

## Article

# Relationship between Social Networks, Support Patterns, and Health Problems among the General Hungarian Population during the Last Phase of the COVID-19 Pandemic

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**Abstract:** Numerous research works prove that social relationships and the support they provide have particular importance in maintaining both mental and physical health: they help to deal with stressful life situations, overcome diseases, and maintain health. It is also known that certain periods of life and life events can be critical in terms of social support, as they involve the narrowing of possible sources of support, so the lack of a network of contacts and social support increases not only the risk of becoming lonely but also the occurrence or worsening of diseases. This study investigates the relationship between social network factors and support provided through networks and health problems, taking into account the perceived personal and general impact of COVID-19. The data came from a cross-sectional study, a representative sample of 5000 Hungarian participants was conducted during the dwindling period of the pandemic. We used a latent profile analysis to separate the different groups of respondents based on the support received from different sources of relationships, aiming at capturing the diversity of supported support combinations based on the type of relationships in the network, the form of support, and frequency. Multilevel regression was used to examine the impact of social connectivity factors, emerging patterns, and COVID-19-related perceived consequences on health conditions. Our results confirm that the “poorly supported network” plays a key role in the occurrence of chronic diseases and depression. It seems interesting, however, that the probability of poor physical and mental health was higher in the group of those receiving financial and in-kind support mainly from family compared to the group of those receiving support from multiple sources of relationships. The models also suggest that network integration plays a major role in maintaining mental and physical health during an epidemic crisis.



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## 1. Introduction

The COVID-19 pandemic had severe consequences at both macro and micro levels (World Health Organization 2020). On the one hand, healthcare systems in all countries were under great pressure from the influx of patients with COVID-19, especially at the beginning of the pandemic, which also resulted in a series of spill-over effects, such as the postponement of certain health services due to high numbers of COVID-19 patients or severe staff shortages in healthcare and social care facilities. On the other hand, it affected the lives of hundreds of millions of people, as it changed people's ways of socializing, working, studying, and living. Moreover, the highly contagious COVID-19 had a significant impact not only on physical health but also on mental health at the individual level (Pulvirenti et al. 2020; Wu et al. 2021). It caused common mental health problems such as anxiety, sleep disorders, depression, frustration, and stress-related disorders that may be caused by worrying about becoming infected, increasing work pressure, lifestyle changes, and worsening living conditions (Fiorillo and Gorwood 2020; Tang et al. 2022; Vindegaard

and Benros 2020). Torales et al. (2020) also warned of the risk that these COVID-19-related mental health symptoms could develop into long-term health issues. The long-proven correlation, i.e., that the lack of network and support available through it is a significant risk factor for deteriorating health status, was confirmed once again in the stressful crisis situation brought about by COVID-19 (Mahamid et al. 2023). Although several research projects examined the role of social relationships and social support in mental wellbeing during COVID-19, the information available on the relationship between the consequences of the pandemic on the public and private sectors, social network factors and support, and health outcomes is scarce. Another added value of the present study is that, in addition to the impact of supportive relationships revealed by previous research, it seeks to shed light on how combinations of different forms of support and frequency of support provision—support patterns—are related to mental and somatic health.

The study is structured as follows: in the next chapter, we provide an overview of the theoretical and empirical antecedents relevant to our analysis, and then our hypotheses are presented. The data and method chapter includes the database used, the variables of the analysis, and a description of the methods used. In the results section, descriptive data and coefficients obtained from regression models are presented. Finally, in the discussion section, we summarize the results obtained and the shortcomings of the research, and we discuss the prospects for further development.

## 2. Overview of Research Literature Used

### 2.1. Sociodemographic Factors and Health

The investigation of the factors that play a role in the development and maintenance of health inequalities has been the focus of research for several decades (Marmot and Bobak 2000). Considerable scientific interest emerged in the wake of the so-called Black report (McIntosh Gray 1982), commissioned by the British government in 1980, which meticulously showed that diseases occur unequally among different social classes of British society (Whitehead and Dahlgren 2006). Following the publication of the frequently cited document concerned, the view that, in addition to biological characteristics, factors related to health behaviour and environmental factors of epidemiological importance as well as social factors, also play a decisive role in the differences between the health status of individual social groups gained popularity in scientific circles (Marmot and Bobak 2000). Since then, a large number of international and domestic studies proved that groups with an unfavourable socio-economic situation (those with low education, low income, who are excluded from the labour market, living in poor housing conditions, etc.) have worse health indicators, even in economically developed welfare states (without claiming to be exhaustive, Hoffmann 2008; Kovács 2012; Lahelma et al. 2006; Orosz and Kollányi 2016; Torssander and Erikson 2010). For example, in terms of life expectancy at birth, there is an average difference of 5–10 years, and in the case of morbidity, a difference of 10–20 years can be observed between the lowest and highest strata of European societies, regardless of the fact whether health indicators between the top and bottom social groups are reviewed based on education, employment position, or financial status (Mackenbach 2006).

Differences in terms of social status also show significant differences based on mental health status indicators. A number of studies confirm that low socio-economic status is associated with a higher prevalence of mental disorders (Chen et al. 2019; Lewis et al. 2003; Pino et al. 2018; Pulkki-Råback et al. 2012). Additionally, some research also indicated that an unfavourable socio-economic status increases the risk of death related to mental health (Kivimäki et al. 2007).

### 2.2. Social Relationships, Social Support, and Health

It has long been known in the literature that—in addition to the above-mentioned socio-economic factors—social relationships also play an important role in explaining health status: they help to cope with stressors, mitigate the harmful consequences of difficult life events, maintain mental and physical health, and in recovery from the dis-

ease(s) (Golden et al. 2009). Social relationships can positively influence health through two mechanisms: the main effect model or the stress-buffering model (Cohen and Wills 1985; Cohen et al. 2000). According to main effect model, social relationships have a direct beneficial effect on an individual's health, regardless of the existence of a stressful situation, since contact with other people increases the likelihood of positive emotions and reduces the intensity and duration of negative emotions, thereby promoting a healthy psychological and emotional state (Cohen et al. 2000; Rees and Freeman 2007). However, according to the stress-reducing model, social relationships have a positive effect on health only in stressful situations: they dampen the negative effects of stress on health, relieve anxiety, help the individual to cope with difficulties, and it is important for the person receiving support to be certain that helping persons are available in crisis situations (Werner-Seidler et al. 2017).

Epidemiological studies established as early as the 1980s that social relationships influence morbidity and mortality to the same extent as, for example, smoking, physical activity, or even obesity (House et al. 1988). It was proven that people with a higher number of and more intimate relationships have a 50% higher chance of survival compared to those who are lonely or have few social relationships (Heffner et al. 2011; Holt-Lunstad et al. 2010; Tay et al. 2013). Several studies reported that inadequate social integration and low social support have a significant impact on the development of somatic diseases—especially cardiovascular diseases and cancer—and their worsening and mortality (Lett et al. 2005; Zhou et al. 2022).

It was also proven that social isolation causes allostatic overload in the long term, i.e., it triggers inflammatory processes in the body, which can lead to the development of various diseases (e.g., cardiovascular lesions) (Seeman et al. 2014; Yang et al. 2014; Steptoe and Kivimäki 2013). According to the results of other research, adult social isolation is a source of chronic stress (Everson-Rose and Lewis 2005), and compared to healthy individuals, it can result in one-and-a-half to two times higher risk in terms of ischemic heart disease and death (Kamiya et al. 2010).

It is also well documented in the literature that the support available through networking is also key to health, especially mental health: a smaller network, fewer interpersonal relationships, and a low level of social support predict the development and worsening of mental problems (Kawachi and Berkman 2001; Cacioppo et al. 2006). Domènec-Abella et al. (2017) found that the size of an individual's network of relationships—more specifically, the structural deficiencies of a network—transfers the effect of loneliness on depression, while L. Liu et al. (2016) found that the lack of social support affects depression through the increase of the feeling of loneliness.

Mental health is not only related to the size of social networks but also to the quality of relationships; as several studies confirmed, the quality of relationships is more strongly related to mental health than other characteristics of the relationship network (Werner-Seidler et al. 2017). Additionally, other qualitative characteristics of the social network, such as the ties' strength, also have an impact on mental well-being. Anglo-Saxon and Israeli studies focusing on the impact of strong relationships of family and friends, assuming a higher level of trust, on health generally show that friend-focused social networks—as opposed to networks rich in family relationships—contribute more to the protection of both mental and physical health (Adams and Blieszner 1995; Litwin 1998; Litwin and Shiovitz-Ezra 2011). At the same time, Japanese and Hong Kong studies did not find a significant difference between these two types of networks in terms of mental well-being (Fiori et al. 2006; Cheng et al. 2009). According to the authors, the different results can be explained by cultural differences (Fiori et al. 2008). In Western societies, older adults value independence and autonomy, and since family ties are deeply embedded in the social context, they cannot be broken easily; this excessive dependence can lead to emotional distress and a feeling of vulnerability for those involved. Meanwhile, East Asian societies are organized around a traditional family system and consider family cohesion highly important, so in such a cultural context, being with family members can provide effective emotional support, which can have a beneficial effect on the mental well-being of the individuals concerned.

(Cornwell 2011). Hungarian studies also report that social support received from family members and friends shows a significant negative correlation between depression and perceived stress levels and a positive one with subjective well-being (Ocsovszky et al. 2020).

Recent research (Aartsen et al. 2004; Moore et al. 2016) drew attention to the fact that not only can social networks influence health status, but adverse changes in an individual's health condition also affect the social network as well. Deterioration in physical health was shown to lead to a decrease in friend/neighbour relationships and an increase in the intensity of family relationships. As health declines, the elderly tend to rearrange their social relationships: they limit their attention to those relationships that provide them with the most emotional and functional support. These relationships are more likely to be the most intimate family/kin relationships that can provide long-term instrumental support (Aartsen et al. 2004; Albert et al. 2021; Kuijer et al. 2001).

Moore et al. (2016) explored the impact of health conditions on social networks not only among elderly adults but among the adult population as a whole and found that chronic disease(s) and depressive symptoms transform network diversity and core network size in very different ways. Their research results reveal that poor physical health is associated with a more insular and kin-based network, while depressive symptoms are more likely to be associated with a network based on acquaintances. However, as the authors themselves point out, these empirical findings do not conclusively prove that a network rich in weaker relationships, i.e., more weak acquaintance relationships and fewer strong kinship relationships, leads to depressive states or that the coping strategy for depressive status is to have a higher number of weak bonds. It can also only be assumed that poor physical health makes it difficult to establish or maintain weak relationships and, therefore, may lead to the dwindling of these non-kinship relationships; thus, longitudinal studies would be needed to prove causation.

### 2.3. Health-Related Correlations of Risk Perception and Social Networks in the COVID-19 Context

It is known from previous epidemic research, such as studies related to H1N1, SARS, and Ebola viruses, that the fear of developing severe disease and the chance of dying induces increased feelings of anxiety in all age groups of the population (Taha et al. 2014). In addition, if the threat is continuous, as it was during the COVID-19 pandemic, fear and worry can become stressful and chronic. This is confirmed by empirical surveys conducted in the months following the COVID-19 outbreak among populations in the US and European countries, which confirmed a significant increase (up to 10–11% in some countries) in the prevalence of both generalised anxiety disorder and depression (Atzendorf and Gruber 2021; McGinty et al. 2020).

During the pandemic periods, some research focused on exploring the relationship between the perceived risks of COVID-19 and health status, with special regard to mental health. The results of C. Liu et al. (2021) demonstrated that the perceived risk of COVID-19—especially the perception of uncontrollability—significantly increased the incidence of both depressive symptoms and post-traumatic stress disorder (PTSD) symptoms. A Turkish study also confirmed that the perception of COVID-19 risk and coronavirus fear positively predicted depression, anxiety, and stress, while resilience negatively predicted decreased mental health (Yildirim et al. 2020). Examining perceived risks of COVID-19 in different areas of life, Han et al. (2021) revealed that the risk perception of suffering from economic consequences of COVID-19 was more strongly associated with anxiety and overall mental health than the risk perception of being infected.

The relationship between health status and the perception of COVID-19-related risk was also explored by a separate group of research in the context of social relationships and social support (Mahamid et al. 2023; Mauer et al. 2022). These recent research findings confirmed the stressful and uncertain situation caused by COVID-19 as well as the fact that the lack of social support and relationship isolation increase the vulnerability of an individual's psychological health. Alcover et al. (2020) also showed that perceived social support reduced the incidence of mental problems to a lesser extent than the size of the

social network. Some research examining the indirect impact of social networks and support pointed out that emotional, informational, or instrumental support provided through a network mediated the relationship between COVID-19-related risk perception and mental health problems (insomnia, stress, depression, and anxiety), buffering the negative impact involved (Szkody et al. 2021). C. Liu et al. (2021) showed a very different impact of support received from various sources, i.e., through strong and weak bonds, on the incidence of mental health problems in the early stages of COVID-19. According to their results, greater social support from weak-tie networks correlated with a higher incidence of mental health symptoms, while greater support from family and friends, i.e., through strong bonds, facilitated the probability of a lower incidence of mental health issues. Reasons for these different relationships are attributed to the various functions each support has, i.e., strong ties such as intimate friends and family members usually generally provide practical and emotional support, whereas colleagues and acquaintances are often considered weak ties that could provide more information support that would always turn into spreading rumours and negative emotions in a pandemic context, which further arouses pressure (C. Liu et al. 2021).

### 3. Research Hypotheses

This study explores how the characteristics of the social network and the support provided through these relationships correlate with mental and physical health during the dwindling period of the epidemic, taking the perceived personal and general impact of COVID-19 into account. Its novelty lies in the fact that while previous studies focused primarily on exploring the role of support(s) provided by individual sources of relationship, we investigate how combinations of different types of support received from different sources are related to health status.

Based on the broad literature review presented above, three hypotheses and one explorative question were proposed in this study. Firstly, we posited a hypothesis that the vulnerable groups—for example, people with lower education, the poor, the elderly, and those living in bad settlement infrastructure conditions—are more likely to be “sicker” and have less favourable physical and mental health (H1). Secondly, we proposed two hypotheses on the role of social network factors and combinations of social support. In the case of those with poor health status indicators, the size and diversity of the network of contacts, i.e., the higher degree of social integration, alleviates the difficulties of coping (H2). A combination of low financial support and low practical/in-kind help, i.e., a lower level of mobilized resources, was associated with a higher risk of somatic and mental illnesses (H3). Finally, taking the adverse outcomes of the pandemic on social and private spheres into consideration, we raised an explorative question to explore whether a stronger association was found between perceived impact on personal life with health problems than on society in general with health disorders (Q1).

### 4. Data and Methods

#### 4.1. Sample

During the analysis, we relied on the data of a survey based on a personal questionnaire conducted between 10 October and 16 November 2021 within the confines of the Mobility Research Center project within the Excellence Cooperation Programme of the Hungarian Academy of Science (MTA). The data collection was carried out on a nationally representative sample of 5000 respondents aged at least 18 or older, living in Hungary, and having Hungarian citizenship. During the selection of the sample, a two-stage, proportionally stratified probability sampling procedure was used. The primary sampling units were the settlements, and the final sampling units were the appropriate age groups of the population. In the settlements included in the sample, the residential addresses were randomly selected according to the number of cases in the sample frame. In addition to the address, the address cards given to the interviewers included the gender and age group of the person visited. The procedure of the address search was as follows: in the street and at

the house number provided. As a rule, the interviewer had to look first for a respondent who matched the gender and age group written on the address card. When the interviewers failed to complete their mission for some reason (507 times due to refusal to answer or move away from the address provided), they tried to go to the right of the address concerned to the next house/apartment until they managed to find a suitable quota person.

The sample reflects the proportions typical of the entire adult population in this area in terms of gender, age (3 age groups), education (4 education levels) and settlement type (4 settlement levels). The research was approved by the Research Ethics Committee of the HUN-REN Centre for Social Sciences (file number: TK-14/2021). All participants provided informed consent and the data were used in accordance with the data management policy.

#### 4.2. Measuring Tools and Procedure

##### 4.2.1. Health Status Indicators

The health status indicators used in our study are based on the self-assessment and reports of the respondents. (1) We approached the characterization of the general somatic state of health from the point of view of the existence of long-term disease(s) and created a dichotomous variable to describe it, which measures whether the respondent has any long-standing chronic disease. The question in the questionnaire reads as follows: "Do you have any chronic disease or health problem that has lasted for at least 6 months or is expected to last for at least 6 months?". As far as the health status of respondents aged 18 and older is concerned, 19.5 percent of them claimed to have some kind of long-standing illness. (2) To characterize the state of mental health, i.e., psychological condition, we used the abbreviated, nine-item version (BDI-S) of Beck's Depression Scale ([Beck and Beck 1972](#)), regarded in the literature as one of the most reliable measuring tools for mental disorder, to assess the severity of depressive symptoms. The development of the shortened version of the measurement tool in Hungarian is attributed to Mária Kopp and her colleagues ([Kopp et al. 1990](#)), and the Hungarian version was validated both in clinical and average populations ([Rózsa et al. 2001](#); [Kopp et al. 1995](#)). Those filling in the items of the scale can indicate how typical they consider the statements provided to be for their own situation on a four-point Likert scale (0 = not typical at all, 3 = absolutely typical). Certain items of the questionnaire ask about symptoms such as social withdrawal, inability to make decisions, sleep disorders, fatigue, excessive worry due to physical symptoms, inability to work, pessimism, dissatisfaction, and lack of joy. Excessive worry about physical symptoms can be measured, for example, through this question: "I worry so much about physical complaints that I cannot think about anything else." A higher score on the scale indicates more depressive symptoms. The internal reliability of the scale in our sample is excellent (Cronbach's alpha = 0.96). The score of the nine-item Hungarian version was transformed into a value equivalent to the score of the entire scale, as determined by [Kopp et al. \(1990\)](#). In our sample, the mean of the BDI-S scale is 6.64 (SD = 12.96). Almost four-fifths of the sample (77.4%) is not depressed, a little less than 8% suffer from mild depressive symptoms, almost 4% can be described as having moderately severe, and one-tenth (11.1%) can be described as having severe depression; based on the combined ratio of the latter two groups, one-sixth of the sample (15.1%) meets the clinical criteria of major depression.

##### 4.2.2. Social Integration: The Individual Network of Connections

Social relationships were approached through the size of the ego-centric network and characterized by (1) strong and (2) weak ties. (1) As an indicator of *strong ties*, we used the number of confidential, important conversational relationships, which was assessed by the questionnaire using the name generator of "important things" ([Burt 1984](#)). The questionnaire asked respondents to say how many people (up to five) they discuss their most important problems with<sup>1</sup>. The question, therefore, assesses the close-strong relationships that can provide emotional support for the respondent. Regarding the confidential relationship network of the respondents, it can be established that a sixth of them (16.4%) do not have a single confidential relationship, half of the sample (49.4%) have one confidant,

and only a third (34.3%) have two or more confidential conversational relationships. (2) We also used a quantitative indicator to measure *weak ties*. The number of weak ties was revealed by the questionnaire using the position generator technique (Lin and Dumin 1986); the respondents were asked about 21 different prestigious occupations, such as accountant, high school teacher, driver, car mechanic, lawyer, and journalist, and they had to indicate whether they knew people with such an occupation in person. This question, therefore, measures what positions/occupations the respondents can achieve in their social network, which can enable them to access various social resources. Respondents have an average of 9.7 acquaintances ( $SD = 5.33$ ): a quarter (24%) have 5 or fewer weak ties, nearly a third (36.3%) have 6–10 weak ties, and two-fifths have 11 or more weak ties (39.7%).

#### 4.2.3. Social Support: Mobilized Resources

We approached the measurement of social support from the point of view of the instrumental, tangible support received from the narrower and wider environment. By means of two resource generator questions, the questionnaire asked about the type and intensity of support from different contact sources, i.e., what resources the respondents had access to through their social network and how often they could use them.<sup>2</sup> The following question was asked from the respondents: “*In the last years, to what extent did you receive financial support and money from (1) your family members, (2) your friends, acquaintances, (3) your neighbours, (4) a helping organization, community, (5) your workplace (from his employer, workplace organization, trade union), (6) from the state, (7) from the local government and (8) from other sources?*”. Then, they were asked the same question in terms of in-kind support: “*In the past 2 years, to what extent have you received in-kind support, services, help at work (including childcare, shopping, patient care, regular phone calls, etc.) (1) from your family members, (2) from friends, acquaintances, (3) from your neighbours, (4) from a support organization, community, (5) from your workplace (employer, workplace organization, trade union), (6) from the state, (7) from the local government and (8) from other sources ?*”. Four possible answers could be indicated: not received at all, to a small extent, to a moderate extent, to a significant extent. During the analysis, these variables were used as categorical variables, where a higher value indicates a more frequent occurrence of the form of support provided by the source concerned. The respondents in our sample mostly received support from their families during the period under review (financial support was 23% and in-kind support was 33.4%), followed by support from friends and acquaintances (financial support: 5.9%, in-kind support: 19.6%). Among the forms of support received from other sources of relationships, the help in kind provided by neighbours stands out (19.3%); however, their financial support is less typical (3.9%). Moreover, 6.6 and 5% of the respondents received financial support from the state and local government, respectively, which is similar to the financial support provided by friends and acquaintances, but their in-kind assistance is low (less than 3%) compared to the rate of the support in kind received from the civil community, organizations, or even workplaces (the latter are all around 4%).

#### 4.2.4. Perceived Impact of the COVID-19 Pandemic Situation

Two indicators were created to measure the impact of the coronavirus pandemic that reflect the perception of the impact of COVID-19: (1) on one's own personal life and (2) on society in general. Respondents were asked the following question: “*In your opinion, how has the coronavirus changed the following factors?*”. Then, they had to rate the influence of COVID-19 on 11 different dimensions<sup>3</sup> on a scale of 1 to 5 (1 = very negatively, 5 = very positively) according to their perception. After inverting the values of the items so that the higher values show negative changes perceived in each area, based on these variables (1) the first index, which measures *how COVID-19 affected the personal life of the respondent*, was formed by adding three variables related to the respondent's financial situation, work, and health, and then they were divided by three. The Cronbach alpha value of the three variables is 0.85. This high value indicates that we correctly assumed a latent one-dimensional structure between these variables. (2) The other index measuring the *general impact of COVID-19*

was also created by adding up the ratings of the eight areas listed (such as the situation of the Hungarian economy, prices, relations between generations, and solidarity) by the respondents in terms of how negatively they were affected by the pandemic, and then divided them by eight (Cronbach's alpha value for these variables is 0.91, which also indicates high internal consistency between the variables). The two COVID-19 indices were included in the analyses as continuous variables. The average of the index measuring the general impact of the coronavirus is 3.58 ( $SD = 0.84$ ) and the index measuring its impact on the respondent's own life is 3.34 ( $SD = 0.87$ ). Slightly more than half of the respondents (51.9%) perceived the negative impact of the coronavirus pandemic to a greater extent than average in various areas of life, and 37.1% of them experienced an above-average negative impact of the pandemic in their own lives. In other words, the impact of COVID-19 on respondents' own lives was perceived as negative to a lesser extent than the impact on society as a whole.

#### 4.2.5. Demographic and Socio-Economic Characteristics

The variables describing the demographic and socio-economic background of the respondents were also included in the analysis: *gender* (female), *age* (listed as categorical variables: 18–34 years, 35–54 years, 55 years and older), *social status* (taking into account the actual form of cohabitation, dichotomous variable: whether they live alone), *education* (categorical variables: no higher than eight classes of elementary education, high school without a diploma, high school with a diploma, higher education), the *subjective income situation* (categorical variables: can cover usual expenses with difficulties, with minor difficulties, they can cover them relatively easily and easily or very easily), as well as the variables of the *type of settlement of the place of residence* (categorical variables: capital city, another big city, small town, village).

#### 4.3. Statistical Methods

Statistical analyses were performed with the STATA 16.0 program (Release 16. College Station, TX, USA: StataCorp LLC) and the tidyLPA package of the R 4.1.2 program (Rosenberg et al. 2018). In the first step, we performed a model-based cluster analysis. Based on the forms of support received from contact sources, we explored different groups of respondents using model-based clustering. Since all of our group-forming variables are ordinal measurement level indicators, we used the "latent profile analysis" (LPA) method to create support patterns. The correlations of the relationship network and emerging support patterns with health were analysed by using multilevel regression. We report weighted results in the study.

### 5. Results

#### 5.1. Characteristics of Respondents

As indicated in Table A1 in Appendix A, slightly more than half of respondents were male (53.4%) and in married or common-law relationships (55.3%). The majority of the respondents (35.2%) were middle-aged (35–54 years); slightly more than a quarter (26.6%) were between 18 and 34 years of age, a fifth (21.3%) of them were respondents of 65 years old or older, and less than a sixth of them (17.2%) were between the age of 55 and 64 years old. As far as the educational level is concerned, a vast majority (53.5%) had secondary education, 28.8% of them received no higher than elementary education, and 17.7% of the respondents graduated from college or university. Socio-economic status was measured by subjective income situation, revealing that 17.5 percent of participants in a household can cover usual expenses with difficulties, 34.9 percent can do so with minor difficulties, 33.2 percent can cover them relatively easily, and 14.4 percent can do so easily. With regard to the type of settlement, the majority of the respondents (35.4%) were in a small town, a somewhat lower proportion (29.4%) were in villages, while the proportion of those living in the capital (18.1%) or in another big city (17.1%) was roughly the same.

## 5.2. Correlations of Relationship Network, the Support Received from Relationship Resources, and Health

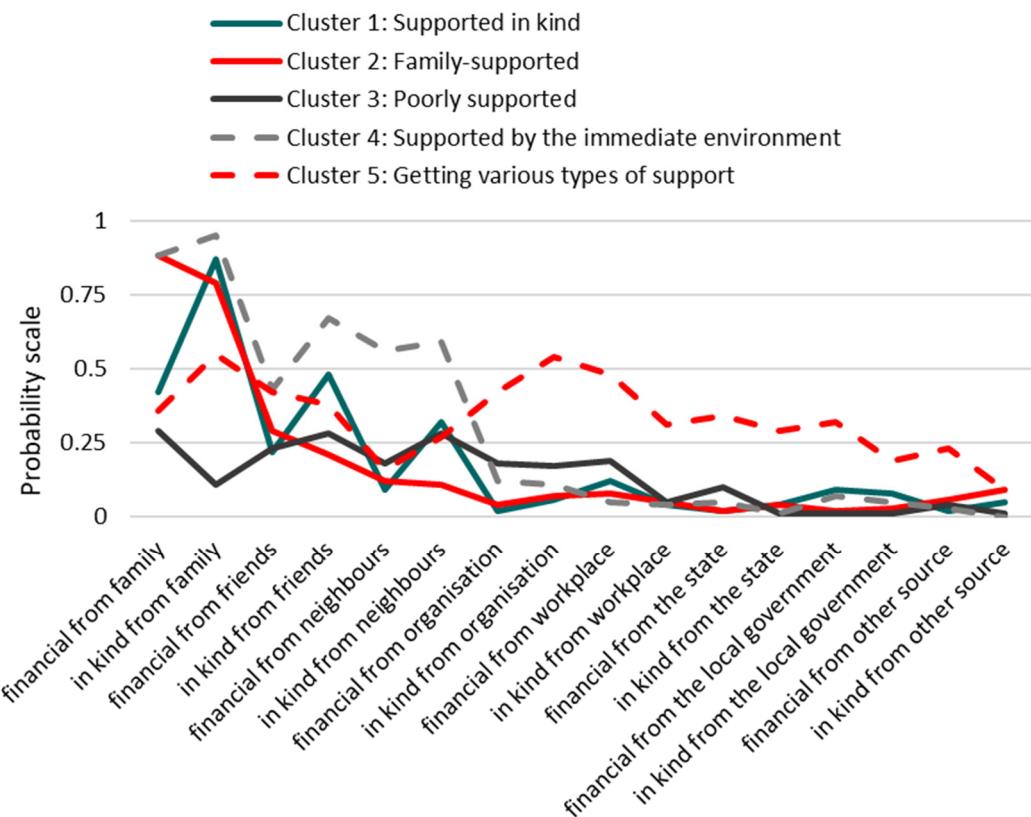
### 5.2.1. Patterns of Support Received from Different Contact Sources

The central question of this study is how the combinations of the intensity (degree) of the network of relationships and the forms of support received from different sources of relationships are related to somatic and mental health. In order to find the answer, the first step was to explore what help network patterns could be identified in our sample. Our goal was to capture the diversity of support combinations based on the type of help and support provided from relational sources (material support or in-kind support, service, work assistance) and intensity (extent) (and then examine their impact on health). The objective of the research was to take all these characteristics into account and find patterns of support that are typical for certain groups of respondents.

Based on the forms of support received from various sources, groups of respondents were created using the latent profile analysis (LPA) method, which, in essence, classifies individuals into latent groups (profiles) based on the observed variables, namely by estimating for each respondent the probability of belonging to a specific profile (Collins and Lanza 2010). In our case, the observed variables included the variables of the intensity of financial and in-kind support and help received from the narrower and wider environment, which were measured by means of 16 indicators (as presented in detail in Section 4.2.3). During the analysis, two to six group solutions were reviewed, and in order to find the best model solution, we took into account the fit of the model (Akaike information criterion, Bayesian information criterion), the significant result of the Lo-Mendell-Rubin probability ratio test (LMR-LRT), the size of the groups (at least 5% of the sample) and the higher entropy value (Nylund et al. 2007). According to the test statistics of the latent profile analysis, the most optimal division is the five-group model structure (in the case of models with different numbers of groups, the fit indicators of the latent profile analysis are included in Table A1 of Appendix A).

Among the latent profiles of the pattern of support (see Figure 1), those belonging to *Cluster 1* (13%) typically receive in-kind help and “care”, most likely through their close family and friend relationships, which is why we named them “*Supported in kind*”. The second cluster (12.4%) includes those whose family relations are supportive both in terms of financial and in-kind help, but at the same time, they do not, or only to a below-average degree, receive help from other sources of relationship; these were coined “*Family-supported*”. Those belonging to Cluster 3, which represents the largest proportion of the sample (57.7%), hardly receive any support: they obtain around the average level of in-kind assistance from friends and neighbours, but their in-kind support from other sources is minimal, and their financial support is also poor (below the average of the sample in all sources of support), so we called them “*Poorly supported*”. Cluster 4, which represents the smallest proportion of the sample (7.7%), includes those “*Supported by the immediate environment*”, among whom support in kind primarily from family, neighbours, acquaintances, and friends is common, but unlike those included in cluster 1, financial support is also present among them; they can mainly rely on the financial help of their family and friends. The respondents belonging to another small group of the sample (*cluster 5*, 9.2%) include those “*Getting various types of support*”; these are characterised by receiving exceptionally high institutional, community, organizational, and state and local government support, and they can also rely on the financial and in-kind help of their family, friends, acquaintances, and neighbours.

It is evident, based on the group ratios presented, that well over half of the sample received very little support and were essentially left alone. One out of every five respondent could count on the support of their close circle: they received money and support services. One of the other two groups (an eighth of the sample) received only caring attention; the smallest (almost a tenth of the sample) was able to use a variety of supports from all kinds of sources.



**Figure 1.** Probability indicators shown by clusters identified through the forms of support received from different sources.

#### 5.2.2. The Influence of Network of Connections and the Support Received from Connection Sources

To answer the question of how the relationship network and patterns of support influence chronic conditions and mental health, we reviewed multivariate regression models. The *dependent variables* of our regression models are, thus, the dichotomous variables of involvement in the various aspects of health that we examine: (1) the existence of chronic diseases and persistent health problems and (2) the occurrence of severe and moderately severe depression.

The *main explanatory variables* are, on the one hand, three-category variables showing low, medium, and high levels of social integration based on the size of the network of connections: indicators of (1) strong and (2) weak ties, on the other hand, (3) five-category variable expressing typical helper-network characteristics identified based on the type (form) of support received from various sources of connections and on its intensity: those supported in kind, supported by family, those of poor support, respondents supported by a narrower environment, and those with a variety of supports.

Our models were built in several steps. During the regression estimation of unfavourable physical and mental health, variables of demographic and socio-economic status were included in the equation first [models (1) and (2)]. In models (3) and (4), we examined the effect of the characteristics of the network of relationships, and in models (5) and (6), the effect of our other main explanatory variable, the configurations of support, were reviewed. Finally, in models (7) and (8), we analysed the perceived personal and general impact of COVID-19. The models were significant at each step. The estimation results are presented in Tables 1–4.

Reviewing the results of models (1) and (2) (Table 1) constructed with demographic and socio-economic background variables, the *gender of the respondent* is only related to unfavourable physical health: males are more likely to have a chronic disease(s), but at the same time, there is no significant gender difference regarding mental health.

In terms of the effect of *age*, we found that respondents belonging to the oldest age group clearly have the most unfavourable health conditions: both chronic diseases and depressive symptoms show the highest frequency of occurrence among the 64+ age group. It is clear from our results that the risk of long-term health problems increases linearly with increasing age; however, this trend is not observed in the case of depression. Although a significantly higher level of depression is expected among the oldest, over 64, and middle-aged adults (35–54 years old) compared to the youngest taken as a reference group (respondents of 18–34 years old), the difference is not significant among older adults who are still working (amongst those between 55 and 64 years old).

**Table 1.** The effect of demographic and socio-economic status variables on health status among the population aged 18 and older.

	Dependent Variable					
	(1) Chronic Disease, Persistent Health Problems			(2) Severe and Moderately Severe Depression (BDI-S)		
	OR	Robust Std. Err	z	OR	Robust Std. Err	z
GENDER (ref: female)	1.202	0.092	1.73 ***	1.053	0.089	0.61
35–54 years old	4.903	1.044	7.46 ***	1.211	0.142	1.63 **
55–64 years old	15.07	3.187	12.75 ***	1.189	0.158	1.30
64+	39.55	8.363	17.39 ***	1.505	0.198	3.11 ***
SOCIAL STATUS (ref: lives in a family)	1.098	0.104	0.98	1.295	0.122	2.73 **
Elementary School	1.890	0.211	3.10 ***	1.577	0.244	2.95 ***
High school without diploma	1.112	0.176	0.68 *	1.276	0.153	2.45 **
High school diploma	1.000	0.150	0.00	1.017	0.146	0.12
EDUCATION (ref: higher education)						
Hard and very hard	2.758	0.497	5.63	2.543	0.447	5.30 ***
At the cost of minor difficulties	1.593	0.265	2.80 **	1.784	0.288	3.58 ***
Relatively easy	1.023	0.168	0.14 ***	1.171	0.189	0.98
SUBJECTIVE INCOME SITUATION (ref: they can easily live off their income)						
Capital	0.648	0.091	-3.05 ***	2.086	0.271	5.66 ***
Other big city	1.348	0.168	2.38 ***	1.866	0.238	4.89 ***
Small town	1.201	1.259	1.80 *	1.365	0.153	2.78 ***
SETTLEMENT TYPE (ref: village)						
Wald $\lambda^2$		868.68 ***			192.98 ***	
Pseudo R <sup>2</sup>		0.238			0.094	
N		4812			4811	

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ . Source: KEP3 data collection, 2021.

**Table 2.** Reviewing the impact of network characteristics on health among the population aged 18 and older.

	Dependent Variable					
	(3) Chronic Disease, Persistent Health Problems			(4) Severe and Moderately Severe Depression (BDI-S)		
	OR	Robust Std. Err	z	OR	Robust Std. Err	z
Has no strong tie	2.503	0.356	6.45 ***	2.395	0.307	6.81 ***
Has 1 strong tie	1.518	0.194	3.26 ***	1.262	0.134	2.18 ***
STRONG TIES (ref: having 2 or more strong ties)						
WEAK TIES (ref: Has 11 or more weak ties)						
Has 0–5 weak ties	1.772	0.214	4.73 ***	2.725	0.341	8.01 ***
Has 6–10 weak ties	1.187	0.136	1.49 ***	1.703	0.195	4.63 ***
Wald $\lambda^2$		817.84 ***			333.71 ***	
Pseudo R <sup>2</sup>		0.268			0.108	
N		4791			4793	

\*\*\*  $p < 0.01$ . Notes: Not all variables included are listed in the table. During the modelling procedure, the results were adjusted for gender, age, social status, education, subjective income situation, and the type of settlement of the place of residence. Source: KEP3 data collection, 2021.

**Table 3.** Reviewing the impact of support patterns on the health status of the population aged 18 and older.

	Dependent Variable							
	(5) Persistent Chronic Disease, Health Problems			(6) Severe and Moderately Severe Depression (BDI-S)				
	OR	Robust Std. Err	z	OR	Robust Std. Err	z		
PATTERNS OF SUPPORT (ref: Getting various types of support)								
Family supported	1.848	0.219	3.17	***	1.982	0.215	2.81	***
Supported by the immediate environment	1.519	0.207	3.06	**	1.518	0.228	2.58	*
Supported in kind	1.544	0.331	2.03	**	1.873	0.365	2.76	**
Poor support	2.551	0.652	3.86	***	5.941	1.813	5.84	***
Wald $\lambda^2$			817.84 ***			333.71 ***		
Pseudo R <sup>2</sup>			0.268			0.108		
N			4791			4793		

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ ; \*  $p < 0.1$ . Notes: Not all variables included are listed in the table. During the modelling procedure, the results were adjusted for gender, age, social status, education, subjective income situation, the type of settlement of the place of residence, and the number of strong and weak ties. Source: KEP3 data collection, 2021.

**Table 4.** Review of the perceived impact of COVID-19 on the state of health among the population aged 18 and older.

	Dependent Variable							
	(7) Persistent Chronic Disease, Health Problems			(8) Severe and Moderately Severe Depression (BDI-S)				
	OR	Robust Std. Err	z	OR	Robust Std. Err	z		
PERCEIVED IMPACT OF COVID-19								
COVID-19-index: on personal life	1.379	0.129	3.42	***	1.617	0.136	3.62	***
COVID-19-index: in general, on the whole society	1.249	0.110	2.51	***	1.217	0.118	2.12	**
Wald $\lambda^2$		641.80 ***			480.39 ***			
Pseudo R <sup>2</sup>		0.269			0.175			
N		4132			4143			

\*\*\*  $p < 0.01$ ; \*\*  $p < 0.05$ . Comment: Not all variables included are listed in the table. During the modelling procedure, the results were adjusted for gender, age, social status, education, subjective income situation, the type of settlement of the place of residence, and the number of strong and weak ties. Source: KEP3 data collection, 2021.

*Social status* does not correlate significantly with physical health (incidence of chronic diseases) but shows a positive correlation with depression.

With regard to *education* and *subjective income status*, a uniform picture emerges for both chronic diseases and depressive symptoms. It is evident that the risk of chronic and mental illnesses increases with a decrease in educational level and income/financial situation.

Compared to those with higher educational qualifications (graduates), having a primary school and high school education without a high school diploma significantly increases the risk of long-term illnesses and severe depression. A significantly higher incidence of depressive symptoms and long-term illnesses can also be expected among those living with income difficulties than among those having a comfortable life as a result of their income situation.

Reviewing the effect of the type of residence, it was established that the risk of chronic diseases among the residents of the capital is much lower compared to those living in villages and towns, which is a result corresponding to our preliminary expectations since large cities provide access to a wider range of health services. On the other hand, the probability of depression and anxiety increases linearly with the increase in settlement size: compared to people living in villages, the risk of severe and moderately severe depression is higher in all other settlements (larger and smaller towns in the countryside and in Budapest as well but the highest in the capital).

In models (3) and (4) (Table 2), it was reviewed how the *characteristics of the social network* affect health. Since our models were built step by step, it can be checked whether the effect of previously included social and demographic variables changes after the inclusion of network indicators. It was found that the previous variables retained their significant effect; however, in the case of the chronic condition, the effect of two variable categories—high school education without a high school diploma and minor financial and income difficulties—became decisive from five percent to above the one percent significance level.

Model 3 and Model 4 indicate that the size of the network of relationships—whether reviewing the number of confidential/strong ties or the number of weak ties—is significantly related to physical and mental health. Accordingly, the fewer strong and the fewer weak ties a person has, i.e., the lower their integration is in the network of relationships, the more they suffer from persistent illness(es) and severe or moderately severe depression. At the same time evaluating the effect of certain characteristics of the relationship network based on the regression odds ratios, additional interesting correlations emerge. On the one hand, strong ties have a stronger explanatory power than weak ties for the chronic condition. On the other hand, weak, looser ties have a considerably more significant effect on depression than confidential relationships.

In models (5) and (6), in addition to indicators of social and demographic dimensions and the size of the network of relationships, the variable of *support pattern* (Table 3) was also included. The inclusion of the new variable did not change the significant effect of the already included variables in any of the models, but the significance level of social status in the case of depression decreased from five percent to one percent.

Analysing the relationship between the supporting network constellations and the health indicators investigated, the following can be established: compared to the group '*Getting various types of support*' treated as a reference group, each pattern of support has a significantly positive effect on unfavourable physical and mental health, i.e., it increases persistent health problems and the risk of developing depressive symptoms. It is not surprising that '*Poor support*' increases the probability of illness to the most significant extent: the risk of both chronic conditions and depression is highest among those who fail to receive any support or receive support only to a below-average extent from various relationships. Also, the chances of these are increased for those receiving '*frequent financial and/or in-kind help from the family*' compared to those obtaining '*various and intensive support*'. While *financial and in-kind support provided by the immediate environment* (family, friends, acquaintances, neighbours) and only '*in-kind support*' have a very similar effect on the risk of chronic diseases, in terms of the mental health indicator, in-kind support from family and friends is the most decisive. It must be noted that the regression models were also run by treating different categories of the variable, showing the pattern of support as reference groups. The findings described above are clearly visible in all models. If, for example, the group characterized by '*Poor support*' is treated as a reference category, respondents with a '*Getting various types of support*' have the lowest chance of poor mental and physical health (correlation with a negative sign).

Finally, the *direct impact* of COVID-19 was analysed in models (7) and (8) (Table 4). We investigated how the negative impact of the coronavirus pandemic on personal life and on society in general, as perceived by the respondents, affected health. We found that the impact of COVID-19, regardless of whether it negatively affected personal life or society in general, had a significantly positive effect on both depressive and anxiety symptoms and chronic health conditions. In addition, the anxiety experienced in personal life due to the pandemic affected mental and physical health to a greater extent than the negative changes experienced in various areas of society. Although the negative impact of stressful situations on health is known, our results reflect that this was also significant in the era of COVID-19, as it exacerbated pre-existing mental and physical health problems.

## 6. Discussion

This study examined the correlation of embeddedness in the social network, the combination of different forms of support provided by the network, and the COVID-19-related negative impact on mental and physical health among the general Hungarian population during the last phase of the coronavirus pandemic. A few studies discussed the relationship between social network size, social support, and health problems during COVID-19 (C. Liu et al. 2021; Mahamid et al. 2023). Although these studies tested the impact of social support from weak and strong tie networks, they failed to investigate how combinations of different forms of support and frequency of support, i.e., similar support patterns, correlated with mental and physical health.

The findings from this study showed that socio-economic factors are determining factors of unfavourable health status. In accordance with previous research (Jang et al. 2009; Lahelma et al. 2006; Torssander and Erikson 2010) and confirming our *hypothesis 1* (H1), we found that long-lasting health problems and mental illnesses were the most dangerous for the elderly; those with a low level of schooling, at most, vocational school or vocational education; and those living in financial deprivation. These results, in line with the results of previous studies (Hoffmann 2008; Lahelma et al. 2006; Torssander and Erikson 2010), confirm that socio-economic inequalities are associated with unfavourable physical and mental health and that status differences significantly determine health conditions in society as a whole. While women were less likely to have chronic diseases, no significant gender differences were found in terms of mental health. At the same time, international research (Lengua and Stormshak 2000; Oquendo et al. 2001; van de Velde et al. 2010) found that women had a higher risk of depression compared to men and that women and men had the same level of mental well-being. A possible reason for the above may be that during such a special pandemic period, males and females were equally mentally distressed. Social status did not show a significant effect on the occurrence of chronic diseases, but it did on depression, which resonates with previous research findings that marriage and living in a partnership were identified as mental health protective factors (Kopp and Skrabski 2006; Meadows 2009). It also turned out that the type of settlement of the place of residence, that is, the different settlement infrastructure, is also decisive, although it affects physical and mental health differently. Those living in the capital were less likely to report long-term health problems compared to those living in villages and towns. In the case of depressive symptoms, however, the opposite was found: those living in the capital were the ones more likely prone to developing mental problems. This result confirms that the metropolitan environment might reduce social relationships and/or health-conscious living, which are protective factors for mental health (Purtle et al. 2019).

After including variables measuring the effect of the social network factors—the extent of the network—in the models, we found that the smaller the size of the network, the more increased the occurrence of both poor physical health and severe and moderately severe depression. These results support our *hypothesis 2* (H2) based on previous research experiences (Cacioppo et al. 2006; Heffner et al. 2011; Kawachi and Berkman 2001) and reflect that network integration plays an important role in mental and physical maintaining health. At the same time, it emerged as an important result that in terms of physical health, emotionally supportive, confidential relationship-embeddedness, while from the point of view of mental health, social embeddedness, i.e., looser relationships, measured by the number of weak ties—mainly providing access to informational and instrumental support—provide greater protection.

Reviewing the effect of the combinations of “mobilized” resources used through the network of connections and the helper network constellations, it became evident that the poorly supported network was associated with the highest chances for the occurrence of both long-term illnesses and depressive symptoms, i.e., the absence of helping/supporting relationships significantly contributes to poor physical and mental health, which supports our *hypothesis 3* (H3). At the same time, the causality is obviously two-way since poor health and physical limitations narrow the possibilities of contact, and people living with mental

problems often do not notice their supportive relationships. Another considerable result of our analysis is that financial and in-kind help received exclusively from the family as opposed to the cases when respondents receive various support (i.e., when, in addition to the help of family, friends, and acquaintances, institutional, community, organizational, state and local government support is also provided) less likely to contribute to avoiding an unfavourable chronic condition and depression. In other words, a combination of multiple types of support from multiple relational sources is most beneficial for both physical and mental health.

Taking the adverse effects of the pandemic on the public and private sectors into account, the analysis also reviewed how the negative consequences of COVID-19 experienced in personal life and society in general affected physical and mental health. We found that those experiencing the negative impact of the pandemic, to a greater extent, either in their personal lives or in society in general, were more likely to report persistent illnesses and depression. Furthermore, the descriptive results of our exploratory question indicate that the anxiety experienced in personal life due to the pandemic affected mental and physical health to a greater extent than the negative changes experienced in various areas of society (Q1). The COVID-19 pandemic created a great deal of uncertainty and posed threats to individuals, and this increased the perceived negative impact of the epidemic on their personal lives considerably, which resulted in more depression symptoms.

#### *Limitations and Recommendations for Future Research*

This study has several limitations. Firstly, the cross-sectional design precludes conclusions being drawn about the causal relationship between health problems and social network factors, combinations of social support, and COVID-19-related perceived consequences; future longitudinal studies are needed to verify such associations. Secondly, the limitation of the study is that we worked with information on the respondents' self-assessment, which may differ from the medical diagnosis and may overestimate or underestimate either the presence of mental problems or the chronic nature of their condition. Thirdly, the survey relating to a period 12 months prior to data collection—regarding the support received from various contact sources—is inevitably retrospective, so recollection can also cause distortion. Future research should also explore the role of additional factors relevant to health protection, such as resilience and coping strategies. Assessing and analysing these factors in further research with a face-to-face study would help the in-depth understanding of the relationships examined in the present study.

## 7. Conclusions

This study explored the impact of social connectivity factors, support patterns, and COVID-19-related perceived consequences on mental and physical health to find the contributing factors of health problems to enhance health conditions during epidemic crises. The present study revealed significant associations among social network factors (weak and strong tie networks), patterns of support received from different contact sources, perceived negative impact of COVID-19, and mental and physical health. The findings showed that greater strong and weak tie networks and greater social support from multiple relational sources played a crucial role in promoting mental and physical health also during the last phase of the pandemic. Results also revealed that in terms of physical health, emotionally supportive, confidential relationship-embeddedness, while from the point of view of mental health, social embeddedness, i.e., looser relationships, measured by the number of weak ties—mainly providing access to informational and instrumental support—provide greater protection. This suggested that both weak and strong ties deserved more attention on account of their roles in mitigating depression and chronic illness. Furthermore, an important finding was that the perceived negative changes of COVID-19 in personal life were more strongly related to the level of depression than the negative changes experienced in various areas of society. Appropriate information and preparation of the population and

fostering a sense of security during a pandemic are essential in order to alleviate the mental burden caused by unexpected circumstances.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Not available due to ethical restrictions.

**Conflicts of Interest:** The author declares no conflict of interest.

## Appendix A

**Table A1.** Sociodemographic characteristics of the sample.

Characteristics		N	%
GENDER	Male	2668	53.4
	Female	2332	46.6
AGE	18–34 years old	1324	26.6
	35–54 years old	1762	35.2
	55–64 years old	860	17.2
	64+	1064	21.3
SOCIAL STATUS	Lives alone	2233	44.7
	Lives in a family	2765	55.3
EDUCATION	Elementary School	1441	28.8
	High school without diploma	1108	22.2
	High school diploma	1567	31.3
	Higher education	884	17.7
SUBJECTIVE INCOME STATUS	They find it hard or very hard to make a living	847	17.5
	At the cost of minor difficulties	1691	34.9
	Relatively easy	1605	33.2
	Easily	699	14.4
SETTLEMENT TYPE	Capital	904	18.1
	Other big city	856	17.1
	Small town	1771	35.4
	Village	1469	29.4

**Table A2.** Fit indices of latent profile analysis for models containing different groups.

Number of Groups	AIC	BIC	Entropy	Smallest n (%)	BLRT p-Value
2	2905.07	3124.66	0.67	28%	0.01
3	2816.84	3039.29	0.81	12%	0.01
4	2786.80	2933.25	0.89	4%	0.01
5	2663.25	2804.40	0.93	7%	0.01
6	2711.78	2841.71	0.92	2%	0.01

*Notes:* AIC: Akaike information criterion; BIC: Bayesian information criterion; BLRT: Bootstrap Likelihood Ratio Test.

## Notes

<sup>1</sup> The question in the questionnaire reads as follows: “Most people occasionally discuss certain important issues with others. If you think back to the past half year, who are the people with whom you discussed your most important issues?”

- 2 The resource-generator method therefore does not focus on access to social resources, but on their mobilization and use, and primarily takes instrumental resources into account (Kmetty and Koltai 2015).
- 3 8 questions of them measured the impact of COVID-19 in general; how much it affected (1) the situation of the Hungarian economy, (2) prices, (3) the physical health of Hungarians, (4) the mental health of Hungarians, (5) the various intergenerational conflicts, (6) intergenerational helping, (7) quality of family relationships, and (8) communities. Another 3 items focused on the respondent's own personal life, how much COVID-19 affected the respondent's (1) financial situation, (2) work and (3) personal health.

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