BMJ Open

Loneliness among older adults in the community during COVID-19: a cross-sectional survey in Canada

Rachel D Savage,[1,2] Wei Wu,[1] Joyce Li,[1] Andrea Lawson,[1] Susan E Bronskill [ID] ,[1,2,3] Stephanie A Chamberlain,[4] Jim Grieve,[5] Andrea Gruneir,[1,2,4] Christina Reppas-Rindlisbacher,[1,6] Nathan M Stall,[1,3,6] Paula A Rochon [ID] [1,2,3,6]

¹Women's College Research Institute, Women's College Hospital, Toronto, Ontario, Canada
²ICES, Toronto, Ontario, Canada
³Institute of Health Policy, Management and Evaluation, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
⁴Department of Family Medicine, University of Alberta, Edmonton, Alberta, Canada
⁵RTOERO, Toronto, Ontario, Canada
⁶Division of Geriatric Medicine, Department of Medicine, University of Toronto, Toronto, Ontario, Canada

Correspondence to
Dr Paula A Rochon;
paula.rochon@wchospital.ca

ABSTRACT

Objective Physical distancing and stay-at-home measures implemented to slow transmission of novel coronavirus disease (COVID-19) may intensify feelings of loneliness in older adults, especially those living alone. Our aim was to characterise the extent of loneliness during the first wave in a sample of older adults living in the community and assess characteristics associated with loneliness.

Design Online cross-sectional survey between 6 May and 19 May 2020.

Setting Ontario, Canada.

Participants Convenience sample of members of a national retired educators' organisation.

Primary outcome measures Self-reported loneliness, including differences between women and men.

Results 4879 respondents (71.0% women; 67.4% 65–79 years) reported that in the preceding week, 43.1% felt lonely at least some of the time, including 8.3% who felt lonely always or often. Women had increased odds of loneliness compared with men, whether living alone (adjusted OR (aOR) 1.52, 95% CI 1.13 to 2.04) or with others (2.44, 95% CI 2.04 to 2.92). Increasing age group decreased the odds of loneliness (aOR 0.69 (95% CI 0.59 to 0.81) 65–79 years and 0.50 (95% CI 0.39 to 0.65) 80+ years compared with <65 years). Living alone was associated with loneliness, with a greater association in men (aOR 4.26, 95% CI 3.15 to 5.76) than women (aOR 2.65, 95% CI 2.26 to 3.11). Other factors associated with loneliness included: fair or poor health (aOR 1.93, 95% CI 1.54 to 2.41), being a caregiver (aOR 1.18, 95% CI 1.02 to 1.37), receiving care (aOR 1.47, 95% CI 1.19 to 1.81), high concern for the pandemic (aOR 1.55, 95% CI 1.31 to 1.84), not experiencing positive effects of pandemic distancing measures (aOR 1.94, 95% CI 1.62 to 2.32) and changes to daily routine (aOR 2.81, 95% CI 1.96 to 4.03).

Conclusions While many older adults reported feeling lonely during COVID-19, several characteristics—such as being female and living alone—increased the odds of loneliness. These characteristics may help identify priorities for targeting interventions to reduce loneliness.

BACKGROUND

As data emerge on how common, yet harmful, it is to be lonely, loneliness is increasingly recognised as a public health priority. In

Strengths and limitations of this study

► The study leveraged a strong community-based partnership to obtain timely data from a large sample of older Canadians on the impacts of the first wave of COVID-19.
► The study evaluated the association between sociodemographic characteristics, social support, and COVID-19-related attitudes and behaviours, and loneliness, stratified by sex and overall. The data were based on a convenience sample of retired educational staff, who are not fully representative of the Canadian population.
► The perspectives of vulnerable groups who may be at greater risk for loneliness (eg, those with severe mental health illness, low income, no home internet access, and so on) are likely under-represented in this sample.

the USA, more than 40% of respondents to the nationally representative Health and Retirement Study reported feeling lonely.[1] In Canada, one in four older women and one in five older men report feeling lonely at least some of the time.[2] While feelings of loneliness can occur at any age, research has shown that rates of loneliness follow a nonlinear U-shaped distribution, with the highest levels reported in young (<25 years) and older (>65 years) adults.[3] While predisposing factors differ by life stage, older adults are at increased risk because they are more likely to experience events such as retirement, chronic illness, widowhood and living alone.[4] Women report higher rates of loneliness than men,[2,4] possibly due to their longer life expectancy and greater likelihood of outliving their spouse, resulting in prolonged widowhood,[5,6] their caregiver roles,[2,7,8] lower incomes[9] and their greater tendency to acknowledge feeling lonely.[6] Addressing loneliness is important because of its profound impact on health and well-being, including increased risk for

premature death,[10 11] cardiovascular disease, depression, dementia and even suicide.[12–18]

The novel coronavirus pandemic (COVID-19) and accompanying physical distancing and stay-at-home measures (ie, closure of non-essential businesses and public spaces, as well as recommendations to practise physical distancing with anyone outside the home) are expected to intensify feelings of loneliness. Previous infectious disease outbreaks and pandemics have demonstrated increases in loneliness, anxiety and depression from quarantine-induced social isolation.[19 20] Emerging research from the early stages of the COVID-19 pandemic support this hypothesis,[21] with several studies demonstrating elevated rates of loneliness,[22–24] psychological distress,[25 26] and anxiety, depression and stress[27 28] during lockdown periods.

Understanding how older adults have been impacted by COVID-19 is vital to address their needs promptly and effectively and prevent unnecessary harms as the pandemic persists. Cross-sectional studies published as early as April 2020 examined public concerns regarding COVID-19 (eg, becoming infected, reduced healthcare access) and its impact on daily life.[29 30] While valuable, these studies were conducted prior to or on the cusp of the implementation of physical distancing and stay-at-home measures, did not report on mental health, underrepresented older adults,[29] a key high-risk group and did not explore important differences between women and men. More recently, McGinty et al published prevalence estimates of psychological distress and loneliness in the USA; although subgroup analyses focused on psychological distress rather than loneliness.[25]

More data on loneliness in older adults during COVID-19 continue to emerge as the pandemic unfolds,[24 31–34] yet important knowledge gaps remain. A key gap is whether older women and men have shared, or unique, risk factors for loneliness during the pandemic. Before COVID-19, it has been shown that while there are common contributors to loneliness in older adults, like widowhood or declining health, some risk factors affect the sexes differently. For example, mobility problems have been shown to be a strong predictor of loneliness in women, while a reduced social network strongly predicts loneliness in men.[35] There are also comparatively little data on the relationship between COVID-19-specific factors (eg, level of concern, impact to daily life, COVID-19 infection, and so on)[22 24 32] and behaviours (eg, use of technology for social connection) with loneliness in general, but particularly in older adults. Timely data relevant to older women and men are needed to inform public health responses and healthcare delivery.

We conducted an online cross-sectional survey to assess how the first wave of the COVID-19 pandemic affected older adults living in the community in Canada. Our objective was to characterise the extent of loneliness in older adults, including differences between women and men, and examine factors associated with loneliness to identify groups likely to benefit most from intervention.

We hypothesised that loneliness would be common, particularly in women and those living alone, and that higher pandemic concern would increase loneliness.

METHODS
Study design and setting
A closed, online cross-sectional survey was administered to members of the RTOERO (formerly known as the Retired Teachers of Ontario) between 6 May and 19 May 2020. At this time in Ontario, Canada, physical distancing measures (eg, lockdown) had been in place for about 7 weeks; daily case and death counts were in decline after peaks in late April; and outbreaks in long-term care homes were a focus of news headlines (figure 1 for timeline).

RTOERO is a voluntary membership organisation of more than 81 000 retired educators, administrators and educational support staff from child care, K-12 and post-secondary settings that provides group health insurance benefits, as well as other programmes and services, to the broader education community (https://www.rtoero.ca). Members were invited to participate by email from RTOERO's chief executive officer. Two reminder emails were sent at 7 and 10 days. The survey was not publicly advertised. All members were eligible to participate if they had a registered email address (~62 000). Study materials were provided in English and French. Our study design and reporting followed the Checklist for Reporting Results of Internet E-Surveys.[36]

A link to a study information sheet was provided on the survey's home page and informed consent was obtained electronically. Participation was voluntary, and no incentives were provided. Minimal identifying personal information was collected (eg, first three digits of postal code).

Questionnaire
The questionnaire was developed with RTOERO leadership and included 32 questions (online supplemental appendix). Several questions were adapted with permission from the *Stanford Coronavirus Survey* (https://pcrt.stanford.edu/covid). Questions examined the impact of COVID-19 on daily life; loneliness; and the use of digital technologies for social connectivity. We used a single-item, direct measure of loneliness by asking respondents, 'In the past seven days, which statement best applies?' (I did not feel lonely; I felt lonely 1 or 2 days; I felt lonely several days; I felt lonely most days; I felt lonely every day). This approach was adapted from the *Canadian Longitudinal Study on Aging* (CLSA)[2] and the UK's *Community Life Survey*[37] which measure loneliness by directly asking, 'How often do you feel lonely?' (often/always, some of the time, occasionally, hardly ever or never). We chose this approach because it allowed respondents to self-report on loneliness, anchored their response to a time during the pandemic stay-at-home measures and was considered more suitable for the pandemic context, where asking indirectly about feeling 'left out' to infer
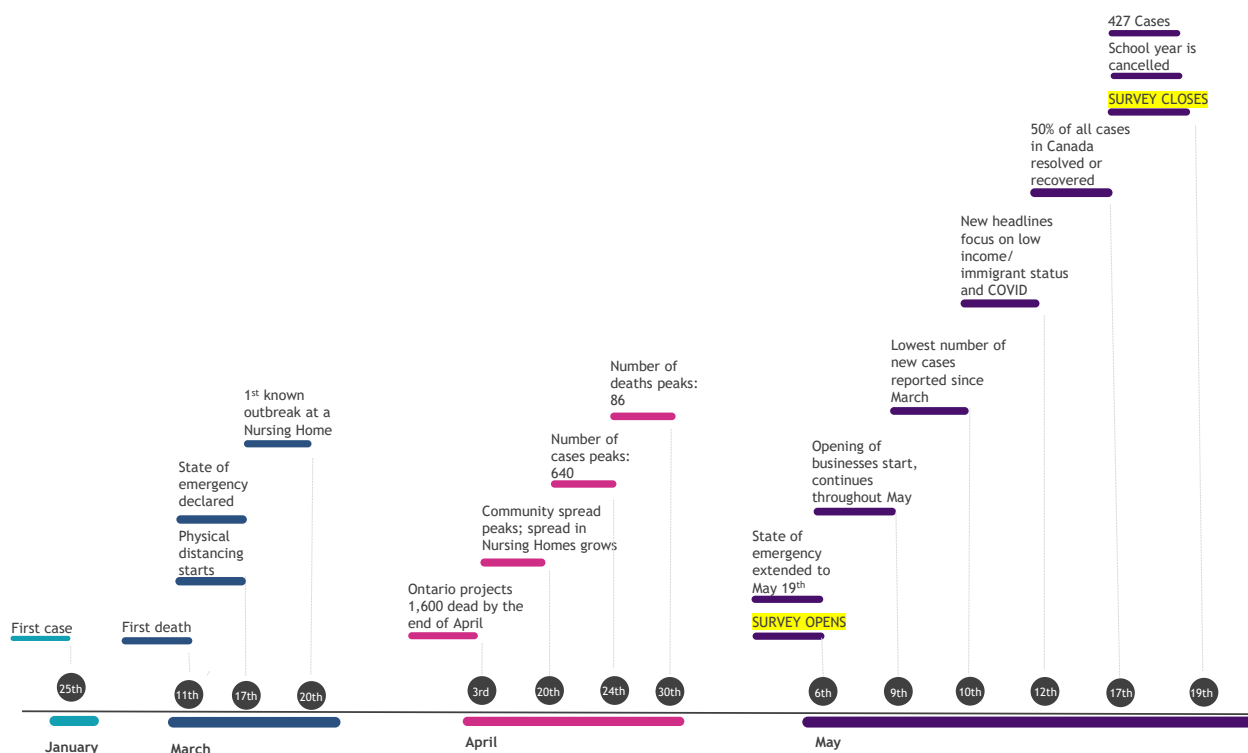
Figure 1 Timeline of COVID-19 in Ontario, Canada's largest province. Physical distancing measures beginning 17 March included closure of all indoor recreational facilities, public libraries, theatres, cinemas, bars and restaurants. Publicly funded schools were closed by this point as well, and all employers in Ontario were asked to facilitate virtual work arrangements for employees. Remaining non-essential businesses were closed on 25 March. Gatherings of more than five people were prohibited on 28 March. On 30 March, Ontario's Chief Medical Officer of Health strongly recommended individuals over 70 years of age or those with compromised immune systems or underlying medical conditions to stay at home. Source: CIHI, COVID-19 Intervention Scan, accessed 11 August 2020, https://www.cihi.ca/en/covid-19-intervention-scan

loneliness may be less relevant as distancing and stay-at-home measures were universally applied.

Respondents were also asked about their history of COVID-19 symptoms and testing, the extent to which they were practising physical distancing and stay-at-home measures, and sociodemographic characteristics (ie, age, sex, ethnicity, language, health status and location of residence). The ethnic response categories we used mirrored those used in Canada's National Health Survey.[38] The questionnaire was pretested in English with 18 RTOERO board members and staff, and in French by one staff member, for usability, technical functionality, clarity, flow, sensitive questions and timing. Pretest results were not included in the final analysis.

Patient and public involvement

As noted above, RTOERO leadership (which comprises members of RTOERO) was involved in all aspects of the study, including questionnaire development, pretesting and participant recruitment. Preliminary results were shared with the team and feedback was incorporated into the final analysis and manuscript. RTOERO's chief executive officer is a coauthor (JG) and critically reviewed the manuscript. Results were shared with RTOERO members through a webinar in the fall of 2020.

Data collection

The questionnaire was administered using SimpleSurvey. Data were stored in an encrypted, password-protected form on the secure SimpleSurvey server and were downloaded to the secure, password-protected Women's College Hospital server accessible to authorised team members. All questions were optional, so completeness checks were not performed; although respondents were reminded of unanswered questions before proceeding to the next section to minimise incomplete data. We used adaptive questioning to reduce the complexity of questions.[36 39] Respondents were able to save their responses and return to the survey later to complete it. The survey completion rate was the number of respondents who finished the survey divided by the number consenting to participate.[36] Surveys were only analysed if the respondent clicked 'Submit' and responded to more than one question.

Exposures

Sociodemographic characteristics—sex, age, living alone, ethnicity, rural residence, health status and caregiver status—were collected based on factors previously reported to be associated with loneliness.[4 5] We additionally collected self-reported measures of social

support—communication frequency, receiving offers of assistance and social media use—as well as attitudes and behaviours towards COVID-19 hypothesised to contribute to loneliness, including level of concern, change in daily routine, extent of physical distancing and perceived positive effects of distancing measures. Variable definitions are presented in the online supplemental eMethods.

Outcome

Our primary outcome was loneliness. Respondents were categorised as lonely 'always or often' if they reported feeling lonely every or most days in the preceding 7 days; lonely 'some of the time' if they reported feeling lonely on 1–2 or several days; and 'not lonely' if they reported they had not felt lonely at all. We further collapsed the first two categories to create a dichotomous variable for loneliness, where respondents were classified as lonely if they reported feeling lonely on 1 or more days in the preceding 7 days.[2 37]

Analysis

X^2 tests were used to identify sex differences. To identify predictors of loneliness for older women and men, exploratory analyses using sex-stratified and sex-pooled multivariable logistic regression models were conducted. In the sex-stratified regression analysis, we calculated unadjusted and minimally adjusted (age and health status) models, and used findings to inform which interactions to test for in the sex-pooled analysis. In the sex-pooled model, we additionally adjusted for all covariates and formally tested for sex interactions with explanatory factors, including age group, living alone, communication frequency, receiving offers of assistance, change in daily routine and perceived positive effects of distancing measures, using interaction terms. Statistical tests were two sided, with $p<0.05$ interpreted as statistically significant. Analyses were performed using SAS V.9.4.

RESULTS

Overall, 5556 RTOERO members responded to the survey, of which 5509 provided consent. A total of 4891 surveys were submitted for a completion rate of 88.8%. We excluded 12 respondents who responded to ≤1 survey question, leaving 4879 respondents included in the analysis.

Characteristics

Most respondents were women (3421/4818 (71.0%)), between the ages of 65 and 79 years (3279/4863 (67.4%)) and completed the survey in English (97.6%) (table 1). They were similar to the broader RTOERO membership in terms of sex (67% female), age distribution (14.5% <65 years; 64% 65–79 years; 21.5% ≥80 years) and preferred language (95% English) (J Grieve, personal communication). One-third of female respondents lived alone (1138/3356 (33.9%)) compared with one-fifth of men (266/1351 (19.7%)). Respondents were predominantly

white (4454/4861 (91.6%)) and in good self-reported health (4370/4873 (89.7%)).

Less than 5% (236/4790 (4.9%)) reported a cold or influenza-like illness in the preceding month. Overall, 8 of 4861 respondents tested positive for COVID-19 (0.2%). Most respondents strongly agreed that the COVID-19 pandemic had changed their daily routine (67.5% females vs 63.2% males, p=0.0047). Additional data on the impact of COVID-19 are reported in online supplemental table 1 and figure 1.

Loneliness during COVID-19

Overall, 43.1% of respondents felt lonely at least some of the time (34.8% some of the time and 8.3% always or often) (table 2). Women were more likely to report feeling lonely than males (p<0.001). Strategies to avoid feeling lonely included connecting with a friend or family member (82.1% women vs 70.7% men, p<0.001) and getting fresh air (65.3% vs 61.9%, p=0.025). Seven per cent (7.1%) described other strategies, such as reading, housework and/or gardening and practising their faith. Most participants frequently spoke with a friend, family member or neighbour, although a small proportion (0.4%) had no connection at all. Many used social networking websites or apps (87.3% females vs 78.2% males, p<0.001).

Sex-stratified model

Most factors associated with loneliness were shared among women and men (table 3). Older age significantly reduced the odds of loneliness in both sexes after adjustment for self-reported health status. Living alone was associated with loneliness in both women and men; although the association was greater in men (adjusted OR (aOR) 3.86 (95% CI 2.88 to 5.18) vs aOR 2.50 (95% CI 2.14 to 2.92)). Self-reported poor health and higher concern for the pandemic were also associated with loneliness, as were experiencing change to a daily routine, and not experiencing any positive effects or 'silver linings' of pandemic distancing measures; effect sizes varied by sex. Among women, receiving offers of assistance (aOR 0.79, 95% CI 0.69 to 0.91) and communicating more often with a friend, family member or neighbour (aOR 0.47, 95% CI 0.34 to 0.66) reduced the odds of loneliness.

Sex-pooled model

Women had increased odds of loneliness compared with men, irrespective of living arrangement (aOR 1.52 (95% CI 1.13 to 2.04) living alone; aOR 2.44 (95% CI 2.04 to 2.92) living with others) (table 4). Increasing age group was associated with decreasing odds of loneliness. The association of living alone with loneliness was significantly greater for men than women (aOR 4.26 (95% CI 3.15 to 5.76) vs 2.65 (95% CI 2.26 to 3.11), p=0.006 for interaction term). Additional characteristics associated with loneliness included: self-reported fair/poor health (aOR 1.93, 95% CI 1.54 to 2.41), being a caregiver (aOR 1.18, 95% CI 1.02 to 1.37) and receiving care from a caregiver (aOR 1.47, 95% CI 1.19 to 1.81). Pandemic-related factors associated with an increased odds of loneliness included

Table 1 Sociodemographic characteristics of older female and male survey respondents

Characteristics	All (n=4879)*	Women (n=3421)	Men (n=1397)
Language of survey	n=4863	n=3421	n=1397
English	4762 (97.6%)	3339 (97.6%)	1365 (97.7%)
French	117 (2.4%)	82 (2.4%)	32 (2.3%)
Age (years)	n=4863	n=3416	n=1395
<65	1027 (21.1%)	846 (24.8%)	174 (12.5%)
65–79	3279 (67.4%)	2295 (67.2%)	945 (67.7%)
80+	557 (11.5%)	275 (8.1%)	276 (19.8%)
Living arrangement	n=4762	n=3356	n=1351
Lives alone	1415 (29.7%)	1138 (33.9%)	266 (19.7%)
Access to private outdoor space	n=4854	n=3407	n=1391
Yes	4706 (97.0%)	3302 (96.9%)	1350 (97.1%)
Ethnicity	n=4861	n=3410	n=1397
White/Caucasian	4454 (91.6%)	3153 (92.5%)	1264 (90.5%)
Black/African Canadian	19 (0.4%)	15 (0.4%)	≤5
Chinese	19 (0.4%)	14 (0.4%)	≤5
Indigenous	11 (0.2%)	7 (0.2%)	≤5
South Asian (Indian, Sri Lankan, and so on)	17 (0.3%)	7 (0.2%)	9 (0.6%)
Southeast Asian (Japanese, Vietnamese, Korean, Cambodian, and so on)	14 (0.3%)	11 (0.3%)	≤5
West Asian (Arabian, Egyptian, Iranian, Afghan, and so on)	10 (0.2%)	7 (0.2%)	≤5
Other/prefer to not say or self-identify	317 (6.5%)	196 (5.7%)	106 (7.6%)
Language spoken most often at home	n=4855	n=3411	n=1388
English	4627 (95.3%)	3251 (95.3%)	1327 (95.6%)
French	165 (3.4%)	120 (3.5%)	41 (3.0%)
Other	63 (1.3%)	40 (1.2%)	20 (1.4%)
Self-reported health status	n=4873	n=3417	n=1397
Excellent/very good/good	4370 (89.7%)	3082 (90.2%)	1238 (88.6%)
Fair/poor	492 (10.1%)	330 (9.7%)	154 (11.0%)
Don't know	11 (0.2%)	5 (0.2%)	5 (0.4%)
Location of residence†	n=4752	n=3348	n=1354
Urban	3962 (83.4%)	2791 (83.4%)	1132 (83.6%)
Rural	751 (15.8%)	531 (15.9%)	209 (15.4%)
Outside Canada	39 (0.8%)	26 (0.8%)	13 (1.0%)

*61 respondents did not identify their gender.
†4405 (92.7%) respondents resided in Ontario and 308 (6.5%) in another Canadian province or territory.

having a high concern for the pandemic (aOR 1.55, 95% CI 1.31 to 1.84), not experiencing any positive effects or 'silver linings' of pandemic distancing measures (aOR 1.94, 95% CI 1.62 to 2.32) and experiencing change to a daily routine (aOR 2.81, 95% CI 1.96 to 4.03). Non-white ethnicity (aOR 0.71, 95% CI 0.54 to 0.94), high frequency of communication (aOR 0.55, 95% CI 0.43 to 0.72) and receiving offers of assistance (aOR 0.79, 95% CI 0.69 to 0.90) reduced the odds of loneliness. None of the other sex-based interactions we explored with explanatory factors were significant. Social media use was not associated with loneliness (aOR 1.13, 95% CI 0.94 to 1.36) and the addition of an interaction term between social media use and age was similarly not significant.

DISCUSSION
In a survey of 4879 older women and men, we found that loneliness was common during the COVID-19 pandemic, with more than one-third (34.8%) of respondents

Table 2 Loneliness and social connection in a sample of older Canadians, May 2020

	All (n=4879)*	Women (n=3421)	Men (n=1397)	P value
Self-reported loneliness in past 7 days	**n=4840**	**n=3398**	**n=1383**	
Did not feel lonely	2675 (55.3%)	1684 (49.6%)	958 (69.3%)	<0.001
Lonely some of the time	1684 (34.8%)	1360 (40.0%)	307 (22.2%)	
Lonely always or often	404 (8.3%)	315 (9.3%)	83 (6.0%)	
Don't know	77 (1.6%)	39 (1.1%)	35 (2.5%)	
Strategies used to avoid feeling lonely†				
Connect with a friend or family member	3841 (78.7%)	2808 (82.1%)	988 (70.7%)	<0.001
Get fresh air	3134 (64.2%)	2235 (65.3%)	865 (61.9%)	0.025
Stay busy with work or projects	1855 (38.0%)	1275 (37.3%)	563 (40.3%)	0.049
Get active	1632 (33.5%)	1137 (33.2%)	470 (33.6%)	0.785
Try to get proper rest and sleep	1221 (25.0%)	806 (23.6%)	397 (28.4%)	<0.001
Engage in a hobby	1012 (20.7%)	704 (20.6%)	297 (21.3%)	0.597
Spend time with my pet	612 (12.5%)	473 (13.8%)	129 (9.2%)	<0.001
Other	347 (7.1%)	248 (7.3%)	95 (6.8%)	0.582
Frequency of speaking with a friend, family member or neighbour	**n=4865**	**n=3412**	**n=1394**	
Not at all	18 (0.4%)	4 (0.1%)	13 (0.9%)	<0.001
1–4 times	1401 (28.8%)	845 (24.8%)	535 (38.4%)	
5–7 times	3446 (70.8%)	2563 (75.1%)	846 (60.7%)	
Uses social networking websites or apps to communicate with friends and family	**n=4868**	**n=3418**	**n=1394**	
Yes	4113 (84.5%)	2983 (87.3%)	1090 (78.2%)	<0.001
No	751 (15.4%)	434 (12.7%)	301 (21.6%)	
Don't know	4 (0.1%)	1 (0.0%)	3 (0.2%)	
Apps used†				
Facebook	3031 (62.1%)	2235 (65.3%)	768 (55.0%)	<0.001
Zoom	2558 (52.4%)	1918 (56.1%)	617 (44.2%)	<0.001
FaceTime	2444 (50.1%)	1874 (54.8%)	546 (39.1%)	<0.001
WhatsApp	1182 (24.2%)	931 (27.2%)	239 (17.1%)	<0.001
Instagram	1125 (23.1%)	914 (26.7%)	201 (14.4%)	<0.001
Skype	772 (15.8%)	523 (15.3%)	244 (17.5%)	0.061
Twitter	575 (11.8%)	429 (12.5%)	141 (10.1%)	0.017
Google Hangouts/Meet	322 (6.6%)	255 (7.5%)	64 (4.6%)	<0.001
Houseparty	212 (4.4%)	178 (5.2%)	34 (2.4%)	<0.001
Other	368 (7.5%)	275 (8.0%)	89 (6.4%)	0.047
Devices used†				
Smartphone	3026 (62.0%)	2204 (64.4%)	791 (56.6%)	<0.001
Desktop/laptop	2579 (52.9%)	1704 (49.8%)	846 (60.6%)	<0.001
Landline telephone	2528 (51.8%)	1776 (51.9%)	714 (51.1%)	0.612
Tablet	2283 (46.8%)	1659 (48.5%)	594 (42.5%)	<0.001
Other	172 (3.5%)	136 (4.0%)	33 (2.4%)	0.006

*61 respondents did not identify their gender.
†Categories not mutually exclusive.

Table 3 OR for loneliness stratified by sex in a sample of older Canadians, May 2020

	Women			Men		
	n (%) Lonely	Unadjusted OR (95% CI)	Age and health-adjusted OR (95% CI)	n (%) Lonely	Unadjusted OR (95% CI)	Age and health-adjusted OR (95% CI)
Sociodemographic characteristics						
Age (years)						
<65 (ref)	440 (52.8)	–	–	65 (38.5)	–	–
65–79	1110 (49.3)	0.87 (0.74 to 1.02)	0.84 (0.72 to 0.99)	248 (27.1)	0.59 (0.42 to 0.84)	0.56 (0.39 to 0.78)
80+	125 (46.3)	0.77 (0.59 to 1.01)	0.70 (0.53 to 0.92)	77 (29.5)	0.67 (0.45 to 1.01)	0.61 (0.40 to 0.92)
Living arrangement						
Lives with others (ref)	935 (43.0)	–	–	242 (23.0)	–	–
Lives alone	714 (63.6)	2.32 (2.00 to 2.67)	2.50 (2.14 to 2.92)	137 (54.2)	3.95 (2.97 to 5.26)	3.86 (2.88 to 5.18)
Ethnicity						
White (ref)	1565 (50.5)	–	–	357 (29.2)	–	–
Non-white	77 (41.6)	0.70 (0.52 to 0.94)	0.70 (0.51 to 0.95)	19 (26.4)	0.87 (0.51 to 1.49)	0.83 (0.48 to 1.43)
Location of residence						
Urban (ref)	1378 (50.4)	–	–	312 (28.5)	–	–
Rural	256 (48.7)	0.94 (0.78 to 1.13)	0.93 (0.77 to 1.13)	58 (29.2)	1.03 (0.74 to 1.44)	1.09 (0.78 to 1.54)
Health status						
Good (ref)	1456 (48.1)	–	–	324 (27.0)	–	–
Fair/poor	216 (66.9)	2.18 (1.71 to 2.78)	2.24 (1.76 to 2.86)*	65 (45.1)	2.22 (1.56 to 3.16)	2.34 (1.64 to 3.34)*
Caregiver to another person						
No (ref)	1198 (49.4)	–	–	304 (28.5)	–	–
Yes	469 (51.0)	1.07 (0.92 to 1.25)	1.05 (0.90 to 1.23)	83 (30.1)	1.08 (0.81 to 1.44)	1.03 (0.77 to 1.39)
Receives care						
No (ref)	1447 (48.5)	–	–	319 (27.5)	–	–
Yes	220 (61.1)	1.67 (1.33 to 2.09)	1.55 (1.23 to 1.97)	68 (37.6)	1.59 (1.15 to 2.20)	1.39 (0.97 to 2.00)
Social support						
Social media use						
No (ref)	213 (50.1)	–	–	91 (31.5)	–	–
Yes	1458 (49.8)	0.99 (0.80 to 1.21)	1.00 (0.81 to 1.23)	299 (28.4)	0.86 (0.65 to 1.14)	0.90 (0.68 to 1.20)
Communication frequency†						
None or low (ref)	120 (68.6)	–	–	55 (36.9)	–	–
High	1551 (48.9)	0.44 (0.32 to 0.61)	0.47 (0.34 to 0.66)	334 (27.9)	0.66 (0.46 to 0.95)	0.74 (0.61 to 1.06)
Received offers of assistance‡						

Continued

Table 3 Continued

	Women			Men		
	n (%) Lonely	Unadjusted OR (95% CI)	Age and health-adjusted OR (95% CI)	n (%) Lonely	Unadjusted OR (95% CI)	Age and health-adjusted OR (95% CI)
No (ref)	1016 (52.5)	–	–	253 (28.7)	–	–
Yes	650 (46.3)	0.78 (0.68 to 0.90)	0.79 (0.69 to 0.91)	136 (29.5)	1.04 (0.81 to 1.33)	1.05 (0.82 to 1.36)
Attitudes and behaviours towards COVID-19						
Concern for pandemic						
Low level (ref)	260 (42.1)	–	–	62 (19.8)	–	–
High level	1407 (51.6)	1.47 (1.23 to 1.75)	1.46 (1.22 to 1.74)	328 (31.8)	1.90 (1.40 to 2.58)	1.86 (1.36 to 2.53)
Extent of practising physical distancing						
None/some (ref)	155 (47.3)	–	–	40 (22.5)	–	–
Most of the time	1231 (49.9)	1.11 (0.88 to 1.40)	1.06 (0.84 to 1.34)	295 (29.9)	1.47 (1.01 to 2.15)	1.41 (0.96 to 2.07)
All of the time	283 (51.4)	1.18 (0.90 to 1.55)	1.06 (0.80 to 1.40)	55 (30.7)	1.53 (0.95 to 2.46)	1.31 (0.80 to 2.14)
No perceived positive effects of distancing						
No (ref)	1331 (46.7)	–	–	306 (27.5)	–	–
Yes	344 (67.3)	2.35 (1.92 to 2.86)	2.25 (1.84 to 2.75)	84 (35.9)	1.48 (1.10 to 1.99)	1.44 (1.06 to 1.95)
Change in daily routine						
No (ref)	46 (34.9)	–	–	6 (8.2)	–	–
Yes	1623 (50.4)	1.90 (1.32 to 2.74)	2.02 (1.39 to 2.92)	383 (30.2)	4.83 (2.08 to 11.24)	5.57 (2.37 to 13.11)

*Adjusted for age group only.
†Self-reported communication with friends, family members or neighbours.
‡Reported receiving offers of assistance from their community to help with daily life during COVID-19 distancing measures.

Table 4 OR for loneliness (sex pooled) in a sample of older Canadians, May 2020

	All respondents			
	Unadjusted OR (95% CI)	Age and sex-adjusted OR (95% CI)	Age, sex and health status-adjusted OR (95% CI)	Fully* adjusted OR (95% CI)
Sociodemographic				
Female sex (ref male)	2.44 (2.13 to 2.80)	2.38 (2.07 to 2.73)	2.41 (2.09 to 2.77)	
Women living alone				1.52 (1.13 to 2.04)
Women living with others				2.44 (2.04 to 2.92)
Age (years)				
65–79 (ref <65)	0.74 (0.64 to 0.86)	0.81 (0.70 to 0.94)	0.78 (0.67 to 0.90)	0.69 (0.59 to 0.81)
80+ (ref <65)	0.61 (0.49 to 0.75)	0.79 (0.63 to 0.98)	0.72 (0.57 to 0.90)	0.50 (0.39 to 0.65)
Living alone	2.83 (2.49 to 3.22)	2.78 (2.42 to 3.18)	2.74 (2.39 to 3.15)	
Living alone in women				2.65 (2.26 to 3.11)
Living alone in men				4.26 (3.15 to 5.76)
Non-white ethnicity	0.75 (0.58 to 0.97)	0.74 (0.57 to 0.96)	0.72 (0.55 to 0.94)	0.71 (0.54 to 0.94)
Rural	0.98 (0.83 to 1.15)	0.95 (0.81 to 1.12)	0.96 (0.82 to 1.13)	1.07 (0.90 to 1.27)
Fair or poor health status	2.14 (1.76 to 2.60)	2.25 (1.84 to 2.76)	–	1.93 (1.54 to 2.41)
Caregiver to another person	1.14 (1.00 to 1.30)	1.04 (0.91 to 1.20)	1.05 (0.91 to 1.20)	1.18 (1.02 to 1.37)
Receives care	1.54 (1.29 to 1.84)	1.76 (1.45 to 2.12)	1.50 (1.24 to 1.83)	1.47 (1.19 to 1.81)
Social support				
Social media use	1.08 (0.92 to 1.26)	0.93 (0.78 to 1.09)	0.96 (0.81 to 1.14)	1.13 (0.94 to 1.36)
High communication frequency	0.65 (0.52 to 0.81)	0.53 (0.42 to 0.68)	0.57 (0.45 to 0.72)	0.55 (0.43 to 0.72)
Received offers of assistance	0.89 (0.79 to 1.00)	0.85 (0.75 to 0.96)	0.85 (0.75 to 0.96)	0.79 (0.69 to 0.90)
Attitudes and behaviours towards COVID-19				
High concern for pandemic	1.65 (1.42 to 1.91)	1.59 (1.37 to 1.86)	1.56 (1.33 to 1.82)	1.55 (1.31 to 1.84)
Extent of practising distancing				
Most of the time (ref none/some)	1.27 (1.05 to 1.53)	1.19 (0.98 to 1.45)	1.15 (0.95 to 1.40)	1.23 (0.99 to 1.53)
All of the time (ref none/some)	1.39 (1.11 to 1.75)	1.29 (1.02 to 1.64)	1.13 (0.89 to 1.44)	1.12 (0.86 to 1.45)
No perceived positive effects of pandemic distancing measures	1.90 (1.62 to 2.22)	2.07 (1.76 to 2.43)	1.97 (1.67 to 2.32)	1.94 (1.62 to 2.32)
Reported change in routine	2.36 (1.72 to 3.24)	2.30 (1.67 to 3.19)	2.50 (1.80 to 3.48)	2.81 (1.96 to 4.03)

*Adjusted for all covariates listed in the table with an interaction term for sex and living alone (p=0.006).

reporting feeling lonely some of the time and 8.3% feeling lonely always or often. More women reported feeling lonely than men and had higher odds of loneliness, despite controlling for factors hypothesised to contribute to sex differences including living alone, health status and caregiving. Our findings are similar to reports from the UK, where 22.4% and 4.1% of older adults reported feeling lonely sometimes or often, respectively, in the first 4 weeks of lockdown,[32] and from the USA, where 13.8% (95% CI 11.4% to 16.6%) of adults aged ≥18 years reported feeling lonely always or often at the beginning of April 2020.[25]

Living alone is as an important risk factor for loneliness, both pre-COVID-19[5 40 41] and during the pandemic.[31–33] We found that living alone predicted loneliness in women and men, although the effect was greater in men. Physical distancing and stay-at-home measures are anticipated to have a greater toll for those living alone as they severely limit opportunities for face-to-face interaction to combat loneliness.[33] The effect of living alone on loneliness may be greater in men because they tend to have fewer social contacts and close friends than women.[35 42 43] Indeed, male respondents in our survey communicated less frequently with family, friends and neighbours, and were less likely to seek out social connection to mitigate loneliness. Having a smaller social network may exacerbate some of the negative effects of living alone. Emerson recently found that older US adults who lived alone were less likely to have a close relationship that provided emotional security and well-being, and more likely to become 'more lonely'

following the onset of COVID-19 than those living with others (42.4% vs 27.9%).[31] Alternatively, our finding may be due to the inherent overlap in the constructs of 'living alone' and 'marital status' because we partially captured the impact of being widowed or unmarried in men versus women. Prior research has shown that being single has a greater impact on men's loneliness, possibly explained by the fact that for many older men, their partners are their main confidante and source of intimacy.[44 45]

We found that older adults' perceptions and pandemic experiences were also associated with loneliness. Respondents who had a high level of concern for COVID-19, experienced changes to their daily routine and reported no perceived positive effects or 'silver livings' from the pandemic had increased odds of loneliness, while receiving offers of support and frequently communicating with family, friends and neighbours were protective. These findings underscore the importance of public health messages from the WHO targeted at older adults, including maintaining regular routines or creating new ones that include exercise, regular cleaning/chores and enjoyable activities; keeping in regular contact with loved ones; and restricting news consumption to specific times of day from reputable sources to reduce undue anxiety or distress.[46]

Family physician visits have been suggested as an important opportunity to screen for loneliness during COVID-19.[47 48] Particular attention is recommended to be paid to patients who are older, live alone or have preexisting health conditions.[47] Our findings suggest that considering the patient's sex, if they have sufficient social support and how the pandemic is affecting their daily routines could further assist in identifying at-risk individuals. Such questions would also be beneficial to align patients more purposefully with interventions. Virtual consultations and social prescribing (ie, linking patients with non-clinical supports in their community such as outdoor exercise classes, walking groups, virtual bereavement programmes, and so on) may be effective strategies to reduce loneliness during COVID-19 and beyond.[47 49 50] Additionally, the Campaign to End Loneliness recently profiled psychological approaches,[51] including cognitive–behavioural therapy (CBT),[52 53] mindfulness[54] and positive psychology,[55] as promising interventions for addressing loneliness in older adults.

Lastly, technology can facilitate social connection and improve access to psychological interventions in the midst of physical distancing measures.[49 56] For older adults experiencing social loneliness as a result of being disconnected from their social network, websites or apps such as FaceTime and Zoom can connect them to family and friends and provide continuity of group activities such as exercise classes, spiritual services, and so on.[57] These platforms can similarly enable access to virtual CBT and other psychological supports.[57] One important consideration, however, is that, in order to be effective, older adults must want to, know how to use, and have access to these technologies.[57] Recent research shows that many older adults

lack access to internet-enabled devices,[58] and are unready for comparable technologies (ie, video telemedicine visits) due to inexperience with technology or physical disability.[59] Consistent with prior research[31 60] and likely a function of electronic survey administration, we found high levels (~85%) of social media engagement, with no increased risk for loneliness overall or by age. Our findings suggest there is a large segment of the older adult population for whom digital media-based interventions may be effective for mitigating and alleviating loneliness. Services that teach older adults how to use and connect with family and friends through social media platforms may be valuable.[61] The importance of offline connection, however, should not be forgotten—phoning parents or older neighbours, and extending offers of assistance can go a long way to making someone feel connected and visible.[62]

A recent US study reported that 30.9% of older adults surveyed felt more lonely after COVID-19-related physical distancing was implemented.[31] Our estimates of loneliness were almost double that of the CLSA's collected between 2010 and 2015 using a similar age group and measurement approach (49.3% of women and 27.1% of men aged 65–79 years felt lonely some of the time vs 24.7% and 17.9%, respectively, for adults aged 65–74 years).[2 63] Comparisons should be made cautiously considering differences in study populations. Longitudinal studies provide the most robust evidence of temporal changes. Using data collected at three time points, Luchetti *et al* found that older adults were the only group studied that showed a slight increase in loneliness in late March 2020 after social distancing measures were implemented in the USA compared with the baseline assessment in January/February, although levels remained stable in April.[33] The study found that this increase was driven primarily by unavailable social connections, rather than feelings of isolation. O'Connor *et al* similarly observed an increase in self-reported loneliness in adults aged ≥60 years at two time points early in the pandemic but not in younger age groups,[64] while other studies have reported no change in loneliness over the course of the first pandemic wave.[26 65] As we move through successive pandemic waves, it will continue to be important to consistently measure how rates of loneliness change across different age groups to assess the longer term effects of protracted physical distancing and stay-at-home measures. Such longitudinal studies will be vital to characterising trajectories, identifying drivers of change and determining at-risk populations who could benefit from additional support, including young adults, who have reported among the highest levels of loneliness during this pandemic.[33 64 65]

Limitations
Our study leveraged a strong community-based partnership to obtain timely data from a large sample of older Canadians on the impacts of COVID-19 during the first wave but had several limitations. Given the cross-sectional study design, causation should not be inferred. Analyses

were exploratory and intended to identify characteristics and circumstances associated with loneliness to help target supports to those who could benefit from them. The second limitation is that the data are based on a convenience sample of retired educational staff, who are not fully representative of the Canadian population. The perspectives of vulnerable groups who may be at greater risk for loneliness (eg, those with severe mental health illness, low income, no home internet access, and so on) are likely under-represented in this sample. As such, our findings may be a conservative estimate of loneliness. Finally, the measure of loneliness used in our study has not been validated; although our findings support its criterion validity.

CONCLUSIONS

While many older adults reported feeling lonely during the first wave of COVID-19, several characteristics—in particular being female and living alone—increased the odds of loneliness. These characteristics may help guide targeting interventions to reduce loneliness as the pandemic persists.

ORCID iDs
Susan E Bronskill http://orcid.org/0000-0002-7341-0655
Paula A Rochon http://orcid.org/0000-0002-5973-4151

REFERENCES

1 Perissinotto CM, Cenzer S I, Covinsky KE. Loneliness in older persons: a predictor of functional decline and death. *Arch Intern Med* 2012;172:1078–83.
2 Raina P, Wolfson C, Kirkland S. The Canadian longitudinal study on aging (CLSA) report on health and aging in Canada, 2018. Available: https://www.clsa-elcv.ca/doc/2639
3 Victor CR, Yang K. The prevalence of loneliness among adults: a case study of the United Kingdom. *J Psychol* 2012;146:85–104.
4 National Academies of Sciences Engineering and Medicine. *Social isolation and loneliness in older adults: opportunities for the health care system. in*. Washington, DC: The National Academies Press, 2020.
5 Cohen-Mansfield J, Hazan H, Lerman Y, *et al*. Correlates and predictors of loneliness in older-adults: a review of quantitative results informed by qualitative insights. *International Psychogeriatrics* 2016;28:557–76.
6 Pinquart M, Sorensen S. Influences on loneliness in older adults: a meta-analysis. *Basic Appl Soc Psych* 2001;23:245–66.
7 Bott NT, Sheckter CC, Milstein AS. women's health, and gender equity: The value of well-timed caregiver support. *JAMA Neurology* 2017;74:757–8.
8 Gender MMHPW. aging, and social policy. In: *Handbook of Aging and the Social Sciences*. Elsevier Inc 2011:323–35.
9 O'Rand AM, Shuey KM. Gender and the devolution of pension risks in the US. *Current Sociology* 2007;55:287–304.
10 Holt-Lunstad J, Smith TB, Baker M, *et al*. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect Psychol Sci* 2015;10:227–37.
11 Hoogendijk EO, Smit AP, van Dam C, Dam C, *et al*. Frailty combined with loneliness or social isolation: an elevated risk for mortality in later life. *J Am Geriatr Soc* 2020;68:2587–93.
12 Valtorta NK, Kanaan M, Gilbody S, *et al*. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart* 2016;102:1009–16.
13 Cacioppo JT, Hughes ME, Waite LJ, *et al*. Loneliness as a specific risk factor for depressive symptoms: cross-sectional and longitudinal analyses. *Psychol Aging* 2006;21:140–51.
14 Cacioppo JT, Hawkley LC, Thisted RA. Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago health, aging, and social relations study. *Psychol Aging* 2010;25:453–63.
15 Amieva H, Stoykova R, Matharan F, *et al*. What aspects of social network are protective for dementia? not the quantity but the quality of social interactions is protective up to 15 years later. *Psychosom Med* 2010;72:905–11.
16 Rafnsson SB, Orrell M, d'Orsi E. Loneliness, social integration, and incident dementia over 6 years: prospective findings from the English longitudinal study of ageing. *The journals of gerontology Series B, Psychological sciences and social sciences* 2017.
17 Peplau LA, Perlman D. *Loneliness: A sourcebook of current theory, research and therapy*. New York: John Wiley, 1982.
18 Stall NM, Savage RD, Rochon PA. Loneliness in older adults. *Can Med Assoc J* 2019;191:E476.
19 Hawryluck L, Gold WL, Robinson S, *et al*. SARS control and psychological effects of quarantine, Toronto, Canada. *Emerg Infect Dis* 2004;10:1206–12.
20 Brooks SK, Webster RK, Smith LE, *et al*. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 2020;395:912–20.
21 Xiong J, Lipsitz O, Nasri F, *et al*. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J Affect Disord* 2020;277:55–64.
22 Tull MT, Edmonds KA, Scamaldo KM, *et al*. Psychological outcomes associated with Stay-at-Home orders and the perceived impact of COVID-19 on daily life. *Psychiatry Res* 2020;289:113098.
23 Buecker S, Horstmann KT, Krasko J. Changes in daily loneliness for German residents during the first four weeks of the COVID-19 pandemic. *Social science & medicine* 2020;113541.
24 Kotwal AA, Holt-Lunstad J, Newmark RL. Social isolation and loneliness among San Francisco Bay area older adults during the COVID-19 Shelter-in-Place orders. *J Am Geriatr Soc* 2020.
25 McGinty EE, Presskreischer R, Han H, *et al*. Psychological distress and loneliness reported by US adults in 2018 and April 2020. *JAMA* 2020;324:93.
26 Niedzwiedz CL, Green MJ, Benzeval M. Mental health and health behaviours before and during the initial phase of the COVID-19 lockdown: longitudinal analyses of the UK household longitudinal study. *J Epidemiol Community Health* 2020.

27 Wang C, Pan R, Wan X, *et al*. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 2020;17:1729.

28 Rossi R, Socci V, Talevi D, *et al*. COVID-19 pandemic and Lockdown measures impact on mental health among the general population in Italy. *Front Psychiatry* 2020;11:790.

29 Nelson LM, Simard JF, Oluyomi A, *et al*. Us public concerns about the COVID-19 pandemic from results of a survey given via social media. *JAMA Intern Med* 2020;180:1020.

30 Wolf MS, Serper M, Opsasnick L, *et al*. Awareness, attitudes, and actions related to COVID-19 among adults with chronic conditions at the onset of the U.S. outbreak: a cross-sectional survey. *Ann Intern Med* 2020;173:100–9.

31 Emerson KG. Coping with being cooped up: social distancing during COVID-19 among 60+ in the United States. *Revista panamericana de salud publica = Pan American journal of public health* 2020;44:e81.

32 LZ L, Wang S. Prevalence and predictors of general psychiatric disorders and loneliness during COVID-19 in the United Kingdom. *Psychiatry research* 2020;291:113267.

33 Luchetti M, Lee JH, Aschwanden D, *et al*. The trajectory of loneliness in response to COVID-19. *Am Psychol* 2020;75:897–908.

34 van Tilburg TG, Steinmetz S, Stolte E, *et al*. Loneliness and mental health during the COVID-19 pandemic: a study among Dutch older adults. *J Gerontol B Psychol Sci Soc Sci* 2020;29.

35 Dahlberg L, Andersson L, McKee KJ, *et al*. Predictors of loneliness among older women and men in Sweden: a national longitudinal study. *Aging Ment Health* 2015;19:409–17.

36 Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of Internet E-Surveys (cherries). *J Med Internet Res* 2004;6:e34.

37 Office for National Statistics. Measuring loneliness: guidance for use of the national indicators on surveys. [Internet], 2018. Available: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/methodologies/measuringlonelinessguidanceforuseofthenationalindicatorsonsurveys [Accessed 16 Jul 2020].

38 Canada S. Canadian Community Health Survey (CCHS) - 2019. [Internet], 2019. Available: https://www23.statcan.gc.ca/imdb/p3Instr.pl?Function=assembleInstr&a=1&&lang=en&Item_Id=1207185#qb1208869 [Accessed 6 Jul 2020].

39 Dillman DA, Smyth JD, Christian LM. *Internet, mail, and mixed-mode surveys: the tailored design method*. 3rd edn. Hoboken, NJ, US: John Wiley & Sons Inc, 2009.

40 Menec VH, Newall NE, Mackenzie CS, *et al*. Examining individual and geographic factors associated with social isolation and loneliness using Canadian longitudinal study on aging (CLSA) data. *PLoS One* 2019;14:e0211143.

41 Gierveld JdeJ. A review of loneliness: concept and definitions, determinants and consequences. *Rev Clin Gerontol* 1998;8:73–80.

42 Victor CR, Scambler SJ, Marston L, *et al*. Older People's Experiences of Loneliness in the UK: Does Gender Matter? *Social Policy and Society* 2006;5:27–38.

43 Dykstra PA, Fokkema T. Social and emotional loneliness among Divorced and married men and women: comparing the deficit and cognitive perspectives. *Basic Appl Soc Psych* 2007;29:1–12.

44 Nicolaisen M, Thorsen K. Loneliness among men and women – a five-year follow-up study. *Aging Ment Health* 2014;18:194–206.

45 Antonucci TC, Akiyama H. An examination of sex differences in social support among older men and women. *Sex Roles* 1987;17:737–49.

46 World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak, 2020. Available: https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf?sfvrsn=6d3578af_2 [Accessed July 14 2020].

47 Razai MS, Oakeshott P, Kankam H, *et al*. Mitigating the psychological effects of social isolation during the covid-19 pandemic. *BMJ* 2020;369:m1904.

48 Killgore WDS, Cloonan SA, Taylor EC, *et al*. Loneliness: a signature mental health concern in the era of COVID-19. *Psychiatry Res* 2020;290:113117.

49 Galea S, Merchant RM, Lurie N. The mental health consequences of COVID-19 and physical distancing: the need for prevention and early intervention. *JAMA internal medicine* 2020.

50 Roland M, Everington S, Marshall M. Social prescribing — transforming the relationship between physicians and their patients. *N Engl J Med* 2020;383:97–9.

51 Campaign to End Loneliness. The psychology of loneliness: why it matters and what we can do, 2020. Available: https://www.campaigntoendloneliness.org/wp-content/uploads/Psychology_of_Loneliness_FINAL_REPORT.pdf [Accessed 18 Dec 2020].

52 Cohen-Mansfield J, Hazan H, Lerman Y, *et al*. Efficacy of the I-SOCIAL intervention for loneliness in old age: lessons from a randomized controlled trial. *J Psychiatr Res* 2018;99:69–75.

53 Jarvis MA, Padmanabhanunni A, Chipps J. An evaluation of a low-intensity cognitive behavioral therapy mHealth-Supported intervention to reduce loneliness in older people. *Int J Environ Res Public Health* 2019;16:1305.

54 Creswell JD, Irwin MR, Burklund LJ, *et al*. Mindfulness-Based stress reduction training reduces loneliness and pro-inflammatory gene expression in older adults: a small randomized controlled trial. *Brain Behav Immun* 2012;26:1095–101.

55 Lim MH, Rodebaugh TL, Eres R, *et al*. A pilot digital intervention targeting loneliness in youth mental health. *Front Psychiatry* 2019;10:604.

56 Merchant RM, Lurie N. Social media and emergency preparedness in response to novel coronavirus. *JAMA* 2020;323:2011.

57 Conroy KK, Mittelstaedt Srikripa;, Stacy; Patel S. Technological advancements to address elderly loneliness: practical considerations and community resilience implications for COVID-19 pandemic, 2020. Available: https://dash.harvard.edu/handle/1/37364389

58 Roberts ET, Mehrotra A. Assessment of disparities in digital access among Medicare beneficiaries and implications for telemedicine. *JAMA Intern Med* 2020;180:1386.

59 Lam K, Lu AD, Shi Y, *et al*. Assessing telemedicine Unreadiness among older adults in the United States during the COVID-19 pandemic. *JAMA Intern Med* 2020;180:1389.

60 Stockwell S, Stubbs B, Jackson SE, *et al*. Internet use, social isolation and loneliness in older adults. *Ageing Soc* 2020;57:1–24.

61 Ibarra F, Baez M, Cernuzzi L, *et al*. A systematic review on Technology-Supported interventions to improve old-age social wellbeing: loneliness, social isolation, and connectedness. *J Healthc Eng* 2020;2020:1–14.

62 Seifert A. The digital exclusion of older adults during the COVID-19 pandemic. *J Gerontol Soc Work* 2020;63:674–6.

63 Raina P, Wolfson C, Kirkland S, *et al*. Cohort profile: the Canadian longitudinal study on aging (CLSA). *Int J Epidemiol* 2019;48:1752–3.

64 O'Connor RC, Wetherall K, Cleare S, *et al*. Mental health and well-being during the COVID-19 pandemic: longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study. *The British Journal of Psychiatry* 2020;57:1–8.

65 Bu F, Steptoe A, Fancourt D. Loneliness during a strict lockdown: trajectories and predictors during the COVID-19 pandemic in 38,217 United Kingdom adults. *Soc Sci Med* 2020;265:113521.