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Risk factors for loneliness among older people in a Nordic regional context – A longitudinal study

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Statement of Ethical Approval

The GERDA data collection in 2010 and 2016 was approved by the Regional Ethical Review Board in Umeå, Sweden (2010-220-32Ö & 05-084Ö; 2016-367–32 & 05-084Ö). In Finland, ethical approval is not needed for anonymous population-based postal surveys (Medical Research Act 488/ 1999; English translation is available at http://www.finlex.fi/en/laki/kaannokset/1999/en19990488). The study follows the guidelines of the Finnish National Advisory Board on Research Ethics (https://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf).

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Abstract

The aim of this study was to examine the prevalence of loneliness among older people and to identify risk factors for loneliness in a Nordic regional context over a six-year period. Longitudinal data from the Gerontological Regional Database (GERDA) study of 4269 older adults living in northern Sweden and western Finland, aged 65, 70, 75, and 80 at baseline in 2010, were analysed. Logistic regressions were used to analyse sociodemographic, social, and health-related risk factors at baseline and changes in these for experiences of loneliness at follow-up. The results showed that most older adults (85%) did not experience loneliness at baseline or at follow-up in our study region. However, three per cent of the sample reported loneliness in both study years, indicating enduring and chronic loneliness. Analyses revealed that being widowed and becoming a widow/er as well as poor self-rated health at baseline and the onset of depression were risk factors for loneliness. Finally, the risk of loneliness was higher in older people living in Sweden. Further work is needed to explore changes and

stability in loneliness as well as to increase our understanding of between-country differences in loneliness.

Keywords: loneliness, older people, longitudinal study, Finland, Sweden

Background

Loneliness is generally perceived as a subjective, unpleasant, and distressing phenomenon resulting from a perceived discrepancy between an individual's desired and achieved levels of social relations (Perlman and Peplau 1981). Loneliness has been studied extensively, and previous research has shown that loneliness is experienced at all ages. Approximately ten per cent of the older adult population appears to experience severe loneliness, whereas 20–30 per cent report occasional loneliness (Dykstra 2009). Older people are at higher risk of experiencing social and health-related changes and losses that might increase experiences of loneliness, suggesting the need to assess risk factors for loneliness in this specific age group. Further, loneliness in old age is related to various negative health outcomes, such as cognitive decline (Boss, Kang and Branson 2015; Lara *et al*. 2019), coronary heart disease and stroke (Valtorta *et al*. 2016), mental health problems (Caccioppo *et al.* 2006; Coyle and Dugan 2012; Mushtaq *et al*. 2014), and increased mortality (Holwerda *et al*. 2012; Tilvis *et al*. 2012; Luo *et al*. 2012; Holt-Lunstad *et al.* 2015), indicating that the reduction of loneliness among older people is a public health issue that should be acknowledged in policy, practice, and research. In this study, we aim to study the risk factors for loneliness over time by analysing older people living in regions of Finland and Sweden.

Changes in loneliness over time

On an individual level, loneliness might fluctuate and change across life span, and occasional periods of loneliness are a normal part of life and are not seen as an elevated health risk (DiTomasso, Fizell and Robinson 2015; Mund *et al.* 2020). It is chronic or enduring loneliness that is of public health concern (Prohaska *et al.* 2020). The evidence for chronic loneliness in later life has been relatively consistent across studies, showing longitudinal loneliness among 13 and 22 per cent (Jylhä 2004; Victor and Bowling 2012; Newall, Chipperfield and Balis 2014; Brittain *et al.* 2017; Hawkley and Kocherginsky 2018). For

example, a British study with an eight-year follow-up found that 22 per cent of the sample felt continuously lonely, 12 per cent overcame their loneliness, and 44 per cent reported absence of loneliness (Victor and Bowling 2012). A Finnish ten-year follow-up study (Jylhä 2004) showed that 17 per cent contentiously felt lonely, 13 per cent overcame their loneliness, and another 19 per cent became lonely between baseline and follow-up. The majority (51%) reported an absence of loneliness at both study points. However, a Swedish seven-year follow-up study revealed that only a small minority (four per cent) of participants reported feeling lonely continuously, challenging the findings that loneliness is a long-term chronic condition (Dahlberg *et al*. 2015). Similarly, a British study analysing loneliness at five time points across eight years found that two per cent of the sample remained consistently lonely over the years (Yang 2018). Considering these inconclusive results, more research is needed to understand loneliness across time in older people.

Risk factors for loneliness

Well-known risk factors for loneliness in older age are widowhood, social isolation, and solitary living (de Jong Gierveld 1998; Pinquart and Sörensen 2003; Dahlberg *et al.* 2021). Loneliness is also influenced by health-related risk factors, such as poor self-reported health (Dykstra, van Tilburg and de Jong Gierveld 2005), functional limitations (Hawkley and Kocherginsky 2018), and depression (Dahlberg *et al.* 2015). Further, sociodemographic risk factors include older age (Donovan *et al.* 2017), low educational level (Nicolaisen and Thorsen 2014), and low socioeconomic status (Donovan *et al.* 2017). Usually, women report higher levels of loneliness than men (Dahlberg *et al.* 2015; Nicolaisen and Thorsen 2014). However, this relationship is ambiguous and tends to be mediated by other factors, such as civil status (Dahlberg and McKee 2014), indicating that, for example, the death of one's spouse or partner is more relevant than gender as an explanation for loneliness.

Changes in loneliness over different time points could also be the result of changes in one's financial status; civil status; social resources, such as social support, social network, and social participation; and health status (Dykstra, van Tilburg and de Jong Gierveld 2005; Aartsen and Jylhä 2011; Newall, Chipperfield and Balis 2014; Dahlberg *et al*. 2015). Aartsen and Jylhä (2011) found a higher incidence of loneliness when people experienced depression, increased physical disability, increased feelings of uselessness and nervousness, loss of a partner, and reduced social activity. In most cases, social and personal resources assessed at baseline did not predict loneliness at follow-up; this was only the case when there was a negative change in these resources. According to the authors, the results confirm the notion that loneliness is a subjective evaluation of the discrepancy between desired and actual resources (see Perlman and Peplau 1981) rather than an evaluation of limited social and health resources. Newall *et al.* (2014) analysed four different loneliness groups: those who became lonely, overcame loneliness, were persistently lonely, and were persistently not lonely. Their results showed that becoming lonely at follow-up was related to changes in living arrangements and perception of social control, whereas living alone, being widowed, poor health, and lower perceptions of control predicted persistent loneliness. Dahlberg *et al.* (2015) assessed changes in loneliness in men and women separately and found different predictors of loneliness in men and women: widowhood, depression, mobility problems, and mobility reduction predicted loneliness for women, while low levels of social contact and social contact reduction predicted loneliness in men. Thus, baseline resources, as well as changes in these resources, predicted loneliness over time.

The Nordic context

A growing body of evidence points to cross-national variation in loneliness rates in later life, with Southern and Eastern European countries tending to report higher levels of loneliness compared to Northern European countries (Sundström *et al.* 2009; Yang and Victor

2011; de Jong Gierveld, Dykstra and Schenk 2012; Vozikaki *et al.* 2018). A recent report on loneliness analysing European Social Survey data confirmed that loneliness levels were lower in the Nordic countries than in other European countries (Dahlberg *et al*. 2020). Furthermore, when comparing the Nordic countries specifically, loneliness was more prevalent in Finland and Sweden than in Denmark, Iceland, and Norway (Dahlberg *et al.* 2020). The reason for cross-national differences could be related to individual as well as societal features, including culture, norms, and welfare-institutional arrangements (de Jong Gierveld and Tesch-Römer 2012; Lykes and Kemmelmeier 2014; Nyqvist, Nygård and Scharf 2019). However, research on how loneliness in older persons changes over time and differs between countries is still limited.

Therefore, the focus of this study is on two Nordic countries: Sweden and Finland. These countries are members of the Nordic welfare model (Kangas and Kvist 2019), where social and healthcare services for older people are mainly tax-financed and delivered on a universal basis by regional and local authorities. Although Sweden and Finland have much in common culturally and socioeconomically, previous work has shown that the regions included here, i.e. parts of northern Sweden and western Finland, differ somewhat from each other in social and health-related aspects (Hörnsten *et al.* 2016; Nyqvist, Nygård and Snellman 2012), suggesting that, besides well-known risk factors for loneliness, region is a significant variable to be analysed.

In this study, we scrutinize various sociodemographic, social, and health-related factors that have been identified as important risk factors for loneliness in previous research conducted with older people (e.g. Dahlgren 2021) by analysing longitudinal data collected in parts of northern Sweden and western Finland. We also assess changes in sociodemographic, social, and health-related aspects in relation to loneliness, given the significant effect of negative changes and losses over time on loneliness.

The main aim of this study is to examine the prevalence of loneliness among older people and to identify the risk factors for loneliness in a Nordic regional context over a six-year period. This aim is further divided into two sub-aims: to study the prevalence of loneliness in 2010 and 2016 and the prevalence of enduring loneliness; and to understand which risk factors at baseline and changes in these factors predict loneliness at the follow-up.

Methods

Sample

The study was based on the GERDA questionnaire study conducted in parts of western Finland and northern Sweden in 2005, 2010, and 2016. The present study used data from the two most recent waves (2010 and 2016), as only these two waves allowed for a longitudinal follow-up. The aim of the GERDA study was to map the health and living conditions of older people residing in the Bothnia region, i.e. both sides of the Gulf of Bothnia, in Västerbotten, Sweden, and in Österbotten/Pohjanmaa, Finland. Although Österbotten and Pohjanmaa belong to the same geographical region in Finland, they are treated here as two separate regions due to different linguistic affiliations. The region is bilingual, with about 51 per cent Swedish speakers, whereas on a national level Swedish speakers are a clear minority and accounts for 5 per cent. Swedish-speaking participants were coded as belonging to Österbotten, while Finnish-speaking participants were coded as belonging to Pohjanmaa. In Finland, the questionnaires were sent out in either Swedish or Finnish, according to the registered language of the respondent. The participants were sampled from the National Tax Board in Sweden and the Population Register Centre in Finland.

In 2010, the postal questionnaire was sent out to every 65-, 70-, 75-, and 80-year-old (born in 1930, 1935, 1940, and 1945) living in rural and semi-urban areas. Different sampling strategies were used for urban and rural participants to address the larger number of older people living in cities: in the city of Vaasa (Finland) and the cities of Umeå and Skellefteå

(Sweden), the questionnaire was sent to every second and third person, respectively. The questionnaire was answered by 3779 respondents in Västerbotten, Sweden, 1906 in Österbotten, Finland, and 1153 in Pohjanmaa, Finland, resulting in a response rate of 70.7, 61.5, and 52.9 per cent, respectively.

In 2016, the questionnaire was sent out to every 66-, 71-, 76-, 81-, and 86-year-old (born in 1950, 1945, 1940, 1935, and 1930) living in rural and semi-urban areas and in the city of Seinäjoki (Finland). It was sent to every second person meeting the age criteria in the city of Vaasa (Finland) and every third person in the cities of Umeå and Skellefteå (Sweden). The questionnaire was answered by 4375 respondents in Västerbotten, Sweden, 2296 in Österbotten, Finland, and 2715 in Pohjanmaa, Finland, resulting in a response rate of 70.8, 61.7, and 54.9 per cent, respectively.

A total of 4696 respondents participated in both waves (i.e. 2010 and 2016) of data collection (Västerbotten, $n = 2693$; Österbotten, $n = 1314$; and Pohjanmaa, $n = 689$). Of these, 4269 respondents (Västerbotten, $n = 2466$; Österbotten, $n = 1182$; and Pohjanmaa, $n = 621$) were included in the present study as they responded to the loneliness item in both study waves.

Variables

Outcome variable

Loneliness was used as an outcome variable and was measured with the question, 'Do you suffer from loneliness?' (yes/no).

Social variables

Frequency of social contact was based on the question, 'How often do you have contact with the following persons?' Friends and neighbours were grouped into one variable, and children, grandchildren, and other relatives into another. The response alternative 'several

times a week' was coded as 'frequent social contact', and 'several times a month', 'few times a year', 'never', and 'does not exist' were combined and coded as 'infrequent social contact'.

Trust in friends and neighbours was assessed with the question, 'How much trust do you have in the following persons?' with the response alternatives being 'much', 'neither much nor little', 'little', or 'cannot say'. Responses were dichotomised with the first response alternative coded as 'high trust' and the three latter as 'low trust'. Respondents were considered highly trusting if they reported having high trust in friends or neighbours.

The number of confidants was based on the question, 'Do you have a confidant with whom you can speak about anything that is sharing both concerns and joys?' The answer alternatives included 'spouse', 'children', 'grandchildren', 'siblings', 'parents', 'other relatives', 'friends', 'neighbours', 'home-care sta□', 'nurses', and 'someone else'. The variable was dichotomised using a median split between '0–1 confidants' and '2 confidants or more'.

Associational activity was assessed by membership in a voluntary organisation. These organisations included sports or outdoor organisations, political parties, religious organisations, and social or health organisations. For each of the nine organisations, the respondents were given three response options: 'active member', 'passive member', and 'not a member'. We counted the number of organisations the respondents said they were active members of. If the respondents were active in any of the nine organisations, they were categorised as an 'active member'; otherwise, they were grouped as 'none or passive'.

Health-related variables

Self-rated health was assessed with the first question of the 36-item Short Form (SF-36; Ware and Sherbourne 1992): 'In general, how would you say your health is?' Responses were based on a five-point scale (excellent, very good, good, fair, or poor). This variable was

dichotomised into ‘good health’ (excellent, very good, or good) and ‘poor health’ (fair or poor).

Depression was assessed using the Geriatric Depression Scale (GDS) 4-item version (D’Ath *et al.* 1994), which is a short assessment for depression comprising four yes/no questions. The four questions were: ‘Are you basically satisfied with your life?’ ‘Do you feel that your life is empty?’ ‘Are you afraid that something bad is going to happen to you?’ and ‘Do you feel happy most of the time?’ Scores of two or less were chosen as the cut-off point for significant depressive symptomatology (D’Ath *et al.* 1994). The present study also included the yes/no question ‘Do you feel depressed?’ Depression was defined in this study as answering ‘yes’ to the yes/no question, or a GDS-4 score ≥ 2. A combination measure was selected to increase the sensitivity for depression and has previously been used in other articles based on the GERDA study (e.g. Hörnsten *et al.* 2016).

Instrumental activities of daily living (IADL) was assessed by four questions: ‘Do you clean your dwelling (vacuum and wipe the floor) without help from others?’ ‘Do you do grocery shopping without help from others?’ ‘Do you use public transportation such as busses, planes, or trains without help from others?’ and ‘Do you cook without help from others?’ A person was considered dependent in IADL if they responded ‘no’ to all four questions. *Personal activities of daily living (PADL)* was measured with the question ‘Do you shower without help from another person?’ A person was considered dependent in PADL if they answered ‘no’ to the question. This question originates from the Katz Index of Independence in Activities of Daily Living (Katz ADL; Katz and Akpom 1976), where bathing is listed as a measure of the least severe degree of disability.

The sociodemographic characteristics of the sample included age (65, 70, 75, or 80 in 2010), gender (male/female), civil status (married, cohabiting/ widowed/ divorced, not married), educational level (lower secondary/upper secondary), region (Västerbotten,

Österbotten, Pohjanmaa) and making ends meet. Making ends meet was assessed with the following question: 'In your economic situation, is it possible to make ends meet?' We grouped the response alternatives so that those who reported 'without difficulty' were categorised as 'making ends meet without difficulties', whereas those who reported 'with some difficulty', 'with difficultly', or 'with great difficulty' were categorised as 'making ends meet with difficulty'.

Analysis

Initially, the distribution (%) of all variables was calculated for study years 2010 and 2016 (Table 1). Next, bivariate analyses, using cross tables with Pearson's chi-square test, were conducted to analyse experienced loneliness in 2016 according to sociodemographic, social, and health-related variables from the 2010 data set and the 2010–2016 variable change scores (Tables 2 and 3). To control the overall Type I error rate, the Bonferroni correction for multiple comparisons was used when performing post hoc analyses (Table 2) (Beasley and Schumacker 1995). Social and health-related change scores were created by subtracting the 2010 dichotomised scores from the 2016 dichotomised scores. This created a scale ranging from no change/positive change to negative change. However, to simplify the analyses, we dichotomised the change variables (no change/positive change vs negative change). A dichotomised change variable was also created for widowhood, identifying participants who had been widowed since 2010 (yes/no) and for the making ends meet variable (no change/positive change vs negative change).

Finally, four logistic regression models were entered stepwise to analyse the risk factors for experiencing loneliness in 2016 (Table 4). These models analysed sociodemographic and social risk factors for loneliness (Model 1), health-related risk factors (Model 2), sociodemographic and social change variables (Model 3), and health-related change variables (Model 4). We compared the models using the log likelihoods. The results

are presented as odds ratios (ORs) and 95% confidence intervals (CIs). IBM SPSS Statistics, Version 26, was used for analysis.

Results

-Table 1 about here-

In 2010, eight per cent of respondents reported loneliness compared to 10 per cent in 2016. The vast majority, 85.3 per cent (n = 3640), reported no loneliness in either year (data not shown). Between 2010 and 2016, seven per cent (n = 298) became lonely, whereas 4.4 per cent (n = 188) overcame loneliness; 3.3 per cent (n = 143) reported loneliness in both study years. The distribution (%) of all included variables is reported for study years 2010 and 2016 (Table 1). A negative change was reported for the included variables in the study sample, with the exception of the variable measuring making ends meet, as a lower proportion of older people reported poor ability to make ends meet in 2016 (33% vs 38% in 2010). Further, a higher proportion of the study population was widowed in 2016 compared to 2010 (12% vs 18%).

-Table 2 about here-

Table 2 presents the bivariate analyses of the association between loneliness in 2016 and sociodemographic, social, and health-related variables in 2010. Loneliness was significantly more common among women and older people with difficulties in making ends meet in 2010. Further, age, region, and civil status in 2010 were also associated with loneliness in 2016. To identify significant differences across categories, additional chi-square post hoc tests were conducted for age, region, and civil status. Post hoc comparisons of loneliness by age group revealed that the null hypothesis for age groups 65, 75, and 80 was rejected, meaning that there were significant differences in loneliness between these three age groups. Also, significant loneliness differences were observed for Västerbotten and

Österbotten, but not for Pohjanmaa. Finally, the null hypothesis for civil status categories was rejected, indicating a difference in loneliness among the three civil status categories.

Regarding the social variables, experience of loneliness in 2010, infrequent social contact with family and relatives, low trust in friends and neighbours, low (0–1) number of confidants, and none or passive membership in associations were significantly associated with loneliness in 2016. In addition, poor self-rated health, depression, and dependency in IADL in 2010 were also significantly associated with loneliness in 2016.

Table 3 presents the bivariate analyses between loneliness in 2016 and 2010–2016 change scores. Loneliness in 2016 was significantly associated with becoming widowed, a negative change in trust, a negative change in the number of confidants, and negative changes in health, including self-rated health, depression, IADL, and PADL.

-Table 3 about here-

Table 4 presents the four logistic regression models examining the predictors of loneliness in 2016, including sociodemographic, social, and health-related variables from 2010 and the 2010–2016 change variables.

-Table 4 about here-

In Model 1, when analysing social variables, loneliness in 2010 and low trust in friends or neighbours were found to be significantly associated with loneliness in 2016. Participants who reported loneliness in 2010 were more than six times more likely (OR = 6.93) than participants who did not report loneliness in 2010 to report loneliness in 2016. In addition, gender, age group, civil status, region, and economic situation were significantly associated with loneliness in 2016. The likelihood for loneliness at follow-up was higher for women, 75- and 80-year-olds, widowed and single participants, and participants with difficulties making ends meet, and lower for participants living in Österbotten, Finland.

In Model 2, poor self-rated health and depression in 2010 were significant predictors of loneliness in 2016. The sociodemographic and social variables remained statistically significant. In Model 3, when sociodemographic and social change variables were added to the analyses, recent widowhood was associated with a higher likelihood of experiencing loneliness in 2016 compared to those who had not recently been widowed. Widowhood and being single in 2010 were still significantly associated with reports of loneliness at follow-up in Model 3. Also, the likelihood of reporting loneliness in 2016 was lower for participants living in Österbotten, Finland, and for those with infrequent contact with family and relatives. However, the effects of age groups and gender diminished in Model 3 and lost significance.

In the final model (Model 4), which included the health-related change variables, the likelihood of loneliness was higher for widowed and single participants than married or cohabiting participants in 2010. There was a lower likelihood of loneliness among those living in Österbotten, Finland, compared to those living in Västerbotten, Sweden. Of the social variables examined in 2010, only loneliness was significantly associated with loneliness six years later, whereas poor self-rated health in 2010 predicted loneliness in 2016. Participants who were widowed after 2010 and those experiencing depression increments were also significantly more likely to report loneliness in 2016. A comparison of the models showed that there was a significant improvement in the model fit when social and health-related change variables were added (Models 2 and 4).

Discussion

The aim of this study was to analyse the prevalence of and changes in loneliness and to identify risk factors for loneliness in older people over time in regions of Finland and Sweden. The results showed that eight per cent of the sample suffered from loneliness in 2010, increasing to 10 per cent in 2016. Forty-three per cent of those who experienced loneliness in 2010 again reported loneliness in 2016; in comparison, the remaining 57 per cent did not

report suffering from loneliness six years later. Our analyses revealed that baseline resources and negative changes in resources predicted loneliness over time; we found that reported loneliness in 2010, being widowed, and becoming a widow/er were important risk factors for loneliness. Poor self-rated health at baseline and the onset of depression were also risk factors for loneliness. Finally, the risk of loneliness was lower among older people living in Österbotten, Finland, than among people living in Västerbotten, Sweden.

About ten per cent of our study sample reported loneliness at follow-up, which is in line with some previous work (Yang 2018) but does contradict the findings of some studies showing a higher increase of frequent loneliness at follow-up (Dahlberg *et al.* 2015). In line with other work (Tijhuis *et al.* 1999), our study confirms that age itself is not a risk factor for loneliness, while there is a growing propensity of social and health-related risk events when one gets older, such as widowhood and poor health. Our study also revealed that about three per cent of the total sample reported suffering from loneliness in both study years, indicating that this subgroup of older people deserves the most attention, as they might reflect a group of older people with enduring or chronic loneliness. At follow-up, seven per cent of the sample became lonely, while four per cent overcame loneliness, suggesting that loneliness may be a transient experience that fluctuates over time (Mund *et al*. 2020). It should be noted that we assessed experiences of suffering from loneliness instead of frequent loneliness, and our follow-up period was comparatively short, covering six years. Nevertheless, older people experiencing loneliness at baseline were five times likelier to report loneliness at follow-up.

Older people are at a higher risk of social and health-related losses and changes, as was evident in our study. Between 2010 and 2016, there was a negative change at the population level in all indicators studied, an exception being making ends meet. In particular, the number of older people dependent in IADL increased between the study years. Our analyses focused on negative changes, and our bivariate analyses (Tables 2 and 3) revealed

that limited social and health-related resources, including negative changes in these, were associated with loneliness at follow-up. There is a risk that research reporting negative changes hides the fact that some people gain resources, which is something that should be further explored in future work in relation to becoming lonely and recovering from loneliness loneliness. These types of loneliness studies are relatively rare (e.g. Newall, Chipperfield and Balis 2014; Hawkley and Kocherginsky 2018).

Being unmarried or divorced increased the risk of experiencing loneliness. However, becoming a widow/er between the study years increased the likelihood of reporting loneliness at follow-up by four times. Brittain *et al.* (2017) found that among very old adults, length of widowhood was a key factor for loneliness: that those with longer experience of spousal loss experienced lower levels of loneliness compared to those experiencing recent widowhood (within 1–2 years). Since the death of a spouse is one of the most significant life events affecting adults' daily interactions and social exchanges (Stroebe *et al.* 2005), individuals who have lost their spouses require social support and engagement to aid in their adjustment to spousal loss (Sullivan and Infurna 2020).

In our study, the onset of depression between study points, rather than depression at baseline, was related to loneliness at follow-up (Aartsen and Jylhä 2011; Houtjes *et al.* 2014; Dahlberg *et al.* 2015). It has been argued that depression causes reduced social networks and social participation, which might increase loneliness levels over time (Houtjes *et al*. 2014). However, in the literature, there is debate as to whether depression activates loneliness, whether loneliness is a risk factor for the development of depression, or whether the relationship is reciprocal (O'Luanaigh and Lawlor 2008; Schwarzbach *et al*. 2014). More research is clearly needed to understand the temporal relationship between loneliness and depression.

When it comes to other health-related variables, we found that only poor self-rated health—seen as an overall measure of an individual's health status (Lundberg and Manderbacka 1996)—at baseline predicted loneliness six years later. Dykstra *et al.* (2005) suggest that poor health may become a weaker predictor of loneliness over time due to the adaptation and use of coping strategies. Nonetheless, the issue of how to account for the finding that a negative change in self-rated health did not predict loneliness at follow-up is a matter for further research.

In some studies, loneliness has been linked to lower socioeconomic status (Nicolaisen and Thorsen 2014; Donovan *et al*. 2017). Theoretically, a low socioeconomic status could influence the possibility of social integration and, thus, loneliness levels (de Jong Gierveld and Tesch-Römer 2012). Financial problems also influence the health and well-being of older people. Therefore, the relationship between low socioeconomic status and loneliness might be mediated by various health-related factors, as suggested by de Jong Gierveld and Tesch-Römer (2012). This finding was partly confirmed in our study. Difficulties in making ends meet independently predicted loneliness in our first model when controlling for sociodemographic and social variables, but not when controlling for health- and change-related variables.

Besides loneliness at baseline, none of the social variables, neither baseline nor social change variables, were independently related to loneliness at follow-up. While this contradicts some previous longitudinal work (e.g. Dykstra, van Tilburg and de Jong Gierveld 2005; Donovan *et al.* 2017, Dahlberg *et al.* 2021), it corroborates other multivariable analyses showing no significant effects regarding social networks and support or changes in social variables (Dahlberg *et al.* 2015; Yang 2018; Warner and Adams 2016) on loneliness. Still, quality aspects of relationships are important, in terms of understanding loneliness (de Jong Gierveld 1998; Pinquart and Sörensen 2003); however, in the context of other

sociodemographic and health-related variables, the use of social variables to discriminate between the groups might be limited. Also, it might be that the loneliness measure used here could be more related to emotional loneliness, i.e. not having a partner or close confident, and that could be one reason why frequency of contact and other social variables in our study were not significant.

In this study, the highest levels of loneliness were observed in Västerbotten, Sweden. However, this difference was only significant between Swedish speakers in Finland and older people living in Västerbotten in Sweden; no significant difference was reported in relation to Finnish speakers in Finland. One reason for these differences may be that our study region was relatively rural and that the northern region of Sweden is even less populated than the western parts of Finland. The northern region of Sweden has also experienced high migration to the city of Umeå (Garli and Petterson 2011), suggesting an increased risk of social isolation if elderly friends and family are not geographically close, which adheres to the cognitive theory of loneliness (Perlman and Peplau 1981) focusing on subjective perceptions of unmet desires for social contacts. These factors might serve as tentative explanations for the differences in loneliness between the two countries.

Further, we know from previous work conducted in the same region that Swedish speakers in Finland tend to be embedded in social resources to a higher degree than Finnish speakers and Swedish speakers in Västerbotten (Nyqvist, Nygård and Steenbeck 2014). It has been suggested that Swedish speakers in Finland experience a higher degree of social inclusion due to their relatively small number, strong support from various institutions, and lesser geographical mobility (McRae 1999) that could potentially explain observed differences in loneliness.

This study showed that many older people experience social and health-related losses, and that older widowed people, those who are depressed, and those who are in poorer health

are at higher risk of loneliness. Considering that these factors may reinforce one another, social and healthcare services need to be observant in identifying older people facing these changes and problems. So far, there is no consensus as to how to reduce loneliness most efficiently (Masi *et al.* 2011; Cohen-Mansfield and Perach 2015; Coll-Planas *et al.* 2017). It is, however, clear that combatting loneliness requires strategies on both an individual and a societal level (de Jong Gierveld and Tesch-Römer 2012). In order to develop relevant intervention strategies, more work is required to assess the extent to which individual, social, and societal factors explain loneliness and their trajectories in older people.

Limitations

Loneliness has been studied extensively; however, estimates vary across studies, reflecting the different measurement approaches and populations sampled. We analysed a sample of older people between the ages of 65 and 80 at baseline and assessed them again six years later, thus including both younger and much older adults. In our study, loneliness was examined by a direct single-item loneliness question with only a yes/no answer, as opposed to Likert scale responses (see e.g. Eloranta 2015). This approach assumes that respondents understand the definition of loneliness and are willing to admit to being lonely. It has also been argued that direct measures of loneliness might cause social desirability bias (de Jong Gierveld 1987). This could result in an underestimation of loneliness, which might be of less concern if indirectly measuring loneliness using multiple-item scales, such as the Revised UCLA Loneliness Scale (R-UCLA; Russell 1996; Russell, Peplau and Cutrona 1980) or the De Jong Gierveld Loneliness Scale (de Jong Gierveld and Kamphuis 1985). Further, the use of a single-item question cannot discriminate between social and emotional loneliness, as suggested by Weiss (1973). Any comparison of results with other studies must, therefore, be made with caution.

One key methodological challenge in longitudinal research is loss at follow-up. In 2010, the total response rate was 64 per cent (n = 6838), with the highest response rate in Västerbotten, Sweden (71%), followed by Österbotten (62%) and Pohjanmaa (52%) in Finland. Six years later, about 70 per cent of the 2010 respondents in Västerbotten and Österbotten participated in the survey, and 60 per cent of the 2010 respondents in Pohjanmaa. We have no information regarding the reasons for dropout; however, the response rate was lower among the older age group—an age group that is also more likely to be in poorer health (Chatfield, Brayne and Matthews 2005). Therefore, although the response rate was relatively high in 2010, there is a risk of sample selection bias as well as nonresponse bias, especially in Pohjanmaa, which might affect the reporting of loneliness as well as the predictors of loneliness. The reason for regional differences in the 2010 response rate is unknown; however, the pattern of response resembled that of the waves conducted in 2005 and 2016.

Longitudinal studies are important to increase our understanding of changes in loneliness. Our data were collected several years apart, and it is likely that loneliness may have fluctuated within this period. More qualitative as well as quantitative work is needed to explore the stability and changes in levels of loneliness as well as the factors triggering loneliness (see e.g. Morgan and Burholt 2020; Prohaska *et al.* 2020).

Conclusion

Our results are consistent with those of previous longitudinal studies showing that loneliness is predicted by sociodemographic, social, and health-related risk factors. We also demonstrated the need to assess losses and changes in late life loneliness. Further, our study confirmed that most older adults do not experience loneliness, although longitudinal studies are highly important in identifying those at risk for enduring loneliness. Our study adds insights into a Nordic regional perspective on loneliness. Even though older people in Nordic countries experience lower loneliness compared to those in other European countries, our

study implies a diversity in loneliness and a need for further studies to explore the influence of within- and between-country differences.

References

Aartsen, M. and Jylhä, M. 2011. Onset of loneliness in older adults: results of a 28 year prospective study. *European Journal of Ageing,* **8**, 31–38.

Beasley, T.M. and Schumacker, R.E. 1995. Multiple regression approach to analyzing contingency tables: post hoc and planned comparison procedures. *The Journal of Experimental Education*, **64**, 79–93.

Boss, L., Kang, D.-H. and Branson, S. 2015. Loneliness and cognitive function in the older adult: A systematic review. *International Psychogeriatrics*, **27**, 1–13.

Brittain, K., Kingston, A., Davies, K., Collerton, J., Robinson, L.A., Kirkwood, T.B. and Jagger, C. 2017. An investigation into the patterns of loneliness and loss in the oldest old–Newcastle 85+ Study. *Ageing & Society*, **37**, 39– 62.

Chatfield, M.D., Brayne, C.E. and Matthews, F.E. 2005. A systematic literature review of attrition between waves in longitudinal studies in the elderly shows a consistent pattern of dropout between differing studies. *Journal of Clinical Epidemiology,* **58**, 13–19.

Cohen-Mansfield, J. and Perach, R. 2015. Interventions for alleviating loneliness among older persons: a critical review. *American Journal of Health Promotion*, **29**, 109 –25.

Coll-Planas, L., Nyqvist, F., Puig, T., Urrútia, G., Solà, I. and Monteserín, R. 2017. Social capital interventions targeting older people and their impact on health: a systematic review. *Journal of Epidemiology and Community Health*, **71**, 663 –72.

Coyle, C.E. and Dugan, E. 2012. Social isolation, loneliness and health among older adults. *Journal of Aging and Health,* **24**, 1346–63.

Dahlberg, L., Frank, A., Lennartsson, C., McKee, K., Naseer, M. and Rehnberg, J. 2020. *Ensamhet bland äldre personer i Norden*. Nordisk ministerråd, Copenhagen. Available online at http://norden.diva-portal.org/smash/get/diva2:1457841/FULLTEXT01.pdf [Accessed 3 February 2021].

Dahlberg, L., Andersson, L., McKee, K.J. and Lennartsson, C. 2015. Predictors of loneliness among older women and men in Sweden: A national longitudinal study. *Aging & Mental Health,* **19**, 409–417.

Dahlberg, L. and McKee, K.J. (2014) Correlates of social and emotional loneliness in older people: evidence from an English community study. *Aging & Mental Health*, **18**, 504–514.

Dahlberg, L., McKee, K.J., Frank, A. and Naseer, M. 2021. A systematic review of longitudinal risk factors for loneliness in older adults. *Aging & Mental Health*, 1-25. doi:10.1080/13607863.2021.1876638.

D'Ath, P., Katona, P., Mullan, E., Evans, S. and Katona, C. 1994. Screening, detection and management of depression in elderly primary care attenders: The acceptability and performance of the 15 item geriatric depression scale (GDS-15) and the development of shorter versions. *Family Practice*, **11**, 260–266.

DiTommaso, E., Fizell, S.R. and Robinson, B.A. 2015. Chronic loneliness within an attachment framework: Processes and interventions. In Sha'ked, A. and Rokach, A. (eds*), Addressing Loneliness: Coping, Prevention and Clinical Interventions.* Routledge, New York, 241–53.

Donovan, N.J., Wu, Q., Rentz, D.M., Sperling, R.A., Marshall, G.A. and Glymour, M.M. 2017. Loneliness, depression and cognitive function in older US adults. *International Journal of Geriatric Psychiatry,* **32**, 564–73.

Dykstra, P.A. 2009. Older adult loneliness: Myths and realities. *European Journal of Ageing*, **6**, 91–100.

Dykstra, P.A., van Tilburg, T.G. and de Jong Gierveld, J. 2005. Changes in older adult loneliness: Results from a seven-year longitudinal study. *Research on Aging,* **27**, 725–47.

Eloranta, S., Arve, S., Isoaho, H., Lehtonen, A. and Viitanen, M. 2015. Loneliness of older people aged 70: A comparison of two Finnish cohorts born 20 years apart. *Archives of Gerontology and Geriatrics*, **61***,* 254–60.

Garli, F. and Pettersson, Ö. 2011. Befolkningsutveckling och-prognoser: teori och tillämpning för Västerbottens län. CERUM, Umeå universitet. Available online at https://www.diva-portal.org/smash/get/diva2:426810/FULLTEXT01.pdf [Accessed 5 May 2021].

Hawkley, L.C. and Kocherginsky, M. 2018. Transitions in loneliness among older adults: A 5-year follow-up in the National Social Life, Health, and Aging Project. *Research on Aging*, **40**, 365 –87.

Holt-Lunstad, J., Smith, T.B., Baker, M., Harris, T. and Stephenson, D. 2015. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspectives on Psychological Science*, **10**, 227–37.

Holwerda, T.J., Beekman, A.T., Deeg, D.J., Stek, M.L., van Tilburg, T.G., Visser, P.J., Schmand, B.A., Jonker, C. and Schoevers, R. 2012. Increased risk of mortality associated with social isolation in older men: only when feeling lonely? Results from the Amsterdam Study of the Elderly (AMSTEL). *Psychological Medicine,* **42**, 843–853.

Hörnsten, C., Weidung, B., Littbrand, H., Carlberg, B., Nordström, P., Lövheim, H. and Gustafson, Y. 2016. High blood pressure as a risk factor for incident stroke among very old people: a population-based cohort study. *Journal of Hypertension*, **34**, 2059–65.

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

de Jong-Gierveld, J. 1987. Developing and testing a model of loneliness. *Journal of Personality and Social Psychology*, **53**, 119–28.

de Jong Gierveld, J., Dykstra, P.A. and Schenk, N. 2012. Living arrangements, intergenerational support types and older adult loneliness in Eastern and Western Europe. *Demographic Research,* **27**, 167–200.

de Jong-Gierveld, J. and Kamphuls, F. 1985. The development of a Rasch-type loneliness scale. *Applied Psychological Measurement*, **9**, 289–99.

de Jong Gierveld, J. and Tesch-Römer, C. 2012. Loneliness in old age in Eastern and Western European societies: Theoretical perspectives. *European Journal of Ageing*, **9**, 285–95.

Jylhä, M. 2004. Old age and loneliness: cross-sectional and longitudinal analyses in the Tampere Longitudinal Study on Aging. *Canadian Journal on Aging/La revue canadienne du vieillissement,* **23**, 157–68.

Kangas, O. and Kvist, J. 2019. Nordic welfare states. In Greve, B. (ed.) *Routledge Handbook of the Welfare State,* Routledge, London and New York, 124–36.

Katz, S. and Akpom, C.A. 1976. A measure of primary sociobiological functions. *International Journal of Health Services,* **6**, 493–508.

Lara, E., Caballero, F.F., Rico-Ulribe, L.A., Olaya, B., Haro, J.M., Ayuso-Mateos, J.L. and Miret, M. 2019. Are loneliness and social isolation associated with cognitive decline? *International Journal of Geriatric Psychiatry,* **34**, 1613–22.

Liu, B.S. and Rook, K.S. 2013. Emotional and social loneliness in later life: associations with positive versus negative social exchanges. *Journal of Social and Personal Relationships*, **30**, 813 –32.

Luanaigh, C.Ó. and Lawlor, B.A. 2008. Loneliness and the health of older people. *International Journal of Geriatric Psychiatry,* **23**, 1213 –21.

Luo, Y., Hawkley, L.C., Waite, L.J. and Cacioppo, J.T. 2012. Loneliness, health, and mortality in old age: A national longitudinal study. *Social Science & Medicine,* **74**, 907–14.

Lundberg, O. and Manderbacka, K. 1996. Assessing reliability of a measure of self-rated health. *Scandinavian Journal of Social Medicine,* **24**, 218–24.

Lykes, V.A. and Kemmelmeier, M. 2014. What predicts loneliness? Cultural difference between individualistic and collectivistic societies in Europe. *Journal of Cross-Cultural Psychology*, **45**, 468–90.

Masi, C.M., Chen, H.Y., Hawkley, L.C. and Cacioppo, J.T. 2011. A meta-analysis of interventions to reduce loneliness. *Personality and Social Psychology Review*, **15**, 219 –66.

McRae, K.D. 1999. *Conflict and Compromise in Multilingual Societies, Finland*. Wilfred Laurier University Press, Waterloo, ON, Canada.

Morgan, D.J. and Burholt, V. 2020. Loneliness as a biographical disruption—Theoretical implications for understanding changes in loneliness. *The Journals of Gerontology: Series B,* **75**, 2029 –39.

Mund, M., Freuding, M.M., Möbius, K., Horn, N. and Neyer, F.J. 2020. The stability and change of loneliness across the life span: A meta-analysis of longitudinal studies. *Personality and Social Psychology Review*, **24**, 24 –52.

Mushtaq, R., Shoib, S., Shah, T. and Mushtaq, S. 2014. Relationship between loneliness, psychiatric disorders and physical health? A review on the psychological aspects of loneliness. *Journal of Clinical and Diagnostic Research*, **8**, WE01–WE04.

Newall, N.E., Chipperfield, J.G. and Bailis, D.S. 2014. Predicting stability and change in loneliness in later life. *Journal of Social and Personal Relationships*, **31**, 335 –51.

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

Nyqvist, F., Nygård, M. and Scharf, T. 2019. Loneliness amongst older people in Europe: a comparative study of welfare regimes. *European Journal of Ageing*, **16**, 133–43.

Nyqvist, F., Nygård, M., & Snellman, F. 2021. Changes in active ageing in a Nordic regional context: Results based on the GERDA study in 2005 and 2016. *International Journal of Social Welfare,* **00**, 1–14. https://doi.org/10.1111/ijsw.12480

Nyqvist, F., Cattan, M., Conradsson, M., Näsman, M. and Gustafsson, Y. 2017. Prevalence of loneliness over ten years among the oldest old. *Scandinavian Journal of Public Health,* **45**, 411–18.

Nyqvist, F., Nygård, M. and Steenbeek, W. 2014. Social capital and self-rated health amongst older people in Western Finland and Northern Sweden: a multi-level analysis. *International Journal of Behavioral Medicine*, **21**, 337–47.

Perlman, D. and Peplau, L.A. 1981. Toward a social psychology of loneliness. *Personal Relationships,* **3,** 31–56.

Pinquart, M. and Sörensen, S. 2003. Risk factors for loneliness in adulthood and old age: A meta-analysis. In Shohov, S.P. (ed.), *Advances in Psychology Research*. Nova Science Publishers, Hauppauge, NY, 111–43.

Prohaska, T., Burholt, V., Burns, A., Golden, J., Hawkley, L., Lawlor, B., Leavey, G., Lubben, J., O'Sullivan, R., Perissinotto, C., van Tilburg, T., Tully, M., Victor, C. and Fried, L. 2020. Consensus statement: loneliness in older adults, the 21st century social determinant of health? *BMJ Open*, **10**, e034967.

Russell, D.W. 1996. UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, **66***,* 20–40.

Russell, D., Peplau, L.A. and Cutrona, C.E. 1980. The revised UCLA Loneliness Scale: concurrent and discriminant validity evidence. *Journal of Personality and Social Psychology*, **39***,* 472–80.

Schwarzbach, M., Luppa, M., Forstmeier, S., König, H.H. and Riedel□Heller, S.G. 2014. Social relations and depression in late life: A systematic review. *International Journal of Geriatric Psychiatry,* **29**, 1–21.

Stroebe, W., Zech, E., Stroebe, M.S. and Abakoumkin, G. 2005. Does social support help in bereavement? *Journal of Social and Clinical Psychology*, **27**, 1030–50.

Sullivan, C. and Infurna, F.J. 2020. The multidimensional nature of social support and engagement in contributing to adjustment following spousal loss. *Aging & Mental Health*, **24**, 857–69.

Sundström, G., Fransson, E., Malmberg, B. and Davey, A. 2009. Loneliness among older Europeans*. European Journal of Ageing,* **6**, 267–75.

Tijhuis, M.A., de Jong-Gierveld, J., Feskens, E.J. and Kromhout, D. 1999. Changes in and factors related to loneliness in older men: The Zutphen Elderly Study. *Age and Ageing*, **28**, 491–95.

Tilvis, R.S., Routsalo, P., Karppinen, H., Strandberg, T.E., Kautiainen, H. and Pitkälä, K.H. 2012. Social isolation, social activity and loneliness as survival indicators in old age: A nationwide survey with a 7-year follow-up. *European Geriatric Medicine*, **3**, 18–22.

Valtorta, N.K., Kanaan, M., Gilbody, S., Ronzi, S. and Hanratty, B. 2016. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart*, **102**, 1009–16.

Victor, C.R. and Bowling, A. 2012. A longitudinal analysis of loneliness among older people in Great Britain. *The Journal of Psychology*, **146**, 313–31.

Vozikaki, M., Papadaki, A., Linardakis, M. and Philalithis, A. 2018. Loneliness among older European adults: Results from the survey of health, aging and retirement in Europe. *Journal of Public Health,* **26**, 613–24.

Ware, J.E.Jr. and Sherbourne, C.D. 1992. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care,* **30**, 473–83.

Weiss, R.S. 1973. *Loneliness: The Experience of Emotional and Social Isolation.* MIT press, Cambridge, MA.

Yang, K. 2018. Longitudinal loneliness and its risk factors among older people in England. *Canadian Journal on Aging/La Revue canadienne du vieillissement,* **37**, 12 –21.

Yang, K. and Victor, C. 2011. Age and loneliness in 25 European nations. *Ageing & Society*, **31**, 1368–88.

Table 1. Sample characteristics at 2010 and 2016, n=4269.

Characeristics	2010 % (n)	2016 % (n)
Female gender	53.6 (2289)	
Age group (2010)		
65	44.6 (1906)	
70	26.1 (1113)	
75	18.6 (794)	
80	10.7 (456)	
Region		
Västerbotten, Sweden	57.8 (2466)	
Österbotten, Finland	27.7 (1182)	
Pohjanmaa, Finland	14.5 (621)	
Lower secondary education	43.5 (1819)	
Civil status		
Married, cohabiting, living apart with a partner	77.1 (3260)	72.1 (3045)
Widowed	12.3 (521)	18.0 (761)
Divorced, not married	10.6 (449)	9.9 (416)
Making ends meet with di□culties	38.0 (1541)	33.3 (1387)
Loneliness	7.8 (331)	10.3 (441)
Infrequent contacts with family and relatives	35.1 (1481)	40.0 (1679)
Infrequent contacts with friends and neighbours	53.5 (2219)	55.2 (2269)
Low trust in friends or neighbours	28.9 (1220)	36.0 (1553)
0-1 confidant	28.2 (1191)	35.8 (1500)
None or passive membership in associations	45.7 (1934)	49.4 (2068)
Poor self-rated health	29.2 (1236)	38.6 (1637)
Depression	9.7 (410)	12.3 (519)
Dependent in IADL	25.9 (1045)	42.7 (1717)

Dependent in PADL	4.3 (184)	6.4 (271)

Table 2. The distribution (%) of respondents reporting loneliness in 2016 by 2010 sociodemographic, social and health-related variables.

	Lonely in 2016 % (n=441)	
Gender		***
Female (n=2289)	12.3 (282)	
Male (n=1980)	8.0 (159)	
Age (2010)		***
65 (n=1906)	7.7 (146)	
70 (n=1113)	9.9 (110)	
75 (n=794)	13.7 (109)	
80 (n=456)	16.7 (76)	
Region		*
Västerbotten, Sweden (n=2466)	11.2 (276)	
Österbotten, Finland (n=1182)	8.5 (101)	
Pohjanmaa, Finland (n=621)	10.3 (64)	
Civil status		***
Married, cohabiting, living apart with a partner (n=3260)	7.8 (255)	
Widowed (n=521)	21.7 (113)	
Divorced, not married (n=449)	15.4 (69)	
Education		
Lower secondary (n=1819)	11.0 (200)	
Higher secondary (n=2358)	9.5 (225)	
Making ends meet		***
Without di□culties (n=2509)	8.0 (201)	
With difficulties (n=1541)	13.8 (213)	
Loneliness 2010		***
Yes (n=331)	43.2 (143)	
No (n=3938)	7.6 (298)	
Contacts with family and relatives		**
Frequent (n=2733)	9.4 (257)	
Infrequent (n=1481)	12.0 (177)	
Contacts with friends and neighbours		
Frequent (n=1927)	9.7 (197)	
Infrequent (n=2219)	10.7 (238)	
Trust in friends or neighbours		***
High (n=3003)	8.5 (255)	
Low (n=1220)	14.6 (178)	
Number of confidants		***
0-1 (n=1191)	13.2 (157)	
2 or more (n=3031)	9.2 (278)	
Active membership in an association		*

None or passsive (n=1934)	11.4 (220)	
Active (2297)	9.4 (216)	
Self-rated health		***
Good (n=2999)	7.7 (231)	
Poor (n=1236)	16.4 (203)	
Depression		***
No (n=3838)	8.3 (320)	
Yes (n=410)	27.6 (113)	
Independent in IADL		**
Yes (n=2986)	9.1 (271)	
No (n=1045)	12.6 (132)	
Independent in PADL		
Yes (n=4047)	10.2 (413)	
No (n=184)	12.0 (22)	

Significance levels: * p < 0.05, ** p < 0.01, *** p < 0.001

Table 3. The distribution (%) of respondents reporting loneliness in 2016 by 2010-2016 changes.

	Lonely in 2016 (n=441) % (n)	
Becoming widowed		***
No (n=3888)	9.2 (357)	
Yes (n=295)	25.1 (74)	
Changes in making ends meet		
No change, positive change (n=3414)	9.8 (334)	
Negative change (n=534)	12.0 (64)	
Changes in contacts with family and relatives		
No change, positive change (n=3507)	10.0 (351)	
Negative change (n=644)	11.8 (76)	
Changes in contacts with friends and neighbours		
No change, positive change (n=3364)	9.7 (327)	
Negative change (n=650)	11.5 (75)	
Changes in trust in friends or neighbours		*
No change, positive change (n=3542)	9.8 (347)	
Negative change (n=675)	12.6 (85)	
Changes in number of confidants		***
No change, positive change (n=3383)	9.4 (317)	
Negative change (n=756)	14.0 (106)	
Changes in associational activity		
No change, positive change (n=3576)	9.7 (348)	
Negative change (n=585)	12.1 (71)	

Changes in self-rated health		***
No change, positive change (n=3530)	9.5 (336)	
Negative change (n=674)	13.9 (94)	
Changes in depression		***
No change, positive change (n=3862)	7.1 (276)	
Negative change (n=348)	41.1 (143)	
Changes in independent in IADL		*
No change, positive change (n=2970)	9.4 (280)	
Negative change (n=852)	12.0 (102)	
Changes in independent in PADL		***
No change, positive change (n=3962)	9.8 (387)	
Negative change (n=237)	19.4 (46)	

Significance levels: * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4. Odds ratios (OR) and 95% confidence intervals (CI) for the probability of feeling lonely in 2016.

	Model 1			Model 2			Model 3			Model 4		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Female gender	1.38	(1.08-1.77)	*	1.35	(1.04-1.76)	*	1.22	(0.92-1.60)		1.19	(0.86-1.63)	
Age group (2010)												
65	1.00			1.00			1.00			1.00		
70	1.29	(0.97-1.74)		1.28	(0.94-1.74)		1.16	(0.85-1.59)		1.06	(0.74-1.53)	
75	1.59	(1.16-2.17)	**	1.52	(1.09-2.12)	*	1.22	(0.86-1.73)		1.06	(0.71-1.58)	
80	1.92	(1.32-2.77)	**	1.65	(1.10-2.47)	*	1.33	(0.88-2.04)		1.06	(0.64-1.75)	
Civil status												
Married, cohabiting	1.00			1.00			1.00			1.00		
Widowed	1.65	(1.20-2.62)	**	1.77	(1.27-2.48)	**	2.06	(1.42-2.99)	***	2.66	(1.73-4.10)	***
Divorced, not married	1.48	(1.06-2.08)	*	1.55	(1.09-2.20)	*	1.79	(1.23-2.59)	**	2.15	(1.41-3.28)	***
Region												
Västerbotten, Sweden	1.00			1.00			1.00			1.00		
Österbotten, Finland	0.65	(0.49-0.86)	**	0.58	(0.43-0.79)	***	0.64	(0.64-0.87)	**	0.61	(0.42-0.88)	*
Pohjanmaa, Finland	0.87	(0.62-1.21)		0.81	(0.57-1.15)		0.85	(0.59-1.22)		0.88	(0.57-1.34)	
Lower secondary education	1.03	(0.81-1.30)		0.96	(0.75-1.23)		0.92	(0.71-1.19)		0.92	(0.68-1.24)	
Making ends meet with di□culties	1.38	(1.10-1.74)	**	1.23	(0.96-1.58)		1.26	(0.96-1.66)		1.13	(0.81-1.58)	
Social variables												
Loneliness in 2010	6.93	(5.22-9.21)	***	5.52	(3.99-7.64)	***	7.17	(5.27-9.75)	***	5.88	(4.02-8.63)	***
Infrequent contacts with family and relatives	1.18	(0.93-1.50)		1.15	(0.89-1.48)		1.37	(1.03-1.82)	*	0.78	(0.57-1.09)	
Infrequent contacts with friends and neighbours	1.04	(0.82-1.32)		0.96	(0.89-1.48)		1.19	(0.87-1.63)		1.02	(0.71-1.45)	
Low trust in friends or neighbours	1.61	(1.26-2.06)	***	1.49	(1.15-1.94)	**	1.76	(1.31-2.35)	***	0.76	(0.54-1.06)	
Number of confidants, 0-1	1.15	(0.89-1.49)		1.13	(0.86-1.48)		1.10	(0.81-1.50)		0.93	(0.65-1.33)	
Passive or no membership in an association	1.02	(0.81-1.29)		0.98	(0.76-1.25)		1.08	(0.81-1.44)		0.89	(0.64-1.249	
Health-related variables												

Poor self-rated health			1.73	(1.34-2.24)	***				1.85	(1.31-2.62)	***
Depression			1.61	(1.15-2.25)	**				1.28	(0.87-1.89)	
Dependency in IADL			1.29	(0.98-1.71)					0.86	(0.59-1.26)	
Dependency in PADL			0.96	(0.53-1.74)					1.13	(0.51-2.46)	
Changes from 2010 to 2016											
Sociodemographic variables											
Recent widowhood						4.87	(3.34-7.11)	***	4.54	(2.95-6.99)	***
Difficulties in making ends meet increment						1.10	(0.92-1.31)		1.08	(0.69-1.70)	
Social variables											
Freqent contacts with family and relatives reduction						1.37	(0.96-1.95)		1.29	(0.86-1.95)	
Frequent contacts with friends and neighbours reduction						1.44	(0.98-2.11)		1.28	(0.83-1.98)	
High trust in friends and neighbours reduction						1.30	(0.91-1.85)		1.00	(0.67-1.49)	
Numbers of confidants (2 or more) reduction						1.29	(0.94-1.79)		1.29	(0.89-1.87)	
Associational acivity reduction						1.29	(0.89-1.87)		1.13	(0.74-1.73)	
Health-related variables											
Poor self-rated health increment									1.42	(0.94-2.14)	
Depression increment									2.90	(2.44-3.46)	***
Dependency in IADL increment									1.40	(0.97-2.03)	
Dependency in PADL increment									1.30	(0.75-2.26)	
Log likelihood	2149.152		1942.473			1812.649			1387.684		
Cox and Snell R2	0.078		0.086			0.093			0.140		
Nagelkerke R2	0.165		0.184			0.204			0.313		

Significance levels:
* $p < 0.05$,
** $p < 0.01$,
*** $p < 0.001$.