

Associations between sensory loss and social networks, participation, support, and loneliness

Analysis of the Canadian Longitudinal Study on Aging

Paul Mick MD MPH Maksim Parfyonov MD Walter Wittich PhD
Natalie Phillips PhD M. Kathleen Pichora-Fuller MSc PhD

Abstract

Objective To determine if hearing loss, vision loss, and dual sensory loss were associated with social network diversity, social participation, availability of social support, and loneliness, respectively, in a population-based sample of older Canadians and to determine whether age or sex modified the associations.

Design Cross-sectional population-based study.

Setting Canada.

Participants The sample included 21 241 participants in the Canadian Longitudinal Study on Aging tracking cohort. The sample was nationally representative of English- and French-speaking, non-institutionalized 45- to 89-year-old Canadians who did not live on First Nations reserves and who had normal cognition. Participants with missing data for any of the variables in the multivariable regression models were excluded from analysis.

Main outcome measures Hearing and vision loss were determined by self-report. *Dual sensory loss* was defined as reporting both hearing and vision loss. Univariate analyses were performed to assess cross-sectional associations between hearing, vision, and dual sensory loss, and social, demographic, and medical variables. Multivariable regression models were used to analyze cross-sectional associations between each type of sensory loss and social network diversity, social participation, availability of social support, and loneliness.

Results Vision loss (in men) and dual sensory loss (in 65- to 85-year-olds) were independently associated with reduced social network diversity. Vision loss and dual sensory loss (in 65- to 85-year-olds) were each independently associated with reduced social participation. All forms of sensory loss were associated with both low availability of social support and loneliness.

Conclusion Sensory impairment is associated with reduced social function in older Canadians. Interventions and research that address the social needs of older individuals with sensory loss are needed.

Editor's key points

- ▶ In this analysis of data from the Canadian Longitudinal Study on Aging, vision loss (in men) and dual sensory loss (in 65- to 85-year-olds) were independently associated with low social network diversity. Vision loss and dual sensory loss (in 65- to 85-year-olds) were independently associated with low social participation. Hearing, vision, and dual sensory losses were each independently associated with loneliness and reduced availability of social support, respectively.
- ▶ These findings are concerning because social support facilitates positive coping mechanisms that mitigate the effects of sensory loss and other chronic disabling conditions. Living with a chronic health condition often entails relying on others for help with instrumental tasks and emotional support. Unfortunately, individuals with clinically diagnosed sensory loss typically receive little, if any, relationship and communication counseling.



Points de repère du rédacteur

► Dans cette analyse des données de l'Étude longitudinale canadienne sur le vieillissement, la perte de la vue (chez les hommes) et la perte sensorielle double (chez les 65 à 85 ans) étaient associées indépendamment à une faible diversité du réseau social. La perte de la vue et la perte sensorielle double (chez les 65 à 85 ans) étaient indépendamment associées à une faible participation sociale. La perte de l'ouïe, la perte de la vue et la perte sensorielle double étaient chacune indépendamment associées respectivement à la solitude et à un accès réduit au soutien social.

► Ces constatations sont inquiétantes parce que le soutien social facilite les mécanismes d'adaptation positive qui atténuent les effets de la perte sensorielle et des autres problèmes incapacitants chroniques. Vivre avec un problème de santé chronique exige souvent de se fier à autrui pour des tâches instrumentales et du soutien émotionnel. Malheureusement, les personnes qui reçoivent un diagnostic clinique de perte sensorielle ne reçoivent habituellement que peu ou pas de counseling en relations et en communication.

Associations entre la perte sensorielle et les réseaux, la participation et le soutien sociaux ainsi que la solitude

Analyse de l'Étude longitudinale canadienne sur le vieillissement

Paul Mick MD MPH Maksim Parfyonov MD Walter Wittich PhD
Natalie Phillips PhD M. Kathleen Pichora-Fuller MSc PhD

Résumé

Objectif Déterminer si la perte de l'ouïe, la perte de la vue et la perte sensorielle double sont respectivement associées à la diversité du réseau social, à la participation sociale, à l'accès au soutien social et à la solitude dans un échantillon d'une population de Canadiens plus âgés, et déterminer si l'âge ou le sexe modifie les associations.

Conception Étude transversale effectuée dans la population.

Contexte Le Canada.

Participants L'échantillon comptait 21 241 participants appartenant à la cohorte de suivi de l'Étude longitudinale canadienne sur le vieillissement. L'échantillon était représentatif, à l'échelle nationale, des Canadiens de 45 à 89 ans, anglophones et francophones, non institutionnalisés, qui ne vivaient pas dans une réserve des Premières Nations et qui avaient une cognition normale. Les participants pour qui il manquait des données sur l'une ou l'autre des variables dans les modèles de régression multivariés ont été exclus de l'analyse.

Principaux paramètres à l'étude La perte de l'ouïe et de la vue était déterminée selon les rapports fournis par les participants. La *perte sensorielle double* désignait un signalement de la perte de l'ouïe et de la vue. Des analyses univariées ont été effectuées pour évaluer les associations transversales entre la perte de l'ouïe, la perte de la vue et la perte sensorielle double, et les variables sociales, démographiques et médicales. Des modèles de régression multivariés ont servi à analyser les associations transversales entre chaque type de perte sensorielle et la diversité du réseau social, la participation sociale, l'accès au soutien social et la solitude.

Résultats La perte de la vue (chez les hommes) et la perte sensorielle double (chez les 65 à 85 ans) étaient indépendamment associées à une diversité réduite du réseau social. Toutes les formes de perte sensorielle étaient associées à la fois à un faible accès au soutien social et à la solitude.

Conclusion L'incapacité sensorielle est associée à un fonctionnement social réduit chez les Canadiens plus âgés. Il est nécessaire d'effectuer des interventions et de la recherche pour répondre aux besoins sociaux des personnes plus âgées souffrant de perte sensorielle.

The importance of social relationships to health is highlighted in a meta-analysis of 148 studies that found a 50% increased likelihood of survival in individuals with stronger social relationships, comparable with the effect on mortality of smoking and alcohol consumption and exceeding the influence of physical inactivity and obesity.¹ Health effects might be mitigated through social network characteristics, participation in social activities, availability of social support,² or reducing loneliness.³ An individual's social network consists of the sum of his or her interpersonal relationships.² A large network might foster participation in social activities, which might be therapeutic or help prevent health declines.⁴ Healthy relationships promote the exchange of *social support*, defined as "verbal and nonverbal communication between recipients and providers that helps manage uncertainty about the situation, the self, the other or the relationship and functions to enhance a perception of personal control."⁵ Social support can be classified as emotional or informational (eg, empathy and advice), tangible (eg, money), affectionate (eg, love), and interactional (eg, a sense of belonging).⁶ It might reduce stress, improve psychological well-being, promote healthy behaviour, facilitate access to health care,² enable self-management of chronic diseases,⁷ and have positive physiologic effects.⁸ *Loneliness* is the subjective feeling of isolation regardless of objective social network size, and is associated with psychological distress, functional decline, and mortality in the elderly.³ Strengthening social networks, encouraging social participation, increasing social support, and reducing loneliness in older adults are important public health goals, and might be achieved by treating modifiable risk factors or through interventions that strengthen social connections.⁹

Hearing and sight affect mobility and communication and thus, perhaps, a person's social milieu. Studies examining relationships between sensory loss and social outcomes have been qualitative,¹⁰ have measured only single aspects of social function,¹¹ have focused on hearing or vision loss in isolation, or have not been conducted in the Canadian population. Presbycusis and uncorrectable age-related vision loss are common, increasing in prevalence,^{12,13} and associated with physical, mental, and cognitive declines¹⁴⁻¹⁸ but are rarely considered medical or public health priorities.¹⁹ Dual sensory impairment affects many aspects of a person's life.^{20,21} Individuals are more likely to be depressed,²² struggle with activities of daily living and instrumental activities of daily living, and have limited social participation, increasing their dependence on others²³ and diminishing their decision-making control.^{24,25} Effective treatments, such as hearing aids and auditory and visual rehabilitation, are underused.²⁶⁻²⁸ For these reasons, we sought to determine if hearing loss, vision loss, or dual sensory loss are associated with social network diversity, participation in social activities, availability of social

support, and loneliness in a nationally representative sample of Canadians aged 45 to 85, and whether age or sex modified the associations.

— Methods —

A cross-sectional population-based study was performed. Ethics approval was granted by the University of British Columbia clinical research ethics board.

Study cohort

The Canadian Longitudinal Study on Aging (CLSA)²⁹ comprises English- and French-speaking Canadians who, at baseline, were 45 to 89 years of age, did not live on First Nations reserves, were not institutionalized, and had normal cognition. Our analysis was conducted using the first wave of data released for the CLSA tracking cohort, a nationally representative sample of 21 241 adults who completed a telephone survey.³⁰ Participants were excluded from the current analysis if they had missing data for any of the variables used in the multivariable models.

Outcome variables

Associations were analyzed between hearing, vision, and dual sensory loss and social network diversity, social participation, availability of social support, and loneliness.

Social network diversity was determined using a slightly modified version of the Social Network Index (SNI),³¹ a validated measure of social network diversity. The SNI, as originally described, measures 12 possible social roles. In the present analyses participants were scored on the SNI out of 10 roles instead of 12 because the CLSA did not measure the frequency of contact with parents or parents-in-law. Participants scored 1 point if they were married or in a domestic partnership. They also received 1 point (each) if they had interpersonal contact at least every 1 to 2 weeks (during the past year) with children, other close family members, friends, neighbours, work colleagues, schoolmates, fellow volunteers, members of nonreligious community groups, and members of religious groups.

Social participation was measured using 8 items developed for the Canadian Community Health Survey.³² A composite scale comprising a combination of responses to the social participation items has not been validated, so we classified individuals as having low social participation if they did not participate in any social activities at least once per week. Activities included family or friendship activities outside of the household, church or religious activities, sports or physical activities with others, educational or cultural activities with others, service club activities, community or professional association activities, volunteer work, or any other recreational activity involving other people.

Availability of social support was determined using the Medical Outcomes Study Social Support Survey,⁶

a validated scale of overall social support and 4 domains of social support (emotional or informational, tangible, affectionate, and positive interactions). For the overall score and the score for each domain, participants were categorized as having low availability of social support if their scores were below the median.

Loneliness was determined using the following questionnaire item: "In the past week, how often did you feel lonely?" Participants were classified as lonely if they responded "some of the time" (1 to 2 days), "occasionally" (3 to 4 days), or "all of the time" (5 to 7 days). Those who responded "rarely or never" (<1 day) were considered not lonely. To our knowledge, the CLSA loneliness item has not been validated against other measures of loneliness.

Sensory variables

Self-reported hearing was determined using the following multiple-choice item: "Is your hearing, using a hearing aid if you use one ..." Participants were classified as having hearing loss if they responded "fair" or "poor, non-existent, or deaf" (vs "good," "very good," or "excellent"). Self-reported vision was determined using the following multiple-choice item: "Is your eyesight, using glasses or corrective lenses if you use them ..." Participants were classified as having vision loss if they responded "fair" or "poor, nonexistent, or blind" (vs "good," "very good," or "excellent"). Individuals were considered to have dual sensory loss if they had both hearing loss and vision loss defined according to these criteria.

Covariates

In multivariable models, we adjusted for age, sex, race or ethnicity (white or non-white), annual household income (<\$20 000, \$20 000 to \$49 999, \$50 000 to \$99 999, \$100 000 to \$149 999, ≥\$150 000), education level (some secondary, secondary graduate, some post-secondary, postsecondary graduate), smoking status (never a smoker, former smoker, current smoker), and dichotomous self-reported medical history of diabetes, hypertension, angina, myocardial infarction, peripheral vascular disease, transient ischemic attack, stroke, cancer, kidney disease, hypothyroidism, or hyperthyroidism.

Statistical analysis

Univariate analyses were performed to assess cross-sectional associations between hearing, vision, and dual sensory loss, and social, demographic, and medical variables. The χ^2 test was used to assess differences in proportions for categorical variables. Analysis of variance (ANOVA) was used to test for differences between groups (defined by sensory status) in means for continuous variables.

Multivariable regression models were used to analyze associations between sensory loss (hearing, vision, dual) and SNI score, lack of social participation, low availability of social support, and loneliness. Linear

regression was used for SNI score and logistic regression was used for the other outcomes.

The CLSA is a complex sample survey requiring mathematical variance approximation procedures to estimate sampling errors and produce estimates representative of the Canadian population. Inverse probability weights were used in univariate and multivariable analyses as per CLSA guidelines.³³

Effect measure modification

To test for effect modification according to sex and age (45 to 64 years old vs 65 to 85 years old), multiplicative interaction terms were created with the sensory variables in each multivariable model. The interaction terms were entered into the main effects models one at a time. Analysis of variance was performed to determine a global partial *F* test for the presence of interaction. If interaction was present, the multivariable regression was repeated but stratified according to levels of the effect modifier.

Statistical significance was defined as a *P* value less than .05.

— Results —

Of 21 241 participants, 1916 (9.0%) had missing data and were excluded. Participant characteristics are summarized in **Table 1**.

Univariate analysis

Hearing impairment and dual sensory loss were more common in men, while vision loss was more common in women (**Table 2**). Individuals with any type of sensory loss were more likely to be older and have a history of metabolic, cardiovascular, and renal disease, have lower SNI scores, decreased social participation, lower social support (overall and in all subscales), and a higher prevalence of loneliness relative to those who reported no sensory loss.

Multivariable analysis

Social network diversity. Hearing loss was not associated with social network diversity (**Table 3**). Vision loss was independently associated with lower social network diversity among men but not women (*P* = .022). Dual sensory loss was significantly associated with reduced social network diversity among 65- to 85-year-olds but not 45- to 64-year-olds (*P* = .037).

Social participation. Vision loss, but not hearing loss, was independently associated with reduced social participation (**Table 4**). Dual sensory loss was also associated with low social participation, but only in the 65- to 85-year-old age group (*P* = .032).

Availability of social support. Hearing, vision, and dual sensory loss were each independently associated

Table 1. Participant characteristics

CHARACTERISTIC	POPULATION ESTIMATE
Self-rated hearing (using hearing aid if patient has one), % (95% CI)	
• Excellent	26.1 (25.2 to 26.9)
• Very good	32.5 (31.7 to 33.4)
• Good	30.8 (30.0 to 31.7)
• Fair	9.1 (8.6 to 9.6)
• Poor, nonexistent, or deaf	1.5 (1.3 to 1.7)
Self-rated vision (using glasses if patient has them), % (95% CI)	
• Excellent	22.9 (22.1 to 23.7)
• Very good	37.3 (36.4 to 38.2)
• Good	31.9 (31.1 to 32.8)
• Fair	6.4 (6.0 to 6.9)
• Poor, nonexistent, or blind	1.5 (1.3 to 1.7)
Dual sensory loss, % (95% CI)	1.9 (1.6 to 2.1)
Female sex, % (95% CI)	50.4 (49.4 to 51.3)
Age, y, % (95% CI)	
• 45-49	14.3 (13.6 to 15.0)
• 50-59	38.3 (37.4 to 39.3)
• 60-69	28.1 (27.3 to 28.9)
• 70-79	14.8 (14.2 to 15.4)
• 80-85	4.6 (4.3 to 4.9)
Born in Canada, % (95% CI)	84.5 (83.8 to 85.2)
White, % (95% CI)	95.6 (95.1 to 95.9)
Education level, % (95% CI)	
• Some secondary	6.8 (6.4 to 7.2)
• Secondary graduate	12.6 (12.0 to 13.2)
• Some postsecondary	7.5 (7.0 to 7.9)
• Postsecondary graduate	73.1 (72.3 to 73.9)
Total annual household income, % (95% CI)	
• < \$20 000	5.2 (4.8 to 5.6)
• \$20 000-\$49 999	23.7 (23.0 to 24.5)
• \$50 000-\$99 999	36.1 (35.2 to 36.9)
• \$100 000-\$149 999	19.3 (18.5 to 20.1)
• ≥ \$150 000	15.8 (15.0 to 16.6)
Mean SNI score out of 10 (95% CI)	4.25 (4.22 to 4.28)
Median (IQR) social support out of 100	
• Overall	87.8 (74.0 to 97.7)
• Affectionate	100.0 (75.0 to 100.0)
• Emotional or informational	87.5 (71.9 to 100.0)
• Tangible	87.5 (75.0 to 100.0)
• Positive interactions	82.9 (75.0 to 100.0)
Lonely at least 1 day per week, % (95% CI)	21.1 (20.4 to 21.9)
Social participation,* % (95% CI)	
• 0	17.6 (16.9 to 18.3)
• 1	25.7 (24.9 to 26.6)
• 2	25.6 (24.8 to 26.4)
• ≥ 3	31.2 (30.3 to 32.0)
Smoking status, % (95% CI)	
• Current	10.5 (9.9 to 11.0)
• Former	58.2 (57.3 to 59.1)
• Never	31.4 (30.5 to 32.3)
History of medical problems, % (95% CI)	
• Hypertension	33.1 (32.3 to 34.0)
• Diabetes	14.8 (14.2 to 15.4)
• Myocardial infarction	4.8 (4.5 to 5.2)
• Angina	4.2 (3.9 to 4.6)
• Peripheral vascular disease	6.3 (5.9 to 6.8)
• Transient ischemic attack	2.7 (2.5 to 3.0)
• Stroke	1.4 (1.3 to 1.7)
• Hypothyroidism	10.1 (9.6 to 10.7)
• Hyperthyroidism	2.0 (1.8 to 2.3)
• Kidney disease	2.3 (2.0 to 2.5)
• Cancer	13.2 (12.6 to 13.8)

IQR—interquartile range, SNI—Social Network Index.

*Social participation is the number of different types of social activities performed at least weekly.

with lower overall availability of social support and with nearly all domains of social support (Table 5).

Age significantly modified the associations between vision loss and availability of affectionate social support ($P=.025$) and tangible social support ($P=.037$). The associations were present in both age groups but were stronger in the 45- to 64-year-old age group than they were in the 65- to 85-year-old age group.

There was also a significant effect modification by sex for the association between hearing loss and tangible social support ($P=.03$). The association was stronger in women than in men.

Loneliness. Hearing, vision, and dual sensory loss were each independently associated with loneliness (Table 6). There were no significant interactions with age or sex.

— Discussion —

Vision loss (in men) and dual sensory loss (in 65- to 85-year-olds) were independently associated with low social network diversity. Vision loss and dual sensory loss (in 65- to 85-year-olds) were independently associated with low social participation. Hearing, vision, and dual sensory losses were each independently associated with loneliness and reduced availability of social support, respectively.

Vision loss and dual sensory loss might curtail the frequency of social interactions and activities by compromising physical function, mobility, mental well-being, or the ability to communicate using visual cues.³⁴ In addition, others might not understand the implications of vision loss and underestimate or overestimate what a person with visual impairment can or cannot see or do.³⁵ Coping strategies might help (eg, people might readjust their behaviour to maintain relationships and activities) or compound the problem (eg, they might isolate themselves³⁵). A greater tendency among men for harmful coping strategies might explain the sex interaction. Although this proclivity has not been specifically observed in the literature, women might have more pre-existing positive coping strategies (eg, self-efficacy, planning for the future, positive attitudes) than men do to help adjust to new-onset vision loss.³⁶

Hearing loss is a risk factor for falls³⁷ and driving accidents,³⁸ but might affect mobility (and thus opportunities for social interaction) less than visual impairment does. Individuals with hearing loss might be able to adjust their social activities to accommodate their disabilities more easily, rather than abandoning activities altogether. For example, they might participate in more one-on-one interactions rather than group interactions to reduce the communication challenges of attending to multiple speakers with background noise, or they might attend activities but not engage in communication. In contrast, it might be harder to find alternative social activities that can be maintained with even partial success for those with poor vision.

Table 2. Sensory loss among participants

CHARACTERISTIC	HEARING LOSS			VISION LOSS			DUAL SENSORY LOSS		
	NO	YES	P VALUE	NO	YES	P VALUE	NO	YES	P VALUE
Female sex, %	52.1	35.7	<.001	50.0	54.7	<.001	50.6	39.4	<.001
Age, y, %			<.001			<.001			<.001
• 45-49	14.9	9.3		14.1	15.9		14.4	7.2	
• 50-59	39.1	31.8		38.5	36.2		38.4	31.8	
• 60-69	27.8	30.5		28.3	25.0		28.0	30.0	
• 70-79	14.1	20.5		14.7	15.9		14.7	20.9	
• 80-85	4.2	8.0		4.4	6.9		4.5	10.2	
Education, %			<.001			<.001			.002
• Some secondary	6.4	10.4		6.5	10.5		6.7	11.9	
• Secondary graduate	12.6	13.2		12.4	14.7		12.6	15.1	
• Some postsecondary	7.4	8.2		7.4	7.7		7.5	6.8	
• Postsecondary graduate	73.7	68.2		73.6	67.1		73.2	66.3	
Annual household income, %			<.001			<.001			<.001
• <\$20 000	4.9	7.2		4.7	10.2		5.1	10.3	
• \$20 000-\$49 999	23.1	29.2		23.0	32.5		23.5	35.1	
• \$50 000-\$99 999	36.0	36.2		36.5	31.5		36.1	33.6	
• \$100 000-\$149 999	19.8	15.1		19.7	14.1		19.4	10.5	
• ≥\$150 000	16.2	12.4		16.1	11.7		15.9	10.5	
Mean SNI score out of 10	4.26	4.14	.008	4.28	3.94	<.001	4.26	3.81	<.001
No weekly social activities, %	17.2	20.5	.003	17.2	22.5	<.001	17.4	28.1	<.001
Below-median social support, %									
• Overall	46.2	51.7	<.001	45.7	58.8	<.001	46.5	59.5	<.001
• Affectionate	43.9	49.4	.003	43.7	53.7	<.001	44.3	54.1	.002
• Emotional or informational	47.1	52.3	<.001	47.0	55.6	<.001	47.5	56.8	.003
• Tangible	41.1	46.2	<.001	40.7	52.7	<.001	41.4	56.1	<.001
• Positive interactions	44.2	49.7	<.001	44.0	54.5	<.001	44.6	54.4	.002
Lonely at least 1 day per week, %	20.8	23.4	.006	20.5	28.0	<.001	21.0	27.3	.010
Wears a hearing aid, %	2.9	15.4	<.001	4.1	6.1	.001	4.0	14.9	<.001
Smoking status, %			<.001			<.001			.03
• Current	10.3	11.8		10.1	14.5		31.5	24.9	
• Former	57.6	63.4		58.3	56.7		58.1	61.5	
• Never	32.2	24.8		31.6	28.8		10.4	13.6	
History of medical condition, %									
• Hypertension	32.3	40.5	<.001	32.7	38.4	<.001	32.9	46.7	<.001
• Diabetes	14.3	19.1	<.001	14.3	20.0	<.001	14.6	22.1	<.001
• Myocardial infarction	4.5	8.2	<.001	4.7	7.1	<.001	4.8	9.2	<.001
• Angina	3.9	6.9	<.001	4.1	5.8	.004	4.2	8.1	<.001
• Peripheral vascular disease	6.0	9.1	<.001	6.1	9.6	<.001	6.2	12.8	<.001
• Transient ischemic attack	2.5	4.7	<.001	2.6	4.0	.008	2.7	5.6	<.001
• Stroke	1.4	2.2	.005	1.3	3.8	<.001	1.4	4.1	<.001
• Kidney disease	2.1	3.7	<.001	2.0	4.9	<.001	2.2	6.1	<.001
• Hypothyroidism	10.2	9.3	.24	10.1	11.0	.36	10.2	7.8	.12
• Hyperthyroidism	2.0	2.4	.32	2.0	2.6	.23	2.0	1.5	.47
• Cancer	13.0	14.9	.04	13.0	15.0	.07	13.1	16.4	.12

SNI—Social Network Index.

Communication difficulties alone might mediate associations between sensory impairment and reduced social support and loneliness.^{5,39} Individuals with hearing loss might struggle to listen for missing words and meaning during conversations, leading to fatigue, frustration, stress, anger, or resentment in relationships.⁶ For people with vision loss, interpersonal communication might be restricted by loss of nonverbal cues including facial expressions, body language, and lip movement. In single sensory loss, some aspects of communication are spared. Those with hearing loss might compensate by using lip reading or sign language, while those with vision loss can rely on spoken language. The combination of hearing and vision loss, however, creates a compounded problem such that cross-modal compensation is more difficult.⁴⁰ The ubiquitous use of visual and auditory communication methods leads to barriers, exclusion, and isolation of individuals with vision and hearing impairments. Beyond restrictions in communication strategies, inaccessible environments and activities might reduce the range of topics that individuals with dual sensory loss are able to communicate about.⁴¹ Communication partners might not pay adequate attention to or understand people with dual sensory loss,⁴² or might not want to make the perceived extra effort of communicating with them.⁴³

It was not possible to determine whether treating hearing and vision loss moderated the associations with social outcomes because CLSA sensory variables reflect self-reported abilities using amplification devices or

lenses if used by the participants. Therefore, participants who benefit from such devices might have classified their hearing or vision as “good” or better. Observational studies using objective measures of sensory function (eg, audiometry or visual acuity testing) or randomized controlled trials could be performed to determine if treatments of sensory loss reduce the risk of social decline.

The findings are concerning because social support facilitates positive coping mechanisms that mitigate the effects of sensory loss^{44,45} and other chronic disabling

Table 3. Mean difference in SNI score (out of 10) between participants with and without sensory loss

SENSORY LOSS	MEAN DIFFERENCE IN SNI SCORE (95% CI)	P VALUE
Hearing	0.02 (-0.06 to 0.10)	.68
Vision		
• Women	-0.08 (-0.22 to -0.05)	.20
• Men	-0.31 (-0.46 to -0.17)	<.001
Dual		
• 45- to 64-year-olds	-0.09 (-0.31 to 0.13)	.43
• 65- to 85-year-olds	-0.43 (-0.65 to -0.19)	<.001

SNI—Social Network Index.

Table 4. Adjusted relative odds of not participating in any social activities at least once per week during the past 12 months

SENSORY LOSS	ODDS RATIO (95% CI)	P VALUE
Hearing	1.12 (0.98 to 1.27)	.09
Vision	1.20 (1.04 to 1.39)	.01
Dual		
• 45- to 64-year-olds	1.19 (0.82 to 1.75)	.36
• 65- to 85-year-olds	2.07 (1.48 to 2.90)	<.001

Table 5. Adjusted relative odds of having a social support score lower than the median between participants with and without sensory loss

DOMAIN	ODDS RATIO (95% CI)	P VALUE
Overall		
Hearing	1.22 (1.10 to 1.35)	<.001
Vision	1.43 (1.27 to 1.60)	<.001
Dual	1.40 (1.13 to 1.74)	.002
Affectionate		
Hearing	1.19 (1.07 to 1.31)	.001
Vision		
• 45- to 64-year-olds	1.41 (1.22 to 1.64)	<.001
• 65- to 85-year-olds	1.09 (0.92 to 1.29)	.31
Dual	1.34 (1.09 to 1.65)	.006
Emotional-informational		
Hearing	1.13 (1.02 to 1.26)	.017
Vision	1.27 (1.13 to 1.43)	<.001
Dual	1.21 (0.98 to 1.50)	.080
Tangible		
Hearing		
• Women	1.47 (1.24 to 1.73)	<.001
• Men	1.17 (1.03 to 1.33)	.02
Vision		
• 45- to 64-year-olds	1.53 (1.31 to 1.78)	<.001
• 65- to 85-year-olds	1.20 (1.01 to 1.43)	.038
Dual	1.63 (1.31 to 2.02)	<.001
Positive interactions		
Hearing	1.24 (1.12 to 1.37)	<.001
Vision	1.35 (1.20 to 1.52)	<.001
Dual	1.35 (1.09 to 1.68)	.005

Table 6. Adjusted odds ratios of loneliness among participants with sensory loss compared with participants without sensory loss: Loneliness was defined as reporting feeling lonely “some of the time,” “occasionally,” or “all of the time” (vs “rarely or never”).

SENSORY LOSS	ODDS RATIO (95% CI)	P VALUE
Hearing	1.17 (1.04 to 1.32)	.009
Vision	1.24 (1.09 to 1.42)	.001
Dual	1.29 (1.02 to 1.64)	.035

conditions.⁷ Living with a chronic health condition often entails relying on others for help with instrumental tasks and emotional support. Unfortunately, individuals with clinically diagnosed sensory loss typically receive little, if any, relationship and communication counseling. The focus of therapy is usually on augmenting the sensory abilities (eg, with hearing aids or lenses) without addressing activity and participation consequences (eg, with auditory or visual rehabilitation programs).^{46,47} Individuals with sensory impairments might also be targeted for community interventions that aim to increase engagement and reduce loneliness and isolation.⁹

One challenge in trying to improve access to such services is that many doctors or health policy decision makers do not prioritize sensory problems.¹⁹ Diagnosis is often delayed and barriers to effective treatments are rarely addressed in public health campaigns. Hearing aids remain underused because of cost, stigma, or delayed diagnosis of hearing problems. Auditory and visual rehabilitation programs are underused because of lack of availability, awareness, and funding.⁴⁸ In most jurisdictions, implementation of universal design features that help people adapt to their sensory impairments in public spaces, buildings, technologies, or transportation systems is insufficient or not mandated.^{49,50} Public health campaigns that address these deficiencies are needed.

Family doctors play an important role in the management of sensory losses. Screening adults for hearing loss has been shown to reduce delays in seeking help for hearing problems and to increase the uptake of hearing aids, leading to benefits in speech communication.⁵¹ The early detection of vision impairment has been shown to contribute to the reduction of falls in the elderly.⁵² Screening is a 2-step process. First, older patients should be asked if they have noticed a hearing or vision problem. If they reply yes, then they should be examined and, in the absence of a medically treatable cause, referred to an audiologist or optometrist for further workup. If they reply no, then a screening test can be performed (eg, audioscope,⁵³ whisper,⁵⁴ or visual acuity testing⁵⁵). Patients whose screening test results suggest hearing or vision loss should be referred to an audiologist or optometrist for further evaluation and treatment. A basic audiologic workup includes an assessment to determine the degree and type of hearing loss as well as counseling about management of hearing problems. Note that a referral to audiology does not necessarily imply that a hearing aid will be recommended, so willingness to try a hearing aid is not a prerequisite to referral. The basic optometric examination includes refraction, tests of visual acuity and visual field, and a thorough inspection of the anterior and posterior structures of the eye with a fundus examination through a dilated pupil. If needed, a prescription for glasses or contact lenses is issued. Referrals to otolaryngologists or ophthalmologists


are initiated in case of further medical or surgical requirements. In most Canadian provinces, audiologists and optometrists are regulated health professionals and directories of registrants are publicly available.^{56,57}

The results of the present study suggest possible explanatory mechanisms behind the observed associations between sensory loss and cognitive decline, dementia,^{14,58} frailty, depression,^{59,60} and mortality,¹⁵ insofar as poorer social networks, social support, social participation, and loneliness have also been linked to these outcomes.⁶¹⁻⁶³ Consistent with this hypothesis, a recent population-based Dutch study demonstrated that social network size mediated the association between vision loss and depression.⁵⁹

Limitations

Limitations prevent causal inference. The study was cross sectional, and therefore the level of social functioning might have affected ratings of sensory ability. Residual confounding by unmeasured factors cannot be excluded. Exposure misclassification might have occurred, as hearing and vision were assessed by self-report. On the other hand, self-report might be the best method of assessing functional disability, as objective measures such as audiometry or visual acuity testing do not take into account how individuals compensate for their losses.⁶⁴ This might be why, in a population-based multivariable analysis of older adults, lower 36-Item Short Form Health Survey quality of life scores were better predicted by self-reported hearing loss than by audiometric performance.⁶⁵ Another limitation of our study is that the results might not be generalizable to specific subpopulations or populations outside of Canada.

Conclusion

This is the first population-based study investigating the association between sensory impairment and the social lives of Canadians. The finding of modality-specific associations between sensory loss and different domains of social function is novel. Our study contributes to a growing literature implicating sensory impairments as important determinants of health. Further research is needed to determine mechanisms underlying the associations, and whether addressing sensory impairment yields benefits outside of simply improving sensory function. 

Dr Mick is Clinical Assistant Professor and an otolaryngologist-head and neck surgeon in the Department of Surgery in the Faculty of Medicine at the University of British Columbia in Kelowna. **Dr Parfyonov** is a resident in the pediatric neurology program at the University of British Columbia in Kelowna. **Dr Wittich** is Assistant Professor in the School of Optometry at the University of Montreal in Quebec. **Dr Phillips** is Professor of Psychology at Concordia University in Montreal. **Dr Pichora-Fuller** is Professor of Psychology at the University of Toronto in Mississauga, Ont, and a clinical audiologist.

Acknowledgment

This research was made possible using data and samples collected by the Canadian Longitudinal Study on Aging. Funding for the Canadian Longitudinal Study on Aging was provided by the Government of Canada through the Canadian Institutes of Health Research and the Canada Foundation for Innovation. The study is supported by the Canadian Consortium on Neurodegeneration in Aging and is funded by a grant from the Canadian Institutes of Health Research, with funding from several partners.

Contributors

Dr Mick conceived the study, designed the study, acquired data from the Canadian

Longitudinal Study on Aging, performed the statistical analysis, interpreted the results, and edited the manuscript. **Dr Parfyonov** interpreted the results, and wrote and edited the manuscript. **Dr Wittich** designed the study, interpreted the results, and edited the manuscript. **Dr Phillips** designed the study, interpreted the results, and edited the manuscript. **Dr Pichora-Fuller** conceived the study, designed the study, interpreted the results, and edited the manuscript.

Competing interests

None declared

Correspondence

Dr Paul Mick; e-mail paul.mick@interiorhealth.ca

References

- Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med* 2010;7(7):e1000316.
- Berkman LF, Glass T. Social integration, social networks, social support, and health. In: Berkman LF, Kawachi I, editors. *Social epidemiology*. New York, NY: Oxford University Press; 2000. p. 137-73.
- Perisiotto CM, Stijacic Cencer I, Covinsky KE. Loneliness in older persons: a predictor of functional decline and death. *Arch Intern Med* 2012;172(14):1078-84.
- Young FW, Glasgow N. Voluntary social participation and health. *Res Aging* 1998;20(3):339-62.
- Albrecht TL, Adelman MB. *Communicating social support*. Newbury Park, CA: Sage Publications; 1987. p. 19.
- Sherbourne CD, Stewart AL. The MOS Social Support Survey. *Soc Sci Med* 1991;32(6):705-14.
- Gallant MP. The influence of social support on chronic illness self-management: a review and directions for research. *Health Educ Behav* 2003;30(2):170-95.
- Uchino BN, Cacioppo JT, Kiecolt-Glaser JK. The relationship between social support and physiological processes: a review with emphasis on underlying mechanisms and implications for health. *Psychol Bull* 1996;119(3):488-531.
- Cattan M, White M, Bond J, Learmouth A. Preventing social isolation and loneliness among older people: a systematic review of health promotion interventions. *Ageing Soc* 2005;25(1):41-67.
- Hétu R, Jones L, Getty L. The impact of acquired hearing impairment on intimate relationships: implications for rehabilitation. *Audiology* 1993;32(6):363-81.
- Mick P, Kawachi I, Lin FR. The association between hearing loss and social isolation in older adults. *Otolaryngol Head Neck Surg* 2014;150(3):378-84. Epub 2014 Jan 2.
- Zhan W, Cruickshanks KJ, Klein BE, Klein R, Huang GH, Pankow JS, et al. Generational differences in the prevalence of hearing impairment in older adults. *Am J Epidemiol* 2010;171(2):260-6. Epub 2009 Dec 15.
- Congdon N, O'Colmain B, Klaver CC, Klein R, Muñoz B, Friedman DS, et al. Causes and prevalence of visual impairment among adults in the United States. *Arch Ophthalmol* 2004;122(4):477-85.
- Lin FR, Metter EJ, O'Brien RJ, Resnick SM, Zonderman AB, Ferrucci L. Hearing loss and incident dementia. *Arch Neurol* 2011;68(2):214-20.
- Fisher D, Li CM, Chiu MS, Themann CL, Petersen H, Jónasson F, et al. Impairments in hearing and vision impact on mortality in older people: the AGES-Reykjavik Study. *Age Ageing* 2014;43(1):69-76. Epub 2013 Aug 30.
- Kempen GI, Ballemans J, Ranchor AV, van Rens GH, Zijlstra GA. The impact of low vision on activities of daily living, symptoms of depression, feelings of anxiety and social support in community-living older adults seeking vision rehabilitation services. *Qual Life Res* 2012;21(8):1405-11. Epub 2011 Nov 17. Erratum in: *Qual Life Res* 2012;21(8):1413.
- Rovner BW, Casten RJ, Leiby BE, Tamman WS. Activity loss is associated with cognitive decline in age-related macular degeneration. *Alzheimers Dement* 2009;5(1):12-7.
- Reed-Jones RJ, Solis GR, Lawson KA, Loya AM, Cude-Islas D, Berger CS. Vision and falls: a multidisciplinary review of the contributions of visual impairment to falls among older adults. *Maturitas* 2013;75(1):22-8. Epub 2013 Feb 19.
- Lin FR. Hearing loss in older adults: who's listening? *JAMA* 2012;307(11):1147-8.
- Saunders GH, Echt KV. An overview of dual sensory impairment in older adults: perspectives for rehabilitation. *Trends Amplif* 2007;11(4):243-58.
- Heine C, Erber NP, Osborn R, Browning CJ. Communication perceptions of older adults with sensory loss and their communication partners: implications for intervention. *Disabil Rehabil* 2002;24(7):356-63.
- Capella-McDonnell M. The effects of developing a dual sensory loss on depression in older adults: a longitudinal study. *J Aging Health* 2009;21(8):1179-99.
- Crews JE, Campbell VA. Vision impairment and hearing loss among community-dwelling older Americans: implications for health and functioning. *Am J Public Health* 2004;94(5):823-9.
- Brennan M, Horowitz A, Su YP. Dual sensory loss and its impact on everyday competence. *Gerontologist* 2005;45(3):337-46.
- Raina P, Wong M, Massfeller H. The relationship between sensory impairment and functional independence among elderly. *BMC Geriatr* 2004;4:3.
- Overbury O, Wittich W. Barriers to low vision rehabilitation: the Montreal Barriers Study. *Invest Ophthalmol Vis Sci* 2011;52(12):8933-8.
- Lin FR, Thorpe R, Gordon-Salant S, Ferrucci L. Hearing loss prevalence and risk factors among older adults in the United States. *J Gerontol A Biol Sci Med Sci* 2011;66(5):582-90. Epub 2011 Feb 27.
- Davis A, McMahon CM, Pichora-Fuller KM, Russ S, Lin F, Olusanya BO, et al. Aging and hearing health: the life-course approach. *Gerontologist* 2016;56(Suppl 2):S256-67.
- Raina PS, Wolfson C, Kirkland SA, Griffith LE, Oremus M, Patterson C, et al. The Canadian Longitudinal Study on Aging (CLSA). *Can J Aging* 2009;28(3):221-9.
- Kirkland SA, Griffith LE, Menec V, Wister A, Payette H, Wolfson C, et al. Mining a unique Canadian resource: the Canadian Longitudinal Study on Aging. *Can J Aging* 2015;34(3):366-77.
- Cohen S. Social supports and physical health: symptoms, health behaviors, and infectious disease. In: Cummings EM, Greene AL, Karraker KH, editors. *Life-span developmental psychology. Perspectives on stress and coping*. Hillsdale, NJ: Lawrence Erlbaum Associates; 1991. p. 213-34.
- Statistics Canada. *Canadian Community Health Survey—healthy aging (CCHS)*. Ottawa, ON: Statistics Canada; 2010. Available from: www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5146&language=en&db=imdb&adm=8&dis=2. Accessed 2013 Dec 12.
- Canadian Longitudinal Study on Aging. *Sampling and computation of response rates and sample weights for the tracking (telephone interview) participants and comprehensive participants*. Hamilton, ON: Canadian Longitudinal Study on Aging; 2017. Available from: www.clsa-elcv.ca/doc/1041. Accessed 2017 Nov 24.
- Cimarolli VR, Boerner K, Brennan-Ing M, Reinhardt JP, Horowitz A. Challenges faced by older adults with vision loss: a qualitative study with implications for rehabilitation. *Clin Rehabil* 2012;26(8):748-57. Epub 2011 Dec 14.
- Wang SW, Boerner K. Staying connected: re-establishing social relationships following vision loss. *Clin Rehabil* 2008;22(9):816-24.
- Brennan M, Cardinali G. The use of preexisting and novel coping strategies in adapting to age-related vision loss. *Gerontologist* 2000;40(3):327-34.
- Lin FR, Ferrucci L. Hearing loss and falls among older adults in the United States. *Arch Intern Med* 2012;172(4):369-71.
- Picard M, Girard SA, Courteau M, Leroux T, Larocque R, Turcotte F, et al. Could driving safety be compromised by noise exposure at work and noise-induced hearing loss? *Traffic Inj Prev* 2008;9(5):489-99.
- Solano CH, Koester NH. Loneliness and communication problems: subjective anxiety or objective skills? *Pers Soc Psychol Bull* 1989;15(1):126-33.
- Schneider JM, Gopinath B, McMahon CM, Leeder SR, Mitchell P, Wang JJ. Dual sensory impairment in older age. *J Aging Health* 2011;23(8):1309-24. Epub 2011 May 19.
- Hersh M. Deafblind people, communication, independence, and isolation. *J Deaf Stud Deaf Educ* 2013;18(4):446-63. Epub 2013 Jun 7.
- Hart PG. Beyond the common touch point: communication journeys with congenitally deaf-blind people. *AER J* 2010;3(4):160-6.
- Hill C. *Ostracized*. San Diego, CA: In-Between Being Deaf-Blind [blog]; 2010. Available from: <http://in-between-deaf-blind.blogspot.co.uk/2010/10/ostracized.html>. Accessed 2016 Jan 2.
- Singh G, Lau ST, Pichora-Fuller MK. Social support predicts hearing aid satisfaction. *Ear Hear* 2015;36(6):664-76.
- Reinhardt JP. The importance of friendship and family support in adaptation to chronic vision impairment. *J Gerontol B Psychol Sci Soc Sci* 1996;51(5):P268-78.
- Granberg S, Möller K, Skagerstrand A, Möller C, Danermark B. The ICF Core Sets for hearing loss: researcher perspective, part II: linking outcome measures to the International Classification of Functioning, Disability and Health (ICF). *Int J Audiol* 2014;53(2):77-87. Epub 2013 Dec 13.
- Cimarolli VR, Boerner K, Wang SW. Life goals in vision rehabilitation: are they addressed and how? *J Vis Impair Blind* 2006;100(6):343-52.
- Chiang PP, O'Connor PM, Le Mesurier RT, Keeffe JE. A global survey of low vision service provision. *Ophthalmic Epidemiol* 2011;18(3):109-21.
- Strong G. *Design resources. DR-13 vision aspects of universal design*. Buffalo, NY: Center for Inclusive Design and Environmental Access, University at Buffalo, School of Architecture and Planning; 2010. Available from: <http://udeworld.com/documents/designresources/pdfs/VisionAspectsOfUniversalDesign.pdf>. Accessed 2016 May 3.
- David M. *Universal design and barrier-free access. Guidelines for persons with hearing loss*. Ottawa, ON: Canadian Hard of Hearing Association; 2008. Available from: www.chs.ca/sites/default/files/uploads/universal_design_and_barrier-free_access_hardofhearing.pdf. Accessed 2016 May 3.
- Davis A. Population study of the ability to benefit from amplification and the provision of a hearing aid in 55-74-year-old first-time hearing aid users. *Int J Audiol* 2003;42(Suppl 2):S239-52.
- Day L, Fildes B, Gordon I, Fitzharris M, Flamer H, Lord S. Randomised factorial trial of falls prevention among older people living in their own homes. *BMJ* 2002;325(7356):128.
- Canadian Task Force on Preventive Health Care. *The Canadian guide to clinical preventive health care*. Ottawa, ON: Health Canada; 1994.
- Bagai A, Thavendiranathan P, Detsky AS. Does this patient have hearing impairment? *JAMA* 2006;295(4):416-28.
- McGraw C, Déry L, Wittich W. Falls prevention through the Visual Impairment Detection Program. *Insight* 2011;4(2):74-82.
- Canadian Association of Optometrists [website]. *Find a doc*. Ottawa, ON: Canadian Association of Optometrists; 2017. Available from: https://opto.ca/find_doc. Accessed 2017 Dec 12.
- Speech-Language and Audiology Canada [website]. *Find a speech-language pathologist or audiologist*. Ottawa, ON: Speech-Language and Audiology Canada; 2017. Available from: www.sac-oac.ca/find-speech-language-pathologist-or-audiologist-service. Accessed 2017 Dec 13.
- Lin MY, Gutierrez PR, Stone KL, Yaffe K. Vision impairment and combined vision and hearing impairment predict cognitive and functional decline in older women. *J Am Geriatr Soc* 2004;52(12):1996-2002.
- Van Nispen RMA, Vreeken HL, Comijs HC, Deeg DJH, van Rens GHMB. Role of vision loss, functional limitations and the supporting network in depression in a general population. *Acta Ophthalmol* 2016;94(1):76-82. Epub 2015 Nov 6.
- Li CM, Zhang X, Hoffman HJ, Cotch MF, Themann CL, Wilson MR. Hearing impairment associated with depression in US adults, National Health and Nutrition Examination Survey 2005-2010. *JAMA Otolaryngol Head Neck Surg* 2014;140(4):293-302.
- House JS, Robbins C, Metzner HL. The association of social relationships and activities with mortality: prospective evidence from the Tecumseh Community Health Study. *Am J Epidemiol* 1982;116(1):123-40.
- Green AF, Rebok G, Lyketsos CG. Influence of social network characteristics on cognition and functional status with aging. *Int J Geriatr Psychiatry* 2008;23(9):972-8.
- Oxman TE, Berkman LF, Kasl S, Freeman DH, Barrett J. Social support and depressive symptoms in the elderly. *Am J Epidemiol* 1992;135(4):356-68.
- Pope SK, Sowers M. Functional status and hearing impairments in women at midlife. *J Gerontol B Psychol Sci Soc Sci* 2000;55(3):S190-4.
- Dalton DS, Cruickshanks KJ, Klein BE, Klein R, Wiley TL, Nondahl DM. The impact of hearing loss on quality of life in older adults. *Gerontologist* 2003;43(5):661-8.

This article has been peer reviewed. *Can Fam Physician* 2018;64:e33-41