Patterns of social participation among older adults with disabilities and the relationship with well-being: A latent class analysis

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ARTICLE INFO	ABSTRACT
	Aim: Living with a chronic condition or a disability at older age impacts social participation. Social connections and social activities seem interrelated leading to heterogeneous patterns in social participation. The aim of this study was to identify a typology in social participation among older adults with disabilities, and to relate this typology to their background characteristics and well-being measures. *Methods:* A total of 1775 older adults with disabilities or chronic conditions aged 65–97 were sampled from a nationwide panel study in the Netherlands. Social participation was assessed by various measures related to social connections, social informal activities, voluntary work, effort to increase social participation, and online social participation. A latent class analysis was carried out to identify a typology of social participation. Differences between these classes were explored with multinomial regression analyses and pairwise comparisons. *Results:* Four classes were found: social withdrawers (22.5%, n = 399), proximate social dwellers (14.5%, n = 257), moderately active social dwellers (37.2%, n = 660) and pro-active social dwellers (25.9%, n = 459). Background characteristics, such as living alone and severity of disability, differed significantly among classes. Regarding well-being measures, it appeared that pro-active social dwellers had the most positive scores. Social withdrawers were most prone to reduced life satisfaction and health related quality of life and increased loneliness and experienced participation restrictions. *Conclusions:* A typology with four patterns based on a wide spectrum of social participation aspects in older adults with disabilities was identified. This typology may help to assess the risk for reduced well-being of older adults with disabilities.

1. Introduction

During the ageing process, the inability to perform activities with or for others can be a first manifestation of participation restrictions (Griffith et al., 2017; Whiteneck & Dijkers, 2009). Functional disability, often associated with one or more chronic conditions, has been found to be one of the most powerful determinants of social participation (Everard, Lach, Fisher, & Baum, 2000; Mendes de Leon, Glass, & Berkman, 2003). For older adults, difficulties in performing activities feature among the most important determinants of a reduced quality of life (Heikkinen, 2003; Puts et al., 2007). Those difficulties occur in functional disability at the individual level and participation restrictions in performing socially defined roles occur at the societal level (Whiteneck & Dijkers, 2009; WHO, 2001). Improvements in the conceptualization of disability over the last decade have highlighted the

importance of participation in meaningful activities as a potential mechanism linking disability to well-being (Freedman, Stafford, Schwarz, Conrad, & Cornman, 2012).

Studies have repeatedly shown that older adults who are in poor physical health are most prone to decreased well-being (Fokkema, De Jong Gierveld, & Dykstra, 2012). The impact of having one or more chronic conditions on functional disability and social participation restrictions is substantial (Griffith et al., 2017). Individuals suffering from chronic conditions therefore have a higher chance on functional impairments and consequently seem more prone to experience social participation restrictions (Galenkamp & Deeg, 2016). Congruently, engagement in social, employment and voluntary activities appears to be particularly beneficial to older adults, as it has been found to be associated with positive outcomes for physical health and mental well-being (Richard, Gauvin, Gosselin, & Laforest, 2009). In addition, a

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typology study found that older adults experiencing loneliness, isolation, or both were more likely to report poorer physical and mental health (Smith & Victor, 2018). Furthermore, the increase in life expectancy, the related increase in the number of chronic conditions or years with disabilities, and the death of peers at older age enhance the risk for shrinking social networks and feelings of loneliness. The identification of factors that might lead to greater social participation for older adults, especially for those with chronic conditions and/or physical disabilities is important (Douglas, Georgiou, & Westbrook, 2017; Richard et al., 2009).

Aging is a transitional period wherein people experience changes, not only in physical health, but also in social roles and well-being (Gilmour, 2012). As the number of older adults in Western society increases rapidly, these issues become increasingly important. Between 2015 and 2050, the proportion of the world's population over 60 years is expected to nearly double from 12% to 22% (WHO, 2015). Over 30% of the Dutch population above 65 years lives with one or more disabilities, with increasing numbers as people age (Etman, Kamphuis, Pierik, Burdorf, & Van Lenthe, 2016; van Houwelingen et al., 2014). Disability is constructed broadly to denote impairments in body functions and structures and related activity limitations, both of which stem from underlying health conditions (WHO, 2001). Activity limitations refer to the difficulty in performing activities in any domain of life, referring to several dimensions of basic and instrumental activities of daily living, paid and unpaid role activities, and social and leisure activities (Freedman et al., 2012; Jette, 2006). In 2015, the Dutch government implemented the Social Support Act in which municipalities support people with disabilities, including community dwelling elderly with disabilities, by providing tailored solutions to participate in society and to organize (informal) care with the aim to be able to reside at home, rather than being institutionalized in for example nursing homes (van Ginneken & Kroneman, 2015).

The concept social participation suffers from a lack of clarity and multiple concepts are used to define social participation (Douglas et al., 2017). Our study used the definition resulting from a systematic review of definitions of social participation by Levasseur et al.: a person's involvement in activities that provide interaction with others in society or the community (Levasseur, Richard, Gauvin, & Raymond, 2010). Derived from the same study, social participation consists of several aspects on different levels. Six distal to proximal levels of involvement of the individual with others in social activities having different goals were identified: 1) doing an activity in preparation for connecting with others, 2) being with others, 3) interacting with others without doing a specific activity with them, 4) doing an activity with others, 5) helping others, and 6) contributing to society (Levasseur et al., 2010). For the first level, the person informs himself/herself about what is going on in society, the person usually does those activities *alone* and in his/her home. Next regarding level 2–4, being with others, interacting with others, and doing an activity with others refer to activities *with* others, extensively described in the literature of social networks and social support and its impact on wellbeing for older adults, as presented in the next paragraph. The most obvious form of social participation is direct interaction with one's social environment such as family members, relatives, friends and neighbors (Herzog, Ofstedal, & Wheeler, 2002). Although being in direct contact does not necessarily mean being in the same physical environment, but it requires being responsive to environmental situations, such as chatting online (Glass & Balfour, 2003). Lastly, level five and six involve activities *for* others, often referred to as social engagement, where activities require active, meaningful engagement and necessarily a desire for social change, such as by volunteering. As found in a nationwide study in the United States, adults with disabilities are no less likely than those without disabilities to report informal volunteering (Shandra, 2017). A review study by Douglas et al. described three similar aspects in successful ageing, based on the types of social participation by Levasseur et al: social connections, informal social participation, and volunteering. These three

aspects of social participation are positively correlated with each other (Douglas et al., 2017). To illustrate, having more frequent connections with family, friends and neighbors is associated with higher participation in community groups and an increased likelihood of volunteering (Berry, Rodgers, & Dear, 2007).

Social participation and its relation with well-being have been integrated into research about ageing and disability. A systematic review conducted by Hornby-Turner et al. described that social participation was associated with reduced or preserved independence, life satisfaction and well-being (Hornby-Turner, Peel, & Hubbard, 2017). Several models have been developed to explain the complex interrelationships between factors underlying mental well-being and social participation among older adults, and specifically its counterpart loneliness (de Jong Gierveld, 1998). The core element of each of the models is focused on the network-aspect of social participation, examining how individuals build up and maintain heterogeneous networks. An extensive body of research, also from the Netherlands, demonstrates a positive relation between richer social connections and mental well-being. A nonfamily network seems less detrimental than a nonfriends network (Dykstra, van Tilburg, & De Jong Gierveld, 2005; Fiori, Antonucci, & Cortina, 2006; Gilmour, 2012; Hoogendijk, Suanet, Dent, Deeg, & Aartsen, 2016). Older adults who have a diverse network and who participate in social activities were associated with better health than those with a restricted network (Hornby-Turner et al., 2017). With regard to other aspects of social participation, namely social informal activities and voluntary work, participation in community-leisure activities is found to be associated with well-being (Gureje, Oladeji, & Abiona, 2014; Li, Wu, Jin, & Zhang, 2006). Various aspects of social participation seem interrelated and independently related to well-being indicators like loneliness or self-reported quality of life. The heterogeneous population of older adults has been shown to differ in needs and characteristics. Exploration of person-centered typologies contributes to the understanding of differences within heterogeneous populations, including social characteristics of older adults (Douglas et al., 2017). However, thus far it remains unclear how these different aspects of social participation appear in social behavioral patterns.

The present study aims to identify a typology of social participation and to explore how these classes differ with respect to background characteristics as well as well-being among older adults with disabilities or chronic conditions in the Netherlands. Such typology can help community care providers and municipalities to weigh the relative importance of various activities and connections and identify subgroups of older adults with regard to social participation. Also, recognizing those subgroups and their relationship with various indicators will help to tailor social interventions to increase participation and reduce or prevent social isolation of older adults (Doekhie, De Veer, Rademakers, Schellevis, & Francke, 2014; Looman et al., 2018; Machielse, 2011).

2. Methods

2.1. Participants

This study was part of a nationwide panel-study called the 'National Panel of people with Chronic Illness or Disability' (NPCD) (Rijken, Spreeuwenberg, Schippers, & Groenewegen, 2013). The NPCD exists since 1998 and until present it provides information about the experiences and consequences of living with a chronic condition or disability from the patient's perspective, based on a representative national sample. Panel members receive postal or online questionnaires twice a year, in spring and autumn. As the present study was cross-sectional we used data from the autumn measurement point in 2017. Participants with chronic conditions are recruited from a random sample of general practices in the Netherlands, based on the diagnosis of a somatic chronic diseases by a certified general practitioner (GP), including cardiovascular diseases, cancer, respiratory diseases, diabetes, musculoskeletal diseases, neurological diseases and digestive diseases.

Participants with physical disabilities are recruited based on a self-reported physical disability from national population surveys conducted by Statistics Netherlands. New panel members are selected annually to replace participants who either withdrew or had participated for the maximum term of four years. Inclusion criterion for panel members is a diagnosis of a somatic chronic condition, or a physical disability according to population wide survey data. Exclusion criteria include: age ≤ 15 years, being institutionalized, unaware of diagnosis, life expectancy < 6 months according to the GP and insufficient mastery of the Dutch language. The NPCD is registered with the Dutch Data Protection Authority (registration no0.1283171) and all data are collected and handled in accordance with the relevant privacy protection guidelines. Panel members of 65 years and above (n = 2074) received the NPCD autumn 2017 questionnaires of whom 1775 returned it (86%). For the present study, a questionnaire about social participation and well-being was used.

2.2. Measures

2.2.1. Social participation

Social participation was assessed by the following NPCD questionnaire items, based on the social participation concepts defined by Levasseur et al. (2010) and Douglas et al. (2017): social connections (being with others, interacting with others without doing a specific activity with them), informal social activities (doing an activity with others), voluntary work (helping others and contributing to society), effort to increase social participation (in preparation for connecting with others), and online social participation (interacting with others) (Douglas et al., 2017; Levasseur et al., 2010). Ten measures for social participation were determined. Some measures consisted of matrix questions. Each matrix question represented one category, concerning one aspect of social participation (e.g. informal social activities), thereby giving an overall picture of the activity level within each aspect of social participation.

a *Social connections* (contact with whom and size of network structure, items 1–5) have been defined as ties with other people. These ties can be defined by their function (including the frequency of contact) and structure (including the number of ties) (Douglas et al., 2017). Social connection function was measured with four separate items regarding social contacts (how often do you meet with (grand) children, family (in law), friends, and neighbors) rated on a four-point frequency scale: never (score 1, never, seldom or don't have), less than monthly (score 2), monthly (score 3, once or twice a month), and weekly (score 4, at least once a week). Social connection structure was operationalized by questioning the number of ties (0–1 person, 2–5 persons, 6–10 persons, 11–15 persons, and over 15 persons).: never (score 1), less than monthly (score 2), monthly (score 3), and weekly (score 4). Social connection structure was operationalized by questioning the number of ties (0–1 person, 2–5 persons, 6–10 persons, 11–15 persons, and over 15 persons).

b *Informal social activities* (frequency, item 6) were derived from a seven item-matrix question asking for the frequency of participating in informal social activities outside the home: organized sports (in club or groups), non-organized sports, association or club activities, religious activities, restaurant or café visits, museum visits, theatre or cinema visits. Answer options on a four-point frequency scale were never (score 1), less than monthly (score 2), monthly (score 3) and weekly (score 4). Based on the 25%-percentiles of the sum score of the seven indicated frequencies, participants were categorized into a new four-point frequency scale: never (sum scores 7–9), less than monthly (sum scores 10–12), monthly (sum scores 13–15), and weekly (sum scores 16–28).

c *Neighborhood activity* (frequency, item 7) was assessed since living in neighborhoods with more social capital seems to improve the health of individuals with chronic conditions (Mohnen, Völker, Flap,

Subramanian, & Groenewegen, 2015). Activities in the neighborhood were derived from a three-item matrix question asking for the frequency of participating in neighborhood social activities: visiting neighbors for chatting, going with neighbors for a walk or a visit elsewhere, or helping the neighbors, with for example grocery shopping or watering plants. Answer options on a four-point frequency scale were never (score 1), less than monthly (score 2), monthly (score 3) and weekly (score 4). Based on the 33%-percentiles of the sum score of the three indicated frequencies, categories were defined on a three-point frequency scale: never (sum score 3), sometimes (sum scores 4–5) and regularly (sum scores 6–12).

d *Voluntary work* (dichotomous, item 8) was assessed by asking if the participant does voluntary work (yes or no).

e *Effort to increase social participation* (frequency, item 9) was included in an attempt to understand the effort an older adult makes to increase his or her social network or social activity level. The following four self-defined items were included as a matrix question: seeking for information in the neighborhood about social activities, seeking for information online about social activities, undertaking action to meet new people in the neighborhood, undertaking action to meet new people online. Answer options on a four-point frequency scale were never (score 1), sometimes (score 2), regularly (score 3) and often (score 4). Based on the 33%-percentiles of the sum score of the indicated frequencies, categories on a three-point frequency scale were defined as never (sum score 4), sometimes (sum score 5) and regularly (sum scores 6–16).

f *Online social participation* (frequency, item 10) is often underexposed in research and exclusion of online activities may underestimate the participants' social participation. Older adults tend to use online communications, and this has been associated with lower levels of loneliness (Gilmour, 2012; Sum, Mathew, Hughes, & Campbell, 2008; Veenhof & Timusk, 2009). A matrix question was stated regarding the frequency of the following eight items of social online activities: social media in general, getting to know new people, email with friends, social media to chat with friends, visiting a forum, chat with peers with physical disabilities or chronic conditions, visiting dating site and video calling like Skype. Answer options on a four-point frequency scale were never (score 1), less than monthly (score 2), monthly (score 3) and weekly (score 4). Based on the 33%-percentiles of the sum score, final categories were defined as never (sum scores 8–10), sometimes (sum scores 11–16) and regularly (sum scores 17–32).

2.2.2. Background variables

The following *background variables* were evaluated to predict latent class membership: age, sex, household size (living alone or with others), educational level, urbanization level, ethnicity, number of somatic chronic conditions (none, one, two, three, four and more), and severity of disability (no disability, mild disability, average disability, severe disability).

2.2.3. Well-being variables

Four variables measured well-being:

a *Life satisfaction* (score 1–10): Participants rated their life satisfaction in two items: overall life satisfaction and social life satisfaction, both on a visual analogue scale (VAS) ranging from 1 to 10, according to Van Beuningen and De Jonge (2011).

b *Health related quality of life* (score 0–100): Health-related quality of life was assessed with the EQ-5D-VAS. The EQ-5D is a commonly used measure of health-related quality of life (HRQOL) (Wilke & Pickard, 2011). The EQ-5D-VAS contains a VAS in which participants rated their health on a scale ranging from 0 (worst imaginable health state) to 100 (best imaginable health state).

c *Loneliness* (rescored in each of the three categories) was measured by the De Jong Gierveld 11-item loneliness scale (De Jong Gierveld &

Kamphuis, 1985; De Jong Gierveld & Van Tilburg, 1999), consisting of two subscales: emotional (six items) and social (five items) loneliness (Weiss, 1973). Each item is scored on no (score 0) or yes or more or less (score 1). A total loneliness scale was computed by summing all items. Then, the total loneliness scale was categorized into four levels (category 1, score 1–4): not lonely (scores 0,1 or 2), moderate lonely (scores 3 through 8), severe lonely (scores 9 or 10), and very severe lonely (score 11). Total scores of emotional loneliness (category 2, score 1–6) and social loneliness (category 3, score 1–5) were based on the sum score of the items (6 and 5 respectively).

d *Experienced restriction* (score 1–3) was measured by three items, questioning the experienced hardship to perform outdoor activities (as in outside the home), to social contact and to participate in leisure activities. Each item is scored on yes (3), partly (2) and no (1).

2.3. Statistical analyses

Statistical analyses were performed using Stata 15.1. Firstly, descriptive statistics with frequencies and proportions of categorical variables and mean, standard deviation and range for the continuous variables were reported. Secondly, we performed a latent class analysis (LCA) to identify a social participation typology within a population of older adults with chronic conditions and/or physical disabilities. LCA is a person-centered method that seeks to identify latent, unobserved groups and understand how the subgroup's characteristics differ from each other (Hagenaars & McCutcheon, 2002). The aforementioned measures of social participation were used in the LCA. To avoid local likelihood maxima and inaccurate parameter estimates, we used 30 random start values and 5000 iterations. Models were run using the Maximum Likelihood estimation method and the Huber/White/sandwich estimator to obtain the standard errors. We based the final number of classes on the lowest Akaike's information criterion (AIC) and Bayesian information criterion (BIC), which combine goodness of fit and parsimony (Nylund, Asparouhov, & Muthén, 2007), entropy and the Lo-Mendell-Rubin adjusted likelihood ratio test (Lo, Mendell, & Rubin, 2001). The selected model was repeatedly estimated using 50 increasing random start values until the log likelihood was replicated several times to assure a final model solution (Nylund et al., 2007). Beyond the use of those criteria, the interpretability of classes was also considered (Lukociene, Varriale, & Vermunt, 2010). Item response probabilities were computed and interpreted to describe the classes. Thirdly, the relationship between latent social participation classes and background variables were tested with multinomial logistic regression within the selected LCA model. An univariable model screening of all background variables was performed followed by a backwards multivariable multinomial logistic regression consisting of the items having a $p < .20$ in the univariable screening. This was continued until all background variables were significantly ($p < .05$) contributing to the model or considered a confounder. Confounding was assumed when coefficients changed $> 25\%$ among nested models. Relative risk ratios (95% confidence interval) describe the association of background characteristics with the four classes in the final multinomial logistic regression model. Lastly, the natural logarithmic scores of the well-being variables (life satisfaction, health related quality of life, loneliness and experienced restrictions in social participation) were compared between the latent classes using the Kruskal-Wallis equality of populations rank test. This was followed by a Dunn's pairwise comparison test using a Bonferroni correction to identify significant different classes.

Table 1
Background variables of the study participants (n = 1775).

	N	%
Gender		
Female	945	53.2
Male	830	46.8
Age (group)		
65-75	951	53.6
75-85	666	37.5
85+	158	8.9
Living situation		
Alone	555	33.5
With others	1.103	66.5
Education level		
Low (preparatory or vocational education)	596	36.8
Middle (advanced general or intermediate vocational education)	675	41.7
High (university degree)	347	21.5
Urbanization level		
Urban (more than 2500 addresses/km^2)	248	14.0
Semi-urban (1,500-2,499 addresses/km^2)	591	33.3
Intermediate urban-rural (1,000-1,499 addresses/km^2)	397	22.4
Semi-rural (500-999 addresses/km^2)	414	23.3
Rural (up to 500 addresses/km^2)	125	7.0
Ethnicity		
Dutch native	1.549	92.2
Western non-native	117	7.0
Non-western non-native	14	0.8
Number of somatic chronic conditions		
None	478	26.9
1	345	19.4
2	395	22.3
3	302	17.0
> 4	255	14.4
Severity of disability		
No disability	331	20.8
Mild disability	416	26.1
Moderate disability	586	36.8
Severe disability	259	16.3

3. Results

3.1. Background characteristics of the study participants

Background characteristics of the study participants are presented in Table 1. A total of 1775 older adults participated, aged 65–97 (M = 74.5; SD = 6.7), of whom 945 (53%) were women and 830 (47%) were men. In this study sample, 73% was diagnosed with a somatic chronic condition and 79% had a physical disability. More than half of the study sample (57%) had both a physical disability and somatic chronic condition.

3.2. A typology with four classes of social participation

The LCA identified four classes within the study sample. Table 2 presents the model fit statistics of various class solutions. The statistical model with four classes showed the best model fit with the lowest AIC and BIC and was also interpretable qualitatively.

Probabilities of class membership related to social participation can be found in Table 3. An overview of the frequencies (%) of measures of social participation across the four classes is provided in the appendix. The four classes represented 'social withdrawers' (latent class 1, 22.5%, n = 399), 'proximate social dwellers' (latent class 2, 14.5%, n = 257), moderately active social dwellers (latent class 3, 37.2%, n = 660) and 'pro-active social dwellers' (latent class 4, 25.9%, n = 459). Fig. 1 presents the probabilities of measures of social participation across the four classes.

The first class was formed by participants having the lowest probability among all classes to have ties. They had a high probability of having a small network of 2–5 persons. Participants in this class hardly performed informal social activities and neighborhood activities. They

Table 2

Fit indices of latent class analysis of social participation (n = 1775).

#classes	AIC	BIC	Log likelihood	df	Entropy	LMR LRT	p
1	36283.6	36426.1	−18115.8	26	NA	NA	NA
2	35078.5	35369.0	−17486.3	53	0.65	1205.3503	0.00
3	34955.3	35371.9	−17401.6	76	0.63	162.01419	0.00
4	34680.9	35234.5	−17239.5	101	0.63	310.53095	0.00

AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; df = degrees of freedom; LMR LRT = Lo-Mendell-Rubin adjusted likelihood ratio test; NA = Non applicable.

hardly did voluntary work and were unlikely to make an effort to increase their social network or activities. They seldom went online for social participation. People in this class were called **social withdrawers.**

The second class grouped the participants with high probabilities of connecting weekly with their children and neighbors, but less frequent with other family (in law) and friends. Their social network (function) was likely to consist of 2–5 persons. Participants in this class were unlikely to engage in informal social activities outside the home and

had a low probability of participating in neighborhood activities. The class comprised those that are not likely to do voluntary work and hardly try to increase their social network or activities. Lastly, they hardly used online measures for social participation. We labelled people in this class as **proximate social dwellers.**

Participants in the third class were likely to have weekly or monthly contact with their ties, mostly with neighbors and least with other family (in law) than children. Their social network size can be expected to consist of 2–5 persons or 6–10 persons. This class comprised those that

Table 3

Item response probabilities of social participation by older adults with disabilities, according to their latent class membership.

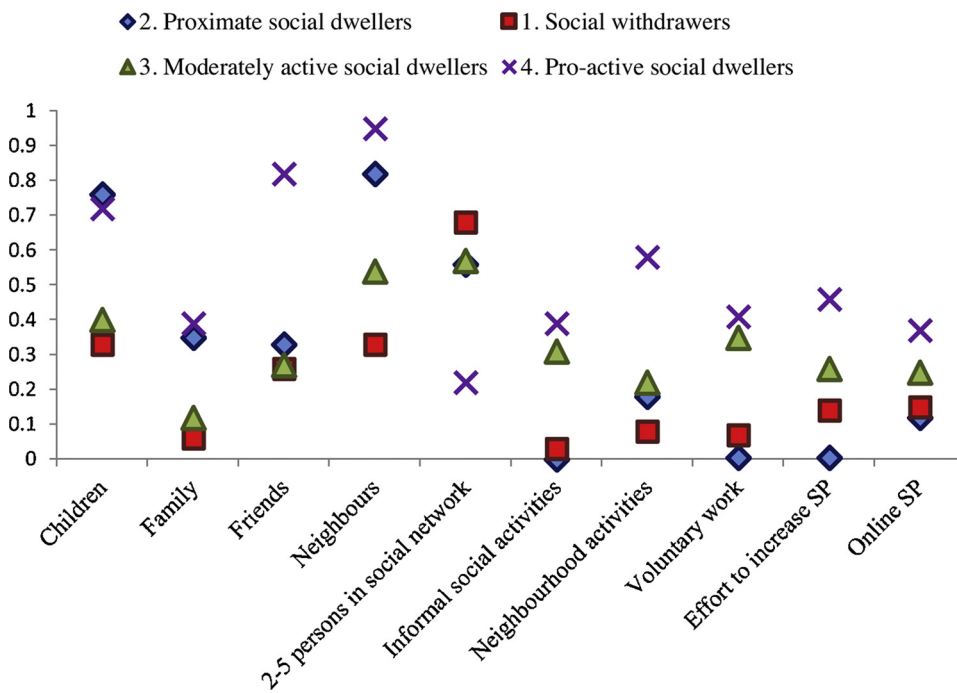|	Social withdrawers (class 1) (n = 399)	Proximate social dwellers (class 2) (n = 257)	Moderately active social dwellers (class 3) (n = 660)	Pro-active social dwellers (class 4) (n = 459)
Contact with children				
Never/seldom	.34	.06	.13	.09
< 1x a month	.12	.01	.11	.02
Monthly	.21	.17	.36	.17
Weekly	.33	.76	.40	.72
Contact with family (in law)				
Never/seldom	.67	.29	.25	.23
< 1x a month	.17	.08	.26	.09
Monthly	.10	.28	.37	.30
Weekly	.06	.35	.12	.39
Contact with friends				
Never/seldom	.30	.01	.01	.01
< 1x a month	.21	.33	.10	.00
Monthly	.24	.33	.62	.17
Weekly	.26	.33	.27	.82
Contact with neighbors				
Never/seldom	.37	.02	.06	.01
< 1x a month	.12	.00	.09	.01
Monthly	.17	.16	.31	.04
Weekly	.33	.82	.54	.95
Size of social network				
0-1Person	.25	.03	.02	.00
2-5	.68	.56	.57	.22
6-10	.05	.34	.31	.45
11-15	.01	.05	.06	.15
Over 15 persons	.00	.03	.04	.18
Informal social activities outdoor				
Never/seldom	.58	.48	.11	.06
< 1x a month	.29	.42	.26	.18
Monthly	.10	.10	.32	.38
Weekly	.03	.00	.31	.39
Neighborhood social activities				
Never/seldom	.80	.46	.39	.15
Now and then	.11	.36	.40	.27
Regularly	.08	.18	.22	.58
Does voluntary work				
No	.93	1.00	.65	.59
Yes	.07	.00	.35	.41
Effort to increase social participation				
Never/seldom	.69	.80	.46	.37
Now and then	.17	.20	.29	.18
Regularly	.14	.00	.26	.46
Online social participation				
Never	.68	.80	.36	.31
Now and then	.17	.08	.39	.32
Regularly	.15	.12	.25	.37

Fig. 1. Probabilities of social participation (SP) among the four latent classes.

From left to right, the figure presents social connections: probabilities based on number of people that have weekly contact with children, family (in law), friends and neighbours, have a network size of 2–5 persons, informal social activities outdoor, neighbourhood activities, voluntary work, effort to increase SP, and online SP.

had no outspoken low or high frequency of doing informal activities outside the home or in the neighborhood and sometimes do voluntary work. Also, people in this class had no outspoken probability of increasing their social network or activities, as well as online social participation. We labelled people in this class as **moderately active social dwellers.**

The fourth and last class consisted of participants having a high probability of frequent contact with all their ties, mostly with children, friends and neighbors. Their social network is likely to consist of 6–10 or more persons. Their probability of doing informal social activities weekly or monthly is comparatively high, especially for doing activities in the neighborhood. Those in this class had the highest probability for doing voluntary work, were trying to increase their social network or activities, and were socializing online. People in this class were called **pro-active social dwellers.**

3.3. Relationship between classes and background characteristics

Most background variables, except ethnicity and urbanization, were associated with class membership in the final multinomial logistic regression model (Table 4). The number of chronic conditions was a confounding variable and therefore remained in the model. Since proximate social dwellers (class 2) fell in between the other classes regarding social participation patterns, this class was used as the reference group to present relative risk ratios and 95% confidence intervals. Social withdrawers (class 1) were more likely to be male. Social withdrawers (class 1) and pro-active social dwellers (class 4) were more likely to live alone. Pro-active social dwellers were significantly less likely to be aged 75–85 or 85+, and moderately active social dwellers were less likely to be aged 85+, compared to proximate social dwellers. Regarding the severity of disability, for the moderate and severe level, pro-active social dwellers differed significantly from proximate social dwellers, facing lower levels of disability. Social withdrawers were more likely to have a disability in general and significantly more likely to be severely disabled compared to proximate social dwellers. Regarding education, moderately active social dwellers and pro-active social dwellers differed significantly from proximate social dwellers, by being more often medium or highly educated.

3.4. Relationship between classes and well-being measures

For all variables measuring well-being, there was a significant difference between classes (Table 5). General life satisfaction was likely to be higher for pro-active social dwellers (class 4) and likely to be lower for social withdrawers (class 1). Regarding social life satisfaction, we saw the same pattern. For loneliness, individuals in the group of social withdrawers experienced a significantly higher rate of loneliness (total score on scale) than all other classes. This was the same for the sub-scores of social loneliness and emotional loneliness. Pro-active social dwellers experienced the lowest level of loneliness. Proximate social dwellers do experience a significantly higher rate of emotional loneliness, however not with regard to social loneliness. Zooming in on HRQOL, there was a significant difference between the social withdrawers (class 1) and proximate social dwellers (class 2) on one hand and the moderately active (class 3) and pro-active social dwellers (class 4) on the other hand, where a lower HRQOL was more likely for the first two groups. Experienced restrictions in performing outdoor activities and in social contacts was more common for social withdrawers, who differed significantly from moderately active and pro-active social dwellers. A similar pattern was observed for restrictions in leisure activities, in which experienced restrictions seemed less likely to be experienced by pro-active social dwellers compared to all other groups.

4. Discussion

This study explored a typology of social participation by latent class analysis using a dataset of multiple aspects of social participation. We found four salient classes of social participation behavior: social withdrawers, proximate social dwellers, moderately active social dwellers, and pro-active social dwellers. Significant differences for background characteristics (sex, living situation, severity of disability, age and educational level) as well as well-being measures (life satisfaction, health related quality of life, loneliness and experienced restrictions in social life) were found.

Table 4

Background variables associated with latent class membership in the multinomial logistic regression model.

	Social withdrawers (class 1)	Proximate social dwellers (class 2)	Moderately active social dwellers (class 3)	Pro-active social dwellers (class 4)
Sex				
Female (1) vs. male (0)	0.7 (0.3-1.4)	Reference	1.1 (0.4-2.7)	1.6 (0.6-3.9)
Age				
75 + (1) vs. 65 +	0.6 (0.2-2.1)	Reference	0.5 (0.2-1.7)	**0.4 (0.2-0.9)**
85 + (2) vs. 65 +	0.4 (0.1-2.4)	Reference	**0.1 (0.0-0.3)**	**0.1 (0.0-0.3)**
Living situation				
With others (1) vs. alone (0)	0.5 (0.2-1.4)	Reference	2.0 (0.6-6.8)	0.8 (0.3-2.7)
Severity of disability				
Mild (1) vs. none (0)	1.6 (0.7-3.6)	Reference	1.7 (0.6-4.7)	1.0 (0.4-2.7)
Moderate (2) vs. none	1.6 (0.7-3.6))	Reference	0.8 (0.3-1.8)	**0.4 (0.1-0.9)**
Severe (3) vs. none	**3.2 (1.2-8.5)**	Reference	0.7 (0.1-3.3)	**0.1 (0.0-0.7)**
Number of chronic conditions				
One vs. none	0.5 (0.2-1.3)	Reference	0.7 (0.2-1.8)	0.6 (0.2-1.7)
Two vs. none	0.6 (0.3-1.3)	Reference	0.9 (0.3-2.4)	1.0 (0.3-2.6)
Three vs. none	0.4 (0.1-1.3)	Reference	0.5 (0.2-1.1)	0.6 (0.2-1.4)
≥ Four vs. none	0.7 (0.2-1.9)	Reference	0.5 (0.2-1.4)	0.5 (0.2-1.6)
Education level				
Medium (1) vs low	1.7 (0.5-5.8)	Reference	**8.0 (2.9-21.7)**	**5.9 (2.6-13.6)**
High (1) vs low	4.6 (0.7-28.4)	Reference	**78 (22.3-273)**	**35.3 (7.9-158.5)**

Relative risk ratios (95% confidence interval) describe the association of background characteristics with the four classes in the final multinomial logistic regression model.

*Numbers in bold differ significantly from the reference class ($p < . 05$).

Table 5

Latent class membership and means of well-being variables. Due to heteroscedasticity, statistical tests were performed after taking the natural logarithmic of each well-being variable. Means are reported for the original variables.

	Social withdrawers (class 1) (n = 399, 22.5%)	Proximate social dwellers (class 2) (n = 257, 14.5%)	Moderately active social dwellers (class 3) (n = 660, 37.2%)	Pro-active social dwellers (class 4) (n = 459, 26.9%)	p	Posthoc
General life satisfaction	7.0	7.7	7.8	8.2	0.00	4 > 2,3 > 1
Social life satisfaction	6.7	7.7	7.7	8.1	0.00	4 > 2,3 > 1
Loneliness (total scale)	2.3	1.6	1.7	1.4	0.00	4 < 2,3 < 1
Social loneliness	3.2	1.7	2.1	1.4	0.00	4 < 1,3; 3,2 < 1
Emotional loneliness	2.9	1.4	1.5	1.0	0.00	4 < 1,2,3
HRQOL (EQ-5D-VAS)	64.8	66	70.7	73.4	0.00	4,3 > 1,2
Experienced restrictions						
Outdoor activities	1.8	1.6	1.6	1.5	0.00	4,3 < 1
Social contacts	1.7	1.5	1.3	1.3	0.00	4,3 < 2 < 1
Leisure	1.6	1.6	1.6	1.4	0.00	4 < 1,2,3

HRQOL = health related quality of life; VAS = Visual analogy scale.

4.1. The four classes and their relationship with background characteristics and well-being measures

The four classes differed among several aspects of social participation. One of the main differences among the classes was regarding the level of activity in social informal activities. There were two relatively 'inactive' groups (social withdrawers and proximate social dwellers), and two more 'active' groups (moderately active social dwellers and pro-active social dwellers), which is in accordance with a previous study describing 'active' participation as participating in group activities among older adults (Katagiri & Kim, 2018). Turning to social connections, differences in the four classes appear to be similar to Wenger's social network typologies, as the 'locally integrated' network typology, characterized by local family, friends and neighbors, seem to overlap with proximate social dwellers, and the 'private restricted' social network typologies show similarities with the social withdrawers (Wenger, 1997). With the present study, we added to previously described typologies as we combined patterns of social networks with patterns in informal social activities, online social participation and volunteering.

Predominantly, older adults with a higher probability of being active in social connections seem also more active in (informal) social activities. This implies that older adults who are more active do also have a stronger social network and vice versa. However, as demonstrated by 'proximate social dwellers', being highly socially connected with their near ties does not correspond with the amount of informal social activities outdoors or activities in the neighborhood they participate in. Potential reasons for an inhibited pattern in those activities may be their background characteristics such as older age or having more chronic conditions. Conversely, the social activity level of pro-active social dwellers was high as well as the frequency of social connections and size of their network. In line with another study, the size of especially the non-relative network seems to be associated with other aspects of social participation. The larger the network, the greater the probability older adults will be introduced to a group, which can lead to active participation in social informal activities (Katagiri & Kim, 2018). More research is needed on the interaction between the benefits of supporting networks and its relation with the performance of informal social activities.

In the context of a broad range of well-being measures, classes differed significantly. It appeared that pro-active social dwellers are the better off, proximate social dwellers and moderately active social dwellers are reasonably well and social withdrawers seem most prone to reduced well-being. Social withdrawers scored the lowest on life

satisfaction and health-related quality of life (HRQOL) and experienced the highest levels of loneliness and restrictions in daily activities. This consists with research that has found that older adults with a lower number of frequent social activities have lower chances of positive self-perceived health, as well as older adults with a smaller range of social ties experience worse well-being (Gilmour, 2012; Litwin & Shiovitz-Ezra, 2011). More specifically, older adults with smaller social networks and infrequent weekly contact with children (like the social withdrawers) were more likely to be lonely later in life, with regard to both social and emotional aspects (Gierveld, van Groenou, Hoogendoorn, & Smit, 2009). Conversely, for the pro-active social dwellers, who were most likely to do voluntary work, doing voluntary work has been shown to associate with a lower probability of experiencing loneliness (Curvers, Pavlova, Hajema, Groot, & Angeli, 2018). In general, our results on the association between social participation and well-being are in line with previous studies (Gilmour, 2012; Gureje et al., 2014; Hornby-Turner et al., 2017; Li et al., 2006; Litwin & Shiovitz-Ezra, 2011; Looman et al., 2018; Richard et al., 2009). Additionally, it can be hypothesized on our findings that as the activity level of older adults with disabilities decreases (participation in social informal activities), the pattern of reduced social connections decreases too. This pattern appears to be associated with reduced well-being of older adults with disabilities. Therefore, not only providing support systems but rather stimulating older adults to engage in social activities could be a way to strengthen older adults experiencing or being at risk for reduced well-being.

Social withdrawers and pro-active social dwellers were most notable regarding individual factors. The social withdrawers distinguish themselves through more frequently living alone and having a more severe disability. Contrarily, pro-active social dwellers deemed to have no or mild disabilities. Our finding that severity of disability has an impact on social participation behavior, as demonstrated in the group of the social withdrawers, is in line with previous studies (Fokkema et al., 2012; Mendes de Leon et al., 2003). Likewise, having several chronic conditions (and thus multi-morbidity) made large contributions to participation restriction and increased loneliness (Fees, Martin, & Poon, 1999; Griffith et al., 2017). Although age differed significantly among groups, where in our study proximate social dwellers belong mostly to age groups of 75–85 or 85 and older, it is of importance to emphasize that age is not specific enough to detect reduced participation or individuals 'at risk', because the ageing process varies substantially between individuals (Slaets, 2006). Differences in education deemed significant in our study, indicating that among older adults with disabilities, those with higher education reach a higher level of social participation (moderately social active social dwellers and pro-active social dwellers). This relationship between educational level and functioning has been explained before, and in particular psychosocial factors such as mastery and self-efficacy that relate to educational level contribute to lower mental functioning (Groffen et al., 2012). The finding that female older individuals appear more pro-active than male individuals regarding social behavior also aligns with the result of previous studies, possibly due to a stronger desire for emotional support or participation in group or community activities (Caetano, Silva, & Vettore, 2013; Momtaz, Haron, Ibrahim, & Hamid, 2014). These pro-active social dwellers also seem to be more probable to live alone. A recent study identified typologies based on indicators of living alone, loneliness and social isolation, indicating that individuals living alone are mostly disposed to loneliness and poorer physical and mental health (Smith & Victor, 2018). Background characteristics, as well as other factors, for example the social activity level of an individual or the size of the social network, are important factors to identify to which typology the individual may belong.

To the best of our knowledge, this is the first typology study including online social participation of older adults to a wide set of participation aspects, despite the knowledge that older adults tend to use the internet for communication (Veenhof & Timusk, 2009). In the Netherlands, 61.7% of people aged 65 and above use internet every day, versus 86.4% of the general population (Statistics, 2019). Online social behavior was not clearly outspoken in the four classes; however, in line with the other social participation aspects pro-active social dwellers were most likely to use online means and proximate social dwellers and social withdrawers the least. It could be associated with age also, as the group of proximate social dwellers was on average the oldest. However, the results suggest that less use of online means to communicate is associated with reduced well-being and higher levels of loneliness as demonstrated in a previous study (Sum et al., 2008). It may be that internet usage or the use of other technologies promote the well-being among older adults, but at this moment evidence of intervention studies showing the effects of these technologies is scarce (Baker et al., 2018; Slegers, van Boxtel, & Jolles, 2008).

4.2. Implications

The insights obtained from this study shed light on the importance of both social connections (frequent contact with ties) as well as the social activity level of older adults with disabilities in the community who have a diverse pattern in their social participation behavior. The identification and characterization of those patterns may help community workers and municipalities to confirm suspicions in assessing risks, in order to attend to their needs. Instruments to assess network types and social activities, such as Practitioner assessment of network type (PANT) (Wenger, 1997) or User-P (Post et al., 2012) have been developed for single aspects of social participation. However, developing and implementing a comprehensive identification tool for social participation (including one's connections, a wide set of informal social activities and activity in volunteering) could help to target groups who are at-risk of social isolation or reduced well-being. Individual factors such as living alone and having a more severe disability may also help to identify elderly at-risk, since this study showed that those characteristics make one more prone to belong to a certain class of social participation that is associated with reduced well-being.

The strong relationship between classes and measures for well-being underlines the necessity of targeting specific older adults in this heterogeneous population. Social participation aspects of the group of pro-active social dwellers, that seemed associated with more positive outcomes on well-being, could be targeted to enhance in the less active groups. Knowing that individuals can be identified based on their social pattern could ease the burdens on municipalities and enable them to focus on interventions especially for subpopulations. A recent review has shown that improving self-management skills (e.g. by interventions designed to improve self-efficacy to obtain support) enhanced emotional health rather than social support interventions itself (Snowden et al., 2014). Enabling older adults to develop and maintain varied social networks and participation in social and recreational activities may help them on a social level and may have a positive impact in other domains including maintaining independence, life satisfaction, well-being, reduced loneliness and physical and mental health (Dykstra et al., 2005; Hornby-Turner et al., 2017). Nevertheless, enlarging and maintaining networks requires more time, initiative, and perseverance from people with disabilities, although faster methods of communication (such as social media, online fora, and other methods) seem to have facilitated contact among network members who do not live nearby each other (Ajrouch, Akiyama, & Antonucci, 2007). Also, this study showed that the effort to increase one's social activities and network seemed associated with more engagement in social activities. Social engagement could be used as an 'active' ingredient for social networks (Golden, Conroy, & Lawlor, 2009). Much more could be done to connect intervention programs to the life worlds of older adults in the community (Pijpers, de Kam, & Dorland, 2016).

4.3. Strengths and limitations

The main strength of this study is its strong empirical base, due to the large sample and a high response rate (86%) within a sample, representing older adults with chronic older adults with disabilities or chronic conditions in the Netherlands. Besides, a rigorous number of measures from several domains of social participation is offered to the latent class analysis. Therefore, various aspects of social participation that have been shown to be interrelated in previous research were taken together in one latent class analysis, including online social participation which has not been included before in similar studies (Gilmour, 2012). Researchers often focus on separate domains in social participation, or measure multiple domains and provide sum scores of sub-domains (Noreau et al., 2004). Relying on sum scores or separate domains makes detection of reduced social participation or increased risk to a certain pattern more difficult. Moreover, many correlated inter-relationships exist between measures of social participation, networks and activities and these are not well understood (Gilmour, 2012). Also, the latent structures underlying these interrelationships are not correctly identified using a linear approach, such as with sum scores. A statistical technique like latent class analysis seemed more appropriate because it takes these interrelationships into account.

However, a few limitations to this study should be considered. No aspects of social cohesion and social support were included, while previous studies have shown their relevance (Douglas et al., 2017). Measures in this questionnaire aimed to monitor actual participation rather than the experience of participation (as social cohesion and social support need to be assessed based on experiences rather than behavior). Therefore, no data was collected about the perception of indicated social participation measures. For the same reason, the quality of social networks was not assessed, while other studies suggested that it is the quality, not the size of social networks that matters for the relationship with health and well-being (Fiori et al., 2006; Routasalo, Savikko, Tilvis, Strandberg, & Pitkälä, 2006). The perception of social participation and the quality of social networks should be assessed beyond the identification of those classes when professionals seek to understand the social participation pattern of the older adult.

Finally, due to the cross-sectional design of this study, the possibility of reverse causation cannot be excluded; that is, individuals with disabilities may be unable to maintain social participation, and those who participate frequently may be in better health, as shown in the group of pro-active social dwellers. Despite the fact that this study included participants from a nationwide panel, experiencing different levels of disabilities or suffering from a lower or a higher number of chronic conditions, there is a possibility of residual confounding by underlying health status (Kanamori et al., 2014). Our study did find a difference in the relationship between social participation and well-being among classes, which implies that those with lower health related quality of life or a more severe disability were unable to maintain or increase on social participation and those who participate frequently may experience a better health. This underlines that social participation may be more of a consequence of functional disability than it is a cause (Gao et al., 2018). Longitudinal studies, a quasi-experimental study and a meta-analytic review have found similar results regarding the effects of social engagement on reporting better health (Gilmour, 2012; Holt-Lunstad, Smith, & Layton, 2010; Ichida et al., 2013; Rodriguez-Laso, Zunzunegui, & Otero, 2007; Sampson, Bulpitt, & Fletcher, 2009). Although our study did not investigate a causal relationship between social participation and well-being among classes, causal inference remains a challenge in these studies, due to the problems concerning

selection and endogeneity (Ichida et al., 2013).

4.4. Main conclusion and future directions

This study provides valuable insights into the complex interaction between aspects of social participation and its heterogeneity. The classes found in this social participation typology have been shown to differ regarding several individual factors as well as well-being measures for older adults with disabilities. Screening for patterns, using the full picture of social participation (including quality of support systems), as well as considering individual factors like living alone or severity of disability may help to identify older adults with disabilities whom are at risk for reduced well-being. In order to screen for social participation patterns, indicators beyond the assessment of social network and social support systems should be developed, including indicators on willingness to increase social participation, behavior to seek for social participation, online social participation and social activities done for others (such as volunteer work). Strengthening older adults to engage actively in social activities should be promoted in older adults with disabilities rather than investing in the amount of (passive) received social support. By promoting skills to build networks or participate in group- or individual recreational activities, older adults experience a sense of having a meaningful role in society and a better emotional health (Dykstra et al., 2005; Galenkamp & Deeg, 2016; Scharn, van der Beek, Suanet, Huisman, & Boot, 2018; Snowden et al., 2014). Enabling older adults to participate in the society in its broadest sense can have a positive impact on well-being. Furthermore, it would be beneficial to explore the effectiveness of social activation interventions with a tailor-made approach for each of the classes, instead of designing a one-size-fits-all approach in social activation. Interventions could focus on a specific aspect or level of social participation, such as doing an activity with others, helping others or the more proximal level of preparations for connecting with others. The heterogeneity of social participation should be integrated in the evaluation of these interventions. Future longitudinal research is recommended on whether individuals could switch from one class to the other, through social activation interventions or other personal and external factors, and if so, how this could be promoted.

Declaration of Competing Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Appendix A

Frequencies (%) of items of social participation across the four classes

	Total* (n = 1775)	Social withdrawers (class 1) (n = 399, 22.5%)	Proximate social dwellers (class 2) (n = 257, 14.5%)	Moderately active social dwellers (class 3) (n = 660, 37.2%)	Pro-active social dwellers (class 4) (n = 459, 26.9%)
Contact w children	(n = 1.642)	(n = 331)	(n = 236)	(n = 631)	(n = 444)
Never/seldom	253 (15.41)	112 (36.86)	10 (4.24)	79 (12.52)	42 (9.46)
< 1x a month	199 (7.25)	43 (12.99)	0 (0)	69 (10.94)	7 (1.58)
Monthly	411 (25.03)	66 (19.94)	34 (14.41)	242 (38.35)	69 (15.54)
Weekly	859 (52.31)	100 (30.21)	192 (81.37)	241 (38.19)	326 (73.42)
Contact with family (in law)	(n = 1,571)	(n = 314)	(n = 202)	(n = 620)	(n = 435)
Never/seldom	527 (33.55)	220 (70.06)	59 (29.21)	148 (23.87)	100 (22.99)
< 1x a month	266 (16.93)	53 (16.88)	10 (4.95)	167 (26.94)	36 (8.28)
Monthly	447 (28.45)	26 (8.28)	54 (26.73)	238 (38.39)	129 (29.66)
Weekly	331 (21.07)	15 (4.78)	79 (39.11)	67 (10.81)	170 (39.08)
Contact with friends	(n = 1.630)	(n = 326)	(n = 222)	(n = 628)	(n = 454)
Never/seldom	110 (6.75)	101 (30.98)	0 (0)	4 (0.64)	5 (1.10)
< 1x a month	168 (10.31)	72 (22.09)	35 (15.77)	61 (9.71)	0 (0.00)
Monthly	616 (37.79)	72 (22.09)	69 (31.08)	419 (66.72)	56 (12.33)
Weekly	736 (45.15)	81 (24.85)	118 (53.15)	144 (22.93)	393 (86.56)
Contact with neigh-bours	(n = 1.665)	(n = 333)	(n = 241)	(n = 635)	(n = 456)
Never/seldom	172 (10.33)	132 (39.64)	2.(0.83)	36 (5.67)	1(0.44)
< 1x a month	100 (6.01)	45 (13.51)	0(0.0)	53(8.35)	2(0.44)
Monthly	313 (18.80)	54 (16.22)	35 (14.52)	213(33.54)	11 (2.41)
Weekly	1.080 (64.86)	102 (30.63)	204 (84.65)	333(52.44)	441 (96.71)
Size of social network	(n = 1.685)	(n = 346)	(n = 250)	(n = 640)	(n = 449)
0-1 Person	109 (6.47)	93 (26.88)	5 (2.00)	11 (1.72)	0 (0.00)
2-5	840 (49.85)	235 (67.92)	140 (56.00)	384 (60.00)	81 (18.04)
6-10	500 (29.67)	13 (3.76)	87 (34.80)	188 (29.38)	212 (47.22)
11-15	122 (7.24)	5 (1.45)	12 (4.80)	36 (5.63)	69 (15.37)
Over 15 persons	114 (6.77)	0 (0).	6 (2.40)	21 (3.28)	87 (19.38)
Informal social activ-ities outdoor	(n = 1.592)	(n = 331)	(n = 218)	(n = 609)	(n = 434)
Never/seldom	384 (24.12)	202 (61.0)	108 (49.54)	57 (9.36)	17 (3.92)
< 1x a month	424 (26.63)	94 (28.4)	97 (44.50)	157 (25.78)	76 (17.51)
Monthly	413 (25.94)	29 (8.8)	13 (5.96)	199 (32.68)	172 (39.63)
Weekly	371 (23.30)	6(1.8)	0 (0)	196 (32.18)	169 (38.94)
Neighbourhood social activities	(n = 1.598)	(n = 323)	(n = 219)	(n = 623)	(n = 433)
Never/seldom	667 (41.74)	267 (82.7)	105 (47.95)	243 (39.00)	52 (12.01)
Now and then	477 (29.85)	31 (9.6)	76 (34.70)	259 (41.57)	111 (25.65)
Regularly	454 (28.41)	25 (7.7)	38 (17.35)	121 (19.42)	270 (62.36)
Does voluntary work	(n = 1.632)	(n = 336)	(n = 229)	(n = 628)	(n = 439)
No	1.201 (73.59)	313 (98.15)	229 (100)	406 (64.65)	253 (57.63)
Yes	431 (26.41)	23 (6.85)	0 (0)	222 (35.35)	186 (42.37)
Effort to increase social participation	(n = 1.654)	(n = 335)	(n = 240)	(n = 634)	(n = 445)
Never/seldom	870 (52.60)	234 (69.9)	197 (82.08)	280 (44.16)	159 (35.73)
Now and then	365 (22.07)	55 (16.4)	43(17.92)	191 (30.13)	76 (17.08)
Regularly	419 (25.30)	46 (18.7)	0 (0.0)	163 (25.71)	210 (47.19)
Online social partici-pation	(n = 1.775)	(n = 399)	(n = 257)	(n = 660)	(n = 459)
Never	842 (47.44)	279 (69.9)	220 (85.6)	220 (33.33)	123 (26.80)
Now and then	499 (28.11)	64 (16.0)	12 (4.67)	267 (40.45)	156 (33.99)
Regularly	434 (24.45)	56 (14.0)	25 (9.73)	173 (26.21)	180 (39.22)

*Due to missing values, the number of observations between items may differ.

References

Ajrouch, K., Akiyama, H., & Antonucci, T. C. (2007). Cohort differences in social relations among the elderly. In H.-W. Wahl, C. Tesch-Romer, & A. Hoff (Eds.). *New dynamics in old age: Individual, environmental and societal perspectives* (pp. 43–63). New York: Baywood, Amityville.

Baker, S., Warburton, J., Waycott, J., Batchelor, F., Hoang, T., Dow, B., ... Vetere, F. (2018). Combatting social isolation and increasing social participation of older adults through the use of technology: A systematic review of existing evidence. *Australasian Journal on Ageing, 37*(3), 184–193. https://doi.org/10.1111/ajag.12572. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/30022583.

Berry, H. L., Rodgers, B., & Dear, K. B. (2007). Preliminary development and validation of an Australian community participation questionnaire: Types of participation and associations with distress in a coastal community. *Soc Sci Med, 64*(8), 1719–1737. https://doi.org/10.1016/j.socscimed.2006.12.009. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/17241727.

Caetano, S., Silva, C., & Vettore, M. (2013). Gender differences in the association of perceived social support and social network with self-rated health status among older adults: A population-based study in Brazil. *BMC Geriatrics, 13*(1), 122.

Curvers, N., Pavlova, M., Hajema, K., Groot, W., & Angeli, F. (2018). Social participation among older adults (55 +): Results of a survey in the region of South Limburg in the Netherlands. *Health & Social Care in the Community, 26*(1), e85–e93. https://doi.org/10.1111/hsc.12480. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/

28714221.

de Jong Gierveld, J. (1998). A review of loneliness: Concept and definitions, determinants and consequences. *Reviews in Clinical Gerontolog, 8*, 73–80.

De Jong Gierveld, J., & Kamphuis, F. (1985). The development of a Raschtype loneliness scale. *Applied Psychological Measurement, 9*, 289–299.

De Jong Gierveld, J., & Van Tilburg, T. G. (1999). *Manual of the loneliness scale.* Amsterdam: VU University.

Doekhie, K. D., De Veer, A. J. E., Rademakers, J. J. D. J. M., Schellevis, F. G., & Francke, A. L. (2014). *Ouderen van de toekomst: Verschillen in de wensen en mogelijkheden voor wonen, welzijn en zorg.* Utrecht.

Douglas, H., Georgiou, A., & Westbrook, J. (2017). Social participation as an indicator of successful aging: an overview of concepts and their associations with health. *Australian Health Review : A Publication of the Australian Hospital Association, 41*(4), 455–462. https://doi.org/10.1071/AH16038. Retrieved from https://www.ncbi.nlm. nih.gov/pubmed/27712611.

Dykstra, P. A., van Tilburg, T., & De Jong Gierveld, J. (2005). Changes in older adult loneliness: Results from a seven-year longitudinal study. *Research on Aging, 27*(6), 725–747. https://doi.org/10.1177/0164027505279712.

Etman, A., Kamphuis, C. B., Pierik, F. H., Burdorf, A., & Van Lenthe, F. J. (2016). Residential area characteristics and disabilities among Dutch community-dwelling older adults. *International Journal of Health Geographics, 15*(1), 42. https://doi.org/10. 1186/s12942-016-0070-8. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/ 27846880.

Everard, K. M., Lach, H. W., Fisher, E. B., & Baum, M. C. (2000). Relationship of activity and social support to the functional health of older adults. *The Journals of Gerontology Series B, Psychological Sciences and Social Sciences, 55*(4), S208–212. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/11584883.

Fees, B. S., Martin, P., & Poon, L. W. (1999). A model of loneliness in older adults. *The Journals of Gerontology Series B, Psychological Sciences and Social Sciences, 54*(4), P231–239. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/12382592.

Fiori, K. L., Antonucci, T. C., & Cortina, K. S. (2006). Social network typologies and mental health among older adults. *The Journals of Gerontology Series B, Psychological Sciences and Social Sciences, 61*(1), P25–32. Retrieved from https://www.ncbi.nlm. nih.gov/pubmed/16399938.

Fokkema, T., De Jong Gierveld, J., & Dykstra, P. A. (2012). Cross-national differences in older adult loneliness. *The Journal of Psychology, 146*(1-2), 201–228. https://doi.org/ 10.1080/00223980.2011.631612. Retrieved from https://www.ncbi.nlm.nih.gov/ pubmed/22303621.

Freedman, V. A., Stafford, F., Schwarz, N., Conrad, F., & Cornman, J. C. (2012). Disability, participation, and subjective wellbeing among older couples. *Soc Sci Med, 74*(4), 588–596. https://doi.org/10.1016/j.socscimed.2011.10.018. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22226156.

Galenkamp, H., & Deeg, D. J. H. (2016). Increasing social participation of older people: Are there different barriers for those in poor health? Introduction to the special section. *European Journal of Ageing, 13*(2), 87–90. https://doi.org/10.1007/s10433-016-0379-y. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/28804373.

Gao, M., Sa, Z., Li, Y., Zhang, W., Tian, D., Zhang, S., ... Gu, L. (2018). Does social participation reduce the risk of functional disability among older adults in China? A survival analysis using the 2005-2011 waves of the CLHLS data. *BMC Geriatrics, 18*(1), 224. https://doi.org/10.1186/s12877-018-0903-3. Retrieved from https:// www.ncbi.nlm.nih.gov/pubmed/30241507.

Gierveld, J. D., van Groenou, M. B., Hoogendoorn, A. W., & Smit, J. H. (2009). Quality of marriages in later life and emotional and social loneliness. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences, 64*(4), 497–506. https://doi.org/10. 1093/geronb/gbn043 Retrieved from < Go to ISI > ://WOS:000267224500009.

Gilmour, H. (2012). Social participation and the health and well-being of Canadian seniors. *Health Reports, 23*(4), 23–32. Retrieved from https://www.ncbi.nlm.nih.gov/ pubmed/23356042.

Glass, T. A., & Balfour, J. L. (2003). Neighborhoods, aging, and functional limitations. In I. Kawachi, & L. Berkman (Eds.). *Neighborhoods and health* (pp. 303–334). New York: Oxford University Press.

Golden, J., Conroy, R. M., & Lawlor, B. A. (2009). Social support network structure in older people: Underlying dimensions and association with psychological and physical health. *Psychology, Health & Medicine, 14*(3), 280–290. https://doi.org/10.1080/ 13548500902730135. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/ 19444706.

Griffith, L. E., Raina, P., Levasseur, M., Sohel, N., Payette, H., Tuokko, H., ... Patterson, C. (2017). Functional disability and social participation restriction associated with chronic conditions in middle-aged and older adults. *Journal of Epidemiology and Community Health, 71*(4), 381–389. https://doi.org/10.1136/jech-2016-207982. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27754857.

Groffen, D. A., Bosma, H., Tan, F. E., van den Akker, M., Kempen, G. I., & van Eijk, J. T. (2012). Material vs. Psychosocial explanations of old-age educational differences in physical and mental functioning. *European Journal of Public Health, 22*(4), 587–592. https://doi.org/10.1093/eurpub/ckr063. Retrieved from https://www.ncbi.nlm.nih. gov/pubmed/21646362.

Gureje, O., Oladeji, B. D., & Abiona, T. (2014). Profile and determinants of succesful ageing in the Ibadan study of ageing. *Journal of the American Geriatrics Society, 62*, 836–842.

Hagenaars, J., & McCutcheon, A. (2002). *Applied latent class analysis.* Cambridge: Cambridge University Press.

Heikkinen, E. (2003). *What are the main risk factors for disability in old age and how can disability be prevented?* Copenhagen: WHO Regional Office for Europe.

Herzog, A. R., Ofstedal, M. B., & Wheeler, L. M. (2002). Social engagement and its relationship to health. *Clinics in Geriatric Medicine, 18*(3), 593–609. ix. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/12424874.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine, 7*(7), e1000316. https://doi.org/10. 1371/journal.pmed.1000316. Retrieved from https://www.ncbi.nlm.nih.gov/ pubmed/20668659.

Hoogendijk, E. O., Suanet, B., Dent, E., Deeg, D. J., & Aartsen, M. J. (2016). Adverse effects of frailty on social functioning in older adults: Results from the Longitudinal Aging Study Amsterdam. *Maturitas, 83*, 45–50. https://doi.org/10.1016/j.maturitas. 2015.09.002. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26428078.

Hornby-Turner, Y. C., Peel, N. M., & Hubbard, R. E. (2017). Health assets in older age: A systematic review. *BMJ Open, 7*(5), e013226. https://doi.org/10.1136/bmjopen-2016-013226. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/28515182.

Ichida, Y., Hirai, H., Kondo, K., Kawachi, I., Takeda, T., & Endo, H. (2013). Does social participation improve self-rated health in the older population? A quasi-experimental intervention study. *Soc Sci Med, 94*, 83–90. https://doi.org/10.1016/j.socscimed. 2013.05.006. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23931949.

Jette, A. M. (2006). Toward a common language for function, disability and health. *Physical Therapy, 86*(5), 726–734.

Kanamori, S., Kai, Y., Aida, J., Kondo, K., Kawachi, I., Hirai, H., ... Group, J. (2014). Social participation and the prevention of functional disability in older Japanese: The JAGES cohort study. *PloS One, 9*(6), e99638. https://doi.org/10.1371/journal.pone. 0099638. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24923270.

Katagiri, K., & Kim, J. H. (2018). Factors determining the social participation of older adults: A comparison between Japan and Korea using EASS 2012. *PloS One, 13*(4), e0194703. https://doi.org/10.1371/journal.pone.0194703. Retrieved from https:// www.ncbi.nlm.nih.gov/pubmed/29624588.

Levasseur, M., Richard, L., Gauvin, L., & Raymond, E. (2010). Inventory and analysis of definitions of social participation found in the aging literature: Proposed taxonomy of social activities. *Soc Sci Med, 71*(12), 2141–2149. https://doi.org/10.1016/j. socscimed.2010.09.041. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/ 21044812.

Li, C., Wu, W., Jin, H., & Zhang, X. (2006). Succesful aging in Shanghai, China: Definition, distribution and related factors. *International Psychogeriatrics, 18*, 551–563.

Litwin, H., & Shiovitz-Ezra, S. (2011). Social network type and subjective well-being in a national sample of older Americans. *Gerontologist, 51*(3), 379–388. https://doi.org/ 10.1093/geront/gnq094. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/ 21097553.

Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). *Testing the number of components in a normal mixture.* Retrieved Date Accessed, 2019 fromhttps://www.jstor.org/stable/2673445.

Looman, W. M., Fabbricotti, I. N., Blom, J. W., Jansen, A. P. D., Lutomski, J. E., Metzelthin, S. F., ... Consortium, T.-M. R. (2018). The frail older person does not exist: Development of frailty profiles with latent class analysis. *BMC Geriatrics, 18*(1), 84. https://doi.org/10.1186/s12877-018-0776-5. Retrieved from https://www.ncbi. nlm.nih.gov/pubmed/29618334.

Lukociene, O., Varriale, R., & Vermunt, J. K. (2010). The simultaneous decision(S) about the number of lower- and higher-level classes in multilevel latent class analysis. *Sociological Methodology, 40*(40), 247–283. https://doi.org/10.1111/j.1467-9531. 2010.01231.x Retrieved from < Go to ISI > ://WOS:000287124900006.

Machielse, A. (2011). Social isolation among older people: A typology as guide for effective interventions. *Journal of Social Intervention Theory and Practice, 20*(4), 40–61.

Mendes de Leon, C. F., Glass, T. A., & Berkman, L. F. (2003). Social engagement and disability in a community population of older adults: The New Haven EPESE. *American Journal of Epidemiology, 157*(7), 633–642. Retrieved from https://www. ncbi.nlm.nih.gov/pubmed/12672683.

Mohnen, S. M., Völker, B., Flap, H., Subramanian, S. V., & Groenewegen, P. P. (2015). The influence of social capital on individual health: is it the neighbourhood or the network? *Social Indicators Research, 121*(1), 195–214.

Momtaz, Y., Haron, S. A., Ibrahim, R., & Hamid, T. (2014). Social embeddedness as a mechanism for linking social cohesion to well-being among older adults: Moderating effect of gender. *Clinical Interventions in Aging, 9*, 863–870.

Noreau, L., Desrosiers, J., Robichaud, L., Fougeyrollas, P., Rochette, A., & Viscogliosi, C. (2004). Measuring social participation: Reliability of the LIFE-H in older adults with disabilities. *Disability and Rehabilitation, 26*(6), 346–352. https://doi.org/10.1080/ 09638280410001658649. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/ 15204486.

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling, 14*, 535–569. https://doi.org/10.1080/ 10705510701575396.

Pijpers, R., de Kam, G., & Dorland, L. (2016). Integrating services for older people in aging communities in the Netherlands: A comparison of urban and rural approaches. *Journal of Housing for the Elderly, 30*(4), 430–449. https://doi.org/10.1080/ 02763893.2016.1224793 Retrieved from < Go to ISI > ://WOS:000389803700006.

Post, M. W., van der Zee, C. H., Hennink, J., Schafrat, C. G., Visser-Meily, J. M., & van Berlekom, S. B. (2012). Validity of the utrecht scale for evaluation of rehabilitation-participation. *Disability and Rehabilitation, 34*(6), 478–485. https://doi.org/10.3109/ 09638288.2011.608148. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/ 21978031.

Puts, M. T., Shekary, N., Widdershoven, G., Heldens, J., Lips, P., & Deeg, D. J. (2007). What does quality of life mean to older frail and non-frail community-dwelling adults in the Netherlands. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation, 16*(2), 263.

Richard, L., Gauvin, L., Gosselin, C., & Laforest, S. (2009). Staying connected: neighbourhood correlates of social participation among older adults living in an urban environment in Montreal, Quebec. *Health Promotion International, 24*(1), 46–57. https://doi.org/10.1093/heapro/dan039 Retrieved from < Go to ISI > :// WOS:000262962000006.

Rijken, M., Spreeuwenberg, P., Schippers, J., & Groenewegen, P. P. (2013). The importance of illness duration, age at diagnosis and the year of diagnosis for labour participation chances of people with chronic illness: Results of a nationwide panelstudy in the Netherlands. *BMC Public Health, 13*, 803. https://doi.org/10.1186/1471-2458-13-803. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24007362.

Rodriguez-Laso, A., Zunzunegui, M. V., & Otero, A. (2007). The effect of social relationships on survival in elderly residents of a Southern European community: A cohort study. *BMC Geriatrics, 7*, 19. https://doi.org/10.1186/1471-2318-7-19. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/17678536.

Routasalo, P. E., Savikko, N., Tilvis, R. R., Strandberg, T. E., & Pitkälä, K. H. (2006). Social contacts and their relationship to loneliness among aged people - A population-based study. *Gerontology, 52*(3), 181–187.

Sampson, E. L., Bulpitt, C. J., & Fletcher, A. E. (2009). Survival of community-dwelling older people: The effect of cognitive impairment and social engagement. *Journal of the American Geriatrics Society, 57*(6), 985–991. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/19507292.

Scharn, M., van der Beek, A. J., Suanet, B., Huisman, M., & Boot, C. R. L. (2018). Societal participation of individuals aged 55–64 years with and without chronic disease. *European Journal of Public Health,* 1–6.

Shandra, C. L. (2017). Disability and social participation: The case of formal and informal volunteering. *Social Science Research, 68*, 195–213. https://doi.org/10.1016/j.ssresearch.2017.02.006. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/29108597.

Slaets, J. P. J. (2006). Vulnerability in the elderly: Frailty. *The Medical Clinics of North America, 90*, 593–601.

Slegers, K., van Boxtel, M. P., & Jolles, J. (2008). Effects of computer training and Internet usage on the well-being and quality of life of older adults: A randomized, controlled study. *The Journals of Gerontology Series B, Psychological Sciences and Social Sciences, 63*(3), P176–184. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/18559683.

Smith, K., & Victor, C. (2018). Typologies of loneliness, living alone and social isolation, and their associations with physical and mental health. *Ageing and Society,* 1–22. https://doi.org/10.1017/S0144686X18000132.

Snowden, M. B., Steinman, L. E., Carlson, W. L., Mochan, K. N., Abraido-Lanza, A. F., Bryant, L. L., ... Anderson, L. A. (2014). Effect of physical activity, social support, and skills training on late-life emotional health: A systematic literature review and implications for public health research. *Frontiers in Public Health, 2*, 213. https://doi.

org/10.3389/fpubh.2014.00213. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25964921.

Statistics, C. (2019). *Internet access, utilization and facilities.* Retrieved Date Accessed, 2019 fromhttps://statline.cbs.nl/StatWeb/publication/?VW = T&DM = SLNL&PA = 83429NED&LA = NL.

Sum, S., Mathew, R. M., Hughes, I., & Campbell, A. (2008). Internet use and loneliness in older adults. *CyberPsychology & Behavior, 11*(2), 208–211.

Van Beuningen, J., & De Jonge, T. (2011). *The personal wellbeing index: Construct validity for the Netherlands.* Den Haag/Heerlen: CBShttps://www.cbs.nl/NR/rdonlyres/F0C01716-3E08-4A6E-AC30-9234A5EFC5FD/0/2011x1024art.pdf.

van Ginneken, E., & Kroneman, M. (2015). Long-Term Care Reform in the Netherlands: too large to handle? *Eurohealth Systems and Policies, 21*(3), 47–50.

van Houwelingen, A. H., Cameron, I. D., Gussekloo, J., Putter, H., Kurrle, S., de Craen, A. J., ... Blom, J. W. (2014). Disability transitions in the oldest old in the general population. The Leiden 85-plus study. *Age (Dordrecht, Netherlands), 36*(1), 483–493. https://doi.org/10.1007/s11357-013-9574-3. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23990275.

Veenhof, B., & Timusk, P. (2009). *Online activities of Canadian boomers and seniors. Canadian social trends.* Canada: Statistics Canada25–32 catalogue 11-008.

Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation.* Cambridge, MA: The MIT Press.

Wenger, G. C. (1997). Social networks and the prediction of elderly people at risk. *Aging & Mental Health, 1*(4), 311–320. https://doi.org/10.1080/13607869757001 Retrieved from < Go to ISI > ://WOS:A1997YJ97100004.

Whiteneck, G., & Dijkers, M. P. (2009). Difficult to measure constructs: Conceptual and methodological issues concerning participation and environmental factors. *Archives of Physical Medicine and Rehabilitation, 90*(11 Suppl), S22–35. https://doi.org/10.1016/j.apmr.2009.06.009. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/19892071.

WHO (2001). *ICF: International classification of functioning, disability and health. Dutch translation, WHO-FIC collaborating centre.* Bilthoven, Netherlands: World Health Organization.

WHO (2015). *Factsheet ageing and health.* Geneva: WHO.

Wilke, C., & Pickard, A. (2011). *Test-retest reliability of the EQ-5D visual analog scale across populations and conditions. 26th Scientific Plenary Meeting of the EuroQol Group - Proceedings: EuroQol Group*165–172.