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SHARE, the Survey of Health, Ageing and Retirement in Europe, is a research infrastructure for studying the effects of health, social, economic and environmental policies over the life-course of European citizens and beyond. From 2004 until today, 380,000 in-depth interviews with 140,000 people aged 50 or older from 28 European countries and Israel have been conducted. Thus, SHARE is the largest pan-European social science panel study providing internationally comparable longitudinal micro data which allows insights in the fields of public health and socio-economic living conditions of European individuals, both for scientists and policy makers. SHARE has global impact since it not only covers all EU member countries in a strictly harmonized way but additionally is embedded in a network of sister studies all over the world, from the Americas to Eastern Asia. Considering its focus on people aged 50 and older, international orientation, and thematic coverage, SHARE is perfectly suited to provide data on respondents' health, economic, and living situation all across Europe and Israel before and during the ongoing COVID-19 crisis.

Therefore, the aim of this project is to analyse and evaluate the non-intended consequences of the epidemic control decisions to contain the COVID-19 pandemic in 27 European countries using data from SHARE, and to devise improved health, economic and social policies with a transdisciplinary and international team of SHARE researchers from different European research institutions. To reach these aims, several objectives will be pursued: identify healthcare inequalities before, during and after the pandemic; understand the lockdown effects on health and health behaviours; analyse labour market implications of the lockdown; assess the impacts of pandemic and lockdown on income and wealth inequality; mitigate the effects of epidemic control decisions on social relationships; optimise future epidemic control measures by taking the geographical patterns of the disease and their relationship with social patterns into account; better manage housing and living arrangements choices between independence, co-residence or institutionalisation.

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I. Executive Summary

In this deliverable, WP6 focuses on social relations among respondents after about one year from the outbreak of the pandemic with regard to contact, the exchange of social support, volunteering, and loneliness. Apart from that, it explores the psychosocial predictors of COVID-19 vaccine take-up among older adults.

1. Summary of projects and research aims

The aim of the work since the last deliverable was to produce first social results from the 2nd round of the SHARE COVID Survey. We summarize these results in the items below.

2. Overview of all finished and/or started papers by all major WP participants

a. Finished

Howard Litwin, Sharon Shiovitz-Ezra, Bracha Erlich, and Michal Levinsky. Social relationships over the COVID-19 pandemic: What changed from 2020 to 2021? 18 pages.

Howard Litwin and Michal Levinsky. The psychosocial predictors of COVID-19 vaccine take-up among older Europeans. 17 pages.

b. Started/in progress

Michael Bergmann and Melanie Wagner. Receiving informal care during the COVID-19 pandemic. Revisiting the situation of care recipients 18 month after the outbreak of SARS-CoV-2.

3. Description of results

Part 1

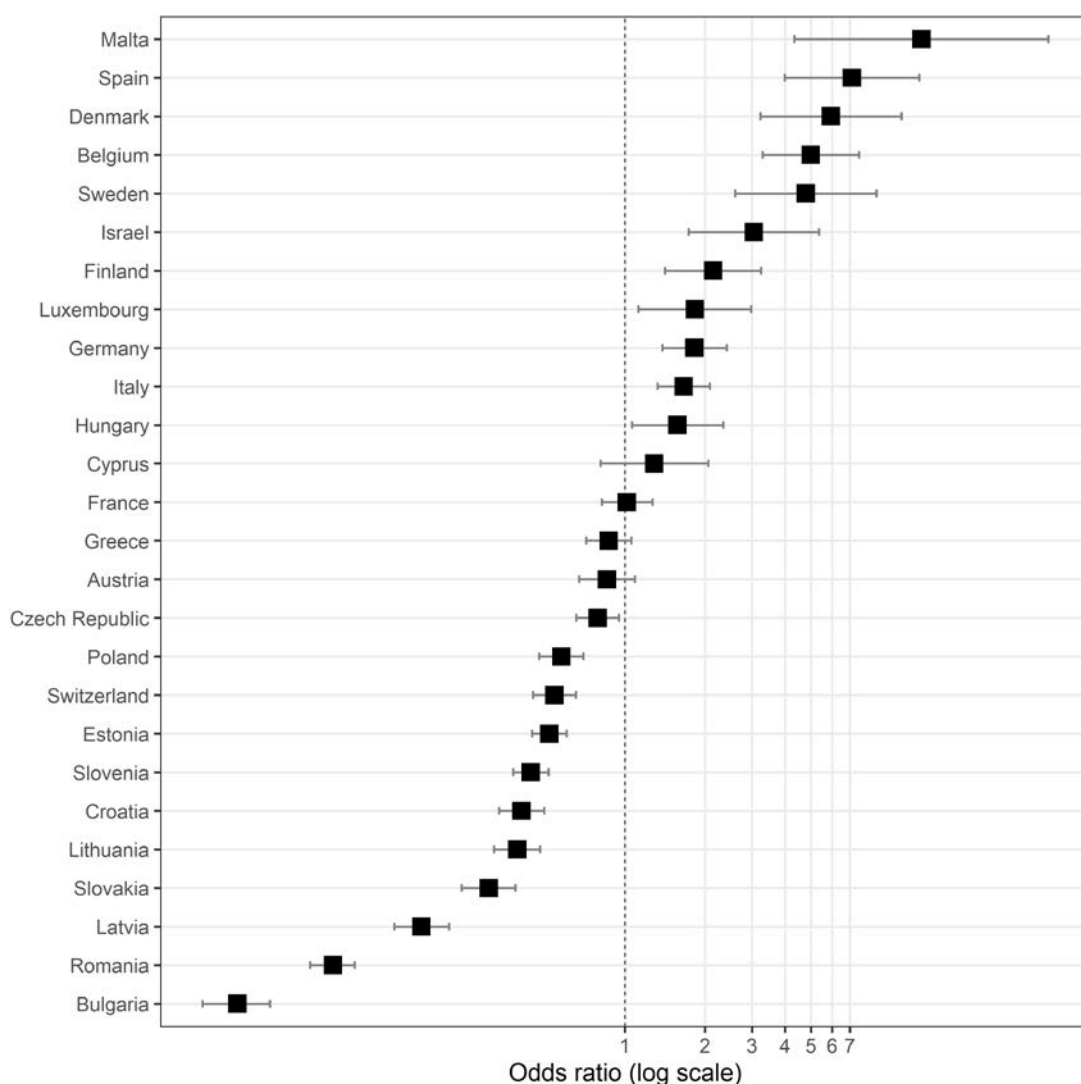
This report examines changes in four key aspects of social relationships among respondents aged 50 and older in 28 countries (n= 46,454), after about one year into the pandemic: 1) contact, 2) the exchange of social support, 3) volunteering and 4) loneliness. It also considers country differences and the background factors that explain the changes. The results revealed that older people were more willing to engage in informal interpersonal social contact at follow-up than had been the case at the outset of the pandemic. This was not true for the oldest age groups, however. The findings also indicated a drop over time in the frequency of electronic contact in most (but not all) countries, particularly among those aged 75 and older and those who had been in poor health before the outbreak. The results also suggest that informal help during the first year of the pandemic was reaching the neediest of older people, although the exchange patterns differed across different countries. Volunteering increased at follow-up in all but one of the countries, reflecting that, to some degree, the pandemic has become normalized. Finally, loneliness increased over the first year of the pandemic to a minor degree, mainly among those who experienced feeling lonely only some of the time. There were differences by country, however, with the extent of loneliness increasing the most in Greece, Latvia, Bulgaria and Hungary.

Part 2

The aim was to verify the psychosocial predictors of COVID-19 vaccine take-up among older adults: personality traits, social network characteristics and subjective age. We used

longitudinal data from SHARE to examine the correlates of actual reported vaccination among persons aged 65 and older, using prior sociodemographic background, health and psychosocial variables, as well as previous self- and social COVID-19 exposure. The psychosocial variables predicted COVID-19 vaccine take-up, but to a small degree. Country of residence and sociodemographic background were more predictive. Respondents who took the vaccine had higher country COVID-19 stringency scores than those who did not take the vaccine, and greater trust in government. The findings underscore the power of national culture and public policy to shape preventive health behaviour among older adults in times of pandemic. They also highlight the contribution of social networks to vaccine take-up among older adults.

Figure 1. Net effects of country deviation from the all-country mean of COVID-19 vaccination rates: Odds-ratios with 95%-confidence intervals



4. Future research aims and next steps

In the next months we will expand and deepen the analyses engaged in thus far. This includes adding the scores from before the pandemic on relevant variables, and relating to additional explanatory variables and outcomes from the next wave of the main survey (Wave 9), which is currently being executed.

II. Papers and drafts of Work Package 2 based on the second SHARE Corona Survey

Deliverable 3 (“First social results from 2nd round SCS”)

Social relationships over the COVID-19 pandemic: What changed from 2020 to 2021?

Howard Litwin, Sharon Shiovitz-Ezra, Bracha Erlich, and Michal Levinsky

Abstract

This report examines changes in four key aspects of social relationships among respondents aged 50 and older in 28 countries (n= 46,454), after about one year into the pandemic: 1) contact, 2) the exchange of social support, 3) volunteering and 4) loneliness. It also considers country differences and the background factors that explain the changes. The results revealed that older people were more willing to engage in informal interpersonal social contact at follow-up than had been the case at the outset of the pandemic. This was not true for the oldest age groups, however. The findings also indicated a drop over time in the frequency of electronic contact in most (but not all) countries, particularly among those aged 75 and older and those who had been in poor health before the outbreak. The results also suggest that informal help during the first year of the pandemic was reaching the neediest of older people, although the exchange patterns differed across different countries. Volunteering increased at follow-up in all but one of the countries, reflecting that, to some degree, the pandemic has become normalized. Finally, loneliness increased over the first year of the pandemic to a minor degree, mainly among those who experienced feeling lonely only some of the time. There were differences by country, however, with the extent of loneliness increasing the most in Greece, Latvia, Bulgaria and Hungary.

INTRODUCTION

The COVID-19 pandemic has brought with it many changes in the social life of older adults, changes that affect the mode and the nature of social relationships among individuals. The SHARE-COVID project administered two Computer Assisted Telephone Interviews (CATI) during the current pandemic: the first in July-August, 2020 (baseline), and the second a year later, in June-August, 2021 (follow-up). Comparison of the data from the two data collection points provides a unique look at what transpired in the realm of social relations over this period. This deliverable examines the changes that were observed in four key aspects of social relationships: 1) contact with one's social ties (by means of face-to-face interaction and/or by means of electronic devices), 2) social support exchange patterns (the giving and/or receiving of help to and/or from family and others), 3) participation in volunteering activity and 4) the experiencing of loneliness.

The analysis also considers the associations that emerged between important sociodemographic characteristics and health variables, on the one hand, and the respective social relationship outcome variables, on the other hand. By means of a series of regression analyses, we identify the factors that most predict the observed changes in the social relationship measures over the pandemic. Based upon these initial results, we also consider the initial policy implications of our findings.

METHOD

Sample

Some 57,303 respondents from 28 countries participated in the first telephone interview (CATI1), and 47,354 respondents from 28 countries participated in the second interview (CATI2). The current analytical sample consists of those respondents that participated in both of these data collection points ($n = 46,454$). We note that 9,949 respondents from CATI1 did not take part in CATI2, and that 837 participants in CATI2 had not taken part in CATI1. We also note that 6,269 persons took part in both of the telephone surveys, but were missing data on key study variables.

Comparison of the respondents in the current analytical sample with those who were excluded revealed that the non-sample was a bit older, somewhat less educated, and had poorer health at baseline. There were also more men in the non-sample group. Consideration of the findings in this report must take into account, therefore, that the study sample is not perfectly representative of the general SHARE population. Nevertheless, it does provide sufficient range to allow meaningful comparisons and analyses.

Variables

As noted, the four key aspects of social relationships that were studied included contact with one's social ties [face to face and electronic], social support exchange, voluntary activity and loneliness. The sociodemographic variables that were controlled in the analyses included age group (50-64, 65-74, 75+), gender (women), education, financial capacity and partner status (partner in household). The health status indicators were self-rated health before the outbreak of the pandemic and perceived change for the worse in one's health since the outbreak. On the latter of the two health measures, a higher score meant worse health. Country of residence was considered by means of dummy variables.

Contact with one's social ties at follow-up was considered, first, by the probe, "During the last three months, how often did you have personal contact, that is, face to face, with the following people from outside your home?" (1. daily, 2. several times a week, 3. about once a week, 4. less often, 5. never). The question was asked separately in relation to own children, own parents, other relatives, other non-relatives like neighbours, friends, or colleagues, and grandchildren. A parallel set of questions was asked regarding frequency of 'contact by phone, email or any other electronic means', with these same relationship categories. For this analysis, we calculated composite scores, one each for face-to-face contact and electronic contact. They were computed as the overall average of the respective contacts with each relationship category (1.00–5.00). For those with partial missing data, for example childless respondents, we averaged the frequencies of the reported relationship categories only. The scores on both measures were recoded such that a higher score reflected more frequent contact.

Social support exchange was gauged from a number of probes. The first asked "Compared to the first wave of the pandemic, how often did you help the following people from outside your home to obtain necessities (own children, own parents, other relatives, and other non-relatives like neighbours, friends, or colleagues). The response categories were: less often, about the same, or more often. A corresponding question asked "Compared to the first wave of the pandemic, how often did the following people from outside your home help you to obtain necessities?" It queried the same set of relationship categories and employed the same response frequencies.

In addition to the questions on social support, the questionnaire inquired about voluntary activity by means of the following question: "Since the outbreak of Corona, did you do any other volunteering activity?" Respondents replied with a simple "yes" or "no."

Finally, loneliness at follow-up was examined by two probes. The first asked "How much of the time do you feel lonely? The response categories were: often, some of the time, and hardly ever or never. A second probe asked "Has that been less so, about the same, or more so than during the first wave?" Both scores were coded such that a higher score indicated greater loneliness.

Analyses

The analyses included initial descriptions of the outcome variables at both of the data collection points, as well as bivariate comparisons of these same measures by country. The third part of the analytic procedure was a multivariate analysis that was executed by means of a series of regressions, according to the level of measurement of each outcome measure (OLS, logistic or multinomial regressions where appropriate). In each of these multivariate regressions, the outcome variable from the domain of social relationships was regressed on the sociodemographic background indicators, the health measures and the country variables.

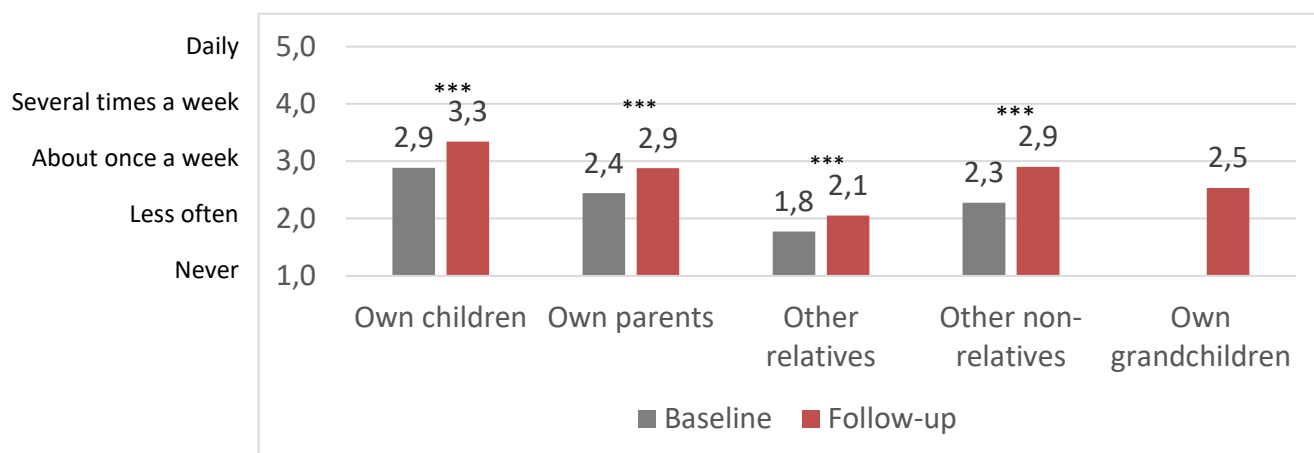
RESULTS

A. Changes in the social relationship variables

The data show that the frequency of in-person contacts with the social network members increased at follow-up compared to that of a year before (Figure 1). This was the case across all the relationship types: own children, own parents, other relatives and non-relatives. The most frequent face to face contact at follow-up was with children, more than once a week on average. In-person contact with

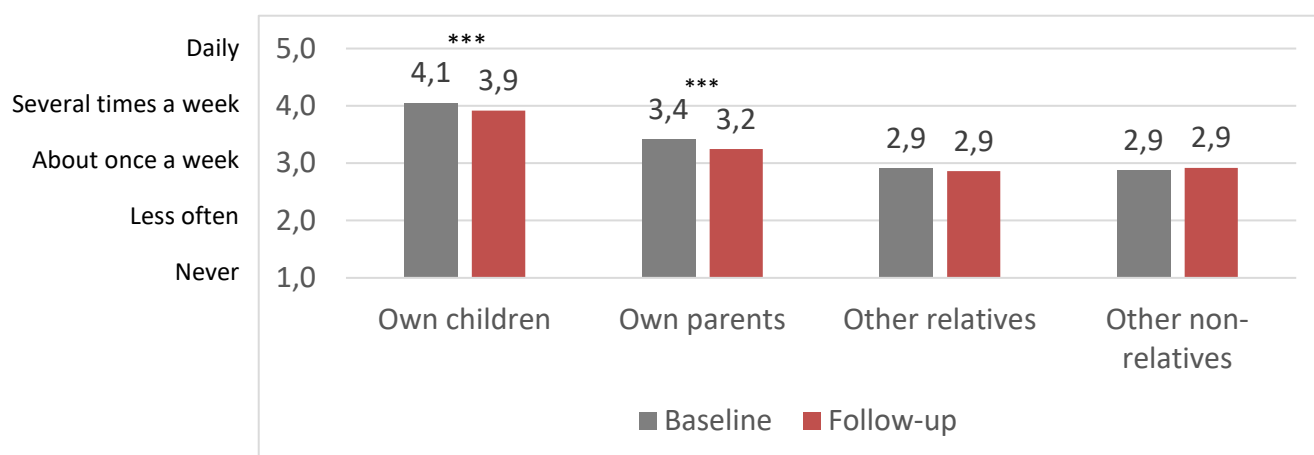
grandchildren, which was asked only at follow-up, was not very frequent, less than once a week, a year and a half after the initial COVID-19 outbreak.

Figure 1: Face to face contact: Frequencies and change from baseline to follow-up



As for the frequency of electronic contact with one's social relations, the trend was somewhat in the opposite direction than that reported for in-person contact. Figure 2 shows that frequency of contact by means of electronic devices actually decreased at follow-up compared to the same at baseline. This may be seen mainly in the respondents' contact with their children and parents. There was no change, on the other hand, in the frequency of electronic contact with other relatives and non-relatives.

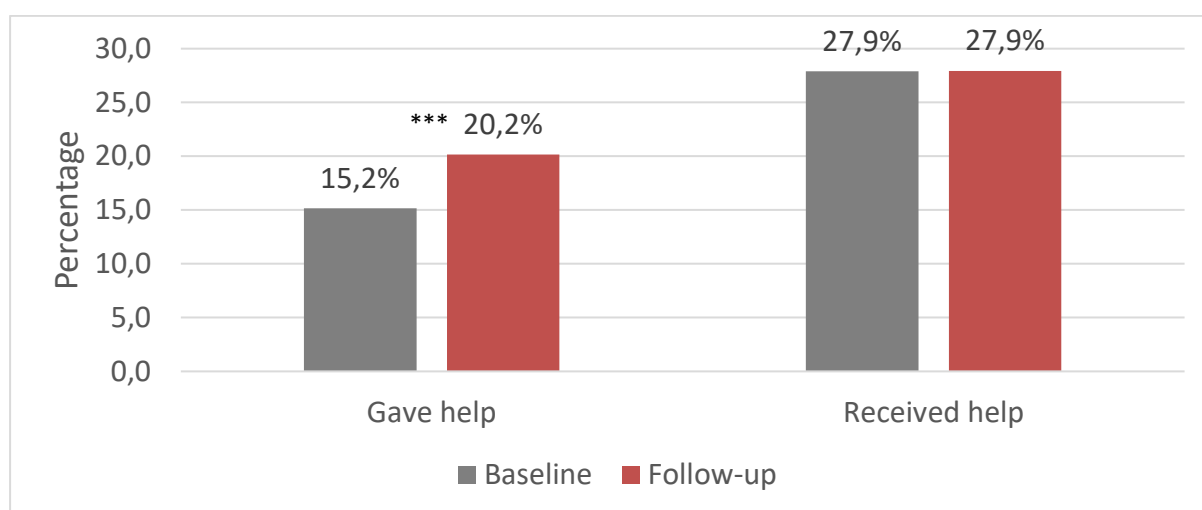
Figure 2: Electronic contact: Frequencies and change from baseline to follow-up



We turn now to social support exchange. Survey respondents were asked whether they received or gave help to obtain necessities, such as food, medications or emergency household repairs. Figure 3 presents the extent of those who gave or received help at baseline and at follow-up. The findings

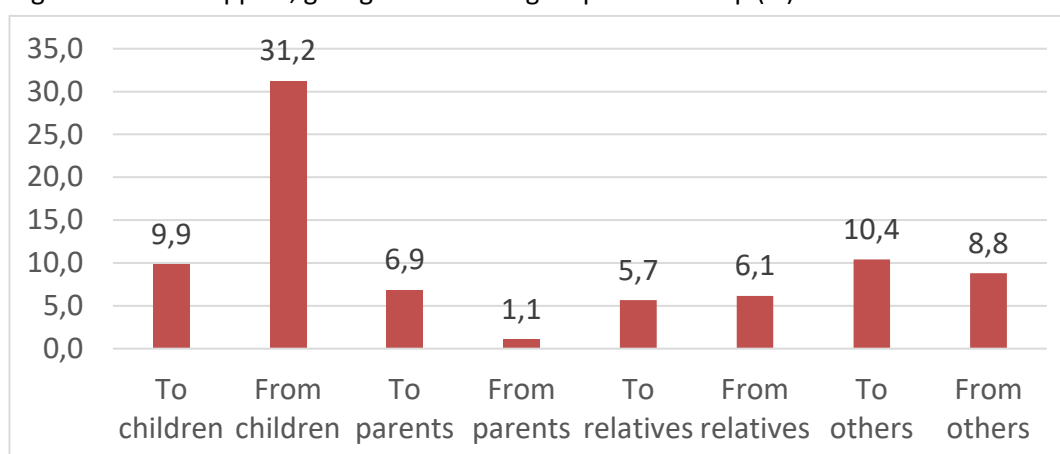
show that at the second data collection point, more older adults reported that they helped their social relationships than was observed at baseline. About 20 percent of adults aged 50 + reported that they helped others during the summer of 2021 compared to only 15 percent immediately following the initial outbreak. This help was given variously at follow-up to children (9.9%), parents (6.9%), relatives (5.7%) and others (neighbours, friends, or colleagues, 10.4%) (Figure 4). However, there was no difference from baseline to follow-up in regard to receiving help from one's social relationships. Almost 30 percent of respondents at both data collection points reported having received help from others. This help was received mainly from their children (31.2%), and to a lesser degree from relatives (6.1%) and from others, namely neighbours, friends, or colleagues (8.8%).

Figure 3: Social support exchange: Frequencies and change from baseline to follow-up



*** p<0.001

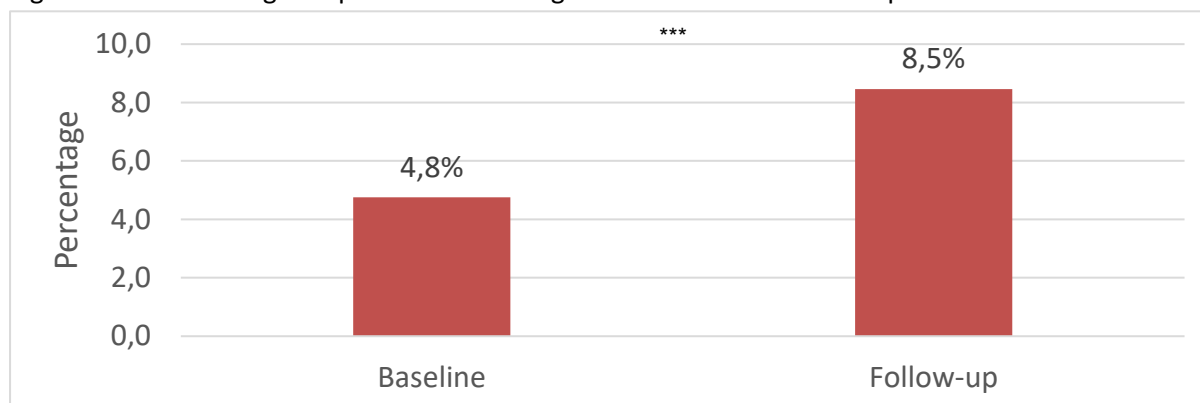
Figure 4: Social support, giving and receiving help at follow-up (%)



*** p<0.001

The survey questionnaire also included a question regarding participation in other voluntary activity during the outbreak. Figure 5 shows that although a minority of respondents engaged in such activity at both data collection points, the extent of volunteering had almost doubled at follow-up.

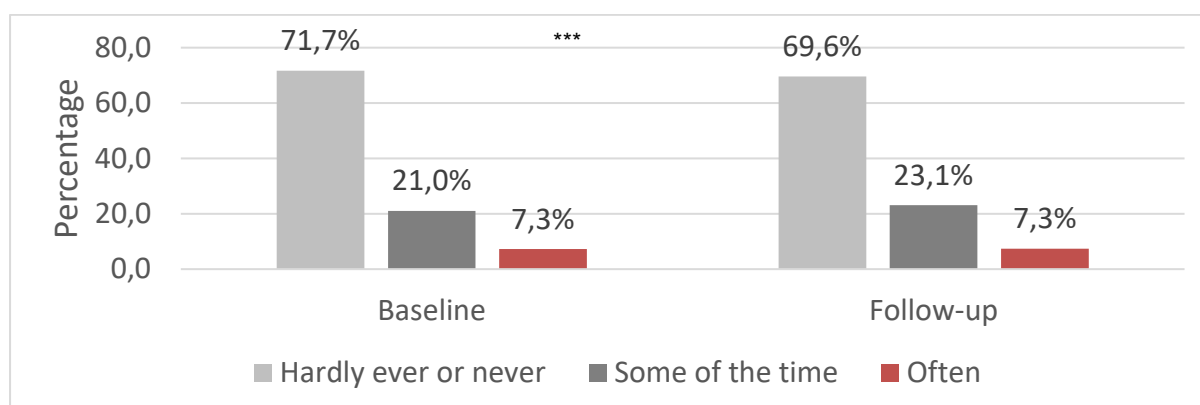
Figure 5: Volunteering: Frequencies and change from baseline to follow-up



*** $p < 0.001$

We also address the changes in the experiencing of loneliness during the pandemic. Loneliness is the subjective marker for perceived deficits in one's social relationships, in terms of quantity and especially quality. Figure 6 indicates roughly similar findings at both baseline and follow-up. At both data collection points waves, about 70% reported loneliness hardly ever or never. However, 21 percent at baseline and 23 percent at follow-up reported loneliness some of the time. Some 7 percent reported intensive loneliness at baseline and at follow-up. In other words, in the time that had passed since the initial outbreak, a slightly greater number of respondents reported that they felt lonely some of the time.

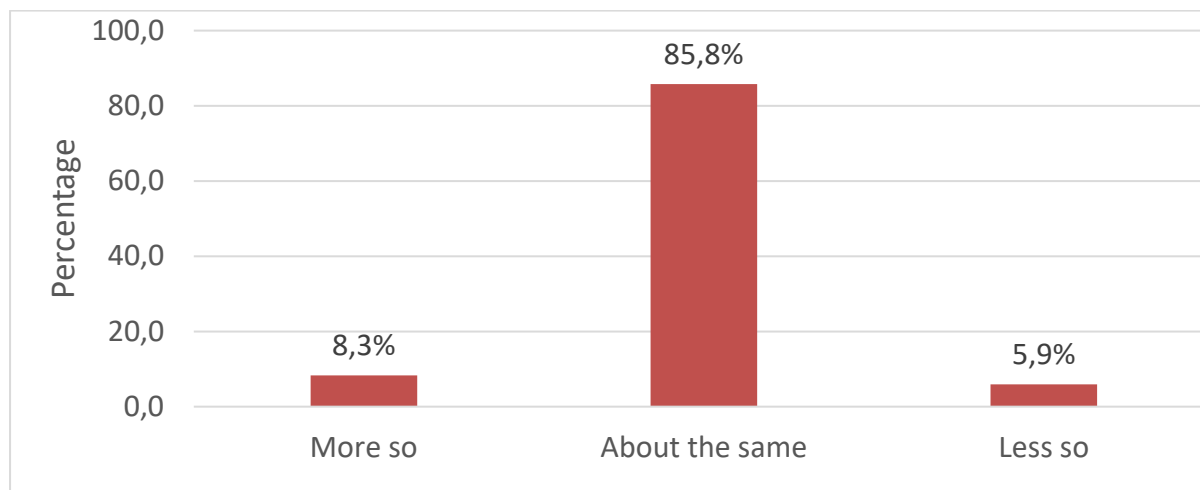
Figure 6: Experiencing loneliness: Frequencies and change from baseline to follow-up



*** $p < 0.001$

Figure 7 presents data on the respondents' own self-evaluation of the change in their state of loneliness. At follow-up, they were asked to compare the degree of loneliness they are experiencing now compared with what they had experienced a year before. The vast majority (86%) indicated feeling "about the same" degree of loneliness, whether hardly ever, some of the time or often. However, 14 percent reported changes in loneliness, with 6 percent indicating change for the better and 8 percent indicating change for the worse.

Figure 7: Loneliness: Self-evaluation of the change from baseline to follow-up



B. Changes in the social relationship variables by country

The next set of graphs and tables reports the comparisons of the same social relationship outcome variables across countries. Looking first at the frequency of in-person contact with one's social relationships, Figure 8 shows that, on the whole, in-person contact among adults aged 50 and over had increased at follow-up across all the countries. However, the extent of the increase varied across countries. It was the greatest in Cyprus, followed by (Israel and Slovenia) and the least in Sweden, Slovakia and Germany, respectively.

In contrast, the frequency of electronic contact had decreased at follow-up, to a small degree, across a majority of the countries (Figure 9). Three countries showed a notably higher frequency of electronic contact at the second data collection point: Romania, Bulgaria and Cyprus. Respondents from Israel, Spain and Italy reported notably lesser electronic contact at follow-up compared to the same at baseline, although the rate in these countries was still higher than the overall mean score for all countries in the summer of 2021.

Figure 8: Face to face contact by country: Frequencies at baseline and at follow-up

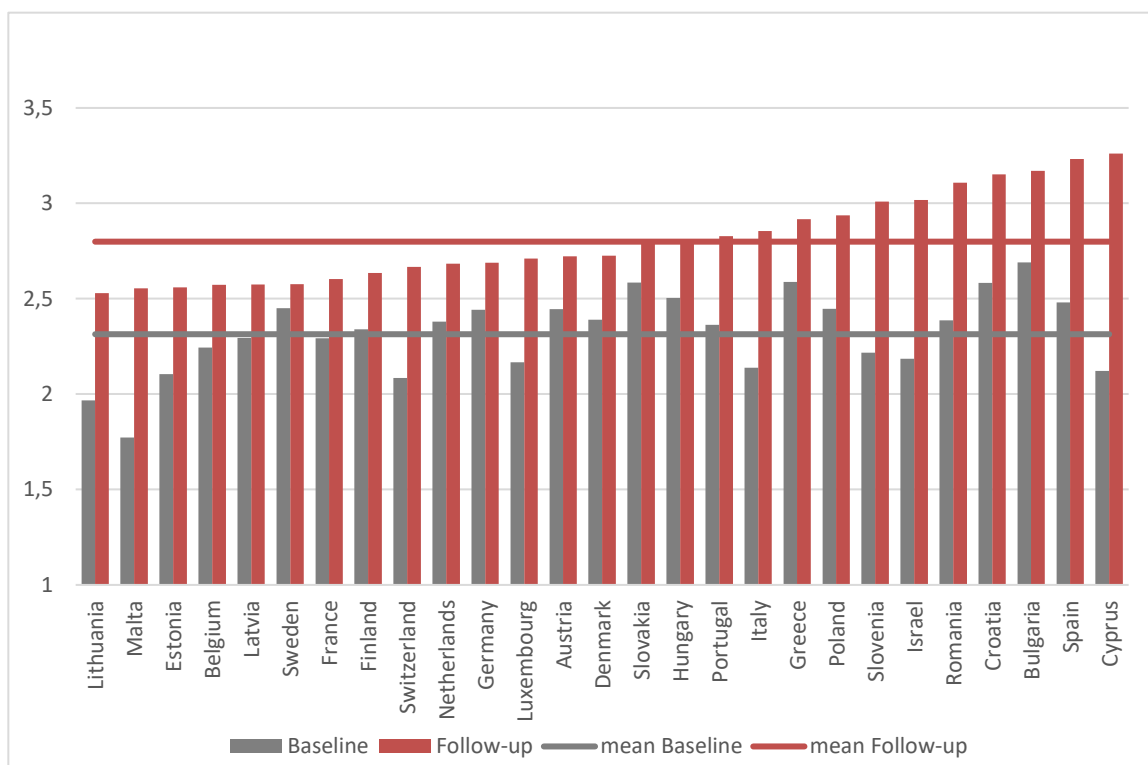


Figure 9: Electronic contact by country: Frequencies at baseline and at follow-up

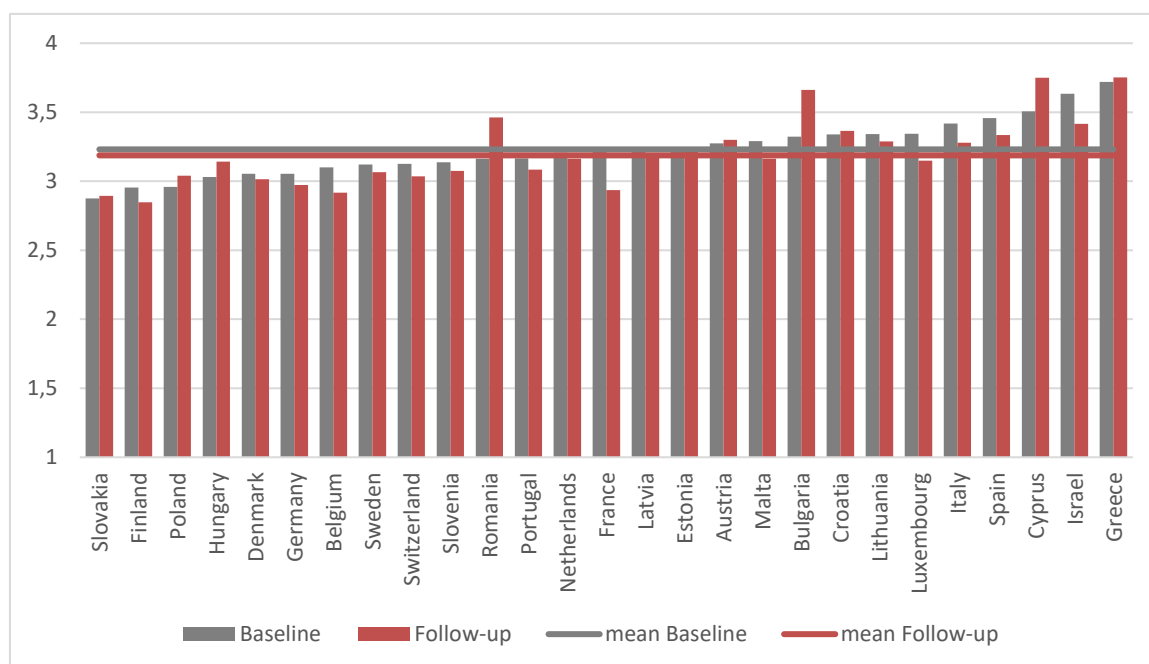


Table 1 presents findings of the instrumental social support provided at follow-up across countries. In Denmark the majority (almost 64%) was not involved in any type of social support, giving or receiving. In Bulgaria and Hungary, however, almost 80% were involved in social support. In Bulgaria some 35 percent engaged in mutual support, giving and receiving support to and from social ties compared to only 3 percent in Slovakia. In 21 SHARE countries, only receiving help from one's social relationships was more frequent than was only giving help. For example, in Slovenia almost 40 percent reported only receiving help from their social ties whereas less than 10 percent reported only giving help. A similar gap was seen also in Hungary (42% vs. 12%).

Table 1: Social support exchange patterns at follow-up (%)

| | Did not give or receive help | Only Received help | Only Gave help | Gave and received help |
|-----------------------|-------------------------------------|---------------------------|-----------------------|-------------------------------|
| Austria | 36.52 | 37.5 | 16.22 | 9.76 |
| Belgium | 42.62 | 21.13 | 26.91 | 9.35 |
| Bulgaria | 21.54 | 28.14 | 15.27 | 35.05 |
| Croatia | 47.53 | 33.63 | 11.55 | 7.28 |
| Cyprus | 44.34 | 26.49 | 18.81 | 10.36 |
| Czech Republic | 50.98 | 27.54 | 13.98 | 7.51 |
| Denmark | 63.71 | 9.14 | 23.68 | 3.46 |
| Estonia | 54.49 | 28.76 | 11.63 | 5.12 |
| Finland | 52.75 | 18.37 | 22.86 | 6.01 |
| France | 49.02 | 17.65 | 26.51 | 6.83 |
| Germany | 40.34 | 22.63 | 24.53 | 12.51 |
| Greece | 54.01 | 31.71 | 9.91 | 4.38 |
| Hungary | 22.29 | 41.92 | 11.62 | 24.18 |
| Israel | 49.80 | 28.77 | 16.50 | 4.93 |
| Italy | 47.53 | 29.22 | 16.68 | 6.57 |
| Latvia | 41.88 | 34.30 | 13.12 | 10.71 |
| Lithuania | 48.83 | 29.73 | 15.86 | 5.59 |
| Luxembourg | 41.87 | 26.84 | 21.32 | 9.97 |
| Malta | 53.17 | 23.84 | 12.35 | 10.63 |
| Netherlands | 46.80 | 28.55 | 16.79 | 7.86 |
| Poland | 53.28 | 18.12 | 22.88 | 5.72 |
| Portugal | 55.75 | 23.68 | 12.03 | 8.54 |
| Romania | 43.23 | 25.44 | 12.49 | 18.85 |
| Slovakia | 56.00 | 25.39 | 15.34 | 3.27 |
| Slovenia | 44.04 | 41.51 | 9.40 | 5.05 |
| Spain | 38.45 | 23.21 | 23.68 | 14.65 |
| Sweden | 43.88 | 29.30 | 17.40 | 9.42 |
| Switzerland | 36.52 | 37.50 | 16.22 | 9.76 |

As for participation in voluntary activity, a comparison of the rates of volunteering across the SHARE countries during the pandemic indicates an overall increase in the rate of such participation (Figure 10). Bulgaria presents the largest difference between the two data collection points, with less than a 5 percent volunteering activity rate reported at baseline and almost 20 percent at follow-up. In most countries, the rate of voluntary participation was doubled or more between baseline and follow-up (see for example Denmark and Switzerland with less than 10% in wave 1 and more than 20% in wave 2, a year later). The Netherlands presents the highest volunteering participation at both data collection points (17% at baseline and 30% at follow-up, a year later). The findings, thus, indicate that a year into the pandemic, volunteering participation had rebounded in most countries.

Figure 10: Volunteering across countries: Frequencies at baseline and at follow-up

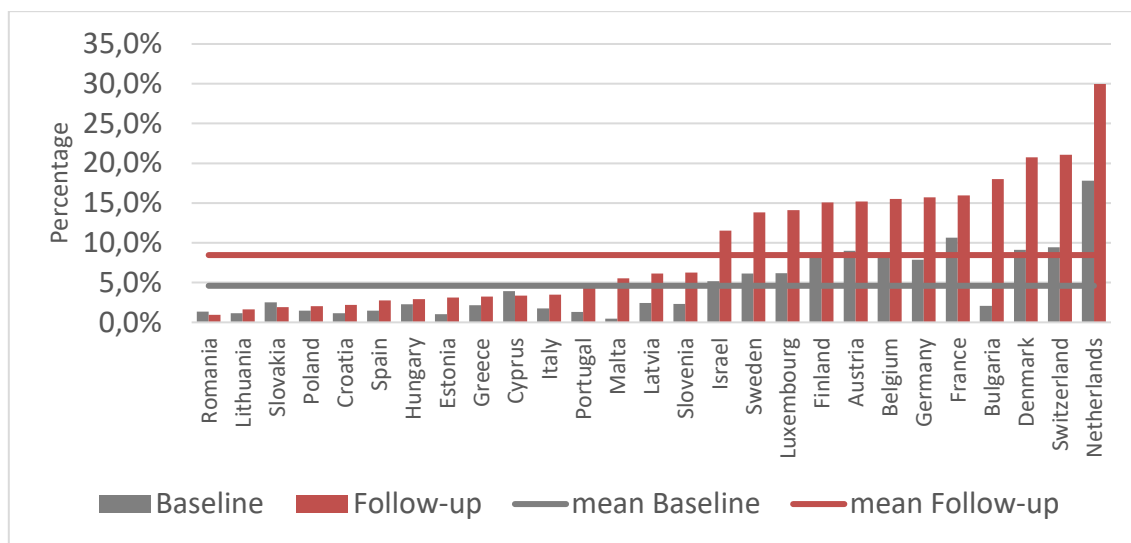
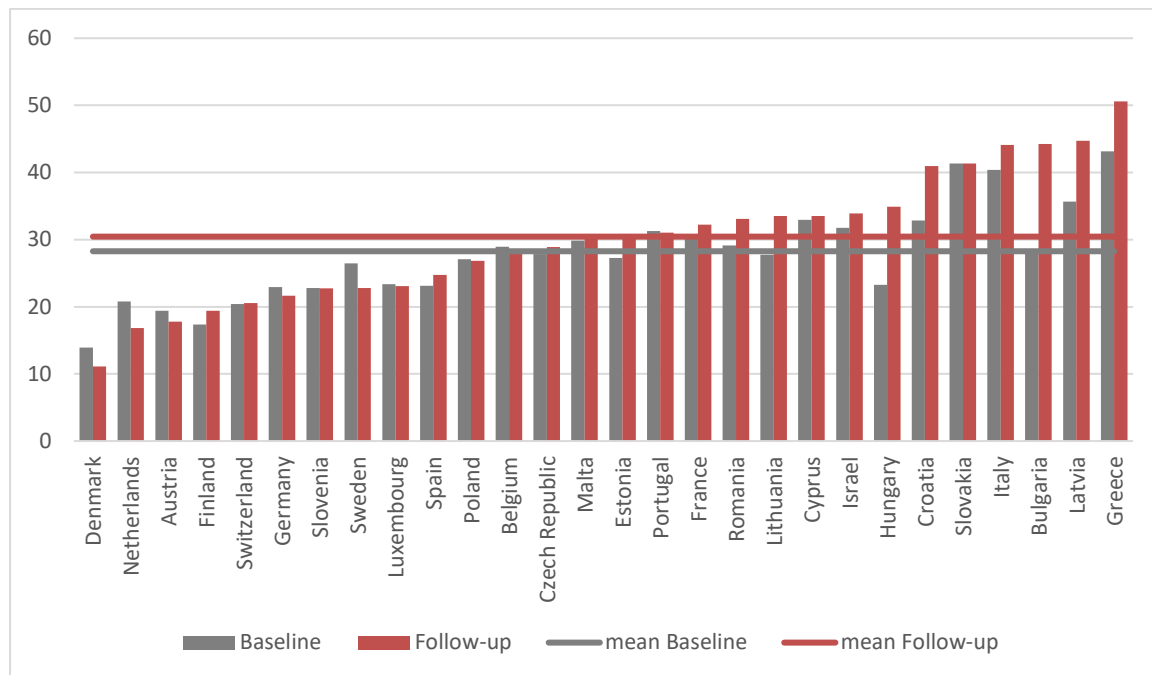


Figure 11 presents the extent of felt loneliness across the SHARE countries at both time points in the current study. Greece presented the highest percentage of loneliness, both at baseline and at follow-up, with a noticeable increase at follow-up. Specifically, in the summer of 2021, one in two people aged 50 and over in Greece reported feeling lonely to some degree. Respondents from Italy, Bulgaria and Latvia also presented high rates of loneliness, with more than 40 percent indicating some degree of loneliness at follow-up (an increase compared to the respective baseline measurements).

Respondents from Bulgaria presented the highest gap between the two data collection points (less than 30% at baseline to more than 40% at follow-up). Respondents from Denmark, on the other hand, presented the opposite trend. Only 12 percent of the Danish respondents reported loneliness at follow-up (the lowest rate in all the SHARE countries), and this was a decrease from the first wave (14%).

Figure 11: Loneliness (some of the time and often) at baseline and at follow-up (%)



C. Sociodemographic and health predictors of change in the social relationship variables

The current analysis sought to understand what accounted for the relative changes that were observed in the respective social relationship outcome measures from the start of the pandemic to about a year later. Toward this end, we executed regression analyses according to the level of measurement of each outcome variable. Each regression procedure controlled for the baseline score of the relevant outcome measure as well, such that the outcome measure actually represents the change in the respective score at follow-up. A positive change score reflects a greater extent of engagement in the outcome measure at the second data collection point.

Table 2 presents the results of the regression of social contact (face-to-face and electronic) at follow-up. The statistics show that the frequency of face-to-face contact about a year after the outbreak was explained mostly by the frequency of face-to-face contact that was maintained immediately after the outbreak of COVID-19. Beyond that, however, it can be seen in the table that the two older age groups had a decrease in the extent of such contact compared to the reference group, those aged 50-64. More educated respondents were also observed to have had a decrease in their degree of face-to-face contact. On the other hand, those in better health before the outbreak, financially better off respondents and women were seen to have had an increase in their face-to-face contacts at follow-up.

As for electronic contact, the results in Table 2 show that women, the more highly educated and those with better health before the outbreak increased their contact frequency a year or so into the pandemic. Conversely, respondents aged 75 and older and those with a partner in the household were seen to have had a decrease in their electronic contact frequency.

Table 3 presents the results of a multinomial regression of social support exchange at follow-up, in which the pattern of no exchange served as the reference category. Here too, the baseline measurement is controlled in the analysis. As may be seen in the table, those who were in receipt of such informal social support a year or so into the pandemic were more likely to be older, female,

and in worse health since the start of the pandemic. Respondents who had higher income and education, as well as those with a partner in the household and better health before the pandemic were less likely to be receipt of informal help.

Table 2: Predictors of social contact at follow-up: OLS regressions

| | Contact | |
|--------------------------------|--------------|------------|
| | Face-to-face | Electronic |
| | Beta | Beta |
| Background | | |
| Age group ^A | | |
| 65-74 | -0.042*** | -0.007 |
| 75+ | -0.116*** | -0.054*** |
| Women | 0.014** | 0.105*** |
| Education | -0.035*** | 0.066*** |
| Financial capacity | 0.029*** | -0.003 |
| Partner in household | -0.008 | -0.011* |
| SRH before outbreak | 0.040*** | 0.046*** |
| SRH change for worse | -0.005 | 0.005 |
| Baseline Social contact | | |
| Face-to-face | 0.323*** | |
| Electronic | | 0.385*** |
| Observations | 33,524 | 33,394 |
| R-squared | 0.1860 | 0.2589 |

A Reference category: age group (50-64)

* p<0.05, ** p<0.01, *** p<0.001

Adjusted for country

Women were also more likely to give informal help, however, as were the more educated, the better off financially and those in better health before the pandemic began. On the other hand, respondents aged 65-74 were less likely than those aged 50-64 to be help providers, and those aged 75 and older were much less likely. In addition, having given social support shortly after the outbreak strongly predicted the provision of such help a year later as well.

The group of respondents that engaged in mutual exchange, that is, both gave and received support at follow-up were most likely to have been those who engaged in such mutual exchange at the outbreak. In addition, women and those in worse health after the outbreak were more likely to be involved in reciprocated support at follow-up. Older respondents, the better well-off financially and those with a partner in the household were less likely.

The next analysis, a logistic regression, looked at voluntary activity about one year after the start of the pandemic (see Table 4). The regression coefficients reveal that such activity at follow-up was more likely among the more highly educated and well-off financially, among those in better health at baseline and among those aged 65-74. In contrast, female respondents and those aged 75 and older were less likely to be “volunteers”. Most predictive of volunteering activity at follow-up, however, by far, was engagement in such activity at baseline.

Table 3: Predictors of social support exchange at follow-up: Multinomial regressions

| | Social support ^A | | |
|---------------------------------------|-----------------------------|-----------|------------------------|
| | Received help | Gave help | Gave and received help |
| | RRR | RRR | RRR |
| Background | | | |
| Age group ^A | | | |
| 65-74 | 1.599*** | 0.656*** | 0.722*** |
| 75+ | 3.061*** | 0.335*** | 0.620*** |
| Women | 1.499*** | 1.146*** | 1.355*** |
| Education | 0.884*** | 1.090*** | 1.003 |
| Financial capacity | 0.929*** | 1.050* | 0.916** |
| Partner in household | 0.782*** | 0.934 | 0.814*** |
| Self-rated health before the outbreak | 0.731*** | 1.066** | 0.970 |
| Self-rated health change | 1.240*** | 0.981 | 1.276** |
| Baseline Social Support* | | | |
| Received help | 4.985*** | 1.088 | 3.782*** |
| Gave help | 1.155* | 5.101*** | 3.242*** |
| Gave and received help | 3.768*** | 4.249*** | 10.691*** |
| Observations | 33,292 | | |
| Pseudo R-squared | 0.1746 | | |

A Reference category: age group (50-64); social support (no exchange)

* p<0.05, ** p<0.01, *** p<0.001

Adjusted for country

Table 4: Predictors of volunteering activity at follow-up: Logistic regression

| VARIABLES | Volunteering activity ^A |
|--|------------------------------------|
| | OR |
| Background | |
| Age group ^A | |
| 65-74 | 1.177** |
| 75+ | 0.719*** |
| Women | 0.837*** |
| Education | 1.213*** |
| Financial capacity | 1.150*** |
| Partner in household | 0.967 |
| Self-rated health before the outbreak | 1.168*** |
| Self-rated health change | 0.878 |
| Baseline volunteering^A | |
| Volunteering | 11.933*** |
| Observations | 33,632 |
| Pseudo R-squared | 0.2126 |

A Reference category: age group (50-64); volunteering (no volunteering)

** p<0.01, *** p<0.001

Adjusted for country

Table 5 presents the results of the multivariate analysis of loneliness at follow-up. The strongest predictor was having felt lonely at baseline. Beyond that, however, a greater sense of loneliness was felt by the oldest respondents (aged 75 and older), women and those who had a change for the worse in their health. Protective against loneliness at follow-up, however, was good health before the outbreak, as well as higher education, better financial capacity, having a partner in the household.

Table 5: Predictors of loneliness at follow-up: OLS regression

| VARIABLES | Beta |
|---------------------------------------|-----------|
| Background | |
| Age group ^A | |
| 65-74 | 0.010 |
| 75+ | 0.058*** |
| Women | 0.047*** |
| Education | -0.016** |
| Financial capacity | -0.047*** |
| Partner in household | -0.125*** |
| Self-rated health before the outbreak | -0.080*** |
| Self-rated health change | 0.017*** |
| Baseline loneliness | |
| Loneliness | 0.408*** |
| Observations | 33,388 |
| R-squared | 0.3119 |

A Reference category: age group (50-64)

** p<0.01, *** p<0.001

Adjusted for country

CONCLUSIONS

The period immediately following the outbreak of the pandemic in 2020 was characterized by the implementation of mandated restriction of face-to-face contact in most European countries. Our findings from the follow-up survey that was administered more than a year into the pandemic showed that, in general, the extent of face-to-face contact with one's social ties had increased at follow-up from that which was reported shortly after the outbreak. This was the case for all the relationship types that were queried at the outset of the pandemic, and in all the SHARE countries. The increased face-to-face contact was observed mainly among the younger age group of older adults (age 50-64), women, those who were better off financially and those who had better health at baseline. It can be tentatively concluded, therefore, that a year or more after the outbreak of COVID-19, some older people were more willing to engage in informal interpersonal social contact than had been the case at the outset of the pandemic. This was not true for the oldest age groups, however, those aged 75 and older, and to a lesser degree, those aged 65-74, both of which reported fewer face-to-face contacts at follow-up. Programs should be put into place, therefore, to identify those

older individuals who remain out of contact with their social ties for extended periods, and services should be offered to assist them in restoring their most meaningful interpersonal social connections.

Our follow-up findings also indicated that there was a drop over time in the frequency of electronic contact in most (but not all) countries. The reduction in electronic contact was observed particularly among those aged 75 and older and those who had been in poor health even before the outbreak of the pandemic. Stated differently, the findings suggest that the most vulnerable members of the older population experienced diminished electronic contact with their social ties as time passed and the pandemic continued. It could be that their initial limited computer and/or electronic skills was what discouraged them from further engagement in this medium of social connection. Alternatively, it might be the case that electronic contact (unlike face-to-face contact), provided them with less satisfaction and it may have even exacerbated their sense of isolation. Efforts should be made, therefore to improve the quality of this mode of contact so that those respondents who were most easily discouraged by it will not relinquish the opportunity to remain in touch with their social ties, especially in periods of repeated surges of COVID-19 and the corresponding restricted face-to-face contact that may ensue.

Informal social support is a key component of community care. It complements the efforts of formal services and sometimes substitutes for them. As such, the exchange of social support is important in society at any time, and especially in times of pandemic, when the interpersonal contacts that are needed for such exchange may be limited by pandemic control policies. The SHARE data reveal that those who were in exclusive receipt of informal social support at follow-up (that is, respondents who did not reciprocate with the provision of support) were indeed the most vulnerable segment of the older population. They were more likely to be older, less educated and less well off financially, with poorer health prior to the pandemic and worse health change since its outbreak. It seems, therefore, that informal help during the first year of the pandemic was reaching mainly the neediest of older people. How many such needy people remained without help during the first year of the pandemic, however, needs to be further explored. They may be the individuals who are most at risk.

Comparison of the exchange of informal support by country showed that the exchange patterns differed in different settings. Respondents from two countries, Bulgaria and Hungary, reported the greatest degree of support provision and/or receipt compared to those from other countries. It could be that the relative lack of formal services in these settings is what pushes older people in these societies to practice support exchange. In contrast, Denmark was the country with the least reported exchange of informal support during the pandemic. Whether it was the availability of formal services in the country's welfare-state regime that explains this particular finding, or rather the greater adherence by Danes (compared to those from other countries) to pandemic-related contact restrictions remains to be determined.

Volunteering also increased at follow-up in all of the countries, (except Romania). Voluntary activity is a sign of civic solidarity and of a sense of mutual responsibility. The fact that such activity increased a year or more into the pandemic reflects that, among some people at least, the pandemic has become normalized. That is, despite the risks and the restrictions related to pandemic control, almost twice as many people were willing, at follow-up, to engage in action that is aimed at helping others beyond the usual circle of one's family and friends. The multivariate analysis showed that volunteering increased primarily among respondents in the middle age group, those aged 64-75, and among those who were healthier, better educated and better off financially. The data thus suggest that some newly retired persons, especially among the men, seek meaningful social engagement, even in times of pandemic. Programs should be implemented, therefore, to promote such "active ageing" behaviour.

Finally, loneliness is a measure of perceived social isolation. It is subjective in nature. People may feel lonely despite having some social contact, while others with little social contact may, nevertheless, not feel lonely at all. The issue of loneliness takes on greater importance at times of pandemic, as in the case of COVID-19, when pandemic-control measures may increase both objective and subjective isolation.

Our findings revealed that over the first year of the pandemic, loneliness increased only to a minor degree, mainly among those who experienced feeling lonely some of the time. There were differences by country, however. Respondents in Denmark, Austria and the Netherlands reported the least loneliness, and in each of these countries the rate of loneliness at follow-up was less than at the outset of the pandemic. It is worthwhile, therefore, to look at the policies of pandemic control that were enacted in each of these particular settings, to gain some insights as to how to control loneliness while attempting to control the pandemic as well. Conversely, it is useful to consider what was going on in the countries in which the extent of loneliness increased meaningfully at follow-up, particularly Greece, Latvia, Bulgaria and Hungary.

The psychosocial predictors of COVID-19 vaccine take-up among older Europeans

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Abstract

Objectives: To verify the psychosocial predictors of COVID-19 vaccine take-up among older adults: personality traits, social network characteristics and subjective age.

Methods: We used longitudinal data from SHARE to examine the correlates of actual reported vaccination among persons aged 65 and older, using prior sociodemographic background, health and psychosocial variables, as well as previous self- and social Covid exposure.

Results: The psychosocial variables predicted COVID-19 vaccine take-up, but to a small degree. Country of residence and sociodemographic background were more predictive. Respondents who took the vaccine had higher country COVID-19 stringency scores than those who did not take the vaccine, and greater trust in government.

Discussion: The findings underscore the power of national culture and public policy to shape preventive health behavior among older adults in times of pandemic. They also highlight the contribution of social networks to vaccine take-up among older adults.

Key words: Big-Five, social network, subjective age, social exposure, SHARE

Introduction

This study looks at the role of psychosocial factors in relation to COVID vaccine take-up among older adults in Europe and Israel. Vaccination against the COVID-19 virus is currently the prime strategy that has been adopted by most countries in order to stem the pandemic (Kourlaba et al., 2021) and to prevent serious COVID-related disease (Haas et al., 2021), especially in the older population. Yet, large numbers of people, to varying degrees in different countries, still refrain from receiving this particular vaccination (Ruiz & Bell, 2021).

Psychosocial factors are known to enhance or restrain health behaviors (Cornwell & Waite, 2009; Friedman, Veazie, Chapman, Manning, & Duberstein, 2013; Watt et al., 2014). In the current study, we examine three particular psychosocial domains in relation to the take-up of COVID-vaccine. These include: 1) personality traits, as measured by the Big-Five Inventory (Lin & Wang, 2020), 2) the interpersonal environments in which older people are embedded, measured in terms of their personal social networks (Wu & Sheng, 2019), and 3) the subjective perception of one's age (Kotter-Gruhn, Kornadt, & Stephan, 2016). This last factor is relevant in the context of the current inquiry, insofar as COVID-related disease is particularly dangerous for older people. However, research indicates that chronological age alone does not adequately capture the age factor, and that health behavior may be guided by how old a person feels (Montepare, 2020; Westerhof et al., 2014).

The present study makes use of a unique data set provided by the Survey of Health, Ageing and Retirement in Europe (Börsch-Supan et al., 2013). In light of the current pandemic, SHARE administered two supplemental rounds of telephone interviews among the members of its panel sample (Scherpenzeel et al., 2020). These data, linked to relevant data from previous waves of SHARE, allow for the analysis of current health behavior, specifically COVID vaccination take-up, controlling for a range of background variables and psychosocial factors. The data also promote consideration of country differences in relation to the outcome variable of interest, insofar as the SHARE survey covers all the member countries in the European Union, as well as two associated countries (Switzerland and Israel).

Literature review

The literature identifies vaccine hesitancy as a major health concern, especially in times of pandemic (Shacham et al., 2021). Estimates of COVID-19 vaccination intention, or the likelihood that one will take the vaccine, generally show such intentions to prevail among some two thirds of the adult population. In the United States, for example, two studies show intended vaccination take-up to be 62 percent (Ruiz & Bell, 2021) and 69 percent (Reiter, Pennell, & Katz, 2020), respectively. A survey in Belgium found that 34 percent will definitely get vaccinated against Covid-19 and 39 percent would probably do so (Kessels, Luyten, & Tubeuf, 2021). An online research panel in the United Kingdom revealed, in July 2020, that 64 percent were very likely to get a vaccination for COVID-19 (Sherman et al., 2021). However, a cross sectional survey, executed in the spring of 2020, indicated that only some 58 percent of the adults in a Greek sample were going to get vaccinated (Kourlaba et al., 2021).

Intended COVID-19 vaccine take-up varies by several sociodemographic characteristics. Men are generally more willing to be vaccinated than women (Kelly et al., 2021; Robertson et al., 2021). Older adults express greater vaccine intention than younger age groups (Gerussi et al., 2021; Kourlaba et al., 2021; Sherman et al., 2021). More highly

educated individuals (Robertson et al., 2021; Viswanath et al., 2021) and the more affluent report greater COVID-19 vaccine willingness, as do those who are partnered (Ruiz & Bell, 2021). Finally, studies in a range of settings show significant racial and ethnic differences in COVID-19 vaccine take-up intentions (Kelly et al., 2021; Muhsen et al., 2021; Robertson et al., 2021; Viswanath et al., 2021).

The Health Belief Model (HBM) adds additional parameters for the prediction of health-related behaviors (Litwin & Levinsky, 2021). We employ the model, in this case, in relation to COVID-19 vaccine take-up. The HBM maintains that beyond the effects of demographic variables, individual health-related actions are shaped by one's personality. This occurs through a number of pathways that include perceived susceptibility, severity, benefits and barriers (Glanz & Bishop, 2010).

Several studies have examined the Big-Five personality inventory (McCrae & John, 1992) in relation to health-related behaviors. Thus, for example, data from the Health and Retirement Study reveal that the personality traits of conscientiousness and extraversion were related to preventive cancer screenings among older adults (Aschwanden et al., 2019). Conscientiousness has also been found to be related to help-seeking for depression (Schomerus et al., 2013). Another study found that assertiveness (lower agreeableness and higher extroversion) predicted greater utilization of Emergency Department visits by older patients (Chapman et al., 2009). Among older primary care patients, neuroticism, openness, and agreeableness were associated with greater awareness of care needs (Sorensen, Duberstein, Chapman, Lyness, & Pinquart, 2008). Finally, a study of the general adult population in the United States found that people high in agreeableness, conscientiousness and emotional stability (low neuroticism) were more likely to regard vaccination as beneficial (Lin & Wang, 2020).

Another psychosocial domain of interest in relation to vaccination take-up is the realm of social relationships that one maintains, measured in the present study in terms of social networks. The personal social network is the most intimate interpersonal environment in which people are embedded (Litwin, 1996). Berkman, et. al., (2000) explain that social networks influence health-related behaviors through the provision of social support, social influence, social engagement, and access to resources and material goods (Berkman et al., 2000).

Social networks affect older people's health behaviors, especially among women (Rennemark & Hagberg, 1999). Data from the U.S. National Health and Nutrition Examination Survey revealed, for example, that the size of friendship networks correlated with health-promoting behavior among older Americans (Watt et al., 2014). A Chinese study found that the size, closeness and frequency of contacts of friend networks had a greater impact than the same among family networks did on health-promoting behavior. However, support provided by the family [as measured on the Chinese version of the Medical Outcomes Study Social Support Survey (MOSSS-C)] had an even stronger effect (Wu & Sheng, 2019). Data from the National Social Life, Health, and Aging Project, a longitudinal study of aging in America, underscore that social network characteristics and marital relationships influence health outcomes (Wong & Waite, 2015). Another study using HRS data found that social interaction and marital status were both related to an increased likelihood of visiting a dentist (Burr & Lee, 2013).

The third psychosocial domain addressed in the present study is subjective age, or how old one feels, as opposed to chronological age (Kotter-Gruhn et al., 2016). Subjective age may affect health behaviors (Takatori, Matsumoto, Miyazaki, Yamasaki, & Moon, 2019).

A recent study of older Americans revealed, for example, that subjective age predicted engagement in the majority of the everyday behaviors that were examined (Montepare, 2020). Moreover, a meta-analysis of 19 longitudinal studies showed that subjective aging has a significant effect on health and health behaviors (Westerhof et al., 2014). Consequently, we consider subjective age as well, in relation to the outcome of interest: COVID-19 vaccine take-up.

Based upon the above literature review, we tentatively propose the following study hypotheses:

1. COVID-19 vaccine take-up in Europe and Israel will be greater among men, older people, those more highly educated, those with higher incomes, and the partnered.
2. People high in conscientiousness and agreeableness, as well as those low in neuroticism, will report greater vaccine take-up.
3. Social network will positively correlate with vaccine take-up.
4. Subjective age will positively correlate with vaccine take-up.
5. COVID-19 vaccine take-up will vary by country.

Method

Sample

The present study focused upon people aged 65 and over who participated in SHARE, the longitudinal survey of adults aged 50 and older in Europe and Israel (Börsch-Supan et al., 2013). We concentrated the analysis on the older segment of the population insofar as they have the greatest risk of COVID-19-related illness. Baseline socio-demographic and personality data were drawn from Wave 7 of the survey (2018). The three network variables were taken from Wave 8 of SHARE (2020), as were partner and health status. Subjective age and the COVID-19 vaccine take-up outcome were retrieved from the second Computer Assisted Telephone Interview that was administered by SHARE in mid-2021.

The initial sample numbered 19,273 respondents having the requisite data. However, some 885 persons (4.6%) had responses on the subjective age ratio (explained below) that were two standard deviations above or below the mean (Amidan, Ferryman & Cooley, 2005; Barnett & Lewis 1994). We considered them as outliers and excluded them from the sample. The resultant analytic sample numbered some 18,388 persons from 26 countries (See Figure 1).

Variables

The outcome variable of vaccine take-up that was addressed in the current analysis was a dichotomous measure. Those who reported that they had received at least one shot of the vaccine, or had a scheduled appointment to be vaccinated in mid 2021, were given the value of one. Those who were yet undecided, or were decidedly against the vaccination, received the value of zero.

Personality traits were measured on the BFI-10, a ten-item inventory that is designed for use in large surveys with limited interview time. Prior testing has underscored that the brief version obtains sufficient reliability (Rammstedt & John, 2007). Analysis of the SHARE personality data confirmed that the five expected dimensions emerged: 1) openness, 2) conscientiousness, 3) extraversion, 4) agreeableness, and 5) neuroticism. Moreover, the results for the pooled sample found congruency between the idealized Big-Five structure and the actual scores ($c = .94$) (Levinsky, Litwin, & Lechner, 2019). Two statements, one

positive and one negative, measured each of the personality traits, according to a 5-point scale of agreement. The score for each personality trait is the mean of the pair of respective items (one reverse-coded).

SHARE administered a name generator in Wave 8 on which respondents cited up to six persons with whom they had discussed matters of importance in the previous year, and a seventh person who was important to them for any other reason (Litwin, Stoeckel, Roll, Shiovitz-Ezra, & Kotte, 2013). From these data, we derived three relevant measures of social network that we employed in the current analysis. *Network size* was a count of the cited confidants, 0-7. *Contact frequency* was tapped on a 7-point scale; the higher the score, the more frequent the mean contact in the network. *Satisfaction with the network* was measured on a scale from 0-10, the higher the score, the greater the satisfaction.

Subjective age was derived from the following survey question: "Many people feel older or younger than they actually are. What age do you currently feel?" As recommended in the literature (Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013), we subtracted respondents' subjective age from their chronological age and then divided the result by chronological age. A negative value on the resultant ratio indicates that the respondent feels older than his or her chronological age, while a positive value indicates feeling younger than one's actual age.

Background sociodemographic variables in the analysis were age, gender (male=0, female=1), education (elementary=0, high school+=1) and income, measured on a 4-point scale of the difficulty in making ends meet (a higher score indicates fewer such difficulties). We also took into account partner status (no live-in partner=0, live-in partner=1). Mobility difficulties were included in order to control for disability (0-10; the higher the score the greater the disability). Finally, country of residence was taken into account by means of dichotomous dummy variables. The country variable was included in order to address differences by national character, culture and/or policy.

Furthermore, following from the Health Beliefs Model, we controlled for two additional indicators of the perceived severity of the pandemic, measured in terms of extent of awareness of COVID exposure (self and social) at the time of the first Computer Assisted Telephone Interview in the summer of 2020. We defined social exposure as knowing people who had any level of COVID experience or symptoms. The term does not refer to infection-inducing physical contact with others. The social exposure severity variable was counted in relation to partner; parent; child; other household member; other relative outside household; neighbor, friend or colleague; caregiver; and other. One point each was initially given for experiencing symptoms and having negative test results, 2 points for positive test results, 5 points for hospitalization, and 10 points for death. Self-exposure was tapped on the same scheme (except for death). See Litwin & Levinsky, (2021) for a more detailed explanation of the scoring of these variables.

Analysis

The analysis first executed univariate descriptions of the variables in the current sample. This was followed by examination of the bivariate associations between the study variables and the outcome measure—COVID-19 vaccine take-up. In the main part of the analysis, we regressed the dichotomous vaccine take-up measure on the respective study variables in four stages, by means of logistic regressions. The respective stages were: 1) sociodemographic and health variables (Model A), 2) psychosocial variables (personality traits, social network measures and subjective age) (Model B), 3) COVID-19 exposure

likelihood of having taken the vaccine. The effects of the other variables in Model C remained unchanged from the previous model, and here, too, the additional explained variance was small.

Finally, Model D added the country dummy variables to the analysis (not shown here, see Figure 1 below for the specific country effects). The addition of the country variables notably increased the explained variance. The effects of the background and health variables remained about the same in this round, but education emerged as another significant predictor in the final model. Among the personality traits, only conscientiousness remained associated with COVID-19 vaccine take-up, and negatively so. Network size retained its positive effect, albeit attenuated. Network satisfaction also emerged in this model as a positive predictor, while mean contact frequency lost its previous significance. Subjective age emerged as well as a predictor—older people who felt younger were less likely to take the vaccine. Awareness of social exposure to COVID remained a positive predictor of vaccine status, but self-exposure lost its prior association.

>>>>>>>>>Table 3 about here<<<<<<<<<<<<<<<<<<<<<<<<<<

Figure 1 presents the net effects of country deviation from the all-country mean of COVID-19 vaccination rates. The graph shows the respective odds-ratios with 95% confidence intervals. Countries having confidence intervals that overlap with the value 1 demonstrate that at the 95% confidence interval, their individual country effect did not differ from the all-country mean. As may be seen, respondents from Malta had the highest likelihood of being vaccinated, followed respectively by those from Spain, Denmark, Belgium, Sweden, Israel, Finland, Luxembourg, Germany, Italy and Hungary. In comparison, respondents from Bulgaria had the lowest likelihood of having taken the vaccine. Also lower in vaccine take-up likelihood were those from Romania, Latvia, Slovakia, Lithuania, Croatia, Slovenia, Estonia, Switzerland, Poland and the Czech Republic. The vaccination rate in four of the countries (Austria, Greece, France and Cyprus) did not differ significantly from the overall country mean.

>>>>>>>>>Figure 1 about here<<<<<<<<<<<<<<<<<<<<<<<<<<

In order to identify possible explanations for these country differences, we ran two supplemental analyses. First we examined the COVID-19 Stringency Index on July 1, 2021 (the midpoint of the 2-month data collection period) vis a vis our vaccination status variable. The index is based on nine response indicators (e.g. school closures, workplace closures, and travel bans), rescaled from zero to 100; the higher the score, the stricter the measures adopted ("COVID-19 Stringency Index," 2021). A t-test revealed that the stringency scores of vaccinated respondents (M=46.52, SD=11.34) was higher than the corresponding scores for the non-vaccinated respondents (M=42.32, SD=9.24) ($T=-18.73$, $p<.000$).

We also tested vaccination status as a function of trust in the institutions of government, data for which is available from the European Foundation for the Improvement of Living and Working Conditions (*Democracy and trust during COVID-19*, 2021). The data set is limited to member countries in the European Union. Consequently, two associate member states (Switzerland and Israel) are not included in this particular analysis. Similar to the results of the previous bivariate analysis, here too the t-test revealed that the trust in institutions scores of vaccinated respondents (M=4.06, SD=1.16) was higher than the

corresponding scores for the non-vaccinated respondents ($M=3.53$, $SD=0.75$) ($T=-23.43$, $p<.000$).

Discussion

The aim of this study was to verify whether there are meaningful psychosocial predictors of COVID-19 vaccine take-up among older adults. We used longitudinal data from SHARE to examine the correlates of actual reported vaccination as of mid 2021 among persons aged 65 and older, based upon prior sociodemographic background, health and psychosocial variables from 2018 and 2020, as well as self- and social Covid exposure that was reported in 2020. Among the psychosocial variables of interest, we looked at personality traits, social network characteristics and subjective age (the latter variable was queried in 2021). The study was informed by the Health Beliefs Model, as well as by other relevant conceptual frameworks, namely social networks and subjective age.

First of note is that the vast majority, some five sixths of the study sample, had been vaccinated or were scheduled to do so. As reported earlier, several studies of vaccine intention prior to the actual vaccine roll-out have reported positive intentions to take the vaccine among some two thirds of adults in various settings. The higher percentage of take-up in our sample may be explained by two factors. We note that we concentrated our study on older adults, as they are at the greatest risk for COVID-related illness. Studies have documented that older adults generally have higher vaccine intention (Kourlaba et al., 2021; Robertson et al., 2021; Sherman et al., 2021). However, our data also suggest that vaccine take-up may be even greater than prior vaccine intention. It could be that, in some cases, initial hesitancy has been overcome by the passage of time and the diffusion of COVID-vaccine related information. Nevertheless, a sixth of our sample of older adults still refrained from taking the vaccine. Our study sought to understand why.

We tested five hypotheses. Based upon the literature, we posited, first, that vaccine take-up will be greater among men, older people, the educated, those with higher incomes and the partnered. The multivariate logistic regression confirmed all of these predictors in the final model, except for gender. It could be that after partner status is controlled, the lesser rate of take-up among the women disappears. We note, also, that even within this sample of older persons (age 65 and older), the age factor was significant, albeit to a small degree. The study also considered disability and found that those with greater mobility difficulty had a lesser likelihood of vaccine take-up, suggesting a potential problem with mobility and access to vaccination distribution points.

Our second hypothesis, which posited that high conscientiousness, high agreeableness and low neuroticism predict greater vaccine take-up, was not confirmed in the present analysis. In fact, the only significant personality trait to emerge was conscientiousness, but in the opposite direction than expected: greater conscientiousness correlated with greater vaccine hesitancy (i.e. lesser take-up). It might be that, unlike as in other vaccines, the efficacy of the SARS-CoV-2 (COVID-19) vaccine is still in doubt in the minds of several people. Conscientiousness reflects the propensity to be self-controlled and goal directed (Erlach & Litwin, 2019). Hence, people that are more conscientious may still require greater proof of COVID-19 vaccine efficacy before agreeing to take it (Reiter et al., 2020).

In contrast, our third hypothesis was largely confirmed. We posited that social network would positively correlate with vaccine take-up, and indeed, network size and

satisfaction were positive predictors in the final model. Mean contact frequency was not significant, perhaps because it is an average across different relationships. Future research should look at other measures of contact in this regard. Nevertheless, the results underscore that older people with more meaningful social ties in their interpersonal environments were also more likely to be vaccinated for COVID-19. This echoes the earlier finding that having a partner also predicts greater vaccine take-up (Ruiz & Bell, 2021; Wong & Waite, 2015).

Our fourth hypothesis examined whether subjective age predicts COVID vaccine take-up. This is another innovation of the current research. To the best of our knowledge, subjective age has not yet been considered in relation to the COVID vaccine. The logistic regression analysis showed that subjective age was not significant in the preliminary models, but emerged as an important predictor of vaccine hesitancy. That is, even within this sample of older persons, those who felt younger than their actual chronological age were less likely to get vaccinated. Since the coronavirus does not differentiate by subjective age and all older people (chronologically) are at greater risk than younger aged people are, it is essential to recognize this potential obstacle to preventive health behavior. Feeling younger than one is may be beneficial to one's self image in late life, but it does not apparently promote protective behavior (i.e. vaccine take-up) in times of pandemic.

The block of psychosocial variables together (personality, social network and subjective age) was significant, but it explained only a small amount of the variance in the vaccine take-up outcome measure. Consequently, it was necessary to explore other potential explanatory factors. Toward this end, we considered two additional factors. The first was drawn from the Health Beliefs Model and posits perceived severity as a motive for health-related behavior. We did not pose a formal hypothesis for this aspect of the analysis. The regression showed that, in the final model, the extent of earlier self-exposure to the COVID experience was not a motivator for vaccine take-up, but the social exposure variable was a significant predictor. Stated differently, the more a person was aware of people in his or her social network having been exposed to aspects of the COVID experience, the greater the likelihood that he or she would subsequently take the vaccine. This finding complements what was already found in relation to social network, namely that COVID-19 vaccine take-up is encouraged by social relationships. It is also encouraged, apparently, by one's awareness of exposure to the virus, in any of its aspects, among the people in one's interpersonal milieu.

The second additional factor of interest was the country of residence. One's country can reflect ethnic, racial or cultural differences, as well as different policies enacted in relation to controlling the pandemic. Our last hypothesis, therefore, was that COVID-19 vaccine take-up would vary by country. This hypothesis was confirmed. Moreover, the addition of the country variable to the regression analysis considerably raised the amount of variance that was explained by the final model. The following paragraph discusses the country findings and their implications.

First, a supplemental analysis revealed that respondents who took the vaccine had higher country COVID-19 stringency scores than those who did not take the vaccine, on average. We interpret this to mean that national policies in relation to the pandemic made a significant difference in the propensity of older Europeans to get vaccinated. The more stringent the measures enacted in a given country, the more likely one was to take the vaccine. A second supplemental analysis found a similar trend in relation to trust in the

institutions of government. That is, those respondents who resided in countries where the level of general trust was higher were also more likely to take the vaccine.

We should note a limitation of the current inquiry. We were not able to address all the factors that have variously been found to predict vaccine take-up or hesitancy, as for example the extent of general vaccine knowledge and belief in conspiracy theories (Ruiz & Bell, 2021), or exposure to different sources of media and general confidence in scientists (Viswanath et al., 2021). Nevertheless, the main aim of the current study was to clarify the role of key psychosocial factors in relation to COVID-19 vaccine take-up. The unique capacity of the SHARE data enabled us to execute this goal as planned.

In sum, we found that psychosocial variables (specifically personality traits, social networks and subjective age) do predict COVID-19 vaccine take-up, but only to a small degree. The most predictive variable in this regard, reflecting the power of culture on the one hand and public policy, on the other hand, to shape preventive health behavior among older adults in times of pandemic, was country of residence. The block of variables with the next greatest explanatory power was the collection of background sociodemographic and health variables. This underscores previous findings and updates them in real time, that is, the prediction of actual COVID-19 vaccine take-up. Finally, as the Health Beliefs Model predicts, perceived severity also played a role in promoting vaccination behavior, but principally the awareness of COVID-related exposure within the respondents' social networks. This particular finding gives additional backing to the contribution of social networks to protective health behaviors in late life.

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Table 1. Europeans aged 65 and older: Univariate description of study variables (N=18,388)

| Variables | | <i>N</i> | <i>%</i> | <i>mean</i> | <i>sd</i> | <i>range</i> |
|------------------------------|--------------------|----------|----------|-------------|-----------|--------------|
| OUTCOME | | | | | | |
| Vaccinated | No | 3,024 | 16.4 | | | |
| | Yes | 15,364 | 83.6 | | | |
| BACKGROUND AND HEALTH | | | | | | |
| Gender | Men | 7,633 | 41.5 | | | |
| | Women | 10,755 | 58.5 | | | |
| Marital status | No Live-in partner | 6,479 | 35.2 | | | |
| | Live-in partner | 11,909 | 64.8 | | | |
| Education | Elementary | 6,197 | 33.7 | | | |
| | Secondary + | 12,191 | 66.3 | | | |
| Age | | | | 74.89 | 6.96 | 65-105 |
| Income | | | | 2.82 | 1.00 | 1-4 |
| Mobility limitations | | | | 1.79 | 2.34 | 0-10 |
| PSYCHOSOCIAL | | | | | | |
| Big-5 - Openness | | | | 3.33 | 0.94 | 1-5 |
| Big-5 - Conscientiousness | | | | 4.15 | 0.78 | 1-5 |
| Big-5 - Extraversion | | | | 3.51 | 0.93 | 1-5 |
| Big-5 - Agreeableness | | | | 3.70 | 0.82 | 1-5 |
| Big-5 - Neuroticism | | | | 2.64 | 1.01 | 1-5 |
| SN – size of network | | | | 2.78 | 1.62 | 0-7 |
| SN – frequency of contact | | | | 5.98 | 1.26 | 0-7 |
| SN – network satisfaction | | | | 8.97 | 1.31 | 0-10 |
| Subjective age (ratio) | | | | 0.07 | 0.09 | -0.15-0.32 |
| COVID EXPOSURE | | | | | | |
| Self-exposure | | | | 0.07 | 0.31 | 0-3 |
| Social exposure | | | | 0.57 | 1.25 | 0-14 |

Table 2. Bivariate comparisons of the study variables by vaccination status: T-tests

| Variables | <i>Unvaccinated</i> N=3,024 | | <i>Vaccinated</i> N=15,364 | | T/Z ^a |
|------------------------------|--------------------------------|-----------|-------------------------------|-----------|------------------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> | |
| Background and Health | | | | | |
| Age | 74.63 | 7.33 | 74.94 | 6.88 | -2.241* |
| Female | 0.64 | | 0.58 | | 6.068*** |
| Live-in partner | 0.55 | | 0.67 | | -12.514*** |
| Education | 0.60 | | 0.68 | | -8.538*** |
| Income | 2.33 | 0.96 | 2.91 | 0.98 | -30.263*** |
| Mobility limitations | 2.37 | 2.77 | 1.68 | 2.23 | 14.841*** |
| Psychosocial | | | | | |
| Big-5 - Openness | 3.27 | 0.02 | 3.34 | 0.01 | -3.450*** |
| Big-5 - Conscientiousness | 4.20 | 0.79 | 4.14 | 0.78 | 3.800*** |
| Big-5 - Extraversion | 3.52 | 0.94 | 3.51 | 0.92 | 0.650 |
| Big-5 - Agreeableness | 3.67 | 0.02 | 3.70 | 0.01 | -2.250* |
| Big-5 - Neuroticism | 2.75 | 1.02 | 2.62 | 1.01 | 6.450*** |
| SN – size of network | 2.40 | 1.50 | 2.85 | 1.63 | -14.108*** |
| SN – frequency of contact | 6.12 | 0.03 | 5.98 | 0.01 | 4.150*** |
| SN – network satisfaction | 8.89 | 1.54 | 8.98 | 1.26 | -3.550*** |
| Subjective age (ratio) | 0.06 | 0.00 | 0.07 | 0.00 | -5.156*** |
| COVID exposure | | | | | |
| Self-exposure | 0.04 | 0.26 | 0.07 | 0.32 | -5.101*** |
| Social exposure | 0.26 | 0.80 | 0.63 | 1.31 | -15.083*** |

^aFor the categorical variables (female, partner, education), Z tests for proportion were calculated instead of T-tests

Table 3. Background, health, psychosocial and COVID-19 exposure predictors of COVID-19 vaccination rates among Europeans aged 65 and older during the pandemic: Logistic regressions

| VARIABLES | Model A OR | Model B OR | Model C OR | Model D ^a OR |
|------------------------------|---------------|---------------|---------------|----------------------------|
| Background and Health | | | | |
| Age | 1.022*** | 1.023*** | 1.025*** | 1.018*** |
| Female | 0.986 | 0.956 | 0.948 | 0.957 |
| Live-in partner | 1.482*** | 1.493*** | 1.485*** | 1.457*** |
| Education | 1.042 | 1.015 | 1.016 | 1.396*** |
| Income | 1.694*** | 1.629*** | 1.574*** | 1.262*** |
| Mobility limitations | 0.932*** | 0.930*** | 0.928*** | 0.953*** |
| Psychosocial | | | | |
| Big-5 - Openness | | 1.009 | 1.001 | 1.032 |
| Big-5 - Conscientiousness | | 0.859*** | 0.858*** | 0.924** |
| Big-5 - Extraversion | | 0.943* | 0.936** | 1.044 |
| Big-5 - Agreeableness | | 1.033 | 1.029 | 1.021 |
| Big-5 - Neuroticism | | 0.983 | 0.982 | 0.996 |
| SN – size of network | | 1.137*** | 1.123*** | 1.046** |
| SN – frequency of contact | | 0.957* | 0.962* | 0.974 |
| SN – network satisfaction | | 1.019 | 1.018 | 1.060*** |
| Subjective age (ratio) | | 1.344 | 1.252 | 0.532* |
| COVID exposure | | | | |
| Self-exposure | | | 1.228* | 1.059 |
| Social exposure | | | 1.309*** | 1.121*** |
| Pseudo R ² | 0.0631 | 0.0714 | 0.0808 | 0.2057 |
| Observations | 18,388 | 18,388 | 18,388 | 18,388 |

*** p<0.001, ** p<0.01, * p<0.05

^a Model D adds the country variables (individual country effects not shown here, see Figure 1).

Figure 1. Net effects of country deviation from the all-country mean of COVID-19 vaccination rates: Odds-ratios with 95%-confidence intervals

