

THE EFFECT OF INTERPERSONAL CONTACT VIA INTERNET AND TELEPHONE ON LONELINESS IN THE ELDERLY

A EUROPEAN CROSS-NATIONAL PERSPECTIVE

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Index

ACKNOWLEDGEMENT	3
INDEX	4
ABSTRACT	5
1 INTRODUCTION	5
2 LITERATURE	6
2.1 DEFINITION OF CORE CONCEPTS	6
2.1.1 <i>The elderly</i>	6
2.1.2 <i>Loneliness</i>	7
2.1.3 <i>Interpersonal contact via internet and telephone</i>	8
2.1.4 <i>The collectivism-individualism thesis</i>	9
2.2 THEORY.....	10
2.2.1 <i>Loneliness and European regional differences</i>	10
2.2.2 <i>The Internet and telephone use among over-65s in Europe</i>	12
2.2.3 <i>Loneliness and use of internet and phone</i>	14
2.3 RESEARCH QUESTIONS AND HYPOTHESES	15
3 METHOD	19
3.1 DATA DESCRIPTION	19
3.1.1 <i>European Quality of Life Surveys</i>	19
3.1.2 <i>Hofstede & Minkov: Individualism-Collectivism</i>	20
3.1.3 <i>Eurostat</i>	21
3.2 DESCRIPTION VARIABLES AND OPERATIONALIZATION	21
3.2.1 <i>Dependent variables</i>	22
3.2.2 <i>Independent variables</i>	22
3.2.3 <i>Control variables</i>	23
3.3 STATISTICAL METHODS	26
4 RESULTS	28
5 DISCUSSION	32
6 BIBLIOGRAPHY	35
APPENDIX	42
APPENDIX 1: ASSUMPTIONS FOR TESTING HYPOTHESIS ONE, THREE AND FIVE	42
APPENDIX 3: ASSUMPTIONS FOR TESTING HYPOTHESIS TWO	46
APPENDIX 3: GRAPHS.....	53
APPENDIX 4: UNIVARIATE STATISTICS	53
APPENDIX 5: BIVARIATE STATISTICS	55

Abstract

The elderly represent a large proportion of the population in Europe and the prevalence of loneliness among these older people varies heavily across European countries. This study wants to explain this variation by investigating the influence of the use of internet and telephone for interpersonal contact among over-65s on their feelings of loneliness across 32 European countries. The question will be asked whether there are national differences in loneliness among over-65s between more individualistic and collectivistic cultures in Europe due to differences in the use of telephone and internet for interpersonal contact. To carry out this research, there will be conducted a multilevel regression analysis on the individual- and country level with data from the European Quality of Life Survey, Hofstede Insights and Eurostat that will be analyzed with the programs SPSS and MLwiN. The results testify that there is no significant effect of the degree of individualism in a country on the degree the elderly use internet and telephone for interpersonal contact. Out of this study there could also be concluded that there is found a significant effect of interpersonal contact via the Internet and telephone on loneliness among over-65s in Europe, but there is no influence on this effect of the degree of individualism typical for a country. Nowadays, internet and telephone seem crucial in reducing feelings of loneliness among elderly. These techniques should be acknowledged by politics and social organizations working with elderly as possible tools in tackling the problem of loneliness in the older population.

1 Introduction

The corona crisis has been an eye-opener for the loneliness problem among the elderly. The virus spread an awareness of how older people are becoming the most vulnerable for social isolation in times of lockdowns and social quarantines (Armitage & Nellums, 2020). But, although this is a common belief, it is not the case that older people are lonely above average. However, it is true that they need more care because being lonely has a negative impact on one's health (Chen & Schulz, 2016; Courtin and Knapp, 2017). If older people cannot rely on confidants for their daily care, this work must be done by formal care providers. However, the pressure on the care sector is high and raising, and the cost of it is expensive for the state (Rooms, 2018). If the welfare states in Europe and the Western world do not want to be under pressure because of the high costs of the elderly health provision, loneliness among older people seems to must become an important political agenda item in the future (Chen & Schulz, 2016; Mihalopoulos et al., 2020).

The older population in Europe is large in comparison to other regions, and this population continues to grow in the recent decades thanks to increasing lifespans because of better health care and an increase of people's material wealth (Albertone et al., 2015; Singh & Misra, 2009). However, this large proportion of older people are also increasingly challenged to remain engaged members of today's society through evolutions out of the 20th and 21st centuries (Amichai-Hamburger & Ben-Artzi, 2003). The world wide web is just one example of the many developments that have drastically changed the lives of many (König, Seifert & Doh, 2018). And also people from older generations are finding their way on the global web, although many of them have not yet made the move, therefore there is not only a digital divide between young and old generations, but also within the older population itself (König, Seifert & Doh, 2018). The importance of remote contact was also emphasized during the corona crisis, especially in the vulnerable older population that was obligated to stay at home (Brooke & Jackson, 2020);

Armitage & Nellums, 2020). There were for example big differences found in feelings of loneliness between grandparents able to call with their children, grandchildren and friends; and ones not able to call with anyone of their loved ones (Brooke & Jackson, 2020).

Within the European continent, there are sharp differences in loneliness between the different regions and countries (Lykes & Kemmelmeier, 2014; Sundström, Fransson, Malmberg, & Davey, 2009). In previous studies, the differences are often attributed to the difference in expectations people have about their social lives. Authors attribute these different expectations to the differences between individualistic and collectivistic cultures and societies (Fokkema, Gierveld & Dykstra, 2012; Lykes & Kemmelmeier, 2014; Malmberg, & Davey, 2009). This research may offer an alternative to this individualism-collectivism idea, in which the use of the Internet and telephone for interpersonal contact is a mediating factor between the degree of individualism in a country and the feeling of loneliness in European over-65s. With the further popularization of the Internet, in which not only young people but also more and more elderly started to use the web, it may be interesting to link the use of the Internet and the already longer established use of telephone with loneliness problems among the older population (König, Seifert & Doh, 2018). Whether the use of the Internet and telephone for interpersonal contact with friends and family has an impact on feelings of loneliness in the over-65s has not yet been investigated at a cross-national level in Europe, nor has it been compared across different countries and regions within Europe. This study will seek to provide insight into the extent to which a European cross-regional difference in the use of the Internet and telephone for interpersonal contact in the over-65s may be the cause of the difference in feelings of loneliness between people from different European countries depending on their position on the individualism-collectivism scale.

2 Literature

2.1 Definition of core concepts

2.1.1 The elderly

Because the elderly have a different evolution in the use of the Internet and telephone, and find other effects of it on their well-being (Briede-Westermayer et al., 2020; Mcgaughey et al., 2013), it is interesting to conduct a separate analysis for people in the age group of 65-plus on the influence of contact over the phone and the Internet on loneliness. Because of the COVID-19 pandemic it is clear that these older people are extra vulnerable for ending up in social isolation, this potential of being ‘locked up’ made the use of remote contact even more interesting and even necessary for the older generation (Brooke & Jackson, 2020; Armitage & Nellums, 2020).

There are several ways to define the concept of ‘the elderly’, which means that the public perception of what is old can vary greatly (WHO, 1999). Conventionally, ‘the elderly’ are those who have reached the age of 65. People from 65 through 74 are seen as ‘early elderly’ and those over the age of 75 as ‘late elderly’ (Orimo, 2006). In the statistics, older people are categorized according to whether or not an age limit is exceeded. The United Nations defines older people as people over the age of 60, while the World Health Organization (WHO) claims that people in developed world economies are defined as old when they are 65 or older (Eurostat, 2019).

This study chose to use the age limit of 65 to label people as the elderly. This because most studies see to use this age limit in Europe, thus the reasoning of the WHO is followed (WHO, 1999). The following terminology was applied (Eurostat, 2019; WHO, 1999): the elderly (older people) are people aged 65 and over. In this study, the term 'elderly' is used for people who have exceeded their 65th birthday.

2.1.2 Loneliness

Before defining the concept of loneliness, it is important to indicate that it should not be confused with social isolation. Social isolation is a concept that is objectively quantifiable, when someone is socially isolated, they have a lack of meaningful relationships and social contact. This cannot just be blindly linked to feelings of loneliness, which is a subjective concept (Holt-Lunstad, Smith, Baker, Harris & Stephenson, 2015). Loneliness can therefore be seen as the subjective evaluation that the number of social relationships is smaller compared to the number of relationships someone sees as desirable or that the desirable intimacy in these relationships is not realized. For example, a person can be objectively socially isolated without feeling lonely and on the other hand, people can feel lonely even though they have frequent social contact (Fokkema, Gierveld & Dykstra, 2012). There is recognized that a lack of interpersonal interaction is always important for one's experience of loneliness, but that not all interactions are created equal, and that different social interactions, especially those involving friends or family, vary in whether they help reduce loneliness in individualistic and collectivistic societies (Lykes & Kemmelemer, 2014).

Loneliness is a container concept; it has been defined in many different ways over the years. Perlman and Peplau describe it in 1998 as 'the experience one has when the social needs are not met'. It is so that these social needs can arise both qualitatively and quantitatively. The concept can therefore be divided into two dimensions; on the one hand, loneliness can be seen as a qualitative concept that focuses on how good the social relationships are, on the other hand it is a quantitative concept that looks at the number of social interactions and relationships that a person has (Shiovitz-Ezra, 2013). Loneliness is considered to be the outcome of the evaluation of the match between the quantity and quality of existing relationships and one's relationship desires (Peplau & Perlman, 1982). In this research paper, loneliness includes both the qualitative and the quantitative dimension.

Furthermore, the concept of loneliness is divided in a different way. DiTommaso and Spinner (1997) refer in their work 'Social and emotional loneliness: A re-examination of Weiss typology of loneliness' to the two components of Weiss (1973). Weiss explains that two components of loneliness can be observed: social loneliness and emotional loneliness. The first refers to the absence of a wider, binding social network such as family, friends and neighbors, which can occur for example when people move and do not yet know many people in their immediate vicinity. The second component of loneliness relates to the absence of an intimate relationship such as a best friend or partner, a confidant to which one can turn for emotional support, a divorce or the death of the partner are possible situations in which this can occur (Weiss, 1973; DiTommaso & Spinner, 1997). The loneliness of social isolation, according to Weiss, results from the absence of an engaging social network that can only be remedied by access to a satisfying social network (Weiss, 1973; DiTommaso & Spinner, 1997). The emotional type of loneliness, Weiss postulates,

can only be alleviated by the instalment of a satisfactory attachment relationship where one is absent, or by the reinstatement or replacement of one that has been lost (Weiss, 1973; DiTommaso & Spinner, 1997).

For this research, there is no focus on social or emotional loneliness, a general approach to loneliness has been chosen that can include both the social and emotional aspect of the concept. Because there will be a multilevel analysis on the individual- and country level, the emergence of loneliness is seen as an interplay of personal factors and environmental conditions and constraints (Fokkema, Gierveld & Dykstra, 2012).

2.1.3 Interpersonal contact via internet and telephone

For many, the Internet has become something commonplace. It is used for shopping, information and inspiration search, banking, watching television, contact with loved ones, and many other things. It seems that all aspects of our lives are influenced by the Internet (Amichai-Hamburger, Ben-Artzi, 2003). But above all, the Internet has also become a social environment where people from all over the world are connected to each other despite their different locations and timetables. So, this technology of the Internet offers a place where people can meet to do business, collaborate, solve problems, organize projects and participate in conversations (Quaglio & Millar, 2020).

Researchers in computer mediated communication (CMC) attribute in 2006 the Internet's popularity as a social medium to at least four characteristics of internet communication topic (Peter & Valkenburg, 2006). First, it is so that in internet communication, people have more time to reflect on the content of what can or want to be said than in face-to-face communication. As a consequence, they can easily control if, when, how, how much and what they communicate to others on the internet; hence it offers controllability (McKenna and Bargh, 2000). Second, internet communication conveys fewer social status cues than face-to-face communication (Kiesler et al., 1984). As a result, contact between communication partners may not only emerge more easily in internet communication than in face-to-face communication, it may also be of greater reciprocity in the sense that communication partners feel that they and others are more responsive in internet communication than in face-to-face communication (Peter & Valkenburg, 2006). Finally, due to anonymity and reduced visual and auditory cues, people may more easily overcome shyness on the internet than in face-to-face settings (McKenna and Bargh, 2000). This may make it easier for people to talk about a greater number of topics and to feel less inhibited in disclosing personal or intimate information about a particular topic (Peter & Valkenburg, 2006). Controllability, reciprocity, breadth and depth of internet communication are central to explanations of how and why people communicate online (Peter & Valkenburg, 2006). Further, Peter and Valkenburg (2006) argue that although there is a common ground in why people communicate via the internet, there is less clarity around what is now actually considered as internet communication and what not. By internet communication there is mostly meant private, largely text-based interpersonal communication in a dyadic or small-group setting using internet applications such as email, internet relay chat or instant messaging (Peter & Valkenburg, 2006).

Internet use is a broad concept. This study focuses only on using the Internet to interact with loved ones, as this particular use of the Internet is found to have a significant impact on loneliness in the over-65s by Chen and Schulz in 2016. In this study people have been asked how often they have

contact with loved ones via the Internet, reference is made to social media that allows this; Skype, Facebook, WhatsApp, Instagram, Snapchat... but other programs that allow contact with loved ones can also be counted. This contact can therefore occur via chat, calling or video calling (Perrin, 2015).

For contact by phone there may be different interpretations, so this can include the home phone and/or mobile phone. Also, this can be the use of a smartphone with connection to the internet, which makes the use of the Internet and phone for interpersonal contact seem inextricably linked today (McGaughey, 2013; Chen & Schulz, 2016). The interpersonal contact via the Internet and/or telephone therefore includes many possible ways of remote contact.

2.1.4 The collectivism-individualism thesis

In this paper, the 32 European countries surveyed in the European Quality of Life Survey of the year 2016 are placed on a scale that reflects the extent to which national cultures are seen as more individualistic or collectivistic (Hofstede & Minkov, 2010). This distinction is best understood to the extent to which people belonging to the culture are encouraged to think about themselves as independent or interdependent human beings, by promoting interdependence in collectivistic cultures and independence in individualistic cultures (Kanagawa, Cross, & Markus, 2001; Oyserman & Lee, 2008).

According to Hofstede, individualism is typically characterized by valuing autonomy and placing personal goals above those of others, while collectivism is linked with putting the interests of the group (such as a family or community) above one's own interests (Hofstede & Minkov, 2010). Hofstede and Minkov (2010) say that individualism can be defined as the preference for a loose social framework in which individuals are expected to take care only of themselves and their immediate family. Collectivism, on the contrary, represents the preference in an individual for a fixed social framework in the society in which someone can expect their relatives or members of the ingroup to take care of them in exchange for unconditional loyalty. The position of the society on this dimension is reflected in whether people their self-image is being defined in terms of "I" (individualistic societies) or "we" (collectivistic societies) (Hofstede & Minkov, 2010). Individualism-Collectivism is seen as one dimension of culture that can be defined as a set of shared ideas that determines the goals and perspectives of individuals in a collective (Chiu et al., 2011). The degree of individualism in a country confirms in particular how the fulfilling of the needs of an individual should be achieved: reciprocally in (smaller) groups in collectivistic cultures, or by the members themselves in individualistic cultures. Out of this follow ideas about how to relate and to whom, such as responsibility for the other, or the value attached to self-prudence. Important in the context of loneliness is that this also includes norms about how an individual should be socially connected (expected ideal social connection), and also about what types of relationships a person should establish, or even how connected one should feel to certain others (e.g., in parent-child relationships) (Lykes & Kimmelmeier, 2014).

When studying individualism in societies, two types of data can be distinguished: average scores of individuals in a society and characteristics of societies as wholes (Lykes & Kimmelmeier, 2014). Although the two are closely interlinked, in this research will be only focused on the degree

of individualism at the level of the society, which is represented as the level of individualism at the country level (Lykes & Kimmelmeier, 2014).

It is important to note that the degree of individualism in a country is a continuum and not a dichotomy, which means that each nation is more likely to hold a position on the scale than to be placed in a specific category (Hofstede & Minkov, 2010). The individualism indexes used in this study come from "Cultures and Organizations: Software of the Mind" by Hofstede and Minkov (2010). The position of a country on this dimension shows a solution by society to a universal dilemma: the sought-after strength of a person's relationships with the group(s) with which one identifies (Hofstede & Minkov, 2010).

2.2 Theory

2.2.1 Loneliness and European regional differences

Because loneliness can have serious negative consequences for both mental and physical health, and that this is the case especially for elderly, many efforts have already been made to collect empirical information about the phenomenon (Lykes & Kimmelmeier, 2014; Fokkema, de Jong Gierveld & Dykstra, 2012). For example, there has been found that having a partner is of great importance to reduce the chance of living in loneliness, but also that the intimacy of the relationship with the spouse is decisive to prevent loneliness. So, there is an effect both qualitatively and quantitatively (Shiovitz-Ezra, 2013).

Research into the effect of gender on loneliness in the elderly found that older women with a small majority show more loneliness than the older men and that this gap increases as older age occurs (Pinquart and Sörensen, 2001; Nicolaisen and Thorsen, 2014). This is due to the lower life expectancy in men compared to women, which makes women more likely to stand alone (Hansen & Slagsvold, 2015). Another study shows that this difference between men and women is mainly found in former Communist countries in Europe (Goodwin, 2006). Loneliness levels in these countries are on average 5 to 15 % higher for women than for men due to a lower life expectancy of men in these countries compared to men elsewhere in Europe (Hansen & Slagsvold, 2015). Gender differences in loneliness are completely or largely explained by differences in health, living arrangements, and socioeconomic status (Botev, 2012). The heightened risk of women may be more pronounced in Southeastern European countries given the higher prevalence of financial difficulties, widowhood, and health problems among older women in many of these countries than in Western European countries (Petrov, 2007).

Furthermore, age is a major factor in the chance to live in solitude. A large body of Western cross-sectional and longitudinal studies have explored associations between age and loneliness (Dykstra, 2009; Pinquart and Sörensen, 2001; Yang and Victor, 2011). Loneliness is shown to be quite stable between the age of 25 and 80 but to increase rapidly above age 80. In young old age (age 60–80), the percentage that reports frequently feeling lonely is 5–10 percent, while an additional 20–40 percent report occasional feelings of loneliness. In advanced old age (80+), about 40 to 50 percent often feel lonely (Dykstra, 2009; Yang and Victor, 2011).

In older adults and the elderly, the proportion who is living alone or in institutions such as an old people's home rather than with family is higher, so this also something that increases the risk of

loneliness as one gets older (Dykstra, 2009). The result of aging is also that one is less able to come outside to meet people and is therefore more vulnerable to live in solitude, because one becomes dependent on people who come on visit to have social contact (Arsenijevic & Groot, 2018).

Health is also a strong predictor of loneliness. Loneliness is a pervasive social issue in many countries, with negative mental and physical health consequences for those that are experiencing it (Lykes & Kimmelmeier, 2014). As mentioned above, when people have poorer physical health, people are less likely to meet people outdoors, and therefore the risk of loneliness is higher (Arsenijevic & Groot, 2018). But mental health also plays a role in the risk of loneliness, when people deteriorate cognitively their social network also shrinks (Börsch-Supan & Schuth, 2014). Numerous other studies also indicate that older adults who are in poor health are most vulnerable to loneliness (De Jong Gierveld, Van Tilburg, & Dykstra, 2006; Pinquart & Sörensen, 2001; Victor, Scrambler, Bond & Bowling, 2000).

Chen and Schulz confirm in 2016 that both the physical and mental health of the elderly weakens greatly when combined with the feeling of loneliness, Courtin and Knapp came in 2017 also to this conclusion. So, it seems that health and loneliness can reinforce each other.

As already mentioned, loneliness is a subjective concept, different types of interactions will have different implications for feelings in loneliness (Holt-Lunstad et al., 2015). Dykstra (2009) identified three sets of factors as explanations of cross-national differences in loneliness: differences in population composition, country-level characteristics, and interactions between individual characteristics and country. Loneliness does not only depend on one's personal experiences, it is always created in the context of a certain culture with the typical normative values and customs. These cultural differences are mainly divided as individualistic and collectivistic (Rokach et al., 2002; Hofstede & Minkov, 2010).

Several studies have concluded that there is a greater sense of loneliness among citizens from collectivistic cultures than from individualistic cultures (Dykstra, 2009; Fokkema, de Jong Gierveld & Dykstra, 2012; Lykes & Kimmelmeier, 2014). Lykes and Kimmelmeier (2014) say that just because collectivistic cultures glorify interpersonal connections with loved ones, their absence is more likely to be perceived as painful and thus make a person feel lonely more quickly. Loneliness is seen here as a psychological response to not meeting cultural expectations. People from more collectivistic cultures are therefore more likely to feel lonely than people in more individualistic cultures even if they experience similar levels in social isolation (Lykes & Kimmelmeier, 2014; Niedzwiedz et al., 2016). It is true that in more collectivistic cultures the discrepancy between the ideal social connection and the actual connection is often higher, and this is what leads to loneliness (Lykes & Kimmelmeier, 2014). Hendrix (2018) says that a development towards more individualism (versus collectivism) would make people neglect their relationships with friends and family more, which is why they really lack contact or meaningful relationships, and then start to feel lonely. Swader argues in 2018 that individualism at the society level reduces loneliness, but it is not known exactly how this effect takes shape because this is not done through personal loyalty of individualistic norms. As a result, people who choose to be more independent are more likely to be lonely, but the degree of individualism in a society can at least partly compensate for this effect. Swader (2018) therefore finds that the best way to reduce loneliness is when people have strong face-to-face social contacts but live in a supportive individualistic society. This research will make a possible contribution to this by also adding the effect of remote contact on loneliness in the analysis.

It appears that in countries with generous social security schemes, where per capita public expenditure on health and welfare services is among the highest in Europe, people enjoy better social and psychological well-being than in countries where the state provides less (Hansen & Slagsvold, 2015). In many of the former socialist countries, formal support structures are largely absent (Iecovich et al. 2004). Hence, older people in Eastern Europe may be particularly prone to loneliness because of inequalities in health, social integration, and socioeconomic resources, which in turn may be driven by macro-level socioeconomic inequalities and different levels of welfare provision. The fact that wide country heterogeneity in loneliness remains after controlling for various living conditions prompts the adoption of a cultural perspective to understand this variation (Hansen & Slagsvold, 2015). This research will provide a possible insight in this variation by including the country variable of individualism in this multilevel analysis of loneliness and can control for most of the relevant factors at country level by including the comprehensive variable of GDP per capita.

In Europe, individualism at country level matters for the extent to which contact with family and friends, obtaining assistance in daily life and having a confidant help to reduce loneliness (Lykes & Kemmelmeier, 2014). It is therefore the case that not all relationships contribute equally to reducing loneliness, and that this depends on the degree of individualism in a culture (Lykes & Kemmelmeier, 2014). The research by Lykes and Kemmelmeier (2014) also showed that there are not only systematic cultural differences in the extent to which people experience loneliness, but that there are also cultural differences in the predictors of loneliness. Which confirms the importance of considering incorporating culture and context into analyzing loneliness. There are several studies confirming the cross-national differences in loneliness between European regions (e.g., Sundström, Fransson, Malmberg, & Davey, 2009; Lykes & Kemmelmeier, 2014; Niedzwiedz et al., 2016). This is attributed to several factors, such as the previously mentioned individual expectations regarding social contacts, poverty, health or household size. The main predictors will be included as control variables, both at the individual as at the country level.

2.2.2 The Internet and telephone use among over-65s in Europe

The Internet is becoming more and more established in all generations of the population and therefore also more studies have been done in the past two decades on the use of Internet in the older population (Selwyn, Gorard, Furlong & Madden, 2003; Hamer & Stamatakis, 2014; Van Deursen & Helsper, 2015; Friemel, 2016; König, Seifert & Doh, 2018). Previous research based on data collected in 2015 found that 49 percent of over-65s use the Internet in Europe. However, the situation varies widely between European countries (König, Seifert & Doh, 2018). It is true that, despite the fact that the Internet has become a part of everyday life for many, not every household in Europe has the Internet at its disposal. In 2017, for example, an average of 90 percent of north European households have access to internet and 63 to 75 percent of households in countries from Eastern and Southern Europe do (OECD, 2017).

While younger generations might find it difficult to imagine a life without a smartphone and computer, in the year 2017 in Europe there were more than two-fifths of people aged 65-74 in the EU-27 who had never used a computer (König, Seifert & Doh, 2018; Eurostat 2015). These numbers were, according to data of Eurostat from 2017, much higher in Italy and Romania with

more than two thirds of people who had never used a computer, and around three quarters of people in Croatia (73 percent), Bulgaria (74 percent) and Greece (78 percent). There can be concluded that there are strong national differences in the use of computers and mobile phones in Europe (König, Seifert & Doh, 2018; Eurostat 2015).

There are several studies that confirm that age is a strong predictor of the degree people make use of the Internet. The use of the Internet is negatively related to age, i.e., the proportion of internet users is consistently lower in older generations than in younger ones (König, Seifert & Doh, 2018). Brandtzaeg, Heim and Karahasanović (2011) also concluded, based on European data, that age is the biggest factor in the use of the Internet. The older someone is, the less likely they are to use the Internet. This is also confirmed in the study 'Internet use among older Europeans' by König, Seifert and Doh (2018) which says that over-65s are far from a homogeneous group on internet use. On average, only 10% of Europeans over the age of 80 use the Internet and 36% between the ages of 70 and 75, compared with 73% of people between the ages of 50 and 55. Furthermore, the health and well-being of over-65s also have an impact on internet use (König, Seifert & Doh, 2018). Health problems that hinder internet access in the elderly are mainly cognitive in nature, as these problems are also more likely to occur as people age (Freese et al., 2006). A later study by Hamer and Stamatakis (2014) confirms that better cognitive fitness is significantly associated with increased internet use.

It is also the case that internet access can help with mental health problems (Van Deursen & Helsper, 2015). Internet use does not require physical movements and can therefore offer the possibility to maintain a social network from your own home. This means that people who are mentally less healthy are less likely to try out the Internet and therefore less likely to maintain their mental health, so (mental) health and internet use seem to reinforce each other. Also, for effective telephone use, increasing physical and mental problems is a concern, especially defects in the senses cause a major limitation (Bronwyn, Martin, & Poon, 1999).

The level of education also predicts the use of internet; the higher that older adults are educated, the more likely they are to use the Internet (König et al., 2018). What goes with this is socioeconomic status, which also has a positive relationship with internet use, studies in Europe and the United States confirm this (König et al., 2018; Yu & Chang, 2016).

While the variables described above reveal clear social inequalities in the likelihood of someone becoming an internet user in old age, differences between genders are less clear. Friemel (2016) found no relationship between gender and being present online. On the other hand, many studies conclude that among the elderly men are more online than women (König et al., 2018; Selwyn, Gorard, Furlong & Madden, 2003; Van Deursen & Helsper, 2015).

Study of Conci et al. in 2009 refutes stereotypes that older people are not ready for communication technology. For example, it is so that the growth in the use of mobile phones in people over the age of 65 is much greater than in the younger generations (Igbaria et al., 1997; Conci et al., 2009). Conci found out in 2007 that older people consider mobile phones to be useful for communication and safety, and that therefore the use of the over-65s is high. Ling (2008) also confirms that safety is an important reason for older people to use a mobile phone and that it is an important tool in preserving older people's freedom. According to the same author, mobile communication is also a suitable means for developing new relationships and already existing friendships. Actually, the pressure of having a mobile phone comes from having social interactions (Ling, 2008).

The main difficulties for older people in the use of computers and smartphones are finances, limited vision, lack of interest and a lack of knowledge about the use of technological equipment (Conci et al., 2009). The physical changes that people typically undergo as they age are often a hindrance to the use of electronic devices, especially if they are small like mobile phones (Roupa et al., 2010). Many mobile phones are not designed with the needs and capabilities of seniors in mind, but rather with young people who are often used to the use of electronic equipment from an early age (Briede-Westmayer et al., 2020). Next to that, it is important to mention that study finds out that the elderly are one of the groups that have the strongest growth in the use of smartphones (Mcgaughey et al., 2013; Mohadis, 2014).

It is true that the older population is embracing the new technology, which is probably due to its multifunctionality, ranging from being in contact with others, safety and social interaction, to reducing boredom. In fact, it seems that older people are gaining more from technology compared to young people (Mcgaughey et al., 2013).

2.2.3 Loneliness and use of internet and phone

One possible way to tackle the phenomenon of social isolation and loneliness in the elderly is to use modern technology. Technology use provides a relative cheap and easily available way for communication that offers the opportunity to reduce loneliness and social isolation in the elderly (Chippis & Jarvis, 2016). The geographical distance to friends and family, mobility problems and time-consuming roles (e.g., caregiver) can affect older people's ability to social interaction, making them vulnerable to social isolation and developing feelings of loneliness. Remote contact via telephone and/or internet can help to avoid that people end up with feelings of loneliness (Leist, 2013). Maintaining social relationships is defined as a core element of healthy aging (Leist, 2013). Since a significant proportion of older people live alone, social media offers the opportunity to participate in meaningful social contact (Leist, 2013). Pedro et al. (2019) tells that also the phone is a fundamental tool to maintain relationships for elderly people living alone. The possibility for the elderly to use a phone, whether it is a telephone or smartphone, gives a big freedom to them by making it possible to connect with friends and family from a distance that could not be reached without these tools (Pedro, 2019).

Previous research has already concluded that there is a negative correlation between internet use and loneliness among the elderly, as the internet is used more, feelings in loneliness decrease (Bond, Burr, Wolf, & Feldt, 2010; Carpenter & Buday, 2007). Both the studies of Pedro et al. (2019) and Luo et al. (2019) conclude that contact via (mobile) phone is positively correlated with social activity and negatively correlated with feelings of loneliness in the elderly. According to Chen and Schulz (2016), internet use in the elderly can help to combat social isolation through four mechanisms: the promotion of social support around them, maintaining contact with the outside world without physical movement, developing more social networks and strengthening self-confidence. Also mobile phones offer great potential in improving the quality of life of seniors by reducing social isolation and improving ties with family and friends (Mcgaughey et al., 2013).

A systematic review of 25 studies showed that the use of ICT (information and communication technology) – such as Skype, Windows, Live Messenger and telephone – can increase social

support and social connection, thus preventing social isolation in the elderly (ages 66-83 years) (Chen and Schulz, 2016). Delello also concludes in 2015 that ICT in general (which is referring to internet, mobile/smartphone, iPads, social networking sites and audio/video chat apps) are an effective way for older people to stay connected to their fellow human beings. On the other hand, there is the review of studies by Karimi (2012) which says that ICT is not a guarantee of good quality communication. For example, when ICT communication is not reciprocal, it can cause an increase in loneliness instead of a decrease for older people. Previous research on telephone use also found that the number of outgoing telephone calls was not associated with loneliness in the elderly, but that the number of incoming phone calls did have a negative correlation with loneliness (Petersen et al., 2016). Chen and Schulz (2016) conclude that there is a need for more studies on the effect of ICT on loneliness in the elderly, they say that ICT in general is a promising tool for avoiding social isolation in the elderly, but it does not work for every person. This study will analyze whether the effect of the use of the Internet and telephone for interpersonal contact on loneliness is different for countries in Europe according to their degree of individualism. Chen and Schulz (2016) also recommend that mobile phone apps be included in analyses of loneliness in the elderly, which will happen in the analysis of this study.

It is also possible that the use of the Internet can promote social isolation through convenience. This seems to occur because people who are connecting frequently with loved ones online have less time to meet people in real life, and actually this encounter in real life is an important to feel connected with someone (Fokkema and Knipscheer, 2007). It therefore seems recommended that internet/email for interpersonal contact be used complementary to face-to-face contact, rather than as a substitute (Fokkema and Knipscheer, 2007; Cornejo et al., 2013; Lelkes, 2013). Khalaila and Vitman-Schorr (2018) also found that video calls are a convenient way to overcome barriers to connecting people who cannot meet face-to-face, but who are more likely to support existing relationships than create new ones. This research will go further on this divide and complement of face-to-face contact and remote contact by including both remote contact and face-to-face contact.

2.3 Research questions and hypotheses

The general problem of this study can be formulated in the following question:

"Are there national differences in loneliness among over-65s between more individualistic or collectivistic cultures in Europe, and are these due to differences in the use of telephone and internet for interpersonal contact?"

The following research questions are drawn up from this:

- What effect does the degree of individualism in a culture have on the feeling of loneliness among over-65s in Europe?
- What effect does the degree of individualism in a culture have on the degree of interpersonal contact via telephone and internet among over-65s in Europe?
- What effect does interpersonal contact via internet and telephone have on experiencing loneliness among over-65s in Europe?

- Does the use of internet and telephone for interpersonal contact have a mediating effect on the relationship between the degree of individualism in a culture and loneliness in over-65s in Europe?
- How does the possible effect of interpersonal contact over internet and telephone on the experience of loneliness in the over-65s in Europe vary according to where countries are located on the IC continuum?

Based on these research questions and on the basis of the theory discussed, the following hypotheses were put forward as possible substantiated answers to the research questions:

Additive effect

The first goal of this study is to re-examine whether the degree of individualism typical of a national culture has an effect on loneliness, this first hypothesis is based on previous studies (e.g., Lykes & Kemmelmeier, 2014; Fokkema et al., 2012; Jylhä & Jokela, 1990).

- 1) European over-65s from a more collectivistic society are more likely to be lonely.

It seems that citizens in more individualistic cultures generally use the Internet and telephone more for contact with loved ones than in cultures that are more collectivistic (König, Seifert & Doh, 2018; OECD, 2017). This is verified with the following hypothesis:

- 2) Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe.

As mentioned before, using the Internet and telephone to stay in touch with family and friends has a negative correlation with experiencing loneliness (e.g., Mcgaughey et al., 2013; Lelkes, 2013; Chen and Schulz, 2016). Out of these findings comes the third hypothesis:

- 3) The use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness.

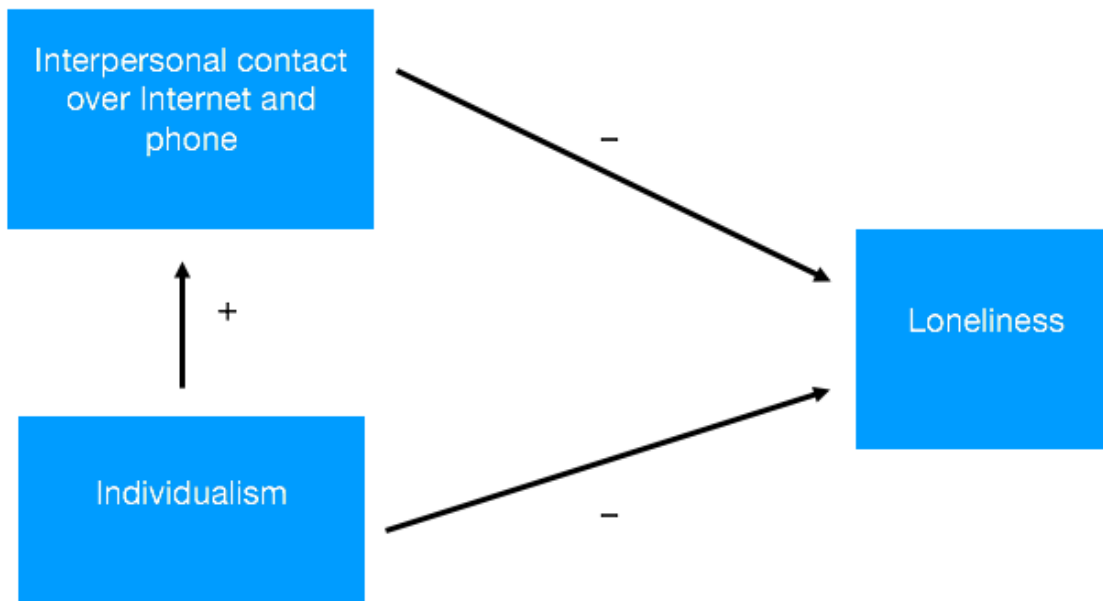


Figure 1: Additive effects

Mediator effect

Older people from a more individualistic society are believed to use the Internet and telephone more for contact with loved ones than older people in a less individualistic society (König, Seifert & Doh, 2018; Eurostat 2015). This may show that the effect of the degree of individualism in a country on loneliness can be partly explained by the degree of interpersonal contact via telephone and internet.

- 4) The use of internet and telephone for interpersonal contact has a mediating effect on the relationship between the degree of individualism in a country and loneliness in European over-65s.

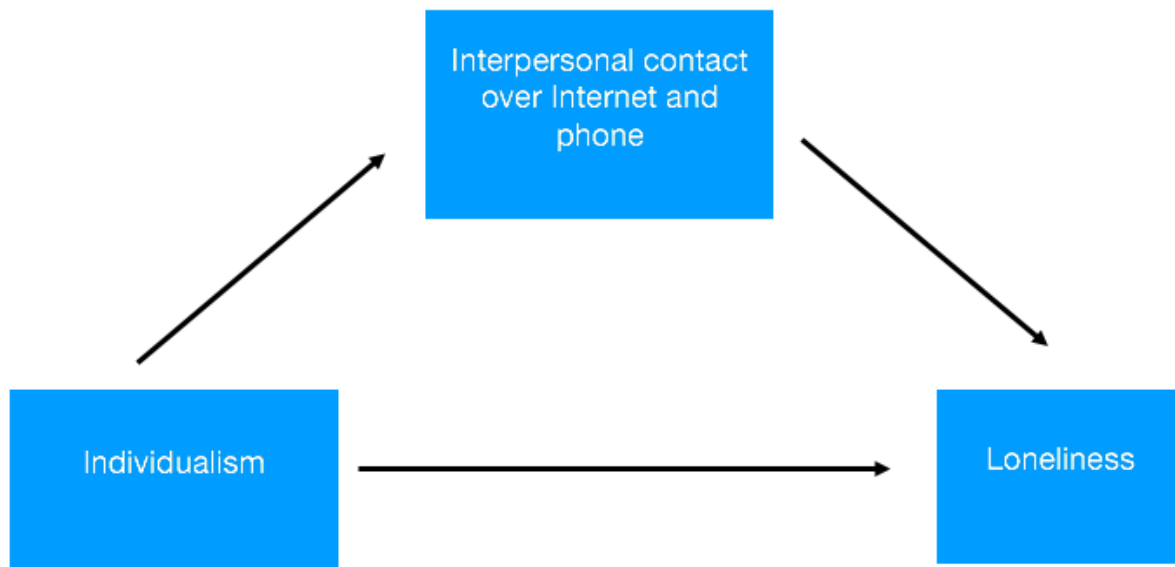


Figure 2: Mediator effect of interpersonal contact via the internet and telephone between individualism and loneliness

Moderator effect

It is believed that over-65s from a more individualistic society are more likely to settle for remote contact than older people from a more collectivistic culture. This assumption comes from the finding of previous research that says that the ideal image about social bonding in individuals in collectivistic societies is higher (Lykes & Kemmelmeier, 2014; Niedzwiedz et al., 2016).

- 5) Living in an individualistic society ensures a stronger effect of interpersonal contact over the phone or the Internet on experiencing loneliness in European over-65s.

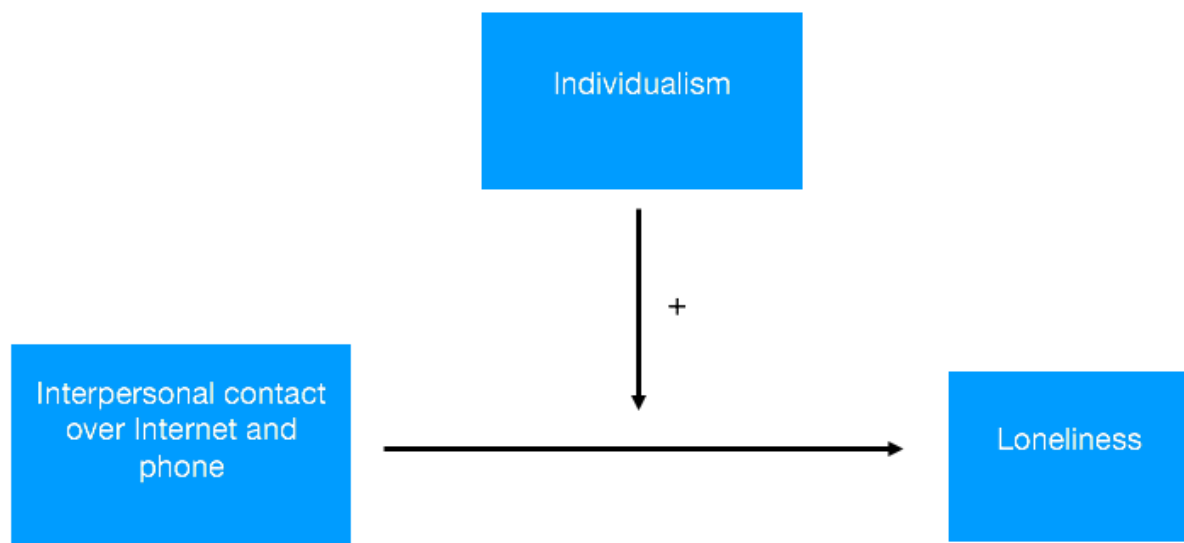


Figure 3: Moderator effect of individualism on the effect of interpersonal contact via the Internet and telephone on loneliness.

3 Method

The five hypotheses ‘European over-65s from a more collectivistic society are more likely to be lonely’, ‘Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe’, ‘The use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness’, ‘The use of internet and telephone for interpersonal contact has a mediating effect on the relationship between the degree of individualism in a country and loneliness in European over-65s’ and ‘Living in an individualistic society ensures a stronger effect of interpersonal contact over the phone or the Internet on experiencing loneliness in European over-65s’ will be tested against the results obtained from the analyses. The necessary conclusions will be drawn from this to answer the research questions. The type of research used here is therefore a test study. To test the hypotheses, three datasets are used, one carried out on an individual level by the Eurofound (2016) and two carried out at country level, one by Hofstede and Minkov (2010) and one by the European Social Survey (2016).

3.1 Data description

3.1.1 European Quality of Life Surveys

The dataset with variables containing information on the level of European individuals that will be used comes from the fourth wave 4 of the European Survey on Quality of Life (EQLS), collected

by Eurofound. This research documents people's living conditions and social situations and explores topics relevant to the lives of European citizens. The data was collected between September 2016 and March 2017. This happened in 32 countries: the 27 EU Member States, five candidate countries (Albania, Montenegro, Serbia and Turkey) and former member the United Kingdom. The results of this survey provide information on quality of life and quality of public services. In this research we will focus on the domains in all three of these aspects that are relevant for loneliness in over-65s.

In each country, a stepped, stratified, random sample was taken. This has been done on the basis of high-quality national registers, personal registers or registers of households and addresses (or it was also possible that a number of instructions were called at random addresses). The national samples have been broken down into groups by region and degree of urbanization. A number of sample units were randomly selected per subpopulation in proportion to the size of the population. A random sample of households was then drawn within each primary sample unit. Finally, in each household, the respondent was randomly selected, unless personal registers were used. The target population is residents of the aforementioned countries aged 18 years or older.

The target of the sample size per country was 1000 cases. In order to reflect the larger population in certain countries, the target size was increased to 1300 for the United Kingdom, for Germany to 1600 and for Turkey until 2000. Eurofound also offered countries the opportunity to supplement their sample themselves. This was done by Italy, which also increased the target size there to 2000. The total sample size, after deleting the incomplete interviews, for the fourth wave (2016) of the European Quality of Life Survey was ultimately 8937 cases for all 32 countries combined. The survey was based on a questionnaire with interviews conducted in the houses of the respondent. The interviews were translated every time in the country's national language or languages. In order to ensure the quality of data collection, the Eurofound surveys follow the quality criteria of the European statistical system as developed by Eurostat. Eurofound and its contractor for the European Quality of Life Survey 2016 (Kantar Public in Belgium) carried out a large number of quality checks during the preparation and implementation of the survey in order to obtain high-quality results.

A total of 104 questions and 262 items are available in the European Quality of Life Survey 2016. The questionnaire of the previous survey was evaluated in consultation with policy makers and experts in the field of survey research. A high-quality questionnaire is a key element for a successful survey, which is why Eurofound invests heavily in the development and translation of its questionnaires (Eurofound, 2016).

3.1.2 Hofstede & Minkov: Individualism-Collectivism

Hofstede's study (1980) was the first to offer a national index of individualism versus collectivism. It is the most influential study of individualism and collectivism done at country level (Hofstede, 2001). The question of whether it is still relevant to use these figures is appropriate, but the datasets were kept up-to-date and are still used in a lot of research (Lykes & Kemmelmeier 2014; Van Zomeren 2018; Hofstede & Minkov, 2010). From 1976 to 1979 Hofstede reduced national cultures to four dimensions (Hofstede, 1980). One was individualism versus collectivism (IC), a dimension of national culture that is strongly correlated with national prosperity and before that

marks the cultural differences between economically developed nations and those with less developed economies (Hofstede & Minkov, 2010).

All countries in the IBM studies were given an individualism index score that is low for collectivistic societies and high for individualistic societies. The scores reflect relative positions of the countries opposite each other.

The scale with the scores in national individualism for the 32 included countries (Hofstede & Minkov, 2010). The countries have been broken down into the different regions on the basis of the United Nations Geoscheme:

- Eastern Europe: Czech Republic (58), Hungary (80*), Poland (60), Romania (30), Slovakia (52), Bulgaria (30)

- Northern Europe: Sweden (71), Estonia (60), Finland (63), Ireland (70), Latvia (70), United Kingdom (89), Lithuania (60), Denmark (74)

- Southern Europe: Spain (51), Italy (51), Slovenia (27), Serbia (25), Albania (20*), Malta (59), Greece (35), Montenegro (24*), Portugal (27), Croatia (33), Turkey (37), Cyprus (35**)

- Western Europe: Belgium (75), France (71), Germany (67), Austria (55), Luxembourg (60), The Netherlands (80)

(*) Certain country scores cannot be found in Hofstede's books. These scores are - partially or completely - not from Professor Hofstede; but they were added by research projects of other researchers or internal projects of Hofstede Insights. Because this has happened under the management of Hofstede Insights, all references can be made to Hofstede Insights as the original source (Hofstede Insights, n.d.).

(**) The individualism score was only measured in the Greek part of Cyprus.

The scores in individualism of the countries are based on research by Minkov and Hofstede in the third and final edition of 'Cultures and Organizations, Software of the Mind (2010)', pages 255-258.

3.1.3 Eurostat

The control variable at country level 'GDP per capita' comes from a dataset of Eurostat. The indicator is calculated as the ratio of real GDP to the average population of the year 2016. GDP measures the value of total final output of goods and services produced by an economy within a certain period of time. It is a measurement for economic activity in a region and is also used as a proxy for the development in a country's material living standards. However, it is a limited measure of economic welfare. For example, neither does GDP include most unpaid household work nor does GDP take account of negative effects of economic activity, like environmental degradation. Real GDP per capita is calculated as the ratio of real GDP to the average population of a specific year and is based on rounded figures. The data providers are Eurostat and the statistical office of the European Union, the numbers are based on data reported by the countries (Eurostat, 2017).

3.2 Description variables and operationalization

3.2.1 Dependent variables

Loneliness. The data on loneliness were obtained on the basis of the following question: “Please indicate for each of the statements which is closest to how you have been feeling over the last two weeks”. Where the theorem about loneliness is “I have felt lonely”. The possible options the respondents could choose from were: ‘All the time’, ‘Mostly’, ‘More than half the time’, ‘Less than half the time’, ‘Sometimes’ or ‘Not at all’. In addition, respondents could also refuse to reply (‘Refusal (SPONTANEOUS)’) or there could be indicated that people did not know how lonely they felt (‘Don’t know’). Only one of the options could be indicated.

Although reducing the categories of the variable to only two has drastic effects for the declaration effect of the variable, this was necessary to be able to conduct a regression with loneliness as dependent variable. To be able to do a logistic regression analysis wherein there could be tested whether people felt lonely or not according to their characteristics on different variables at the individual- and country level, the variable has been transformed into the two categories ‘Never lonely’ and ‘Sometimes or more lonely’. The category ‘Not at all’ has become the category ‘Never lonely’. The categories ‘All the time’, ‘Mostly’, ‘More than half the time’, ‘Less than half the time’ and ‘Sometimes’ have been merged into the category ‘Sometimes or more lonely’.

3.2.2 Independent variables

Remote contact (via internet and telephone). The independent variable containing the data on contact over the internet and telephone was questioned as follows: “And on average, how often do you have contact with friends or family living outside your household by phone, the Internet or by post? Any family members or relatives”. The respondent could choose between the options: ‘Every day or almost every day’, ‘At least once a week’, ‘One to three times a month’, ‘Less often’ or ‘Never’.

In addition, it could also be indicated that people did not know which option to choose (‘Don’t know’) or that they refused to reply (‘Refusal (SPONTANEOUS)’). When searching for internet and telephone contact with family, there could also be answered that the respondent did not have any family members ‘Don’t have such relatives (SPONTANEOUS)’. Only one of the options could be chosen by the respondent.

In addition to the survey for interpersonal contact with family via the internet and telephone, the same was questioned for friends and neighbors (“And on average, how often do you have contact with friends or family living outside your household by phone, the Internet or by post? Any of your friends or neighbours”). This could be answered in the same way as the contact with family, only the answer that the question cannot be answered due to a lack of such family members was not optional here. As can be seen, this survey also included mail, this will be taken into account further, but the focus will be on contact via the internet and telephone. After all, a longitudinal study by the European Commission shows that mail is used less and less for contact with loved ones and is therefore only a minimal fraction of distance contact, even among the elderly (European Commission, 2018).

Thus, the search for interpersonal contact via the internet and telephone therefore leads to two variables: one about family members and one about friends and neighbors. The variables representing remote contact with friends or neighbors and remote contact with family or relatives will be merged towards the variable ‘remote contact’. Because there is a linear relation with the

variable of loneliness, the variable of remote contact can be used as a scale (David, 2009). The variable will be a scale with nine levels going from 0 to 8, with 0 representing 'never' and 8 'every day or almost every day'.

Individualism (at country level). Professor Geert Hofstede carried out an extensive study on how values in the working environment are influenced by culture. A large dataset of people's value scores was analyzed in IBM studies between 1967 and 1973 (Hofstede, 1980). The data included more than 70 countries. In the 2010 edition of the book 'Cultures and Organizations: Software of the Mind', the scores on individualism cover 76 countries. These were based in part on replications and extensions of the IBM study on different international populations and by different researchers (Hofstede Insights, n.d.; Hofstede & Minkov, 2010). In this study there will be 32 countries with their degree of individualism included. All countries in the IBM studies were given an individualism index score that is low for collectivistic societies and high for individualistic societies. The scores in individualism of the 32 countries included in this study reflect their relative position to each other.

3.2.3 Control variables

To avoid the degree of loneliness being explained by an independent variable other than internet and telephone use for social contact, control variables will be included in the analysis of this study. It is possible that respondents are characterized by one of these variables and that this explains the differences in loneliness rather than the interpersonal contact via the Internet and telephone. As already mentioned, there are many factors that influence the likelihood of suffering from loneliness, these that prove most relevant for this analysis according to existing literature are included here.

Face-to-face contact. The variable that measures direct interpersonal contact with family members was questioned as follows: "On average, how often do you have direct face-to-face contact with the following people living outside your household? Any family members or relatives". Where you could choose between: 'Every day or almost every day', 'At least once a week', 'One to three times a month', 'Less often' or 'Never'.

In addition, it could also be indicated that people did not know ('Don't know') or there could be refused to reply ('Refusal (SPONTANEOUS)'). This survey was done both for contact with family members and for contact with friends or neighbors. When searching for face-to-face contact with family, there could also be answered 'Don't have such relatives (SPONTANEOUS)' in the absence of such family members. Only one of the possible options could be identified. The search for face-to-face contact with friends or neighbors was similar, the question sounded like this: "On average, how often do you have direct face-to-face contact with the following people living outside your household? Any of your friends or neighbours".

The search for face-to-face contact thus establishes two variables: one about family members and one about friends and neighbors. The variables representing face-to-face contact with friends or neighbors and face-to-face contact with family or relatives will be merged towards the variable 'face-to-face contact'. Because there is a linear relation with the variable of loneliness, the variable of face-to-face contact can be used as a scale (David, 2009). The variable of face-to-face

contact can be, just as the variable of remote contact, used as a scale with nine levels going from 0 to 8, with 0 representing 'never' and 8 'every day or almost every day'.

Age. To make sure that the younger elderly are not less lonely just because of their age, but because they use more internet and telephone for social contact, age is included as a control variable. It is true that age is a major factor in loneliness; the older one is, the more likely one is to live alone (Dykstra, 2009). Which can be linked with the fact that the older someone is, the higher the chance that someone lost him or her partner (Dykstra, 2009). Aging, for example, also makes one less able to come out and meet people, which has big impacts in how many social contacts someone experiences (Arsenijevic & Groot, 2018; König, Seifert and Doh, 2018). The age of the respondent was questioned as follows: "Let's start with you. What was your age last birthday?". Where the interviewer that asked the question, fills in the number of years that the respondent answered. The variable is going from 65 years until the category '90 or older' which includes people that exceeded their 90th birthday. The category of '90 or older' has been made up to avoid that there were some people reaching very high birthdays that could influence the analysis.

Gender. To be able to check whether people are lonely because of their internet and phone use for interpersonal contact and not because characteristics linked with gender(types), gender has been included as a control variable. For the gender of the respondent, only the two standard categories of male or female were used. Therefore, people who do not identify with these categories were not taken into account. The previous study generally found that women report more feelings of loneliness than men (Pinquart and Sörensen, 2001; Nicolaisen and Thorsen, 2014), but there are also analyses that prove otherwise (Mummery, & Sharkey, 2006). Also, the effect of gender on the use of remote contact via internet is found to be double, with some studies concluding that men are using it more than women (e.g., König et al., 2018) and others finding no difference (Friemel, 2016).

Education. Because the degree in which one is educated has a major influence on the degree to which a person experiences a feeling of loneliness, the education of the respondent has been included in the analysis (Nimrod, 2015). The education followed by the respondent was questioned as follows: "What is the highest level of education you completed?". The possible answers to this are all possible training courses in the country where the respondent lives. This list of training courses was therefore always adjusted by country. The possible answers were converted into a scale with nine categories in another variable. This scale is subdivided according to the International Standard Classification of Education (ISCED) and will be used to use and compare this cross-national control variable (ISCED, 2011). These nine ISCED levels are:
ISCED 0: Early childhood education ('less than primary' for educational attainment)
ISCED 1: Primary education
ISCED 2: Lower secondary education
ISCED 3: Upper secondary education
ISCED 4: Post-secondary non-tertiary education
ISCED 5: Short-cycle tertiary education
ISCED 6: Bachelor's or equivalent level
ISCED 7: Master's or equivalent level
ISCED 8: Doctoral or equivalent level

Only one of the options could be chosen by the respondent. These nine ISCED-levels have been reduced to three categories including primary-, secondary- and tertiary education for the analysis. For this ISCED level 0 representing 'Early childhood education ('less than primary' for educational attainment)' and ISCED level 1 representing 'Primary education' have been changed into the category 'Primary education'. The ISCED level 2 representing 'Lower secondary education', the ISCED level 3 representing 'Upper secondary education' and the ISCED level 4 representing 'Post-secondary non-tertiary education' were merged into the category 'Secondary education'. Further the ISCED level 5 representing 'Short-cycle tertiary education', the ISCED level 6 representing 'Bachelor's or equivalent level', the ISCED level 7 representing 'Master's or equivalent level' and the ISCED level 8 representing 'Doctoral or equivalent level' have been merged into the category 'Tertiary education'. This has been done to end up with more cases in each category and to end up with better interpretable results. For the analysis this categorical variable of education will be transformed into dummy variables with the category 'Primary education' as the reference category.

Making ends meet. Material wealth of people turns out to be a very big factor in predicting loneliness, which also includes a lot of the other predictors like education level, urbanization, living environment, education completed, size of social network, digitalization in the (former) workplace... (Niedzwiedz et al., 2016).

The survey of the respondent's ability to make ends meet was done with the question: "A household may have different sources of income and more than one household member may contribute to it. Thinking of your household's total monthly income: is your household able to make ends meet...?". This could be answered with: 'Very easily', 'Easily', 'Fairly easily', 'With some difficulty', 'With difficulty', 'With great difficulty', 'Refusal (SPONTANEOUS)' or 'Don't know'. Only one of the options could be chosen by the respondent. As there can be seen, in terms of material wealth, only money was focused. There has been chosen to not use a variable that reflects the absolute material wealth of the respondent's household because this research is cross-national and there are different standards in European countries for what can be seen as 'many', 'enough' or 'too little' in terms of finances. It is also the case that the subjective nature of the question measures the sense of ability to make ends meet of the person in question, which is more important in the feeling of loneliness than the absolute financial situation in which one is located.

Living at the countryside. The extent to which the urbanization of the respondent's living environment is interpreted by the respondent him- or herself, was questioned as follows: "Would you consider the area in which you live to be...?". This degree of urbanization is subjective, it is the degree to which the respondents interpret the environment in which they live in terms of urbanization rate.

The possible answers to the question were: 'The open countryside', 'A villager/small town', 'A medium to large town', 'A city or city suburb', 'Refusal (SPONTANEOUS)' or 'Don't know'. Only one of the options could be identified. No clear effect on urbanization has been found in previous studies. Savikko, Tilvis, Strandberg and Pitkälä (2006) reported greater loneliness in rural areas compared to urban areas among aging adults, while other researchers found no differences (e.g., Hawthorne, 2008; Mullins, Elston, & Gutkowski, 1996). Because when considering urbanization, the division rural versus non-rural living area was founded to have the most significant impact on the feeling of loneliness (Savikko et al., 2006), the scale has been reduced to two categories: 'living at the countryside' and 'not living at the countryside'. The

category 'The open countryside' was renamed in the category 'living at the countryside'. The category 'A villager/small town', 'A medium to large town' and 'A city or city suburb' have been merged into the category of 'not living at the countryside'.

Living with people. The question of the size of the household is as follows: "I'd like to start by asking you a few questions about your household. Including yourself, can you please tell me how many people usually live in this household?". The variable has been adjusted for this analysis in one that is representing whether people live alone in their household or not. This has been done because the impact of living alone opposite to live with more in a household is one of the strongest predictors for experiencing loneliness in the elderly (Routasalo et al., 2006), also because it is strongly correlated with the predictor of whether one has a partner or not (Shiovitz-Ezra, 2013). Latest trends in Europe make this variable of someone living alone or with people even more relevant; most European countries are confronted with an increase in the proportion of older adults living alone. Western and northern European countries are forerunners in this respect, but in more and more other countries, older adults, after widowhood or divorce, are deciding to continue living independently for as long as possible (Fokkema, de Jong Gierveld, & Dykstra, 2012).

Children outside household. The question: "Do you have any children that are not living in your household?" is interesting to include in this study as a control variable because an analysis is done into the effect of remote contact with people outside the household. It could be that having children (inside and outside the household) reduces the feeling of loneliness. The possibility of children within the household is included in the variable 'Living with people'. The question could be answered with the following options: 'Yes', 'No' or 'Refusal (SPONTANEOUS)'. There could only one option indicated. Children outside the household seem to be relevant when researching interpersonal contact via the internet and telephone of over-65s, because several studies confirm that the family network in the elderly is very important in avoiding loneliness, and that the links with the children play a crucial role in this (de Jong Gierveld & Dykstra, 2008). Many older adults lack children and grandchildren to care for them, and when government provision falls short, they may lack resources to help them combat loneliness (Botev, 2012).

Gross domestic product (at country level). There will also be a check on variable GDP at country level. Gross domestic product is a comprehensive factor of various aspects in a country such as education level, national prosperity, economic development... (Ahmad & Schreyer, 2016), and as already mentioned also strongly related to the degree of individualism in a country (Hofstede & Minkov, 2010). The values of this variable are counted in euro and has been diminished by three decimals to become better interpretable results of the effect of it on feelings of loneliness. These GDP values of the European countries concerned come from the dataset of the eighth 'European Social Survey' (ESS 8) from 2016.

3.3 Statistical methods

Because this study analyzes on the level of individuals and countries, a multilevel analysis is appropriate to take into account that people living in the same country are more likely to have the same characteristics than people living in different countries (Aarts et al., 2014). These so called 'nested data' will be considered by running analyzes on both the individual and country level.

Although the countries in this study have not been obtained out of a random sample, there can be done a multilevel analysis because the amount of country level units is with an amount of 32 higher enough (Stegmueller, 2013).

All the cases that had one or more missing values, meaning that there has been responded that people don't know the answer on the question, refuse to answer or did not answer at all, in one of the included variables were deleted out of the final dataset used for the testing of the variables. This to avoid that these missing values could have an influence on the results.

To check the first ('European over-65s from a more collectivistic society are more likely to be lonely'), the third ('The use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness') and fifth ('Living in an individualistic society ensures a stronger effect of interpersonal contact over the phone or internet on experiencing loneliness in European over-65s') hypothesis there will be used a multilevel logistic regression analysis. This because the dependent variable 'Loneliness' contains out of two categories. In the analysis the variable 'GDP per capita' (2016) will be used as control variable on the country level, the variables of face-to-face contact, education level, making ends meet, age, gender, living with people, having a child outside the household and living at the countryside; will be used to control on the individual level. The analysis will happen by using the program MLwiN.

There will be conducted four models. First, a null model without any predictor variables will be built to check whether a multilevel analysis is actually necessary. This will be done by looking at the significance level of the unexplained variances at the country level. Second, the random intercept model on level 1 will be built (random intercept model – level 1) to check whether the level 1 variables explain a significant amount of the variance at the country level. Then the country level variables 'Individualism' and 'GDP per capita' can be introduced which makes up the random intercept model – level 1&2. The model gives further insight in how these country level variables explain a significant amount of variance at the country level. With this model the first hypothesis ('European over-65s from a more collectivistic society are more likely to be lonely') and third hypothesis ('The use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness') can be tested.

For the fifth hypothesis 'Living in an individualistic society ensures a stronger effect of interpersonal contact over the phone or internet on experiencing loneliness in European over-65s' the slope of the effect of the variable remote contact will be able to vary across the countries to measure the effect of the degree of individualism in a country on the effect of interpersonal contact over telephone and internet on loneliness. This moderation effect will also be tested in the program MLwiN. A comparison will be made of the intercept and inclination of the regression lines, after which the possible difference will be explained via a cross-level interaction effect (Bennett, 2016). The testing of the assumptions for this multilevel logistic regression can be found in the appendix (appendix 1).

For the second hypothesis 'Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe', there will be used a multilevel linear regression. For this there will be three models conducted. Again, a null model to check whether a multilevel analysis is necessary by checking whether the unexplained variance at the country level is significant, then a model with only the level 2 variables to check the effect of individualism without controlling for the variables on the individual level. And finally, the variables at the individual level will be added to the analysis which gives a model

containing all the variables at country- and individual level with which there can be checked whether living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe.

There will be controlled on the country level by the variable GDP per capita and on the individual level by the variables: remote contact, face-to-face contact, education, making ends meet, age, gender, living with people, having a child outside the household and living at the countryside. The multilevel linear regression will be conducted in the program MLwiN. The testing of the assumptions for this multilevel linear regression can be found in the appendix (appendix 2).

The fourth hypothesis 'The use of internet and telephone for interpersonal contact has a mediating effect on the relationship between the degree of individualism in a country and loneliness in European over-65s', will be tested manually by taking the product of the effect of individualism on remote contact and the effect of remote contact on loneliness to find the indirect or mediation effect of interpersonal contact via internet and telephone.

This fourth hypothesis will be double checked by using the PROCESS 3.5v program of Andrew F. Haze in the program SPSS. This is done to measure the indirect effect of the degree of individualism in a European country on loneliness in the over-65s through the use of internet and telephone for interpersonal contact.

4 Results

The analysis of loneliness testing the first, third and fifth hypothesis consists of four models. First there has been conducted a model without any predictor variables (null model) to see whether there is a significant amount of variance at the country level. A Wald-test with P-value of zero revealed that the unexplained country variance with a value of 0.488 and a standard error of 0.128 was indeed significant. Because of that a multilevel analysis on the individual- and country level of the variable loneliness is useful. Another test, the loglikelihood Chi squared test finding a significant lower loglikelihood value for the null model compared to a model with only variance at the individual level, also confirmed that it is indeed significantly better to use a multilevel model. The second model (Random intercept model - level 1) has been obtained by adding the variable of remote contact together with the control variables at the individual level (face-to-face contact, education level, making ends meet, age, gender, living with people, having a child outside the household and living at the countryside) into the regression analysis. By doing this the unexplained variance at the country level decreased to 0.404 with a standard error of 0.106. By performing a Wald-test showing a P-value of zero, there has been found that this value is significant, which means that there is still a significant amount of variance to explain and it can be interesting to add variables at the country level to the analysis.

Because of adding the level 2 (country level) variables individualism and GDP per capita, there is a decrease of the unexplained variance to 0.220 with a standard error of 0.060. Again, a Wald-test showed that this value is significant and that there is still a significant amount of variance at the country level left unexplained in the 'Random intercept model – level 1&2'.

With the random intercept model consisting of the variables at both levels, hypothesis one 'European over-65s from a more collectivistic society are more likely to be lonely' could be investigated. The negative effect size of individualism on feelings of loneliness by elderly amounts -0.013 with a standard error of 0.005. Out of these values of the effect size and standard

error a t-value of -2.6 has become, because this is higher than the limit value of 2.58 (99%-confidence interval), it shows that the effect is significant at the 0.01 confidence level even for adding all the control variables at both the level of individual and country. The alternative hypothesis can be accepted; there can be concluded that European over-65s from a more collectivistic society are more likely to be lonely. Which does confirm findings out of previous studies (Dykstra, 2009; Fokkema, de Jong Gierveld, & Dykstra, 2012; Lykes & Kemmelmeier, 2014). This finding confirms that there is a significant effect of the degree of individualism in a culture wherein an over-65 lives on the risk to which he or she is exposed to have feelings of loneliness. So, it can occur that two people out of different countries are experiencing the same amount of social isolation, but one is experiencing loneliness and one is not due to the degree of national individualism typical for their country.

Also, the third hypothesis 'The use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness' can be checked with the random intercept model containing of the level 1 and 2 variables (Random intercept model – level 1&2). The effect size of remote contact via internet and telephone on loneliness is -0.026. This effect gives by dividing it with its standard error of 0.013 a t-value of 2 which gives a significance on the 0.05-level. Although the negative effect of use of internet and telephone for interpersonal contact in the elderly is only significant at the 0.05-level, the alternative hypothesis can be accepted, the use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness. This finding is confirming previous literature saying that internet and phone use has the potential to reduce feelings of loneliness among elderly (Chipps & Jarvis, 2016; Bond, Burr, Wolf, & Feldt, 2010; Carpenter & Buday, 2007; Pedro et al., 2019). And it contradicts literature concluding that it is necessary to use interpersonal contact via internet or phone complementary to face-to-face contact to have an effect on loneliness, because however by controlling for face-to-face contact the results say that remote contact can be partially a substitute for live conversations in decreasing feelings of loneliness for people over the age of 65 in the 32 European countries included (Fokkema and Knipscheer, 2007; Cornejo et al., 2013; Lelkes, 2013; Stockwell, 2020).

As a final step, the slope of the regression line of remote contact is made possible to vary across countries (Random slope model) to check the fifth hypothesis 'Living in an individualistic society ensures a stronger effect of interpersonal contact over the phone or the Internet on experiencing loneliness in European over-65s'. Doing this, the unexplained variance at the country level increased to 0.223 with a standard error of 0.061, meaning that this variable is less valuable than the variable without random slope. By using a Wald-test showing a P-value of 0.354, there could be concluded that the random slope variance of 0.001 with a standard error of 0.002 is not significant.

Checking the covariance of the variances of the intercepts and slopes, there is found that it is a negative value of -0.009 with a standard error of 0.007. Because this variance value is negative, there could be assumed that there is a fanning in pattern (see appendix 3). Nevertheless, a Wald-test showed with P-value of 0.217 that this covariance is not significant. The fanning in pattern is not significant. Because of this non-significance of the covariance there is no necessity to explain the covariance by adding a cross-level interaction effect in the multilevel regression analysis. The alternative hypothesis can be denied, there is no influence of living in a more individualistic society on the effect of interpersonal contact via internet and telephone on loneliness among

European over-65s. People who live in a more collectivistic society do not experience more or less influence on their feelings of loneliness by using internet and telephone to stay in touch with loved ones. This is contradicting the assumption that over-65s from a more individualistic society are more likely to settle for remote contact than older people from a more collectivistic culture, which is coming out of previous research that says that the ideal image about social bonding in individuals in collectivistic societies is higher than in individualistic countries (Lykes & Kimmelmeier, 2014; Niedzwiedz et al., 2016). There can be concluded that all of the elderly in Europe, coming out of a more collectivistic or individualistic culture, experience approximately the same amount of effect from using internet and telephone for contacting friends and family on their feelings of loneliness.

Table 1: Loneliness regressed on variables at country- and individual level.

Variable	Null model		Random intercept model – level 1		Random intercept model – level 1&2		Random slope model	
	Logodds ratios	SE	Logodds ratios	SE	Logodds ratios	SE	Logodds ratios	SE
<i>Intercept</i>	0.075	0.126	0.093	0.115	0.045	0.088	0.040	0.089
Individual variables								
<i>Remote contact</i>			-0.026*	0.013	-0.026*	0.013	-0.027	0.015
<i>Face-to-face contact</i>			-0.169**	0.017	-0.170**	0.017	-0.171**	0.018
<i>Education</i>								
- Secondary			-0.236**	0.069	-0.247**	0.069	-0.246**	0.069
- Tertiary			-0.349**	0.087	-0.361**	0.087	-0.360**	0.087
(primary as reference)								
<i>Making ends meet</i>			-0.354**	0.021	-0.347**	0.022	-0.347**	0.022
<i>Age</i>			0.022**	0.004	0.021**	0.004	0.022**	0.004
<i>Gender</i>			-0.226**	0.051	-0.225**	0.051	-0.225**	0.051
<i>Living with people</i>			-1.347**	0.054	-1.354**	0.054	-1.355**	0.054
<i>Child outside household</i>			-0.083	0.053	-0.086	0.053	-0.088	0.053
<i>Living at countryside</i>			-0.085	0.083	-0.082	0.083	-0.075	0.083
Country variables								
<i>Individualism</i>					-0.013**	0.005	-0.014**	0.005
<i>GDP per capita</i>					-0.015*	0.006	-0.013*	0.006
Variance (country level)	0.488**	0.128	0.404**	0.106	0.220**	0.060	0.223**	0.061
- Slope							0.001	0.002
- Covariance							-0.009	0.007
N individuals = 8937; N country = 32.								
Standard error (SE)								
*. Correlation is significant at the 0.05 level (2-tailed).								
**. Correlation is significant at the 0.01 level (2-tailed).								

To check the second hypothesis 'Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe', while controlling for GDP per capita on the country level and for face-to-face contact, education, making ends meet, age, gender, living with people, having a child outside household and living at the countryside at the individual level; the effect of individualism in a country has been found to have a negative effect on the degree elderly use internet and telephone for interpersonal contact in that country. However, by doing a t-test using the effect size (-0.003) and the standard error (0.005) this effect was found not to be significant. The alternative hypothesis 'Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe' can be rejected, there is no relation between individualism and the use of internet and telephone for interpersonal contact among elderly. Previous literature reports that there are big differences in internet and telephone use between European countries (König, Seifert & Doh, 2018; OECD, 2017), out of the results obtained in this study there can be concluded that this is not due to differences in the degree of individualism typical for these countries.

The mediation effect remote contact via internet and telephone on the effect of individualism on loneliness is investigated by checking the fourth hypothesis 'The use of internet and telephone for interpersonal contact has a mediating effect on the relationship between the degree of individualism in a country and loneliness in European over-65s'.

By taking the product of the effect of individualism on remote contact (-0.003) and the effect of remote contact on loneliness (-0.026), there has been found that the indirect or mediation effect has a negligible indirect effect size of 0.000078. Because the effect of individualism on the degree over-65s use internet and telephone for interpersonal contact was already non-significant, there could be expected that this mediation effect would be not noteworthy.

When checking this with the program PROCESS 3.5v program of Andrew F. Haze in SPSS, this has been confirmed by finding the rounded result of 0.0001. The values of BootLLCI and BootULCI, which are both zero, confirm that the indirect effect is not significant. The alternative hypothesis 'The use of internet and telephone for interpersonal contact has a mediating effect on the relationship between the degree of individualism in a country and loneliness in European over-65s' can be rejected, there is no mediation effect of remote interpersonal contact via telephone and internet on the relationship between the degree of individualism in a country and loneliness in European over-65s. There can be said, considering the variable of the degree of individualism in a country, that the direct effect of individualism on loneliness is also the total effect.

<i>Table 2: Interpersonal contact via internet and telephone regressed on variables at individual- and country level.</i>						
	Null model		Random intercept model – level 2		Random intercept model – level 1&2	
Variable	(b)	SE	(b)	SE	(b)	SE
<i>Intercept</i>	5.429**	0.079	5.426**	0.078	5.435**	0.067
<i>Country variables</i>						
<i>Individualism</i>			-0.003	0.005	-0.003	0.004
<i>GDP per capita</i>			0.007	0.006	0.004	0.005
<i>Individual variables</i>						
<i>Face-to-face contact</i>					0.415**	0.013
<i>Education</i>						
- <i>Secondary</i>					0.553**	0.055
- <i>Tertiary</i>					1.041**	0.069
(<i>Primary as reference</i>)						
<i>Making ends meet</i>					0.090**	0.017
<i>Age</i>					-0.019**	0.003
<i>Gender</i>					-0.333**	0.041
<i>Living with people</i>					0.048	0.043
<i>Child outside household</i>					0.247**	0.043
<i>Living at the countryside</i>					-0.201**	0.066
Variance						
- Country	0.182**	0.050	0.174**	0.047	0.126**	0.035
- Individual	4.050**	0.061	4.050**	0.061	3.430**	0.051
N individuals = 8937; N country = 32.						
Standard error (SE)						
*. Correlation is significant at the 0.05 level (2-tailed).						
**. Correlation is significant at the 0.01 level (2-tailed).						

5 Discussion

This study examined whether over-65s in Europe experience less loneliness because of the use of internet and telephone for interpersonal contact with loved ones and compared these different effects between elderly from different European countries among the position of the countries on the scale of national individualism. There have been tested five hypotheses on the basis of two multilevel models. The first ('European over-65s from a more collectivistic society are more likely to be lonely'), the third ('The use of internet and telephone for interpersonal contact in European over-65s reduces the chance of experiencing loneliness') and the fifth ('Living in an

individualistic society ensures a stronger effect of interpersonal contact over the phone or internet on experiencing loneliness in European over-65s') hypothesis have been tested by a multilevel logistic regression with loneliness as dependent variable. The second ('Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe') and fourth ('Living in a more individualistic society increases the likelihood of using telephone and internet for interpersonal contact among over-65s in Europe') hypothesis were tested by a multilevel linear regression with contact via internet and phone as dependent variable.

Looking back at the results obtained in this study, there can be pronounced that there is a significant negative effect of the degree of individualism in a society of a country on the feelings of loneliness among over-65s. Elderly who are living in more collectivistic societies in Europe have more chance to experience loneliness than elderly living in more individualistic societies. This means that the elderly experience bigger risk to end up lonely than the elderly from more individualistic countries, which is something several previous studies already concluded (Dykstra, 2009; Fokkema, de Jong Gierveld, & Amp; Dykstra, 2012; Lykes & Kemmelmeier, 2014). It could be interesting to elaborate further on this effect by future research to find out which characteristics typical for collectivistic cultures are actually decisive in this relation. To be able to take this effect into account by for example policy makers or social workers it seems important to find out how these effects actually influence people's thinking patterns around social interactions. Because there has no relation been found between individualism and the use of internet and telephone for interpersonal contact for elderly, this study could not disprove the assertion that these national differences in loneliness are linked with the higher expectations around social contact in collectivistic cultures, both on the level of the individual and on the level of the society/community (Fokkema, Gierveld & Dykstra, 2012; Lykes & Kemmelmeier, 2014). People who are living in more or less individualistic countries do not use more or less the Internet and/or the telephone to stay in touch with loved ones. Because of this finding, there can be inferred that remote contact is not a cause of the national differences between more individualistic and collectivistic countries in loneliness among elderly. Further, the fact that earlier studies are confirming differences in internet and telephone use between European countries is not denied here (König, Seifert & Doh, 2018; OECD, 2017), but it so that this study concludes that these differences are not a consequence of unequal levels of individualism between these countries. Further research could investigate in where these unequal levels in use of internet and telephone for interpersonal contact between countries finds it origins.

That people living in more or less individualistic societies do not use more or less remote contact to have interpersonal contact, has also been confirmed by finding out that the mediation effect of remote contact on the relationship between the degree of individualism in a country and loneliness in European over-65s is non-existent. There is first of all no effect of living in a more collectivistic or individualistic country on the degree elderly use remote contact, neither is there an interaction effect of this remote contact between the degree of national individualism and loneliness among the elderly.

Further, there has been found that the use of internet and telephone for interpersonal contact in European over-65s reduces their chance of experiencing feelings of loneliness. Remote contact, next to face-to-face contact, seems to be an essential tool for narrowing down loneliness among elderly. Contact via telephone and internet can be significantly helpful in reducing loneliness among elderly, although this effect is relatively small. This is confirming several previous studies which also see a negative correlation between the use of internet and feelings of loneliness

(Delello, 2015; Chen & Schulz, 2016; Khalaila and Vitman-Schorr, 2018), and studies finding that phone use can help to avoid social isolation and feelings of loneliness among elderly (Mcgaughey et al., 2013; Pedro et al., 2019). Considering that there is a significant effect of using internet and telephone for contacting friends on loneliness in the elderly, there can be suggested that future research could elaborate more on the relationship between remote contact and loneliness. There can for example be more focused on the different effects for face-to-face contact and contact from a distance, and how these two are interlinked. Seeing nowadays that the screen is already totally accepted as a tool in interhuman connection, the question whether interpersonal remote contact can replace the face-to-face contact seems to become for example more and more relevant for the future.

Lastly, there can be said that there is no influence of living in a more individualistic society on the size of the effect of remote contact via internet and telephone on loneliness among European over-65s. Living in a more individualistic society does not have an impact on the degree of which remote contact reduces loneliness among over-65s. This effect does not differ significantly between European countries, out of which there can be assumed that in all included European countries contact via internet and telephone can reduce partially feelings of loneliness among elderly. To get more insights in the absence of a moderating effect of the degree of individualism in a country on the effect of remote contact via internet and telephone on whether over-65s experience feelings of loneliness or not, future study could conduct more specific analyzes comparing less countries or countries from different regions like northern Europe versus southern Europe.

Lockdown periods have spread awareness about the importance of remote contact in avoiding people ending in total social isolation, especially for the older population (Brooke & Jackson, 2020; Armitage & Nellums, 2020). Although interpersonal contact via internet and telephone can only partially help in reducing feelings of loneliness, this study confirms that the use of remote contact can be a crucial in avoiding that people completely languish in loneliness in times of isolation. If there is a will to avoid the elderly have no social contact for long periods of time, there can be invested in technologies that enable contact from a distance like the Internet and the telephone, knowing that these have a significant impact on decreasing feelings of loneliness. With the aging population in Europe (Albertone et al., 2015), the use of the Internet and telephone can be seen as an opportunity to partially tackle the problem of the lonely elderly weighing on the care system (Fokkema & Steyaert, 2005; Chen & Schulz, 2016; Rooms, 2018). This should be acknowledged by politicians and social organizations working with elderly. The promotion of internet and telephone among elderly can be an interesting agenda item for European governments. Retirement homes should/could invest in digitalization of their infrastructure and people. Because loneliness is higher in the elderly in more collectivistic societies, it can be especially important for governments in countries with a higher degree of collectivism to find ways to deal with loneliness among the elderly. Enabling remote contact via internet and telephone can be one of the decisive tools to tackle the loneliness problem in the older population.

6 Bibliography

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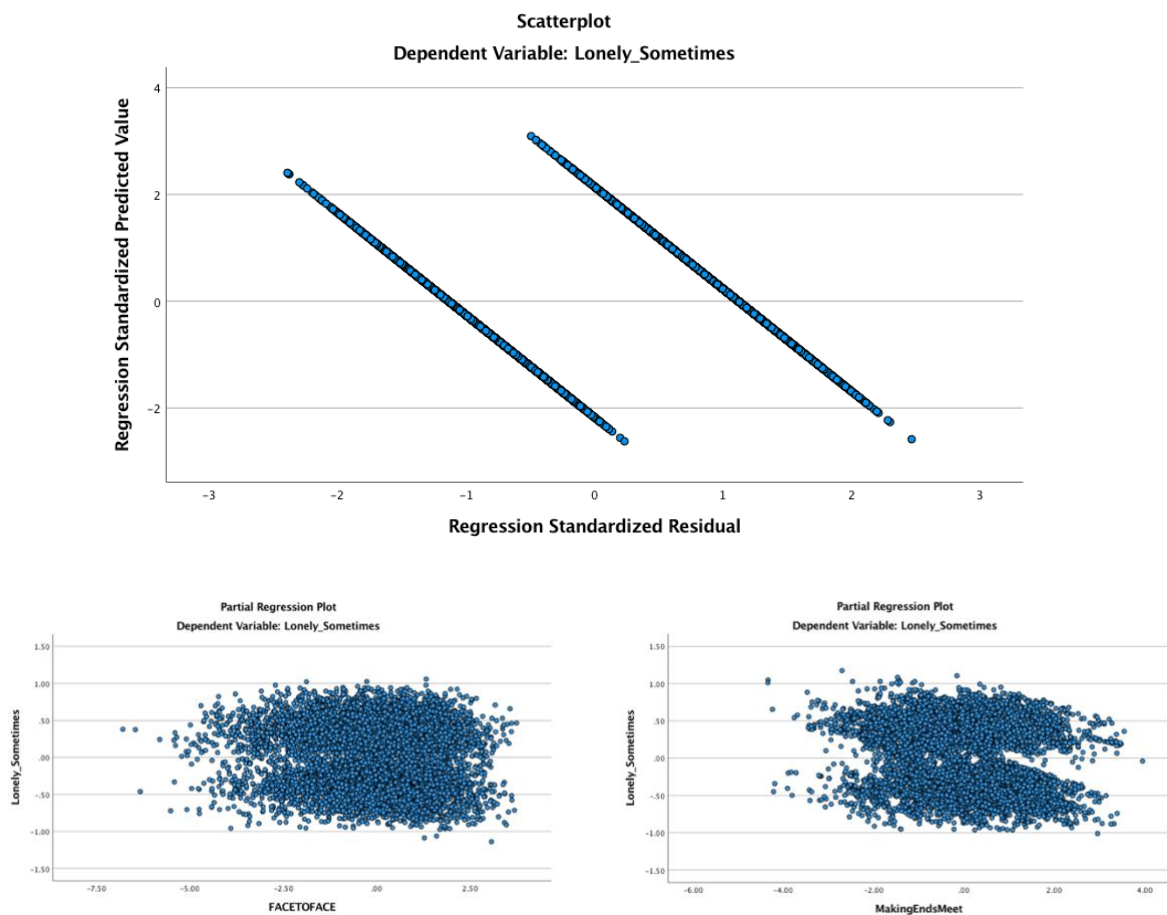
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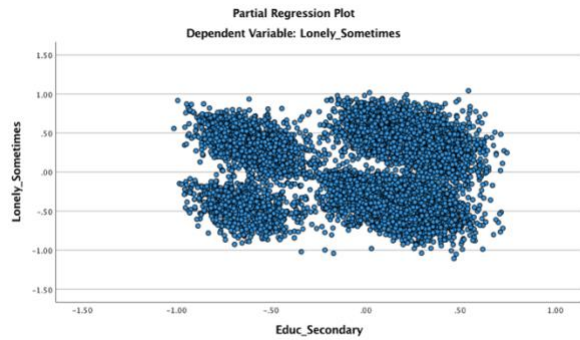
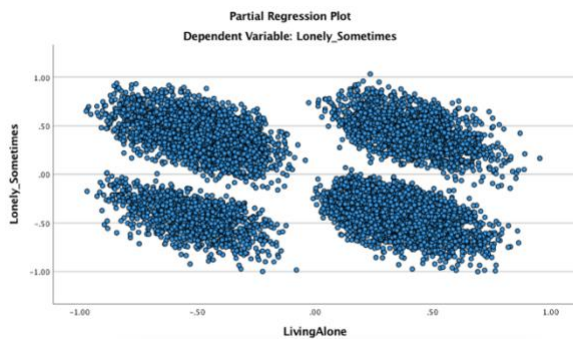
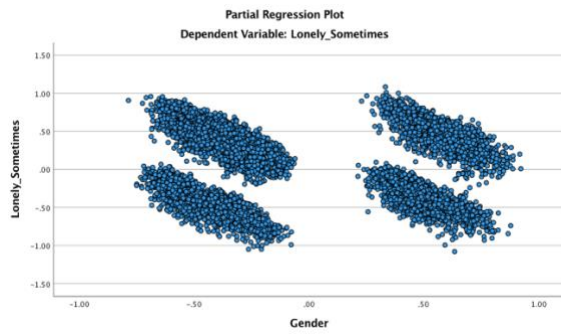
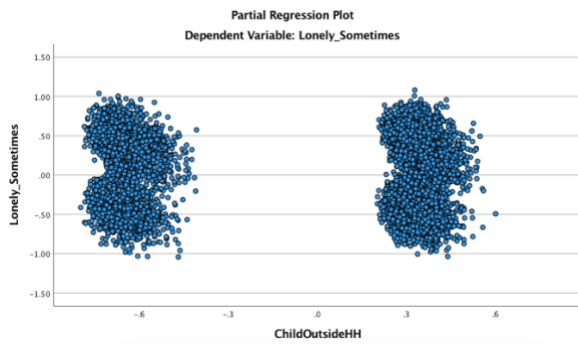
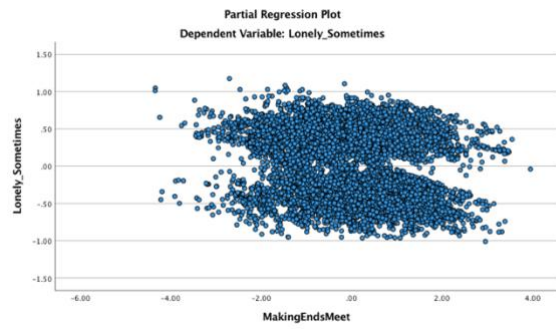
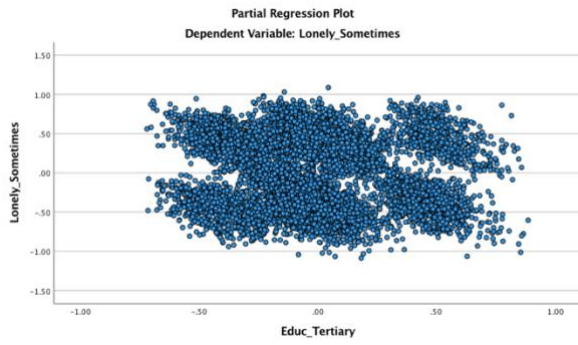
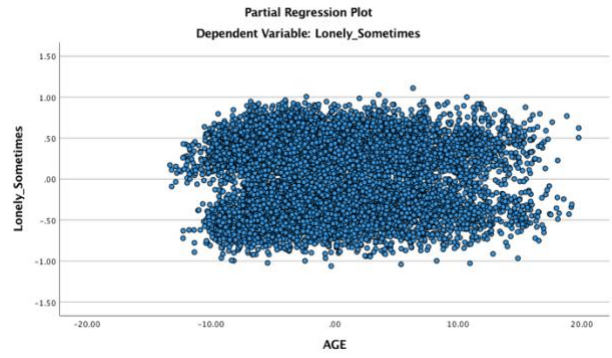
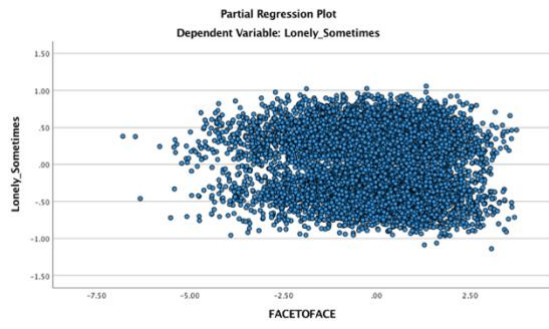
Appendix 1: Assumptions for testing hypothesis one, three and five

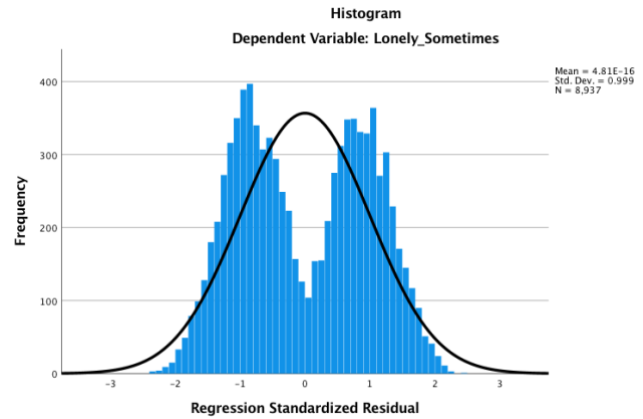
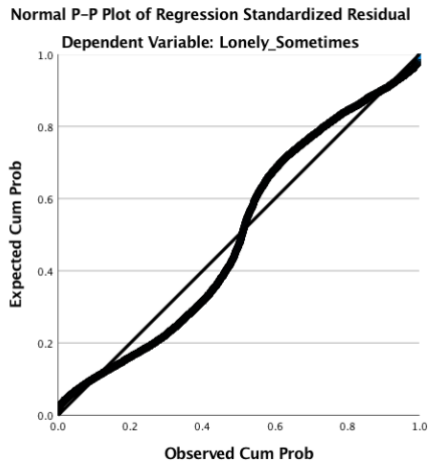
Level 1

1) Linearity and homoscedasticity

The scatterplot of the standardized predicted values shows that the variance of the residuals is equally distributed. When looking at the different separated partial regression plots, there can be concluded that all the variables at level 1 also have an equal distribution from the left to the right. The normal PP-plot of regression standardized residual shows that the data is linearly distributed, although there is some deviance the points are following approximately the linear line.







2) No multicollinearity

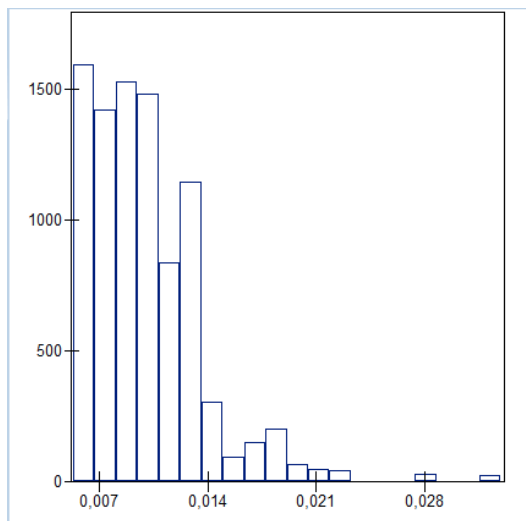
All the VIF-values of the independent variables at level 1 are lower than 3, there is no problem of multicollinearity.

3) No autocorrelation

The value contained by doing the Durbin-Watson test amounts 1.759. Which is between 1.5 and 2.5 meaning that there is no autocorrelation, the residuals at level 1 are independent of each other.

4) No outliers

Looking at the influences of the level 1 residuals, there were no values that deviate from the other values found that could have an influence on the results.

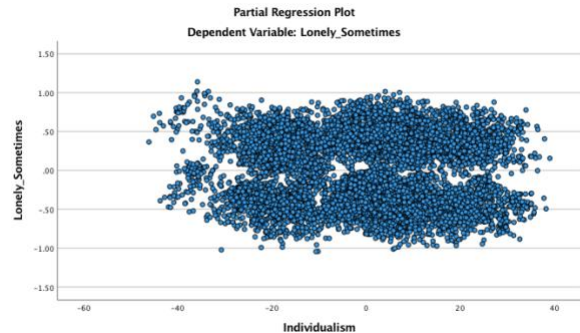
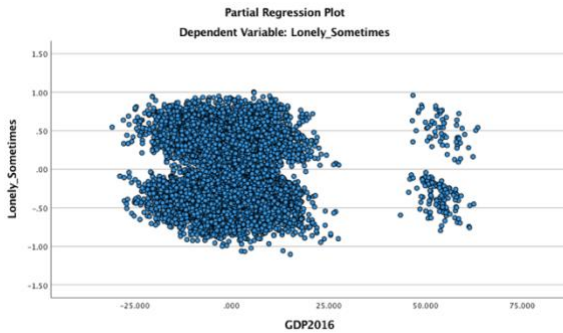


Level 2

1) Linearity and homoscedasticity

The scatterplot of the standardized predicted values shows that the variance of the residuals is equally distributed (see graph at level 1 residuals). When looking at the different separated partial regression plots, there can be concluded that all the variables at the level 2 also have an equal distribution from the left to the right, there is homoscedasticity.

The normal PP-plot of regression standardized residual shows that the data is linearly distributed, although there is some deviance the points are following approximately the linear line (see graph at level 1 residuals).



2) No multicollinearity

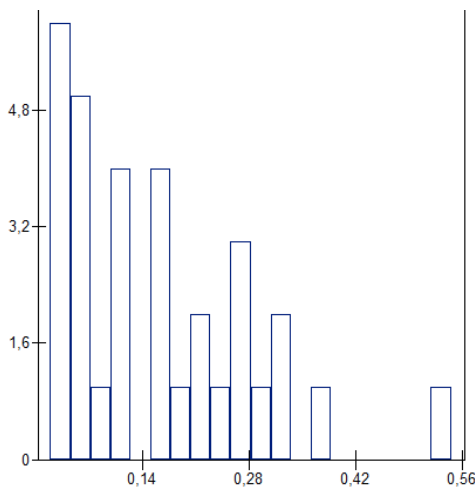
All the VIF-values of the level 2 independent variables are lower than 3, there is no problem of multicollinearity.

3) No autocorrelation

Durbin-Watson test has a value of 1.744. Which is between 1.5 and 2.5 meaning that there is no autocorrelation, the residuals at level 2 are independent of each other.

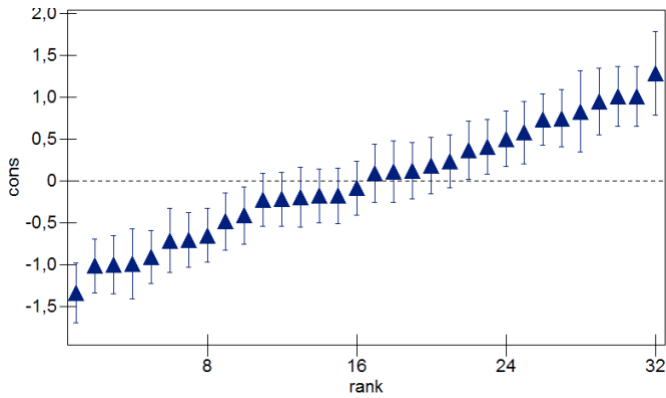
4) No outliers

Looking at the influences of the level 2 residuals, there were no values that deviate from the other values found that could have an influence on the results.

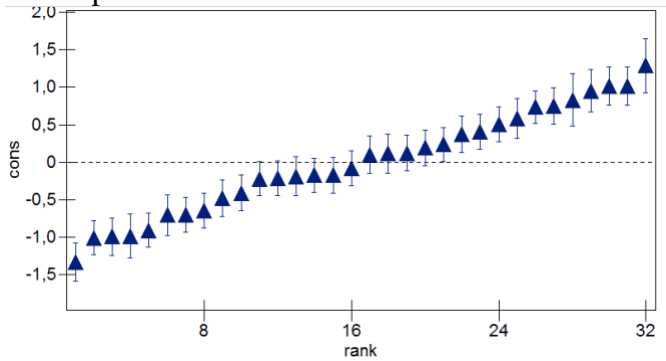


5) Further residual analysis

Catterpillar plots of intercepts of level 2 residuals at confidence level of 1.96, to compare country intercepts with general intercept:



Catterpillar plots of intercepts of level 2 residuals at confidence level of 1.40, to compare country intercepts with each other:

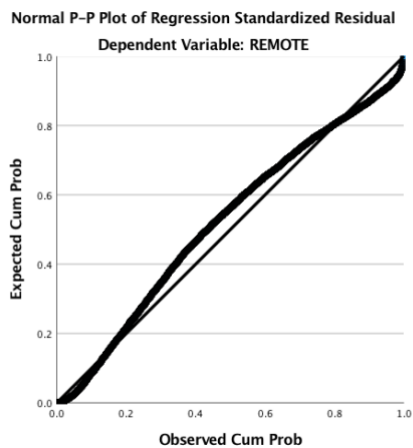
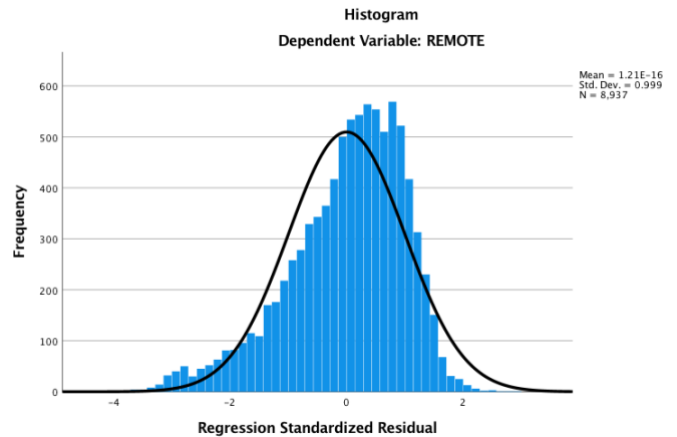
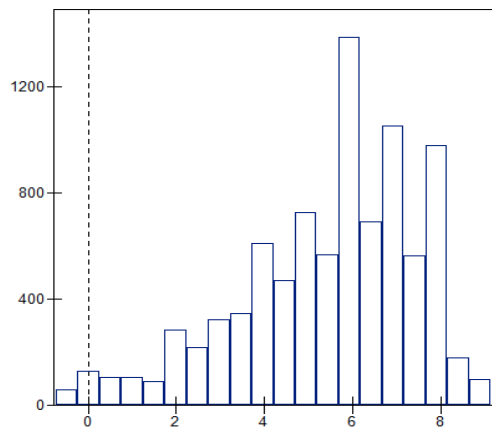


Appendix 3: Assumptions for testing hypothesis two

Level 1

1) Normality

The cases of the variable remote contact follow approximately the linear regression line.

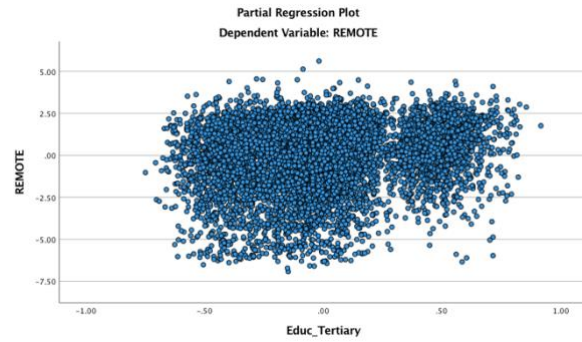
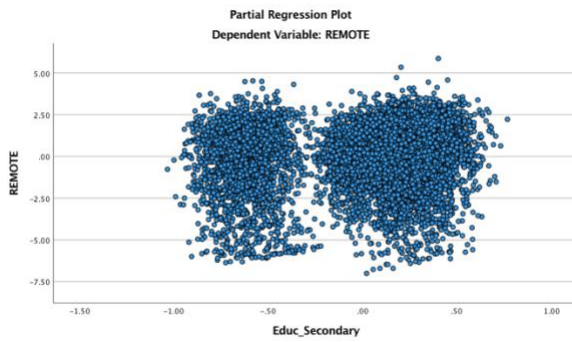
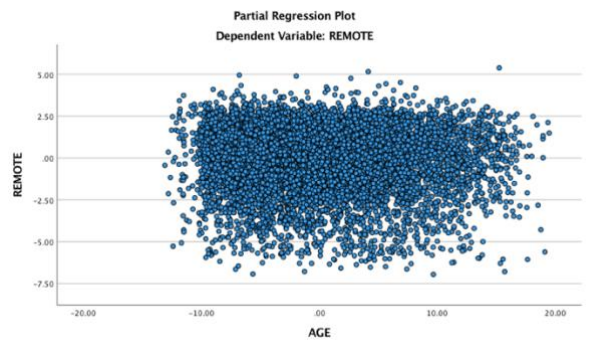
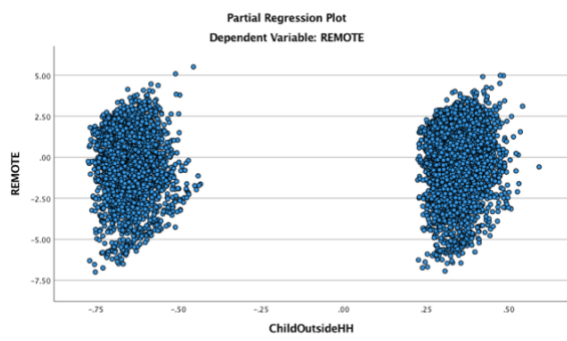
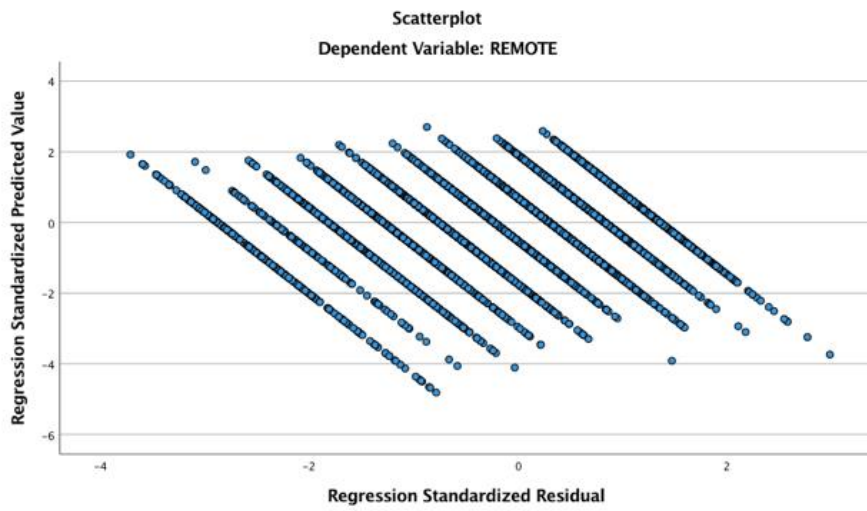


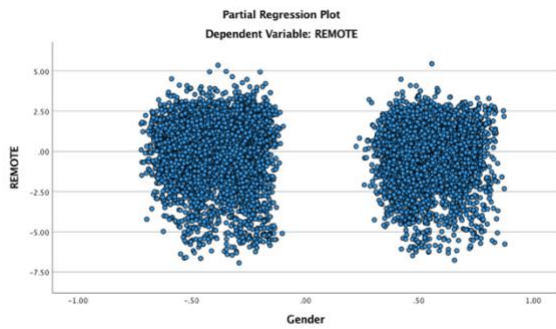
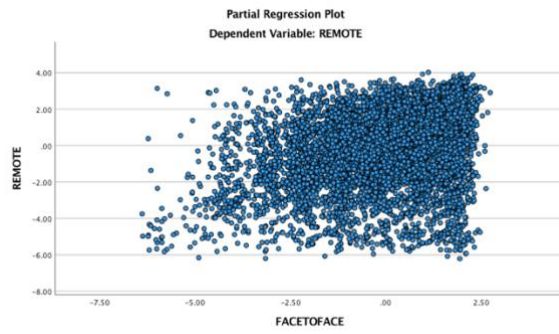
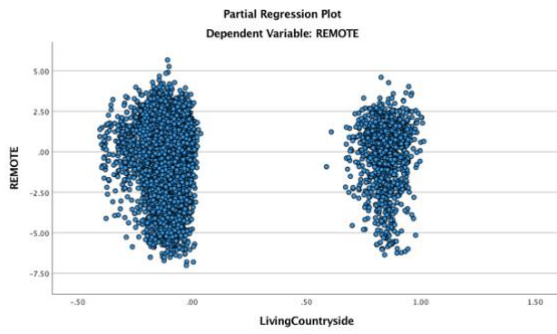
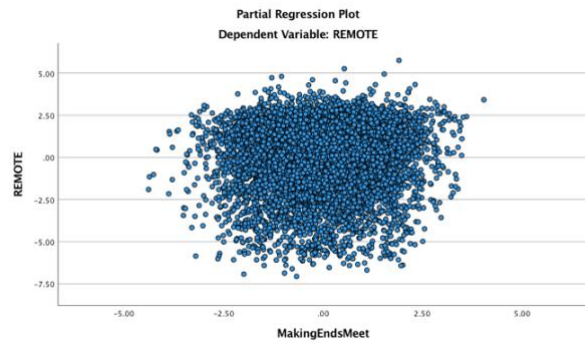
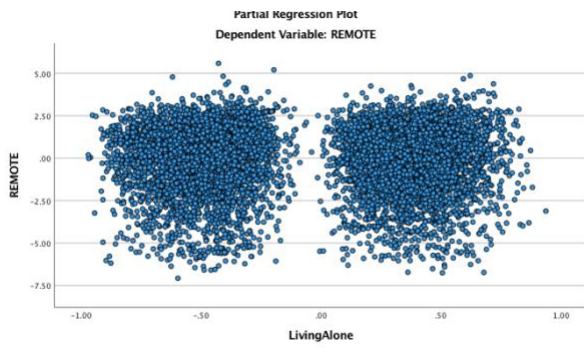
2) No autocorrelation

The Durbin-Watson value is 1.641. Which is between 1.5 and 2.5 meaning that there is no autocorrelation. The residuals at level 1 are independent.

3) Linearity and homoscedasticity

The scatterplot of the standardized predicted values shows that the variance of the residuals is equally distributed. When looking at the different separated partial regression plots, there can be concluded that all the variables at the level 1 also have an equal distribution from the left to the right, there is homoscedasticity. The normal PP-plot of regression standardized residual shows that the data is linearly distributed, although there is some deviance the points are following approximately the linear line.



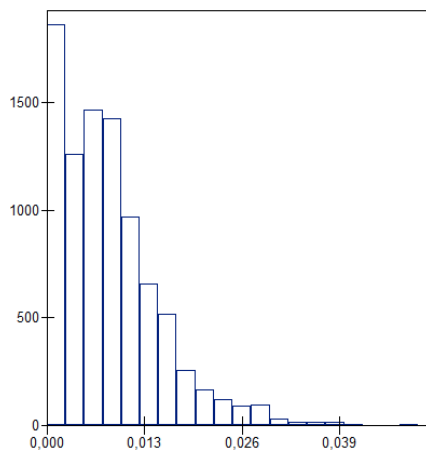


4) No multicollinearity

All the VIF-values of the level 1 independent variables are lower than 3, there is no problem of multicollinearity.

5) Outliers

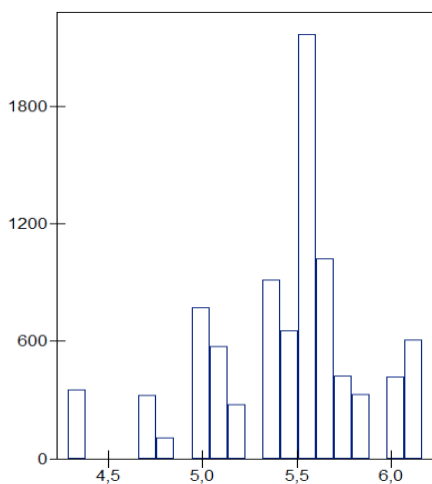
Looking at the influences of the level 1 residuals, there were no values that deviate from the other values found that could have an influence on the results.



Level 2

1) Normality

Although the level 2 residuals are not perfectly normally distributed this is not crucial for the analysis, there can still be conducted a multilevel analysis.



2) No multicollinearity

All the VIF-values of the level 1 independent variables are lower than 3, there is no problem of multicollinearity.

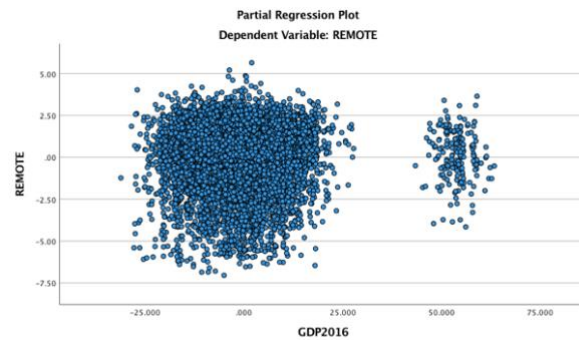
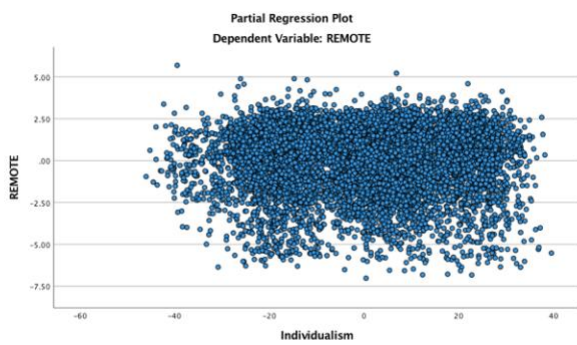
3) No autocorrelation

The Durbin-Watson value is 1.640. Which is between 1.5 and 2.5 meaning that there is no autocorrelation. The residuals at level 2 are independent.

4) Linearity and homoscedasticity

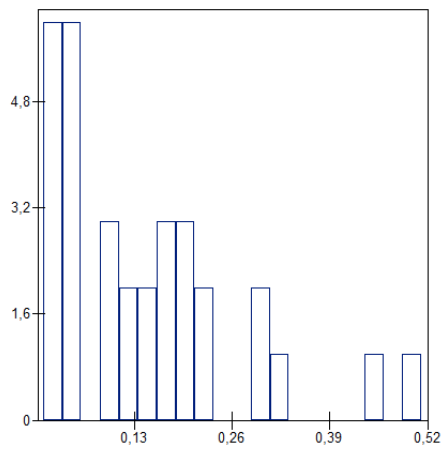
The scatterplot of the standardized predicted values shows that the variance of the residuals is equally distributed (see graph at level 1 residuals). When looking at the different separated partial regression plots, there can be concluded that all the variables at the level 2 also have an equal distribution from the left to the right, there is homoscedasticity.

The normal PP-plot of regression standardized residual shows that the data is linearly distributed, although there is some deviance the points are following approximately the linear line (see graph at level 1 residuals).



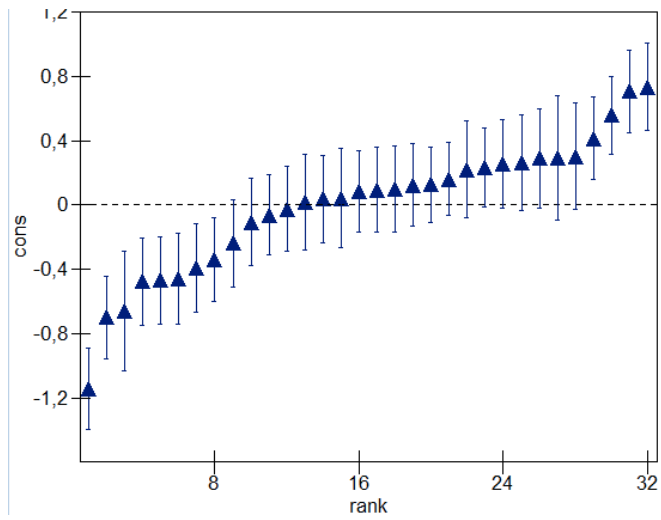
5) Outliers

Looking at the influences of the level 2 residuals, there were no values that deviate from the other values found that could have an influence on the results.

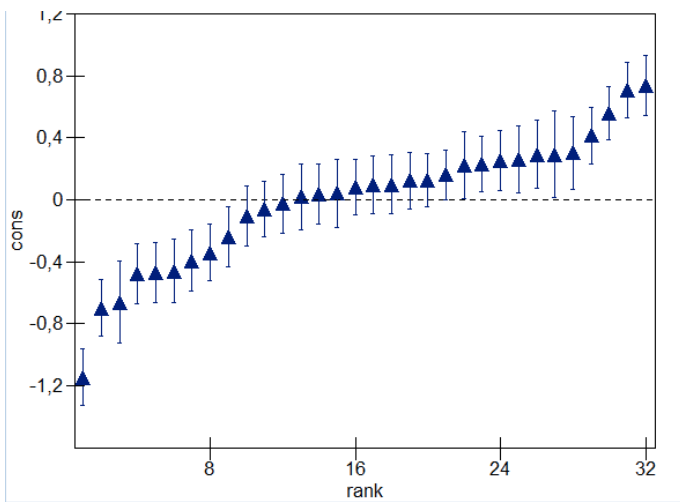


6) Residual analysis

Catterpillar plots of intercepts of level 2 residuals at confidence level 1.96, to compare with general intercept:

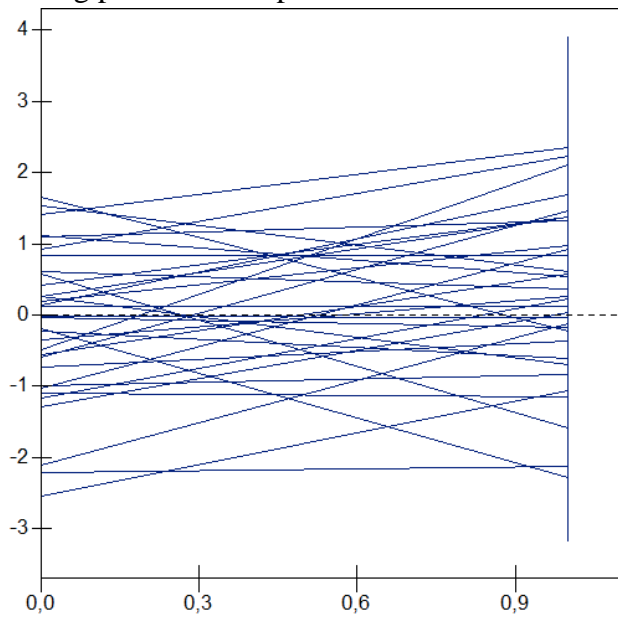


Catterpillar plots of intercepts of level 2 residuals at confidence level of 1.40, to compare country intercepts with each other:



Appendix 3: Graphs

Fanning pattern of the prediction lines of loneliness with random slope of remote contact:



Appendix 4: Univariate statistics

Table 3: Univariate descriptives of the categorical variables.

Variable	Frequency	Percentage
<i>Loneliness</i>	8937	
Never	4435	49.6
Sometimes or more	4502	50.4
<i>Remote contact</i>	8937	
0 (=Never)	323	3.6
1	119	1.3
2	494	5.5
3	536	6.0
4	1155	12.9
5	1150	12.9
6	2143	24
7	1487	16.6
8 (=Every day or almost every day)	1530	17.1
<i>Face-to-face contact</i>	8937	
0 (=Never)	30	0.3
1	36	0.4
2	203	2.3
3	302	3.4
4	746	8.3
5	1288	14.4
6	2060	23.1

7	2141	24.0
8 (=Every day or almost every day)	2131	23.8
<i>Gender</i>	8937	
Female	5126	57.4
Male	3811	42.6
<i>Education</i>	8937	
Primary	2269	25.4
Secondary	5005	56.0
Tertiary	1663	18.6
<i>Making ends meet</i>	8937	
With great difficulty	775	8.7
With difficulty	1087	12.2
With some difficulty	2188	24.5
Fairly easily	2143	24.0
Easily	1796	20.1
Very easily	948	10.6
<i>Living with people</i>	8937	
No	3842	43.0
Yes	5095	57.0
<i>Living at the countryside</i>	8937	
No	7880	88.2
Yes	1957	11.8
<i>Child outside household</i>	8937	
No	3067	34.3
Yes	5870	65.7

Table 4: Univariate descriptives of the metric variables.

Variable	Mean	Standard deviation	Range
Individualism (country level)	54.42	20.088	69
GDP per capita (country level)	24.25	15.21	78.76
Age	73.46	6.48	25

Appendix 5: Bivariate statistics

<i>Table 5: Pearson's correlations between the variables and the dependent variable 'Loneliness'.</i>	
Variable	Pearson's correlation
<i>Remote contact</i>	-0.105**
<i>Face-to-face contact</i>	-0.096**
<i>Gender</i>	-0.135**
<i>Education</i>	
- <i>Secondary</i>	-0.033**
- <i>Tertiary</i>	-0.140**
<i>(Primary as reference)</i>	
<i>Making ends meet</i>	-0.329**
<i>Living with people</i>	-0.298**
<i>Living at countryside</i>	-0.068**
<i>Child outside household</i>	-0.055**
<i>Individualism</i>	-0.155**
<i>GDP per capita</i>	-0.221**
* . Correlation is significant at the 0.05 level (2-tailed).	
** . Correlation is significant at the 0.01 level (2-tailed).	