The impact of social distancing on loneliness in times of the Covid-19 pandemic

Abstract

The problem of loneliness has become more prevalent during the Covid-19 pandemic. Social distancing measures have been taken in order to battle the coronavirus. People have a hard time finding social support and fulfilling their desired levels of social interaction, now that social contact has been limited. This study investigates the relationship between individual social distancing behaviour and loneliness, and possible interacting effects of age, living situation and gender, using structural equation modelling on the fourth wave of the Understanding America Study Covid dataset (n= 6344). Individual social distancing behaviour was not found to be associated with higher levels of loneliness. Being of young age, living alone and being of the female gender were associated with increased loneliness. As there was no significant relationship found between individual social distancing behaviour and loneliness, further research may look into other factors related to the elevated levels of loneliness during the Covid-19 pandemic.

Keywords

Loneliness; social distancing; age; living situation; gender; inequality; Covid-19 pandemic; lockdown

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Introduction

In December 2019, a new infectious disease was detected in the Chinese province Wuhan (World Health Organization, n.d.). On March 11, the World Health Organisation declared the outbreak of the virus, now named Covid-19, a global pandemic, after which the Google search volumes on the coronavirus skyrocketed (World Health Organization, 2020; Effenberger et al., 2020), showing that the virus took hold of people's daily thoughts and lives. In order to minimise the number of victims of Covid-19, many countries implemented the strategy known as social distancing, trying to restrict social transmission of the Covid-19 virus as much as possible (Koh, 2020). It implies that people should try to remain at a distance from other people, their own household excluded (Centers for Disease Control and Prevention, 2020). Throughout the world, schools were closed and curfews were implemented (Financial Times, 2021; United Nations Educational, Scientific and Cultural Organisation, n.d.; C.B. & N.G., 2021). The lives of many people were put on hold and while the focus of the world is on physical health, this seems to have put immense pressure on people's mental health as well. The measures taken to battle the coronavirus seem to have cut off people from the people around them, while they are suddenly no longer allowed to see each other or go to social events, as this now poses a threat to their physical health during the pandemic. People may start to feel isolated, or even lonely, as there is a lack of social interaction. The "normal" lives of many have been put on hold all of the sudden and people experience lots of anxiety and uncertainty (Limcaoco et al., 2020; Ho et al., 2020).

While the social distancing measures taken to battle the Covid-19 pandemic lead to social isolation, the problem of loneliness is becoming more and more prevalent (Wright, 2020; Hwang et al., 2020). Research conducted in the United States of America found the highest levels of loneliness amongst people who still had to strictly practice social distancing due to the regulations in their living area, although levels remained augmented after these social distancing regulations were eased (Killgore et al., 2020). When someone is feeling lonely, this person experiences a discrepancy between their actual social contact and their desired social contact (Jones, 1981; Peplau & Perlman, 1979). Loneliness is the perception of being socially isolated; it is not equal to social isolation (Hawkley & Cacioppo, 2010). There may be people who do not desire to have a lot of social contact, so these people might not feel lonely even though they are objectively alone. Research conducted by Holt-Lunstad (2021) found that the levels of loneliness may have even increased by 20 to 30%. Groarke et al. (2020) found the same result in the United Kingdom, where their cross-sectional research showed that 27% of

the adults are experiencing loneliness during the pandemic. This is a remarkable incline which should be investigated.

Loneliness seems to be associated with a variety of mental health issues and the Covid-19 pandemic seems to further aggravate public mental health. The Rijksoverheid Groningen (2021) has found that Dutch people rate their lives substantially lower than before the Covid-19 crisis, demonstrating this deterioration of public mental health. Loneliness seems to precede depression during the Covid-19 pandemic, and loneliness is found to be a risk factor for many other mental health issues (Cacioppo et al., 2010; Groarke et al., 2020; Xiong et al., 2020; Victor & Yang, 2012; Killgore et al., 2020). Anxiety and even mortality seems to increase when loneliness increases (Kantor & Kantor, 2020; Jia et al., 2020; Killgore et al., 2020). It was found that even 34,9% of respondents experiencing loneliness dealt with thoughts of suicide. There are also other ways in which loneliness poses risks. It was found that experiencing loneliness would raise the prevalence of early death by 26% (Holwerda et al., 2016; Holt-Lunstad et al., 2015). Furthermore, an association has been found between loneliness and dementia (Sutin et al., 2020). Moreover, both loneliness and anxiety are associated with a higher blood pressure, higher heart rates and a decreased functioning of the immune system (Holt-Lunstad et al., 2015). Research found that being lonely for a long time can be just as unhealthy as smoking fifteen cigarettes a day (Hawkley & Cacioppo, 2010; Wright, 2020). Furthermore, what is perhaps most important during the Covid-19 pandemic, is that mental health issues, such as loneliness, can throw the immune system off balance (Miller, 2011). As a result, loneliness is found to increase the risk for infectious diseases (Prince et al., 2007). Meanwhile, mental health care services, such as the Geestelijke Gezondheidszorg in the Netherlands, are being flooded by requests for help and are worried about the decreasing resistance of society (De Nederlandse Geestelijke Gezondheidszorg, 2020). However, the Dutch government did not intervene yet (Geestelijke Gezondheidszorg nieuws, 2021). A mental health crisis is being ignored during times of a physical health crisis, while mental health cannot be separated from physical health. It is of utmost importance to handle the mental consequences of the Covid-19 measurements well, in order to be able to battle the virus.

Before the Covid-19 pandemic, some socio-demographic groups seemed to have a higher risk of being lonely (Groarke et al., 2020). Certain age groups were found to be a risk factor for loneliness. Pinquart and Sörensen (2001) found a U-shaped relation between age and loneliness. Both the younger and the older cohorts experienced increased levels of loneliness. Furthermore, living alone is a risk factor that is often mentioned in research on loneliness (Bu et al., 2020; Victor & Yang, 2012). When one is living alone, the desired social contact will

not be found at home, making people living alone more vulnerable to loneliness. Another risk factor discussed in the research field is gender. Loneliness seems to be unequally distributed over the different genders as well. There is some discrepancy to be found on this gender-distribution of loneliness. According to Barreto et al., 2021), men seem to experience higher levels of loneliness than women. By contrast, according to Victor and Yang (2012), women seem to experience more loneliness than men. This research hopes to clarify this discrepancy. During the Covid-19 pandemic many lives have changed. It would be interesting to study whether the relationship between social distancing and loneliness is different for the aforementioned risk groups compared to groups who are less at risk. Whereas some social distancing measures have a bigger impact on certain groups in society, this research could help clarify what measures may be preferably be taken only as a last resort. For instance, closing schools and universities could increase the levels of loneliness even more amongst the young people who already form a risk group.

Previous research conducted upon loneliness during the Covid-19 pandemic often select a time-span during which governments imposed social distancing regulations upon the population, in order to investigate the relationship between social distancing and loneliness. For instance, some studies analyzed the differences in loneliness between a pre-pandemic dataset and a dataset that was collected during the Covid-19 pandemic (Bu et al., 2020; Wong et al., 2020). Meanwhile, Wickens et al. (2021) decided to select a wave that was measured during the period in which strict social distancing regulations were implemented. By contrast, this study is aiming to contribute to the research field by particularly investigating social distancing on an individual level. Social distancing regulations may be imposed population-wide, however, it is not self-evident that every individual perfectly abides by these rules (Fazio et al., 2021). Therefore, it is interesting to explore the relationship between one's individual social distancing behaviour and loneliness.

This study aims to contribute to the research field on the impact of social distancing during the Covid-19 pandemic on loneliness. During this research, the emphasis will lie on individual social distancing behaviour, whereas previous research more often focused on population-wide social distancing measures. Furthermore, it will be investigated whether the impact of social distancing on loneliness is heterogeneous among different socio-demographic groups.

This research investigates to what extent social distancing, in the context of the Covid-19 pandemic, are related to feelings of loneliness, and whether different effects are found for age, living situation and gender.

Theory

An increase in loneliness in times of the Covid-19 pandemic has been reported by several studies (Hwang et al., 2020; Wright, 2020; Holt-Lunstad, 2021; Groarke et al., 2020). Holt-Lunstad (2021) found that loneliness may have even increased by 20 to 30%. As stated before, the feeling of loneliness is a consequence of a discrepancy between one's actual social contact and one's desired social contact (Jones, 1981; Peplau & Perlman, 1979). Social interaction has shown to be of utmost importance for people. According to the Social Baseline Theory (Coan & Sbarra, 2015), it has become ingrained in the human brain that social relationships are necessary and that a certain baseline of social interaction is required. As the Evolutionary Theory of Loneliness argues (Cacioppo et al., 2006), feelings of loneliness have an evolutionary advantage. Seeking social interaction has made it more likely for our ancestors' genetic disposition to survive through their offspring, since the ancestors could work together in providing the necessary care for their children. On the other hand, ancestors who did not experience the feeling of loneliness did not seek social interaction. As they wandered off and lived alone, the care they could provide to their offspring was less secure, making their own genetic disposition less likely to survive. Loneliness serves as an emergency alarm in order to ensure survival. Thus, when there is a lack of social interaction, the brain enters a state of distress. Social relationships provide the social and emotional support that is needed as a buffer of stress when one is dealing with stressors in life, providing an inhibiting mechanism for loneliness (Lakey & Cohen, 2000; Shor & Roelfs, 2015).

However, the social distancing measures taken to battle the Covid-19 pandemic are specifically focused on reducing social interaction in order to prevent social transmission of the virus from taking place, whereas social and emotional support is particularly needed in the midst of a global pandemic that is causing a lot of stress (Kar et al., 2021; Xiong et al., 2020). This means that social distancing is going straight against the human need for social interaction in times of distress. Now that social interaction is very restricted, the odds are even higher that people's actual levels of social contact do not fulfill their desired levels of social contact, leading to more people experiencing more loneliness during the Covid-19 pandemic. *H1: Thus, it is expected that people who practice social distancing experience higher levels of loneliness than people who do not abide by the social distancing measures*.

Furthermore, age is found to be associated with loneliness by several studies. Victor and Yang (2012) reported higher levels of loneliness for people aged under 25 years, lower levels of loneliness for people older than 25 years and younger than 65 years, and finally, again

moderately increasing levels of loneliness for people aged over 65 years. This U-shaped relationship is in line with earlier research conducted by Perlman (1990).

For young people, social interaction shapes who they are, the behaviour they show and the roles they will adapt to in society (Brignall III & Van Valey, 2007). According to the *social cognitive theory* (Bandura, 1989), social interaction will form the playing ground for the youth to learn about behaviours and the incentives that may follow. When this playing ground is taken away, the youth will no longer have a context in which they can learn about social behaviour (Friedman, 2007). It is clear that social interaction plays a huge role in their development, which may explain the strong urge in young people to seek social interaction. Thus, young people are more likely to have a high desired level of social interaction compared to older people. Moreover, becoming separated from one's family and friends is found to put people at risk for loneliness (Peplau & Perlman, 1979). Most young adults go through this process when moving out and studying in another place, making them more vulnerable to experiencing feelings of loneliness. Meanwhile, for most adults the risk factors are less prevalent, thus the middle-aged group seems to experience lower levels of loneliness (Victor & Yang, 2012). They are more likely to already have a partner, since the average age to get married in the US is 28,1 years old for women and 30,5 years old for men (Census, 2020). Moreover, this adult group is less likely to live alone than young people (Our World in Data, n.d.). Both being married and living together with other people are found to be protective factors against loneliness (Page & Cole, 1991; Victor & Yang, 2012). For older people, a moderate, yet relatively smaller, increase of loneliness has been found (Victor & Yang, 2012). Older people more often deal with the loss of social ties, for instance, due to death, increasing the discrepancy between the actual and the desired social interaction, which puts them at higher risk for loneliness (Dykstra et al., 2005). This implies that social contact is especially important for older people. However, being of older age seems to only be moderately associated with higher levels of loneliness. This may be explained by the *disengagement theory* (Cumming & Henry, 1961). This theory entails that having social ties becomes less and less important to older people, as a natural part of the process of aging. Due to their decreasing demand for social interaction, the discrepancy between the actual social interaction and the desired social interaction might not be as substantial as expected, leading to lower levels of loneliness (Perlman, 1988). *H2.1 Thus, young people are more likely to experience loneliness than older people.*

Furthermore, a longitudinal research conducted by Rumas et al. (2021) during the Covid-19 pandemic found a negative relationship between age and loneliness, implying that younger people would experience the highest levels of loneliness. This finding is supported by

Wickens et al. (2021). During the Covid-19 pandemic, particularly the quantity of social interaction has been restricted due to the social distancing measures. Meanwhile both Nicolaisen and Thorsen (2017) and Green et al. (2001) found that young adults mostly attach value to the quantity of social interaction. Young adults seem to be more future-oriented than older adults (Nurmi, 1992). As these young adults are trying to build the life they want to have, a large social network may provide the support they need in the form of social capital. Through the solidarity within social relationships, the sources of the people around someone become available to that person as well (Häuberer, 2011). For instance, someone may get introduced to their potential partner through an acquaintance, or a friend of a friend may help them get a job by putting in a good word for them with the manager of the company they work at. On the other hand, according to the *socioemotional selectivity theory* (Carstensen et al., 1999) emotional closeness and the quality of a relationship is more important for older people. Victor & Yang (2012) argue that the quantity of social interaction is a protective factor against loneliness for young people, whereas for adults of middle-age and old age, the quality of social interaction is a bigger protective factor against loneliness. Since social distancing particularly affects the quantity of social interaction, young people were affected more severely. Moreover, older people often already have lower levels of social contact, so they may be more used to having little social contact, leading to a smaller discrepancy between their actual and their desired social interaction compared to younger people (Cornwell, 2011; Palgi et al., 2020). Meanwhile, the social ties of adults of middle-age often partially consist of ties to their partner and their children, who they will stay in contact with during the Covid-19 pandemic nonetheless.

In short, during the Covid-19 pandemic, young adults were disproportionately struck by the measures, since the universities and other places related to social activities for young people, such as cinemas, sports facilities and shopping centers, were closed (United Nations Educational, Scientific and Cultural Organisation, n.d.; Leo, 2021; Rose, 2020; Thomas & Berk, 2020). Social interaction became very rare for young people, exactly in the period of their lives when they needed it the most. *H2.2 Thus, the relationship between social distancing and loneliness is likely to be stronger for young adults than for older people*.

Even before the Covid-19 pandemic, loneliness was on the rise in many parts of the world (Hwang et al., 2020). Nowadays, we are living in the age of living alone, where in the USA, 28% of the households are single-person households (Ortiz-Ospina, 2019; USAFacts, 2019). However, living alone has been found to be a risk factor for loneliness (Victor & Yang, 2012). This implies that the risk of loneliness is posed to even more people in modern society.

For people who live alone, having social interaction at home is not obvious. People who live together with other people could fulfill their desired levels of social contact at home. Meanwhile, people who live alone have to put in more effort, go outside and meet up with people in order to socially interact. *H3.1 Therefore, people who are living alone are more likely to experience higher levels of loneliness than people who live together with others.*

Research found that those who are living alone are also more likely to experience loneliness during the Covid-19 pandemic (Wickens et al., 2021; Parlapani et al., 2020). During the Covid-19 pandemic, having social contact outside of one's own household has become very rare, since people are practicing social distancing in order not to spread the virus. Therefore, people have to rely on their own household in order to engage in social contact. However, when living alone, social contact cannot be found within one's household. As people who are living alone cannot find social interaction both within and outside of their own household, the likelihood increases that they cannot fulfill their desired levels of social interaction. *H3.2 Thus, the relationship between social distancing and loneliness is likely to be stronger for people who live alone compared to people who live together with others.*

Another risk factor for loneliness discussed in the research field is gender. Women are more likely to live long and thus, are more likely to end up becoming a widow when their partner passes away (Nicolaisen & Thorsen, 2014). Losing a close emotional bond has been found to increase the level of loneliness, increasing the risk of women for loneliness (Peplau & Perlman, 1979). Moreover, the longer one lives, the more social ties one will lose due to peers passing away earlier than them. Furthermore, women live alone more often than men, increasing their risk of loneliness (De Vaus & Qu, 2015). On the other hand, women are socialized to invest in a bigger social network, which serves as a protective factor for loneliness (Okun & Keith, 1998). Therefore, in general, women seem to experience lower levels of loneliness (Barreto et al., 2021). *H4.1 Thus, men are more likely to experience higher levels of loneliness than women.*

However, research conducted in Spain reported that women have experienced a stronger increase of loneliness than men during the Covid-19 pandemic (Ausín et al., 2020). This higher prevalence of loneliness among women compared to men has also been found in research conducted by Wickens et al. (2021). As schools are closing during the lockdown, children must stay at home and have to be taken care of. In a still prevailing culture in which the men are responsible for the income and the women are responsible for taking care of the household, women are still more often being burdened by this responsibility than men (Chesley, 2017). Moreover, in the USA, women earned 18% less than men in 2019 (Laughlin

& Wisniewski, 2021). Due to this ever-existing pay gap between women and men, it would, financially, be a sensible decision to let the women stay at home to take care of the children who no longer physically go to school (Census, 2019; Gogoi, 2020), while men, who earn more money per hour than women, are responsible for the income. This implies that women more often are forced to stay at home than men, making them lose more ties during the Covid-19 pandemic, since they are less likely to stay in contact with their colleagues. Meanwhile, women are more socialized to value a very big social network than men, leading to higher desired levels of social interaction amongst women compared to men. During the Covid-19 pandemic, women experience decreasing levels of actual social interaction, while simultaneously having higher desired levels of social interaction compared to men. Therefore, women would experience a bigger discrepancy between their actual and desired social interaction than men. *H4.2 Thus, the relationship between social distancing and loneliness is likely to be stronger for women.*

Methods and data

The Understanding America Study, also known as UAS, (Center for Economic and Social Research, 2020) will be used in order to examine the relationship between the social distancing measures and loneliness. The dataset consists of approximately 8900 respondents from households in the United States of America drawn from a random sample of adults aged 18 and older. The surveys are distributed online. In order to prevent a bias from being created, panel members that do not have online access are provided with the necessary equipment in order to participate. This study has been ever ongoing since 2014 and once to twice a month, each respondent receives a survey to fill out. When the Covid-19 pandemic started, a special longitudinal survey was launched to track the impact of the pandemic and to track the way in which people behave during and how they experience the pandemic. This UAS Covid-10 study was launched on 2020, March 10th and subsequently, the respondents have received a survey every 2 weeks.

For this research, wave 4 of the UAS Covid-19 data will be used to examine the impact of the social distancing measures on loneliness. The data in this wave were measured between April 29, 2020 and May 26, 2020. During this period of time, the majority of US states were in lockdown, making the data suitable for investigating the relation between social distancing and loneliness (Luchetti et al., 2020). Furthermore, the data of this wave contain the variables that are relevant to this study.

A sample of 6968 respondents was selected, of which 6354 respondents actually filled out the entire survey and 565 panel members did not participate. The data contained 49 incomplete cases, in which the respondents dropped out, leaving their response unfinished. These incomplete cases have been left out of the analysis. The variables relevant to this study do not contain many missing values, decreasing the likelihood that the conclusions would be distorted by the missingness. In the end, the analysis includes 6344 observations, excluding some of the 6354 cases due to missingness on the relevant variables. This amounts to a response rate of 91,04%.

Operationalization

In the Understanding America Study, *loneliness* is measured as a 4-point scale variable, which is an item from the Center for Epidemiologic Studies Depression Scale (Radloff, 1977). *Loneliness* is measured by the question: "In the past 7 days, how often have you felt lonely?" The answer categories are 1 "Not at all or less than 1 day", 2 "1-2 days", 3 "3-4 days", and 4 "5-7 days". This variable will be used as a continuous variable when performing the analyses.

In order to measure *social distancing*, a sum score has been computed, using five items of the questionnaire. The respondents were asked if they, in the last seven days, have 1) "Gone out to a bar, club, or other place where people gather"; 2) "Gone to a friend, neighbor, or relative's residence (that is not your own)"; 3) "Had visitors such as friends, neighbors or relatives at your residence"; 4) "Attended a gathering with more than 10 people, such as a reunion, wedding, funeral, birthday party, concert, or religious service" ; 5)"Remained in your residence at all times, except for essential activities or exercise". The first four items have been reversed, so that a higher score on this scale represents more social distancing. The respondents could answer with 'yes', 'no' and 'unsure'. Both the options 'no' and 'unsure' have been recoded as 0, whereas 'yes' has been recoded as 1. The sum score of these items ranges from 0, if the respondent answered 'no' or 'unsure' to all of the items, to 5, if the respondent answered 'yes' to all of the items.

In the UAS dataset, *age* was measured as a continuous variable. Since the expectation is that young people experience the lowest levels of loneliness in comparison with older people, *age* will be included in the model as a continuous variable as well.

Living situation is measured by a dummy-variable, indicating whether the respondent lived together with any other household members at the time of participating in the research. The variable contains two categories: 0 means "no" (living with others) and 1 means "yes" (living alone).

Gender is measured as a dummy-variable. After recoding the variable, 0 indicates "male" and 1 indicates "female".

Furthermore, *unemployed* will be included in the analysis as a control variable, since an association has been found between unemployment and loneliness (Bu et al., 2020). When one is unemployed, one does not have the social ties with colleagues that having a job normally provides (Lauder et al., 2004). This could lead to a bigger discrepancy between the actual and the desired social contact. The variable in the dataset indicates whether a respondent is working for pay. *Unemployed* is measured by a dummy-variable indicating whether a respondent is working for pay. The answer options are 0, which means "employed" and 1, which means "unemployed".

The descriptives of the variables included in the analysis are to be found in Table 1. Table 1 shows that in the past seven days, people have felt lonely on average during 1 to 2 days. It is also shown that 17% of the respondents live alone, 58% of the respondents are of the female gender, and 42% of the respondents are unemployed. The average age in the dataset is 51 years old.

Table 1 Descriptives

	Mean	SD	Min	Max
Loneliness	1.56	0.89	1	4
Social distancing	3.96	1.11	0	5
Age	50.55	16.04	18	101
Living alone	0.17	0.37	0	1
Female	0.58	0.49	0	1
Unemployed	0.42	0.49	0	1

Note: The sample used for the analysis model consists of 6344 respondents.

For this research, two models will be analyzed. The first model contains the direct effect of social distancing on loneliness. In the second model, interaction terms between social distancing, age, living situation and gender will be incorporated as well. All missing values are recoded as NA.

By definition, all dichotomized and categorical variables are not normally distributed. Only loneliness is of an interval measurement level. Loneliness seems to be right skewed (skew_2se = 24.3842) and the distribution seems to have a higher peak (kurt_2se = 9.5697). The Anderson-Darling test indicates that the residuals are not normally distributed (A = 932.69;

p < .001). Interaction terms will be added to the model to account for the possible heterogeneity of residuals in certain variables between groups.

A multivariate regression analysis, using the Structural equations modeling approach (SEM), will be performed in order to test the hypotheses mentioned in the theoretical framework. This SEM approach will provide some fit indices that can be interpreted in order to determine the fit of the model (Iacobucci, 2010). An F-statistic test is shown, based on which it can be determined whether the model explains a significant amount of variance. The main focus of this research is to examine the relationship between social distancing and loneliness, and the effect of age, living situation, and gender on the relationship between social distancing and loneliness.

Results

In Table 2, a correlation matrix including all variables is presented. In the following section, standardized coefficients will be reported. Using standardized coefficients will facilitate the interpretation of the size of the effects found.

Table 2 Correlation matrix including the dependent and all the independent variables *r= 0.7566973*. *** P < ,001 ** P< ,01 * P <,05

	Loneliness	Social distancing	Age	Living alone	Female	Unemployed
Loneliness	1.00					
Social distancing	-0.01	1.00				
Age	-0.17**	0.09**	1.00			
Living alone	0.13**	0.00	0.15**	1.00		
Female	0.11**	0.05**	-0.12**	0.02	1.00	
Unemployed	0.03*	0.10**	0.36**	0.08**	0.05**	1.00

Table 3 Multivariate regression model with loneliness as the dependent variable

	Model 1		Model 2	
	Estimate	Std. Error	Estimate	Std. Error
Social distancing	-0.004	0.010	-0.053	0.034
Age	-0.012***	0.001	-0.016***	0.003
Living alone	0.378***	0.029	0.091	0.109
Female	0.141***	0.022	0.226**	0.081
Unemployed	0.180***	0.024	0.177***	0.024
Social distancing * age			0.001	0.001
Social distancing * living alone			0.072**	0.026
Social distancing * female			-0.021	0.020
(Intercept)	1.984***	0.053	2.181***	0.140

*** P < ,001 ** P< ,01 * P <,05

The results of the multivariate regression analysis of model 1 are shown in Table 3. Model 1 is used to study the relationship between social distancing, age, living situation and gender, and loneliness. When examining the fit indices, the χ 2 goodness-of-fit test is significant, indicating a poor model fit (χ 2(5)= 478.408; p < .001). However, the χ 2 goodness-of-fit test is known for being sensitive to the sample size, thus, as the sample size increases, the test will automatically report a more significant statistic (Iacobucci, 2010). Furthermore, both the comparative fit index (CFI = 1.000) and the root mean square error of approximation (RMSEA = 0.000) indicate a good model fit. Model 1 appears to be significant, explaining 7,2% of the variance in loneliness (F(5, 6338)= 99.29; p < .001).

Hypothesis 1 stated that people who practice social distancing experience higher levels of loneliness than people who do not abide by the social distancing measures. However, model 1 shows that the individual's social distancing behaviour is not significantly related to loneliness (β= -0.004; p= .653). Thus, hypothesis 1 is not supported by the data, as the data show no significant relationship between social distancing and loneliness. On the other hand, the relationships between age, living situation and gender, and loneliness are found to be significant. As was stated by hypothesis 2.1, young people are more likely to experience

loneliness than older people. A negative significant relationship is found between age and loneliness (β= -0.012; p< .001). This indicates that the data are in support of hypothesis 2.1. Next, hypothesis 3.1 argued that people who are living alone are more likely to experience higher levels of loneliness than people who live together with others. In model 1, living situation and loneliness are significantly related. People who live alone are more likely to experience higher levels of loneliness compared to people who live with others (β= 0.378; p < .001). Therefore, hypothesis 3.1 is supported by the data. Furthermore, hypothesis 4.1 stated that men were more likely to experience high levels of loneliness than women. However, model 1 shows that being of the female gender is positively related to higher levels of loneliness (β= 0.141; p < .001). Therefore, the data do not support this hypothesis. By contrast, the data show a relationship in the opposite direction. Finally, the control variable of being unemployed is significantly related to loneliness as well. Being unemployed is positively related to increased levels of loneliness (β= 0.180; p < .001).

Hereafter, model 2 will be discussed. Model 2 contains the interaction terms, indicating whether the relationship between social distancing and loneliness differs for people of a different age, in a different living situation, and of a different gender. The results of the multivariate regression analysis of model 2 can be found in Table 3 as well. First, the fit indices will be examined again. The χ 2 goodness-of-fit test is also significant, indicating a poor model fit once again (χ 2(8)= 491.461). Furthermore, the comparative fit index (CFI = 1.000) and the root mean square error of approximation (RMSEA = 0.000) both again indicate a good model fit. Model 2 appears to be significant as well, explaining 7,4% of the variance in loneliness (F(8, 6335)= 63.78; p < .001). Thus, the explained variance increased marginally by 0.2% when adding the interaction terms to the analysis model.

First, hypothesis 2.2 argued that the relationship between social distancing and loneliness is likely to be stronger for young adults than for older people. However, model 2 shows no significant moderating effect of age on the relationship between social distancing and loneliness (β= 0.001; p= .103). This indicates that the relationship between social distancing and loneliness is not stronger at any particular age. Thus, hypothesis 2.2 is not supported by the data. Furthermore, hypothesis 3.2 stated that the relationship between social distancing and loneliness is likely to be stronger for people who live alone compared to people who live together with others. Model 2 shows that there is a significant moderating effect of the living situation on the relationship between social distancing and loneliness (β= 0.072; p - .006). This indicates that the relationship between social distancing and loneliness is stronger for people who live alone. Therefore, hypothesis 3.2 is supported by the data. Finally, hypothesis 4.2

argued that the relationship between social distancing and loneliness is likely to be stronger for women. However, no significant moderating effect is found of gender on the relationship between social distancing and loneliness (β= -0.021; p= .277).

Finally, a sensitivity analysis is performed to check the robustness of the results. Previously, social distancing was measured by a sum score, consisting of four different items. For this sensitivity analysis, this sum score has been replaced by one of these four items. Now, only the item "Remained in your residence at all times, except for essential activities or exercise." was used to measure social distancing. However, changing the operationalization of social distancing did not affect the results of both model 1 and model 2, supporting the robustness of the results.

Discussion

The goal of this study was to examine the impact of social distancing on loneliness during the Covid-19 pandemic, as loneliness is found to become an increased threat (Holt-Lunstad, 2021; Wright, 2020; Hwang et al., 2020). Furthermore, it is studied whether this impact differs for different socio-demographic groups. Moreover, this research was aiming to contribute to the research field on loneliness by investigating how individual social distancing behaviour affected the experienced levels of loneliness.

Previous research showed that loneliness is found to be a risk factor for many other mental health issues, physical health issues, and it can even have a mortal impact (Cacioppo et al., 2010; Groarke et al., 2020; Xiong et al., 2020; Victor & Yang, 2012; Killgore et al., 2020; Kantor & Kantor, 2020; Jia et al., 2020; Holwerda et al., 2016; Holt-Lunstad et al., 2015; Sutin et al., 2015; Hawkley & Cacioppo, 2010; Wright, 2020). Furthermore, loneliness is found to increase the risk for infectious diseases (Prince et al., 2007), indicating that loneliness may even complicate the fight against the Covid-19 pandemic. Mental health should not be neglected in the process of protecting one's physical health. However, the risk for loneliness is not equally distributed over the population. Some socio-demographic groups are at higher risk than others. It is important to gain clarity on what factors play a role in the increase of loneliness and who is the most severely affected by the social distancing measures, in order to fight the threat posed by loneliness.

The two models, based on previous findings and theoretical frameworks, have been tested using the UAS Covid dataset. To sum up, individual social distancing behaviour does not seem to be related to feelings of loneliness. This was a remarkable result, as previous studies reported an increase of loneliness during periods in which social distancing measures were

taken (Hwang et al., 2020; Wright, 2020; Holt-Lunstad, 2021; Groarke et al., 2020). These studies often simply selected a time span during which these social distancing measures were implemented population-wide, assuming that people's behaviour would be impacted by these regulations. However, this research measured social distancing in terms of individual behaviour. According to Fazio et al. (2021), it is not self-evident that every individual abides by these regulations. Based on these data, loneliness is not significantly related to the individual social distancing behaviour. Perhaps the experience of being in a lockdown and feeling socially restricted is related to loneliness, rather than the individual's choice whether or not to abide by the social distancing measures.

Furthermore, age, living situation and gender were all found to be significantly related to loneliness. Young age seems to be related to higher levels of loneliness compared to older age. This is in line with previous research conducted by Victor and Yang (2012), who found higher levels of loneliness amongst young adults, compared to older people. However, the individual's social distancing behaviour does not seem to be related to loneliness in a different way for people at different ages. Social distancing is related to higher levels of loneliness, and this relationship was expected to be stronger for young people.

This seems, however, not to be the case. Moreover, living alone seems to be associated with higher levels of loneliness, supporting Victor & Yang's finding (2012) that living alone is a risk factor for loneliness. According to the data, living alone also seems to worsen the impact of individual social distancing behaviour on loneliness, possibly making the impact of the social distancing measures on their mental health even more disastrous. Finally, being of the female gender seems to be associated with higher levels of loneliness as well. This contradicts earlier findings, reporting that men are more likely to experience higher levels of loneliness compared to women (Barreto et al., 2021). However, it is important to keep in mind that these data have been collected in times of the Covid-19 pandemic. Previous research also reported elevated levels of loneliness in women compared to men during the pandemic (Ausín et al., 2020; Wickens et al., 2021). The finding that women experiencing higher levels of loneliness than men may also be explained by other factors specific to the period of Covid-19 pandemic, other than social distancing behaviour. In order to explain this difference between women and men, further research must look further into other factors apart from social distancing behaviour. Based on these data, the individual social distancing behaviour is not stronger related to loneliness for women than for men.

There are a few possibly important remarks to be made considering this study. During this study, social distancing was specifically measured in terms of individual behaviour.

However, as the individual social distancing behaviour seemed to not be significantly related to higher levels of loneliness, these elevated levels of loneliness must have been caused by another factor. As suggested before, perhaps due to the message of a lockdown including social distancing regulations, people feel like they experience a loss of social interaction, immediately making them feel like their desired level of social contact is more difficult to fulfill. This could lead to feelings of loneliness. In order to further investigate this in more detail, follow-up research could compare the levels of loneliness measured in wave 4, which was collected during a period of social distancing measures, to another UAS data wave from the Center for Economic and Social Research collected before the Covid-19 pandemic. Moreover, there may be other factors that have not been taken into account. Wave 4 of the UAS data contained items on whether the respondent had connected socially with friends or family, either online or in person. All of the items used to measure individual social distancing behaviour concerned social interaction in person, however, virtual contact has not been taken into consideration. Furthermore, the relationship between age and loneliness may have been weakened by the U-shaped relationship reported by earlier research (Victor & Yang, 2012; Perlman, 1990; Pinquart & Sörensen, 2001). Yet, the relationship found based on these data was still significant. In order to account for smaller discontinuities in the relationship between age and loneliness, age could be analyzed using a nonlinear regression including splines.

There are also some stronger aspects to this study. One remarkable strong aspect is the large sample size of the UAS Covid dataset. This characteristic of the dataset increases the power to detect significant effects when they are there. Furthermore, a very low correlation coefficient was found for the relevant variables overall. Thus, there was no issue of multicollinearity, and the model did not contain an abundance of variables measuring the same construct. The relevant variables did not contain many missing values, limiting the likelihood that the missingness would have substantially distorted the results. Finally, this study tried to contribute to the research field by analyzing the relationship between the individual social distancing behaviour and loneliness. This approach of investigating the individual behaviour seemed to be uncommon during previous studies and would possibly yield new insights into the measures taken to fight the Covid-19 pandemic.

Finally, this research has found that people of young age, people who are living alone and people of the female gender are at higher risk of experiencing higher levels of loneliness during the Covid-19 pandemic. For people who are living alone, the social distancing measures may be even more disastrous for their perceived levels of loneliness. Meanwhile, as loneliness is found to have serious consequences, it is important to make a well-considered trade-off

between physical and mental health. Governments should support research on strategies for decreasing loneliness in these risk groups. Moreover, they should explore different strategies that could help fight the coronavirus, while still having the least negative impact on people's mental health.

Thus, some socio-demographic groups in society experience substantially higher levels of loneliness in times of the Covid-19 pandemic. Where people normally resort to each other in times of crisis, they now have to do the opposite by staying far away from each other. People can no longer find the required social support that having social interaction would normally provide. The coronavirus will be harder to fight if mental health is neglected. A focus on mental health, including loneliness, is of utmost importance and should always be considered when formulating social health policies.

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