	No partner	Referent					
	Partner	.169	.166, .172	.000	-.006	-.009, -.002	<.001
Health Behaviour Factors							
Smoking Status							
	No	Referent					
	Yes	-.545	-.549, -.541	.000	-.353	-.357, -.349	.000

Alcohol Frequency							
	Did not drink this month	Referent					
	Less than once a month	-.015	-.20, -.011	<.001	-.048	-.052, -.044	.000
	At least once a month	.084	.08, .089	.000	-.097	-.101, -.093	.000
	At least once a week	.223	.22, .226	.000	-.028	-.032, -.025	<.001
Physical Activity Indicator CPAG							
	Below CPAG Guidelines	Referent					
	Above CPAG Guidelines	.183	.18, .186	.000	.014	.011, .017	<.001
Health and Healthcare factors							
Self-Rated General Health		-.357	-.358, -.355	.000	-.258	-.260, -.257	.000
Healthcare Provider							
	No	Referent					
	Yes	.181	.175, .187	.000	.005	-.001, .011	.039
Self-rated Life Stress		-.166	-.167, -.165	.000	-.077	-.078, -.076	.000
High Blood Pressure Status							
	No	Referent					
	Yes	-.176	-.179, -.173	.000	-.017	-.019, -.014	<.001
Heart Disease Status							
	No	Referent					
	Yes	-.286	-.29, -.281	.000	-.003	-.007, .002	.146
Diabetes Status							
	No	Referent					
	Yes	-.25	-.254, -.246	.000	-.002	-.002, .006	.115
Mood Disorder Status							
	No	Referent					
	Yes	-.528	-.533, -.523	.000	-.148	-.153, -.142	.000
Anxiety Disorder Status							
	No	Referent					
	Yes	-.514	-.519, -.509	.000	-.088	-.094, -.082	.000
Dental Health and Dental Care							
Insurance Status							

	No Insurance	Referent					
	Employer/private plan insurance	.240	.238, .243	.000	.068	.065, .071	.000
	Government-sponsored insurance	-.365	-.371, -.358	.000	.08	.073, .088	.000
Wears Dentures							
	No	Referent					
	Yes	-.379	-.382, -.376	.000	-.353	-.356, -.350	.000
Teeth brushing Frequency							
	Twice or more per day	Referent					
	Once or less per day	-.303	-.307, -.30	.000	-.117	-.120, -.113	.000
Reason For Dental Professional Visit							
	Visits twice or more a year for check-ups or treatments	Referent					
	Visits once or less than once a year for check-ups or treatment	-.012	-.015, -.009	<.001	-.079	-.082, -.076	.000
	Only for emergency care	-.596	-.60, -.592	.000	-.481	-.485, -.476	.000
	Never	-.402	-.409, -.396	.000	-.673	-.683, -.664	.000

Table 4. Pearson Correlations of SROH and SRON Variables

	SROH	Uncomfortable to eat food	Avoids certain foods	Persistent pain	Bleeding gums	Dry mouth	Persistent bad breath	Satisfaction with oral appearance
SROH	**1**	**.410****	**.397****	**.366****	**.204****	**.232****	**.220****	**.531****
N	**3,978,753**	**3,973,898**	**3,975,657**	**3,974,502**	**3,607,413**	**3,966,192**	**3,855,383**	**3,963,425**

**** Pearson's Correlation is significant at the 0.01 level (2-tailed).**