



The impact of social-relationship patterns on worsening mental health among the elderly during the COVID-19 pandemic: Evidence from Hungary

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ARTICLE INFO

Keywords:

COVID-19
Hungary
Mental health
Patterns of social relationships
Elderly age group
Latent class analysis

ABSTRACT

Evidence indicates the coronavirus pandemic has severely affected the oldest age group: in Hungary 92.7 per cent of those who died due to COVID-19 infection were 60 years of age or older. The age structure of the deceased was very similar in other countries. As, due to their underlying health status, elderly people are more vulnerable to the serious diseases caused by the coronavirus, strict government restrictions were introduced worldwide to protect them when the epidemic broke out. However, this social isolation can cause severe psychological and emotional strain. The study aim was to examine how patterns of social relationships were related to changes in mental health of the elderly during the COVID-19 pandemic in Hungary. We used the database of SHARE COVID-19 for our analysis. Descriptive and multivariate analyses were conducted. Findings of this study suggest that the network lacking contacts increases the severity of depression, anxiety, sleeping disorders, and loneliness the most among the elderly. Interestingly, the group with an intense close-knit network had a higher risk of worsening mental symptoms compared to multiple contact actives. Moreover, electronic communication – telephone, Skype – did not help either: there was a particularly high probability of worsening depression in this group. Another interesting result is that both in the group dominated by family contacts and among those with multiple relationships, the chances of worsening mental symptoms were lower, thus, personal contact – whether they include family members or other acquaintances – is truly protective. Results demonstrate that both the network characterised by lack of contact network and electronic contact activity contribute to greater risk of worsening mental health within elderly. A network pattern characterised by various types and forms of contacts is the most beneficial to mental health, and intensive contacts of limited scope alone are not sufficient to protect mental health.

1. Introduction

In December 2019, a new human coronavirus (SARS-CoV-2) emerged in Wuhan, the most populous city in central China, and within a few months, it spread rapidly around the world, and was coined COVID-19 (Adalja et al., 2020). When as many as almost 125,000 people were registered worldwide on March 12, 2020 (involving more than 20,000 patients and 1000 deaths in Europe), the World Health Organization (WHO) declared COVID-19 a pandemic (WHO Regional Office for Europe, 2020). Following the WHO's announcement, preventive government regulations were introduced in all countries of the world, including Hungary, to curb the spread of the virus. Epidemiological measures in all countries have included a public call for increased hygiene and social distancing, encouraging people not to leave their place

of residence if it is possible ("Stay at home!" Recommendations), to seek personal protection, minimize contacts and encounters and keep a physical distance of at least 1.5 m apart. In addition, in order to prevent the spread of the infection to large numbers of people in confined spaces, public educational institutions and public venues (restaurants and other service providers) were closed in many countries, travel were restricted or banned, and mass events (such as cultural and sporting events, festivals, trade fairs) were cancelled and even workplaces were shut down (European Center for Disease Prevention and Control, 2020). In Hungary, the government declared an emergency on 11 March 2020 (Magyar Közlöny, 2020),¹ and, as in most countries of the world, measures were taken to restrict people's daily lives in several stages, which were only lifted only gradually with the first decline of the first wave of the pandemic.

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¹ Government Decree 40/2020. (III.11.) on the declaration of an emergency situation (Magyar Közlöny, [Hungarian Gazette] 11/03/2020).

Although the positive effect of epidemiological measures and social distancing on the reduction of the number of infections and the flattening of the pandemic curve has been demonstrated (see, for example, [Vokó & Pitter, 2020](#)),² its negative socio-psychological consequences are inevitable ([Atzendorf & Gruber, 2021](#); [Brooks et al., 2020](#)). The correlation between social isolation and mental health is documented in detail in the relevant literature: isolation adversely affects the functioning of the nervous system, increases the prevalence and severity of loneliness, depression and other mental illness related symptoms (without seeking to be exhaustive: [Armitage & Nellums, 2020](#); [Cacioppo et al., 2006](#); [Cacioppo & Hawkley, 2019](#); [Santini et al., 2016](#)). It has also been shown that the elderly and those living alone are most at risk for mental health problems ([Chou et al., 2006](#); [Dykstra, 2009](#)) and that all of these pose risk factors for severe physical illness (among the elderly, they primarily increase the risk of developing high blood pressure, cardiovascular diseases, and neurocognitive impairments). It also significantly deteriorates general physical health ([Gerst-Emerson & Jayawardhana, 2015](#); [Hawkley et al., 2010](#); [Knox & Uvnas-Moberg, 1998](#)) and in the long run, increases the risk of morbidity in the elderly ([Holt-Lunstad et al., 2015](#); [Steptoe et al., 2013](#)).

As the scope for contact with others were significantly reduced following the restrictive measures introduced following the outbreak of the coronavirus pandemic, based on the guidance by WHO, the uncertainty surrounding the pandemic the changed daily routine, financial pressures and limited control over life resulted in increased stress ([Peters et al., 2020](#)). As a result a serious concern emerged in the relevant scientific discourse with regard to the effect of COVID-19 on the mental health of the population, particularly on that of the elderly. Studies following the outbreak quickly confirmed that the risk of COVID-19 infection and mortality is age-related: the elderly are most at risk of coronavirus infection and severe manifestation of the disease ([Posch et al., 2020](#); [Rajgor et al., 2020](#)). According to one of the earliest clinical estimates, people over the age of 60 in Wuhan were 5.1 times more likely to die after developing symptoms than those between the ages of 30 and 59, and the risk of infection increased by nearly 4% per year with the progress of one's age ([Wu et al., 2020](#)).³ As the elderly are one of the most vulnerable groups, in addition to those with a chronic underlying disease, in many countries of the world, various government measures have been taken to protect them. In Hungary, for example, the government introduced a ban on visiting or leaving old people's homes and social institutions, and a specific shopping time-slot was dedicated for the elderly (only people over the age of 65 could shop in grocery stores and pharmacies in the early morning hours).⁴

Although it is known from previous research on pandemics, such as the H1N1 virus, that fear of developing a serious illness and mortality causes increased anxiety in all age groups of the population ([Taha et al., 2014](#)), during the new coronavirus pandemic, due to the higher risk of infection and death, the elderly population was presumably more affected mentally than other age groups and experienced higher levels of stress and anxiety compared to other age groups.

After the outbreak, many studies have focused on the assessment of the physical and mental health of elderly adults. Research in the early stages of the pandemic has even shown that the coronavirus pandemic did not significantly affect the well-being of the elderly ([Kivi et al., 2021](#); [López et al., 2020](#)), but later studies conducted after the first closures

indicated severe consequences in terms of the mental health of the elderly population ([Atzendorf & Gruber, 2021](#); [Brooke & Jackson, 2020](#)). Both U.S. and European and Chinese studies have shown that the elderly population experienced a higher sense of depression and loneliness compared to the pre-pandemic period ([Krendl & Perry, 2020](#); [Atzendorf & Gruber, 2021](#)), as well as that the quality of sleep among them deteriorated significantly ([De Pue et al., 2021](#); [Stanton et al., 2020](#)). An international comparative study points out that both the number of deaths associated with coronavirus infection and the duration of restrictive measures have a significant impact on mental well-being: in countries with high mortality rates and a high number of days with restrictions, the elderly population, i.e. those older than 60 was more likely to report feeling depressed ([Atzendorf & Gruber, 2021](#)). The authors also showed that the effect of macro factors on feelings of depression increases significantly with the advancement of age: the elevated mortality rate associated with high coronavirus infection within the oldest age group (over 80 years), and results in a higher incidence of depression in this group compared to that of the elderly of 60–79 years old.

For the protection of mental health, the literature has long emphasized the importance of social relationships and the social support they provide, especially in the late life ([Antonucci et al., 2014](#)). It is also known that few social nexuses and scarce social community activities reduce the ability to cope with difficulties in old age and increase the risk of mental health problems such as anxiety and depression ([Santini et al., 2016](#); [Schwarzbach et al., 2014](#)). In addition to the size of the personal network, the quality of contacts is of paramount importance for mental health, and several studies point out that the quality of relationships is more strongly related to mental health than other characteristics of the network ([Cutrona & Russell, 1990](#)). A study by [Mak et al. \(2009\)](#) of elderly SARS survivors, conducted 18 months after the physical recovery of the respondents, on the impact of social support available through formal and informal relationships on mental well-being found that support from family members, friends, and health professionals contributed more to the improvement of the mental state of the elderly compared to the support received from other sources of relationships. Their results also showed that support by family members and friends — verbal support and encouragement — had a significantly more beneficial effect on survivors' mental health than support received from healthcare professionals. These results confirm the well-known mechanism of action that social support (support available through family/friends and health professionals) promotes and support stress management abilities, and help the coping strategies needed to overcome difficulties ([Mak et al., 2009](#)). According to the stress-buffering hypothesis, social support available through a network of contacts is in fact mitigates the negative effects of stress on mental well-being and relieves anxiety ([Cohen & Wills, 1985](#); [Raffaelli et al., 2013](#)). Some studies have also confirmed that, of a variety of socio-relationship resources, social support from family/friends plays a prominent role in reducing the risk of depression in old age ([Teo et al., 2015](#)). However, according to [Kauppi et al. \(2018\)](#), it is not clear that the effect of "strong ties" in the Granovetter sense is more significant in the case of physical or mental health than that of "weak ties". Indeed, based on data from a Finnish longitudinal study, the authors found that not only a small number of strong nexuses (up to 2 strong relationships) and a small number of weak relationships (up to 5 weak relationships) increase the risk of death, but also many strong bonds when they are coupled with even only a few weak bonds. The authors argue that social support available through more distant, peripheral connections in a network of relationships can also contribute to maintaining health and general well-being ([Kauppi et al., 2018](#)). An Australian longitudinal study has also shown that of the strong ties, the ones with friends contribute more to the well-being of elderly people than nexuses with relatives ([Giles et al., 2005](#)).

Disaster studies highlight that social network plays a key role in maintaining the well-being of the elderly after natural disasters ([Hikichi](#)

² An analysis by [Vokó and Pitter \(2020\)](#) for 28 European countries proves that the spread of the coronavirus was slower in countries with higher levels of population mobility restriction, i.e. community distancing "flattens the epidemic curve".

³ Analysis based on Wuhan case numbers published by 29 February 2020. Of course, when interpreting the high mortality rate among the elderly, it cannot be ignored that most of them had at least one chronic illness.

⁴ § 3 of Government Decree 168/2020. (IV. 30.) on protective measures (Magyar Közlöny [Hungarian Gazette], 30 April 2020).

et al., 2017; Rafiey et al., 2016). Regarding the 2011 earthquake and tsunami in Eastern Japan, Hikichi et al. (2016) reported that “experiencing” a natural disaster led to increased cognitive decline among elderly survivors. Their later study (Hikichi et al., 2017) also revealed that norms of social-community relations and mutual assistance help to avoid impairment of cognitive abilities in the elderly, i.e., mitigate the impact of disaster experiences on cognitive decline.

Several data on Hungary’s aging population confirms an unfavourable situation in international comparison. The *active aging index* (AAI), which is an indicator calculated by taking employment, health and lifestyle, as well as socio-social components of the aging process into account (e.g. participation in family and social life) (Zaidi et al., 2012), suggests that Hungary is expected to face serious challenges in terms of challenges of aging on the level of the society. Based on its AAI figures, Hungary is among the last ones in the ranking of European countries; only Greece, Croatia and Romania have a worse situation (UNECE / European Commission, 2019: 19). Out of the four dimensions taken into account, Hungary is particularly lagging behind in the field of ‘Social Participation’, and in fact, from this point of view, Hungary’s situation has only gotten worse since 2008. The health status of the Hungarian elderly is also quite negative based on both subjective and objective aspects of health. Data from the European Health Interview Survey (EHIS) show that merely a fifth (20.6%) of the elderly Hungarian population consider their health to be good or very good, and the percentage of those satisfied with their health is lower only among the Polish, Estonian, Portuguese, Latvian and Lithuanian elderly (European Union, 2020: 53). The proportion of people with chronic diseases is also high – even in European comparison: 80.5% of people over the age of 65 have long-standing illnesses or health problems, which is 16 percentage points higher than the EU average (European Union, 2020: 70). In terms of their mental health, a tenth of them (9.8%) suffer from depression, of which 3.2% suffer from major depression, and it is one of the countries with the worst situation in the ranking of EU member states: in Europe, Hungarians aged 55–64 have the highest incidence of depressive symptoms, while in terms of those aged 65–74 and those over 74, this figure is higher only in Portugal and Bulgaria (European Union, 2020: 82). According to SHARE data, the size of the personal network of the Hungarian elderly is slightly smaller than the European average, and the number of their friends is not even half of the European average (only the Polish elderly have fewer friends) (Tomini et al., 2016). Compared to European countries, friends are less likely to be found in their contact network, while the presence of a child or a partner as “confidants” is higher (Litwin et al., 2013; Stoeckel & Litwin, 2013). Based on their social relationships, the elderly in Hungary are considered particularly lonely in Europe: six out of ten elderly people have no or only minimal social relationships, and nearly a tenth of them have no relatives or acquaintances with whom they have a confidential relationship (Messing & Ságvári, 2020a). Other studies also draw attention to the fact that the majority (almost three-quarters) of the daily contacts of the Hungarian elderly take place in person, while the non-personal contacts are more likely to take place over the phone, and the proportion of communication via internet phoning and chatting is very little – almost negligible (Albert et al., 2021).

The empirical results presented above point out the protective role of the network of contacts. However, access to social support was severely limited at the time of the coronavirus pandemic, especially for the elderly, who represent one of the most vulnerable groups in terms of COVID-19. The pandemic period spent in isolation had severe consequences for the already vulnerable, elderly age group (e.g., higher anxiety, depression, see Krendl & Perry, 2020; Atzendorf & Gruber, 2021). It is likely that telephone conversations, video calls, and electronic connections may have helped mitigate the negative effects of isolation. Although more and more research is focused on the impact of COVID-19 on mental health, the correlation between social network and mental health has not been fully explored. And, besides a few trivialities, there is hardly any information available on the role of contacts during a

pandemic, especially concerning the well-being of the elderly age group. There is an obvious shortage of such studies in Hungary.

In Hungary, a few years after the post-socialist transition, an authoritarian political system emerged (Scheiring, 2020; Todosijević & Enyedi, 2008). The situation of the Hungarian rule of law has been a topic at the European Parliament for years: in its resolution adopted in May 2017, the EP stated that the situation in Hungary justifies the initiation of the procedure under Article 7, and it must be examined whether there is a clear risk of a violation of the EU’s core values: i.e.: those of freedom, democracy, equality, rule of law, respect for human dignity and human rights. (Motion for a resolution – B8-0295/2017).⁵ In September 2022, the following majority parliamentary decision was made⁶: „Hungary can no longer be considered a full democracy” [2018/0902R(NLE)].⁷ The way the Hungarian government handled the coronavirus epidemic can also illustrate this decision and situation: the state of emergency in terms of governing was extended; the handling of the pandemic was carried out in a completely centralized system, infection and death data were only made public with a lag time, so the specialists could not perform risk estimation. Hospital capacities were transformed under military command and without involving specialists, and hospitals were often emptied without prior professional assessments, so that the patients who were hospitalized were sent home immediately or within a short notice of merely a few days. In the meantime, the population accepted that only the “operative board” wearing military uniform provided information on daily illnesses; it was forbidden to visit patients in hospitals – which is understandable – but the doctors (by central order) were not allowed to comment on the conditions prevailing in the hospitals, nor could photographs or video reports be taken. The government’s decisions were reported by the public-service media, education to protect against COVID-19 and the inclusion of civil assistance and other, for example, non-medical expert activities, were pushed back. The lack of information and the central management of the crisis situation completely ignoring social cooperation results (may result) in the deterioration of social uncertainty and the loss of trust in institutions. In such circumstances, it is almost solely the people’s crisis network of contact can provide support.

The present country-specific analysis therefore examines the correlation between changes in the mental health of the elderly population during the pandemic and social relationships in a post-communist country where modernization was delayed, was created a prematurely born welfare state (Kornai, 1992, 2015), and this manifests in the relationship of individuals to power (authority) as well. Authoritarian, traditional attitudes prevail in Hungary: individuals typically do not want to take risks or take responsibility, they expect “protection” from the state; they primarily trust and prioritize their family, blood, national, and kinship relationships, and are distrustful of others; do not accept cultural and behavioural differences, are exclusionary, non-accepting (Barna & Koltai, 2018; Messing & Ságvári, 2020b; Szabó & Gerő, 2022).

In light of the fact that there is a high lack of trust in Hungary, and this lack of trust is also strong with regard to the participation elements of social capital – including assistance activity⁸ – we believe that the situation and support of the elderly and sick – especially in extreme

⁵ https://www.europarl.europa.eu/doceo/document/B-8-2017-0295_EN.html.

⁶ Based on a proposal made by Green Party politician Gwendoline Delbos-Corfield in 2022 after the reports by Rui Tavares in 2013 and Judith Sargentini in 2018 on the critical destruction of democratic institutions.

⁷ https://www.europarl.europa.eu/doceo/document/TA-9-2022-09-15_EN.html.

⁸ The index prepared from data on assistance within the family and to the sick and disabled, the elderly, neighbours and immigrants is the lowest in Hungary in Europe (Sik & Giczi, 2009). In addition to all this, the level of NGO activity in Hungary is also very low, for example, the rate of active membership of NGOs within the European Union is the highest in Sweden and Finland, and the lowest in Hungary alongside with Bulgaria and Romania (Sik & Giczi, 2009: 70).

epidemic conditions – leads to the discovery of important relationships failed to be examined so far.

1.2. Research questions

The aim of this study is to explore how the mental health of the elderly population changed in Hungary after the outbreak of the COVID-19 pandemic, and to examine how the characteristics of the network of their contacts relate to changes in mental health caused by the coronavirus pandemic. We were seeking to explore how combinations of the frequency of different types of contacts affected the deterioration of certain mental problems, specifically depression, anxiety, loneliness, and sleep disorders. The specific objectives specific objectives are to examine: (i) how did the negative impact of the coronavirus pandemic affect the mental health of people aged 50 and older in Hungary; (ii) what patterns of social relations have mitigated the negative impact of the pandemic on mental health, and was there any difference in the effects of strong-weak relationships or their combinations; and (iii) do the strengths of the effects differ in certain age groups of the elderly.

2. Methods

2.1. Data

Our data are from the Survey of Health, Ageing and Retirement in Europe (SHARE) COVID-19 survey (SHARE-COVID-19, Börsch-Supan, 2020a), fielded from June to August 2020, between the first and second waves of the pandemic in 28 countries. Some socioeconomic background information was imputed from the Wave 7 database (Börsch-Supan, 2020b).⁹ The SHARE Corona Survey is a computer assisted telephone interview, which focuses on the social and economic consequences of the pandemic, and was combined with the core questionnaire of the panel. This short supplementary questionnaire specifically addresses how the pandemic itself and the epidemiological measures following its outbreak affected the living conditions, physical and mental health as well as health behaviours, economic and labour market situation, and family and social relationships of the target population (Scherpenzeel et al., 2020), and its survey was combined with the panel's questionnaire. Respondents under the age of 50 included in the national samples were excluded from the analysis, so the combined data set of the 26 European countries we analysed contains the data of 49,322 persons, of which the Hungarian sub-sample size is 980.¹⁰

2.2. Measures

2.2.1. Outcomes

The variables that are in the focus of our analysis are four indicators of mental health. Different aspects of mental health were measured using the following dichotomous variables based on the possibilities

provided by the questionnaire: 1. feeling depressed ("In the last month, have you been depressed?"), 2. feeling anxious ("In the last month, have you felt nervous, anxious, or on edge?"), 3. occurrence of sleep disorders ("Have you had trouble sleeping recently?" [including disturbance in the rhythm of sleep]), 4. feeling lonely ("How much of the time do you feel lonely?"). The first three variables could be marked with yes or no answers, and the last could be answered by means of a three-point scale. In our analysis, all four variables are listed as dichotomous variables, adding that in case of the last variable, those reporting often feeling lonely are considered to be lonely.

We also used four variables to measure the changes in mental health caused by the coronavirus pandemic, both directly and indirectly, which show the perception of the whether his or her mental well-being changed negatively compared to the status before the outbreak of COVID-19. Respondents were specifically asked whether they had experienced a mental problem in the last month and whether it was more so, less so or about the same as before the outbreak of Corona. From the original three-category variables, the following binary indicators were developed: 1. even more depressed, 2. even more anxious, 3. suffering from sleep disorders even more, 4. even more lonely. I has to be noted here that respondents not experiencing the symptoms listed (i. e., did not feel depressed, anxious, lonely, or did not suffer from a sleep disorder) were coded with 0.

2.2.2. Social relationships

To measure the social network, we approached it in terms of the frequency of contact with the immediate and extended environment. The data collection aimed at assessing the intensity of personal and electronic contact with persons outside the household. Respondents were in fact asked, "Since the outbreak of Corona, how often did you have personal contact with (1) own children, (2) own parents, (3) other relatives, and (4) other non-relatives like neighbours, friends or colleagues?" Then the same question was asked regarding electronic communication: "Since the outbreak of Corona, how often did you have contact by phone, email or any other electronic means (1) with own children, (2) with own parents, (3) with other relatives and (4) non-relatives?". Five possible answers could have been marked: daily, several times a week, about once a week, less often, never. In the analysis, these variables were dichotomized as follows: a value of 1 indicates that the respondent was in contact with people outside his or her household at least on a weekly basis, and a value of 0 indicates that the respondent was in contact with people outside his or her household at least once a week. Furthermore, for both personal and electronic contacts, variables showing the frequency of contact with the child(ren) and parents were combined.

2.2.3. Controll variables

A number of additional variables that may have an impact on mental health were also included in the analysis, although we prefer to treat them as control variables. The respondents' physical health status (dichotomous variable: whether he or she has any chronic illness), isolation after the outbreak of the coronavirus pandemic (dichotomous variable: has he or she left his/her home since the outbreak), and the coronavirus involvement of the respondents and their close relatives¹¹ (whether the respondent or a member of their respective close families/acquaintances experienced symptoms of a coronavirus, had a positive test result, were hospitalized for coronavirus infection, or had a family member/acquaintance died of a coronavirus) were taken into account. To measure involvement, an index was developed by scoring disease

⁹ SHARE is a longitudinal survey (cross-national panel study) carried out under the coordination of the Max-Planck Institute for Social Law and Social Policy in Munich, using the same methodology and questionnaire, the first wave of which was conducted in 2004, had two further data recordings have been carried out ever since. The survey was conducted in all countries based on a multi-stage, proportionally stratified probability sample design. The primary sampling units were the geographical areas (municipalities or zip codes), while the final sampling units were the population of the appropriate age. The composition ratio of the respondents included in the sample corresponds to the composition of the target population (population 50+) in terms of age (3 age groups: 50–64 years, 65–74 years, 75+) and gender. In addition to the panel study sample, an update sample is added to the database during each wave of data collection, creating nationally representative samples of the population aged 50 plus (Scherpenzeel et al., 2020).

¹⁰ Data for Austria and Ireland were not available at the time of the analysis, and Israel, as a non-European country, was excluded from the review.

¹¹ Involvement in coronavirus infection was surveyed in detail in the respondents' contact network and asked respondents as to how many people were affected for 8 contact categories: 1) spouse or partner, 2) parent, 3) other member of the household, 5) a relative outside the household, 6) a neighbour, friend or colleague, 7) a caregiver, 8) another person.

states according to their severity.¹² The COVID involvement of the respondent's contact network was calculated by multiplying the scores obtained as described by the number of individuals named in all contact categories and then summed to get a single indicator. The index thus created is included in the models as a continuous variable. In addition, variables describing the sociodemographic background of the respondent were included in the analysis, including: gender (female), age (categorical variables: 50–64 years, 65–74 years, 75 years or older), household size (dichotomous variable: whether he or she lives alone), education (categorical variable: primary,¹³ secondary,¹⁴ higher,¹⁵ education), labour market status (dichotomous variable: employed) type of settlement of residence (categorical variable: capital, other large cities, small town, village).¹⁶

2.3. Statistical analysis

We used several methods to answer our research questions. First of all, we examined how the mental health of the elderly in Hungary evolved in a European comparison during the first wave of the coronavirus pandemic, and the extent to which the incidence of certain mental illnesses deteriorated as a result of the pandemic. We also explicitly explored the sociodemographic characteristics of those affected by negative changes in mental health. Finally, we examined by multivariate analysis how the patterns of social relationships emerging among Hungarian respondents based on the intensity of social contact are related to the deterioration of mental health, which can be considered as a medium-term consequence of the first wave of the coronavirus pandemic.

Based on social relationships, different groups of respondents were explored using model-based clustering. As each of our clustering variables is a binary indicator, we used the method of “latent class analysis” (LCA) to generate network patterns. We applied explanatory models to analyse the factors influencing the change in various mental problems during the first wave of the pandemic by means of logistic regression. The accepted significance level during the analyses was $p < 0.05$. We present weighted results in the study. All analyses were done using Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC.

3. Results

3.1. Mental health during the coronavirus pandemic

First, we show how the involvement of the elderly population in Hungary and other European countries evolved in terms of different aspects of mental health in the period after the first closures following the outbreak of the coronavirus, and how this changed compared to the pre-pandemic period. We do this bearing in mind the fact that international comparisons may be distorted by the fact that they are highly culturally dependent, so the perception of individual mental symptoms and their changes as well as the severity of disease control measures could vary from country to country at the time of data collection.

Hungarian respondents reported a very similar proportion of mental illness symptoms: between 36.4 and 36.8 per cent reported depression, anxiety, sleep disorders, and loneliness during the period surveyed (Fig. 1). As far as the correlation between mental health indicators are concerned, depression and anxiety are more strongly correlated (ρ 0.553) than depression with sleep disorder (ρ 0.370) or feelings of loneliness (ρ 0.283). Feelings of loneliness show a similarly weak correlation with both anxiety (ρ 0.288) and sleep disorder (ρ 0.282), and the same is true for the correlation between sleep disorder and anxiety (ρ 0.329). Thus, being affected by mental issues does not necessarily mean co-occurrence; if it does, depression is more likely to be accompanied by anxiety and nervousness.

The results on mental health in Hungary can be considered very unfavourable in international comparison (see Fig. 2, gray bars). In the period following the first closures after the outbreak of the pandemic, Hungary had one of the highest rates of depression in the over-50 population, outperformed by only a few southern European countries and Poland, while in terms of anxiety, sleep disorder and loneliness, Hungary was found in the first quarter in the ranking of countries. It is also clear that respondents in Northern Europe, Switzerland and the Netherlands were typically less affected by the mental health problems under review (the proportion of those affected was below 20% in these countries).

Regarding the deterioration in various aspects of mental health, Hungarian respondents – compared to the pre-pandemic period – mostly indicated the worsening of difficulties sleeping: almost a third reported this issue (31.1%). If only those with sleeping disorder complaints are considered, 85 per cent of them have experienced the deterioration of their symptoms. A seventh (13.5%) of the sample reported an increase in feelings of anxiety and more than one-tenth (11.5%) reported an increased feeling of depression, accounting for 27 and 32 per cent of anxiety and depressed respondents, respectively. The proportion of those who felt more lonely than before the pandemic appears to be quite low: 5.6 per cent of the total sample (15.3% of respondents who declare themselves lonely), which is probably explained by the fact that those being lonely seek less contact with others, so the pandemic situation did not cause a significant deterioration in their case. The correlations of indicators of worsening mental problems show that the increase in feelings of depression and anxiety is primarily related (ρ 0.608) and that the correlation between the increase in feelings of loneliness and feelings of depression is relatively strong, albeit weaker than moderate (ρ 0.465). The correlation between deterioration in other mental health indicators is weak ($\rho \leq 0.3$). All of this means that the feeling of depression that intensified during the first wave of the pandemic was more likely to be accompanied by an increased feeling of anxiety and loneliness.

Comparing these results with those of other European countries (see green bars in Fig. 2), it can be seen that the mental problems of Hungarian respondents, with the exception of the sleep disorder, increased less due to the coronavirus pandemic (but note that a significant proportion are affected by mental symptoms). Hungary, together with Slovakia, the Czech Republic and Slovenia, is one of the countries with the lowest rates of anxiety, depression and loneliness (their proportion is less than 15%). In contrast, respondents from southern European countries (such as Portugal, Malta, Spain, Italy, and Greece) indicated the greatest exacerbation of the mental problems studied, each with the lowest incidence of these symptoms in the elderly population. At the time of SHARE COVID-19 data collection, these countries still had the strictest restrictive measures in place in Europe and the highest number

¹² 1 point was given in the index for the presence of symptoms, 2 points for a positive test result, 5 points for hospital care, and 10 points for the death of an acquaintance.

¹³ The combination of categories ISCED 0, ISCED1 and ISCED2, surveyed in accordance with the uniform international classification of education, which means that the respondent has at most a vocational school or a vocational qualification.

¹⁴ ISCED3 and ISCED4 categories combined, which means that the respondent has a high school diploma.

¹⁵ ISCED5 and ISCED6 categories combined, which means that the respondent has a degree of higher education (college or university).

¹⁶ We also intended to use the indicator of the financial and income situation, but a very high proportion of Hungarian respondents (36% of them) refused to reveal their income situation.

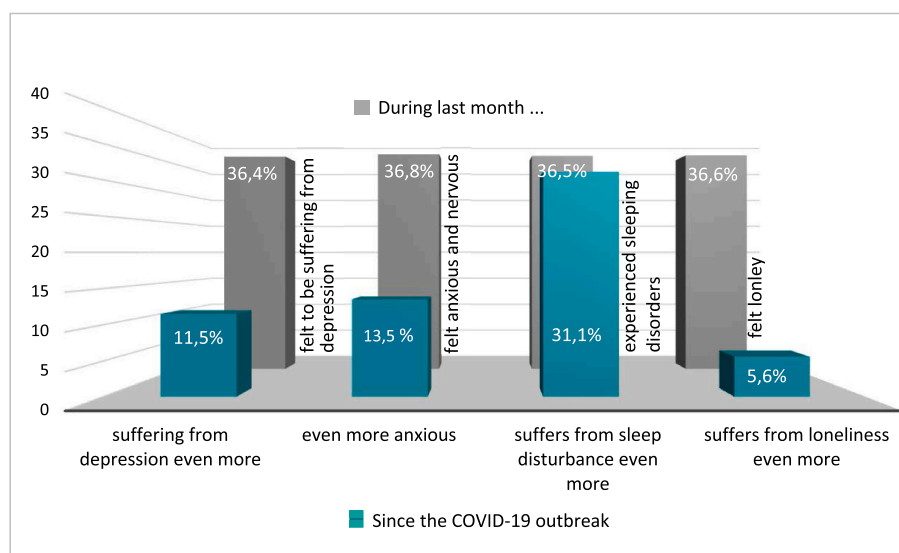


Fig. 1. Prevalence and deterioration of mental problems in the elderly population in Hungary during the period following the first closures after the COVID-19 outbreak.

of COVID-19 infections per 100,000 inhabitants (excluding Malta).¹⁷ However, in terms of sleep disorders, the situation in Hungary is not favourable at all: after Estonia and along with other Central European countries, Hungary has one of the highest rates of reports of worsening sleep problems.

3.2. Sociodemographic differences in worsening mental health

Taking a closer look at how the worsening of various mental illness symptoms after an outbreak of coronavirus correlates with the characteristics of sociodemographic categories in Hungary (see Table A1 in the Appendix), it is evident that the deterioration of all four mental problems under review is significantly more common among women, those with no higher than a primary school education, and those in single-person households, i.e., those living alone. Looking at different age groups, young retirees between the ages of 65 and 74 show significantly higher rates of increased depression, anxiety, and feelings of loneliness than those younger (50–64 years) and older than them (over 74 years old). However, the latter group, the oldest of the elderly, are those who are most likely to have rather severe sleeping problems. Labour market status also shows a significant correlation with the deterioration in the mental problems assessed. Deterioration in depression, anxiety, and loneliness is higher among retirees compared to the working and other inactive groups, while the latter inactive group is most affected by increased sleep disorder. With regard to the type of settlement of the respondents' place of residence, it can be seen that the proportion of those perceiving a worsening of depression, loneliness and anxiety is the highest among those living in the capital, and the lowest among those living in villages and small towns. Exacerbation of sleep problems is significantly higher among villagers. The latter is interesting because mental problems (including all four indicators under review here) mostly affect those living in villages; the effect of the settlement

hierarchy is clearly visible (while in terms of changes during the Covid pandemic, this settlement hierarchy can only be detected in the worsening of sleep disorders). It should be noted that, with the exception of the type of settlement of the place of residence, the possible socio-economic factors underlying mental problems are the same as those presented for the deterioration of mental problems.

3.3. Patterns of social relationships and worsening mental health during the coronavirus pandemic

The key question in this study is how combinations of family and social relationships influenced mental health (more specifically, its deterioration) during the coronavirus pandemic. To this end, we first examined what network patterns can be identified among the elderly age group in Hungary. Our goal was to capture the diversity of contact combinations based on the type (near or far), mode (personal or electronic), and intensity (strong or weak) of network relationships and then examine their impact on mental health. The intention of the research was to take into account all these characteristics to find patterns of networking or communication relationships that are specific to each group of respondents. The specific pandemic situation has minimized the possibility of specific encounters, but has multiplied various telephone and Internet connections with either family members and acquaintances, or service providers. Thus, we used a solution that allowed us to design a model structure that allowed us to distinguish typical groups of connection users.

In the following, we used the method of latent class analysis (LCA), whereby individuals can be classified into latent groups based on categorical observed variables by estimating for each respondent the probability of belonging to a certain class (Collins & Lanza, 2010). In our case, the observed variables are the intensity of face-to-face and electronic contacts with persons outside the household, which were measured by means of six binary indicators: 1) frequent - at least weekly - personal contact with children and parents; 2) frequent personal contact with other relatives; 3) frequent personal contact with friends, acquaintances, neighbours; 4) frequent electronic contact with children and parents; 5) frequent electronic contact with other relatives; 6) frequent electronic contact with friends, acquaintances, neighbours. In the analysis we examined 2–5 group solutions and in order to determine the best model solution we took into account the fitting of the model (Akaike information criterion, Bayesian information criterion), the significant result of the Lo-Mendell-Rubin probability quotient test

¹⁷ Based on the Stringency Index calculated by the Oxford Coronavirus Government Response Tracker (OxCGRT) project, which is based on 9 indicators: school closures; job closures; cancellation of public events; restrictions on public gatherings; closure of public transport; requirements to stay at home; public information campaigns; restriction of internal movements; and control of international travel. The actual daily value of the index is provided by the average score of the nine indicators and essentially reflects the rigor of government policies (for a full description of the calculation of the index, see Hale et al., 2021).

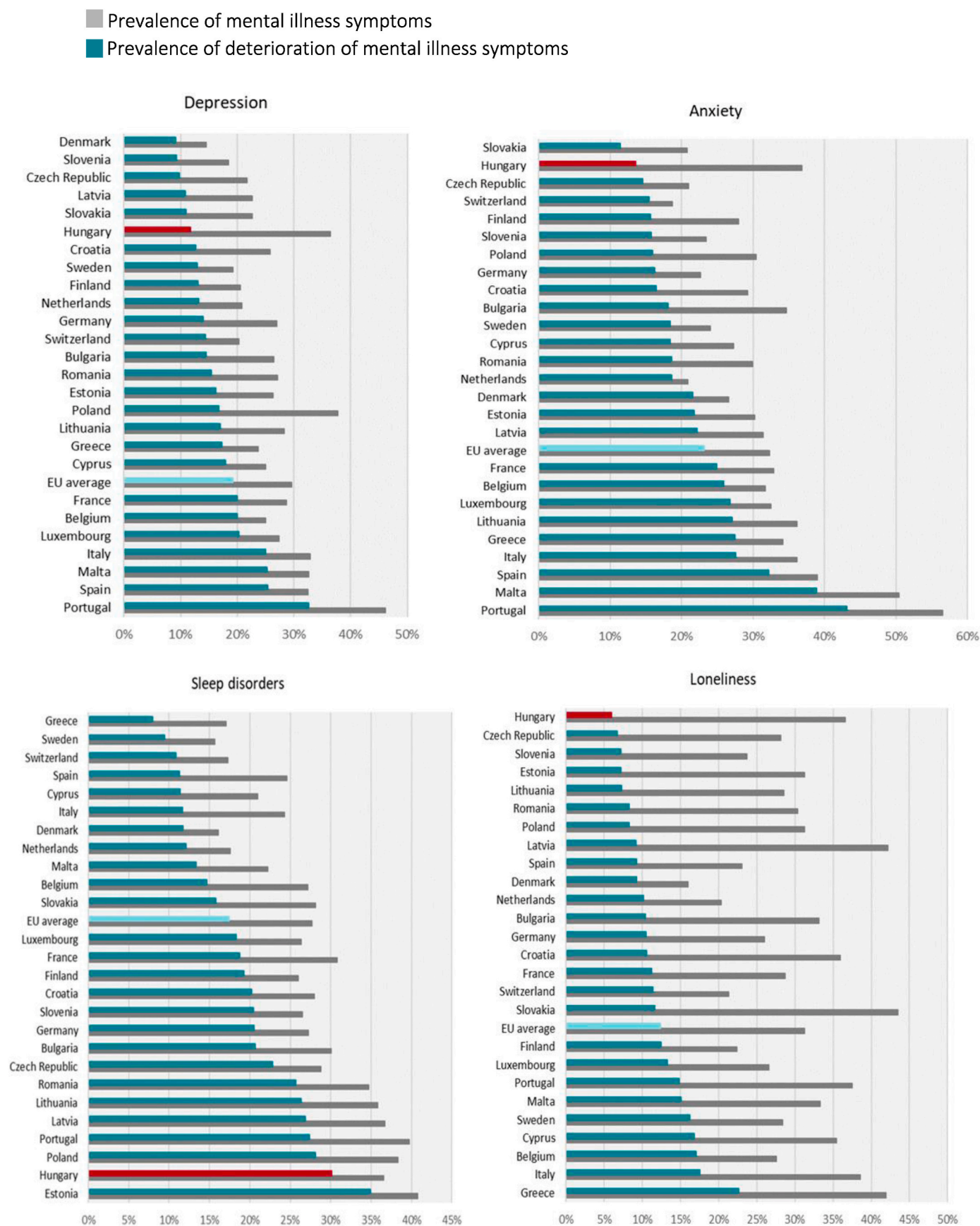


Fig. 2. Prevalence and deterioration in mental health problems in the elderly population in Europe after the first closures following an outbreak of coronavirus. *Note:* In the figure, the countries are arranged in descending order according to the proportion of those affected by the deterioration in the mental problem under review.

(LMR-LRT), the size of the classes (they should be at least 5% of the sample) and a higher entropy value (Nylund et al., 2007). According to the test statistics of the latent class analysis, the most optimal division is the four-class model structure.

Of the latent classes in the pattern of social contacts (see Fig. 3), those in *Class 1* (16.5%) typically have “*lack of contact*”: they do not have frequent contact with persons outside their household, either personally or electronically. *Class 2* (58.8%), who make up the largest part of the sample, have intensive family contacts (both personal and electronic), but lack regular interactions with distant relatives and friends and acquaintances, thus we coined them “*family active*”. *Class 3* respondents (15%) are “*electronic-contact active*” who are more likely to have intensive electronic contacts with both close family members and other relatives, as well as with distant acquaintances, but lack regular personal encounters. The smallest *Class 4* (9.7%) making nearly a tenth of the sample included “*multiple contact actives*”: these respondents are characterised by having frequent personal contacts with both close and distant family members, relatives and non-relatives, but they are also more likely to boast intensive electronic contacts as well (in terms of the frequency of electronic communication, they are only surpassed by Class 3).

To answer the question of how patterns of social relationships among the elderly affect the deterioration of perceived mental illness symptoms during the coronavirus pandemic, we examined multivariate regression models. The worsening of each mental illness symptom was described separately, i.e., in four models. Thus, the dependent variables of our regression models are the dichotomous variables of the intensified feeling of involvement in different aspects of mental health compared to the period before the coronavirus outbreak: (1) depression, (2) anxiety, (3) sleep disorder, and (4) indicators of negative changes in terms of loneliness. The main explanatory variable is the four-category variable expressing the typical network characteristics identified based on the type, mode and intensity of family and social contacts: (1) characterised by lack of contacts, (2) characterised by family contacts, (3) characterised by electronic contacts, (4) contact-actives, of which categories the latter, the group of contact actives, was used as the reference category. In the course of the analysis, we establish correlations by controlling personal variables (e.g. physical health status, involvement in coronavirus infection, isolation during the pandemic, gender, age, marital status, education, labour market status, and type of settlement). The estimation results are shown in Table 1.

The results of multivariate logistic regression clearly show the significant effect of social contact patterns on the worsening of the mental illness symptoms under review after the outbreak of COVID-19. Regarding the deterioration in all four mental problems reviewed here [models (1), (2), (3), and (4)], each network constellation has a positive

effect on the ‘multiple contact-active’ category highlighted as a reference group, i.e., intensive personal and compared to an electronic family/acquaintance network. On the other hand, it is consistently seen that the ‘*lack of connection*’ network is correlated with the highest chances with worsening depression, anxiety, sleep disorders, and feelings of loneliness. ‘*Electronic contact activity*’ and ‘*family contact activity*’ also have a smaller positive effect. The latter result, whereby frequent contact with family members/relatives is more likely to increase mental health deterioration compared to an intensive family and acquaintance network, reflects that limited intensive contacts alone are not sufficient to protect mental health. According to other hypotheses, closure with family members and forced intense time being spent together may even increase mental burden among those with the symptoms reviewed.

We note that the regression models were also run by treating different categories of the variable showing the pattern of social relationships as reference groups. The findings described above are clearly visible in all models. For example, if the ‘electronic-contact active’ network pattern is treated as a reference group (see Appendix Table A2), respondents with ‘family-active’ and ‘multi-active’ network constellations are less likely to experience the deterioration of the mental illness symptoms under study. And compared to the limited intensive – family – network, we find smaller odds ratios in the contact-active category in each model, i.e. the contact activity reduces the worsening of the mental problems reviewed the most (compared to the electronic contact activity).

As far as the other independent variables are concerned, physical health and isolation also have a positive effect on all four aspects of mental health: the existence of a chronic illness and “staying at home” after a pandemic were associated with a higher incidence of depression, anxiety – worsening of your loneliness or sleep disorder. Involvement in coronavirus infection is positively related to worsening of depression, anxiety, and loneliness, but negatively to deteriorating sleep problems: i. e., the more severely and widely the respondent’s network was affected by the infection, the greater the chance of depression, anxiety and an increased sense of loneliness was, while worsening of the sleep problems was less possible. Taking a closer look at the impact of socio-demographic background variables, it is evident that women, respondents with a low level of education, and those living alone and no working are significantly more likely to feel more depressed, anxious, lonely, and more likely see the worsening of their sleep problems after the outbreak. Assessing the effect of age, both those aged 65–74 and those aged 74 and over were more likely to experience depression, anxiety, and feelings of loneliness than those treated as reference, while deterioration in sleep disorder was less pronounced. It is noteworthy that young retirees (aged 65–74) are more likely to have worsening depression, anxiety and feelings of loneliness than their older

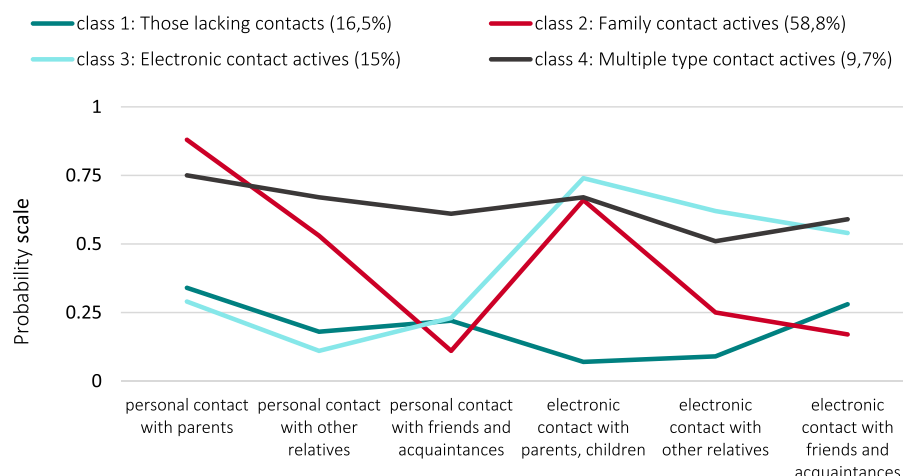


Fig. 3. Probability indicators for latent classes identified in terms of regular family and social contacts.

Table 1

Coefficients of logistic regression models (separate regression models for each worsening mental illness symptoms).

	Since the COVID-19 outbreak ...			
	(1) suffers from depression even more	(2) even more anxious	(3) suffers from sleep dist. even more	(4) suffers from loneliness even more
PATTERNS OF SOCIAL RELATIONSHIPS (ref: Multiple type contact actives)				
Those lacking contacts	2.812*** (0.612)	2.018*** (0.639)	1.314*** (0.602)	2.138*** (0.908)
Family contact actives	1.213** (0.472)	1.308*** (0.479)	1.566*** (0.448)	1.359*** (0.585)
Electronic contact actives	2.349*** (0.595)	1.943** (0.651)	1.126** (0.564)	1.640*** (0.794)
PHYSICAL HEALTH STATUS (ref: Having no chronic illnesses)	2.731*** (0.663)	1.307*** (0.570)	1.365** (0.374)	1.810*** (0.499)
ISOLATION (ref: Has left his/her home since the outbreak of the pandemic)	1.201** (0.309)	0.416 (0.438)	1.118** (0.309)	1.507*** (0.480)
COVID-19-INVOLVEMENT	1.577** (0.402)	1.376** (0.408)	−0.408 (0.398)	0.184 (0.657)
SEX (ref: Male)	1.345** (0.430)	1.365*** (0.456)	1.127*** (0.282)	1.402*** (0.613)
AGE (ref: <64)				
65–74	2.447*** (0.484)	2.267*** (0.511)	−1.606*** (0.482)	1.786*** (0.553)
>74	2.015*** (0.523)	1.404*** (0.546)	−1.466*** (0.534)	1.551*** (0.730)
MARITAL STATUS (ref: Does not live alone)	1.550*** (0.425)	2.150*** (0.393)	1.307*** (0.343)	2.274*** (0.640)
HIGHEST EDUCATIONAL LEVEL (ref: Tertiary)				
Primary	1.892*** (0.665)	1.692*** (0.554)	1.449*** (0.381)	1.370*** (0.731)
Secondary	0.0116 (0.428)	−0.683** (0.493)	1.331*** (0.325)	−0.393 (0.822)
EMPLOYMENT STATUS (ref: Have paid employment)	1.412*** (0.545)	1.621*** (0.500)	1.370*** (0.582)	1.960*** (0.706)
PLACE OF RESIDENCE (ref: Village)				
Capital	2.371*** (0.409)	−0.750*** (0.446)	−1.126*** (0.407)	1.877*** (0.575)
Other big cities	0.149 (0.547)	−0.566** (0.599)	−1.445*** (0.378)	1.241*** (0.813)
Small town	1.385*** (0.500)	−0.341** (0.483)	−0.637*** (0.362)	1.170*** (0.608)
Observation	732	732	732	732
Pseudo R ²	0.230	0.196	0.181	0.356

***p < 0.01; **p < 0.05. Robust standard errors in brackets. Data: SHARE Wave 7 Release 7.1.1 and Wave 8 Release 0.0.1 beta.

counterparts (respondents of over 75). In the case of sleep disorders, an opposite correlation can be seen there: the sleep problems of those aged 65–74 and those over 74 were less likely to worsen compared to the reference group of those aged 50–64. The effect of the type of settlement of residence on the increased feeling of depression and loneliness is significant and positive: compared to the village/rural residence chosen as a reference, people living in the capital reported the greatest chance of deteriorating depression and loneliness, and the chance rates linearly increasing with the increase of the size of settlement show that, compared to Budapest, chances of deterioration is much less likely in other cities or towns. Regarding the deterioration in anxiety and sleep disorder, however, it can be seen that those living in small and large cities were less likely to feel more anxious or experience the worsening of their sleep problems since the outbreak compared to the group of those living in villages.

4. Discussion and suggestion for future research

Our study reviewed the correlation between patterns of social relations and worsening mental health in the elderly population following the outbreak of the coronavirus pandemic using the database of a large-sample questionnaire survey conducted in the summer of 2020 (SHARE COVID-19 survey). It sought to explore the adverse effects of the pandemic on various aspects of mental health in the 50-year-old and older age group of the population in Hungary. The data we analysed were collected between June and August 2020, at a special time when the first wave of the coronavirus had subsided in most countries, including as Hungary, where restrictive measures introduced after the outbreak were phased out during this period.

Our descriptive results showed that more than a third of the elderly in Hungary reported depression, anxiety, loneliness, and sleep problems during the study. These results reflect an unfavourable picture in international comparison: among the European countries included in the SHARE survey, Hungary is one of the countries with the highest prevalence of these mental illness symptoms at the time of the first wave. Regarding the deterioration in mental health, compared to the pre-pandemic period, Hungarian respondents mostly reported worsening sleep issues (one-third), one-seventh reported anxiety, more than one-tenth reported depression and nearly 6% reported increased feeling of loneliness. We also showed that, compared to other European countries, the mental problems of the elderly age group (with the exception of sleep disorders) worsened to a lesser extent in Hungary due to the coronavirus epidemic (compared to, for example, southern European countries). A possible explanation for this may be related to the duration of the restrictive measures and/or the incidence of coronavirus-related infections, as well as the differences in the number of deaths between countries, as in most southern European countries, for example, the strictest restrictive measures were in place at the time of SHARE COVID-19 data collection and the number of COVID-19 infections per 100,000 population was also the highest. A recent study revealed an association between depression and the duration of restrictive measures and the number of coronavirus-related deaths (Atzendorf & Gruber, 2021), however, further studies are needed to investigate the correlation between other mental illness symptoms and macro-level factors.

Using multivariate regression models, we sought to answer how networking patterns and other background factors identified based on the type, mode, and intensity of family and social relationships influenced changes in mental health problems. According to our results, the *network characterised by lack of contact network* has the highest chance to correlate with worsening depression, anxiety, sleep disorders and feelings of loneliness, i.e. rare personal and/or electronic contact with persons outside the household (family members/relatives and acquaintances, friends) contributed significantly to the deterioration of mental well-being. In a statistical sense, *electronic contact activity* has a slighter but also positive effect: a network characterised by mainly electronic contact also increased the likelihood of worsening of various mental illness symptoms (especially the chances of worsening depression). In other words, the wide range of opportunities offered by the wide spread of virtual world and new communication technologies – e.g.: texting, e-mail, Skype, FaceTime – they cannot play as effective a role in protecting mental health as in person, “palpable” relationships. The obvious reason for this – at least in Hungary due to the affordability of IT devices and access to infrastructure – is, on the one hand, the existence of the IT gap, and on the other hand the fact that it is difficult to prepare the older generation (digital immigrants and digital illiterates) for the use of IT devices (Vajda, 2020). Direct transfer of knowledge, which was tried earlier, is not effective, learning in an emergency can only be realised with prepared support capacity, which is/has also been missing. In any case, the results of their research also suggest that there is a serious lag in the transfer of knowledge and the development of IT culture. Our results also reveal that an intense, but limited-scope network (*family contact-active*) is less likely to contribute to the prevention of the

deterioration of mental health compared to a network characterised by intense family and acquaintance relations (*multiple-contact active*). In other words, a network pattern characterised by various types and forms of contacts is the most beneficial to mental health, and intensive contacts of limited scope alone are not sufficient to protect mental health. A diverse network, in which, in addition to close ties, weak connections are also intensively available, provides potential access to people who are useful in an emergency, to those who provide important information support, and/or these more distant/weak connections can also be emotionally intensive.

A further remarkable result of the analysis is that although the more senior age groups are more likely to have worsened mental health compared to the 50–64 age group, it is the younger elderly, i.e. the 65–74 age group, who most probably experienced worsened mental health and not the oldest. Differences within the older age group suggest that the ‘*paradox of aging*’ also exists in the context of the coronavirus epidemic. With aging, individuals become more aware of the finiteness of life, so the level of subjective and emotional well-being changes less or may even improve (Carstensen, 2019; Mroczek & Kolarz, 1998). All of this may explain why the oldest seniors were not as mentally affected by the pandemic as the seniors who were roughly a decade younger than them.

Examination of additional potential risk factors has shown that the existence of a chronic illness; “staying at home” after the pandemic, and involvement in the coronavirus infection are significantly associated with deteriorating mental health. Another findings of ours is that women, as well as respondents with a low level of education, and those living alone but no longer work are significantly more likely to feel more depressed, anxious, lonely, and have worsened their sleep problems after the outbreak compared to the pre-pandemic period. These results are consistent with findings from other COVID-19 studies whereby poorer physical health, perception of COVID-19 symptoms, isolation, or time spent at home are risk factors for deteriorated mental health, as well as, being a woman, having a low level of education, or being retired or unemployed and living alone (Atzendorf & Gruber, 2021; Mendez-Lopez et al., 2022; Robb et al., 2020). The type of settlement is also an important determinant of the change in mental health in advanced age: the sleep disorder and anxiety of the elderly living in small rural settlements and villages worsened, while those living in cities (especially the capital) felt more depressed and lonely than before the outbreak. This may also be due to the fact that the everyday contacts of the metropolitan population related to their place of residence, neighbourhood and work – their information channels – are certainly significantly different from the everyday meetings, communication and source of information of those living in a rural environment where they “know almost everybody by sight”. The exact forms of these can be explored by a separate research and an attempt can be made to explore why sleep disorders and anxiety have worsened in smaller settlements rather than in large cities. We are not aware of any COVID-19 study that examined the effect of settlement type on mental health; further research is clearly justified.

4.1. Limitations

This study had several limitations. It is important to emphasize that our results obtained from the analysis of data on the population aged 50 and over cannot be generalized to other groups of the population. Furthermore – due to the cross-sectional nature of the study – no causal contacts can be detected based on our results, only probable explanations were revealed during the study of the contacts. The study has a limitation which should also be taken into account: we worked with information based on the respondents’ own perception, which may differ from the medical diagnosis and may overestimate or underestimate the presence of mental problems. Besides, pre-pandemic issues are necessarily retrospective, so recollection can cause some distortion, too. Nevertheless, to the best of our knowledge, this is the first study to

examine the medium-term impact of the coronavirus epidemic in terms of mental health and its changes in Hungary. On top of that, the scope of the study included one of the most vulnerable groups, the elderly population.

5. Conclusions

We found that the patterns of social relations were associated with the deterioration of mental health in the elderly population following the COVID-19 outbreak in Hungary. Our results suggest that both the network characterised by lack of contact network and electronic contact activity contribute to greater risk of worsening mental health within our population of older adults. A network pattern characterised by various types and forms of contacts is the most beneficial to mental health, and intensive contacts of limited scope alone are not sufficient to protect mental health. It appears that a diverse network, in which, in addition to close ties, weak connections are also intensively available, provides potential access to people who are useful in an emergency, to those who provide important information support, and/or these more distant/weak connections can also be emotionally intensive.

Author statement

Á.Gy. designed the research, analysed the data and wrote the paper.

Data sharing

All data used in this study are available free of charge to all scientific users worldwide after individual registration (<http://www.share-project.org/data-access/user-registration.html>). SHARE data are DOI registered datasets (<http://www.share-project.org/data-documentation/share-data-releases.html>). This study uses data from SHARE Waves 7 and 8 (DOIs: <https://doi.org/10.6103/SHARE.w7.711>, <https://doi.org/10.6103/SHARE.w8cabetta.001>).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical statement

Hereby, I, Ágnes Györi, consciously assure that for the manuscript submitted the following is fulfilled.

- 1) This material is the authors’ own original work, which has not been previously published elsewhere.
- 2) The paper is not currently being considered for publication elsewhere.
- 3) The paper reflects the authors’ own research and analysis in a truthful and complete manner.
- 4) The paper properly credits the meaningful contributions of coauthors and co-researchers.
- 5) The results are appropriately placed in the context of prior and existing research.
- 6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
- 7) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

Declaration of competing interest

No potential conflict of interest was reported by the author.

Data availability

Data will be made available on request.

Acknowledgements

Research in this article is a part of the EU Horizon 2020 SHARE-COVID19 project. The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N211909,

SHARE-LEAP: GAN227822, SHARE M4: GA No261982, DASISH: GA No283646) and Horizon 2020 (SHARE-DEV3: GA No676536, SHARE-COHESION: GA No870628, SERISS: GA No654221, SSHOC: GA No823782) and by DG Employment, Social Affairs & Inclusion. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources are gratefully acknowledged (see www.share-project.org).

Appendix

Table A1

Worsening mental health by sociodemographic characteristics among the elderly population in Hungary (%)

	Since the COVID-19 outbreak ...			
	suffers from depression even more	even more anxious	suffers from sleep dist. even more	suffers from loneliness even more
SEX				
Male	9.2	7.9	12.0	1.9
Female	15.0	15.8	30.5	7.7
	p = 0,000; CV = 0,105	p = 0,000; CV = 0,119	p = 0,000; CV = 0,219	p = 0,000; CV = 0,130
AGE				
<64	8.3	7.5	11.6	2.5
65–74	19.4	20.4	25.7	9.6
>74	9.5	8.9	39.1	3.2
	p = 0,000; CV = 0,156	p = 0,000; CV = 0,182	p = 0,000; CV = 0,256	p = 0,000; CV = 0,149
MARITAL STATUS				
Living alone	22.1	20.1	36.7	15.5
Otherwise	10.4	10.9	19.5	1.5
	p = 0,000; CV = 0,159	p = 0,000; CV = 0,126	p = 0,000; CV = 0,188	p = 0,000; CV = 0,275
HIGHEST EDUCATIONAL LEVEL				
Primary	24.6	24.3	38.3	11.5
Secondary	11.4	10.5	23.7	4.9
Tertiary	9.4	10.3	14.1	4.0
	p = 0,000; CV = 0,174	p = 0,000; CV = 0,175	p = 0,000; CV = 0,196	p = 0,000; CV = 0,119
EMPLOYMENT STATUS				
Have paid employment	9.1	6.4	8.3	2.9
Otherwise	16.9	17.6	33.3	7.8
	p = 0,000; CV = 0,103	p = 0,000; CV = 0,149	p = 0,000; CV = 0,266	p = 0,000; CV = 0,094
PLACE OF RESIDENCE				
Capital	30.2	24.7	11.5	18.5
Other big cities	9.1	7.1	18.8	1.9
Small town	12.8	11.8	22.6	2.9
Village	11.5	14.5	36.2	6.9
	p = 0,000; CV = 0,195	p = 0,000; CV = 0,148	p = 0,000; CV = 0,208	p = 0,000; CV = 0,233

Data: SHARE Wave 7 Release 7.1.1 and Wave 8 Release 0.0.1 beta.

Table A2

Coefficients of logistic regression models (separate regression models for each worsening mental illness symptoms)

(Adalja et al., 2020)	Since the COVID-19 outbreak ...			
	(1)	(2)	(3)	(4)
	suffers from depression even more	even more anxious	suffers from sleep dist. even more	suffers from loneliness even more
PATTERNS OF SOCIAL RELATIONSHIPS (ref: Electronic contact actives)				
Those lacking contacts	1.763***	1.586***	1.356***	1.654***
Family contact actives	−1.201**	−1.391***	−1.373***	−1.219***
Multiple type contact actives	−1.175**	−1.349***	−1.318***	−1.530***
CONTROLL VARIABLES				
Yes	Yes	Yes	Yes	Yes
Observation	732	732	732	732
Pseudo R2	0.230	0.196	0.181	0.356

*** p < 0.01; **p < 0.05. All regressions include individual-level control variables and place of residence. The sample sizes are the same as in Table 1. Data: SHARE Wave 7 Release 7.1.1 and Wave 8 Release 0.0.1 beta.

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