OSLOMET

Development of loneliness among older adults after retirement

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Foreword

This master thesis is the final work of the master program in International Social Welfare and Health Policy, Oslo Metropolitan University. It serves as documentation of my research during the study, which has been made from August 2018 until January 2021. It presents the results of a study towards development of loneliness among older adults and the factors leading to loneliness after retirement. My interest in this topic arises, as loneliness has become an important issue among older adults because of the increase in the life expectancy of people.

It was a true learning experience and I had fun digging into many, many books and documentations on this subject but it was also a road paved with delays and unexpected problems.

Lastly, may this thesis be useful for readers and for future research about similar topics or any other related field.

Oslo, November 12, 2020
Apsara Sapkota

Table of content

Part I Introductory chapter

1. Introduction

The increase in the life expectancy of people has made retirement a very long and meaningful phase in later life. The proportion of older adults in general, and retirees in particular, continue to rise (Jonsson, 2011; Toossi, 2004). Thus, an in-depth examination of the social and emotional functioning of older adults after retirement is needed. The present study aims to examine if there is an increase in loneliness among older adults (57 years and above) after retirement and the factors leading to loneliness after retirement; the geographic focus is Norway.

A commonly used definition of loneliness is that it involves an unwanted discrepancy between the quality and quantity of relationships one has and the ones one would like to have (Perlman & Peplau, 1981). Definitions of loneliness give more importance to the feeling of being socially isolated, contrary to being alone (Luhmann & Hawkley, 2016; Letitia Anne Peplau & Perlman, 1982).

Retirement is one of the major transitions among older adults (Fonseca, Kapteyn, Lee, Zamarro, & Feeney, 2014). The age of eligibility for retirement in Norway is 67 years (Rogne & Syse, 2018). They can take early retirement at the age of 62 and have the right to continue their work until 70 years of age (Hernoes, Sollie, & Strøm, 2000; Midtsundstad, 2014). After the age of 70, it depends on the employer's decision to keep them at work or not (Midtsundstad, 2014). The transition to retirement is linked with a decrease in the social contacts of the individual (Ayalon, Palgi, Avidor, & Bodner, 2016). This decrease in social contacts makes an individual socially isolated and may lead to experience the feeling of loneliness after retirement.

Loneliness has been considered a major research topic in social, health, and developmental psychology. There is a large number of empirical studies reporting that loneliness is a risk factor for numerous health-related problems, including insomnia (Luanaigh & Lawlor, 2008), early aging (Louise C Hawkley & Cacioppo, 2007), high chance of early mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Holwerda et al., 2012), and depressive symptomatology (J. T. Cacioppo, Hawkley, & Thisted, 2010; Luanaigh & Lawlor, 2008).

People after retirement undergo various changes in their life. There might be a decrease in social

contacts, they have more spare time, and there might be a change in the diet, alcohol, and cigarette consumption. Some of them even lose their partner and might become more isolated. All these circumstances can increase social isolation, which may lead to a feeling of loneliness. Since not all people become lonely after retirement, it is of interest to know which factors lead to being lonely. In this study, I investigate two main research question, which are:

    a. Is there an increase in the percentage of males and females feeling lonely after retirement?
    b. Which factors lead to loneliness after retirement?

I do this research through a quantitative study. I use the second wave and third wave data from the population-based Norwegian Life Course, Aging, and Generation (NorLAG), which were collected in three waves by Statistics Norway in collaboration with Norwegian Social Research (NOVA). The article is written for the European Journal of Ageing.

2. Theoretical framework

Theories on the relations between loneliness and age focus mainly on changes in social relationships and networks as determinants of loneliness. According to these theories, loneliness increase in old age when there is a decrease in the size of social network and emotional support as a result of the death of their partners through retirement and decreased physical mobility (Pinquart & Sorensen, 2001). The feeling of loneliness also increases among older people when there is a decrease in social activities. According to the activity theory and continuity theory, this increased feeling of loneliness maybe because of the incapability of people to replace new activities or roles which are lost (Aartsen & Jylhä, 2011).

In contrast, there are also some studies that do not assume an age-related increase in loneliness. For instance, according to socioemotional selectivity theory, older people focus more on an emotionally rewarding relationship than younger people, and they stay away from social contacts which are emotionally unpleasant (Carstensen, Isaacowitz, & Charles, 1999). Thus, older people may continue the types of social relationships, which are important to combat loneliness. This theory is also supported by recent empirical evidence which shows that although the frequency

of social contacts declines with increasing age, the frequency of contact with family members remains stable throughout their life, which may be very important to provide emotional support (Sander, Schupp, & Richter, 2017). Furthermore, the quality of the relationship among older people is high (Pearl A. Dykstra, Theo G. van Tilburg, & Jenny de Jong Gierveld, 2005), which may prevent them from experiencing the feeling of loneliness. At the same time, more frequent and more serious health problems, physical limitations such as sensory deficits, death of their spouse and friends, adult children not sharing the same household with their parents may limit the social interactions to a severe level in old age, thereby increasing the feeling of loneliness. In addition to this, they have lower relationship quality as it is difficult for them to maintain social ties (Pinquart & Sorensen, 2001).

We can find different views regarding the association between loneliness and age. For example, loneliness is not confined to people who are old. Rather it is faced by the people of all age groups (J. T. Cacioppo et al., 2010; Jong-Gierveld, van Tilburg, & Dykstra, 2006). According to Wiseman and Barber (2008), feeling of loneliness is also experienced by teenagers as well as children. A cross-sectional study done on the American and Asian college students found that every individual experience the feeling of loneliness at some point in their life, which doesn't depend on age, gender, social strata, education, and relationship status (Medora, Woodward, & Larson, 1987).

Many cross-sectional studies show that levels of loneliness increase in old age. For instance, a cross-sectional study in 25 European nations reported an increased level of loneliness in old age (Yang & Victor, 2011). Similar findings were obtained in a study using cross-sectional data in Ankara, reporting that loneliness increases with age (Hazer & Boylu, 2010). Similarly, another cross-sectional study from the United Kingdom found non-linear age differences, with a slight decrease in the level of loneliness in people in their 60s and the level of loneliness increase again in their 80s (Demakakos, Nunn, & Nazroo, 2006). Another cross-sectional study which used data from 11 European countries reported that the level of loneliness is high in late life (Hansen & Slagsvold, 2016).

There are many longitudinal studies that show the feeling of loneliness increases with increasing age among people who are 65 years or older (Dahlberg, Andersson, McKee, & Lennartsson, 2015; Pearl A Dykstra, Theo G Van Tilburg, & Jenny De Jong Gierveld, 2005; Louise C. Hawkley & Kocherginsky, 2018; Heikkinen & Kauppinen, 2011). The feeling of loneliness increases with age at a population level (Heikkinen & Kauppinen, 2011). However, the pattern may be different at an individual level. For instance, a longitudinal study among older people aged 65 years and above in Great Britain has shown that loneliness can increase and decrease over time. There was an increase in loneliness in 15% of a sample of older people and a decrease in 25% of the sample over an eight-year period (Victor & Bowling, 2012).

Although most of the studies show an increase in loneliness with age, the level of increase in loneliness is uncertain. For example, the Bangor Longitudinal Study of Ageing shows a moderate increase in the level of loneliness in elderly people (Wenger & Burholt, 2004). Another longitudinal study in Isreal shows an increase in the mean level of loneliness with an increase in age (Cohen-Mansfield, Shmotkin, & Goldberg, 2009). While a longitudinal study done in the United Kingdom show a minor increase in loneliness across old age (Victor & Bowling, 2012). There are different results, which may be due to crude analytical approaches used in most of the studies to study changes in the level of loneliness. Thus, very limited information is provided by the research about longitudinal changes in the level of loneliness at specific ages.

There are different life courses for men and women, especially as they get older. Older women, more often than men, live alone (Nolen-Hoeksema & Rusting, 1999). On average, women live longer than men and tend to marry men who are older than themselves, which means that women are more likely to enter widowhood and at a younger age than men (Cohen-Mansfield et al., 2009; Lennartsson & Lundberg, 2007). The level of loneliness is thus higher for women than for men in late life (Hansen & Slagsvold, 2016).

People experience a feeling of loneliness in different ways (H. Z Lopata, 1969; H.Z Lopata, 1979). According to Weiss, the concept of loneliness is divided into two categories: social and emotional loneliness. There is a lack of satisfying social network and feeling of being rejected in social loneliness, whereas emotional loneliness is the state of not having a close committing

relationship such as an intimate partner (Russell, Cutrona, Rose, & Yurko, 1984). There are different predicators for social and emotional loneliness (Van Baarsen, Snijders, Smit, & Van Duijn, 2001). For instance, low income, poor health, lack of contact with family, and friends are the predicators of social loneliness. Whereas, marital status, particularly being a widow, lack of contacts with family and relatives, and low income are the predicators of emotional loneliness (Dahlberg & McKee, 2014; Drennan et al., 2008). A cross-sectional study on older people aged 65 and over in Ireland reported that the level of emotional loneliness is higher than social loneliness among the elderly (Drennan et al., 2008). This is because people need more affection and intimacy as they grow older (de Jong Gierveld, Broese van Groenou, Hoogendoorn, & Smit, 2009).

Although the feeling of loneliness increases with an increase in age, most of the scientific studies show that the frequency of severe loneliness among older adults is comparatively less. This ranges from 3% in Nordic countries to approximately 30% in southern European countries (Jylhä & Jokela, 1990). A cross-national survey consisting of data from 12 European countries on people aged 65 years or older also found that older people from northern Europe, particularly Nordic countries experience less feeling of loneliness than in southern Europe (Sundström, Fransson, Malmberg, & Davey, 2009) which is because of being unmarried, economic hardship and bad health condition in southern Europe (Fokkema, De Jong Gierveld, & Dykstra, 2012).

Factors leading to loneliness

(a) Social relationships: Most of the studies have mentioned that quality of relationships plays a vital role in loneliness than quantity (Louise C Hawkley et al., 2008; Pinquart, 2003; Pinquart & Sorensen, 2001). There are some studies that focus on indicators of good relationships, such as having close friends or having a spouse/cohabitating partner as predicator of loneliness. For instance, a review shows that loneliness is higher in non-married status in older people. This is because married people get company from their spouse and spouse's social network. In the same way, a meta-analysis reported that a good relationship with spouse and adult children is associated with a low level of loneliness in older people (Pinquart, 2003). Moreover, older people are not included in social relations (Precupetu, Aartsen, & Vasile, 2019), which may be

because of disabilities and mobility difficulties. This social exclusion results in lower mental wellbeing in older people (Burholt et al., 2019; Precupetu et al., 2019).

(b) Personality: Extraversion plays a vital role in making people busy in social interactions, which might prevent loneliness. In addition to this, extraversion is associated with positive affect (Larsen & Ketelaar, 1991; Lucas & Fujita, 2000). In the same way, a high level of neuroticism is associated with an increase in sensitivity to negative stimuli (Larsen & Ketelaar, 1991). Thus, people who have a high level of neuroticism may experience more feelings of loneliness than people who are emotionally stable. This is because these people have high relationship distress, and they normally take and explain social situations in a pessimistic way (Ozer & Benet-Martinez, 2006).

There are some cross-sectional studies on adolescents (Asendorpf & Van Aken, 2003; Vanhalst et al., 2012) and undergraduate students (J. T. Cacioppo et al., 2006; Saklofske & Yackulic, 1989; Stokes, 1985). All of these cross-sectional studies reported that low levels of extraversion and high levels of neuroticism are related to an increase in the feeling of loneliness. Other cross-sectional studies on older adults also show that a high level of neuroticism and low level of extraversion is associated with a high level of loneliness (Hensley et al., 2012; Long & Martin, 2000). A longitudinal study, which examined the association between big five personality traits and loneliness, shows that neuroticism is associated with a high level of loneliness in young adults over a 15-year period. But, predicative effect in changes in the level of loneliness was not shown by other personality traits (Mund & Neyer, 2016).

(c) Socioeconomic status: Loneliness is higher in low educated people because of less possibilities of participating in social activities and size of the social network being smaller (Pinquart & Sorensen, 2001; Routasalo & Pitkala, 2003; Savikko, Routasalo, Tilvis, Strandberg, & Pitkälä, 2005). However, the association between education and loneliness was weaker than income and loneliness (Pinquart & Sorensen, 2001). The cross-sectional study on older people (aged 51 and above) of 14 European countries shows that there is a higher risk of loneliness among the people who are poor and do not participate in social activities (Niedzwiedz et al., 2016). A longitudinal study on the older adult in the gap of 3.5 years shows that lack of sufficient financial resources is associated with an increased level of loneliness, even when controlling for

several covariates (Cohen-Mansfield et al., 2009). In contrast to this, a longitudinal study on Dutch nationality aged 55-85 years that used 16-years longitudinal data found that socioeconomic status is not associated with loneliness (Kok, Aartsen, Deeg, & Huisman, 2016).

(d) Physical health problem: Loneliness is higher in people with poor health and functional limitations (Cohen-Mansfield et al., 2009; Pearl A Dykstra et al., 2005). A longitudinal study in people aged 60 and over in Finland with a follow-up time of 20 years shows that level of loneliness increases with age because of an increase in disability in the old people (Jylhä, 2004). Results from seven years of the longitudinal study show that level of loneliness increases in the people who initially have good health and subsequently face health problems (Pearl A. Dykstra et al., 2005).

Summary and implication

Previous research indicates that there is a higher risk for an increase in the feeling of loneliness among older adults, especially after retirement, as there is a reduction in social contacts and loss of social roles. In addition to this, there are also other factors such as social relationships, socioeconomic factors, personal characteristics, and physical health conditions, which might play an important role in increasing the feeling of loneliness among older adults. Being a widow, being divorced, having bad health conditions, poor financial conditions, introvert nature of the individual leads to a higher risk for an increase in loneliness among older adults. These factors will be included in my study in order to investigate whether the increased loneliness varies between different groups of individuals.

3. Method and data

Data is derived from NorLAG comprising a nationally representative sample from 30 municipalities and townships in Norway. Data collection was carried out through computer-assisted telephone interviews and self-administered postal questionnaires. NorLAG database includes a wide range of information on core life domains for a total of 11,028 respondents born between 1922 and 1966, along with their close family members. Annual data from public registers were added with the respondent's informed consent. To date, three waves of survey data collection have been conducted. The first wave (T1) of data collection was done in 2002

(N=5,559).

I use second wave (T2) and third wave (T3) data for my study. The study sample was N= 1,040 when I started. Since there were some missing values on loneliness 2007 and loneliness 2017, the study sample is reduced to N= 903 for 2007 and N= 836 for 2017. The study sample consists of the people born between 1932-1960, working during T2, and got retired during T3.

The analysis was directed towards determining models to predict loneliness in older adults after retirement from the data collected in 2007 and 2017 and from examining the contribution of changes in variables assessed in 2007 and 2017. Descriptive analysis of the major variables was performed for entire samples and for males and females for both periods. After that, I carried out a probability model to find out the probability of feeling lonely after retirement. The first probability model showed that there was a significant effect of the probability of feeling lonely before retirement on the probability of feeling lonely after retirement. So, another probability model was carried out to identify the probability of feeling lonely before retirement. The criterion for test significance for the analysis was $p < .05$. IBM Statistical Package for Social Science (SPSS) for Windows was used to analyze the data.

4. Findings

The descriptive statistics of the variables included in the study (N=903 for 2007 and N= 836 for 2017) are shown in table 1 and table 2. Table shows that there is a slight increase in the mean value of loneliness among males and females in 2017 compared to 2007. Among males, the percentage of the participants feeling lonely increases from 20% to 22% from 2007 to 2017. Whereas, among females, the percentage of participants feeling lonely increases from 24.8% to 25.2% from 2007 to 2017.

Table 3. shows the probability of feeling lonely in 2017 in the entire sample, analyzed by a linear probability model. There is a significant effect ($p < 0.001$) of loneliness 2007 on loneliness 2017. The probability of feeling lonely in 2007 compared to the probability of not feeling lonely in 2007 increase the probability of feeling lonely in 2017 by 24 percentage points in the entire sample when there is a control for many other factors.

Civil status also has a significant effect (widow $p < 0.001$ and divorced $p < 0.05$) on the probability of feeling lonely in 2017. Being a widower compared to being married in 2017 increases the probability of feeling lonely in 2017 by 21 percentage points. Similarly, being divorced compared to being married in 2017 increases the probability of feeling lonely in 2017 by 10 percentage points. Income also has a significant effect ($p < 0.05$) on the probability of feeling lonely in 2017.

Even when the probability model is splitted by gender, there is a significant effect ($p < 0.001$) of loneliness 2007 on loneliness 2017 for both males and females. The probability of feeling lonely in 2007 compared to the probability of not feeling lonely in 2007 increases the likelihood of feeling lonely in 2017 by 26 percentage points among males and 23 percentage points among females when controlling for many other factors. Being a widower compared to being married in 2017 increases the likelihood of feeling lonely in 2017 by 23 percentage points among males and 18 percentage points among females. Among females, there is a significant effect ($p < 0.05$) of higher-level university education on loneliness 2017. Having a higher-level of university education compared to not having university education in 2017 decreases the likelihood of feeling lonely in 2017 by 20 percentage points. There was also a significant effect of income ($p < 0.05$) in the probability of feeling lonely in 2017 among females.

Results from table 3 show that there is not any effect of age and number of years of retirement on loneliness after retirement. However, there are effects of other factors that might change over the life course. In addition, there is a significant effect of loneliness before retirement on loneliness after retirement. Hence, the situation before retirement seems to be of importance for the probability of feeling lonely after retirement. In order to see the positive and negative effect of various factors in loneliness before retirement, another linear probability model will be carried out by taking loneliness 2007 as a dependent variable. In this, I include functional limitations, social contacts, extraversion, neuroticism, and agreeableness variables to see its effect on the probability of feeling lonely before retirement.

The probability of feeling lonely in 2007 in the entire sample and among males and females is shown in table 4. There is a significant effect ($p < 0.05$) of age on the probability of feeling lonely in 2007 in the sample. An increase in age in 2007 increases the likelihood of feeling lonely in 2007 by 1 percentage point when controlling for many other factors.

There is a significant effect of civil status (single $p < 0.01$, widow $p < 0.05$, and divorced $p < 0.001$) on the probability of feeling lonely in 2007 for the entire sample. Being single, a widower, and being divorced compared to being married in 2007 increases the likelihood of feeling lonely in 2007 by 17 percentage points. Individuals without social contacts compared to individuals having social contacts in 2007 decreases the likelihood of feeling lonely in 2007 by 9 percentage points. This effect was also significant ($p < 0.01$). There was also a significant effect ($p < 0.001$) of neuroticism in 2007 on the probability of feeling lonely in 2007 in the sample. This means that there is an increase in the probability of feeling lonely in 2007 with an increase in neuroticism in 2007.

After splitting the probability model by gender, there was a significant effect ($p < 0.05$) of age on the probability of feeling lonely in 2007 among males. An increase in age in 2007 increases the likelihood of feeling lonely in 2007 by 1 percentage point among males when there is a control for many other factors. Being single and being divorced compared to being married in 2007 increases the likelihood of feeling lonely by 17 and 15 percentage points among males. Whereas, being divorced compared to being married in 2007 increases the likelihood of feeling lonely in 2007 by 19 percentage points among females. Having bad health condition compared to having good health condition in 2007 increases the probability of feeling lonely in 2007 by 13 percentage points among males. There was also a significant effect ($p < 0.05$) of individuals without social contacts compared to individuals having social contacts among both males and females on loneliness 2007. The likelihood of a decrease in the probability of feeling lonely in 2007 is 9 percentage points for both males and females. Moreover, with an increase in extraversion in 2007 there is a decrease in the probability of feeling lonely in 2007 among females by 1 percentage points. There was also a significant effect ($p < 0.001$) of neuroticism in 2007 on the probability of feeling lonely in 2007 among both males and females. This implies

that with an increase in neuroticism, there is an increase in the probability of feeling lonely in 2007.

The model explains 9% of the variation in loneliness for the entire sample, 7.8% of the variation in loneliness for males, and 8.9% of the variation in loneliness for females after retirement. Whereas, the model explains 13.9% of the variation in loneliness for the entire sample, 12.7% of the variation in loneliness for males, and 13.5% of the variation in loneliness for females before retirement.

5. Discussion and conclusion

This study examined the probability of feeling lonely before and after retirement and the factors that lead to loneliness. There is a slight increase in the percentage of males and females feeling lonely after retirement. The probability of feeling lonely compared to the probability of not feeling lonely before retirement increases the probability of feeling lonely after retirement in the entire sample and among males and females. Being a widower compared to being married also increases the probability of feeling lonely in the entire sample and among males and females. However, there is not any effect of being divorced in the probability of feeling lonely among males and females after retirement.

Having a higher level of university education compared to not having university education decreases the probability of feeling lonely among females. This result is supported by the research done by Pinquart and Sorensen (2001), which mentioned that people with higher education are connected to a better knowledge of opportunities for social interaction that decreases the feeling of loneliness. In addition to this, there is an increase in the probability of feeling lonely with an increase in income in the entire sample and among females. This finding is in contrast with the results of other research (Pinquart & Sorensen, 2001; Routasalo & Pitkala, 2003; Savikko et al., 2005).

Since loneliness after retirement is more associated with loneliness before retirement, another probability model was carried out to examine the probability of feeling lonely before retirement. The probability model shows that there are increases in the probability of feeling lonely with an

increase in age in the entire sample and among males before retirement. This general increase in loneliness with age is supported by previous research (Dahlberg et al., 2015; Pearl A Dykstra et al., 2005; Louise C. Hawkley & Kocherginsky, 2018; Heikkinen & Kauppinen, 2011). However, there is no effect of age on the probability of feeling lonely among females.

Being single and being divorced compared to being married increases the probability of feeling lonely among males before retirement. Whereas, being divorced compared to being married increases the probability of feeling lonely among females before retirement. Nevertheless, in the entire sample, being single, being a widower, and being divorced compared to being married increases the probability of feeling lonely before retirement. This finding is supported by previous research (Pinquart, 2003). Results from the longitudinal studies demonstrate that loneliness is higher in people with poor health (Cohen-Mansfield et al., 2009; Pearl A Dykstra et al., 2005). In my analysis also, there is an increase in the probability of feeling lonely among males with a bad health condition.

In research by Carstensen, Isaacowitz, and Charles (1999), older adults focus more on emotionally rewarding relationships than younger people. Therefore, they stay away from social contacts that are emotionally unpleasant. In my study also, people without social contacts have less probability of feeling lonely in the entire sample and among females. This is also supported by another research (Sander et al., 2017), which mentions that although there is a decline in the frequency of social contacts with increasing age, the frequency of contact with family members remains stable throughout their life, which may be very important to provide emotional support.

There is a decrease in the probability of feeling lonely with an increase in the value of extraversion among females. This result is in line with the research done by Larsen and Ketelaar (1991), and Lucas and Fujita (2001), illustrate that extraversion is associated with a positive effect, which plays the main role in making people busy in social interactions that might prevent from loneliness.

There is an increase in the probability of feeling lonely with an increase in the value of neuroticism in the entire sample and among males and females. This result is supported by

previous research. Research done by Ozer and Benet- Martinez (2006) shows that a high level of neuroticism leads to dissatisfaction, conflict, and finally, dissolution of a close relationship that further increases the feeling of loneliness. In the same way, another study by Larsen and Ketelaar (1991) illustrates that a high level of neuroticism is associated with an increase in sensitivity to negative stimuli, and thus, individuals who have a high level of neuroticism may experience more feeling of loneliness than people who are emotionally stable.

The factors that explain the probability of feeling lonely before and after retirement for the entire sample and among males and females are not the same. For the entire sample, age and being single explain the probability of feeling lonely before retirement but not after retirement. Whereas, income explain the probability of feeling lonely after retirement but not before retirement. Among males, age, being single, being divorced, and having bad health conditions explain the probability of feeling lonely before retirement but not after retirement. Whereas, being a widow explain the probability of feeling lonely after retirement but not before retirement. Among females, being divorced explains the probability of feeling lonely before retirement but not after retirement. However, being a widow, high university education, and income explain the probability of feeling lonely after retirement but not before retirement.

This study provides novel information on nature and factors leading to loneliness before and after retirement among older adults. However, there are some limitations to this study. The first limitation is that interpretive caution is warranted as there is a limited study sample. The effect may not be identifiable in small samples due to large random sampling errors if the intensity of a population effect is low to medium (Rosenthal, 1984). Another limitation of this study is my inability to include other aspects, such as family contact and relationship that could moderate the feeling of loneliness among older adults.

Overall, it is found that there is an increase in the probability of feeling lonely among older adults after retirement when there is a control for loneliness before retirement. For the entire sample, age, being single, being a widow, being divorced, without social contacts, and neuroticism were the factors that lead to loneliness before retirement. Among males, age, being single, being divorced, bad health condition, without social contacts, and neuroticism predicted

loneliness, and among females being divorced, without social contacts, extraversion and neuroticism predicted loneliness before retirement. Whereas, loneliness before retirement, being a widow, being divorced, and income were the factors that lead to loneliness in the entire sample after retirement. Among males, loneliness before retirement and being a widow are the predicators of loneliness, and among females, loneliness before retirement, being a widow, higher university education, and income were the predicators of loneliness after retirement. Thus, the factors that lead to loneliness are social relationships, personality traits, socioeconomic status, and physical health.

In other words, this study shows that there are both shared and different predicators for loneliness among males and females, and those significant predicators for loneliness among males and females separately may not be significant in the entire sample. Similarly, an overall model of predicators of loneliness in older adults may tell us little about the predicators for males and, females respectively. This study contributes to existing knowledge and paves the way for future research aiming at better understanding of the predicators for loneliness among older adults after retirement.

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Table 1. Socio-demographic characteristics of males and females 2007 and 2017

| | 2007 | | | | | | | | | | 2017 | | | | | | | | | |
| | Males | | | | | Females | | | | | Males | | | | | Females | | | | |
	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX
Loneliness	0.20	0.40	443	0	1	0.248	0.43	460	0	1	0.22	0.41	419	0	1	0.252	0.43	417	0	1
Socio-demographic																				
Age	70.13	3.98	443	57	85	69.4	3.48	460	62	79	70.17	3.94	419	57	81	69.4	3.52	417	62	79
Higher education (%)	38.4		442			47		460			39.7		418			47.9		417		
Income (in 100000 Nok)	3.74	2.35	443	0.05	36.00	2.66	1.09	460	0.01	14.90	4.01	3.75	414	0.10	62.60	3.14	2.11	417	0.04	31.8
Married (%)	80.6		443			67.8		460			80.2		419			64.3		417		
Single (%)	6.1		443			5.7					4.8		419			5.5		417		
Widower (%)	1.1		443			6.5		460			4.3		419			10.6		417		
Divorcee (%)	12.2		443			20		460			10.7		419			19.7		417		
Self report data																				
People who wants more contacts with others (%)	8		427			7.6		433			4.9		345			2.1		333		
Extraversion	18.17	4.40	344	8	28	19.38	4.54	354	6	28	18.17	4.44	380	8	28	19.27	4.54	384	6	28
Neuroticism	10.52	4.18	334	4	26	12.24	4.54	324	4	25	10.45	4.26	370	4	26	12.05	4.54	352	4	25
Agreebleness	21.63	3.35	343	13	28	23.14	3.23	339	14	28	21.64	3.30	380	13	28	23.14	3.23	365	14	28
People with bad health condition (%)	17.6		443			16.7		460			22.2		419			20.4		417		
People with functional limitations (%)	28.7		443			30.9		459			32.5		136			30.8		128		
Number of years of retirement											5.63	3.92	419	0	10	4.91	3.73	417	0	10

Note. SD=standard deviation, MIN= minimum, MAX=Maximum.

25

Table 2. Socio-demographic characteristics of the entire sample 2007 and 2017

	2007					2017				
	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX
Loneliness	0.22	0.42	903	0	1	0.23	0.42	836	0	1
Socio-demographic										
Age	69.8	3.75	903	57	85	69.8	3.75	836	57	81
Women (%)	50.9		903			49.9		836		
Register data										
Higher education (%)	42.7		902			43.9		835		
Income (in 100000 Nok)	3.2	1.90	903	0.01	36.00	3.58	3.07	831	0.04	62.60
Married (%)	74.1		903			72.2		836		
Single (%)	5.9		903			5.1		836		
Widower (%)	3.9		903			7.4		836		
Divorcee (%)	16.2		903			15.2		836		
Self report data										
People who wants more contacts with others (%)	7.4		860			2.9		678		
Extraversion	18.44	4.82	879	4	28	18.72	4.52	764	6	28
Neuroticism	11.66	4.59	875	4	26	11.23	4.47	722	4	26
Agreebleness	22.12	3.49	854	11	28	22.37	3.35	745	13	28
People with bad health condition (%)	17.2		903			21.3		836		
People with functional limitations (%)	29.8		902			31.6		835		
Number of years of retirement						5.27	3.84	836	<1	10

Note. SD=standard deviation, MIN= minimum, MAX=Maximum.

Table 3. The probability of feeling lonely in 2017 in the entire sample and among males and females.

Variables	Entire sample		Male		Female	
	B	S.E	B	S.E	B	S.E
Loneliness 2007	.238***	.038	.262***	.056	.226***	.052
Gender (ref = male)						
Female	.019	.031				
Age	.166	.114	.245	.143	.006	.198
Age * Age	-.001	.001	-.002	.001	2.158E-5	.001
No. of years of retirement	-.013	.019	-.004	.028	-.023	.026
Retirement years * Retirement years	.001	.002	.000	.003	.003	.001
Civil status (ref = married)						
Single	-.028	.069	.040	.098	-.101	.099
Widower	.207***	.058	.225*	.106	.175*	.073
Divorced	.104*	.043	.123	.070	.081	.057
General health condition (ref = good health condition)						
Bad health condition	.051	.037	.050	.052	.043	.054
Education (ref = without university education)						
University education at lower level	-.002	.033	.017	.051	-.019	.045
University education at higher level	-.085	.053	-.019	.066	-.195*	.090
Income after tax in 100000 NOK	.012*	.005	.008	.006	.023*	.010
Constant	-5.973	4.010	-8.754	5.058	-.372	6.924
R2	.090		.078		.089	
Total number	749		366		383	

Note. *p < 0.05; **p < 0.01; ***p < 0.001.*

Table 4. The probability of feeling lonely in 2007 in the entire sample, and among males and females.

Variables	Entire sample		Male		Female	
	B	S.E	B	S.E	B	S.E
Gender (ref = male)						
Female	.029	.031				
Age	.010*	.004	.011*	.005	.008	.006
Civil status (ref = married)						
Single	.173**	.059	.172*	.080	.144	.090
Widower	.173*	.073	.108	.190	.160	.084
Divorced	.174***	.040	.148*	.059	.189**	.054
General health condition (ref = good health condition)						
Bad health condition	.063	.041	.126*	.055	.011	.061
Functional limitations (ref = without functional limitations)						
With functional limitations	-.049	.033	-.058	.044	-.056	.049
Social contacts (ref = having social contacts)						
Without social contacts	-.094**	.030	-.090*	.039	-.092*	.045
Education (ref = without university education)						
University education at lower level	-.039	.031	-.068	.045	-.021	.046
University education at higher level	-.052	.050	-.053	.058	-.066	.106
Income after tax in 100000 NOK	.005	.008	.002	.008	.019	.022
Extraversion	-.006	.003	.001	.004	-.013**	.005
Neuroticism	.023***	.003	.023***	.005	.023***	.005
Agreeableness	-.004	.004	-.006	.006	-.001	.007
Constant	-.529	.299	-.631	.400	-.315	.454
R2	.139		.127		.135	
Total number	780		388		392	

Note. *p < 0.05; **p < 0.01; ***p < 0.001

Part II Article

Abstract

Research has long demonstrated that feeling of loneliness increases in older adults, which is a key risk factor for poor health. However, less is known about the development and factors leading to loneliness after retirement. These questions were examined using second and third wave data obtained 10 years apart in the population-based NorLAG study (N=903 for 2007 and N= 836 for 2017). Results indicated that there is a slight increase in the percentage of males and females feeling lonely after retirement. Moreover, there is a significant effect of loneliness before retirement on loneliness after retirement. However, there is not any effect of age and number of years of retirement on loneliness after retirement. A probability model was carried out to identify the probability of feeling lonely before and after retirement. For the entire sample, age, being single, being a widow, being divorced, without social contacts, and neuroticism predicted loneliness before retirement. Among males, age, being single, being divorced, bad health condition, without social contacts, and neuroticism predicted loneliness and among females being divorced, without social contacts, extraversion and neuroticism predicted loneliness before retirement. Whereas, loneliness before retirement, being a widow, being divorced, and income predicted loneliness in the entire sample after retirement. Among males, loneliness before retirement and being a widow predicted loneliness and among females, loneliness before retirement, being a widow, higher university education, and income predicted loneliness after retirement. Thus, the factors that leads to loneliness are social relationships, personality traits, socioeconomic status, and physical health.

Keywords: loneliness, older adults, retirement, health, social relationships, personality

Introduction

Many studies indicate that feeling of loneliness increases in old age as the frequency of social contacts typically decreases because of the loss of social roles through retirement, widowhood, reduction in choice of social partner, and decreased physical mobility (Pinquart & Sorensen, 2001). Loneliness is associated with increased risks for early mortality (S. Cacioppo, Grippo, London, Goossens, & Cacioppo, 2015) and poor mental and physical health in the elderly (Luanaigh & Lawlor, 2008). Nowadays, loneliness is considered as one of the major social problems in society (Gierveld, Van Tilburg, & Dykstra, 2018) as it decreases productivity and cost high for society. Fighting loneliness thus helps to improve individual well-being and also decreases the risk of poor physical and mental health and early mortality (Bouwman, van Tilburg, & Aartsen, 2019).

Loneliness is an unpleasant experience that occurs when a person's network of relationships is deficient in some important way (de Jong-Gierveld, 1987). Loneliness is expected to be influenced by the human life course and life events. The human life course is characterized by the normative and social time tables regulating life events, such as education, employment, and retirement (Giele & Elder, 1998). Retirement is one of the major transitions among older adults (Fonseca et al., 2014). The transition to retirement is related to a decrease in the social contacts of the individual (Ayalon et al., 2016). There is also a risk for social exclusion for older people after retirement (Burholt et al., 2019). Furthermore, there is a change in the lifestyle of the individual after retirement as they have more spare time, which may positively or negatively affect their health, including physical activity, changes in the diet, alcohol, and cigarette consumption (Rogne & Syse, 2018). There is a higher risk of developing cardiovascular disease and heart disease after retirement (Behncke, 2012). These changes in lifestyle and health problems may lead to experience the feeling of loneliness after retirement.

A cross-sectional study shows that people living alone with poor physical and mental health experiences 10 times higher feeling of loneliness than people with good health conditions and living together with spouse, friends, or families (Sundström et al., 2009). There are four different sets of variables as possible sources of loneliness, which are social relationships, personality, socioeconomic status, and physical health problems, and functional status (Pinquart, 2003).

(a) Social relationships: Establishing and maintaining good relationships with friends, family members, and spouse is very important (Ozer & Benet-Martinez, 2006). A lack of close social relationships or lack of social ties is considered to be one of the major sources of loneliness (Pinquart, 2003). Studies show that loneliness is affected by changes in social relations. For example, the dissolution of close relationships by death, divorce, or breakup increases the level of loneliness (Letitia A Peplau, 1982). This is because such life events can decrease the size of personal and family networks considerably (Wrzus, Hänel, Wagner, & Neyer, 2013). According to Pinquart (2003), the level of loneliness is higher in widowed, divorced, and never married persons than married persons. A longitudinal study over 20 years reported that both social and emotional loneliness is higher in divorcees and people without a partner (Kok et al., 2016).

(b) Personality: Extraversion is one of the most important personality traits that predict social factors such as popularity, social acceptance, and social status among adult people (Ozer & Benet-Martinez, 2006). Thus, people with high extraversion traits may experience less feeling of loneliness as these people are more positive towards life, and they may have more participation in social activities. Along with extraversion, other personality traits such as neuroticism and agreeableness are also equally important. Neuroticism has a direct effect on the quality of relationships. Research has found that a high level of neuroticism and low levels of agreeableness result in dissatisfaction, conflict, and finally dissolution of close relationship (Ozer & Benet-Martinez, 2006), which increases the feeling of loneliness (Letitia A Peplau, 1982).

(c) Socioeconomic status: Socioeconomic status is an important socio-demographic source that has an influence on the level of loneliness (Cohen-Mansfield, Hazan, Lerman, & Shalom, 2016; Pinquart & Sörensen, 2000). With sufficient financial resources, people may have more opportunities to be involved in social activities that help people to counteract loneliness (Cohen-Mansfield et al., 2016; Louise C Hawkley et al., 2008). Income and education are the main indicators of socioeconomic status. Older adults with good financial resources have an alternative to use paid services for caregiving and transportation that increases social contacts and peoples' mobility. In the same way, people with higher education are connected to better knowledge of opportunities for social interaction and hence associated with a decrease in the

feeling of loneliness (Pinquart & Sorensen, 2001). Studies show that lower-income and lower education are linked with a higher level of loneliness (Cohen-Mansfield et al., 2016; Pinquart & Sorensen, 2001).

(d) Physical health problem: Poor health and poor functional status are associated with an increase in loneliness in older people. This is because people with health problems have fatigue and mobility difficulties, which acts as a barrier to participating in social activities that help them counteract loneliness (Cohen-Mansfield et al., 2016). Reviews of empirical studies show that poor physical health is associated with an increase in loneliness in older adults (Cohen-Mansfield et al., 2016; Louise C Hawkley & Capitanio, 2015; Ong, Uchino, & Wethington, 2016). A longitudinal study in older Americans reported that changes in the level of loneliness have a predictive effect on self-rated health and functional limitations, but the opposite predictive effects were comparatively less (Luo, Hawkley, Waite, & Cacioppo, 2012).

Aims

The study asks whether and how loneliness is influenced by later life events of older adults (57 years and above). I study if there is an increase in the percentage of males and females feeling lonely after retirement and what are the factors leading to loneliness after retirement. The geographic focus is Norway. I consider how socio-demographic factors, subjective health, and personality traits affect loneliness after retirement.

Methods and materials

In this study, I use second (T2) and third wave (T3) data from the population-based Norwegian Life Course, Aging, and Generation (NorLAG). The second wave of data collection was done during 2007 and 2008 that included a gross sample of 5,269. It comprised of individuals aged 45 and above who participated in the first wave (T1). The response rate for the telephone interview was 71.6%, and the postal questionnaire was 79% (Slagsvold et al., 2012).

The third wave of data was collected during 2017 that included a gross sample of 9,000 persons. The gross sample comprised of individuals aged 50 and above who participated in T1 and T2.

The response rate for the telephone interview was 70%, and the postal questionnaire was 74% (NorLAG).

At first, I started with a sub-sample (N=1,040) born between 1932-1960 and working during T2 (some of them at work despite passing the retirement age) and got retired during T3 were selected. Later on, the study sample is reduced to N= 903 for 2007 and N= 836 for 2017 due to missing values on the dependent variables (loneliness 2007 and loneliness 2017).

Dependent and independent variables

In the analysis, loneliness was dichotomized into 0 = not feeling lonely 1 = feeling lonely (included all types of loneliness). The number of years of retirement ranges from 0 to 10 years. Civil status was categorized into 1 = single 2 = married 3 = widow 4 = divorced. General health condition was dichotomized into 0 = bad health condition 1 = good health condition. Education was recoded into three categories; 0 = no university education 1 = low university education (bachelor's degree) 2 = high university education (master's degree and doctorates). Income was scaled from 1000 to 1750000 kr per year after tax. Social contacts were recoded into 0 = without social contacts and 1 = having social contacts. General health condition was dichotomized into 0 = bad health condition 1 = good health condition. Functional limitations were dichotomized into 0 = without functional limitations and 1 = with functional limitations. Extraversion was scaled from 4 to 28, with a higher score indicating a more extrovert nature. Neuroticism was scaled from 4 to 26 where a higher score indicating more neuroticism. Agreeableness was also scaled from 11 to 28 where a higher score indicating a more agreeable nature. Additionally, gender and age were also included.

Statistical analysis

A descriptive analysis of the major variables is performed for males, females, and the entire sample for both periods as a first step. Then, I carry out linear regression analysis where loneliness 2017 is a dependent variable and loneliness 2007 and other socio-demographic factors as independent variables to find out the probability of feeling lonely after retirement. If there is a positive effect of the probability of feeling lonely before retirement on the probability of feeling

lonely after retirement, I carry out another linear regression analysis to find out the probability of feeling lonely before retirement.

Results

Table 1 and 2 presents the descriptive statistics of the major variables included in the study (N=903 for 2007 and N= 836 for 2017). Between 2007 and 2017, the mean value of loneliness in the participants was increased from 0.20 to 0.22 among males and 0.248 to 0.252 among females (see the top of the table). This means that 20% of the male participants and 24.8% of female participants were feeling lonely in 2007, and 22% of the male participants and 25.2% of female participants were feeling lonely in 2017 (as loneliness is recoded as not feeling lonely and feeling lonely). The mean age for males was 70.13 years in 2007 and 70.17 years in 2017. Whereas, the mean age for females was 69.4 years in both time periods. On average, 38.4% of males and 47% of female participants had higher education in 2007, and 39.7% of males and 47.9% of females had higher education in 2017. There was inflation of 24.4% from 2007 to 2017 (ssb.no) in the income of the individuals for which we have not adjusted. The percentage of individuals reporting bad health conditions increased from 17.6% in 2007 to 22.2% in 2017 among males. Among females, this percentage increased from 16.7% in 2007 to 20.4% in 2017. The share of individuals with functional limitations also increased from 28.7% in 2007 to 32.5% in 2017 among males. Whereas, this percentage decreased from 30.9% in 2007 to 30.8% in 2017 among females. There was a decrease in the percentage of the individuals who wanted contacts with others from 8% in 2007 to 4.9% in 2017 among males and from 7.6% in 2007 to 2.1% in 2017 among females.

There was more variation in civil status among males and females in 2007 and 2017. Among males, 80.6% of the participants were married in 2007, which was reduced to 80.2% in 2017. 6.1% of the individuals were single in 2007, which was decreased to 4.8% in 2017. In the same way, 12.2% of the individuals were divorced in 2007, which was decreased to 10.7% in 2017. Whereas, 1.1% of the individuals were widow in 2007, which was increased to 4.3% in 2017. Among females, 67.8% of the participants were married in 2007, which was reduced to 64.3% in 2017. 5.7% of the individuals were single in 2007, which was decreased to 5.5% in 2017. In the same way, 20% of the individuals were divorced in 2007, which was decreased to 19.7% in

2017. Whereas, 6.5% of the individuals were widow in 2007, which was increased to 10.6% in 2017.

Table 1. Socio-demographic characteristics of sample 2007 and 2017

| | 2007 | | | | | | | | | | 2017 | | | | | | | | | |
| | Males | | | | | Females | | | | | Males | | | | | Females | | | | |
	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX
Loneliness	0.20	0.40	443	0	1	0.248	0.43	460	0	1	0.22	0.41	419	0	1	0.252	0.43	417	0	1
Socio-demographic																				
Age	70.13	3.98	443	57	85	69.4	3.48	460	62	79	70.17	3.94	419	57	81	69.4	3.52	417	62	79
Higher education (%)	38.4		442			47		460			39.7		418			47.9		417		
Income (in 100000 Nok)	3.74	2.35	443	0.05	36.00	2.66	1.09	460	0.01	14.90	4.01	3.75	414	0.10	62.60	3.14	2.11	417	0.04	31.8
Married (%)	80.6		443			67.8		460			80.2		419			64.3		417		
Single (%)	6.1		443			5.7					4.8		419			5.5		417		
Widower (%)	1.1		443			6.5					4.3		419			10.6		417		
Divorcee (%)	12.2		443			20		460			10.7		419			19.7		417		
Self report data																				
People who wants more contacts with others (%)	8		427			7.6		433			4.9		345			2.1		333		
Extraversion	18.17	4.40	344	8	28	19.38	4.54	354	6	28	18.17	4.44	380	8	28	19.27	4.54	384	6	28
Neuroticism	10.52	4.18	334	4	26	12.24	4.54	324	4	25	10.45	4.26	370	4	26	12.05	4.54	352	4	25
Agreebleness	21.63	3.35	343	13	28	23.14	3.23	339	14	28	21.64	3.30	380	13	28	23.14	3.23	365	14	28
People with bad health condition (%)	17.6		443			16.7		460			22.2		419			20.4		417		
People with functional limitations (%)	28.7		443			30.9		459			32.5		136			30.8		128		
Number of years of retirement											5.63	3.92	419	0	10	4.91	3.73	417	0	10

Note. SD=standard deviation, MIN= minimum, MAX=Maximum.

There is a slight increase in loneliness among males and females after retirement (table 1). The purpose of this study is to investigate whether increased loneliness varies between different groups of individuals. My analysis is restricted to participants who were working in 2007 and were retired before or in the year 2017.

Figure 1. Mean value of loneliness in 2007 and 2017 with the number of years of retirement
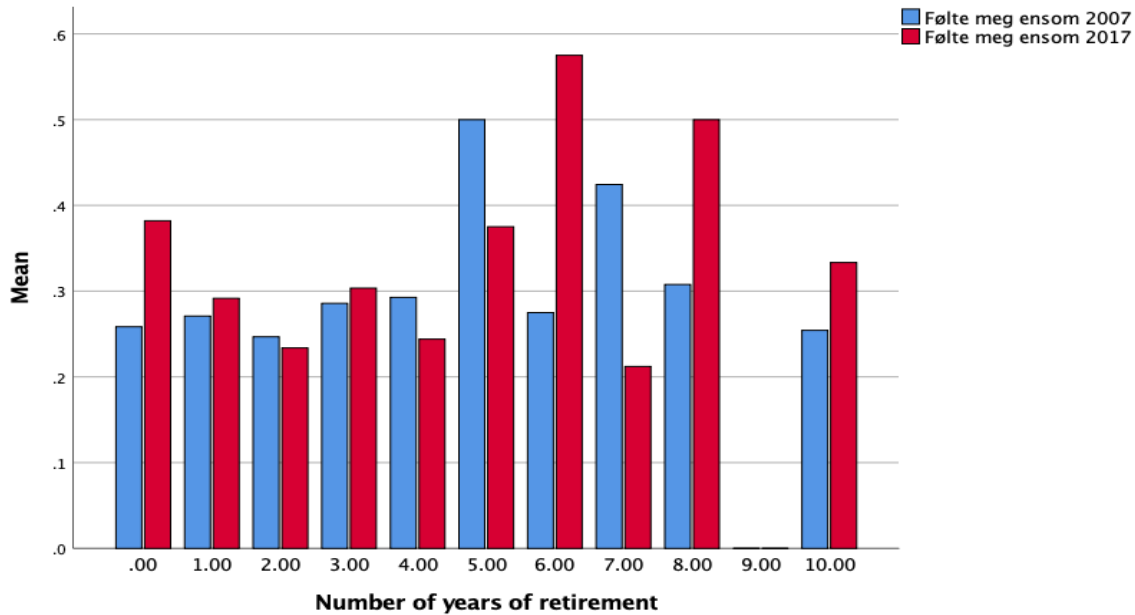

Figure 1 shows the mean value of loneliness in 2007 and 2017 with the number of years of retirement. Loneliness was ordered from the lowest to the highest number of years of retirement. There is a variation in loneliness in 2007 and 2017 by retirement years. During the first year of retirement, there is an increase in the level of loneliness. But between 1st to 4th year of retirement, variation in loneliness is not huge. Whereas, between 5th to 10th years of retirement, there is a huge variation in loneliness. It shows that during 5th and 7th years of retirement, people were experiencing more feelings of loneliness before they were retired. Whereas, during 6th, 8th, and 10th years of retirement, the level of loneliness after retirement is higher than before retirement. Since there is variation in the loneliness, it is of interest to find out if this variation has something to do with age, education, income, health status, marital status, or personality of the individual.

The probability of feeling lonely in 2017 in the entire sample, analyzed by the linear probability model, is shown in table 3. The probability of feeling lonely in 2007 compared to the probability of not feeling lonely in 2007 increase the likelihood of feeling lonely in 2017 by 24 percentage points in the entire sample, when controlling for many other factors. This effect is also significant ($p < 0.001$).

Table 3. The probability of feeling lonely in 2017 in the entire sample and among males and females.

Variables	Entire sample		Male		Female	
	B	S.E	B	S.E	B	S.E
Loneliness 2007	.238***	.038	.262***	.056	.226***	.052
Gender (ref = male)						
Female	.019	.031				
Age	.166	.114	.245	.143	.006	.198
Age * Age	-.001	.001	-.002	.001	2.158E-5	.001
No. of years of retirement	-.013	.019	-.004	.028	-.023	.026
Retirement years * Retirement years	.001	.002	.000	.003	.003	.001
Civil status (ref = married)						
Single	-.028	.069	.040	.098	-.101	.099
Widower	.207***	.058	.225*	.106	.175*	.073
Divorced	.104*	.043	.123	.070	.081	.057
General health condition (ref = good health condition)						
Bad health condition	.051	.037	.050	.052	.043	.054
Education (ref = without university education)						
University education at lower level	-.002	.033	.017	.051	-.019	.045
University education at higher level	-.085	.053	-.019	.066	-.195*	.090
Income after tax in 100000 NOK	.012*	.005	.008	.006	.023*	.010
Constant	-5.973	4.010	-8.754	5.058	-.372	6.924
R2	.090		.078		.089	
Total number	749		366		383	

*Note, *p < 0.05; **p < 0.01; ***p < 0.001.*

There is a significant effect of civil status (widow $p < 0.001$ and divorced $p < 0.05$) on the probability of feeling lonely in 2017. Being a widower compared to being married in 2017 had a significant effect on the probability of feeling lonely in 2017. The likelihood is 21 percentage points. Similarly, being divorced compared to being married in 2017 increases the likelihood of feeling lonely in 2017 by 10 percentage points. There was also a significant effect of income ($p <$

0.05) in the probability of feeling lonely in 2017 in the sample. This means an increase in the probability of feeling lonely in 2017 with an increase in income in 2017 after control for central socioeconomic and demographic factors.

Even when the probability model is splitted by gender, the probability of feeling lonely in 2007 compared to the probability of not feeling lonely in 2007 increases the likelihood of feeling lonely in 2017 by 26 percentage points among males and 23 percentage points among females when controlling for many other factors. This effect was significant ($p < 0.001$) for both males and females. Among males, being a widower compared to being married in 2017 increases the likelihood of feeling lonely in 2017 by 23 percentage points, and the effect was also significant ($p < 0.05$). Among females, being a widower compared to being married in 2017 had a significant ($p < 0.05$) effect on the probability of feeling lonely in 2017. The likelihood is 18 percentage points. Among females, having a higher level of university education compared to not having university education in 2017 decreases the likelihood of feeling lonely in 2017 by 20 percentage points. The effect was also significant ($p < 0.05$). There was also a significant effect of income ($p < 0.05$) in the probability of feeling lonely in 2017 among females. This means that there is an increase in the probability of feeling lonely in 2017 with an increase in income in 2017.

Results from table 3 indicate that neither age nor number of years since retirement has a significant effect on loneliness after retirement. However, there are effects of other factors that might change over the life course. In addition, there is a significant effect of loneliness 2007 on loneliness 2017. This means that an increase in the probability of feeling lonely among participants before retirement leads to an increase in the probability of feeling lonely among participants after retirement. In addition, the t-value of loneliness 2007 is high (t-value = 6.386), which means that it has more effect in loneliness 2017. Thus, the situation before retirement seems to be of importance for the probability of feeling lonely after retirement. In order to see the positive and negative effect of various factors in loneliness before retirement, another linear probability model will be carried out by taking loneliness 2007 as a dependent variable. In this, functional limitations, social contacts, extraversion, neuroticism, and

agreeableness variables will also be included to see its effect on the probability of feeling lonely before retirement.

Table 4. The probability of feeling lonely in 2007 in the entire sample, and among males and females.

Variables	Entire sample		Male		Female	
	B	S.E	B	S.E	B	S.E
Gender (ref = male)						
Female	.029	.031				
Age	.010*	.004	.011*	.005	.008	.006
Civil status (ref = married)						
Single	.173**	.059	.172*	.080	.144	.090
Widower	.173*	.073	.108	.190	.160	.084
Divorced	.174***	.040	.148*	.059	.189**	.054
General health condition (ref = good health condition)						
Bad health condition	.063	.041	.126*	.055	.011	.061
Functional limitations (ref = without functional limitations)						
With functional limitations	-.049	.033	-.058	.044	-.056	.049
Social contacts (ref = having social contacts)						
Without social contacts	-.094**	.030	-.090*	.039	-.092*	.045
Education (ref = without university education)						
University education at lower level	-.039	.031	-.068	.045	-.021	.046
University education at higher level	-.052	.050	-.053	.058	-.066	.106
Income after tax in 100000 NOK	.005	.008	.002	.008	.019	.022
Extraversion	-.006	.003	.001	.004	-.013**	.005
Neuroticism	.023***	.003	.023***	.005	.023***	.005
Agreeableness	-.004	.004	-.006	.006	-.001	.007
Constant	-.529	.299	-.631	.400	-.315	.454
R2	.139		.127		.135	
Total number	780		388		392	

*Note. *p < 0.05; **p < 0.01; ***p < 0.001*

Table 4 shows the probability of feeling lonely in 2007 in the entire sample and among males and females. The probability model shows that there is a significant effect ($p < 0.05$) of age on the probability of feeling lonely in 2007 in the sample. An increase in age in 2007 increases the

likelihood of feeling lonely in 2007 by 1 percentage point when controlling for many other factors.

For the entire sample, there is a significant effect of civil status (single $p < 0.01$, widow $p < 0.05$, and divorced $p < 0.001$) on probability of feeling lonely in 2007. Being single compared to being married in 2007 had a significant effect on the probability of feeling lonely in 2007. The likelihood is 17 percentage points. Similarly, being a widower and being divorced compared to being married in 2007 increases the likelihood of feeling lonely in 2007 by 17 percentage points. Individuals without social contacts compared to individuals having social contacts in 2007 decreases the likelihood of feeling lonely in 2007 by 9 percentage points. This effect was also significant ($p < 0.01$). There was also a significant effect ($p < 0.001$) of neuroticism in 2007 on the probability of feeling lonely in 2007 in the sample. This means that there is increase in the probability of feeling lonely in 2007 with an increase in neuroticism in 2007.

After splitting probability model by gender, there was a significant effect ($p < 0.05$) of age on probability of feeling lonely in 2007 among males. An increase in age in 2007 increases the likelihood of feeling lonely in 2007 by 1 percentage point among males when there is a control for many other factors. Among males, being single and being divorced compared to being married in 2007 increases the likelihood of feeling lonely by 17 and 15 percentage points. Among females, being divorced compared to being married in 2007 increases the likelihood of feeling lonely in 2007 by 19 percentage points, and the effect was also significant ($p < 0.01$). Having bad health condition compared to having good health condition in 2007 increases the probability of feeling lonely in 2007 by 13 percentage points among males. This effect was significant ($p < 0.05$). There was a significant effect ($p < 0.05$) of individuals without social contacts compared to individuals having social contacts among both males and females on loneliness 2007. The likelihood of a decrease in probability of feeling lonely in 2007 is 9 percentage points for both males and females. In the same way, with increase in extraversion in 2007 there is a decrease in probability of feeling lonely in 2007 among females by 1 percentage points. This effect was also significant ($p < 0.01$). There was also a significant effect ($p < 0.001$) of neuroticism in 2007 on probability of feeling lonely in 2007 among both males and females.

This implies that with increase in neuroticism, there is increase in probability of feeling lonely in 2007.

The model explains 9% of the variation in loneliness for the entire sample, 7.8% of the variation in loneliness for males, and 8.9% of the variation in loneliness for females after retirement. Whereas, the model explains 13.9% of the variation in loneliness for the entire sample, 12.7% of the variation in loneliness for males, and 13.5% of the variation in loneliness for females before retirement.

Discussion

There is a slight increase in the percentage of individuals feeling lonely after retirement. It should also be noted that probability of feeling lonely after retirement is higher among males. This finding is in contrast with previous research, which suggested that the level of loneliness is higher for women than for men in late life (Hansen & Slagsvold, 2016). This is because women live longer as compared to men and tend to marry men who are older than themselves, which means that women are more likely to enter widowhood at a younger age than men (e.g., Lennartsson & Lundberg, 2007).

I found that probability of feeling lonely compared to probability of not feeling lonely before retirement increases probability of feeling lonely after retirement in entire sample and among males and females. Being a widower compared to being married also increases probability of feeling lonely in entire sample and among males and females. However, there is no effect of being divorced in probability of feeling lonely among males and females after retirement.

Having a higher level of university education compared to not having university education decreases probability of feeling lonely among females. This result is supported by the research done by Pinquart and Sorensen (2001), which mentioned that people with higher education are connected to a better knowledge of opportunities for social interaction that decreases the feeling of loneliness.

In addition to this, there is increase in probability of feeling lonely with increase in income in the entire sample and among females. This finding is in contrast with the results of other research (Pinquart & Sorensen, 2001; Routasalo & Pitkala, 2003; Savikko et al., 2005).

Since loneliness after retirement is more associated with loneliness before retirement, another probability model was carried out to examine probability of feeling lonely before retirement. The probability model shows that there is an increase in probability of feeling lonely with an increase in age in the entire sample and among males before retirement, which was not observed among the participants after retirement. This general increase in loneliness with age is supported by previous research (Dahlberg et al., 2015; Pearl A Dykstra et al., 2005; Louise C. Hawkley & Kocherginsky, 2018; Heikkinen & Kauppinen, 2011). However, there is no effect of age on the probability of feeling lonely among females.

Being single and being divorced compared to being married increases probability of feeling lonely among males before retirement. Whereas, being divorced compared to being married increases the probability of feeling lonely among females before retirement. Nevertheless, in the entire sample, being single, being a widow and being divorced compared to being married increases the probability of feeling lonely before retirement. This finding is supported by previous research (Pinquart, 2003). Results from the longitudinal studies demonstrate that loneliness is higher in people with poor health (Cohen-Mansfield et al., 2009; Pearl A Dykstra et al., 2005). In my analysis also, there is increase in probability of feeling lonely among males with a bad health condition.

In my study, people without social contacts have less probability of feeling lonely in the entire sample and among females. This is supported by research done by Sander, Schupp, and Richter (2017), which mentions that although there is a decline in the frequency of social contacts with increasing age, the frequency of contact with family members remains stable through out their life, which may be very important to provide emotional support.

There is a decrease in probability of feeling lonely with an increase in the value of extraversion among females. This result is in line with the research done by Larsen and Ketelaar (1991), and

Lucas and Fujita (2001), illustrate that extraversion is associated with a positive effect which plays the main role in making people busy in social interactions that might prevent from loneliness.

There is increase in probability of feeling lonely with increase in the value of neuroticism in the entire sample and among males and females. This result is supported by previous research. Research done by Ozer and Benet- Martinez (2006) shows that a high level of neuroticism leads to dissatisfaction, conflict, and finally, dissolution of the close relationship that further increases the feeling of loneliness. Similarly, another study by Larsen and Ketelaar (1991) illustrates that a high level of neuroticism is linked with an increase in sensitivity to negative stimuli, and thus, individuals who have a high level of neuroticism may experience more feeling of loneliness than people who are emotionally stable.

Conclusion

Overall, it is found that there is an increase in the probability of feeling lonely among older adults after retirement when there is a control for loneliness before retirement. Moreover, all people do not experience the feeling of loneliness after retirement. This is because of their social relationship and personality traits. For the entire sample, age, being single, being divorced, widowhood, and a higher level of neuroticism are associated with more loneliness before retirement. But, individuals without social contacts reported less loneliness. Similarly, loneliness before retirement, widowhood, being divorced, and higher-income are associated with more loneliness after retirement. Among males, age, being single, being divorced, bad health conditions, and a higher level of neuroticism are associated with more loneliness, and individuals without social contacts are associated with less loneliness before retirement. Similarly, loneliness before retirement and widowhood is associated with more loneliness after retirement among males. In the same way, among females, being divorced and a higher level of neuroticism is associated with more loneliness before retirement. Whereas, without social contacts and a higher level of extraversion is associated with less loneliness before retirement. Similarly, loneliness before retirement, widowhood, and higher-income are associated with more loneliness after retirement. Whereas, individuals with a higher level of university education reported less loneliness after retirement. I take this result to illustrate the utility of combining self-report and

register data and conclude that the development of loneliness among older adults is more related to several socioeconomic and demographic factors and less related to retirement per se.

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Appendix

Table 2. Socio-demographic characteristics of entire sample 2007 and 2017

	2007					2017				
	Mean	SD	N	MIN	MAX	Mean	SD	N	MIN	MAX
Loneliness	0.22	0.42	903	0	1	0.23	0.42	836	0	1
Socio-demographic										
Age	69.8	3.75	903	57	85	69.8	3.75	836	57	81
Women (%)	50.9		903			49.9		836		
Register data										
Higher education (%)	42.7		902			43.9		835		
Income (in 100000 Nok)	3.2	1.90	903	0.01	36.00	3.58	3.07	831	0.04	62.60
Married (%)	74.1		903			72.2		836		
Single (%)	5.9		903			5.1		836		
Widower (%)	3.9		903			7.4		836		
Divorcee (%)	16.2		903			15.2		836		
Self report data										
People who wants more contacts with others (%)	7.4		860			2.9		678		
Extraversion	18.44	4.82	879	4	28	18.72	4.52	764	6	28
Neuroticism	11.66	4.59	875	4	26	11.23	4.47	722	4	26
Agreebleness	22.12	3.49	854	11	28	22.37	3.35	745	13	28
People with bad health condition (%)	17.2		903			21.3		836		
People with functional limitations (%)	29.8		902			31.6		835		
Number of years of retirement						5.27	3.84	836	<1	10

Note. SD=standard deviation, MIN= minimum, MAX=Maximum.