

Experience of loneliness during the COVID-19 pandemic

a cross-sectional study of 50 968 adult Danes

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BMJ Open Experience of loneliness during the COVID-19 pandemic: a cross-sectional study of 50 968 adult Danes

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ABSTRACT

Objectives To examine the level of loneliness experienced during the COVID-19 pandemic in Denmark and to identify associated behavioural patterns and demographic factors.

Design Cross-sectional cohort study.

Setting Includes Danish active and former blood donors.

Participants A questionnaire was sent to 124 307 active and former blood donors, of these a total of 50 968 participants completed the study questionnaire (response rate=41%).

Primary and secondary outcome measures Subjective experience of loneliness was measured using the 3-item University of California, Los Angeles Loneliness Scale (UCLA-3). Besides the UCLA-3, the respondents answered items on sociodemographic and economic characteristics, items on precautionary measures taken to avoid COVID-19 infection as well as on COVID-19 anxiety.

Results The participants indicated their experienced level of loneliness both before and during the pandemic. Comparing the two reports yielded a mean increase in loneliness scores of 14.1% ($p<0.001$). Exploratory factor analysis identified the factor *well-being*, which comprised three questionnaire items related to emotional health, physical health and happiness. A high score on the factor *well-being* was associated with reduced levels of loneliness (coefficient=-0.47, 95% CI -0.49 to -0.46). Furthermore, women were more likely than men to have experienced increased levels of loneliness during the pandemic (coefficient=0.27, 95% CI 0.25 to 0.29). Furthermore, a negative correlation between higher age and change in loneliness score was observed.

Conclusions The findings document an increase in the level of experienced loneliness during the COVID-19 pandemic, particularly affecting individuals with low well-being, women and younger individuals.

INTRODUCTION

During the COVID-19 pandemic, several public health measures such as social distancing and shut down of leisure-time activities were introduced to mitigate spread of the virus. While serving their purpose of slowing down the pandemic, these interventions also

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Large sample size.
- ⇒ Equal proportion of inclusion between sexes.
- ⇒ Combined register data with extensive questionnaire data.
- ⇒ The study is susceptible to recall bias.

had the potential to increase levels of loneliness. Indeed, some longitudinal follow-up studies with data before and during the pandemic have reported increased levels of loneliness during the COVID-19 pandemic,¹⁻⁴ while other studies did not observe any overall change.⁵⁻⁷ The incongruent reports may be a result of differences in measurement methods or the selection of study samples in terms of age^{1,3,5} or health status.²

Identification of factors associated with changes in experienced level of loneliness may help identify vulnerable individuals and thus guide interventions to prevent COVID-19-related loneliness. This is important since loneliness is associated with adverse health outcomes such as depression,⁸ anxiety⁴ and suicidal thoughts.^{8,9} Numerous demographic factors including sex, age, educational level and cohabitation status have been studied as possible risk factors of increased levels of loneliness during the COVID-19 pandemic, although with inconclusive results seen for sex^{2,3,5,6} and age.^{1-3,5-7,10} Consistent findings include that being single or living alone is associated with elevated levels of loneliness,^{1-3,7,10} as well as educational level not being associated with loneliness.^{2,3,5,10} Only a single study examined behavioural patterns and emotions, reporting psychological distress to be associated with lower levels of loneliness during the COVID-19 pandemic.¹⁰

The aim of this study was to quantify the level of loneliness during the COVID-19 pandemic in Denmark and to assess changes in levels of loneliness experienced during this time. Finally, this study aimed to identify behavioural patterns and demographic factors associated with such changes.

The study was performed in a large national cohort comprising both active and former blood donors. Blood donors are a selected population group who are generally healthier than the background population, independently of donor status (active or former).^{11 12} Furthermore, since blood donation is an active voluntary act, the study population likely comprised individuals with a surplus level of energy and community spirit. This combined with the presumption that blood donors are less likely to suffer from specific disorders, impacting their ability to live an active social life makes the level of loneliness in this specific cohort prone to be affected by social distancing

mandated during the COVID-19 pandemic. On the other hand, it can also be speculated that individuals with an active social life prepandemic may be more likely to have the support structures or coping mechanisms in place and therefore less likely to experience loneliness. Investigating loneliness and associated factors among this specific cohort will therefore add important new insights into the derived effects from the COVID-19 pandemic and drivers hereof.

METHODS

Study population

The present study included participants from the Danish Blood Donor Study (DBDS) (aged 18–70 years) and a sample of former blood donors, aged 70 years or above (figure 1). The DBDS is a nationwide prospective cohort study in which blood donors are included upon donation

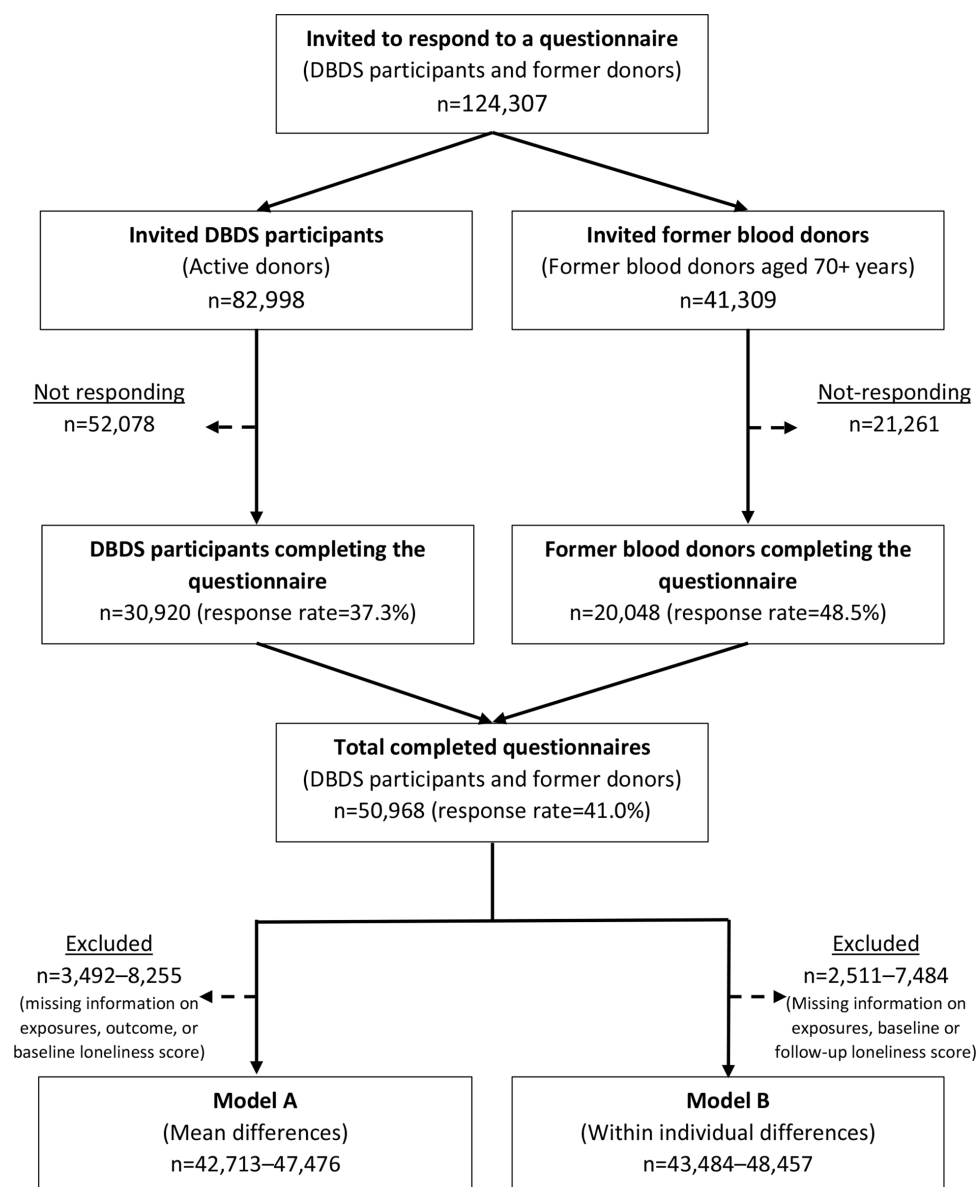


Figure 1 Selection of the study sample (Denmark, 2020–2022). DBDS, Danish Blood Donor Study.

in a blood bank.¹³ The DBDS is described in further detail elsewhere.^{13 14}

Of 124307 invited individuals (the DBDS participants and former donors), 50968 answered the questionnaire and thus participated in the study, yielding a response rate of 41.0% (figure 1).

Measures

Participants were invited to respond to a questionnaire sent through the governmental, personal, password-protected email system e-Boks¹⁵ between October 2020 and December 2020, resembling the second wave of COVID-19 in Denmark.

Outcome

In the present study, levels of loneliness were the outcome. The level of loneliness was measured using the 3-item University of California, Los Angeles Loneliness Scale (UCLA-3),¹⁶ which is a validated shortened version of the revised UCLA loneliness scale (R-UCLA).¹⁷ R-UCLA has been translated into Danish with high reliability and validity.¹⁸ UCLA-3 has been observed to correlate highly with R-UCLA,¹⁶ indicating that the UCLA-3 is a high-quality measure of loneliness. The UCLA-3 consists of three questions: "How often do you feel left out?", "How often do you feel isolated from others?" and "How often do you feel that you lack companionship?" Each of the questions is rated on a scale ranging from 1 to 3 (1=hardly ever, 2=some of the time and 3=often). The total UCLA-3 loneliness score is the sum of the scores from each question and range from 3 to 9, with 9 indicating a high level of loneliness.¹⁶

To estimate the respondents' experienced change in their feeling of loneliness, they were asked to answer the three items in UCLA-3 two times in the same questionnaire. First, based on how they remembered feeling prior to the onset of the COVID-19 pandemic (before 1 February 2020) and second, based on how they were currently feeling, that is, after the onset of the pandemic in Denmark (after 1 February 2020). Individual mean differences in the level of loneliness were calculated by subtracting the score prior to 1 February 2020 (the baseline score) from the score after 1 February 2020 (the follow-up score).

Sociodemographic factors

Information on the independent variables *sex* (male or female) and *age* (30 years or less, 31–40 years, 41–50 years, 51–60 years, 61–70 years and 71 years or more) was retrieved from the Danish Civil Registration System, containing information on birth date and sex for all individuals alive or born after 2 April 1968.¹⁹ Data on *educational level* (no formal education, primary education, secondary education, vocational training or semi-advanced education and university degree) and *cohabitation status* (living together or living alone) were obtained from the questionnaire. The following items were also retrieved from the questionnaire: occupational

status before the COVID-19 pandemic, avoiding crowded places, staying more at home, working more from home, lowering travel activities, avoiding public transport, presence of COVID-19 symptoms, emotional health, physical health, happiness, chronic somatic disorders and personal stamina. One item, previous psychiatric disorders, was a constructed item using register data. Participants with a previous psychiatric disorder were identified as those with a recorded diagnosis in the Danish National Patient Register²⁰ or with at least one of the following prescriptions registered in the Danish National Prescription Register (Anatomical Therapeutic Chemical Classification System [ATC] codes: N05A (antipsychotics), N06A (antidepressants), N05B (anxiolytics) and NA06B (psychostimulants, agents used for attention deficit hyperactivity disorder or nootropics))²¹ (figure 2). The Danish National Patient Register contains information on hospital diagnoses recorded since 1995,²⁰ while the Danish National Prescription Register contains data on collected prescribed medicine since 1994.²¹

Statistical analyses

Descriptive statistics

Mean differences in the level of loneliness before and during the COVID-19 pandemic were assessed with means and SD and compared by a paired t-test. The demographic variables were assessed using count with percentages.

Exploratory factor analysis

A total of 13 items that potentially influenced the level of loneliness during the COVID-19 pandemic were chosen for exploratory factor analysis. The aim of this analysis was to identify potential underlying statistical constructs reflected by the items, reducing the number of statistical tests in the final analysis.

Individuals with missing information on one or more of the 13 items (n=5182) were excluded from the exploratory factor analysis. The maximum likelihood method was used to extract factors and a scree test (based on a scree plot displaying the total number of factors against eigenvalues) indicated that a three-factor solution fitted the data most appropriately (figure 2). Consequently, three factors were retained for a promax rotation (oblique rotation allowing the factors to correlate). When interpreting the rotated factor pattern, an item was assessed as part of a factor if the loading was 0.40 or higher and <0.40 on other factors.

The exploratory factor analysis identified three combined factors: *prepandemic isolation*, *COVID-19 preventive measures* and *well-being*. The factor *prepandemic isolation* consisted of the three items: occupational status before the COVID-19 pandemic, working more from home and chronic somatic disorders. A high score on *prepandemic isolation* reflected that the individual was isolated even before the COVID-19 pandemic. The factor *COVID-19 preventive measures* contained four items: avoiding crowded places, staying more at home, lowering travel activities and avoiding public transport. A high score on this factor

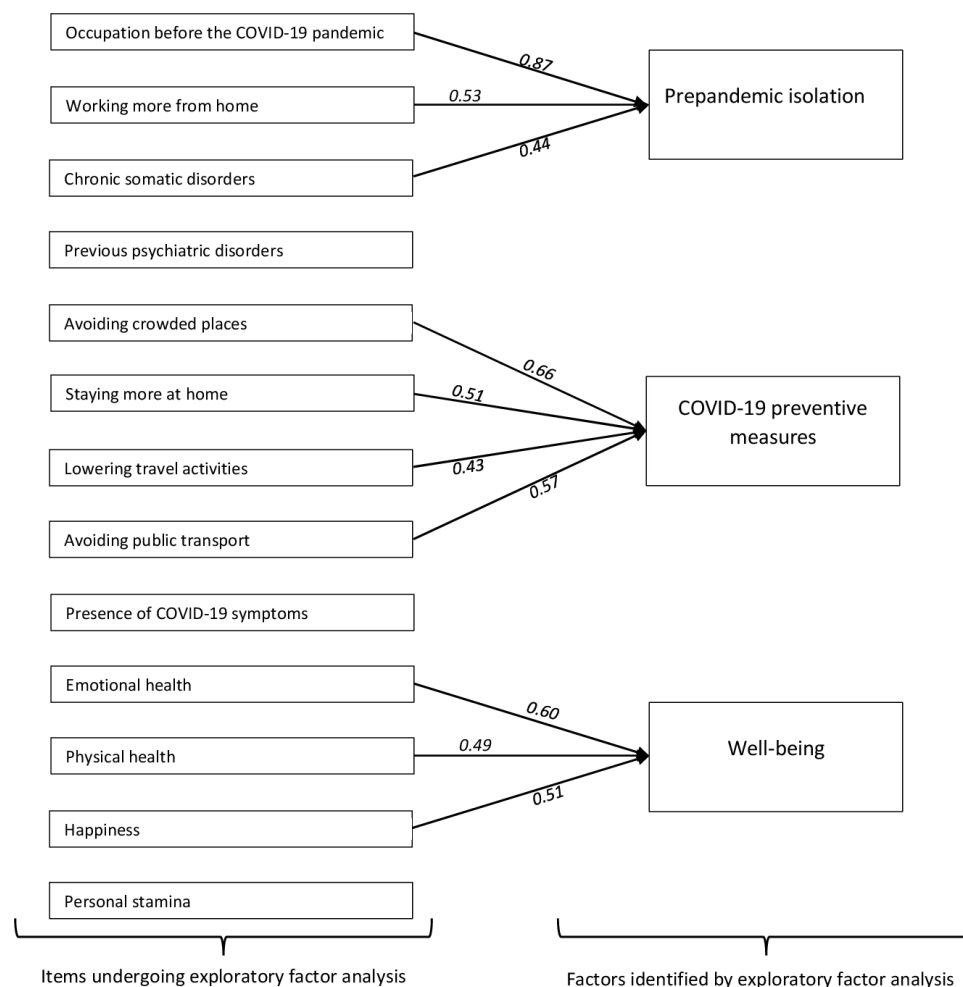


Figure 2 The three factors, prepandemic isolation, COVID-19 preventive measures and well-being, identified from exploratory factor analysis (Denmark, 2020–2022).

indicated that an individual performed more COVID-19 preventive measures. The factor *well-being* included three items: emotional health, physical health and happiness, higher scores on *well-being* indicated a better well-being (ie, better emotional and physical health, and more happiness) (figure 2). These factors were included in the subsequent multivariate regression analyses.

Multivariate regression models

Mean differences in the level of loneliness before and during the COVID-19 pandemic were assessed by multivariate linear regression models where the difference in loneliness levels was used as the outcome (model A). A total of seven linear regression models were fitted, one for each independent variable of interest (the three factors (*prepandemic isolation*, *COVID-19 precautionary measures* and *well-being*) and the demographic variables (sex, age, educational level and cohabitation status)). Each model was adjusted for the baseline loneliness score in addition to model-specific confounders.

Generalised linear mixed models were used to examine within-individual differences in the level of loneliness before and during the COVID-19 pandemic (model B). In this analysis, each individual had two data lines describing

the outcome, level of loneliness, before and during the COVID-19 pandemic in addition to the independent variables (although they did not change). For each of the seven independent variables (*prepandemic isolation*, *COVID-19 precautionary measures*, *well-being*, sex, age, educational level and cohabitation status), a model with model-specific confounders was fitted. The independent variables and the adjustment variables all entered the models as fixed effects, while subject ID was included as a random effect.

The assumptions of model A and model B were assessed graphically, and no deviations were observed.

All statistical analyses were performed in SAS V.9.4 with a significance level of 5%.

PATIENT AND PUBLIC INVOLVEMENT

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Descriptive characteristics

The mean level of experienced loneliness increased from 3.75 (SD 1.3) to 4.28 (SD 1.5) on a scale from 3

Table 1 Mean level of loneliness before and during the COVID-19 pandemic in Denmark and demographic characteristics of the study sample of 50968 Danish blood donors (Denmark, 2020–2022)

Level of loneliness, mean (SD)*	
Before the COVID-19 pandemic	3.75 (1.3)
During the COVID-19 pandemic	4.28 (1.5)
Sex, n (%)	
Male	25872 (50.8)
Female	25096 (49.2)
Missing	—
Age, n (%)	
30 years or less	3750 (7.4)
31–40 years	4743 (9.3)
41–50 years	6835 (13.4)
51–60 years	8829 (17.3)
61–70 years	6882 (13.5)
71 years or more	19929 (39.1)
Missing	—
Educational level, n (%)	
No formal education	609 (1.2)
Primary education	2836 (5.6)
Secondary education	1517 (3.0)
Vocational training or semi-advanced education	34782 (68.2)
University degree	10763 (21.1)
Missing	461 (0.9)
Cohabitation status, n (%)	
Live together	30683 (60.2)
Live alone	19609 (38.5)
Missing	676 (1.3)

*Difference in the level of loneliness before and after the COVID-19 pandemic significant at $p < 0.001$ by paired t-test.

to 9 ($p < 0.001$), corresponding to a mean increase of 14.1% (table 1). The proportion of males and females in the study was almost equal, with marginally more males (50.8%) than females (49.2%). A total of 53.5% of the respondents were between 31 years and 70 years. The majority of the respondents had an educational level corresponding to at least vocational training or semi-advanced education (89.3%), and approximately two-thirds (60.2%) were living alone (table 1).

Multivariate regression models

To evaluate the associations of behavioural patterns and demographic factors with the level of loneliness, we designed two complementary models (table 2 and figure 3). In model A, the outcome was the difference in levels of loneliness meaning each individual was one observation. Thus, in this model we investigated the effects of the explanatory variables on the change in level

of loneliness before to during the pandemic. In model B, each individual had two lines (one prepandemic and one during the pandemic) of loneliness scores to investigate the within-individual differences in the level of loneliness (table 2). Examining mean differences in the level of loneliness, high scores on the factor *well-being* were associated with a low level of loneliness ($B = -0.47$ (95% CI -0.49 to -0.46)) (table 2). In addition, females experienced higher levels of loneliness than males ($B = 0.27$ (95% CI 0.25 to 0.29)) (table 2). Young individuals were more likely to experience a higher increase in level of loneliness compared with older individuals according to the predictions made by both models A and B (figure 3).

In model A, high scores on the factor *COVID-19 preventive measures* ($B = 0.15$ (95% CI 0.13 to 0.16)) and living alone ($B = 0.09$ (95% CI 0.06 to 0.11)) were both associated with high loneliness during the COVID-19 pandemic (table 2).

Model B, assessing within-individual differences, reached mostly similar results as model A (table 2 and figure 3), only the results on the associations of *prepandemic isolation* and educational level with the level of loneliness were incongruent.

DISCUSSION

In this study of 50968 individuals, we observed an increase in the level of experienced loneliness during the COVID-19 pandemic in Denmark. As expected, individuals scoring high on the factor *well-being* experienced lower levels of loneliness, while females experienced higher levels of loneliness compared with males. In addition, we saw indications that younger individuals experienced higher levels of changes of loneliness than older individuals.

Previous knowledge and interpretation

The inverse association between *well-being* defined by the three underlying items applied in this study and the level of loneliness is novel. While these findings are consistent with observations that individuals with mental or physical illness experience higher levels of loneliness compared with individuals without illness,²² they seem to be in contrast with reported associations from a longitudinal study, which showed that high psychological distress was associated with decreased levels of loneliness during the pandemic.¹⁰ The latter finding, however, may reflect that some individuals experience the behavioural consequence of the COVID-19 lockdown procedures as a psychological or social relief. The contrast in our findings may also be explained by the difference in study designs. It is possible that the feeling of well-being is produced by a low level of loneliness. Then again, it is also possible that those who were experiencing a high level of well-being while answering the questionnaire were more likely to recall their prior feeling of loneliness as low due to their current state of mind.

Table 2 The associations of prepandemic isolation, COVID-19 preventive measures, well-being, sex, educational level and cohabitation status with change in the level of loneliness during the COVID-19 pandemic in Denmark (Denmark, 2020–2022)

	Model A†	Model B
	B (95% CI)	B (95% CI)
Prepandemic isolation‡	−0.05** (−0.07 to −0.03)§	0.07** (0.05 to 0.09)¶
COVID-19 preventive measures††	0.15** (0.13 to 0.16)§	0.12** (0.11 to 0.14)¶
Well-being‡‡	−0.47** (−0.49 to −0.46)§	−0.48** (−0.50 to −0.47)¶
Sex		
Male	Ref.§§	Ref.¶¶
Female	0.27** (0.25 to 0.29)	0.26** (0.24 to 0.28)
Educational level***		
No formal education	−0.23** (−0.34 to −0.12)	0.14* (0.04 to 0.24)
Primary education	−0.22** (−0.28 to −0.16)	0.09** (0.04 to 0.13)
Secondary education	0.04 (−0.03 to 0.11)	0.28** (0.22 to 0.34)
Vocational training or semi-advanced education	−0.10** (−0.13 to −0.07)	0.04* (0.02 to 0.07)
University degree	Ref.†††	Ref.‡‡‡
Cohabitation status§§§		
Live together	Ref.¶¶¶	Ref.****
Live alone	0.09** (0.06 to 0.11)	0.31** (0.28 to 0.33)

Model A: mean differences, calculated in a (multivariate) linear regression model.

Model B: within-individual difference, calculated in (multivariate) generalised linear mixed model.

B (95% CI): beta-coefficient with 95% confidence intervals.

The factor *prepandemic isolation* consists of the items occupational status before the COVID-19 pandemic, working more from home, chronic somatic disorders.

The factor *COVID-19 preventive measures* consists of the items avoiding crowded places, staying more at home, lowering travel activities, avoiding public transport.

The factor *well-being* consists of the items emotional health, physical health and happiness.

*P≤0.05.

†Adjusted for baseline loneliness score.

‡Adjusted for *well-being*, sex, age, educational level and cohabitation status.

§n=42 730.

¶N=43 484.

**P<0.001.

††Adjusted for *prepandemic isolation*, *well-being*, sex, age, educational level and cohabitation status.

‡‡Adjusted for sex, age, educational level and cohabitation status.

§§N=47 476.

¶¶N=48 457.

***Adjusted for sex and age.

†††N=47 190.

‡‡‡N=48 145.

§§§Adjusted for sex, age and educational level.

¶¶¶N=46 713.

****N=47 645.

Ref., reference group.

The higher level of loneliness observed among females compared with males is in line with a previous study.⁶ However, most studies failed to establish an association between sex and the level of loneliness during the COVID-19 pandemic.^{2 3 5} This may be a consequence of selected study samples comprising either older adults (50+ years)^{3 5} or clinical samples of individuals in primary care,² making comparisons with the present study difficult. Nonetheless, several studies predating the COVID-19 pandemic have observed that females experienced higher levels of loneliness than males.^{23 24} This may indicate

either that females are more vulnerable to loneliness or generally more prone to report loneliness than males.

Findings on the association between age and loneliness during the pandemic have been contradicting. Our finding, which indicated that young age could be associated with increased levels of loneliness, is similar to that of a large representative study of a US population.⁶ However, other studies have observed that old individuals experienced higher levels of loneliness during the pandemic compared with young individuals,^{1 7 10 25} while some studies did not find an association between age and

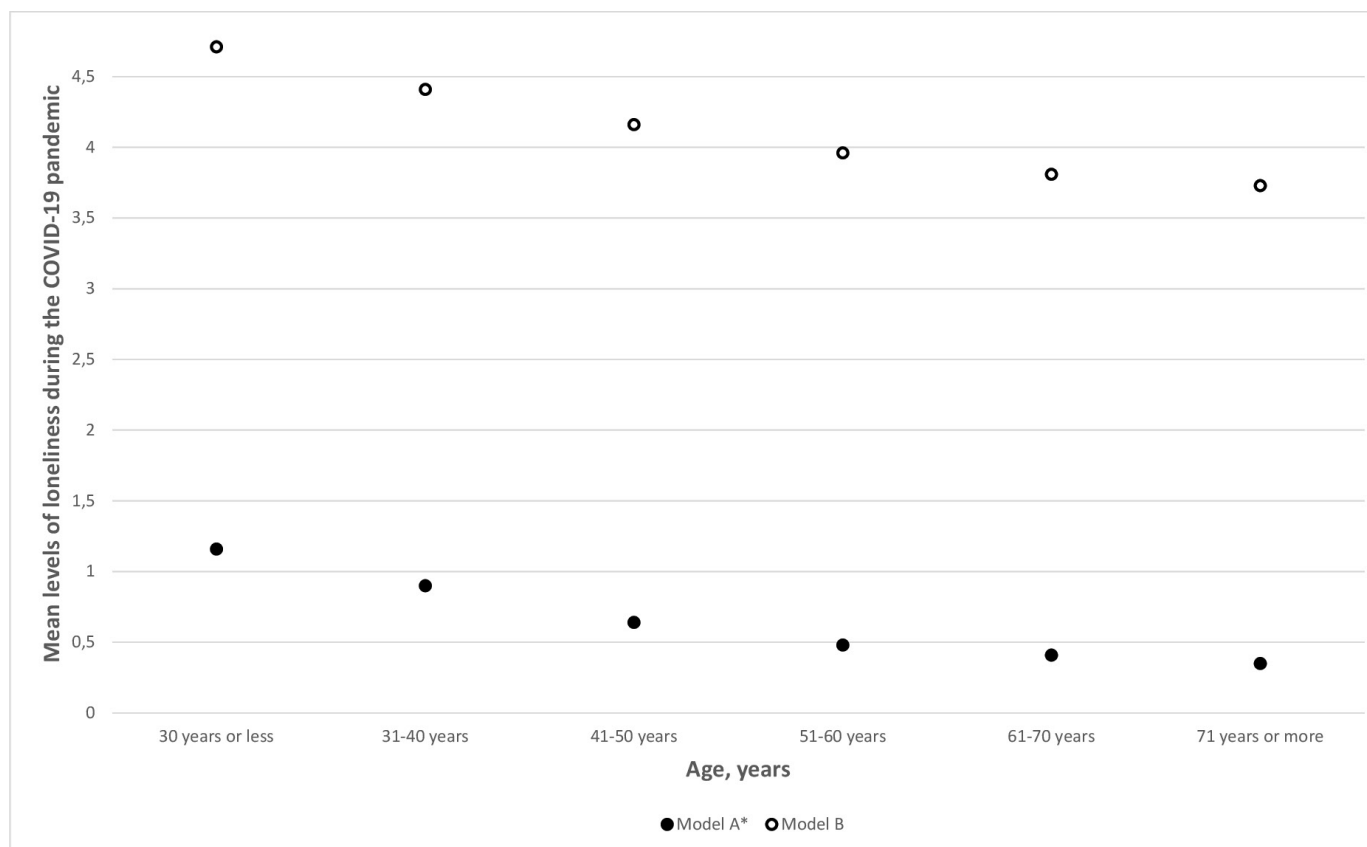


Figure 3 The association between age and change in the level of loneliness during the COVID-19 pandemic in Denmark (Denmark, 2020–2022).

Model A: mean differences, calculated in a (multivariable) linear regression model, n=47 476.

Model B: within-individual difference, calculated in (multivariable) generalised linear mixed model, n=48 457.

*Adjusted for baseline loneliness score.

the level of loneliness.^{2 3 5} Thus, the association between age and loneliness during the pandemic need further investigation. Prepandemic studies have observed that, in particular, young individuals have a higher risk of experiencing loneliness.^{23 26} Hence, it is possible that young individuals are more susceptible to loneliness in general. One possible explanation could be that many young individuals may not have settled with a partner or have had children. Hence, young individuals may depend more on social activities outside the residence for their social interactions and therefore be more sensitive to precautionary measures such as social distancing and shut down of leisure-time activities compared with older individuals.

Not surprisingly, high scores on the factor *COVID-19 preventive measures* and living alone were associated with high levels of loneliness, possibly because introduction of individual-level precautionary measures and living alone may be associated with more social isolation. None of the previous studies examined the association between individual-level precautionary measures and the level of loneliness during the pandemic, but the results on the association between civil status and the level of loneliness is in accordance with the existing literature.^{1-3 7 10} Thus, it appears that the individuals who complied with the official behavioural guidelines for avoiding COVID-19

infection are the ones who were most likely to feel lonely. This knowledge indicates that it may be a good idea for future COVID-19 or other virus-related public health guidelines to include advice on how to uphold a sense of a social life while social distancing.

Strengths and limitations

The present study has several strengths. First, the large sample size of the study enabled detection of even small differences and reduced random errors. In addition, males and females were almost equally represented and the participants had a wide age-span, which ensured representativeness in terms of both sex and age of the general Danish population aged 18–80 years. Finally, we used a combination of questionnaire and register data (not depending entirely on self-reports), allowing a broad inclusion of variables potentially associated with changes in the level of loneliness during the COVID-19 pandemic. However, a major limitation is the fact that this study is susceptible to recall bias since we asked the respondents to remember how lonely they were feeling prior to the pandemic. This bias may vary due to differential recall in subgroups of the independent variables (ie, the level of loneliness is recalled differently depending on the status of the independent variable), resulting in misestimations

of the associations between the independent variables and the level of loneliness. Moreover, we only had access to information on psychiatric diagnoses from 1995 and onwards and only for those who were admitted to a hospital when receiving the diagnosis of the somatic part of the hospital register, likely leading to under-reporting of psychiatric disorders that required hospitalisation. In contrast, the use of the Danish National Prescription Register allowed for identification of all collected prescriptions related to psychiatric disorders. Finally, the results of this study should be generalised with caution, because the response rate was relatively low and it was based on a population of Danish active and former blood donors, who are required to be generally healthy.¹³

CONCLUSION

The present study found that the mean level of experienced feeling of loneliness increased during the COVID-19 pandemic in Denmark. The probability for increase in loneliness was highest among individuals with low well-being, females and young individuals. This may be because of large vulnerability to loneliness, governmental restrictions limiting social interaction or fear for deterioration of existing health conditions. In future studies, it is important to monitor the longitudinal effects of loneliness. Moreover, studies on how to best deal with loneliness during a pandemic are important as it may be preferred that future virus-related public health guidelines include advice on this.

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Contributors LANC, DH, MS: did the statistical analyses. LANC and MD: wrote the first manuscript draft. LANC, DH, CE, HH, JN, KB, KRN, KAK, KMD, MTB, SRO, SS, TFH, TW, MD, OBP: planned the study, ensured data collection, data handling, revising of the first manuscript draft and interpreting the results. TW: secured financial funding for the study. LANC: guarantor of the study.

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Patient consent for publication Not applicable.

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