Determinants of self-rated health among Canadian seniors over time: A longitudinal population-based study

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Abstract

Self-rated health has been found to be an effective and inexpensive measure of people's overall health. Although cross-sectional studies have identified determinants of self-rated health (SRH), there is a limited insight into the determinants of SHR overtime and their impact on the change of SRH overtime. This present study compares determinants of SRH among a large community-dwelling cohort of Canadian seniors (N= 3,255) at three points in time (1991, 1996, and 2001), and examines the effects of determinants on change in SRH over a 10-year period. Data analyzed were from the Canadian Study of Health and Aging - a large-scale longitudinal population-based study conducted between 1991 and 2001. The results showed that most seniors (over 80%) rated their health as good, and their SRH remained surprisingly constant over time. Only a person's physical and instrumental functioning and the number of chronic diseases were consistently associated with SRH at each point in time (1991, 1996, & 2001). Factors including cognition, daily functioning, chronic disease, and availability of help were significantly linked to self-rated health over time. These determinants should be considered important stimuli for improving health among seniors.

1 Introduction

Self-rated health (SRH) has been found to be a simple and reliable indicator of future health needs, healthcare services utilization, quality of life, and mortality, and also been considered as an important tool in disease screening (Rohrer et al. 2007; May et al. 2006). The measure is based on asking individuals to evaluate their health status on a simple question using a four or five point scale. It has been widely used in health studies since 1950s (Jylha, 2009; Darviri et al. 2012; Bath, 1999; Su et al. 2011; Pappa et al. 2006). Poor SRH is associated with negative health outcomes, such as chronic disease (e.g. cancer, epilepsy, etc.) (Manor et al. 2001), shorter survival (Lee, 2000), and mortality (Jylha, 2009; Cesari et al. 2009), etc,.

Given that SRH has a significant impact on the public's health, it is important to identify the determinants of SRH in different settings and populations. Determinants of SRH in different populations could address public health policies, indicate health services needs, and health prevention directions for a given population (Darviri et al. 2012). In the literature there is an increased emphasis on determinants of SRH (Darviri et al. 2012; Arnadottir et al.2011; Bailis et al. 2003). In general, those with low socioeconomic status, and getting older are more likely to rate their health low, whereas those with a more active lifestyle tend to rate their SRH high (Foraker et al. 2011; Ishizaki et al. 2009; Tsai et al. 2010).

Members of different subgroups of a population may rate their health using different metrics (Lindeboom et al. 2004; Zimmer et al.2000). As populations age globally in both developed and developing countries, there are potential consequences in terms of its impact on healthcare costs, economic strain, education, employment, social engagement,

etc (Weir et al. 2010). Health prevention and promotion in the elderly are increasing seen as key elements to encourage healthy aging.

Although many findings have identified determinants of SRH using cross-sectional studies (Prus et al.2011; Perruccio et al. 2012), there is a limited insight into the influence of determinants on the change in SRH overtime. The objectives of this present study were to: 1) compare determinants of SRH among a large cohort of Canadian seniors at three time points (1991, 1996, and 2001); and 2) examine the effects of determinants on change of SRH over a 10-year period.

2 Data and Methodology

2.1 Data

Data analyzed were from the community component of the longitudinal Canadian Study of Health and Aging (CSHA). The CHSA involved a longitudinal survey of a large sample of Canadian seniors over a decade, both institutions and community. The CSHA was conducted in 18 centres distributed across all Canadian provinces. Ethical approval for the original study was obtained from the Ethics Review Board at each 18 study centers. Canada has a provincially base single payer health care system for hospital and physician services. The community sample (N=9,008) was chosen randomly from health care lists in nine provinces and the Enumeration Composite Record in the province of Ontario. The institutional sample (N=1,255) was randomly selected from residents in stratified random samples of institutions in each region. The study sample was assessed at three time points. We examined data from the community dwelling community survey

sample. At the Wave 1 (1991/1992) a total of 8,949 community-dwelling individuals

aged 65 years and over completed a screening interview. The overall response rate for

participation by community residents was 72.1%. At the Wave 2 (1996/1997), all living

subjects from the community sample at the Wave 1 who had *not* been diagnosed with

dementia in CSHA-1 were again asked to participate in a screening interview; 5,701

participants completed that follow-up interview. Similarly, 3,255 respondents finished the

Wave 3 (2001/2002) follow-up screening interview. Detailed information on this survey

is published elsewhere (The Canadian Study of Health and Aging Study Group, 1994a, b).

To examine both cross-sectional and longitudinal relationships between determinants and

SRH among seniors, this study we selected respondents who had completed all three

phases community interview and were dementia free in 2001/2002 (N= 3,255) (Figure 1).

2.2 Measures

This is a secondary analysis of the original survey data. All information analyzed was

derived from the screening assessments of the CSHA across its three Waves.

   Self-rated health. "How would you say your health is these days? Would you say

your health is very good, pretty good, not too good, or poor or very poor?" was

consistently asked across three phases and is the dependent measure used in this analysis.

This question is considered as a robust measure of health status (Pietilainen et al. 2011).

Responses were re-categorized for analysis into three levels *good* (very good + pretty

good), *fair* (not too good), and *poor* (poor + very poor).

Baseline characteristics. Baseline socio-demographic characteristics included age, gender, place of living (rural/urban), education, ethnicity (Caucasian/others), and nature of longest lifetime job.

Characteristics examined across three Waves. The following characteristics were assessed at all three survey Waves: marital status, cognitive function assessed by the Modified Mini-Mental State exam (3MS) (Teng et al. 1987), Physical Activities of Daily Living (PADL) and Instrumental ADL (IADL) (Fillenbaum et al. 1981; George et al. 1985), number of chronic diseases, living alone, and having someone to count on for help.

Episodic characteristics. At the Wave 1, subjects were also asked whether they were a primary caregiver, those receiving help were asked how far away did they live from the person who helped them. At the Wave 2 and Wave 3, two questions about income, yearly income and how satisfied respondents were with their income, were added into the questionnaire.

2.3 Statistical analysis

Cross-tabulation analyses were used to: 1) examine the differences between selected subjects and the rest of survey sample at the Wave 1; and 2) analyze the relationship between determinants and SRH at each wave. In addition to age, gender, rurality, longest life-time job and education, other characteristics significant at $P<0.10$ were initially included in multivariate analyses. A separate ordinal logistic regression was developed for each wave with SRH as the dependent variable. Test of proportional odds assumption was used to assess model fit. To examine the determinants associated with changes of SRH over the 10-year period, we fitted a longitudinal logistic generalized estimating

equation (GEE) model accounting for the dependence between repeated measurements within the same individual. The GEE approach is outlined in the work of Zeger and Liang (1985) describing a quasi-likelihood approach for modeling correlated and/or repeated measures. GEE is a common choice for marginal regression models of repeated data especially in providing information on regression parameters. Data analyses were performed using STATA 11.1 (StataCorp LP, College Station, TX, USA) and SAS 9.2 (SAS Institute Inc., Cary, NC, USA). The significance level was at $P<0.05$.

3 Results

3.1 Comparisons between selected subjects and non-selected subjects

Those with the completed screening questionnaire in all three Waves of the CSHA comprised the study cohort. Table 1 presents the comparisons between our study cohort and the rest of the initial community sample. There were no significantly statistical differences of age, gender, marital status, place of residence, education, ethnicity, and baseline SRH between selected and non-selected subjects ($P>0.05$).

3.2 SRH of the study cohort at all three Waves of the CSHA

Table 2 presents percentages of different levels of SRH of the study cohort at all three Waves of the CSHA. Though relatively constant through time, the proportion of those rated themselves (about 80%) having good health slightly increased over the 10-year period. Conversely, the proportion of those rated themselves having fair health decreased

over the study period. The proportion of people rated their health as poor remained constantly.

3.3 Comparisons of determinants associated with SRH in 1991, 1996, and 2001

All characteristics including those variables consistently measured across three Waves and other variables only measured in a specific Wave or in two Waves were fully considered in an initial univariate analyses. At each Wave, age, gender, rurality, nature of longest job during the life time, education, and those characteristics significant at $P<0.10$ in the univariate analyses were initially included in multivariate regression models. After test of proportional odds assumption, three final multivariate ordinal logistic regression models were developed. Table 3 shows all three multivariate models for determinants associated with SRH. At the Wave 1, being married (including common law), having had a higher skilled job, fewer limitations on physical and instrumental daily functioning, fewer chronic diseases, living with others, and having someone to count on for help were associated with better SRH ($P<0.05$). At the Wave 2, better SRH was associated to having intact cognition, fewer limitations on physical and instrumental daily functioning, fewer chronic diseases, and satisfaction with income ($P<0.05$). At the Wave 3, better SRH was associated to having fewer limitations on physical and instrumental daily functioning, fewer chronic diseases, having someone to count on for help, and satisfaction with income ($P<0.05$). Only physical and instrumental functioning and number of chronic diseases were consistently associated with SRH over three Waves. Seniors with fewer physical and instrumental functioning limitations and fewer chronic diseases were more likely to consistently report good SRH.

3.4 Effect of determinants on the change of SRH over time

Characteristics including baseline socio-demographic factors (sex, age, education, rurality, nature of longest life-time job), and repeated measures of marital status, cognitive function, daily functioning, number of chronic diseases, whether living alone or not, and having someone to count on for help were initially included in the GEE modeling. Table 4 presents the fitted GEE model for the effect of determinants on the change of SRH over the 10-year period. Nature of longest job, cognition, physical and instrumental daily functioning, having chronic disease, whether or not having someone to count on for help, and an interaction of ethnicity with time were associated with SRH over time ($P<0.05$). Compared to non-Caucasian and Caucasian at other Waves, being Caucasian at the Wave 2 was more likely to be associated with *poor* SRH. Seniors who were cognitively intact, having fewer limitations on physical and instrumental daily functioning, fewer chronic diseases, and someone to count on for help were more likely to report good SRH over the 10-year period.

4 Discussion and Conclusions

This longitudinal population-based data provide a unique opportunity to compare determinants of SRH among Canadian seniors at three points of time (1991, 1996, and 2001), and examine the effects of determinants on change of SRH over the 10-year period. In this study, we found that: 1) Good SRH was endorsed by over than 80% of the study cohort over the 10-year period; 2) daily functioning and number of chronic diseases

were consistently associated with SRH at each Wave; 3) seniors who were cognitively intact, had fewer restraints on daily functioning, fewer chronic diseases, and had someone to count on for help reported better SRH over the 10-year period.

Surprisingly, we found over than 80% of the study cohort rated their health as good and there was a slightly increasing trend of this rating over the 10-year period. Amstadter et al. (2010) using the US national household population survey found that 22.3% seniors aged 60 and older rated their SRH as "poor" and "poor" SRH was associated with unemployment, low income, low social support, marital status, use of social services, needing help in activities of daily living, and suffered by emotional problems. Although there are some discrepancies between the proportions of good or poor SRH, the determinants of SRH are generally consistent across different studies.

In the literature poor SRH has been consistently associated with lower education and lower income (Monnat, 2011), poorer access to health services (Mitchell et al. 2006), ethnicity (Franzini et al. 2005), more chronic health problems (Asfar et al. 2007), limited functioning (Mitchell et al. 2006), less physical exercise (Tsai et al. 2010), etc. A significant association between income and health was consistently found in both rural and urban settings (Nummela et al. 2008). Adequate income supports good health. Increasing active social participation and access to help from others improves health in both urban and rural areas (Nummela et al. 2009). Encouragingly, our findings are consistent with previous literature. Daily functioning and number of chronic diseases were consistently associated with SRH at all three Waves of CSHA. Being married, cognitively intact, not living alone, having someone to count on for help, and having had a higher skilled job were associated with better SRH at different Waves. When measured,

being satisfied with income was associated with higher SRH. More importantly, having intact cognition, fewer restraints on daily functioning, fewer chronic diseases, and someone to count on for help was associated with good SRH over the 10-year period. This finding indicates that compared to other determinants of SRH, these predisposing factors are relatively more important in the long term and attention should be paid to them. Notably, the interaction between time and ethnicity was associated with longitudinal SRH, being Caucasian at the Wave 2 was associated with *poor* SRH. This phenomenon could be partially explained by the healthy immigrant effect as Canada is a nation of immigrations and health is an important selection criterion, but this effect is in decline over time (Gushulak et al. 2011).

Our findings are consistent with the previous literature on SRH among seniors (Galenkamp et al. 2013; van Gool et al. 2011; Spiers et al. 1996), and suggest that these determinants are important to seniors in rating their overall health at any one time and over time.

Despite the strengths of longitudinal study design and a comprehensive number of potential health determinants, two limitations should be noted. First, unlike previous studies we analyzed a cohort of seniors who had completed a 10-year follow-up. Because we targeted an aging population, a large number of the baseline sample of seniors died during the decade of follow up. However, there were no significantly statistical differences of age, gender, marital status, place of residence, education, ethnicity, and baseline SRH between selected and non-selected subjects. Second, this is a secondary analysis of the original survey data. All determinants analyzed were derived from the

screening assessments of the CSHA across its three Waves. Some factors were not consistently assessed across the three Waves.

In conclusion, the major determinants of SRH among Canadian seniors identified in the study using cross-sectional and longitudinal models are level of daily functioning, number of chronic diseases, cognitive function, and whether or not having someone to count on for help. These predisposing determinants should be important stimuli for improving health. Attention should be paid to the improved management of these determinants, as they have positive effects on public health.

Conflict of interest statement

The authors have no conflicts of interest to disclose.

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Table 1 Characteristics of selected subjects (N=3,255) and non-selected subjects

(N=5,694) in the community sample at Baseline (Wave 1) of the CSHA

Factors	Selected	Non-selected
Gender		
Males	1244 (38.2%)	2241 (39.4%)
Females	2011 (61.8%)	3453 (60.6%)
Age		
65-74 years	1350 (41.5%)	2303 (40.4%)
75-84 years	1332 (40.9%)	2356 (41.4%)
85+ years	573 (17.6%)	1035 (18.2%)
Marital Status		
Unmarried	236 (7.3%)	398(7.0%)
Married/Common law	1652 (51.0%)	2899 (51.3%)
Separated, widowed, or divorced	1352 (41.7%)	2351 (41.6%)
Place of residence		
Urban	2736 (89.5%)	4736 (83.2%)
Rural	322 (10.5%)	630 (11.1%)
Education		
0-6 years	552 (17.4)	965 (17.4%)
7-12 years	1905 (60.1%)	3420 (61.5%)
13+ years	714 (22.5%)	1172 (21.1%)
Ethnicity		
White	3131 (98.7%)	5458 (98.6)

Black	8 (0.3%)	21 (0.4%)
Others	32 (1.0%)	58 (1.0%)
Self-rated health		
Good	2609 (80.5%)	4601 (81.7%)
Fair	517 (16.0%)	856 (15.2%)
Poor	114 (3.5%)	174 (3.1%)

Table 2 Self-rated health of the study cohort (N=3,255) at all three Waves of the CSHA

Study period	Good	Fair	Poor
Wave 1 (1991)	80.5%	16.0%	3.5%
Wave 2 (1996)	81.2%	15.1%	3.7%
Wave 3 (2001)	82.8%	13.6%	3.6%

Table 3 Multivariate ordinal logistic regression for determinants associated with *poor*

self-rated health based on the cohort (N=3,255) at each Wave of the CSHA

Factors	Wave 1		Wave 2		Wave 3	
	OR	95%CI	OR	95%CI	OR	95%CI
Marital Status						
Married/Common law	1		…[a]	…	…	…
Unmarried	0.68	0.43-1.08	…	…	…	…
Separated, widowed, or divorced	1.52	1.12-2.05	…	…	…	…
Cognitive Function						
Cognitive intact	…	…	1		…	…
Cognitive impairment	…	…	1.64	1.22-2.19	…	…
Physical activities of daily living						
No difficulty	1		…	…	1	
Difficulty with 1-2 PADLs	1.50	1.14-1.97	…	…	1.48	1.11-1.96
Difficulty with 3 + PADLs	1.66	0.74-3.72	…	…	1.31	0.59-2.91
Instrumental activities of daily living						
No difficulty	1		1		1	
Difficulty with 1-2 IADLs	2.10	1.67-2.64	2.61	2.04-3.35	2.35	1.77-3.13
Difficulty with 3-4 IADLs	4.32	2.96-6.31	4.57	3.27-6.40	3.61	2.29-5.69
Number of Chronic Diseases						
None	1		1		1	
1-3 diseases	3.73	1.51-9.24	6.66	1.62-27.32	4.77	1.16-19.70
4-6 diseases	12.81	5.19-31.61	26.75	6.54-109.47	9.88	2.40-40.63

7 or more	32.54	12.93-81.92	47.57	11.19-202.24	28.91	6.88-121.51
Living Alone						
Yes	1		…	…	…	…
No	1.51	1.12-2.04	…	…	…	…
Someone to Count on for Help						
Yes	1		…	…	1	
No	1.77	1.12-2.81	…	…	3.84	1.79-8.23
Longest Job						
Profess/Tech	1		…	…	…	…
Skilled/Manger	1.41	1.00-1.98	…	…	…	…
Unskilled/Semiskilled	1.78	1.26-2.50	…	…	…	…
Unemployed	1.25	0.79-1.96	…	…	…	…
Satisfaction with Income						
Satisfied	…	…	1		1	
Acceptable	…	…	1.69	1.20-2.37	1.53	1.01-2.32
Not satisfied	…	…	3.25	1.96-5.41	2.17	1.18-3.99
Ethnicity						
Caucasian	1		…	…	…	…
Non-Caucasian	2.27	1.05-4.89	…	…	…	…
No. of Days per Week Outside						
More than two days a week	…	…	…	…	1	
Less than one day a week	…	…	…	…	2.05	1.50-2.80
Never	…	…	…	…	2.07	1.10-3.92

Note. ⋯ [a] factors not included in the model.

Table 4 Determinants consistently associated with *poor* self-rated health over a 10-year period

Determinants	Estimate	S.E.	Z	OR	95%CI	
Wave						
Wave 1	0.38	0.67	0.57	1.46	0.39	5.47
Wave 2	-1.82	0.98	-1.86	0.16	0.02	1.11
Wave 3	Reference					
Ethnicity						
Caucasian	-0.75	0.42	-1.57	0.47	0.21	1.07
Non-Caucasian	Reference					
Longest job						
Unemployed	-0.07	0.14	-0.49	0.94	0.72	1.22
Unskilled/Semiskilled	0.31	0.10	3.02**	1.36	1.10	1.65
Skilled/Manger	0.22	0.10	2.21*	1.25	1.02	1.51
Professionals	Reference					
Cognition						
Abnormal	0.36	0.08	4.53***	1.43	1.23	1.67
Normal	Reference					
Physical activities of daily living						
Difficulty > 2 PADLs	0.58	0.19	3.13**	1.79	1.23	2.56
Difficulty in 1-2 PADLs	0.36	0.08	4.52***	1.43	1.22	1.68
No difficulty	Reference					
Instrumental activities of daily living						
Difficulty > 2 IADLs	1.23	0.11	10.67***	3.42	2.72	4.26

Difficulty in 1-2 IADLs	0.82	0.07	10.90^{***}	2.27	1.95	2.61
No difficulty	Reference					
Chronic diseases						
7 or more	3.30	0.27	12.13^{***}	27.11	15.80	46.06
4~6 diseases	2.39	0.26	9.03^{***}	10.91	6.49	18.17
1~3 diseases	1.24	0.27	4.69^{***}	3.46	2.05	5.81
None	Reference					
Someone to count on for help						
No	0.66	0.16	4.25^{***}	1.93	1.43	2.61
Yes	Reference					
Wave ´ ethnicity						
Wave 1 ´ Caucasian	0.03	0.68	0.04	1.02	0.27	3.84
Wave 2 ´ Caucasian[a]	2.16	0.99	2.19^{*}	8.67	1.26	59.74
Intercept1	-5.97	0.50	-12.00^{***}			
Intercept2	-3.90	0.50	-7.88^{***}			

Note. $^{*}p<0.05.$ $^{**}p<0.01.$ $^{***}p<0.001.$

[a] Compared to non-Caucasian and Caucasian at other Waves.