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# Social isolation and mortality among Canadian seniors

by Heather Gilmour and Pamela L. Ramage-Morin

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# Social isolation and mortality among Canadian seniors

by Heather Gilmour and Pamela L. Ramage-Morin

## Abstract

**Background:** Subjective and objective measures of isolation have been associated with increased risk of mortality in many studies, and some have found differential effects.

**Data and methods:** Canadian Community Health Survey-Healthy Aging data (2008/2009) linked to the Canadian Vital Statistics—Death Database were used to estimate the prevalence of social isolation measured objectively (low social participation) and subjectively (feelings of loneliness and weak sense of community belonging). Associations with death during the 8 to 9 year follow-up period were examined with multivariate Cox proportional hazards models controlling for sociodemographic and health-related characteristics. Structural equation models (SEM) examined direct paths with survival time and indirect effects through health status controlling for covariates that were significant in the Cox models. Analyses were stratified by sex.

**Results:** An estimated 525,000 people (12%) aged 65 or older felt socially isolated and over 1 million (1,018,000) (24%) reported low participation. In multivariate Cox models, low participation was significantly associated with death for men and women even when the potential confounding effects of subjective isolation, socio-demographic characteristics, health status, and health behaviours were considered. Subjective isolation was not associated with death in final multivariate models for men or women. SEM revealed significant associations between low participation and survival time for men and women. In addition to the direct effects, there were significant indirect effects mediated by health status. There were no direct effects of subjective isolation on survival for men or women, only indirect effects mediated through health status.

**Interpretation:** Subjective and objective isolation differed in their association with mortality.

**Keywords:** loneliness, morbidity, data linkage, path analysis, structural equation modelling, aging

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The impact of social isolation and loneliness on health and well-being is recognized globally as a public health issue. The United Kingdom appointed a Ministerial lead on loneliness<sup>1</sup> and the World Health Organization recognizes the impact of social isolation on disability and death.<sup>2</sup> Research generally demonstrates that social isolation is associated with increased risk of mortality<sup>3-7</sup> on par with or greater than more traditional risk factors such as alcohol use, smoking and obesity.<sup>8</sup>

Social isolation can be experienced at any age, although some circumstances relate more specifically to older ages.<sup>9-12</sup> These may include transitions to retirement and accompanying role loss, ill health, loss of a spouse or friends, mobility problems, vision and hearing loss, lower income, residential changes, and changes in access to transportation. At a broader social level, ageism may contribute to social isolation.<sup>12</sup> Social isolation experienced by marginalized populations such as the LGBTQ community can continue into the senior years, adding to other factors associated with aging.<sup>13</sup>

While there may be an intuitive understanding of social isolation, measurement of this concept varies. Objective measures such as the size of social networks and the frequency of social participation reflect the structural aspects of social relationships while subjective feelings of social isolation<sup>11</sup> or loneliness<sup>14</sup> embody the functional aspects of relationships.<sup>3</sup> Associations between both subjective and objective measures of isolation and risk of death are evident in some studies<sup>5,7,15-18</sup> although others report different associations depending on the measure.<sup>19-21</sup>

The primary goal of this study was to examine an objective and a subjective measure of social isolation and their associations with mortality for Canadian seniors aged 65 or older. Prevalence

estimates of social isolation using each measure are presented. Selected factors associated with social isolation were examined prior to their inclusion in the multivariate models. Note that data on transitions (e.g. retirement) and changes in life circumstances (e.g. loss of spouse) were not available in the cross-sectional data on which this study was based. Associations with survival were assessed with multivariate Cox proportional hazards models adjusting for selected sociodemographic and health-related characteristics. Structural equation models (SEM) were used to examine direct relationships between social isolation measures and death and indirect effects mediated through health status.

Social isolation was defined objectively as infrequent social participation (low participation) and subjectively as feelings of loneliness and a weak sense of community belonging (subjective isolation). Because of evidence showing different associations between measures of social isolation and mortality by sex,<sup>6,22-24</sup> men and women were analyzed separately.

## Methods

### Data sources

*Canadian Community Health Survey—Healthy Aging (CCHS-HA)*

The cross-sectional 2008/2009 CCHS-HA collected information about factors that contribute to healthy aging, targeting people aged 45 or older living in private dwellings in the 10 provinces. About 4% of the population were excluded: residents of the three territories, First Nations reserves, certain remote regions, institutions and Canadian Forces bases, and full-time

members of the Canadian Forces. Data were collected from December 2008 through November 2009. Computer-assisted personal interviews were conducted for 94% of the sample; telephone interviews were permitted to accommodate the language needs of respondents. The overall response rate was 74.4%. Detailed documentation for the CCHS-HA is available at: <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5146>.

### *The Canadian Vital Statistics—Death Database (CVSD)*

The CVSD is an administrative dataset that includes demographic and cause of death information for deaths that occur in Canada. Data are collected annually from provincial and territorial vital statistics registries. Deaths that occurred from December 2008 through December 31, 2017 that linked to CCHS-HA records were used in this analysis. Detailed documentation for the CVSD is available at: <http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=1202355>.

### **Data linkage**

Linkage approval (007-2018) was granted by the Chief Statistician of Canada and performed in accordance with the Directive on Record Linkage. CCHS-HA respondents who agreed to share and link their data were probabilistically linked to the Derived Record Depository (DRD) in the Social Data Linkage Environment (SDLE) at Statistics Canada. Probabilistic record linkage works with non-unique identifiers (e.g., name, sex, date of birth, and postal code) and estimates the likelihood that records refer to the same entity.<sup>25</sup> Only employees directly involved in the process have access to the information required for linkage and do not access health and/or death-related information. An analytical file without identifying information was created for this study.

### **Study sample**

The study was based on CCHS-HA respondents aged 65 or older with data linked to the CVSD for those who died

(Appendix Table A). Follow-up ranged from 8 to 9 years, from the CCHS-HA interview date to December 31, 2017. The study sample comprised 13,037 individuals (5,408 men, 7,629 women); 4,953 respondents (2,175 men, 2,778 women) died in the follow-up period between their CCHS-HA interview and December 31, 2017.

### **Definitions**

#### *Social isolation measures*

*Low participation* was based on the social participation module that questions respondents about eight community-related activities. Respondents were asked how often in the past 12 months (at least once a day/week/month/year or never) they participated in each activity. Individuals whose overall participation was less than weekly were classified as having *low participation* versus high participation (one activity or more on a daily or weekly basis). The “weekly” benchmark was selected based on earlier studies.<sup>13,26</sup>

- family or friendship activities outside the household
- church or religious activities such as services, committees or choirs
- sports or physical activities with others
- other recreational activities involving others, including hobbies, bingo and other games
- educational and cultural activities involving others such as attending courses, concerts or visiting museums
- service club or fraternal organization activities
- neighbourhood, community or professional association activities
- volunteer or charity work

Although low participators did not participate in any of the eight activities on a weekly basis, 4% of them participated in 4 or more activities on a monthly basis.

*Subjective isolation* was a composite of two measures capturing loneliness and sense of community belonging. The three-Item Loneliness Scale was

based on the Revised UCLA Loneliness Scale.<sup>27</sup> Respondents were asked “How often do you feel: that you lack companionship? left out? isolated from others?” Response category values (1 = hardly ever; 2 = some of the time; 3 = often) were summed. Respondents who scored 4 to 9 were categorized as lonely versus a score of 3. Sense of community belonging was determined with one question: “How would you describe your sense of belonging to your local community? Would you say it is very strong? Somewhat strong? Somewhat weak? Very weak?” Individuals who were lonely and reported a “somewhat” or “very” weak sense of community belonging were considered isolated.

#### *Covariates*

*Age* in years was grouped (65 to 74, 75 or older) for prevalence estimates and the number and percentage of deaths, and entered as a continuous variable in the multivariate analyses. *Seniors* refers to the study population, that is, those aged 65 or older. The highest level of educational attainment by any household member (less than post-secondary, post-secondary graduation or more) was selected as a measure of socioeconomic status. It represents a family resource that is often correlated with levels of income and wealth<sup>28</sup> and is suitable when transitions from employment to retirement are likely in the population. Place of residence was dichotomized as urban or rural. A combination of *marital status* and *living arrangements* classified individuals as married/common-law versus not married/common-law (i.e. single, widowed or divorced); the latter was further divided into those who were living alone versus with others where “others” could be a child, friend, sibling or other. A dichotomous variable classified respondents as married or common-law versus neither for the path analysis (SEM).

The Health Utility Index Mark 3 (HUI3)<sup>29</sup> was used to assess *functional health status* in eight domains: vision, hearing, speech, mobility, dexterity, cognition, emotion, and pain and discomfort. Overall scores were categorized

into levels of disability for reporting prevalence: no/mild disability (0.89 to 1.00), moderate disability (0.70 to 0.88), or severe disability (less than 0.70)<sup>30</sup> Continuous HUI3 scores were used in multivariate models – higher scores equate to better health status.

*Smoking status* was categorized as current (daily or occasional), former, or never smoked. For the path analysis current and former smokers were grouped together and compared to those who had never smoked.

*Physical activity* was based on the Physical Activity Scale for the Elderly (PASE). It captures self-reported occupational, household and leisure activity over the previous 7 days.<sup>31</sup> Higher scores indicate higher levels of physical activity. Using scores from the population (weighted), respondents' activity levels were classified into quartiles as least active (score: < 58), low to moderate (58 to 99), moderate to high (100 to 143), or most active (> 143). Continuous PASE scores were used in the multivariate analyses.

### Analytical techniques

Cross-tabulations were used to estimate the prevalence of low participation and subjective isolation, and the number and percentage of deaths by social isolation measures and selected characteristics. Associations between social isolation and mortality were examined using Cox proportional hazards models with subjective isolation and low participation entered into models simultaneously. These social isolation variables were moderately correlated (0.28 for men and 0.38 for women), suggesting that they are related, but distinct, concepts. Variance inflation factors ( $\leq 2.9$ ) and tolerance estimates ( $\geq 0.2$ ) demonstrated that multicollinearity was not a problem. Adjusted models controlled for potential confounders measured at the time of the CCHS-HA interview. The first model controlled for age; the second added sociodemographic variables (household education; marital status and living arrangements; urban/rural residence) and the final model included health-re-

lated characteristics (health status, smoking status, and physical activity). The selection of covariates was based on the literature and availability in the CCHS-HA. The proportional hazards assumption was tested by visual examination of SAS PROC LIFETEST plots.

The direct and indirect impact of subjective isolation and low participation on survival were assessed using SEM with Stata/MP 14.2. Indirect paths were assessed with functional health status (HUI3) as a single hypothesized mediator. HUI3 underwent an arc sine transformation to approximate a normal distribution. The SEM analyses controlled for covariates found to be significantly associated with mortality in the fully-adjusted Cox proportional hazards models (men: age, smoking status, physical activity; women: age, smoking status, physical activity, household education, living arrangement). An arc sine transformation was also applied to the outcome variable, time to death. The model goodness of fit was assessed using the Standardized RMR (SRMR) and the coefficient of determination (CD).

Sampling weights were used to account for the survey design and non-response, and to adjust for differences in agreement to link and share. The use of sampling weights is essential to account for unequal probabilities of selection and to reduce the potential for bias resulting from differing response, share, and agreement to link rates. Bootstrap weights were applied using SAS-Callable SUDAAN 11.0 to account for underestimation of standard errors due to the complex survey design.<sup>32</sup> The significance level was set at  $p < 0.05$ .

## Results

### Baseline characteristics of the study population

The weighted study sample ( $n=13,037$ ) represented 4.2 million people aged 65 or older with a mean age of 74 years in 2008/2009. Almost half (45%) were men, and most (63%) were married or common-law; 54% lived in households where at least one person was a postsecondary

### *What is already known on this subject?*

- There is no gold standard for the definition and measurement of social isolation.
- Some definitions focus on objectively measured characteristics such as the number of social contacts or frequency of social participation.
- Others are based on subjective feelings such as loneliness or perceptions of being excluded.
- Both subjective and objective assessments of social isolation have been associated with increased risk of death.

### *What does this study add?*

- Men and women aged 65 or older were equally likely to be low participators – an objective measure of social isolation.
- Women were more likely than men to report feelings of social isolation.
- Low participation was associated with risk of death (shorter survival time) for both men and women.
- Subjective social isolation was not directly associated with death; there was an indirect effect mediated through health status.

graduate; 79% lived in an urban setting; 10% were current smokers, 56% former smokers and 35% had never smoked; mean physical activity (PASE) score was 106 and mean HUI3 score was 0.81.

### Subjective isolation and low social participation

From the 2008/2009 CCHS-HA, an estimated 525,000 people (12%) age 65 or older felt isolated in that they reported feelings of loneliness and a weak or somewhat weak sense of community belonging. At 15%, women were more likely than men (10%) to report sub-



**Table 1**  
**Prevalence of social isolation measures by sociodemographic characteristics, by sex, household population aged 65 or older, Canada excluding territories, 2008 to 2009**

Characteristics	Low participation								Subjective isolation							
	Men				Women				Men				Women			
	Number	%	95% confidence interval		Number	%	95% confidence interval		Number	%	95% confidence interval		Number	%	95% confidence interval	
	'000		from	to	'000		from	to	'000		from	to	'000		from	to
<b>Overall</b>	<b>470</b>	<b>24.7</b>	<b>22.9</b>	<b>26.5</b>	<b>548</b>	<b>23.5</b>	<b>21.8</b>	<b>25.2</b>	<b>182</b>	<b>9.6</b>	<b>8.4</b>	<b>10.9</b>	<b>343</b>	<b>14.8</b>	<b>13.6</b>	<b>16.2</b>
<b>Age group</b>																
65 to 74 <sup>†</sup>	267	23.8	21.7	26.1	276	22.2	19.8	24.8	107	9.6	8.1	11.3	174	14.1	12.4	16.1
75 or older	203	25.9	23.3	28.6	271	25.0	22.9	27.1	75	9.6	8.1	11.2	169	15.7	14.0	17.5
<b>Education</b>																
Post-secondary <sup>†</sup>	259	23.2	20.9	25.8	244	21.3	19.2	23.5	89	8.0	6.6	9.7	161	14.1	12.3	16.1
Less than post-secondary	201	26.6	24.2	29.2	283	25.0*	22.8	27.3	88	11.7*	10.0	13.8	175	15.6	13.8	17.5
<b>Marital status and living arrangement</b>																
Married / common-law <sup>†</sup>	356	23.4	21.4	25.5	260	22.5	19.8	25.4	95	6.3	5.2	7.5	133	11.5	9.5	13.9
Not married / common-law																
Living with others	29	41.5*	32.6	51.0	94	34.5*	30.0	39.4	11 <sup>E</sup>	16.5 <sup>EE</sup>	11.2	23.7	55	20.4*	16.2	25.3
Living alone	85	27.3*	24.3	30.6	194	21.5	19.7	23.4	75	24.2*	20.6	28.2	155	17.4*	15.9	19.1
<b>Place of residence</b>																
Urban <sup>†</sup>	121	27.4	23.9	31.4	112	23.9	20.8	27.4	39 <sup>E</sup>	8.9	6.6	11.9	59	12.8	10.0	16.2
Rural	349	23.8	21.9	25.9	436	23.4	21.5	25.4	143	9.8	8.5	11.2	284	15.4	13.9	16.9

<sup>E</sup> use with caution

\* significantly different from estimate for reference category ( $p < 0.05$ )

<sup>†</sup> reference category

**Source:** 2008/2009 Canadian Community Health Survey-Healthy Aging (CCHS-HA) linked to Canadian Vital Statistics Database (CVSD) up to December 31, 2017.

jective isolation (Table 1). Over 1 million (1,018,000) older Canadians (24%) reported low participation with no difference in the percentages for men and women. Seniors who were not married or living with a common-law partner were more likely than partnered individuals to report low participation and subjective isolation. Non-partnered seniors who lived with others were particularly likely to be low participators – 41% of men and 35% of women. Lower household education was associated with low participation for women and subjective isolation for men. Age group and place of residence (urban or rural) were not associated with either measure of social isolation.

## Death

An estimated 33% of men and 26% of women died during the follow-up period (Table 2). Low participators in 2008/2009 were more likely than those who participated regularly to die, and the same was true for men and women who reported subjective isolation compared to those who did not feel isolated.

There was a greater likelihood of death for older people and residents of lower-education households. Individuals who were married or in a common-law relationship were less likely than those who were not in such a relationship to die over the follow-up. More severe disability, being a current or former smoker, and lower levels of physical activity were associated with an increased likelihood of death.

Low participating men and women had, on average, shorter survival times than individuals who participated more frequently in community-related activities (Table 3). For example, the average survival time for women who were low participators was approximately 8 months shorter than those who were high participators. There was no difference in average survival times for men based on subjective isolation. However for women, there was a significant association between feeling isolated and shorter survival times.

Low participation and subjective isolation were further examined in multivariate models that included both measures. Low participation was sig-

nificantly associated with death for men and women even when the potential confounding effects of subjective isolation, socio-demographic characteristics, health status, and health behaviours were considered (Table 4). For women, subjective isolation was associated with mortality when low participation and socio-demographic characteristics were considered (HR 1.4), but lost significance in the final model when controlling for health status and behaviours. Subjective isolation was not associated with death in any of the models for men. As expected, increasing age, smoking and lower physical activity scores were significantly associated with mortality; higher functional health scores were protective. For women only, lower household-level education and not being married or having a common-law partner were associated with death in the fully adjusted model.

Consistent with the survival analysis, results of path analysis showed that low participation was significantly associated with survival time for men and women (Figure 1). In addition to the direct effects, there were significant indirect effects mediated by health status. That

**Table 2**  
**Number and percentage of deaths during 8- to 9-year follow-up, by social isolation measures and other selected baseline characteristics (2008/2009), by sex, household population aged 65 or older, Canada excluding territories**

Baseline characteristics (2008/2009)	Men				Women			
	Number '000	%	95% confidence interval		Number '000	%	95% confidence interval	
			from	to			from	to
<b>Total</b>	<b>621</b>	<b>32.5</b>	<b>30.8</b>	<b>34.3</b>	<b>603</b>	<b>25.8</b>	<b>24.4</b>	<b>27.2</b>
<b>Social isolation measure</b>								
Low participation								
Yes	195	41.4*	37.9	45.0	204	37.2*	33.7	40.9
No†	426	29.7	27.7	31.7	398	22.3	20.8	23.8
Subjective isolation								
Yes	70	38.6*	33.0	44.4	123	35.8*	31.2	40.5
No†	545	31.7	29.9	33.6	474	24.1	22.7	25.6
<b>Sociodemographic</b>								
Age group								
65 to 74†	206	18.4	16.6	20.4	145	11.7	10.2	13.3
75 or older	415	52.6*	49.6	55.6	458	42.0*	39.6	44.4
Education								
Post-secondary†	308	27.6	25.4	29.9	241	21.0	19.0	23.1
Less than post-secondary	299	39.5*	36.5	42.5	349	30.7*	28.8	32.8
Marital status and living arrangement								
Married / common-law†	454	29.7	27.7	31.7	182	15.7	13.8	17.8
Not married / common-law								
Living with others	29	42.3*	33.7	51.3	105	38.3*	33.7	43.1
Living alone	138	44.3*	40.7	48.0	317	35.1*	33.1	37.1
Place of residence								
Urban†	144	32.5	28.7	36.6	119	25.4	22.2	28.9
Rural	477	32.5	30.5	34.6	484	25.9	24.3	27.5
<b>Health status and behaviours</b>								
Health utilities index								
No or mild disability†	268	24.2	22.1	26.5	207	16.8	15.2	18.7
Moderate disability	149	41.0*	36.5	45.7	128	27.6*	24.3	31.2
Severe disability	187	46.9*	42.8	51.1	251	43.1*	40.2	46.1
Smoker								
Current (daily or occasional)	78	41.9*	36.2	48.0	85	36.9*	31.7	42.4
Former	432	32.6*	30.6	34.7	269	26.0*	24.0	28.2
Never†	110	27.7	23.9	32.0	249	23.2	21.4	25.0
Physical activity								
Least active	204	55.1*	50.9	59.2	321	45.9*	42.8	49.0
Low to moderately active	144	36.7*	32.6	41.1	157	23.5*	21.0	26.1
Moderately to high active	156	30.9*	27.4	34.6	89	16.2*	13.8	19.1
Most active†	116	18.1	15.7	20.7	36	8.7	6.9	10.8

\* significantly different from estimate for reference category (p < 0.05)

† reference category

Source: 2008/2009 Canadian Community Health Survey-Healthy Aging (CCHS-HA) linked to Canadian Vital Statistics Database (CVSD) up to December 31, 2017.

is, men and women who were low participators in 2008/2009 had an increased risk of mortality (direct effect) as well as poorer health status (lower HUI3 score) which was associated with shorter survival time (indirect effect). The direct effect accounted for 89% of the total effect for men and 85% for women. There were no direct effects of subjective isolation on survival for men or women, only indirect effects through health status. Assessment of the fit for path

analysis models were considered acceptable with SRMR=0.000 and CD=0.257 for men, SRMR=0.000 and CD=0.298 for women.

## Discussion

Mortality risk in community dwelling seniors was estimated prospectively in relation to objective and subjective social isolation using linked population-based survey and administrative data. About

12% felt isolated and 24% were low participators in 2008/2009. Survival and path analyses revealed that low participation was associated with mortality, while subjective isolation was only related to mortality indirectly via health status.

The lack of a gold standard for defining and measuring social isolation makes comparisons with other studies a challenge.<sup>11,33-36</sup> The term is often used interchangeably with “loneliness”, a related but distinct concept.<sup>9,11</sup> Loneliness has been defined as mismatch between the actual and desired quality and quantity of social connections<sup>14</sup> whereas social isolation is a broader concept, encompassing an individual's place among social networks and not just feelings of inadequate personal connections.<sup>34,37,38</sup> Zavaleta et al.<sup>34</sup> describe it succinctly as “a deprivation of social connectedness” (pg. 367). Nonetheless, a body of research using a variety of measures (e.g., social contacts, network size, loneliness, social support, or composite indexes that combine several aspects of social isolation) provides robust evidence that a lack of social connectedness negatively impacts longevity.<sup>3,6,8,16,39-41</sup>

The combination of loneliness and weak sense of community belonging measures, used successfully in a previous study,<sup>42</sup> captures what Weiss<sup>43</sup> refers to as emotional loneliness - the absence of close ties or personal relationships - and social loneliness - the absence of connections to a broader social network such as friends and community groups. Similar to the discrepancy theory of loneliness,<sup>35</sup> the intersection of loneliness and weak sense of community belonging permits the identification of those who subjectively appear most vulnerable, those who feel isolated both from close personal relationships and the broader community. Objective isolation represents a lack of social contacts measured in a quantitative manner - in this study by infrequent participation in community-related activities. The subjective and objective measures are conceptually distinct<sup>44</sup> but also linked - the larger the network the more likely a person's need for close relationships will be met, reducing feelings of loneliness.<sup>45</sup>

**Table 3**  
**Mean survival time by social isolation measures and sex, household population aged 65 or older, Canada excluding territories, 2008 to 2009**

Social isolation measure	Men			Women		
	Mean survival time (days)	95% confidence interval from	95% confidence interval to	Mean survival time (days)	95% confidence interval from	95% confidence interval to
<b>Low participation</b>						
Yes	1,570*	1,469	1,672	1,630*	1,543	1,716
No†	1,714	1,642	1,786	1,877	1,821	1,934
Difference	144	...	...	247	...	...
<b>Subjective isolation</b>						
Yes	1,601	1,437	1,764	1,667*	1,538	1,796
No†	1,680	1,616	1,743	1,824	1,772	1,875
Difference	79	...	...	156	...	...

... not applicable

\* significantly different from estimate for reference category ( $p < 0.05$ )

† reference category

Source: 2008/2009 Canadian Community Health Survey-Healthy Aging (CCHS-HA) linked to Canadian Vital Statistics Database (CVSD) up to December 31, 2017.

Our study, which investigates subjective and objective social isolation as separate albeit related entities, joins others<sup>18,20,21,39-40</sup> in identifying the effect of each on mortality accounting for the effect of the other. Consistent with these previous studies, our results indicate an independent association between objective isolation and mortality that did not persist for subjective isolation.<sup>20,21,39,40</sup> Beller and Wagner<sup>18</sup> further identified a synergistic effect whereby the interaction between loneliness and an objective measure of social interactions was significant and the higher level of one, the larger the effect of the other on mortality. The current study did not find a significant interaction between subjective and objective isolation in relation to mortality. Ellwardt<sup>21</sup> found that the association between subjective isolation (emotional and social loneliness) and mortality did not persist when mental health was added to the model and hypothesized that the relationship with mortality was indirect. In this study, we hypothesized that the pathway through which social isolation is associated with mortality is through functional health status (which includes an emotional health domain). Path analysis supported this conclusion. Together, these results emphasize the importance of including both subjective and objective measures of isolation in analyses.

Our study treats marital status and living arrangements – combined into a single covariate – as a potential confounder in the relationship between social isolation and mortality rather than as a measure of social isolation itself. Klinenberg<sup>46</sup> points out that since the mid-1900s, living alone has become increasingly common and that it is not synonymous with loneliness or social isolation. Certainly the loss of a spouse may lead to social isolation but so too may an unhappy marriage<sup>3,45</sup> or becoming a caregiver for an ailing partner.<sup>47,48</sup> Our study revealed that for women, not having a partner (married or common-law) was a risk factor for mortality over and above the impact of social isolation; for men, the apparent association was better accounted for by health status and behaviours.

### Strengths and Limitations

A strength of this study is the large sample, representative of the senior household population in 2008 to 2009. It includes an extensive follow-up period of eight to nine years with linkages to quality vital statistics death data. The inclusion of an objective and subjective measure of social isolation permits the examination of their relative contributions to mortality. In addition, the large sample allows the associations between social isolation and mortality to be analyzed separately for men and women.

There are a number of limitations to note. Although functional health status was conceptualized as being on the causal pathway between social isolation and mortality, these exposures were measured at the same time in the cross-sectional CCHS-HA. While this study posits social isolation as a risk factor for poor health, the opposite may also be true. Social isolation, health status, behaviours and other covariates were measured only at baseline and therefore it is not possible to establish if they varied during the follow-up period. Data on transitions (e.g. employed to retired) and changes in life circumstances (e.g. loss of spouse) that may be associated with social isolation were not available in the cross-sectional data on which this study is based. The CCHS-HA does not include residents of long-term care facilities. Proxy respondents (2.2% of the CCHS-HA sample) were excluded from the analysis. While this has the potential to introduce bias, so too would inclusion of survey records completed on behalf of infirm individuals.<sup>49</sup> An analysis of selected characteristics of the CCHS-HA data indicated that proxy respondents were more likely to be men, older, and in worse health than self-reporting respondents.<sup>42</sup> CCHS-HA data are self-reported and not verified by any other source. Some variables of potential relevance (for instance, medication use and history) were not available. Probabilistic linkage was used to match survey records to death information; the possibility of false links or missed links exists. The CVSD includes death information for events occurring predominantly in Canada; respondents who died outside of Canada account for less than 0.2% of the linked data. The primary goal of the study was to examine associations between social isolation and mortality. As such, only selected factors associated with social isolation, health status and mortality were included for use in the multivariate models. Future research could examine whether the relationships between social isolation and mortality differed for specific populations identified by characteristics such as LGBTQ, Indigenous and minority language status.



**Table 4**  
**Adjusted hazard ratios relating survival over 8 to 9 year follow-up to social isolation measures and other selected baseline characteristics (2008/2009), by sex, household population aged 65 or older, Canada excluding territories**

Baseline characteristics (2008/2009)	Men									Women								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	Adjusted hazard ratio	95% confidence interval from to		Adjusted hazard ratio	95% confidence interval from to		Adjusted hazard ratio	95% confidence interval from to		Adjusted hazard ratio	95% confidence interval from to		Adjusted hazard ratio	95% confidence interval from to		Adjusted hazard ratio	95% confidence interval from to	
<b>Social isolation measure</b>																		
Low participation																		
Yes	1.5*	1.3	1.7	1.5*	1.3	1.7	1.3*	1.1	1.5	1.7*	1.5	1.9	1.7*	1.5	2.0	1.4*	1.2	1.6
No <sup>†</sup>	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Subjective isolation																		
Yes	1.1	0.9	1.4	1.1	0.8	1.3	0.9	0.8	1.2	1.4*	1.2	1.7	1.4*	1.1	1.6	1.1	0.9	1.3
No <sup>†</sup>	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Age (continuous)	1.12*	1.11	1.13	1.11*	1.10	1.12	1.10*	1.09	1.11	1.12*	1.11	1.13	1.11*	1.10	1.12	1.10*	1.09	1.11
<b>Sociodemographic</b>																		
Education																		
Post-secondary <sup>†</sup>	...	...	...	1.0	...	...	1.0	...	...	...	...	...	1.0	...	...	1.0	...	...
Less than post-secondary	...	...	...	1.2	1.0	1.4	1.0	0.9	1.2	...	...	...	1.2*	1.0	1.3	1.2*	1.0	1.3
Marital status and living arrangement																		
Married / common-law <sup>†</sup>	...	...	...	1.0	...	...	1.0	...	...	...	...	...	1.0	...	...	1.0	...	...
Not married / common-law																		
Living with others	...	...	...	1.2	0.9	1.7	1.1	0.8	1.5	...	...	...	1.6*	1.3	2.0	1.4*	1.1	1.9
Living alone	...	...	...	1.2*	1.1	1.4	1.1	1.0	1.3	...	...	...	1.4*	1.2	1.6	1.3*	1.1	1.6
Place of residence																		
Urban <sup>†</sup>	...	...	...	1.0	...	...	1.0	...	...	...	...	...	1.0	...	...	1.0	...	...
Rural	...	...	...	1.1	0.9	1.3	1.2	1.0	1.4	...	...	...	1.1	0.9	1.3	1.1	0.9	1.3
<b>Health status and behaviours</b>																		
Health utilities index (continuous)	...	...	...	...	...	...	0.53*	0.41	0.69	...	...	...	...	...	...	0.46*	0.37	0.57
Smoking																		
Current (daily or occasional)	...	...	...	...	...	...	2.2*	1.6	2.9	...	...	...	...	...	...	2.6*	2.1	3.2
Former	...	...	...	...	...	...	1.3*	1.0	1.5	...	...	...	...	...	...	1.5*	1.3	1.7
Never <sup>†</sup>	...	...	...	...	...	...	1.0	...	...	...	...	...	...	...	...	1.0	...	...
Physical activity (continuous)	...	...	...	...	...	...	1.00*	0.99	1.00	...	...	...	...	...	...	0.99*	0.99	1.00

... not applicable

\* significantly different from estimate for reference category (p<0.05)

<sup>†</sup> reference category

**Source:** 2008/2009 Canadian Community Health Survey-Healthy Aging (CCHS-HA) linked to Canadian Vital Statistics Database (CVSD) up to December 31, 2017.

## Conclusion

Our study identifies and quantifies direct and indirect associations between social isolation measures and mortality. Mechanisms through which social isolation impacts health status and mortality are likely many and varied. For example, low social participation could reflect deficits in social networks, mobility problems, lack of transportation, geographic isolation or other factors such as hearing or vision loss that present challenges to social participation. Feelings

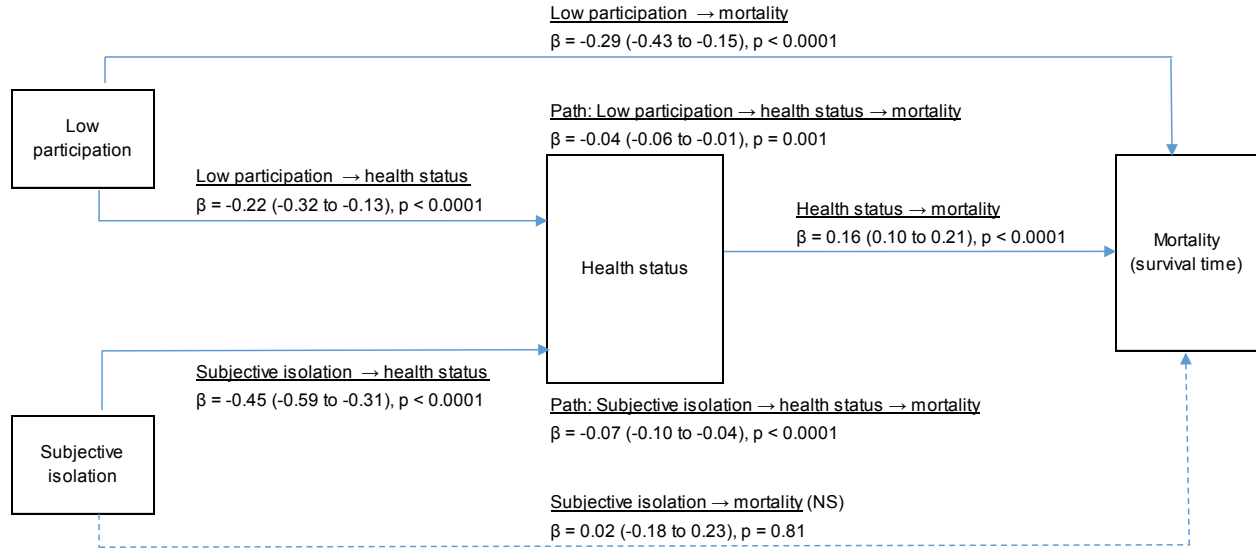
of isolation could be the result of loss or change in relationships through death or separation, physical and mental health problems, ageism and other factors that leave people feeling lonely and detached from the community.

Our results support screening and initiatives such as social prescribing by primary care clinicians<sup>50</sup> and Age-Friendly Communities (AFC).<sup>51,52</sup> In the former, physicians screen and refer their patients to non-clinical community services that address the social deter-

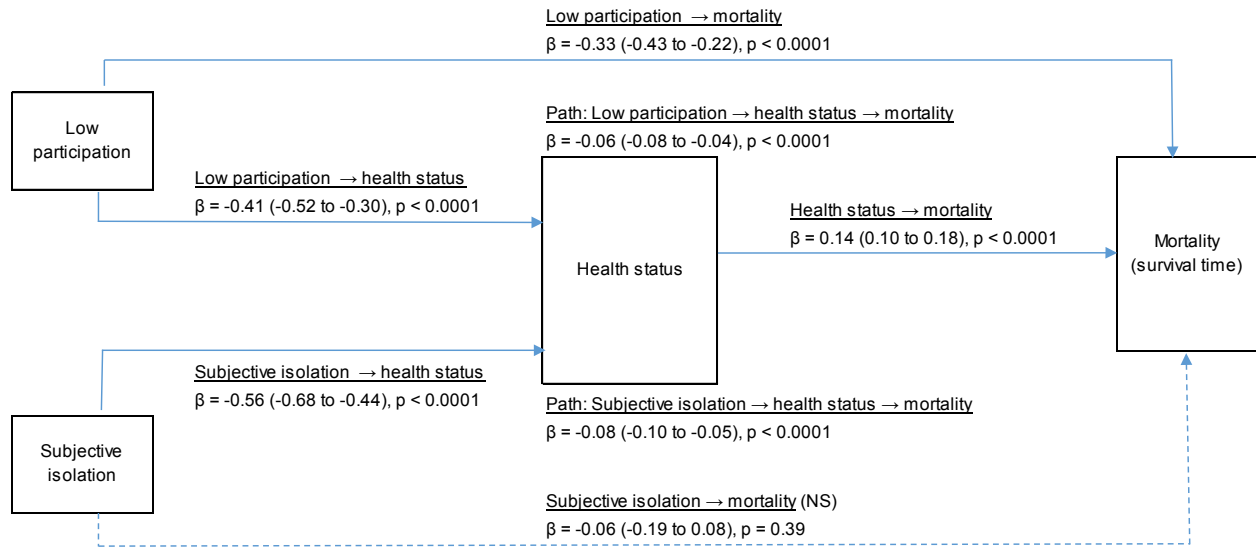
minants of health, including social isolation, taking individuals' needs and interests into consideration.<sup>50,53</sup> The AFC approach,<sup>54</sup> which has been implemented globally including in some Canadian communities, provides guidelines to adapt structures and services to better respond to the needs of an aging population in several domains including social participation. Addressing social isolation is an upstream approach with the potential to help improve quality of life and delay morbidity and mortality.

**Figure 1**  
**Summary of structural equation modelling between social isolation measures and selected characteristics at baseline (2008 to 2009) and mortality (2008 to 2017), by sex, household population aged 65 or older, Canada excluding territories**

Men



Women



**Notes:** For men, the model controlled for age, smoking (never smoked versus current or former smoker) and physical activity on health status, education and marital status (married or not). The beta values represent the effect of being socially isolated on survival time. Significant paths are indicated by solid lines.

**Source:** 2008/2009 Canadian Community Health Survey-Healthy Aging (CCHS-HA) linked to Canadian Vital Statistics Database (CVSD) up to December 31, 2017.

Currently many Canadians are experiencing social isolation as a result of the COVID-19 pandemic; seniors in particular are advised to physically isolate

themselves to reduce the risk of infection. While this study examines associations between social isolation and mortality over a nine-year period, it also points to

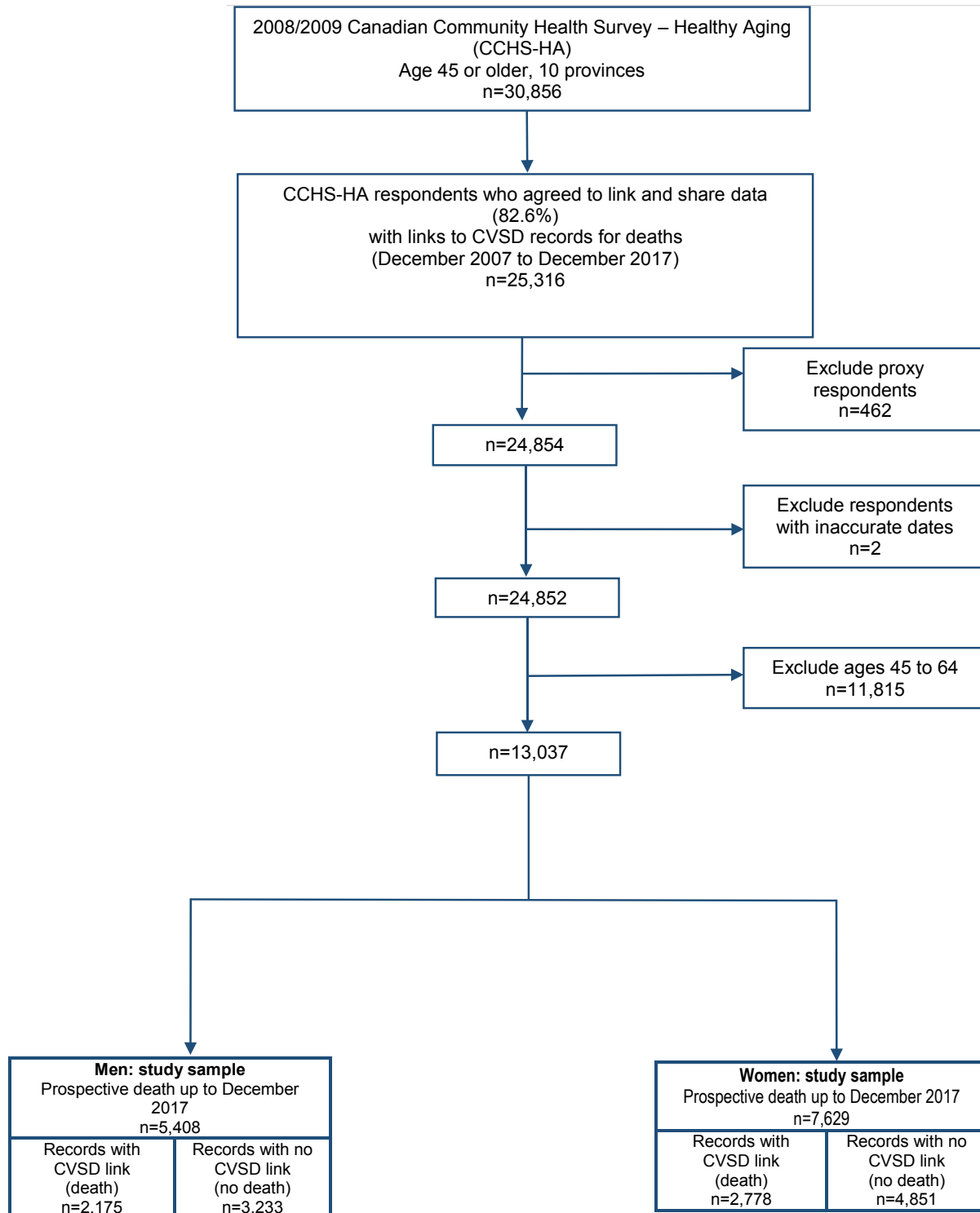
the importance of seniors returning to their activities and interactions following the pandemic to prevent the development of long-term social isolation. ■

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Research. Consultations included stakeholders from Human Resources and Social Development Canada and provincial and territorial health ministries. The addition of 5,000 respondents aged 45 to 54 was funded by the CLSA.

**Appendix****Figure A**  
**Study sample and exclusion criteria**

# References

- HM Government. *A connected society: a strategy for tackling loneliness*. London: Department for Digital, Culture, Media and Sport, 2018. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/750909/6.4882\\_DCMS\\_Loneliness\\_Strategy\\_web\\_Update.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/750909/6.4882_DCMS_Loneliness_Strategy_web_Update.pdf)
- World Health Organization (WHO). *World Report on Ageing and Health*; 2015. Available at: <https://apps.who.int/iris/handle/10665/186463>
- Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine* 2010; 7(7): e1000316. Doi:10.1371/journal.pmed.1000316.
- Nyqvist F, Pape B, Pellfolk T, et al. Structural and cognitive aspects of social capital and all-cause mortality: A meta-analysis of cohort studies. *Social Indicators Research* 2014; 116(2): 545-566.
- Rico-Urbe LA, Caballero FF, Martín-María N, et al. Association of loneliness with all-cause mortality: A meta-analysis. *PLOS One* 2018; 13(1): e0190033.
- Shor E, Roelfs DJ. Social contact frequency and all-cause mortality: A meta-analysis and meta-regression. *Social Science & Medicine* 2015; 128: 76-86.
- Leigh-Hunt N, Bagguley D, Bash K, et al. An overview of systematic reviews on the public health consequences of social isolation and loneliness. *Public Health* 2017; 152: 157-171.
- Pantell M, Rehkopf D, Jutte D, Syme L, Balmes J, Adler N. Social isolation: A predictor of mortality comparable to traditional risk factors. *American Journal of Public Health* 2013; 103(11): 2056-2062.
- Community Development Halton (CDH). Seniors: Loneliness and Social Isolation. 2016. Available at: <https://cdhalton.ca/2016/03/31/seniors-loneliness-and-social-isolation/>
- Andrew, M; Keefe, J. Social vulnerability among older adults: A social ecology perspective from the National Population Health Survey of Canada. *BMC Geriatrics* 2014; 14(90):1-14.
- Keefe K, Andrew M, Fancey P, Hall M. Final Report: A Profile of Social Isolation in Canada, 2006. Available at: [https://www.health.gov.bc.ca/library/publications/year/2006/keefe\\_social\\_isolation\\_final\\_report\\_may\\_2006.pdf](https://www.health.gov.bc.ca/library/publications/year/2006/keefe_social_isolation_final_report_may_2006.pdf)
- Bryant T, Brown I, Cogan T, et al. What do Canadian seniors say supports their quality of life? *Canadian Journal of Public Health* 2004; 95(4):299-303.
- Anderson GO, Thayer CE. Loneliness and social connections: A national survey of adults 45 and older. AARP Research and GfK Custom Research, Inc. 2018. DOI: doi.org/10.26419/res.00246.001
- de Jong Gierveld J. A review of loneliness: concept and definitions, determinants and consequences. *Reviews in Clinical Gerontology* 1998; 8: 73-8.
- Berkman L, Syme S. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda county residents. *American Journal of Epidemiology* 1979; 109(2):186-204. DOI: 10.1093/aje/kwx103
- Holt-Lunstad J, Smith TB, Baker M, et al. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspectives on Psychological Science* 2015; 10(2):227-37.
- Perissinotto CM, Stijacic Cenzer I, Covinsky KE. Loneliness in older persons: A predictor of functional decline and death. *Archives of Internal Medicine* 2012; 172(14): 1078-1083.
- Beller J, Wagner A. Loneliness, social isolation, their synergistic interaction, and morality. *Health Psychology* 2018; 17(39):808-813.
- Shaw JG, Farid M, Noel-Miller C, et al. Social isolation and Medicare spending: Among older adults, objective social isolation increases expenditures while loneliness does not. *Journal of Aging and Health* 2017; 29(7): 1119-1143.
- Stephoe A, Shankar A, Demakos, Wardle J. Social isolation, loneliness, and all-cause mortality in older men and women. *Proceedings of the National Academy of Sciences* 2013; 110 (15): 5797-5801
- Ellwardt L, van Tilburg T, Aartsen M et al. Personal networks and mortality risk in older adults: A twenty-year longitudinal study. *PLOS One* 2015; 10(3):e0116731.
- House J, Robbins C, Metzner H. The association of social relationship and activities with mortality: prospective evidence from the Tecumseh Community Health Study. *American Journal of Epidemiology* 1982; 116(1):123-140.
- Forster L, Stoller E. The impact of social support on mortality: a seven-year follow-up of older men and women. *Journal of Applied Gerontology* 1992; 11(2):173-186.
- Tilvis RS, Laitala V, Routasalo PR, Pitkälä KH. Suffering from loneliness indicates significant mortality risk of older people. *Journal of Aging Research* 2011; Article ID 534781.
- Sanmartin C, Decady Y, Trudeau R, et al. Linking the Canadian Community Health Survey and the Canadian Mortality Database: An enhanced data source for the study of mortality. *Health Reports* 2016; 27(12): 10-8.
- Gilmour H. Social participation and the health and well-being of Canadian seniors. *Health Reports* 2012; 23(4): 23-32.
- Hughes ME, Waite LJ, Hawkey LC, Cacioppo JT. A short scale for measuring loneliness in large surveys: Results from two population based studies. *Research on Aging* 2004; 26(6): 655-672.
- Diemer MA, Mistry RS, Wadsworth ME, et al. Best practices in conceptualizing and measuring social class in psychological research. *Analysis of Social Issues and Public Policy* 2013; 13(1): 77-113.
- Feeny D, Furlong W, Torrance GW et al. Multi-attribute and single-attribute utility functions for the Health Utilities Index Mark 3 system. *Medical Care* 2002; 40: 113-128.
- Feng Y, Bernier J, McIntosh C, Orpana H. Validation of disability categories derived from Health Utilities Index Mark 3 scores. *Health Reports* 2009; 20(2): 43-50.
- Washburn RA, Smith KW, Jette AM, Janney CA. The Physical Activity Scale for the Elderly (PASE): Development and Evaluation. *Journal of Clinical Epidemiology* 1993; 46(2):153-162.
- Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5(3): 283-310.
- Cornwell EY, Waite LJ. Social Disconnectedness, Perceived Isolation, and Health among Older Adults. *Journal of Health and Social Behavior* 2009; 50(1): 31-48. DOI: doi.org/10.1177/002214650905000103.
- Zavaleta D, Samuel K, Mills CT. Measures of social isolation. *Social Indicators Research* 2017; 131(1): 367-391. DOI: 10.1007/s11205-016-1252-2.
- Newall NEG, Menec VH. Loneliness and social isolation of older adults: Why it is important to examine these two social aspects together. *Journal of Social and Personal Relationships* 2017; 36(3): 925-939. DOI: 10.1177/0265407517749045.
- Wister A, Cosco T, Mitchell B, et al. Development and concurrent validity of a composite social isolation index for older adults using the CLSA. *Canadian Journal on Aging* 2019; 38(2): 180-192. doi: 10.1017/S0714980818000612.



37. Zavaleta D, Samuel K, Mills C. *Social Isolation: A Conceptual and Measurement Proposal*. Oxford Poverty and Human Development Initiative (OPHI), Working Paper no. 67. Oxford, United Kingdom: University of Oxford, 2014.
38. Hawthorne G. Measuring social isolation in older adults: Development and initial validation of the friendship scale. *Social Indicators Research* 2006; 77(3): 521-548.
39. Hakulinen C, Pulkki-Råback L, Virtanen M, et al. Social isolation and loneliness as risk factors for myocardial infarction, stroke and mortality: UK Biobank cohort study of 479 054 men and women. *Heart* 2018; 104(18):1536-1542. DOI: 10.1136/heartjnl-2017-312663.
40. Tanskanen J, Anttila T. A prospective study of social isolation, loneliness, and mortality in Finland. *American Journal of Public Health* 2016; 106(11):2042-2048.
41. Holt-Lunstad J. Why social relationships are important for physical health: A systems approach to understanding and modifying risk and protection. *Annual Review of Psychology* 2018; 69:437-458.
42. Ramage-Morin PL. Hearing difficulties and feelings of social isolation among Canadians aged 45 or older *Health Reports* 2016; 27(11): 3-12.
43. Weiss R.S. (1973) *Loneliness: The experience of emotional and social isolation*. Cambridge, MA: The MIT Press.
44. Cornwell E, Waite LJ. Measuring social isolation among older adults using multiple indicators from the NSHAP study. *Journal of Gerontology: Social Sciences* 2009; 64B(S1): i38-46.
45. de Jong Gierveld J, van Tilburg TG, Dykstra PA. Loneliness and social isolation. Author version, accepted for publication (2016) in: Vangelisti A, Perlman D, Eds. *The Cambridge Handbook of Personal Relationships, second edition*. Cambridge: Cambridge University Press. Available at: <https://pdfs.semanticscholar.org/67bc/66d9f7d27349de61b163bddd8b6557d15ae.pdf>.
46. Klinenberg E. Social isolation, loneliness, and living alone: Identifying the risks for public health (editorial). *American Journal of Public Health* 2016; 106(5): 786-786. Follow-up on: Pantell M, Rehkopf D, Jutte D, Syme L, Balmes J, Adler N. Social isolation: A predictor of mortality comparable to traditional risk factors. *American Journal of Public Health* 2013; 103(11): 2056-2062.
47. Turcotte M. Family caregiving: What are the consequences? *Insights on Canadian Society* (Catalogue 75-006-X) Ottawa: 2013. Available at: <https://www150.statcan.gc.ca/n1/pub/75-006-x/2013001/article/11858-eng.htm>.
48. Turner A, Findlay L. Informal caregiving for seniors. *Health Reports* 2012; 23(3): 33-36.
49. Shields M. Proxy reporting of health information. *Health Reports* 2004; 15(3): 21-33.
50. Alliance for Healthier Communities. *Rx: Community – Social Prescribing in Ontario, Progress Report, 2019*. Available at: <https://www.allianceon.org/sites/default/files/documents/Rx-Community-Progress-Report-EN-June2019-web.pdf>
51. Cao Q, Dabelko-Schoeny HI, White KM, Choi MS. Age-friendly communities and perceived disconnectedness: the role of the built environment and social engagement. *Journal of Aging and Health* 2019; Jul 26:898264319865421.
52. Levasseur M, Dubois M-F, Généreux M, et al. Capturing how age-friendly communities foster positive health, social participation and health equity: a study protocol of key components and processes that promote population health in aging Canadians. *BMC Public Health* 2017; 17:502.
53. Mulligan K, Bhatti S, Raymer J, Hsiung S. Social prescribing: Creating pathways towards better health and wellness. *Journal of the American Geriatrics Society* 2019. DOI: 10.1111/jgs.16249.
54. World Health Organization (WHO). Towards and age-friendly world. Available at <https://www.who.int/ageing/age-friendly-world/en/> Accessed April 14 2020.