

THE ASSOCIATION BETWEEN SELF-RATED HEALTH AND KEY INDICATORS
OF HEALTH IN AN OLDER POPULATION: ANALYSIS OF THE CANADIAN
LONGITUDINAL STUDY ON AGING

by

Hanan Elawadi

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Dedication

To those who loved me more than themselves to my parents (Elsebaie and Laila).

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Abstract

Self-rated health (SRH) is a global indicator of health which reflects a person's integrated perception of their own health. To obtain an in depth understanding of SRH, this study examined the association between SRH and key indicators of health in particular measures of physical health, psycho-social, health behaviours and clinical health measure.

This population-based sample was comprised of 51,338 men and women aged 45-85 years from the Canadian Longitudinal Study on Aging (CLSA) and included both tracking and comprehensive cohorts. Ordinal logistic regression models assessed odds ratios and confidence intervals and estimated the association between SRH and key objective and subjective indicators of health.

Fully adjusted model revealed that SRH has statistically significant association with numerous health measures in particular measures of physical, cognition, depression and clinical health measures. SRH has the ability not only to reflect physical, psycho-social and health behaviours but also it accounts for clinical health measures.

List of Abbreviations Used

ADL	Activities of Daily Living
CCHS	Canadian Community Health Survey
CLSA	Canadian Longitudinal Study on Aging
IADL	Instrumental Activities of Daily Living
MAT	Mental Alternation Test
RAVLT	Rey Auditory Verbal Learning Test
SRH	Self-Rated Health
CES-D10	Center for Epidemiologic Studies Short Depression; 10 item Scale
BMI	Body Mass Index
FEV1	Forced Expiratory Volume in the first second
FVC	Forced Vital Capacity
CDC	Centers for Disease Control and Prevention
OR	Odds Ratio
CI	Confidence Interval
SES	Socioeconomic Status
CDC	The Centers for Disease Control and Prevention
WHO	World Health Organization

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Chapter 1 Introduction

According to Statistics Canada, people are living longer. Over the next two decades the proportion of individuals aged 65 years and older is expected to grow rapidly, meaning close to one in four individuals in Canada will be seniors (1). It is well documented that the prevalence of chronic diseases increases with age (2,3). Chronic diseases cost the Canadian economy \$100 billion annually in lost productivity and \$90 billion in treatment costs (4). This means chronic diseases consume 67% of all direct health care resources (4). In order to assess the changing health care system needs to help people to live longer and healthier, it is essential to evaluate the health of the aging population. Therefore, investigators and policy makers are interested in better understanding the aging process and seeking feasible ways to identify individuals with the greatest health care needs. This information is important in guiding the decision-making process with respect to resource allocation and planning for preventive public health care programs.

One of the most popular measures of health is Self-Rated Health (SRH) or perception of health. SRH is a global indicator of health which reflects a person's integrated perception of their own health and it can be influenced by many biological, psychological and social factors (5,6). SRH has been used widely in many studies and large health surveys (7-9).

Due to its simplicity and popularity, it is important to understand how SRH is associated with other subjective and objective measures of health. Therefore, using large national population-based sample of older adults (ages 45-85) from the Canadian Longitudinal

Study on Aging (CLSA), we examined the relationship between SRH and several subjective/ objective measures of key indicators of health including physical, psychosocial, health behaviours and clinical health measures.

Chapter 2 Background

2.1 Health of the Aging Population

According to Statistics Canada, over the next two decades the proportion of Canadians aged 65 years and over will grow rapidly (1). By 2030, the year in which the youngest baby boomers will reach age 65, close to one in four individuals in Canada will be seniors (1-3). Many seniors are active in society and are engaged in volunteer work. However, elderly people are also at risk of experiencing chronic conditions and disability. In 2014, around 2 million or 40% of Canadians aged 65 and older reported having one or more of the four major chronic diseases (cardiovascular disease, cancer, chronic respiratory disease and diabetes) (10). This has the potential to impact the economy and health care system over the next 25 years. That is why many policy makers are aiming to better understand aging and measure the health and health deficits of elderly people. Studies that measure the health of the population will help in the evaluation and development of health care interventions. This will improve the prevention and management of chronic conditions as early as possible to decrease disabilities (11-13).

2.2 Definition and Measuring of Health

In 1946, the World Health Organization (WHO) defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (14). Questionnaires of up to 100 questions were developed to measure the concept with minimal error (5,7). Many research studies tried to overcome the mathematical challenges of scaling to measure population health and to be able to develop a tool to compare health in different countries (7). The WHO worked in collaboration with 15 centres around the

world to develop the WHOQOL-100 and the WHOQOL-BREF to measure quality of life in a wide variety of cultures (7,15). Despite significant advances in measurement, the question of how to measure health is likely to always exist, mainly because of the complexity and abstract nature of health itself (5).

Generally, the measurement of health can be categorized as subjective and objective. Subjective measures depend on the expression of individuals' general feeling about their own health. They are commonly used in health research to evaluate pain, level of well-being, and depression which cannot be captured by physical measures or laboratory tests. Objective measures, on the other hand, assess individuals with no or minimal judgment from individuals such as mortality rates, laboratory findings and absence or presence of chronic diseases (5,16). The distinction between subjective and objective measures is not clear sometimes, especially when observing behaviours. For example, in assessing the ability to climb stairs, it can be considered as a subjective measure if reported by the person and objective if it is observed and reported by a health professional without subjective interpretation. Notably, we should not assume that objective measures are better than subjective measures only because they were conducted by an expert. Longitudinal studies have shown that subjective self-ratings of health are consistently found to predict mortality as well as or even better than physical measures (5).

2.3 Self Rated Health

2.3.1. SRH Definition and Utility

Self-rated health (SRH), also known as perceived health, self-assessed health or subjective health is considered as a global health status indicator that measures health with one brief question (6,17). It has been used widely in medical, psychosocial and general population health research using survey data throughout the world. It has been included in many important health surveys such as the National Population Health Survey (NPHS), the Canadian Community Health Survey (CCHS) (8,9), the US National Health Interview Survey (NHIS) and National Health and Nutrition Examination Survey (NHNES) (7). SRH was also used by the Organisation for Economic Co-operation and Development (OECD) as a summary indicator of health of the general population in 2015 and 2017 (18). All of these health surveys have been used to track population health trends, measure health disparities, and to inform policy.

The popularity of SRH is in part due to its practical advantages of being a single item tool, easy to apply, cost-efficient in terms of time and money as it doesn't require training and does not fatigue participants compared to multi-item scales. (5). While some researchers are still reasoning how these advantages may outweigh the loss of information, many studies explain the important theoretical view of this single item in providing actually more information since it provides a better overall subjective assessment of a multidimensional, latent concept that is very challenging to measure (19).

2.3.2. Measurement and Construction of SRH

SRH has been measured in several ways with respect to wording, and a number of response options have been used (20). It can be divided into three versions; the first way is non-comparative or a global question: “How do you rate your health?” The second version is age comparative: “In comparison to others at your age, how do you rate your health?” The third interpretation is time comparative: “How would you rate your health in comparison to how it was in a given time in the past?” (21). The classic response option is varied between three (good, average, or poor) or four (excellent, good, fair, or poor) and up to five options (excellent, very good, good, fair, or poor) (21). Therefore, the comparisons between the results of SRH studies using different kinds of questions and response scales can only be made with caution to address any bias related to these different scales (18).

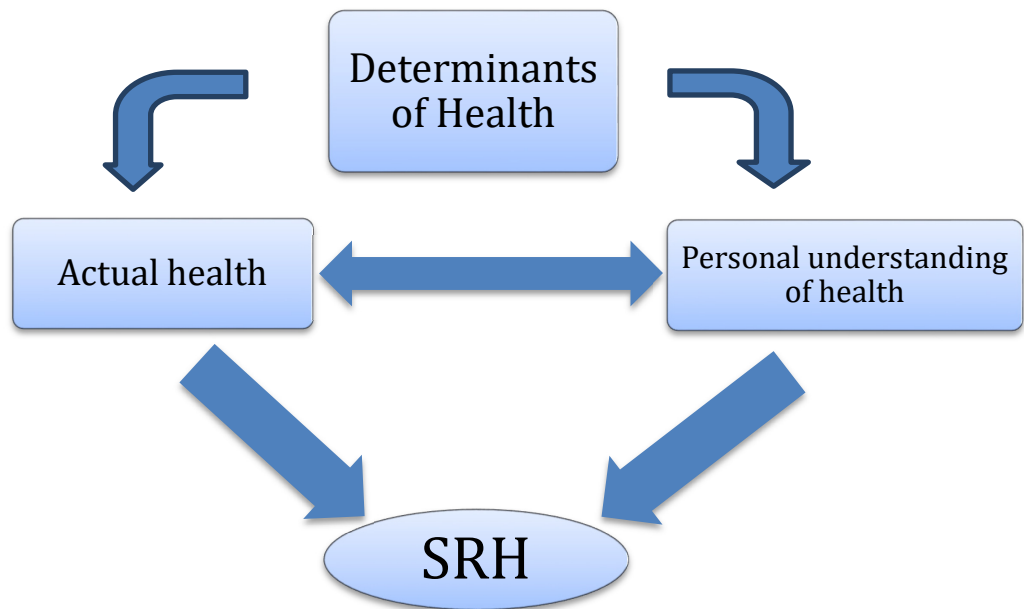


Figure 1. Explanatory diagram of the mechanism of SRH

Conceptually, SRH reflects a person's integrated perception of their own health which is different from one person to another based on their definition of health (17). Many studies concluded that SRH was found to be able to comprehensively comprise many domains of health and give us inclusive information about an individual's general health that is easy to quantify and use in research (6).

It may seem surprising that a single SRH question performs so well. In 1994, Krause and Jay identified that the variation in response between individuals is mainly due to the variation of an individual's own perception of health and expectations (6,22). In 2009, Jylhä defined the response variation as the cognitive or processing part of the SRH (6,22). To better understand the response variation, a series of qualitative studies were undertaken, in which participants were asked to describe what factors they relied on when they rate their health (22-25).

Narratives show that people consider a complex, multidimensional concept when they rate their health. Qualitative studies of SRH suggest that both health and illness are revealed as people rate their own health. Therefore, people may consider three main aspects of health; the presence or absence of disease, their function (ability to fulfil their duties and absence of disability), and a general feeling of well-being, strength and existence (22,26-29). For example, copied from an interview by Idler (30), a conversation between interviewer and participants. "Interviewer: What went through your mind when you rated your health as "fair"? Respondent: Well, my health... see that's a hard question, it depends on different things. As far as my weight I feel that it's very, very poor but as far as my cholesterol I

think it's absolutely excellent, 125, is excellent. But when you say things like my knees are hurting me, some days they are, some days they're not. My knees are in poor condition, but my heart is in good condition. My ankle hurts cause I broke it last year. But I feel good cause I can walk. You can't really say, let's just say one specific thing, but if you're talking about general stuff, I have to say, oh, I may be excellent health wise in one way, and very poor health wise in another way. Interviewer: So, when you average it all out? Respondent: It's right in the middle. It's like those shades of grays between the black and white. So, I can't say everything about me is poor and not everything about me is excellent.” (Idler) (30).

Jylhä Marja (2009) suggested a framework of evaluation model reflecting the most important factors that people consider while evaluating their own health and what people used as a reference of comparison to their health in general (6). Her framework considered numerous factors such as: age, culture, comparison or reference group, health expectations, previous health experience and negative or positive disposition (6).

Jylhä Marja (2009) considered age as one of the most important factors that affect our health and it showed a paradoxical relation with SRH as elderly adults perceived their health more positively than young people. This was hypothesized to occur for two reasons; first, the older adults were more likely to be negotiating between what is normative and what is a health problem for their age (6). Second, most elderly adults, in spite of having health and functional problems, showed a positive assessment of their health when comparing their health with other people at their age but with lower health (6,31,32). This

may be due to the fact that there are more variations in health at older age than younger age. In other words, elderly adults likely compare their health with less healthy individuals at their age, whereas young adults will be more likely to compare their health with young healthy individuals, given that there is less variation in health status.

Regarding health expectations, young people may expect their own health differently from older people who may expect to have some degree of health problems (33). For example, old and young people diagnosed with the same chronic condition may rate their health differently based on their understanding, expectations and adaptations (6,32).

Having experience with a previous health condition and the ability to adapt with health conditions can affect health assessment; for example, a person who has full recovery from breast cancer will consider it as a positive component of their health (34). Moreover, it has been shown that, in comparison to young adults, older individuals with multiple comorbidities are less likely to further lower the rate of their health if they are diagnosed with another new chronic condition (6,34).

Different personalities of individuals can also shape their decision about their own health; such as having health optimism (assessing health as good despite having poor objective health) or health pessimism (assessing health as poor despite having good objective health) (35-37). It has been shown that having depression can alter the framework of evaluation and may lead to a more negative interpretation of one's own situation and many studies showed that the likelihood of a better SRH decreased with more depressive symptoms (38-

40). A large study of from 60 countries all over the world, the WHO World Health Survey (WHS) studied the effect of five major chronic health conditions (depression, angina, arthritis, asthma and diabetes) on the decrease of health. They concluded that after adjusting for socioeconomic factors and health conditions, depression had the largest effect on deteriorating the mean of health scores compared with the other chronic conditions. Moreover, individuals who have depression and one or more chronic condition had the worst health scores compared to all other disease's states (41).

2.3.3. SRH and its Association with Mortality and Important Health Outcomes

The relationship between SRH and other measures of health such as mortality has been greatly studied. This relationship was first documented in the early 1980s by Mossey and Shapiro when their research analysis of the Manitoba Longitudinal study concluded that an older adult's perception of health was an important predictor of seven-year survival, better than medical records and self-reported chronic conditions (42). Kaplan and Camacho 1983 suggested that SRH can reveal symptoms of various psychosocial conditions such as social isolation, negative life events, depression, and job stress which are usually unreported or untreated by medical care system (17).

Since then, the research area of SRH has become very active. Reviews and meta-analyses of more than twenty studies showed the robust association between SRH and mortality (19,20,30). Yet, these studies could not provide us with a clear justification for this association. Benyamini (2011) in his recent review article concluded four reasons. First, SRH can be considered as a summative proxy for different important measures and

indicators of health as proved by many studies (19,22,43-45). Second, the SRH can be used as a dynamic estimation. In other words, SRH can reflect the individual's knowledge of current and future health circumstances that may modify the decline of health in the future. Thus, SRH can reflect the person's own judgment about their trajectory of health, instead of only the current health level. (19,46). The third explanation is: SRH can influence our health behaviours which consequently affect the health status such as lifestyle modifications (47). Notably, this association between SRH and health behaviours was found mostly in cross sectional studies with lack of causation. In saying that, further research is needed to know whether high SRH leads to higher engagement in healthy behaviours or if having a healthy lifestyle leads to better SRH (19,48,49). Finally, it was argued that SRH can reflect important resources that affect health such as education, social support, income and more importantly optimism which consider as an internal resource (19,20,50). Again, it is difficult to tell if these factors reflect health status in the future or they have a causal effect on health in the future (19).

The association between SRH and prediction of health outcomes has been shown in many studies. For example, SRH was found to be a significant predictor of the decline of physical health function (51-53). Also, SRH was a significant predictor of the onset of major chronic conditions such as coronary heart disease, diabetes, stroke, lung disease, arthritis, but not cancer (54). Moreover, SRH was used in the disease risk screening tools in the British women's Heart and Health prospective cohort study. The study showed that SRH can measure the risk of development of cardiovascular disease in elderly women (6,55). This result was concluded after they compared the predictive power of SRH with that of the

general practice (GP) model, which used age, systolic blood pressure, smoking habit and self-rated health, and the standard Framingham risk tool (6,55). This result was supported by other studies such as the study on women with suspected myocardial ischemia by Rutledge et al. which studied the association between SRH and five major CVD events (myocardial infarction, heart failure, stroke, and CVD-related death). After 9 years follow up, they found that women with poor SRH developed CVD events faster than women with good SRH. The study concluded that SRH has clinical utility in predicting major CVD events in women after controlling for sociodemographic factors, CVD risk factors, and coronary artery disease severity (56).

2.3.4. SRH and Important Health Measures

The association between SRH and other various health measures was investigated in several studies in the literature. Mantzavinis et al. (2005) classified 133 measures into seven main categories after they studied 56 papers on the most important determinants of SRH (57). The three main measures that most studies used are physical health, functional limitation, and mental health (6,58). The well-known Whitehall and Gazel studies (2006), analyzed the cross-sectional association between SRH and 35 measures from the Whitehall II (England) study and 33 measures from the Gazel (France) study. After running their analysis, they determined that 34.7% of the variance in SRH was explained by five determinants (symptom score, sickness absence, longstanding illness, minor psychiatric morbidity, number of recurring health problems) in Whitehall II. In Gazel, 41.4% of the variance in SRH was explained by four measures; physical tiredness, number of health problems in the past year, physical mobility, number of prescription drugs used. They concluded that, among workers aged 35-50 years, mental and physical health measures contributed most in determining SRH. The contribution of age, early life factors, family history, sociodemographic variables, psychosocial factors, and health behaviours was modest (59).

A longitudinal study in Japan by Murata et al (2006) examined the important factors associated with SRH and with mortality after 7.3 years of follow up for all-cause mortality (60). They found that psychological factors (especially factors related to wellbeing) were associated with SRH and not with mortality, while both self-rated health and mortality were significantly associated with age, functional status, and social relations. They concluded

that a stronger effect of self-rated health on mortality was marked for young-old age group, people with no functional impairment and whom had shorter follow-up period. While, the economical, psychological, and social factors were related to self-rated health; they determined that illnesses and functional status were the major determinants of self-rated health (60).

2.3.5. SRH and Gender

The gender difference in health has been studied extensively in the literature and the pattern was varied (61,62). Some studies reported that males tend to assess their health higher than women do (30,63,64), and other studies showed that women tend to assess their health better than men (44,65-67), and yet, other studies found that the gender difference has disappeared after they adjusted for health measures in their analyses (68,69).

In a large European study that examined cultural and gender differences in self-rated health, using data from four areas (Tampere, Finland, Florence, and Italy) of the European Longitudinal Study on Aging, it was found that after they adjusted for age, education and several indicators of disease and disability, there was no substantial difference in self-rated health between genders in any area (69).

Different studies showed that women's SRH is indeed more inclusive compared to men (70). Van Doorn (1998) suggests that women may report more accurate SRH than men as women are more aware of their physical symptoms (71). Another study provided evidence that women's SRH was more inclusive and sensitive to various health problems and was

more associated with negative affect or emotional distress that reveals the impacts of stressful health related and non-health related factors (72). They found that while negative affect is associated with poorer health in both genders, it was more related to serious health problems in men and more related to broad factors not related to serious health problems in women (72). They found that SRH was more associated with mortality in women after they controlled for the negative affect (70,72).

2.3.6. SRH and Social Relations

Different terms and conceptions of social relations were identified in the literature. Social network, social support, social integration, or social participation were often used in the research with different views making it difficult to have unified model to use and compare between studies. To make it more clear, Due et al. (1999) proposed his popular framework and divided the overall social relations into two main concepts; the social structure and the social function. He defined the social structure as “the individuals with whom one has an interpersonal relationship and the connections between these individuals” and the social function as “the interpersonal interactions within the structure of the social relations” (73). Then, the later was divided further into emotional support, instrumental support, informational support and appraisal (73).

Idler and Benyamini (1997) suggested that people take social relations into account when they assess their overall health and thus they conceptualize the social relations as one of many components of SRH (30). However, the strong association between social relations and mortality was documented by many research studies and inconsistencies can be seen (74,75). These inconsistencies could be because of the different used measures of social relations itself, which vary greatly between studies, or because of the natural variations of social support over the different life stages, in terms of its type, effect and how useful it could be to improve the health and helping to cope with the illness (75,76).

A cohort study in the US studied whether social relations can modulate the relationship between SRH and mortality (76). After 13 years of follow up, they found that both

structural and functional relations did not modulate the relationship between SRH and mortality and only structural social relations were associated with mortality (76).

2.3.7. The Biological Concept of SRH

Due to the ability of self-rated health to predict mortality and measure health status, there has been increased interest to examine its biological dimension. Jylhä Marja (2006) studied the association of commonly used biomarkers with self-rated health, and the role of these biomarkers in the association between self-rated health and mortality (77). In a population-based sample of older adults aged 71 years, blood levels of albumin, white blood cell count, hemoglobin, HDL cholesterol, and creatinine were examined. The study followed up participants for 4.9 years for all-cause mortality. All of the biomarkers revealed a graded relationship with self-rated health. Then, only hemoglobin and white cell count were significantly associated with fair or poor self-rated health after controlling for sociodemographic factors, diagnosed chronic conditions, and activities of daily living disability. Moreover, self-rated health was a significant predictor of mortality. They concluded that self-rated health has a biological basis and is likely to predict mortality because it covers the spectrum of health conditions (77).

They explained the impact of the levels of biomarkers on SRH by three possible mechanisms. First, biomarkers may act as a proxy for a certain health condition which the individual is aware of and the condition itself that influence SRH. Second, the biomarkers can reveal the severity of the health conditions. Thus, it is the severity that can actually impact the self-assessment. Their third explanation was that the changes in the biochemical

indicators themselves may reflect a change in the physiology of the body that the individual can predict through what they called proprioception or visceroreception which was defined as a system of feelings that represents a sense of physiologic condition in the body (77).

2.3.8. SRH and Aging

Changes or trends in the health of the elderly population have become of great interest. Two decades ago, trends in mortality were believed to be a good indicator of the health of the elderly, and because mortality was decreasing rapidly, it was assumed that health became better (78). However, we do not know whether this increase in life expectancy means extra years with healthy life or unhealthy life, especially with the increased incidence of chronic diseases as people live longer (78). Moreover, it becomes clear that health is multidimensional in nature and mortality or morbidity do not necessarily explain trends in all other dimensions of health. The aging process can lead to changes in all dimensions of health and these changes do not have to be similar (78). This recognition of the complex concept of health led us to the challenging question of how to assess the various effects from changes in any dimension or aspect of health.

It is well known that health declines with age due to the effect of many biological and physiological changes which may lead to the decline of the functional ability and increase of the vulnerability to chronic diseases. Thus, we might assume that elderly adults report poor health generally. However, unexpectedly, the studies addressing changes in SRH and age have yielded mixed results. Some studies showed that elderly people tend to perceive their health in more positive way as demonstrated by the fact that SRH was higher than

expected compared to other objective health measures (30,79,80). They revealed that elderly people tend to be more optimistic than younger people and used peers with inferior health as their reference instead of healthy youthful individuals. This discrepancy was explained as physical health and functional status were less correlated to SRH in elderly as social factors became more correlated in comparison to young people (30,79,80). Yet, another study found that SRH was relatively stable in the elderly (81). The authors explained that elderly people can adapt to their health decline over time and their perception could be changed in response to a sudden drop in health or acute onset of illness or disability and then improved over time (81). On the other hand, Schulz et al. (2006) found that SRH decreased over a five-year period (82). Having such mixed results and explanations, makes it difficult to understand the changes of SRH in elderly. Clearly, further work in a representative sample is needed.

Chapter 3 Study Objectives

The overall goal of this study is to understand SRH in general and how SRH is associated with other indicators of health. To meet this goal, this study had the following objectives:

- (1) Determine the prevalence of SRH and its distribution across different sociodemographic, physical function, psychosocial and health behaviours.
- (2) Determine the association between SRH and other self-rated measures of physical, psychosocial and behavioural health.
- (3) Determine the association between SRH and physical/clinical measures of health.

Chapter 4 Methods

4.1. Study Design

This study is a cross sectional secondary analysis of the Canadian Longitudinal Study of Aging (CLSA). We used self-reported questionnaires on health and function from all 51,338 participants in both the Tracking and Comprehensive cohorts, and the directly assessed physical measurements of health and function in the Comprehensive cohort of the CLSA (n= 30,097).

4.2. Data Source and Study Population

The study uses data from the baseline assessment of the CLSA (2010-2015). The CLSA consists of a stratified random sample of 51,338 Canadian residents aged 45-85 years at the time of recruitment. Team members of the CLSA collaborated with Statistics Canada to choose the best sampling strategy to create a representative sample of Canadians in the required age group. They used the population of the Canadian Community Health Survey (CCHS) as the first sampling frame for the CLSA recruitment (83). Statistics Canada approached participants of the CCHS and if consent was obtained, their contact information was forwarded to CLSA researchers (83,84). The CLSA research team carried out all required follow-up. They sent all potential participants an introductory letter including information about the study and a consent form. Additional sampling frames used were provincial health card registration, and random digit dialing, and similar recruitment processes were followed.

Participants had to be able to complete the interview in English or French. Community-dwelling adults in households or housing such as senior's housing with minimal care were

included. The CLSA excluded Canadian residents of the three territories, full-time members of the Canadian Armed Forces, and persons living on federal First Nations reserves or other First Nations settlements. People with cognitive impairment or in long term care at baseline were also excluded (83). These eligibility criteria were adapted from the Canadian Community Health Survey (CCHS) (83). There are no exclusion criteria for our study other than that of the CLSA itself.

The data was collected in two ways (illustrative diagram of CLSA research platform design overview is included in Appendix A):

- **Tracking participants** (n=21,241): The tracking cohort was randomly selected within age/sex strata in each of the 10 provinces and participants were followed by telephone interview. The data was collected at Computer Assisted Telephone Interview sites (CATI) sites across the country (Dalhousie University, University of Sherbrooke, University of Manitoba, and University of Victoria) (83).
- **Comprehensive participants** (n=30,097): The comprehensive cohort was randomly selected within age/sex strata from within 25 km (and, in locales with lower population density, within 50 km) of 11 sites across the country (Victoria, Vancouver, Surrey, Calgary, Winnipeg, Ottawa, Hamilton, Montreal, Sherbrooke, Halifax, and St. John's) (83). The participants were followed via in-depth in-home interviews and onsite data collection.

The CLSA has a great variety of information on important indicators of health such as physical, psychological, social and health behaviours in a large-scale population-based study. This makes the CLSA a well-suited resource for understanding the interrelationships among factors that affect perception of health in the elderly.

4.3. Ethics Approval and Consent

The Dalhousie University Health Sciences Research Ethics Board granted the ethics approval for this study. Also, the study obtained approval to access the data from the CLSA's Data and Sample Access Committee (DSAC), and an inter-institutional Access Agreement was signed with McMaster University.

4.4. Key Variables and Measures

Objectives of the present research study were addressed using items from within the following main health domains:

- Physical health: measured by activities of daily living, number of chronic conditions, sensations (vision and hearing), and body pain. Clinical measures of body mass index, waist circumference, handgrip strength, 4-meter walk test, standing balance, forced expiratory volume in the first second (FEV1), and forced vital capacity (FVC) were considered as objective measures of health.
- Psycho-social health: measured by depression (CES-D10), life satisfaction, cognitive tests (REYI, REYII, and MAT), social support, and social participation).
- Health behaviours: smoking and alcohol.

We adjusted for the following important sociodemographic factors age, sex, ethnicity, marital status, education, income, and work/retirement status.

More information about the CLSA questionnaires can be found on the CLSA website,

<https://www.clsa-elcv.ca/researchers>.

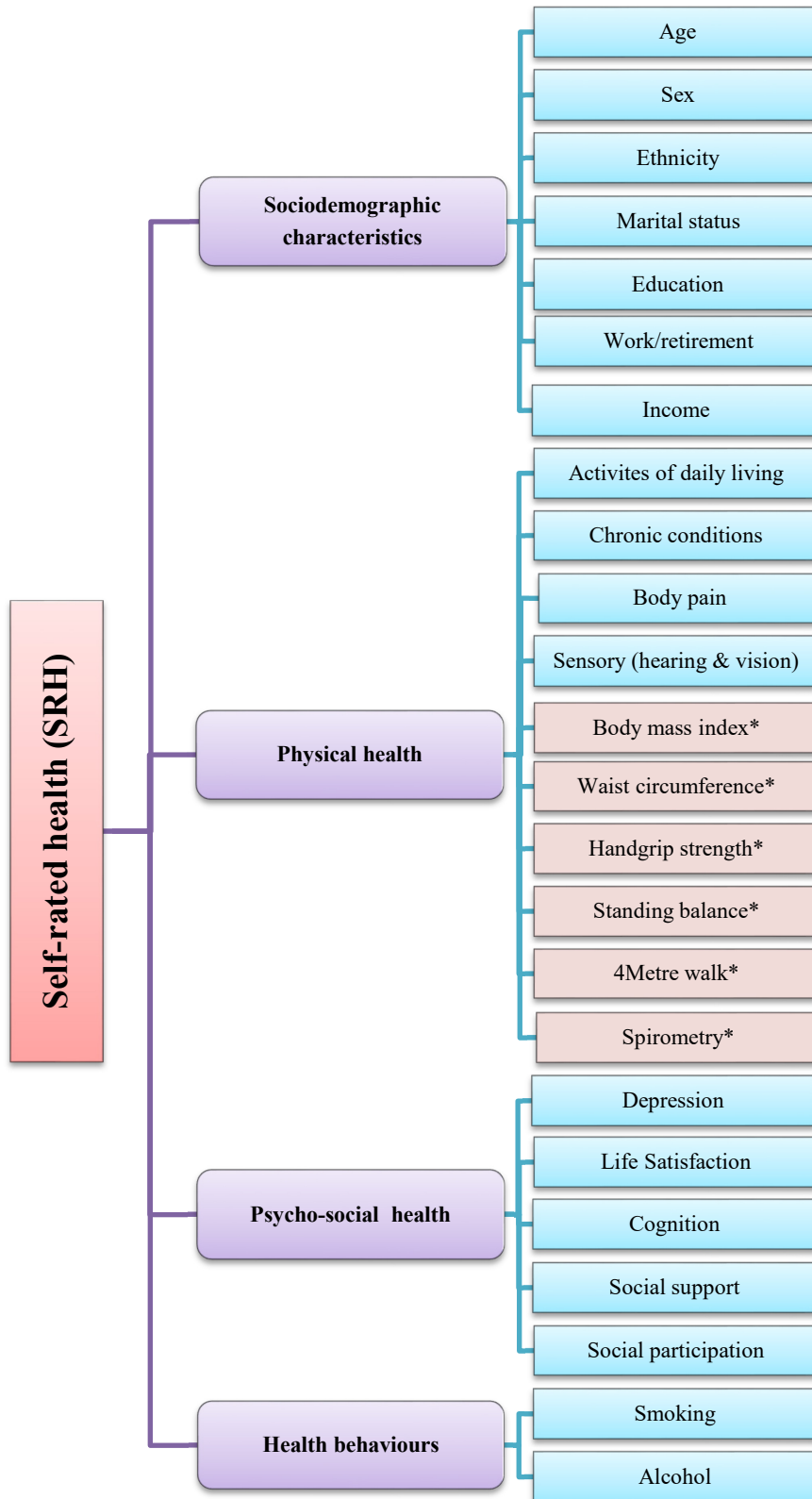


Figure 2: Variables used in the analytical approach to model self-rated health (SRH).
 * Clinical measured variables.

Dependent/ outcome variable

Self-rated health

SRH was measured by asking all participants, “In general, would you say your health is excellent, very good, good, fair, or poor?” This was treated in the analysis as an ordinal variable with three levels (1) high self-rated health (excellent and very good); (2) middle self-rated health (good); and (3) low self-rated health (fair and poor).

Independent variables

Measurements of indicators of Health: [physical health, psycho-social health and health behaviours]

1-Physical health (Daily living activities, chronic conditions, pain and sensations)

Daily living activities Basic Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) were measured using a modified version of the Older Americans Resources and Services (OARS) Multidimensional Functional Assessment Questionnaire (85,86). All participants were asked seven questions related to basic activities of daily living such as dressing and eating, and seven questions related to instrumental activities of daily living such as preparing meals, shopping and using the telephone. For each question, participants were asked to respond whether they can complete the task without help, with some help, or are completely unable to perform it. The scale has been widely used in research studies in elderly and individuals with disabilities to measure self-care capacity with high validity and reliability (86,87).

This study used the derived variable generated by the CLSA. This derived variable estimates the overall ADL and IADL performance for each participant on a 5-point scale (ranging from (1) no functional impairment to (5) total impairment). We categorized this derived variable in the analysis to three levels as “no functional impairment”, “mild or moderate” and “severe or total impairment”.

Chronic Conditions: All participants were asked to identify if they have chronic conditions by answering whether a doctor had ever told them that they had a chronic condition. For example, “Has a doctor ever told you that you have high blood pressure or hypertension?” In total, 42 chronic conditions were asked about in the questions and include respiratory, cardiovascular, neurological, gastrointestinal, rheumatic, mental health, cancer and vision-related conditions. We created a categorical variable consisting of 4 levels: “no chronic conditions” “one chronic condition” “two chronic conditions”, and “three or more chronic conditions”. Self-reported clinician diagnosed chronic conditions have been shown to have high test-retest reliability ($ICC = 0.96$) in population-based health surveys (88).

Pain: Two questions addressed whether the participant is in pain and the level of pain that they are in: “Are you usually free of pain or discomfort?” and if they reported having pain “how would you describe the usual intensity of your pain or discomfort? Would you say it is mild, moderate, or severe?”. We created, from these two questions, a categorical variable with four levels: “no pain” “mild pain” “moderate pain” and “severe pain”.

Sensations: All participants were asked to rate their hearing and vision by these two questions, “Is your hearing, using a hearing aid if you use one” and “Is your eyesight, using glasses or corrective lens if you use them” choose one answer from the following: (excellent, very good, good, fair or poor). Vision and hearing self-reported health were used as categorical variables with five levels: excellent, very good, good, fair and poor.

2- Psycho-social health:

Psychological functioning was measured by using the data of cognition, depression and life satisfaction variables. Social functioning was measured by using two questionnaires social support and social participation.

Cognition: Was assessed by two domains of cognition, memory and executive function:

Memory: This was assessed using the Rey Auditory Verbal Learning Test (RAVLT), a 15-item word learning test that assesses learning and retention. The RAVLT is measured twice, once after the list is given (immediate recall), and once after the subsequent cognitive tests were administered (delayed recall). It has been shown to be highly sensitive to early detection of cognitive decline (89,90) and demonstrates good test-retest reliability ($.51 \leq r \leq .86$) (91). It is one of the most widely used neuropsychological tests (92,93). In this study, we categorized the scores using tertiles (high, middle, and low) and the participants in high (best) tertile were used as a reference.

Executive function: Executive function is considered to be a set of higher order mental skills that enable us to plan, focus attention and see things from new and different views to

get things done. These skills were measured using the mental alternation test (MAT). The MAT is a two-part test, first participants are required to count aloud from 1-20 and then say the alphabet as quickly as they can. If the participants are able to finish the first part, they continue to the second part where they are asked to alternate between numbers and letters (1-A, 2-B, 3-C ...) as quickly as possible for 30 seconds. Scores are based on the number of correct responses. The MAT is sensitive and specific for the detection of cognitive impairment as measured by the Mini-Mental State Examination in older adults (93,94). In this study, we categorized the scores using tertiles (high, middle, and low) and the participants in high (best) tertile were used as a reference.

Depression: The Center for Epidemiologic Studies Short Depression Scale (CES-D10) was used to measure depression in this study. All participants were asked ten questions that inquire about the feelings of depression, loneliness, hopefulness for the future, and restless sleep. Each question has four possible response options: all of the time, occasionally, some of the time, rarely or never. This is a self-reported question which measures the frequency of having depressive symptoms during the most recent week before completing the survey. The total score ranges between 0 and 30, where a higher score indicates a higher level of depression. A score of 10 or more indicates depression, it has been used extensively in large population health studies with high retest correlations of $r = .71$ and good predictive accuracy when compared to the full-length 20-item version of the CES-D ($\kappa = .97$, $P < .001$) (95,96). This variable was categorized dichotomously for presence or absence of depressive symptoms.

Life Satisfaction: This has been used in many longitudinal studies of aging including the English Longitudinal Study of Ageing (ELSA) as an important measure of self-assessment of health and well-being (5). This was measured by the Satisfaction with Life Scale (SWLS). The SWLS consists of five items where respondents assign a level of agreement ranging from strongly disagree to strongly agree to measure the global life satisfaction. It is one of the most widely used scales to measure the life satisfaction component of subjective well-being with high internal consistency ($.79 \leq \alpha \leq .89$) and test-retest reliability ($.50 \leq r \leq .84$) (97,98). This is a derived variable with a score range from 1 (strongly disagree) to 7 (strongly agree), where a higher value indicates a higher satisfaction with life (97,98). It was categorized into the following categories: extremely dissatisfied, dissatisfied, slightly dissatisfied, neutral, slightly satisfied, satisfied and extremely satisfied (97,98).

Social Support This is measured by using the 19-item MOS Social Support Survey (99), divided into 4 subscales that gather information about the emotional and informational support, positive social interaction, affection and tangible social support. This survey was developed to measure social support of chronically ill patients in clinical studies and considered applicable to the general population as well (5). It has been used and tested in large population-based studies demonstrating excellent reliability with Cronbach alphas greater than 0.91 (5). We generated the overall social support score by averaging the responses over all 19 items. The scores range from 0 – 100, where a higher score indicates a higher level of functional social support (99-101). The overall social support scores were

categorized into tertiles (high, medium and low) the participants in high (best) tertile were used as a reference. The following formula was used to create the overall social support availability scale:

$$100 \times \frac{(\text{observed score} - \text{minimum possible score})}{(\text{maximum possible score} - \text{minimum possible score})} \quad (100).$$

Social participation: Each participant was asked eight 5-point questions measuring the frequency of participation in a variety of social activities, including family or friends, faith or community, sport or physical activities, educational, volunteer, and cultural events. These elements were part of the CCHS-Healthy Aging survey (102). Participants were asked to choose one of the following options: never, yearly, monthly, weekly and daily. This derived variable categorized social participation into five levels “participate daily” “participate weekly” “participate monthly” “participate yearly” and “did not participate in community related activities”.

Clinical measures (Comprehensive cohort):

This study used the following clinical/ physical measures of health as objective indicators of health. These measures are available for the comprehensive cohort only.

- Body Mass Index (BMI) (kg/m^2) (body weight in kg divided by squared body height in meter): A derived variable (BMI Classification for Adults Aged 18 and Over - International Standard) was provided by CLSA. The variable has 7 categories (underweight, healthy weight, overweight, obese - class I, obese - class II, and obese - class III). In the analysis, it was categorized into three categories (healthy weight, overweight, obese class-I and risky weight group) because of the small number of observations in obese - class II, obese - class III and underweight categories; we combined them together to one category (risky weight group).
- Waist circumference (cm): we categorized waist circumference variable by sex into a categorical variable with four levels “less than or equal 80cm for women” “more than 80cm for women” “less than or equal 94cm for men” and “more than 94cm for men”. We used the recommended cut-off points by the WHO report (2008) for both men and women waist circumferences (103).
- Handgrip strength (kg): according to Statistics Canada health report on grip strength reference values from the Canadian Health Measures Survey, 2007 to 2013, the hand grip strength differs between men and women. It increased from childhood to reach its peak in adulthood (35 to 45 years old for men and 30 to 50 years old for

women) and then decreased (104). We categorized the hand grip strength scores by sex into tertiles (high, middle and low) and participants with high (best) tertile (in men and women) were used as a reference.

- 4-meter walk test (sec): In this study, we categorized the scores using tertiles (high, middle, and low) and the participants in high (worst) tertile were used as a reference.
- Standing balance (sec): In this study, we categorized the scores using tertiles (high, middle, and low) and the participants in high (best) tertile were used as a reference.
- Forced expiratory volume in the first second (FEV1) and forced vital capacity (FVC): The Centers for Disease Control and Prevention (CDC) recommended interpretation of pulmonary function test results by age, sex, height, weight and ethnicity using the Third National Health and Nutrition Examination Survey (NHANES III) reference as the standard (105). In this study, we categorized the scores of both variables using tertiles (high, middle, and low) and the participants in the high (best) tertile were used as a reference.

All details about the variables and measurements used by CLSA, are available in the CLSA protocol and data support documentations website:

<https://www.clsa-elcv.ca/researchers/data-support-documentation>

Covariates:

Sociodemographic Variables:

Age: age was measured by asking participants “What is your age in years?”. This variable was categorized to 4 age groups 45-54, 55-64, 65-74 and 75-85.

Sex: All Participants were asked to record their sex (Male or female). This variable was categorized as (0) female (1) male.

Cultural/racial background Ethnicity: participants were asked about their ethnicity by the question, “People living in Canada come from many different cultural and racial backgrounds. Are you...? There is a list of 17 options including “others,” “don’t know” and “refused to answer”. Participants were asked to choose all applicable options. In order to describe the racial background of our study population, this variable was categorized into white, aboriginal, and other minority.

Marital Status: Participants were asked to answer the question, “What is your current marital/partner status?” This variable was categorized to reflect married/partnered, divorced/separated, widowed and single/never married.

Education: was measured by asking the following 4 questions: “What is the highest grade of elementary or high school you have ever completed?” “Did you graduate from high school (secondary school)?” “Have you received any other education that could be counted towards a degree, certificate, or diploma from an educational institution?” “What is the

highest degree, certificate, or diploma you have obtained?” This variable was categorized to reflect less than secondary, secondary graduated, some postsecondary and postsecondary degree.

Work/ retirement status: All participants were asked to provide information about their retirement status by asking the question, “At this time, do you consider yourself to be; completely retired, partly retired or not retired”. This variable was categorized to reflect those who are fully retired, partially retired and not retired. Those who were not retired were asked to provide information about their employment status by answering this question: “Are you currently working at a job or business?” this includes part-time jobs, seasonal work, contract work, self-employment, or any other paid work regardless of the number of hours worked. The answer options were yes or no. This variable was categorized to yes (currently working) and no (currently not working).

Next, the new work/retirement status variable was generated from the previous two variables. From previous questions, we generate a new categorized variable with four categories: (1) Currently working, (2) Currently not working, (3) Completely retired, and (4) Partially retired.

Annual household income: was measured by using the CLSA survey question, “What is your best estimate of your total personal income from all sources, before taxes and deductions, in the past 12 months?” This was a categorical variable which consists of the following five levels:

“less than \$20,000”, “\$20,000 ≤ income < \$50,000”, “\$50,000 ≤ income < \$100,000”, “\$100,000 ≤ income < \$150,000”, and “\$150,000 or more”.

Discussion on variables used in this study:

It is important to note that the distinction between subjective and objective measures is not always clear and there are no definitive criteria to classify health measures into subjective and objective. For example, The Center for Epidemiologic Studies Short Depression Scale (CES-D10) includes questions about feeling sad, fearful and hopeful for the future which can be considered as intrinsic/ subjective responses but also it has been used as highly validated tool to measure depression in many research studies and considered as an objective assessment to screen for depression.

In order to guide our thoughts and develop a rationale for the classification of subjective and objective measures we created a visual diagram (Figure 3). We divided the health variables into subjective and objective measures. The objective measures were divided further into self-reported objective measures (such as age, sex, ethnicity, marital status, education, income, number of chronic conditions, smoking and alcohol) and non-self-reported objective measures (such as body mass index, waist circumference, handgrip strength, 4-meter walk test, standing balance, forced expiratory volume in the first second (FEV1), forced vital capacity (FVC) and cognitive tests).

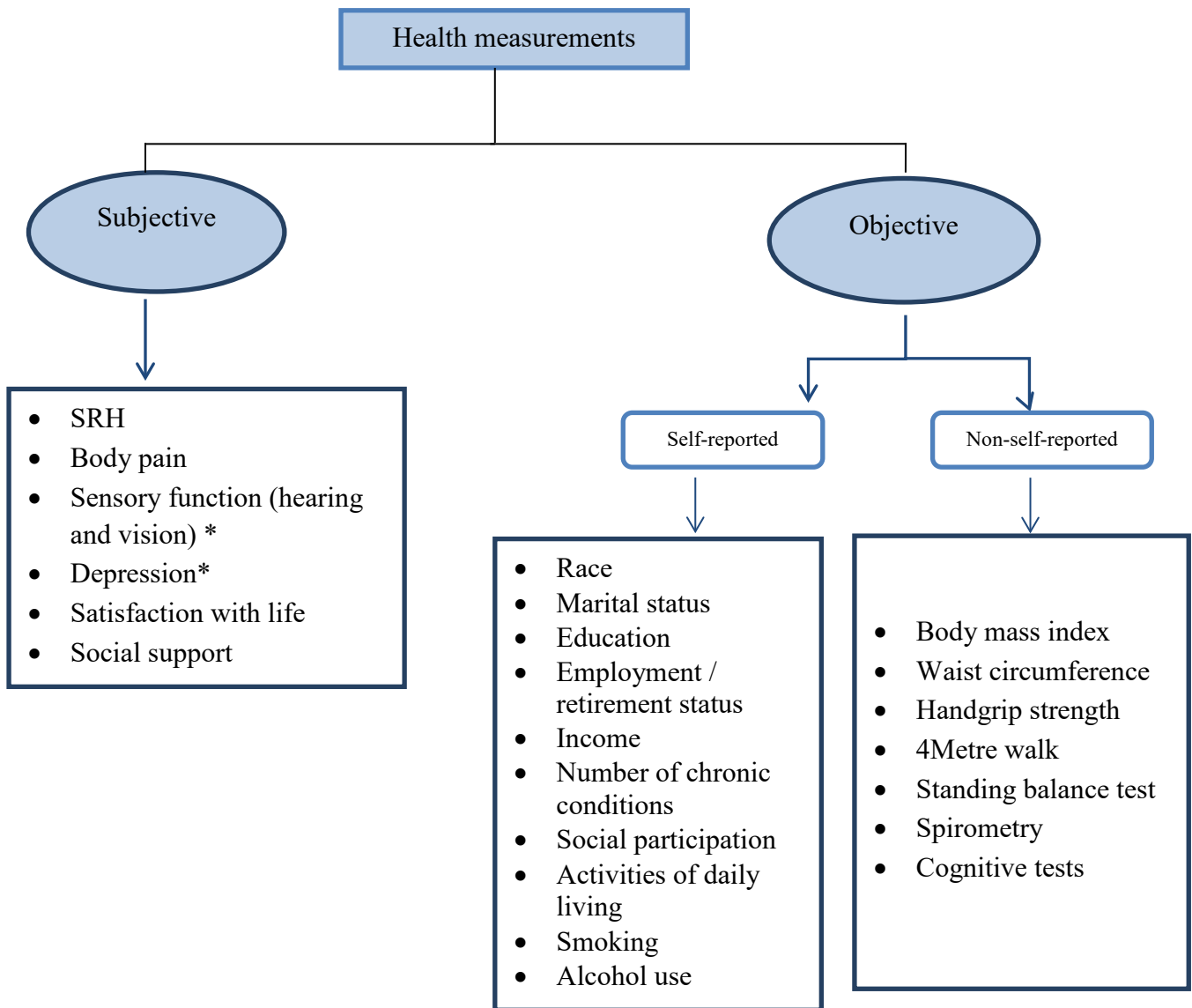


Figure 3: Subjective and Objective health measurements used in the study.

* These measures could be classified in different ways.

4.5 Statistical Analysis

Descriptive Analysis:

In terms of the analytic approach, first, we provided weighted percentages of the categorical variables and the means for the continuous variables to describe the sociodemographic and health characteristics of the participants in this study (Tables 1, 2, 3 & 4). All statistical analyses were conducted using the Stata version 14 software packages. The inflation weights provided by the CLSA were used to calculate the proportions in the Canadian population.

Regression Modelling Analysis:

Our analysis approach for each of the objectives is presented below. We determined the regression analysis based on the nature of the outcome. The analytic weights provided by the CLSA were used. These analytic weights are rescaled to determine the relationship between variables taking into account the data structure. Missing data were treated by listwise deletion by the Stata software in the regression analysis.

Objective # 1:

Determine how older adults perceive their health by different age and sex groups.

A descriptive overview of the outcome (SRH) in different age and sex groups was undertaken to understand the most common patterns and distribution of the self-rated health in older adults (Table 5).

Objective #2:

Determine the association between SRH and other self-rated measures of physical, psychological, social and health behaviours (Table 6 a, b, c & d).

First, we ran unadjusted univariable logistic regression models for SRH with each individual independent variable. These unadjusted models were used to identify the appropriate explanatory/ predictor variables in relation to variation of the outcome and were added to an adjusted ordinal logistic regression model.

An ordinal logistic regression model was chosen based on the nature of the outcome, SRH. SRH treated as an ordinal variable implies that there is an intrinsic order between the categories and the distances between each category are not the same. Therefore, ordinal logistic regression was the best model to choose. We adjusted for covariates such as sociodemographic variables based on the literature review and also as the univariable analysis had shown.

We ran the following models:

SRH= Sociodemographic variables (Unadjusted)

SRH= Physical health variables (Unadjusted)

SRH= Psycho-social health variables (Unadjusted)

SRH= Health behaviours variables. (Unadjusted)

Then, domain-adjusted models:

SRH= Sociodemographic variables. (Adjusted)

SRH= Sociodemographic variables + Physical health variables. (Adjusted)

SRH= Sociodemographic variables + Psycho-social health variables. (Adjusted)

SRH= Sociodemographic variables + Health behaviours variables. (Adjusted)

Next, the final regression model (fully adjusted model) included all appropriate variables based on the previous adjusted analyses.

SRH= Sociodemographic variables + Physical health variables + Psycho-social health variables + Health behaviours variables.

Objective #3: [Analysis on the comprehensive participants only]

Determine the association between SRH and (objective) clinical/ physical measures of health (Table 7).

As the clinical measures are available for the CLSA comprehensive participants only, we ran all previous analyses on the comprehensive participants separately (tables are available but not shown here) and then ran the following analyses:

First, unadjusted univariable models for self-rated health with each individual independent clinical measure, followed by adjusting for the sociodemographic variables. This identified the appropriate variables to add to the final model.

SRH= Clinical/ Physical measures variables (Unadjusted)

SRH= Sociodemographic variables + Clinical/ Physical measures variables (domain-adjusted)

Next, the final regression model (fully adjusted model) included all appropriate variables based on the previous adjusted analyses.

SRH= Sociodemographic variables + Physical health variables + Psychosocial health variables + Health behaviours variables + Clinical/ Physical measures variables.

N.B. This fully adjusted model had the same variables that were included in the previous fully adjusted model for all CLSA participants (tracking and comprehensive cohorts).

Chapter 5: Results

Descriptive statistics were estimated first for the sociodemographic and health characteristics of the study population, then we present the main results of the analytic models. The sampling weights provided by the CLSA, inflation and analytic weights, were used to calculate both descriptive and analytic statistics in the represented Canadian population (columns don't always add up to 100% due to missing data and/or rounding).

5.1.1 Sociodemographic Characteristics of the Cohort

Table 1. shows the sociodemographic characteristics of the cohort by age and sex. Slightly more than half of the cohort (51.5 %) are female and 68.5% are in the age group between 45 and 64 years old. 73.8% of the population are married or lived with a partner, self-identify as white (91.4%) and have a post-secondary degree (73.8%). The majority (47.1%) are working and 37.9% are completely retired. About 33.3% reported household income between 50,000\$ and 100,000\$ while 4.9% reported less than 20,000\$ per year.

Overall, there are notable differences between men and women and across the age groups. The proportions of white ethnicity increased as age increased in both men and women. The percentages of married or living with a partner are higher in men across all age groups than women. 39.5% and 41.3% of women aged 75- 85 years old are married and widowed respectively compared to 77.8% and 13.4% of men respectively at the same age group. More men reported currently working and having more income than women in general across the age groups. 11.9% of women aged 75-85 years old reported income less than \$20,000 compared to 3.1% of men at the same age group.

5.1.2 Health Characteristics of the Cohort

Table 2a. describes the health characteristics for the represented Canadian population.

With respect to the ability to perform basic activities and instrumental activities of daily living, a total of 90.2 % of the population reported no functional impairment and 0.3 % reported severe or total impairment. Having three or more chronic conditions was reported by 53.3%, two chronic conditions reported by 18.5%, one chronic condition and none were reported by 17.3% and 10.9 % respectively.

Overall, the proportions reporting no functional impairment decreased with age in both men and women, but these proportions decreased more in women compared to men across all age groups. Also, women reported having more chronic conditions than men and the proportions increased with age.

Overall, 22.8% and 37.4% reported their vision as excellent or very good respectively.

Looking specifically at the age group 75 to 85 years old, vision was rated as excellent by men (20.2%) more than women (15.6%). The reverse pattern was seen for hearing, 17.1% of women aged 75 to 85 years old rated their hearing as excellent in comparison to 13.4% of men.

Interestingly, the highest rates of serious injuries were seen in the 45-54 years age group; a total of 14.3% reported having serious injuries in the past 12 months. The majority of the cohort (56.3%) reported no pain, while 16.4% and 3.6% reported moderate and severe pain respectively. Notably, women tended to report pain more than men, 24.2% and 6.2% of the

oldest age group of women reported moderate and severe pain respectively in comparison to 15.7% and 3.7% in the same age group of men.

Table 2b. describes the psychosocial health characteristics of the study population.

Overall, women had better cognitive function scores as assessed by the Rey Auditory Verbal Learning Test, (REYI) and (REYII), while, men had better scores in the mental alteration test (MAT) than women. A total of 18.5% of the weighted population had a CESD score 10 or more which indicates having depression. Overall, women at all age groups reported higher symptoms of depression than men; the proportion was highest among women aged between 75 to 85 years (24.8%) in comparison to 16.6% of men at the same age group.

Generally, older adults reported high satisfaction with their life (44.5%). These percentages decreased with age in women; from 48.2% in those 45-54 years old to 40.5% in the older group 75-85 years old. The situation is the opposite among males, the percentages increased from 40.6% of the younger age group to reach highest number (48.0%) in the age group 65-74 years old and then decrease to 46.6% in the oldest group. Notably, the small percentages who reported extremely dissatisfied and dissatisfied were more likely to be young adults.

Social functioning was assessed by two domains: social support and social participation. The overall social support scale shows that younger age group reported having high social support more than oldest age group. In terms of the frequency of participation in a

community related activity, a total of 66.3% reported weekly participation, the percentages increased with age in both men and women.

Table 2c. describes the health behaviours of the represented population. Overall, most people were former daily smoker (37.8%) and never smokers (31.5%). A total of 8.4% are current daily smokers and this percentage decreased as age increased in both men and women.

Overall, men reported using alcohol more than women. Men aged between 75-85 years old (28.9%) reported using alcohol 6-7 times per week during the last 12 months more than of women at the same age group (15.6 %).

5.1.3 SRH of the Cohort by Different Sex and Age Groups

In order to have better understanding of the outcome self-rated health, the percentage of SRH by age and sex groups was summarized in **Table 3**. Overall, women and men have almost the same SRH across all age groups.

21.2% and 39.3% of women rated their health as excellent and very good, which is almost as equal as men who had the proportions of 20.0 % and 38.5 % respectively.

The youngest adult group reported more excellent health (23.1%) than the eldest age group (16.6%). People at the age group 65 to 74 years old reported very good health (40.8%) as 45 to 55 years old group (38.8%).

5.1.4 Clinical/ Physical Health Characteristics of the Cohort.

Table 4 describes the clinical/physical health measures of the study population.

The majority, (39.8%) reported being overweight. Overall, women reported higher percentages of healthy weight across all age categories compared to men and the reverse in the overweight level. Interestingly, women reported more risky weight groups (underweight, obese class II and obese class III) than men across all age categories.

62.3% had waist circumference (more than 80cm in women and more than 94cm in men).

A total of 38.2% and 55.8% scored the high scores in hand grip strength and standing balance respectively. A total of 37.8% scored best (lowest tertile) in the 4-meter walk test and the difference between men and women was noted mainly in the 65-74 age category, as men had better scores than women. In respect to the lung function tests (FEV1 and FVC), men scored high (better) than women in all age groups.

5.2 Main Results

5.2.1 Understanding the Prevalence and Distribution of Self-Rated Health across Sociodemographic, Physical, Psychosocial and Health Behavior Characteristics in the Population

Tables 5a & 5b provide the weighted percentages, both by column and row, of the outcome SRH in different age and sex groups and across different sociodemographic, physical, psychosocial and health behaviors variables.

Self-rated health showed a similar pattern of distribution from excellent to poor across the age groups and by men and women. In general, the proportion of men and women who reported excellent SRH decreased as age category increased, and the proportion who reported poor SRH was similar across all age categories. The majority of men and women in all age categories rated their health as very good.

SRH differed by education levels, marital status and total household income per year. The proportions of men and women who reported higher SRH levels increased as education increased. Most individuals (men and women) with less than secondary education rated their health as good (by row; 36.3% and 35.9% for women and men respectively) while the majority of individuals with post-secondary degree rated their health as very good (by row; 41.0% and 40.2% for women and men respectively).

Similar patterns of self-rated health are seen with respect to marital status and income. The proportion of those who reported excellent SRH was slightly higher among people who

were married or lived with a partner in comparison to divorced/separated, widowed, and never married. Also, as expected, when the total household income per year increased the percentage of poor SRH decreased. only 1.1% and 0.7% of women and men in the highest income category rated their health as poor, compared to 9.6% and 12.6% of women and men in the lowest income category.

In terms of the current work/ retirement status, individuals who are currently working or partially retired reported similar SRH which was relatively higher than currently not working and completely retired groups.

Regarding the number of chronic conditions, the proportion who reported excellent SRH decreased as the number of chronic conditions increased. A total of 43.9% and 35.5% of women and men who had no chronic conditions reported excellent SRH, compared to 12.1% and 10.7% of women and men who had three or more chronic conditions.

The distribution of high and low SRH differed across several psychosocial variables. Individuals with no depressive symptoms reported better SRH. A proportion of 42.5% of women and 40.6% of men who had no depressive symptoms reported very good SRH compared to 28.4% and 27.3% of women men who had depressive symptoms. Social participation showed a positive association with SRH, people who participated daily and weekly in a community related events reported higher SRH more than people who participated less in social events.

In regard to behavioural health habits, (by row) former smokers and never smokers reported higher SRH than the currently smoking population. Compared to all levels of the alcohol drinking groups, people who reported drinking alcohol 5-6 times per week reported slightly higher SRH than other groups.

In summary, examining the prevalence of self-rated health, from excellent to poor, across various key sociodemographic and health characteristics, in both men and women groups, showed its variation among different age strata; excellent SRH proportions decreased slightly as age increased. Individuals with high education, high income and those who were married or lived with a partner reported higher percentages of high SRH. Also, those having higher number of chronic conditions and reporting depressive symptoms has higher percentages of lower SRH.

In respect to health behaviours, never smoked and former smokers showed higher proportions of excellent and very good SRH in comparison to currently smokers. People who reported drinking alcohol 5-6 times per week reported slightly higher SRH than other groups who reported less alcohol drinking.

5.2.2 The Association between SRH and other Self-Reported Measures of Physical, Psychosocial and Behavioural Health Variables.

Tables 6a. 6b. 6c. & 6d. show results from the unadjusted, domain adjusted and fully adjusted ordinal regression models of high, middle and low SRH regressed on key demographic and other health variables. Note that for each table, the domain adjusted model includes all other variables in the table; the fully adjusted model includes all other variables in all of the tables. Each ordinal logistic regression model provided two odds ratios for each variable. The first OR is the odds of middle and low SRH referenced to high SRH and the second is the odds of low SRH referenced to high and middle SRH. Analytic weights provided by CLSA were used in the regression analyses to account for population weighted odds ratios.

Our model tested for the proportional odds assumption which is also called the parallel lines assumption (106-108) The assumption is that the effect of an independent variable on the ordinal dependent variable is constant or identical over all of the categories or levels of the dependent variable. So, if proportional odds/ parallel lines assumptions were not violated, the odds would be the same, if the assumption were violated, the odds would be different (106-108). For the majority of variables, the proportional odds assumption was not violated, and it can be assumed that the effect is constant across levels.

The unadjusted regression models showed significant associations between SRH and all sociodemographic, physical health, psycho-social and health behaviours variables.

Next, we controlled for the sociodemographic variables in the adjusted model for each domain; (Table 6a) adjusted for sociodemographic characteristics, (Table 6b) adjusted for sociodemographic and physical health variables, (Table 6c) adjusted for sociodemographic and psychosocial health; and (Table 6d) adjusted for sociodemographic and health behaviours.

Then, the fully adjusted model controlled for all remaining significantly associated variables at once (sociodemographic, physical, psychosocial and health behaviours). The Bonferroni correction was calculated for each domain adjusted model separately to determine the significance of the association at a new more restricted adjusted p value to account for multiple comparison model (109).

5.2.2.1 The Association between SRH and Sociodemographic Variables

The association of SRH and sociodemographic variables is shown in Table 6a. Generally, the association between SRH and sociodemographic characteristics is significant for most of the factors. With respect to age, unadjusted regression showed that 75-85 years old adults are more likely to report lower SRH in reference to the youngest age group 45-54 years old (OR 1.39; 95% CI 1.31-1.47). After adjusting for all sociodemographic variables, the odds ratio changed to 0.61; 95% CI 0.55-0.69 and decreased even more in the fully adjusted model to 0.44; 95% CI 0.37-0.51. This means that adults 75-85 years old are 56% less likely to report low SRH compared to the 45-54 years old group.

Men were more likely to report lower SRH than women. The odds of having low SRH among males is increased by 28% (95 % CI;1.23-1.34) in the domain adjusted model, and

by 69% (95% CI 1.54-1.86) in the fully adjusted model. Which means that males are 69% more likely to report low SRH compared to females after controlling for all other sociodemographic and health variables.

With respect to education, individuals with less education were more likely to report lower SRH compared to those who had a post-secondary degree.

Marital status was statistically significant in the unadjusted model, but it showed no statistically significant association in the adjusted model. Therefore, it was not included in the final model. Generally, ethnicity showed no significant association, while individuals who were completely retired, having \$20,000 or more but less than \$50,000 in total annual income showed significant association with lower SRH in the fully adjusted model after controlling for sociodemographic variables and other health variables.

5.2.2.2 The Association between SRH and Physical Health Variables

The association between SRH and physical health measures is shown in table 6b. All physical health variables showed a significant association with SRH in the unadjusted model. After adjusting for sociodemographic variables, reporting serious injuries in the last 12 months showed non-significant association and thus, it was not included in the final model.

In the fully adjusted model, the odds ratios of all five physical measures (Functional impairment, number of chronic conditions, self-reported vision, self-reported hearing and pain), remained statistically significant after controlling for all other variables. A dose-

response relationship was seen between SRH and the levels of the independent variable. For example, as the degree of functional impairment increased from mild to severe, the odds of low SRH increased.

In reference to individuals with no chronic conditions the odds of low SRH among people with three or more chronic conditions was 9.27, 95% CI; 8.06-10.65 in the unadjusted model. Then, it became 5.40, 95% CI; 4.72-6.18 in the domain adjusted model, and finally 4.52, 95% CI; 3.90-5.24 in the final, fully adjusted model. Notably, the odds ratios increased as the number of chronic conditions increased, from 1.44 among individuals with one chronic condition to 4.52 among individuals with three or more chronic conditions. Detailed estimates are provided in Table 6b.

5.2.2.3 The Association between SRH and Psycho-Social Health Variables

The association between SRH and psycho-social health showed in table 6c. All psycho-social variables showed significant association with SRH in the unadjusted model. After adjusting for sociodemographic variables, REYII test of cognitive function showed non-significant association and thus, it was not included in the final model.

In the fully adjusted model, the odds ratios of all psycho-social measures; REYI cognitive test, MAT, depression, satisfaction with life (except the overall social support scale), remained statistically significant after controlling for all other variables. These associations showed a dose-response relationship between SRH and the levels of the independent

variable. For example, as the level of satisfaction with life decreased from satisfied to extremely dissatisfied, the odds of low SRH increased.

5.2.2.4 The Association between SRH and Health Behaviours Variables

Table 6 d. shows the association between SRH and health behaviours. The unadjusted model showed that smoking was statistically significant associated with low SRH. Either being former smoker or current smoker increased the odds of low SRH. However, after controlling for all sociodemographic and all health variables this association became significant only for the current smoker group (OR 1.58, 95% CI;1.43-1.74) referenced to never smoked group.

Individuals who reported drinking alcohol once a month or less and those who never drink alcohol were more likely to report low SRH (OR 1.47, 95% CI;1.35-1.59 and OR 1.69, 95% CI; 1.49-1.93) respectively, referenced to people who reported drinking alcohol 2-3 times a week.

5.2.3 The Association between SRH and Clinical Health Measures

Table 7 shows the unadjusted, domain adjusted and fully adjusted logistic regression models of the association between SRH and the objectively assessed clinical measures. These analyses were conducted on the comprehensive group only. The physical clinical measures are adjusted for all measures previously reported in the fully adjusted model (but not shown in the table).

All physical measures showed a significant association at first in the unadjusted model. After adjusting for the sociodemographic variables, all clinical measures remained statistically significant except the forced vital capacity and thus it was not included in the final model.

Our final model showed that obesity class I, risky weight group (underweight, obesity class II, III) and high waist circumference are all associated with low SRH. Moreover, individuals with poor results of 4-meter walk, standing balance, FEV1 are more likely to report low SRH. Only the handgrip strength did not show a significant association with SRH after controlling for all sociodemographic and other health variables.

Table 1. Sociodemographic characteristics of CLSA baseline wave (2010-2015) participants (n=51,338), weighted to represent the Canadian population aged 45-85 years old (10-year age and sex categories)

Age (in Years)	(45-54)		(55-64)		(65 -74)		(75-85)		Total
(Row %)	37.6		30.9		19.2		12.4		100
Sex	Women	Men	Women	Men	Women	Men	Women	Men	Total
(Row %)	18.9	18.7	15.8	15.1	9.9	9.2	6.9	5.5	100
SOCIODEMOGRAPHIC CHARACTERISTICS									
Cultural/Racial background (Col %)									
White	88.5	89.1	91.9	91.3	94.5	93.0	95.5	94.0	91.4
Aboriginal	5.0	3.3	3.8	3.4	2.5	2.2	2.1	1.6	3.4
Visible minority	5.3	6.5	3.1	4.1	2.2	3.9	1.8	3.5	4.2
Missing	1.2	1.1	1.2	1.3	0.8	0.8	0.6	0.8	1.1
Marital status (Col %)									
Married/partnered	76.6	80.7	72.0	81.4	60.7	82.5	39.5	77.8	73.8
Divorced/Separated	11.8	7.8	13.8	8.7	16.9	8.5	13.3	5.5	10.8
Widowed	1.4	0.6	5.3	1.9	16.0	4.4	41.3	13.4	7.1
Never married/single	10.2	10.9	9.0	8.0	6.4	4.5	6.0	3.4	8.2
Missing	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Education (Col %)									
Less than secondary	2.7	3.6	5.0	4.9	10.4	8.1	19.1	15.0	6.6
Secondary graduated	10.6	9.6	14.8	11.7	15.1	10.3	14.0	10.5	11.9
Some postsecondary	6.3	6.3	8.0	7.7	8.1	7.2	8.9	8.0	7.3
Postsecondary degree	80.2	80.3	71.9	75.3	66.0	74.0	57.1	65.7	73.8
Missing	0.1	0.2	0.4	0.4	0.4	0.4	0.9	0.7	0.4
Work/ retirement status (Col %)									
Currently working	79.4	85.7	40.6	48.8	6.9	12.5	1.9	4.2	47.1
Currently not working	9.8	7.4	5.2	3.9	1.8	0.5	1.8	0.1	5.0
Completely retired	6.5	3.9	40.3	31.3	79.3	66.7	90.0	86.3	37.9
Partially retired	3.6	2.9	13.6	15.9	11.6	20.4	4.1	9.3	9.6
Missing	0.7	0.1	0.4	0.0	0.6	0.0	2.3	0.1	0.4
Annual household income (Col %)									
Less than \$20,000	3.4	3.4	5.5	3.8	8.5	4.1	11.9	3.1	4.9
\$20,000 ≤ income < \$50,000	11.7	10.1	23.5	17.3	37.2	28.6	43.3	33.3	21.5
\$50,000 ≤ income < \$100,000	30.3	29.1	36.1	36.7	33.6	42.5	23.1	38.9	33.3
\$100,000 ≤ income < \$150,000	25.7	26.7	17.6	20.1	7.3	12.9	5.0	12.7	18.6
\$150,000 or more	24.4	27.9	11.1	18.2	2.7	8.0	2.1	5.3	15.8
Missing	4.6	2.9	6.2	3.9	10.7	4.0	14.6	6.7	5.8

Table 2a. Physical health characteristics of CLSA baseline wave (2010-2015) participants (n=51,338), weighted to represent the Canadian population aged 45-85 years old (10-year age and sex categories)

Age	45-54		55-64		65-74		75-85		Total
Sex	women	men	women	men	women	men	women	men	
PHYSICAL HEALTH CHARACTERISTICS									
Daily living activities (%)									
No functional impairment	91.8	96.5	88.6	95.0	84.9	92.9	68.6	86.1	90.2
Mild functional impairment	6.6	2.7	9.2	3.7	12.8	5.0	26.6	10.1	7.9
Moderate functional impairment	0.7	0.3	1.2	0.4	0.7	0.7	2.1	2.0	0.8
Severe functional impairment	0.2	0.0	0.2	0.1	0.3	0.1	0.4	0.0	0.2
Total functional impairment	0.0	0.2	0.1	0.0	0.2	0.1	0.2	0.3	0.1
Missing	0.7	0.3	0.7	0.8	1.0	1.2	2.2	1.4	0.9
Number of chronic conditions (%)									
Reported no chronic conditions	14.1	20.3	7.8	13.3	3.9	6.3	0.9	2.5	10.9
Reported one chronic condition	21.1	26.8	14.5	21.2	8.2	14.1	4.3	7.5	17.3
Reported two chronic conditions	21.7	22.0	17.7	20.3	14.1	17.8	8.9	14.8	18.5
Reported three or more chronic conditions	43.1	30.9	60.0	45.3	73.8	61.8	86.0	75.2	53.3
Missing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Self-reported Vision (%)									
Excellent	23.6	24.3	23.1	24.1	20.2	25.0	15.6	20.2	22.8
Very good	37.7	36.4	38.7	38.3	38.7	38.2	34.1	34.9	37.4
Good	30.5	32.1	30.3	30.7	33.0	30.1	37.8	34.8	31.7
Fair	6.7	6.4	6.2	5.5	7.1	5.4	9.6	8.3	6.6
Poor	1.6	0.8	1.7	1.4	1.0	1.3	2.8	1.6	1.4
Missing	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.3	0.1
Self-reported Hearing (%)									
Excellent	34.2	24.3	31.0	20.5	25.7	18.6	17.1	13.4	25.2
Very good	34.7	34.8	34.9	30.4	34.9	29.1	31.1	25.7	32.9
Good	25.6	30.7	27.5	34.8	30.3	36.1	37.9	39.7	31.3
Fair	4.8	8.6	5.8	12.2	7.6	14.0	12.0	17.5	9.1
Poor	0.7	1.5	0.7	2.0	1.3	2.1	1.9	3.6	1.5
Missing	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Reported serious injury in the last 12 months (%)									
Yes	16.3	18.6	13.7	14.9	11.0	11.1	9.8	8.9	14.3
No	83.6	81.1	86.2	85.0	88.9	88.7	90.1	91.1	85.6
Missing	0.0	0.2	0.0	0.1	0.1	0.2	0.1	0.0	0.1
Pain (%)									
No pain	56.0	63.2	53.2	58.3	49.8	60.7	45.0	55.1	56.3
Mild	17.3	14.5	15.4	14.8	14.7	14.6	13.7	13.6	15.1
Moderate	15.3	11.1	19.4	15.2	23.0	14.2	24.2	15.7	16.4
Severe	2.9	2.6	3.9	3.5	5.0	2.9	6.2	3.7	3.6
Missing	8.5	8.7	8.0	8.2	7.5	7.6	10.8	11.9	8.6

Table 2b. Psychosocial health characteristics of CLSA baseline wave (2010-2015) participants (n=51,338), weighted to represent the Canadian population aged 45-85 years old (10-year age and sex categories)

Age	45-54		55-64		65 -74		75-85		Total
Sex	women	men	women	men	women	men	women	men	
PSYCHOSOCIAL HEALTH CHARACTERISTICS									
Cognition (%)									
REYI score (Tertiles):									
High	52.2	34.6	45.7	28.4	37.7	21.5	25.0	11.3	35.9
Middle	32.5	40.6	33.0	39.7	34.1	35.5	33.7	27.5	35.5
Low	9.4	19.7	13.5	25.3	19.8	34.7	34.6	55.0	22.0
Missing	5.9	5.1	7.8	6.6	8.5	8.4	6.8	6.2	6.7
REYII score (Tertiles):									
High	44.1	24.5	36.4	19.6	31.6	14.6	19.0	8.1	27.8
Middle	33.2	36.8	33.3	33.8	33.2	27.4	26.2	17.8	32.1
Low	16.9	32.7	22.0	39.4	27.6	48.4	46.1	65.5	32.7
Missing	5.9	6.1	8.3	7.2	7.6	9.6	8.7	8.6	7.3
Mental Alteration test score (Tertiles):									
High	35.5	40.7	26.0	33.2	17.2	25.6	10.1	15.4	29.1
Middle	37.9	32.9	41.5	34.3	38.9	35.4	30.3	31.0	35.9
Low	18.7	19.1	21.5	21.6	30.7	26.8	46.9	41.5	24.8
Missing	7.9	7.3	11.1	10.9	13.2	12.1	12.7	12.1	10.2
Depression (%)									
CESD score \geq 10	19.6	16.1	21.0	15.78	21.0	14.48	24.8	16.6	18.5
Missing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Satisfaction with life (%)									
Extremely Dissatisfied	1.6	1.7	2.1	1.5	1.3	0.5	0.6	0.4	1.4
Dissatisfied	4.3	4.3	3.7	3.7	2.7	2.1	2.5	1.8	3.5
Slightly Dissatisfied	6.1	8.0	6.5	6.8	5.6	4.8	5.9	3.9	6.3
Neutral	1.6	1.7	1.9	2.3	2.2	1.4	2.0	1.8	1.9
Slightly satisfied	11.8	14.3	13.5	12.4	13.4	10.9	13.8	11.7	12.8
Satisfied	25.2	28.5	27.1	27.4	29.1	30.7	32.0	31.9	28.2
Extremely satisfied	48.2	40.6	44.2	44.5	43.8	48.0	40.5	46.6	44.5
Missing	1.2	0.8	1.1	1.5	1.8	1.5	2.8	1.8	1.4
Social support (Tertiles)									
High	35.5	34.7	33.5	37.0	32.8	37.0	24.6	31.4	34.2
Medium	35.3	31.8	33.5	30.1	33.6	30.8	30.8	30.8	32.4
Low	27.3	31.1	30.4	29.1	28.7	26.8	33.2	27.8	29.3
Missing	1.9	2.4	2.6	3.8	4.9	5.3	11.4	10.0	4.1
Social participation (%)									
Daily	16.5	13.7	18.6	13.2	18.0	17.8	14.7	15.2	15.9
Weekly	67.3	66.6	65.0	63.9	69.0	64.3	70.0	66.4	66.3
Monthly	13.5	16.0	12.8	18.8	10.0	13.1	10.0	12.7	14.0
Yearly or Never	2.0	3.0	2.5	3.3	2.4	3.9	3.8	4.1	2.9
Missing	0.7	0.7	1.1	0.8	0.7	0.9	1.5	1.7	0.9

Table 2c. Health behavior characteristics of CLSA baseline wave (2010-2015) participants(n=51,338), weighted to represent the Canadian population aged 45-85 years old (10-year age and sex categories)

Age	45-54		55-64		65 -74		75-85		Total
Sex	women	men	women	men	women	men	women	men	
HEALTH BEHAVIOURS CHARACTERISTICS									
Smoking (%)									
Daily smoker	10.7	9.7	9.1	10.1	6.6	5.6	4.2	3.0	8.4
Occasional smoker	2.3	2.2	2.0	2.5	1.2	1.0	0.9	0.6	1.8
Former daily smoker	31.8	28.6	36.5	43.3	36.7	54.1	35.5	56.1	37.8
Former occasional smoker	20.0	23.9	18.7	19.5	21.0	16.8	18.3	17.7	20.0
Never smoked	34.7	35.2	33.4	24.3	34.0	22.0	40.2	21.8	31.5
Missing	0.4	0.3	0.4	0.4	0.5	0.5	0.9	0.8	0.5
Alcohol use (during the past 12 months) (%)									
6-7 times a week	8.3	11.7	11.5	17.4	15.1	26.6	15.6	28.9	14.8
5-4 times a week	7.8	10.8	8.2	11.9	7.7	9.3	5.1	7.3	8.9
2-3 times a week	23.2	24.5	19.1	24.0	14.1	18.7	12.0	15.6	20.4
4-2 times a month	26.3	25.4	21.7	20.2	20.1	17.4	16.4	15.9	21.8
Once a month or less	23.0	17.1	25.7	13.7	27.0	14.6	27.7	16.6	20.5
Never drink	9.5	8.9	11.1	10.8	11.5	11.1	16.1	12.9	10.8
Missing	2.0	1.7	2.8	2.0	4.6	2.3	7.2	2.8	2.8

Table 3. Self-Rated Health of CLSA baseline wave (2010-2015) participants (n=51,338), weighted to represent the Canadian population aged 45-85 years old (10-year age and sex categories).

Sex	Women					Men				
Age /SRH (%)	45-54	55-64	65 -74	75-85	Total	45-54	55-64	65 -74	75-85	Total
Excellent	23.1	21.6	20.1	16.6	21.2	21.2	18.6	21.6	17.5	20.0
Very Good	39.8	39.4	40.8	35.9	39.3	38.7	39.8	38.1	35.2	38.5
Good	27.1	26.9	27.0	32.8	27.8	29.9	30.1	29.3	33.1	30.2
Fair	7.8	9.1	9.3	12.4	9.1	8.2	8.9	9.0	11.3	8.9
Poor	2.2	3.0	2.7	2.2	2.5	1.9	2.4	1.8	2.6	2.1
Missing	0.0	0.0	0.1	0.2	0.1	0.0	0.2	0.1	0.2	0.1

Table 4. Clinical/ physical health measures of CLSA baseline wave (2010-2015) comprehensive cohort (n=30,097), weighted to represent the Canadian population aged 45-85 years old (10-year age and sex categories).

Age	45-54		55-64		65 -74		75-85		Total
Sex	women	men	women	men	women	men	women	men	
CLINICAL MEASURES									
Body mass index (kg/m²) (%)									
Healthy weight	44.7	26.1	35.3	24.1	31.0	22.8	34.7	28.7	31.7
Overweight	30.4	45.7	35.2	44.1	37.1	47.6	36.9	49.5	39.8
Obese - Class I	13.3	19.9	16.9	21.9	19.2	21.4	18.1	17.2	18.2
Risky weight group	11.4	8.1	12.3	9.4	12.2	7.9	9.6	4.2	9.9
Missing	0.3	0.3	0.3	0.5	0.5	0.3	0.8	0.4	0.4
Waist circumference (cm) (%)									
<=80 in women & <=94 in men	45.4	43.7	32.2	36.2	28.3	29.8	27.1	30.0	37.0
>80 in women & >94 in men	54.2	55.8	66.8	62.9	70.7	69.1	71.9	69.0	62.3
Missing	0.4	0.5	1.0	1.0	1.1	1.1	1.0	1.0	0.8
Handgrip strength (kg) (tertiles)									
High	55.2	55.1	35.4	38.5	17.8	20.7	6.2	7.0	38.2
Medium	26.9	28.4	34.5	34.2	34.1	36.4	21.1	23.9	30.4
Low	12.1	12.7	21.3	22.6	35.8	37.1	60.0	62.4	24.8
Missing	5.7	3.9	8.9	4.8	12.4	5.7	12.7	6.7	6.7
Standing Balance (sec.) (tertiles)									
High	75.5	79.5	54.4	59.5	27.3	35.6	7.6	10.0	55.8
Medium	13.2	10.6	20.3	17.3	23.2	22.2	11.5	16.0	16.0
Low	9.6	7.9	21.5	19.7	43.7	38.0	64.4	62.5	23.9
Missing	1.8	2.0	3.9	3.5	5.9	4.2	16.6	11.6	4.4
4Metre walk (sec.) (tertiles)									
High	17.9	17.0	25.7	22.9	39.7	31.9	61.6	51.3	27.1
Medium	34.6	36.4	34.5	35.7	31.6	33.3	24.3	30.1	33.9
Low	46.8	45.9	38.5	40.1	27.2	33.1	11.7	17.1	37.8
Missing	0.7	0.7	1.3	1.3	1.6	1.7	2.4	1.4	1.2
FEV1 (L) (tertiles)									
High	19.2	68.1	5.4	56.0	0.7	33.5	0.0	12.5	31.2
Medium	47.4	10.2	37.8	17.6	19.0	26.9	3.8	25.6	25.4
Low	17.9	2.0	38.1	4.1	56.5	12.0	64.3	23.7	21.6
Missing	15.5	19.6	18.8	22.3	23.8	27.7	31.9	38.1	21.8
FVC (L) (tertiles)									
High	16.0	68.1	4.4	57.3	1.1	35.4	0.2	15.5	31.0
Medium	48.2	10.9	36.2	17.6	18.0	28.2	4.3	27.9	25.7
Low	20.3	1.4	40.5	2.8	57.1	8.8	63.6	18.5	21.6
Missing	15.5	19.6	18.8	22.3	23.8	27.7	31.9	38.1	21.8

Table 5a. Self-rated health across different sociodemographic characteristics in CLSA baseline wave (2010-2015) participants (n=51,338), weighted to represent the Canadian population aged 45-85 years old (5-SRH levels and sex categories).

	Women					Men				
	Excellent	V. Good	Good	fair	Poor	Excellent	V. Good	Good	Fair	Poor
Age (n)%	By Column									
45-54	40.1	36.8	35.8	31.6	33.6	41.0	38.0	39.2	34.8	34.7
55-64	31.4	30.9	29.4	30.5	33.1	29.2	31.8	31.2	31.4	36.1
65 -74	18.3	19.8	19.2	19.2	20.8	20.1	19.5	17.9	19.3	15.9
75-85	10.2	12.5	15.6	18.7	12.5	9.6	10.7	11.8	14.5	13.3
	By Row									
45-54	22.3	39.7	27.7	7.9	2.4	20.8	38.0	30.9	8.2	2.1
55-64	20.9	39.9	27.2	9.1	2.8	18.3	39.3	30.4	9.1	2.7
65 -74	19.3	40.5	28.2	9.1	2.8	20.7	39.5	28.6	9.2	2.0
75-85	15.4	36.6	32.7	12.7	2.4	16.8	36.8	31.8	11.6	2.8
Education %	By Column									
Less than secondary	4.3	5.6	9.9	14.5	17.6	3.8	5.4	8.0	11.7	18.2
Secondary graduated	11.4	13.6	15.2	13.7	20.5	7.1	10.4	13.5	15.8	16.2
Some post-secondary	7.3	7.4	8.0	8.9	10.3	6.6	6.5	8.3	8.4	10.4
Post-secondary degree	76.6	73.2	66.7	62.3	49.7	82.3	77.5	69.8	63.3	54.7
	By Row									
Less than secondary	11.4	29.0	36.3	17.2	5.9	11.0	31.0	35.9	15.7	6.3
Secondary graduated	16.9	39.1	31.1	9.0	3.9	12.3	35.5	36.3	12.6	3.4
Some post-secondary	19.1	37.8	29.0	10.5	3.4	17.6	34.0	34.6	10.3	3.4
Post-secondary degree	22.2	41.0	26.8	8.1	1.8	21.7	40.2	28.6	7.7	1.7
Marital status %	By Column									
Married/partnered	72.1	70.6	66.8	60.4	55.9	83.7	84.2	80.1	71.8	68.1
Divorced/Separated	11.7	11.8	12.3	15.0	21.3	7.2	6.8	8.6	10.0	15.1
Widowed	9.1	10.3	12.2	13.8	13.3	2.9	2.8	3.3	4.0	3.9
Never married	7.1	7.3	8.7	10.8	9.5	6.1	6.3	8.0	13.9	12.9
	By Row									
Married/partnered	21.5	40.7	27.6	8.0	2.1	20.1	39.9	29.9	8.0	2.0
Divorced/Separated	19.1	37.4	28.0	11.0	4.5	17.8	33.0	33.0	11.5	4.5
Widowed	16.9	37.0	31.4	11.4	3.1	18.3	34.3	32.6	11.8	3.0
Never married	18.1	35.9	30.6	12.3	3.1	15.7	32.0	31.9	16.5	4.0
Annual household income %	By Column									
Less than \$20,000	3.2	4.3	7.3	13.9	23.1	1.6	2.0	3.8	9.2	18.9
\$20,000 ≤ income < \$50,000	19.6	22.8	29.0	33.8	34.8	13.6	16.2	21.7	28.9	35.6
\$50,000 ≤ income < \$100,000	32.7	34.1	33.3	27.3	19.8	35.3	37.3	35.4	33.4	29.0
\$100,000 ≤ income < \$150,000	19.9	18.8	14.0	11.0	7.2	21.1	21.7	20.7	13.6	6.9
\$150,000 or more	18.6	14.1	8.8	5.0	5.1	25.4	19.5	14.3	10.0	5.3
	By Row									

	Women					Men				
	Excellent	V. Good	Good	fair	Poor	Excellent	V. Good	Good	fair	Poor
Less than \$20,000	10.3	27.0	32.9	20.2	9.6	8.7	22.3	32.9	23.6	12.6
\$20,000 ≤ income < \$50,000	15.8	35.7	32.6	12.3	3.6	14.0	32.9	34.8	13.7	4.4
\$50,000 ≤ income < \$100,000	20.5	41.3	28.9	7.6	1.6	19.3	40.2	30.1	8.4	1.9
\$100,000 ≤ income < \$150,000	24.4	44.7	23.8	6.0	1.1	20.5	41.4	31.2	6.1	0.8
\$150,000 or more	30.5	44.7	20.1	3.7	1.1	27.9	42.1	24.3	5.0	0.7
Work/ retirement status %										
By Column										
Currently working	48.8	45.9	41.9	29.1	15.6	56.2	52.7	50.0	35.7	19.2
Currently not working	4.3	4.3	6.4	10.7	17.6	2.3	3.3	4.5	9.3	14.0
Completely retired	37.0	40.4	44.5	52.8	61.5	29.7	32.7	35.2	44.4	56.7
Partially retired	9.9	9.4	7.2	7.4	5.3	11.8	11.4	10.3	10.6	10.1
By Row										
Currently working	23.2	42.2	27.5	6.2	0.9	21.9	40.5	30.2	6.4	0.9
Currently not working	15.4	29.2	30.9	16.7	7.8	10.7	29.6	32.3	19.7	7.7
Completely retired	17.8	37.6	29.5	11.3	3.7	16.8	36.5	31.0	11.6	3.8
Partially retired	23.6	43.3	23.7	7.9	1.6	21.0	39.9	28.3	8.7	2.1

Table 5b. Self-rated health across different health characteristics in CLSA baseline wave (2010-2015) participants (n=51,338), weighted to represent the Canadian population aged 45-85 years old (5-SRH levels and sex categories).

	Women					Men				
	Excellent	V. Good	Good	fair	Poor	Excellent	V. Good	Good	Fair	Poor
Number of chronic conditions %										
By Column										
Reported no chronic conditions	18.2	8.8	4.0	1.5	0.0	24.4	15.8	7.7	2.9	0.4
Reported one chronic condition	23.9	16.5	8.8	4.7	1.0	28.4	22.2	18.2	8.2	2.8
Reported two chronic conditions	22.4	19.6	14.4	8.2	4.7	22.0	21.8	19.5	12.0	7.2
Reported three or more chronic conditions	35.6	55.2	72.9	85.6	94.3	25.2	40.3	54.7	76.9	89.7
By Row										
Reported no chronic conditions	43.9	41.1	13.3	1.6	0.0	35.5	45.1	17.3	2.0	0.1
Reported one chronic condition	34.0	45.3	17.4	3.0	0.2	27.2	41.8	27.0	3.6	0.3
Reported two chronic conditions	26.5	44.9	23.5	4.3	0.7	21.7	42.2	29.8	5.5	0.8
Reported three or more chronic conditions	12.1	36.4	34.4	13.0	4.1	10.7	33.6	36.0	15.0	4.6
Depression (CESD score \geq 10) %										
By Column										
Yes	9.4	15.1	25.5	46.4	63.5	7.3	11.2	18.6	34.5	53.8
No	90.6	84.9	74.5	53.6	36.5	92.7	88.8	81.5	65.5	46.2
By Row										
Yes	9.1	28.4	34.4	20.2	7.9	9.0	27.3	35.8	19.8	8.0
No	23.4	42.5	26.7	6.2	1.2	21.6	40.6	29.4	7.0	1.3
Social participation %										
By Column										
Daily	22.8	16.7	14.1	13.5	10.3	18.6	15.9	13.4	11.3	9.1
Weekly	68.0	70.9	68.4	61.4	58.2	66.9	68.5	63.1	58.0	50.9
Monthly	7.8	11.2	14.6	19.2	21.2	12.6	13.7	19.8	22.0	27.8
Yearly or Never	1.4	1.2	3.0	5.9	10.2	2.0	2.0	3.8	8.7	12.2
By Row										
Daily	27.8	39.6	23.7	7.3	1.6	24.1	40.7	26.9	6.7	1.4
Weekly	20.3	41.0	28.2	8.2	2.2	20.1	40.6	29.4	8.0	1.8
Monthly	12.8	35.6	33.0	14.0	4.4	15.0	32.2	36.7	12.0	4.0
Yearly or Never	12.1	20.0	34.7	22.2	11.0	11.3	23.1	33.9	23.1	8.5
Smoking %										
By Column										
Never smoked	37.8	35.9	33.9	31.6	27.0	34.1	28.8	23.8	20.9	19.3
Former smoker	55.6	55.3	52.9	51.7	49.8	60.5	62.5	63.6	59.0	56.2
Currently smoker	6.6	8.8	13.2	16.7	23.2	5.4	8.7	12.6	20.2	24.5
By Row										

	Women					Men				
	Excellent	V. Good	Good	fair	Poor	Excellent	V. Good	Good	fair	Poor
Never smoked	22.0	40.4	27.4	8.2	2.0	24.4	40.6	26.4	6.9	1.7
Former smoker	20.9	40.3	27.6	8.7	2.4	19.1	38.9	31.2	8.6	2.1
Currently smoker	12.6	32.6	34.9	14.2	5.6	10.0	31.4	36.0	17.1	5.4
Alcohol %	By Column									
6-7 times a week	16.2	12.5	8.2	6.3	10.3	20.8	18.5	17.9	15.4	12.3
4-5 times a week	10.6	8.8	6.1	3.0	3.3	12.0	11.9	9.2	6.7	2.3
2-3 times a week	22.4	21.0	17.4	11.0	8.6	24.6	25.0	22.7	14.4	11.8
4-2 times a month	22.6	24.3	22.6	21.5	12.6	21.5	21.5	22.1	22.0	11.8
Once a month or less	20.4	24.1	31.8	35.3	39.4	11.8	13.7	17.8	25.8	34.3
Never drink	7.8	9.2	14.0	22.8	25.7	9.4	9.4	10.4	15.7	27.6
	By Row									
6-7 times a week	29.0	43.6	20.2	5.0	2.3	22.2	38.8	29.5	7.6	1.6
4-5 times a week	28.0	45.2	22.2	3.6	1.1	22.6	44.1	26.9	5.8	0.5
2-3 times a week	23.9	43.9	25.8	5.3	1.1	21.0	42.0	30.0	5.7	1.2
4-2 times a month	20.1	42.2	27.7	8.5	1.4	19.6	38.6	31.2	9.2	1.3
Once a month or less	15.5	35.5	33.2	11.9	3.7	14.3	32.8	33.4	14.4	5.0
Never drink	13.3	30.6	33.2	17.4	5.5	17.2	34.0	29.5	13.3	6.0

Table 6a. Unadjusted, domain-adjusted and fully-adjusted ordinal logistic regression models of SRH by sociodemographic and health characteristics (CLSA baseline wave, 2010-2015, n=51,338)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& low vs. high SRH	Low vs. high & middle SRH	Middle& low vs. high SRH	Low vs. high & middle SRH	Middle& low vs. high SRH	Low vs. high & middle SRH
Sociodemographic variables						
Age						
45-54	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
55-64	1.08 (1.03-1.13)	1.15 (1.08-1.24)	0.87 (0.82-0.92)	0.87 (0.82-0.92)	0.75 (0.70-0.80)	0.75 (0.70-0.80)
65-74	1.07 (1.01-1.12)	1.07 (1.01-1.12)	0.68 (0.63-0.73)	0.54 (0.49-0.60)	0.53 (0.48-0.58)	0.53 (0.48-0.58)
75-85	1.39 (1.31-1.47)	1.39 (1.31-1.47)	0.75 (0.69-0.82)	0.61 (0.55-0.69)	0.44 (0.40-0.49)	0.44 (0.40-0.49)
Sex						
Female	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Male	1.11 (1.07-1.16)	1.02+ (0.96-1.08)	1.28 (1.23-1.34)	1.28 (1.23-1.34)	1.54 (1.45-1.63)	1.69 (1.54-1.86)
Racial background						
White	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Aboriginal	1.46 (1.32-1.62)	1.72 (1.50-1.97)	1.38 (1.24-1.53)	1.38 (1.24-1.53)	1.13+ (1.00-1.29)	1.13+ (1.00-1.29)
Visible minority	1.45 (1.31-1.61)	1.12+ (0.96-1.31)	1.42 (1.27-1.59)	1.06+ (0.89-1.26)	1.25++ (1.07-1.45)	0.93+ (0.74-1.18)
Education						
Post-secondary degree	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Some Post-secondary	1.36 (1.26-1.47)	1.55 (1.38-1.72)	1.22 (1.13-1.32)	1.22 (1.13-1.32)	1.05+ (0.95-1.16)	1.05+ (0.95-1.16)
Secondary graduated	1.50 (1.42-1.60)	1.50 (1.42-1.60)	1.26 (1.18-1.35)	1.26 (1.18-1.35)	1.16 (1.07-1.26)	1.16 (1.07-1.26)
Less than secondary	2.49 (2.31-2.69)	2.94 (2.68-3.22)	1.74 (1.60-1.88)	1.74 (1.60-1.88)	1.37 (1.23-1.52)	1.37 (1.23-1.52)
Marital status						
Married/partnered	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	-	-
Divorced/Separated	1.37 (1.29-1.45)	1.71 (1.58-1.86)	0.97+ (0.90-1.04)	1.07 + (0.97-1.18)	-	-
Widowed	1.40 (1.32-1.49)	1.55 (1.41-1.70)	0.97 + (0.90-1.04)	0.97 + (0.90-1.04)	-	-
Single/ Never married	1.68 (1.56-1.80)	1.96 (1.77-2.16)	1.12 ++ (1.03-1.21)	1.12++ (1.03-1.21)	-	-

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& low vs. high SRH	Low vs. high &middle SRH	Middle& low vs. high SRH	Low vs. high &middle SRH	Middle& low vs. high SRH	Low vs. high &middle SRH
Sociodemographic variables						
Annual household income						
Less than \$20,000	3.02 (2.76-3.30)	4.36 (3.93-4.84)	2.48 (2.25-2.74)	3.11 (2.77-3.49)	1.13+ (1.00-1.28)	1.13+ (1.00-1.28)
\$20,000 ≤ income < \$50,000	1.55 (1.47-1.63)	1.86 (1.72-2.01)	1.50 (1.42-1.58)	1.73 (1.59-1.87)	1.11 (1.04-1.19)	1.11 (1.04-1.19)
\$50,000 ≤ income < \$100,000	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
\$100,000 ≤ income < \$150,000	0.80 (0.75-0.85)	0.69 (0.61-0.77)	0.80 (0.75-0.85)	0.80 (0.75-0.85)	0.99+ (0.92-1.07)	0.99+ (0.92-1.07)
\$150,000 or more	0.56 (0.52-0.60)	0.48 (0.42-0.54)	0.56 (0.52-0.60)	0.56 (0.52-0.60)	0.88++ (0.81-0.96)	0.88++ (0.81-0.96)
Work/ retirement						
Currently working	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Currently not working	2.38 (2.17-2.62)	4.68 (4.17-5.26)	1.77 (1.60-1.97)	3.16 (2.78-3.60)	1.20++ (1.06-1.36)	1.20++ (1.06-1.36)
Completely retired	1.44 (1.38-1.51)	2.14 (1.99-2.30)	1.30 (1.22-1.39)	2.02 (1.83-2.23)	1.23 (1.14-1.33)	1.23 (1.14-1.33)
Partially retired	1.08 (1.01-1.15)	1.39 (1.24-1.56)	1.04+ (0.96-1.12)	1.36 (1.19-1.55)	1.11++ (1.01-1.21)	1.11++ (1.01-1.21)

a (The Bonferroni adjusted p value <0.007), [n= 47,216 (listwise deletion)]

b (The Bonferroni adjusted p value <0.003), [n= 36,659 (listwise deletion)]

Bold (statistically significant)

+ (not statistically significant)

++ (not statistically significant, Bonferroni adjusted)

Table 6b. Unadjusted, domain-adjusted and fully-adjusted ordinal logistic regression models of SRH by sociodemographic and health characteristics (CLSA baseline wave, 2010-2015, n=51,338)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& low vs. high SRH	Low vs. high &middle SRH	Middle& low vs. high SRH	Low vs. high &middle SRH	Middle& Low vs. High SRH	Low vs. high &middle SRH
Physical health variables						
Daily living activities						
No functional impairment	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Mild impairment	3.59 (3.34-3.85)	5.46 (5.05-5.90)	2.06 (1.89-2.25)	2.67 (2.41-2.96)	1.82 (1.65-2.01)	2.30 (2.04-2.59)
Moderate impairment	7.24 (5.67-9.26)	12.29 (10.09-14.96)	3.33 (2.48-4.47)	4.53 (3.50-5.87)	2.61 (1.98-3.44)	2.61 (1.98-3.44)
Severe& total impairment	18.78 (12.63-27.92)	18.78 (12.63-27.92)	5.85 (3.36-10.18)	5.85 (3.36-10.18)	2.96 (1.60-5.47)	2.96 (1.60-5.47)
Number of Chronic Conditions						
No chronic conditions	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
One chronic condition	1.50 (1.36-1.65)	1.50 (1.36-1.65)	1.49 (1.33-1.66)	1.49 (1.33-1.66)	1.44 (1.27-1.62)	1.44 (1.27-1.62)
Two chronic conditions	2.04 (1.85-2.24)	2.66 (2.24-3.15)	2.05 (1.84-2.28)	2.05 (1.84-2.28)	1.91 (1.70-2.15)	1.91 (1.70-2.15)
Three ≥ chronic conditions	4.66 (4.28-5.08)	9.27 (8.06-10.65)	3.95 (3.58-4.36)	5.40 (4.72-6.18)	3.49 (3.13-3.89)	4.52 (3.90-5.24)
Self-reported Vision						
Excellent	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Very-good	1.27 (1.21-1.35)	1.07 (0.98-1.17)	1.20 (1.13-1.28)	1.20 (1.13-1.28)	1.15 (1.07-1.24)	1.15 (1.07-1.24)
Good	2.45 (2.32-2.59)	1.98 (1.82-2.15)	1.94 (1.82-2.08)	1.66 (1.52-1.82)	1.77 (1.64-1.91)	1.49 (1.34-1.66)
Fair	4.32 (3.98-4.70)	4.32 (3.98-4.70)	2.63 (2.38-2.91)	2.63 (2.38-2.91)	2.18 (1.95-2.45)	2.18 (1.95-2.45)
Poor	4.43 (3.73-5.27)	6.28 (5.24-7.52)	2.35 (1.89-2.93)	3.04 (2.40-3.85)	2.42 (1.92-3.06)	2.42 (1.92-3.06)
Self-reported Hearing						
Excellent	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Very-good	1.14 (1.08-1.20)	0.97+ (0.89-1.06)	1.06+ (0.99-1.14)	0.95+ (0.86-1.06)	1.02+ (0.95-1.10)	1.02+ (0.95-1.10)
Good	2.00 (1.90-2.12)	1.53 (1.41-1.65)	1.63 (1.53-1.74)	1.33 (1.20-1.47)	1.56 (1.45-1.68)	1.30 (1.17-1.45)
Fair	2.73 (2.54-2.93)	2.73 (2.54-2.93)	1.85 (1.70-2.02)	1.85 (1.70-2.02)	1.68 (1.52-1.85)	1.68 (1.52-1.85)
Poor	3.86 (3.34-4.47)	3.86 (3.34-4.47)	2.17 (1.84-2.57)	2.17 (1.84-2.57)	1.92 (1.58-2.33)	1.92 (1.58-2.33)
Reported serious injury in the last 12 months	1.18 (1.11-1.25)	1.36 (1.26-1.48)	1.03+ (0.96-1.10)	1.03+ (0.96-1.10)	--	--

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& low vs. high SRH	Low vs. high &middle SRH	Middle& low vs. high SRH	Low vs. high &middle SRH	Middle& low vs. high SRH	Low vs. high &middle SRH
Physical health variables						
Pain						
No Pain	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Mild Pain	1.94 (1.84-2.06)	2.33 (2.11-2.57)	1.61 (1.51-1.71)	1.80 (1.62-2.01)	1.55 (1.44-1.66)	1.75 (1.55-1.98)
Moderate Pain	3.64 (3.44-3.84)	5.50 (5.07-5.96)	2.39 (2.25-2.55)	2.98 (2.72-3.27)	2.10 (1.95-2.26)	2.62 (2.53-2.91)
Severe Pain	5.56 (4.95-6.25)	11.90 (10.55-13.42)	2.92 (2.55-3.34)	4.80 (4.15-5.55)	2.51 (2.14-2.94)	4.25 (3.58-5.05)

a (The Bonferroni adjusted p value <0.004), [n= 43,442 (listwise deletion)]

b (The Bonferroni adjusted p value <0.003), [n= 36,659 (listwise deletion)]

Bold (statistically significant)

+ (not statistically significant)

++ (not statistically significant, Bonferroni adjusted)

Table 6c. Unadjusted, domain-adjusted and fully-adjusted ordinal logistic regression models of SRH by sociodemographic and health characteristics (CLSA baseline wave, 2010-2015, n= 51,338)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& Low vs. High SRH	Low SRH vs. High & Middle	Middle& Low vs. High SRH	Low SRH vs. High & Middle	Middle& Low vs. High SRH	Low SRH vs. High & Middle
Psycho-Social health						
Cognition: Memory (REYI)						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.28 (1.22-1.34)	1.28 (1.22-1.34)	1.08++ (1.02-1.15)	1.08++ (1.02-1.15)	1.07++ (1.01-1.14)	1.07++ (1.01-1.14)
Low	1.85 (1.76-1.95)	2.05 (1.91-2.20)	1.27 (1.18-1.38)	1.27 (1.18-1.38)	1.23 (1.15-1.32)	1.23 (1.15-1.32)
Cognition: Memory (REYII)						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.23 (1.17-1.30)	1.23 (1.24-1.37)	1.05+ (0.98-1.12)	1.05+ (0.98-1.12)	--	--
Low	1.60 (1.52-1.69)	1.73 (1.61-1.85)	1.09++ (1.01-1.17)	1.09++ (1.01-1.17)	--	--
Cognition: Executive function (Mental Alteration T.)						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.25 (1.19-1.31)	1.40 (1.28-1.52)	1.13 (1.07-1.19)	1.13 (1.07-1.19)	1.07++ (1.01-1.14)	1.07++ (1.01-1.14)
Low	1.84 (1.75-1.94)	2.28 (2.11-2.48)	1.33 (1.26-1.42)	1.33 (1.26-1.42)	1.21 (1.13-1.30)	1.21 (1.13-1.30)
Depression						
CESD score <10	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
CESD score ≥ 10	3.33 (3.16-3.51)	4.82 (4.51-5.14)	1.90 (1.77-2.03)	2.36 (2.15- 2.58)	1.49 (1.38-1.56)	1.80 (1.63-2.00)
Satisfaction with life						
Extremely Satisfied	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Satisfied	1.82 (1.74-1.92)	2.05 (1.86-2.25)	1.63 (1.54-1.72)	1.63 (1.54-1.72)	1.47 (1.38-1.56)	1.47 (1.38-1.56)
Slightly Satisfied	3.10 (2.92-3.30)	3.90 (3.53-4.30)	2.42 (2.25-2.61)	2.79 (2.50-3.10)	2.02 (1.87-2.19)	2.02 (1.87-2.19)
Neutral	3.83 (3.33- 4.42)	5.25 (4.38-6.29)	3.02 (2.54-3.59)	3.93 (3.19-4.83)	2.43 (2.04-2.91)	2.43 (2.04-2.91)
Slightly Dissatisfied	4.89 (4.50-5.32)	7.07 (6.33-7.89)	3.33 (3.00-3.69)	4.28 (3.76-4.88)	2.44 (2.17-2.74)	2.88 (2.50-3.33)
Dissatisfied	7.49 (6.64-8.45)	11.76 (10.35-13.36)	4.25 (3.67-4.93)	5.91 (5.04-6.94)	3.00 (2.54-3.53)	3.82 (3.19-4.56)
Extremely Dissatisfied	10.43 (8.59-12.68)	21.67 (18.27-25.69)	4.53 (3.59-5.72)	8.12 (6.55-10.08)	2.61 (2.02-3.37)	4.45 (3.45-5.74)
Social support						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.30 (1.23-1.36)	1.30 (1.23-1.36)	1.10++ (1.03-1.16)	0.99+ (0.89-1.10)	1.03+ (0.97-1.10)	1.03+ (0.97-1.10)
Low	2.18 (2.07-2.29)	2.45 (2.29-2.62)	1.23 (1.15-1.31)	1.02+ (0.92-1.13)	1.08++ (1.01-1.16)	0.98+ (0.88-1.08)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& Low vs. High SRH	Low SRH vs. High & Middle	Middle& Low vs. High SRH	Low SRH vs. High & Middle	Middle& Low vs. High SRH	Low SRH vs. High & Middle
Psycho-Social health						
Social participation in community related activities						
Daily	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)	1.00 (--)
Weekly	1.29 (1.22-1.36)	1.29 (1.22-1.36)	1.22 (1.14-1.30)	1.22 (1.14-1.30)	1.25 (1.17-1.35)	1.25 (1.17-1.35)
Monthly	2.21 (2.06-2.38)	2.45 (2.24-2.68)	1.70 (1.56-1.85)	1.70 (1.56-1.85)	1.68 (1.53-1.85)	1.68 (1.53-1.85)
Yearly or Never	4.20 (3.66-4.82)	5.63 (4.88-6.50)	2.10 (1.79-2.46)	2.10 (1.79-2.46)	1.74 (1.45-2.10)	1.74 (1.45-2.10)

a (The Bonferroni adjusted p value <0.004), [n= 40,253 (listwise deletion)]

b (The Bonferroni adjusted p value <0.003), [n= 36,659 (listwise deletion)]

Bold (statistically significant)

+ (not statistically significant)

++ (not statistically significant, Bonferroni adjusted)

Table 6d. Unadjusted, domain-adjusted and fully-adjusted ordinal logistic regression models of SRH by sociodemographic and health characteristics (CLSA baseline wave, 2010-2015, n= 51,338)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& Low vs. High SRH	Low SRH vs. High& Middle	Middle& Low vs. High SRH	Low SRH vs. High& Middle	Middle& Low vs. High SRH	Low SRH vs. High& Middle
Health behaviours						
Smoking						
Never smoked	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Former smoker	1.24 (1.19-1.29)	1.24 (1.19-1.29)	1.27 (1.21-1.33)	1.27 (1.21-1.33)	1.08++ (1.02-1.14)	1.08++ (1.02-1.14)
Currently smoker	2.43 (2.27-2.62)	2.78 (2.55-3.04)	2.05 (1.90-2.21)	2.05 (1.90-2.21)	1.58 (1.43-1.74)	1.58 (1.43-1.74)
Alcohol						
6-7 times a week	1.05+ (0.98-1.13)	1.20 (1.06-1.35)	0.95+ (0.89-1.03)	0.95+ (0.89-1.03)	0.92+ (0.84-1.00)	0.92+ (0.84-1.00)
4-5 times a week	0.89 (0.82-0.97)	0.89 (0.82-0.97)	0.89++ (0.82-0.97)	0.89++ (0.82-0.97)	0.94+ (0.85-1.04)	0.94+ (0.85-1.04)
2-3 times a week	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
4-2 times a month	1.27 (1.19-1.35)	1.54 (1.39-1.71)	1.19 (1.11-1.27)	1.37 (1.24-1.52)	1.16 (1.08-1.26)	1.16 (1.08-1.26)
Once a month or less	1.97 (1.85-2.09)	2.79 (2.53-3.08)	1.66 (1.55-1.77)	2.11 (1.91-2.32)	1.47 (1.35-1.59)	1.47 (1.35-1.59)
Never drink	2.21 (2.06-2.37)	3.81 (3.43-4.22)	1.67 (1.55-1.81)	2.52 (2.27-2.81)	1.32 (1.19-1.45)	1.69 (1.49-1.93)

a (The Bonferroni adjusted p value <0.006), [n= 45,695 (listwise deletion)]

b (The Bonferroni adjusted p value <0.003), [n= 36,659 (listwise deletion)]

Bold (statistically significant)

+ (not statistically significant)

++ (not statistically significant, Bonferroni adjusted)

Table 7. Unadjusted, domain-adjusted and fully-adjusted ordinal logistic regression models of SRH by sociodemographic, health characteristics and clinical measures (CLSA Comprehensive cohort baseline wave, 2010-2015, n=30,097)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& Low vs. High SRH	Low vs. High &Middle SRH	Middle& Low vs. High SRH	Low vs. High &Middle SRH	Middle& Low vs. High SRH	Low vs. High &Middle SRH
Clinical measures						
Body mass index (kg/m²)						
Healthy weight	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Overweight	1.45 (1.36-1.55)	1.45 (1.36-1.55)	1.23 (1.11-1.37)	1.23 (1.11-1.37)	1.24 (1.10-1.41)	0.92+ (0.75-1.13)
Obese - Class I	2.69 (2.49-2.90)	2.69 (2.49-2.90)	1.93 (1.70-2.21)	1.93 (1.70-2.21)	1.99 (1.70-2.23)	1.43 (1.14-1.80)
Risky weight group	4.96 (4.51-5.47)	5.94 (5.28-6.69)	3.01 (2.58-3.50)	4.25 (3.50-5.15)	2.90 (2.44-3.46)	2.90 (2.44-3.46)
Waist circumference (cm)						
<=80 in women & <=94 in men	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
>80 in women & >94 in men	2.18 (2.06-2.32)	2.18 (2.06-2.32)	1.32 (1.19-1.47)	1.10+ (0.93-1.32)	1.26 (1.12-1.42)	1.26 (1.12-1.42)
Handgrip strength (kg)						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.21 (1.13-1.29)	1.21 (1.13-1.29)	1.10++ (1.01-1.20)	1.10++ (1.01-1.20)	1.02+ (0.92-1.13)	1.02+ (0.92-1.13)
Low	1.72 (1.61-1.84)	2.03 (1.83-2.25)	1.20 (1.09-1.33)	1.20 (1.09-1.33)	1.11+ (0.99-1.24)	1.11+ (0.99-1.24)
4Metre walk (sec)						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	0.60 (0.57-0.64)	0.49 (0.44-0.54)	0.78 (0.71-0.85)	0.78 (0.71-0.85)	0.89+ (0.80-0.99)	0.89+ (0.80-0.99)
Low	0.43 (0.40-0.46)	0.30 (0.26-0.33)	0.63 (0.58-0.69)	0.63 (0.58-0.69)	0.75 (0.68-0.84)	0.75 (0.68-0.84)
Standing balance (sec)						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.55 (1.44-1.67)	1.94 (1.69-2.23)	1.16++ (1.04-1.28)	1.16++ (1.04-1.28)	1.00+ (0.88-1.12)	1.00+ (0.88-1.12)
Low	2.17 (2.04-2.31)	2.71 (2.43-3.03)	1.54 (1.39-1.70)	1.54 (1.39-1.70)	1.28 (1.14-1.43)	1.28 (1.14-1.43)
FEV1						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.11 (1.03-1.20)	1.32 (1.14-1.53)	1.19++ (1.03-1.37)	1.19++ (1.03-1.37)	1.18++ (1.06-1.33)	1.18++ (1.06-1.33)
Low	1.56 (1.45-1.68)	1.87 (1.63-2.15)	1.51 (1.24-1.84)	1.51 (1.24-1.84)	1.39 (1.20-1.61)	1.39 (1.20-1.61)

Variables	Unadjusted OR (95% CI)		Domain-adjusted ^a OR (95% CI)		Fully adjusted model ^b OR (95% CI)	
	Middle& Low vs. High SRH	Low vs. High &Middle SRH	Middle& Low vs. High SRH	Low vs. High &Middle SRH	Middle& Low vs. High SRH	Low vs. High &Middle SRH
Clinical measures						
FVC						
High	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference	1.00 Reference
Middle	1.11 (1.03-1.20)	1.36 (1.18-1.58)	1.13+ (0.98-1.31)	1.13+ (0.98-1.31)	--	--
Low	1.53 (1.42-1.65)	1.85 (1.61-2.13)	1.10+ (0.89-1.35)	1.10+ (0.89-1.35)	--	--

a (The Bonferroni adjusted p value <0.003), [n= 19,139 (listwise deletion)]

b (The Bonferroni adjusted p value <0.002), [n= 16,534 (listwise deletion)]

Bold (statistically significant)

+ (not statistically significant)

++ (not statistically significant, Bonferroni adjusted)

Chapter 6 Discussion

6.1 Summary of Results

The primary aim of this study was to obtain an in depth understanding of SRH, one of the most widely used health measurement tools in population health surveys worldwide. To do this, we examined the relationship between the SRH and a number of key sociodemographic, physical, psychosocial and health behaviour measures that are closely related to health in a representative Canadian population ages 45 to 85 years old.

First, we determined how the prevalence of SRH, from poor to excellent, varied by sex and age groups and observed how its distribution changed across different sociodemographic, physical health, psychosocial health, and health behaviours factors, all of which were self-reported. Secondly, we determined the association between SRH and self-reported measures of physical, psychosocial and behavioural health. Finally, we examined the association between SRH and objectively assessed clinical/ physical measures of health.

Key findings from our descriptive analysis of population characteristics showed that the health of the Canadian older adult population is generally healthy. A total of 90.2% of community dwelling Canadians aged between 45-85 did not report any functional impairment and only 0.1% reported having total functional impairment. Overall, 10.9% of the population reported no chronic conditions while the majority (53.3%) reported three or more chronic conditions. This high percentage of people reporting three or more chronic conditions does not mean that our population is not healthy, but rather, it is due to the fact that the CLSA asked about 42 different health conditions, including such conditions as

migraines, allergies, and hypothyroidism. Statistics showed that the percentage of women who reported three chronic conditions or more was higher than men and these percentages increased as age increased. In terms of sensory health, men were more likely to report better eye vision but less likely to report healthier hearing in comparison to women.

Examining the prevalence of self-rated health, from excellent to poor, across various key sociodemographic and health characteristics, in both men and women groups, showed its variation among different age strata; excellent SRH proportions decreased slightly as age increased. Individuals with high education, high income and those who were married or lived with a partner reported higher percentages of high SRH compared to rest of the groups. Also, having higher number of chronic conditions and reporting depressive symptoms indicates higher percentages of lower SRH. In respect to health behaviours, never smokers and former smokers showed higher proportions of excellent and very good SRH in comparison to current smokers. People who reported drinking alcohol 5-6 times per week reported slightly higher SRH than other groups who reported less alcohol drinking.

In the fully adjusted ordinal logistic model, five of the seven sociodemographic characteristics considered: age, sex, education, income and work/retirement status were associated with SRH. Of the fifteen health characteristics considered, the physical health characteristics of activities of daily living, vision, hearing, number of chronic conditions, and pain were associated with SRH, as were the psycho-social characteristics of short-term memory, executive function, depression, satisfaction with life, and social participation.

With respect to health behaviours, both smoking and alcohol consumption were associated with SRH.

Based on the final model, our study showed that people use a wide range of health measures when asked to judge their health, seventeen of the twenty-two health measures we studied were significantly associated with SRH. This confirms the variations of health dimensions that are underlying the overall SRH and thus indicates further support to the validity of the SRH measure in population-health research.

Finally, with respect to the objectively-assessed characteristics of physical/ clinical measures of health among the comprehensive cohort, the fully adjusted model showed that obesity, waist circumference, 4-meter walk test, standing balance and forced expiratory volume were associated with SRH. Based on this final model, our study showed that SRH is associated with clinical/ physical health measure, five of the seven studied clinical measure were significantly associated with SRH. This means that SRH is a subjective synthesis of clinical/ physical health measures that individuals are aware of and able to incorporate into their health rating. Thus, our study confirms the clinical (objective) dimension of SRH which indicates further support to the validity of using SRH in preventive and screening health care programs.

6.2 Comparison with Previous Studies

We may expect that elderly adults should have poorer SRH than young adults because of the increased risk of having adverse health conditions. This was not the case in this study

and other many studies (30,79-82). After controlling for all sociodemographic (domain adjusted model) and all other health variables (fully adjusted model) this association changed to the opposite direction which means that elderly adults rate their health higher than young adults.

This paradox was explained in the literature by different suggestions. Some research studies attributed this association paradox to an independent effect, response shift, reporting behaviors, and optimism. All of these terms were used to explain the unexpected paradox in the association between SRH and aging. Benyamini suggested that SRH has an independent effect or “extra something” which makes it more inclusive to summarize so much information that cannot be achieved by a multi-item scale or single clinical assessment setting (19,110). The optimism, reporting behaviors or response shift were based on social comparison theory which explained how older adults use downward comparisons with others who are less healthy; instead of upward comparison (33,111-113). This downward comparison increased the sense of well-being in the elderly to be able to adapt and better face new illness (58).

While elderly adults in this study cohort reported more chronic conditions than young age groups, elderly adults reported more social participations and higher life satisfaction than young adults. That could explain why our elderly have better SRH as all of these factors were associated with better SRH (58). These differences in SRH between young and old groups, may also be the result of the structure of the cohort. For example, being a current smoker, which was associated with low SRH, was reported more by the younger adults.

Also, non-white ethnicity was associated with lower SRH, which was mainly reported among the young age group.

In this study, a gender difference in SRH was evident. First, the gender difference did not appear in the unadjusted model. Then, after we adjusted for sociodemographic and other health measures, the difference appeared. Men are more likely to report lower self-rated health than women, which echoes the result of many studies (44,65-67) and may explain, partially, the longer survival of women than men as Idler (1983) suggested. Also, it may explain, at least in part, why SRH can predict mortality for men better than for women (especially with the evidence that the power of SRH to predict mortality in short term follow up is stronger than long term follow up prediction, and also the evidence that mortality was more associated with the poor SRH) (20,69,72).

Studying cognitive function especially in the field of aging has become of a great interest to researchers, clinicians, and policy makers particularly in the field of aging. Most studies have excluded individuals with severe cognitive impairment or dementia as one of their exclusion criteria and thus, the validity of SRH in older individuals with cognitive impairment is unknown (114,115). This study showed that the cognitive function measured by REYI and MAT had a significant association with SRH and revealed that individuals with low cognitive function were more likely to report low SRH. This resonates with previous research that suggested that among people with mild to moderate levels of cognitive impairment, SRH is a valid and independent measure of health and can predict mortality (114,115). Further research in this area is recommended to better understand SRH in severely cognitively impaired individuals.

The association between age and depression were examined in many studies. They found that the prevalence of major depression seems to decrease with age, (116-118), while the prevalence of depressive symptoms may actually increase with age. (119-122). Also, depression showed high association with diseases, disability, and mortality (123-126). Therefore, it was important to investigate the role of depressive symptoms on SRH among older adult population. The fully adjusted model showed that individuals with depressive symptoms were more likely to report low SRH (OR 1.80, CI; 1.63-2.00). This supports the findings from previous research which showed an association between poor SRH and depressive symptoms in older people (127,128)

We also found that social participation showed an inverse relationship with SRH. A dose response relationship was demonstrated, which means that when social participation decreases, the likelihood of lower SRH increases. Unexpectedly, overall social support did not show a relationship with SRH after controlling for all other physical, psychosocial and behavioural measures. This result was also demonstrated by another study that found that structural relations (social participation) only was associated with SRH and both structural relations and functional social relations did not affect the association between SRH and mortality (76).

In respect to the clinical/ physical measures of health, the fully adjusted model showed that five (BMI, waist circumference, 4-meter walk test, standing balance and forced expiratory volume) of seven studied clinical measures were significantly associated with SRH. While hand grip strength became not significant. Notably, the forced vital capacity was not statistically significant in the domain- adjusted model and therefore it was not included in

our final model. Our findings contribute to the growing body of literature by suggesting that SRH is associated with objective clinical health measures and supports previous studies that determined the association between SRH and other clinical and biomarkers such as BMI, ratio of total cholesterol to HDL cholesterol, haemoglobin, elevated serum inflammatory markers (77,129,130).

6.3 Study Strengths and Limitations

This study investigated the elements of SRH using baseline data for both tracking and comprehensive cohorts of the Canadian Longitudinal Study on Aging, which is a high quality large national representative sample. The CLSA used a complex sample design and provided inflation and analytic sample weights to assure that the obtained result is representative for the eligible Canadian population. Therefore, this study represents the Canadian population aged 45 to 85 years old, excluding residents in the three territories, individuals living on federal First Nations reserves and other First Nations settlements in the provinces, full-time members of the Canadian Armed Forces, and individuals living in institutions (senior residences that provide only minimal care are included).

This study used self-reported subjective and objective measures and physically assessed clinical measures of health. The CLSA provided health measures that have been designed with research applications in mind and have been established as valid and reliable tools. Some of the used measures were self-reported rather than objectively assessed, such as number of chronic conditions were self-reported instead of actually being tested or reviewed in the medical records, therefore, we cannot exclude response or recall bias. This means that individuals who report high SRH may forget to report health conditions and individuals who reported low SRH may be more likely to report health conditions. However, self-reported health conditions and health record data have demonstrated good agreement in several studies (131-133)

One of the limitations to this study is the CLSA baseline data are cross-sectional, and longitudinal data is necessary to have explanations for the aging and survival influences on health and perception of health. Moreover, we cannot provide explanation for the causal relationship between SRH and the variables included in the study.

Also, the study did not include biomarkers such as haemoglobin, white blood cells count, and cholesterol. Nevertheless, this study used a wide range of important clinical measures such as BMI, 4-meter walk test, standing balance, handgrip strength test and spirometer tests. All of these measures are highly related to health and reflect excellent objective evaluation of the physical health of the population.

The ordinal regression model, particularly the generalized ordered logit/partial proportional odds models, used in this analysis is considered the standard model for an ordinal outcome (SRH) (106). It allows us to test for the proportional odds assumptions which is the assumption that the effect of an independent variable on the ordinal dependent variable is even or identical over all of the categories or levels of the dependent variable. (106).

6.4 Conclusion and Implications

This study aimed to understand self-rated health among the Canadian population aged 45 to 85 and investigate the key subjective and objective health measures that are closely associated with self-rated health. Overall, SRH showed significant association with a wide range of subjective and both self-reported and non-self-reported (clinical) objective health measures which means that people use a wide range of health measures when asked to judge their health.

Gender difference in self-rated health was identified in this study. The fully adjusted model showed that women perceive their health more favourably than men. Also, the age variations in self-rated health was established as we found that elderly adults perceive their health better than young adults.

Self-rated health is an important construct, because of its great ability to offer a unique simple overview about the multidimensional perspectives of health. In this large population-based sample of community-dwelling adults' study, our findings support the growing evidence in the literature that SRH is a useful tool to measure population health. The results of this research project have important implications for public health. While the importance of healthy aging becomes a demand as the population lives longer, expanding our knowledge about the association between SRH and key health measures will help health professions and policy makers to understand more the health of the Canadian population, and thus increase the ability to plan optimal screening health care

programs to support healthy aging in older adults and particularly those who reported poor self-rated health.

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Appendix A

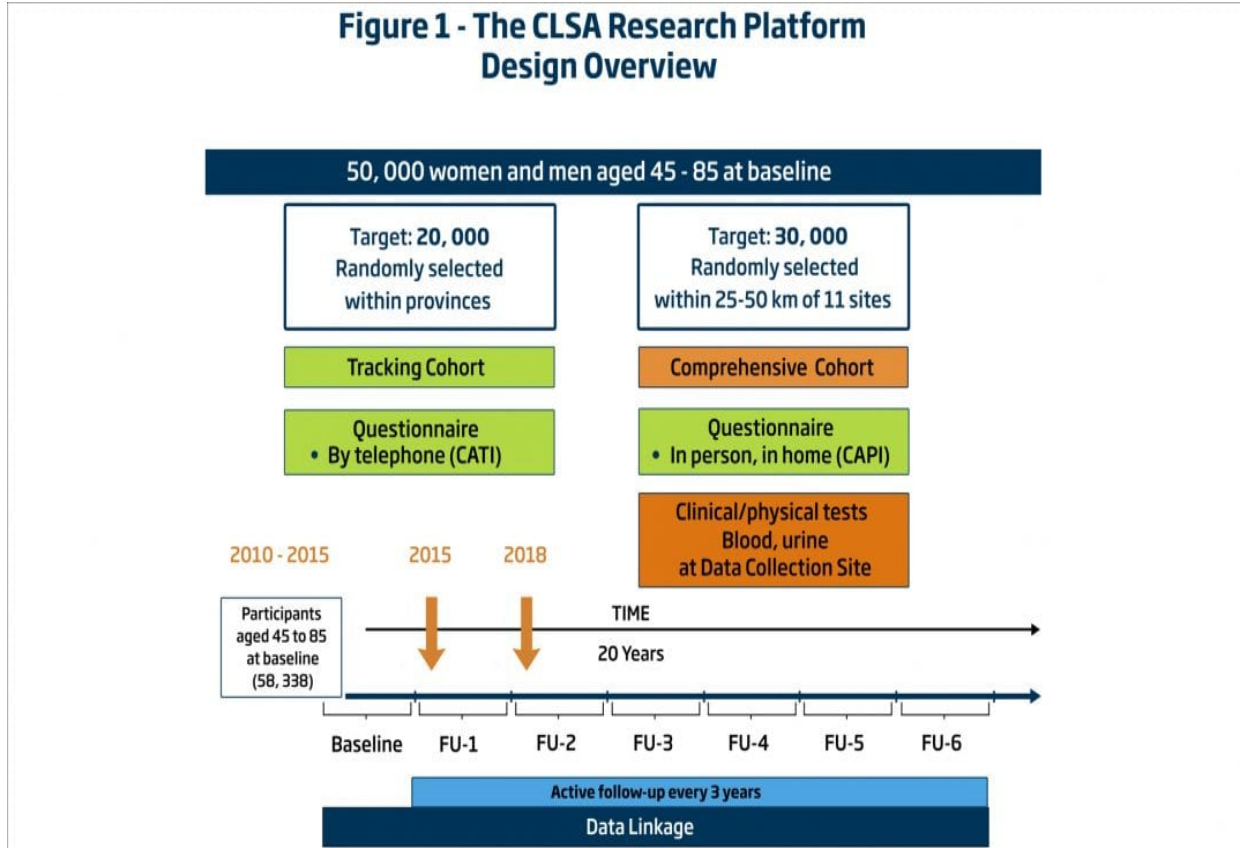


Figure 4: The CLSA research platform design overview

[Image from: <https://www.healtheuropa.eu/canadian-longitudinal-study-on-aging/87316/>]