Deliverable Number: D7.4

Deliverable Title: Final results of geographic analyses

Work Package: 7

Deliverable type: R

Dissemination status: PU

Submitted by: SHARE Central

Authors: Gunnar Malmberg

Date Submitted: July 2024

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under project ID 101015924.

www.share-project.org

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, 616,000 in-depth interviews with 160,000 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.

Please cite this deliverable as:
Deliverable 7.4 of the SHARE-COVID19 project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101015924.

Available at: https://www.mea-share.eu/share-covid19/

Workpackage 7: Refined geographic analyses across EU MS based on 2nd round SCS and Wave 9

Gunnar Malmberg, Umeå University

Summary:

One key task for the research group at Umeå University within the SHARE Covid-19 project has been to provide analyses of the spread of Covid-19 at NUTS III level and how this has been related to (a) changes in older people's daily activities during the pandemic observed at regional level, (b) diffusion effects, (c) sociodemographic conditions at regional level. The aim was also to make our analyses into a source for other researchers doing analyses at regional level. However, since SHARE data at regional level has not been available until recently, for various reasons and outside our control, we have adjusted our plans and performed preparatory analyses on the data available while waiting for access to data at regional level. In the last months the regional data has been available for us, and we have been able to perform, but not complete, the analyses on the regional data.
So far, we have completed the following research:

1. Older people's daily activities during the pandemic analysed at national level

The key focus of our research within the SHARE-Covid-19 project has been to analyse how older people across European countries have adjusted their daily activities during the pandemic at national and regional level. While wating for access to the regional data, we have extended our analyses and made a more profound analysis of older people's daily activities during the pandemic using data at the national level. Altogether we have completed several studies on older people's daily activities and published a number of papers in international journals (Fors Connolly et al 2020; Olofsson et al 2022; Scheel-Hincke LL, Fors Connolly et al 2024; Lestari et al 2024; Fors Connolly et al 2024).
This has been our major contribution to the project and has substantially increased our knowledge about how the pandemic influenced older people's daily activities and their influence on older people's health and quality of life. This work has also been an important preparation for the analyses of daily activities at regional level. Studies that we are now able to complete due to the recent access of regional data.

2. Analyses of the spread of the disease and excess mortality at regional level using alternative data sources

While SHARE-data and SHARE-Covid-19-data has not been available at the subnational regional level until recently, we have meanwhile performed various analyses at regional level, by use of alternative sources, studies that now form a useful point of departure for our analyses of daily activities at regional level. We have specifically explored the interrelation between on one hand sociodemographic conditions at regional level and on the other hand excess mortality, while controlling for the possible influence of diffusion effects. This work will be an important background and source for our, and other researchers', work on the regional data from SHARE.

3. Analyses of daily activities at regional level using the recently available regional data from SHARE

In the last months we have had access to geographic information at NUTS III level, that now enable us to perform analyses on the regional patterns of older people's daily activities during the Covid-19 pandemic. We are currently working on a paper addressing the regional distribution of excess-mortality where we explore the potential impact of older people's activity pattern, when controlling for the effect of sociodemographic conditions at regional level and diffusion effects.

In addition, we are also preparing a study aiming to reveal the regional (subnational) patterns of older people's adjustment of daily activities and how this is associated with sociodemographic conditions and restrictions induced at national level.

Publications on older people's daily activities using data at national level

Fors Connolly F., Olofsson J., Stattin M. & Malmberg G. (2020): Adjustment of daily activities to restrictions and reported spread of the COVID-19 pandemic across Europe. SHARE working paper.

Olofsson J., Fors Connolly F., Josefsson M., Stattin M. & Malmberg G (2022): Sociodemographic factors and adjustment of daily activities during the COVID-19 pandemic – findings from the SHARE Corona Survey". Journal of Aging and Social Policy

Lestari, S.K., Eriksson, M., de Luna, X. Malmberg G. & Ng N:. Volunteering and instrumental support during the first phase of the pandemic in Europe: the significance of COVID-19 exposure and stringent country's COVID-19 policy. BMC Public Health **24**, 99 (2024).

Fors Connolly, F., Olofsson, J. & Josefsson, M. (2024) Do reductions of daily activities mediate the relationship between COVID-19 restrictions and mental ill-health among older persons in Europe? Aging & Mental Health. DOI: 10.1080/13607863.2024.2313726

Scheel-Hincke, L Filip F. Connolly, Jenny Olofsson, Karen Andersen-Ranberg: Strict Danes or relaxed Swedes? Comparing health and daily activities in Sweden and Denmark during the COVID-19 (Accepted for publication in Scandinavian Journal for Public Health).

In the sequel, we present the two recent refined analyses.

BMC Public Health

RESEARCH

Open Access

Volunteering and instrumental support during the first phase of the pandemic in Europe: the significance of COVID-19 exposure and stringent country's COVID-19 policy

Septi Kurnia Lestari[1,2*], Malin Eriksson[3], Xavier de Luna[4], Gunnar Malmberg[1,5] and Nawi Ng[2,6]

Abstract

Background The COVID-19 control policies might negatively impact older adults' participation in volunteer work, instrumental support provision, and the likelihood of receiving instrumental support. Studies that quantify changes in these activities and the related factors are limited. The current study aimed to examine the level of volunteering, instrumental support provision and receipt before and during the first phase of the COVID-19 pandemic in Europe and to determine whether older adults' volunteering, instrumental support provision and receipt were associated with individual exposure to COVID-19 and the stringency of country's COVID-19 control policy during the first phase of the COVID-19 pandemic.

Methods A cross-sectional survey using data from the Survey of Health, Ageing and Retirement in Europe (SHARE) Corona Survey 1 was designed to focus on community-dwelling Europeans aged ≥50 years. History of participation in volunteering work and instrumental support provision or receipt was assessed from the previous SHARE Wave data. The country's COVID-19 control policy stringency index (S-Index) was from the Oxford COVID-19 Government Response Tracker database. A total of 45,669 respondents from 26 European countries were included in the volunteering analysis. Seventeen European countries were included in the analyses of instrumental support provision (N = 36,518) and receipt (N = 36,526). The multilevel logistic regression model was fitted separately to analyse each activity.

Results The level of volunteering and instrumental support provision was lower during the pandemic, but instrumental support receipt was higher. The country S-Index was positively associated with support provision (OR:1.13;95%CI:1.02–1.26) and negatively associated with support receipt (OR:0.69;95%CI:0.54–0.88). Exposure to COVID-19 was positively associated with support receipt (OR:1.64;95%CI:1.38–1.95). COVID-19 exposure on close ones positively associated with volunteering (OR:1.47;95%CI:1.32–1.65), support provision (OR:1.28;95%CI:1.19–1.39), and support receipt (OR:1.25;95%CI:1.15–1.35).

*Correspondence:
Septi Kurnia Lestari
s.kurnia.lestari@gmail.com; septi.lestari@umu.se

Full list of author information is available at the end of the article

Conclusions The COVID-19 pandemic impacted older Europeans' volunteering, instrumental support provision, and instrumental support receipt from outside their household. When someone close to them was exposed to COVID-19, older Europeans were likely to receive instrumental support and to volunteer and provide instrumental support. A stricter country's COVID-19 control policy might motivate older adults to provide instrumental support, but it prevents them from receiving instrumental support from outside their households.

Keywords COVID-19, Social support, Social participation, Volunteering, Older population, SHARE, Europe, Ageing population

Background

The COVID-19 pandemic has had unprecedented impacts on various facets of people's lives. Besides the virus's direct health implications, the pandemic mitigation measures, such as physical distancing, stay-at-home orders, travel limitations, and area lockdowns, have negatively affected social interactions [1]. Moreover, COVID-19 restrictions and financial constraints compelled volunteer organisations to either suspend or scale down their operations [2, 3].

This study assesses changes in older adults' participation in volunteer work and social support and how COVID-19 exposure (have COVID-19 symptoms, have tested positive, or have been hospitalised due to COVID-19) and the stringent country's COVID-19 policy may be associated with European older adults' receipt of instrumental support and participation in volunteering and instrumental support provision.

The COVID-19 pandemic has had a more pronounced impact on the ability of older adults to volunteer and provide or receive instrumental support than their younger counterparts. This is due to the heightened susceptibility of the older population to severe COVID-19 outcomes and fatalities, which is exacerbated by pre-existing health conditions and age-related physiological decline. Therefore, stricter adherence to COVID-19 control policies, notably the stay-at-home order, has been advised for this population [4, 5]. The imposition of COVID-19 restrictions has led to disruptions in the support networks and care exchanges of older adults with individuals outside their households [1], making those who rely on external assistance even more vulnerable [6]. The pandemic has also made it challenging for older adults who volunteered before the pandemic to continue their contributions. Moreover, the disturbance in social interactions and the exchange of social support could detrimentally impact the mental health [7] and overall quality of life [8] of older adults.

Studies have shown that a substantial share of the older European population provided social support and participated in volunteer work before the pandemic. A study showed that about a fifth of Europeans aged 50 and over received support from people outside the household [9]. A third of older European adults provided instrumental support (such as personal care, help related to paperwork, or household chores) for people outside their households [10]. An even larger share of older adults helped care for their grandchildren [11, 12]. Older adults were also active in volunteer work, e.g., 34% in the Netherlands, 29% in Denmark, 28% in Switzerland, 8% in Estonia, 7% in Czechia, and 5% in Spain [13].

During the early phase of the pandemic (spring-summer 2020), about 20% of older adults in 26 European countries had difficulties obtaining support from outside their households [14]. Nonetheless, studies from various countries, including Canada, the USA [15], the UK [16] and Sweden [17] reported older adults' involvement in volunteering and support provision despite the COVID-19 restrictions. However, the levels of instrumental support receipt, instrumental support provision, and volunteering during the first phase of the pandemic remain unclear.

Also, further investigation on the determinants of volunteering, instrumental support provision and receipt during the pandemic is needed. Among the various potential determinants, individual COVID-19 exposure and the country's COVID-19 policy are less explored [18]. Understanding the impacts of COVID-19 exposure and the country's COVID-19 policy on older adults' instrumental support receipt and engagement in volunteer work and instrumental support provision can aid in designing more effective mitigation strategies for future pandemics, ensuring minimal negative impacts on older adults' social support networks.

Building upon prior studies, the current study aims to examine the level of volunteering, instrumental support provision and receipt before and during the first phase of the COVID-19 pandemic and to determine whether older adults' volunteering, instrumental support receipt and provision were associated with individual exposure to COVID-19 and the stringency of country's COVID-19 control policy during the first phase of the COVID-19 pandemic in Europe.

Methods

Data sources

The survey of health, ageing and retirement in Europe (SHARE)

The primary data sources of this study were the SHARE Corona Survey 1 (SCS1) [19], SHARE Wave 7 [20], and

SHARE Wave 6 [21]. SHARE is a cross-national panel database of microdata on socioeconomic, social, and family networks and the health of individuals aged 50 and over. SHARE has collected data approximately every two years since 2004 [22]. In 2020, the COVID-19 outbreak in Europe halted the regular SHARE Wave 8 data collection. In response to the pandemic, the SCS1 was conducted between June and September 2020. It collected data on the changes in the socioeconomic situation, health and health behaviour, mental health, changes in social networks, COVID-19-related symptoms, and healthcare service use during the first phase of the pandemic. Unlike the regular SHARE, interviews in the SCS1 were conducted via telephone instead of face-to-face [23]. Detailed information regarding the SHARE survey method is available elsewhere [22, 23].

Coronavirus government response tracker

The Oxford COVID-19 Government Response Tracker (OxCGRT) is a publicly accessible dataset containing data on COVID-19 policy measures from over 180 countries. The record starts on 1 January 2020 and is continuously updated. Detailed data collection and processing methods have been published elsewhere [24].

The centre for systems science and engineering

The countries' total confirmed COVID-19 cases per million used in the present study were obtained from the Centre for Systems Science and Engineering at Johns Hopkins University [25]. This data is available on the Our World in Data website (ourworldindata.org).

Outcome variables

The primary outcome variables in this study were volunteering, instrumental support provision, and instrumental support receipt during the first phase of the pandemic. Participation in volunteer work was determined from the question, "Since the outbreak of Corona, did you do any other volunteering activity?". Instrumental support receipt was determined from the question, "Since the outbreak of Corona, were you helped by others from outside of the home to obtain necessities, e.g., food, medications or emergency household repairs?". Similar questions were used to determine instrumental support provision.

Explanatory variables

The country's COVID-19 control policy stringency index (S-Index) was calculated from eight containment and closure policies (i.e., schools, workplaces, and public transport closures, public events cancellation, limitations on gatherings, restrictions on local and international travel, and orders to "shelter-in-place") and one health policy indicator (i.e., record presence of public info campaigns). This index ranged from 0 to 100, with a higher index indicating stricter containment policies [24]. In this study, the country's stringency index was the average of individual-level stringency indexes in each country.

The individual-level average stringency index was the sum of daily stringency indexes from 11 March 2020 (the date of WHO's declaration of the COVID-19 pandemic) until the end of the interview month of each respondent, divided by the number of days elapsed between the two dates. The two-time points were chosen because most questions in SCS1 asked about conditions "since the COVID-19 outbreak" and because SHARE only recorded the month and year of the interview.

The COVID-19 exposure status of respondents and their close ones (i.e., family, friends, or neighbours) were determined by asking the respondents whether they or their close ones have ever experienced COVID-19 symptoms, have tested positive, or have been hospitalised due to COVID-19.

Control variables

The country's total COVID-19 cases per million was the average of the total COVID-19 cases per million on each respondent's last date of the interview month. For example, the total COVID-19 cases per million on 30 June 2020 were assigned to respondents interviewed in June 2020. The country's volunteering level before the pandemic was calculated based on SHARE Wave 7 data. The country's levels of providing and receiving instrumental support before the pandemic were calculated based on SHARE Wave 6 data. The individual-level control variables are described in Table 1.

Statistical analyses and analytical sample

Inclusion criteria for the study sample were respondents aged 50 and over, who never resided in a nursing home, and who had complete data on variables required for the analysis. The current study analysed each outcome separately. A total of 51,264 respondents had data on at least one of the three outcome variables before and during the first phase of the pandemic. However, they had missing data in some explanatory and control variables. Thus, different sub-samples were constructed to retain the maximum number of samples in the analyses (see Supplementary Figure A1).

Weighted descriptive analyses were performed to assess the individual characteristics and the level of volunteering, providing instrumental support, and receiving instrumental support by the individual characteristic. A maximum of 51,264 respondents were included in this analysis. Next, the levels of volunteering (N=47,332), instrumental support provision (N=37,820), and instrumental support receipt (N=37,828) before and during the first phase of the pandemic were analysed.

Table 1 Operational definition of the control variables

Variables	Definitions and categories
Sociodemographic	
Sex	*Man* and *woman*.
Age group	*50–59*, *60–69*, *70–79*, and ≥ *80*.
Education level	*Low* (ISCED 0/1/2), *middle* (ISCED 3 – upper secondary education/ISCED 4 – post-secondary non-tertiary), and *high* (ISCED 5/6).
Changes in employment status	*Unemployed* (unemployed at the time of COVID-19 outbreak), *became* unemployed (employed/self-employed/family business at the time of but was unemployed after the COVID-19 outbreak), *stayed employed* (employed at the time of- and after COVID-19 outbreak).
Good household economic status	Since the COVID-19 outbreak, the household has made ends meet *fairly easily* or *easily*.
Social relations during the pandemic	
Lived alone	Household size equal to one.
Frequent social contacts	Reported *daily, several times a week, or about once a week* direct and/or indirect (by phone, email, or any other electronic means) contact with people outside the home.
Health-related factors before the COVID-19 outbreak	
Self-rated health	*Good* (excellent/very good/good health) or *poor* (fair/poor health).
Had a history of chronic condition(s)	Reported at least one of the following: hip fracture, diabetes, heart attack, chronic lung disease, or cancer, based on SHARE Wave 7 data.
Received formal care	Reported that they received home.
Health-related factors after the COVID-19 outbreak	
Changes in self-rated health	*Improved*, *worsened*, or *about the same*.
Had new chronic condition(s)	Reported at least one of the following: hip fracture, diabetes, heart attack, chronic lung disease, or cancer, based on SCS1 data.
Feeling anxious	Reported feeling nervous, anxious, or on edge in the last month.
Feeling sad or depressed	Reported feeling sad or depressed in the last month.
History of the outcomes before the pandemic	
Volunteering	In the last 12 months, done voluntary or charity work (Wave 7).
Instrumental support provision	In the last 12 months, provided help (personal care, help related to paperwork, or household chores) for any family member from outside the household, friend, or neighbour (Wave 6).
Instrumental support receipt	In the last 12 months, received help (personal care, help related to paperwork, or household chores) from any family member from outside the household, friend, or neighbour (Wave 6).

The multilevel logistic regression analyses were separately conducted with volunteering (N=45,669), instrumental support provision (N=36,518), and instrumental support receipt (N=36,526) as the outcomes. Random intercept models were fitted with the country as the grouping variable. Thus, intercept may vary across countries, while the effects of explanatory variables were assumed to be the same for all countries. All models follow the general equation as presented in Eq. 1. Where β_{00} (overall intercept) is the log-odds that the outcome is equal to one when the other parameters are equal to zero. u_{0j} is the country's random effect. *xij* is the value of individual-level explanatory variable x for individual *i* in country *j*, while *vj* is the value of country-level explanatory variable *v* for individuals in country *j*. β_1 and β_{01} are the effect of one unit change of variable x and v, respectively, on the log-odds that the outcome is equal to one when *u* is held constant [26].

$$\log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{00} + \beta_1 x_{ij} + \beta_{01} v_j + u_{0j} \quad \text{(Eq. 1)}$$

We specified four multilevel logistic regression models for each outcome. The first was the null model, which included the outcome variable only. All individual- and country-level control variables were added in the second model. The COVID-19 exposure variables were added in the third model, and the standardised country's S-Index in the final (fourth) model.

Results

Study sample characteristics

Slightly more than half of the study sample were women. About 36% were aged 60–69 years, and about 42% had middle education levels. Around 25% were employed before and during the pandemic, and about 7% became unemployed during the pandemic. During the first phase of the pandemic, 67% had a good household economic status, 26% lived alone, and 65% had frequent direct or online contact with people outside the home.

Regarding health status, 66% reported good self-rated health before and during the pandemic. Only a small share of the study sample had worsened self-rated health. Around 36% reported at least one chronic condition before the pandemic, and about 5% reported new chronic

conditions during the pandemic. About 30% of study samples reported feeling anxious, and a similar share of respondents reported feeling depressed during the pandemic. Around 3% were exposed to COVID-19, and 16% reported that their close ones were exposed to COVID-19 (see Table 2).

Supplementary Table A1 presents country characteristics, including the S-Index, total COVID-19 cases, levels of volunteering, and instrumental support provision and receipt before the pandemic. Denmark had the highest (36.7%) level of volunteering, while Bulgaria had the lowest (3.5%). Instrumental support provision was lowest in Spain (9.0%) and highest in Denmark (57.8%). Czechia (37.2%) had the highest level of instrumental support receipt, in contrast with Portugal (10.1%). In our analytical sample, France had the highest country's S-Index (around 75). The lowest was around 51 in Finland (analytical sample of volunteering) or around 55 in Luxembourg (analytical sample of instrumental support). The country's COVID-19 cases ranged from around 356 per million in Slovakia (analytical sample of volunteering) to around 431 per million in Greece (analytical sample of instrumental support) to about 10,000 per million in Luxembourg.

Levels of volunteering, providing instrumental support, and receiving instrumental support before and during the pandemic

Before the pandemic, 17.1% of respondents participated in volunteer work, but only 5.5% did so during the first phase of the pandemic. About 29.1% of the study sample provided instrumental support before the pandemic, which declined to 21.4%. On the contrary, 17.9% of study samples received instrumental support before, which increased to 22.4% during the pandemic (See Fig. 1).

During the first phase of the pandemic, higher levels of volunteering and providing instrumental support were observed among healthy people, those with higher education levels, good household economic conditions, and those employed before the pandemic, regardless of their employment status after the COVID-19 outbreak. Those in younger age groups had higher levels of providing instrumental support. On the contrary, a higher level of receiving instrumental support was found among the older age groups, those with lower education levels, those not employed, those who lived alone, and those who had poorer health (see Table 2).

COVID-19 exposure and stringent country's COVID-19 control policy as determinants of volunteering, instrumental support provision, and instrumental support receipt

The ICC (Intraclass Correlation Coefficient) from the null model indicated that the between-country differences explained 19.4% variations in the chances of volunteering, 5.1% variations in the chances of instrumental support provision, and 6.0% of variations in the chances of instrumental support receipt. These findings justify the use of multilevel logistic regression analysis in this study. The ICC became smaller when the explanatory variables were added. The ICC in the final model of each outcome is 5.9% for the volunteering model, 1.2% for providing instrumental support, and 5.0% for receiving instrumental support (Supplementary Table A2-A4).

The final multilevel models show that a 7-unit (one standard deviation) increase in the country's S-Index was associated with 13% higher (OR:1.13, 95%CI:1.02–1.26) odds of support provision and 31% lower (OR:0.69, 95%CI:0.54–0.88) odds of support receipt. However, the country's S-Index was not associated with the odds of volunteering (OR:0.89, 95%CI:0.73–1.08). Furthermore, older adults exposed to COVID-19 were more likely (OR:1.64, 95%CI:1.38–1.95) to receive support during the pandemic. This exposure status was not associated with the odds of volunteering and providing support. However, older adults whose close ones were exposed to COVID-19 were more likely to engage in volunteer work (OR:1.47, 95%CI:1.32–1.65), provide instrumental support (OR:1.28, 95%CI:1.19–1.39), and receive instrumental support (OR:1.25, 95%CI:1.15–1.35) (See Fig. 2).

Discussion

As expected, the overall levels of providing support and volunteering were lower during the first phase of the pandemic than before the pandemic. However, the level of receiving support was slightly higher during the first phase of the pandemic. The present study further focused on examining whether individual exposure to COVID-19 and the stringency of the country's COVID-19 control policy during the first phase of the COVID-19 pandemic in Europe were associated with older adults' volunteering, instrumental support provision and receipt using multilevel logistic regression analyses.

Individual COVID-19 exposure was found to be associated with older European adults' receipt of instrumental support and participation in volunteer work and instrumental support provision. When older adults or their close ones were exposed to COVID-19, their need for support was likely to increase. We found that older Europeans were more likely to receive support from outside the household when they or their close ones were exposed to COVID-19. These findings suggest that older European's social support networks reacted to their increased needs due to COVID-19, which aligned with previous studies [15, 27]. On the other hand, we found that older adults also reacted to other people's increased need for support. Older Europeans were more likely to volunteer or provide instrumental support when their

Table 2 Individual characteristics and levels of volunteering, providing instrumental support, and receiving instrumental support during the first phase of the pandemic by individual's characteristics (% and its 95% CI)

	Respondent characteristics	Level of volunteering	Level of providing instrumental support	Level of receiving instrumental support
Sex				
Man	45.8 (44.7–46.9)	5.5 (4.8–6.2)	20.2 (18.7–21.8)	16.5 (15.2–17.8)
Woman	54.2 (53.1–55.3)	5.3 (4.7-6.0)	21.3 (20.2–22.5)	27.9 (26.9–28.9)
Age group				
50–59	25.4 (24.3–26.5)	5.3 (4.3–6.5)	32.9 (30.3–35.6)	7.6 (6.2–9.2)
60–69	36.4 (35.4–37.5)	6.7 (5.8–7.6)	24.4 (22.8–26.0)	13.8 (12.4–15.4)
70–79	22.4 (21.7–23.0)	5.5 (4.9–6.2)	12.3 (11.5–13.3)	31.6 (30.4–32.8)
80+	15.9 (15.3–16.4)	2.5 (2.0-3.2)	5.3 (4.5–6.1)	54.6 (52.9–56.4)
Educational level				
Low	35.6 (34.5–36.6)	2.7 (2.1–3.4)	12.9 (11.4–14.5)	29.0 (27.4–30.7)
Middle	42.3 (41.3–43.4)	5.3 (4.6–6.1)	23.8 (22.4–25.2)	20.5 (19.4–21.6)
High	22.1 (21.2–23.0)	10.0 (8.9–11.3)	27.9 (25.7–30.1)	16.5 (15.2–17.9)
Conditions before the pandemic				
Had chronic condition(s)				
Yes	35.9 (35-36.9)	4.7 (4.1–5.5)	15.4 (14.2–16.6)	32.3 (31.0-33.5)
No	64.1 (63.1–65)	5.7 (5.2–6.4)	23.9 (22.6–25.2)	17.3 (16.3–18.4)
Received home care				
Yes	5.1 (4.8–5.5)	1.7 (1.1–2.6)	8.0 (6.4–10.0)	66.6 (63.3–69.7)
No	94.9 (94.5–95.2)	5.6 (5.1–6.1)	21.5 (20.5–22.5)	20.3 (19.5–21.1)
Conditions during the pandemic				
Had new chronic condition(s)				
Yes	5.0 (4.7–5.4)	4.5 (3.1–6.4)	12.6 (10.4–15.3)	37.3 (34.0-40.6)
No	95.0 (94.6–95.3)	5.4 (5.0-5.9)	21.2 (20.3–22.2)	21.9 (21.1–22.7)
Frequent social contacts				
Yes	65.1 (64.0-66.1)	6.0 (5.4–6.6)	25.0 (23.8–26.3)	23.9 (22.9–24.8)
No	34.9 (33.9–36.0)	4.3 (3.7-5.0)	13.0 (11.8–14.3)	20.5 (19.0–22.0)
Feeling anxious				
Yes	30.6 (29.6–31.6)	4.6 (4.0-5.4)	21.3 (19.5–23.2)	29.0 (27.2–30.8)
No	69.4 (68.4–70.4)	5.7 (5.2–6.4)	20.6 (19.6–21.7)	19.8 (19.0-20.7)
Feeling sad or depressed				
Yes	28.9 (27.9–29.8)	5.2 (4.3–6.2)	19.8 (18.1–21.7)	32.5 (30.9–34.2)
No	71.2 (70.2–72.1)	5.5 (5.0–6.0)	21.2 (20.1–22.3)	18.6 (17.7–19.6)
Good household economic status				
Yes	67.4 (66.4–68.4)	6.6 (6.0-7.3)	22.7 (21.5–23.9)	21.5 (20.6–22.4)
No	32.6 (31.6–33.6)	3.0 (2.5–3.7)	17.7 (16.2–19.3)	25.0 (23.3–26.8)
Lived alone				
Yes	26.5 (25.6–27.4)	6.3 (5.3–7.5)	19.5 (17.8–21.3)	38.6 (36.9–40.4)
No	73.5 (72.6–74.4)	5.1 (4.6–5.6)	21.3 (20.2–22.4)	16.9 (16.0-17.8)
Changes after the outbreak				
Employment status				
Not employed	67.6 (66.5–68.7)	4.7 (4.3–5.2)	14.9 (14.1–15.7)	30.1 (29.1–31.1)
Became unemployed	6.8 (6.2–7.5)	7.0 (5.0-9.8)	35.5 (30.8–40.4)	9.9 (7.2–13.4)
Stayed employed	25.6 (24.5–26.7)	6.7 (5.6–7.9)	32.5 (30-35.2)	6.5 (5.3-8.0)
Self-rated health				
Poor-improved	1.8 (1.5–2.1)	6.0 (3.2–11.0)	18.5 (13-25.8)	33.0 (26.6–40.1)
Poor-worsened	5.1 (4.7–5.5)	2.1 (1.4–3.2)	9.9 (7.7–12.6)	44.6 (41.0-48.2)
Poor-same	21.6 (20.8–22.5)	2.5 (2.0-3.1)	11.2 (9.9–12.7)	37.1 (34.9–39.3)
Good-improved	1.3 (1.1–1.5)	9.7 (6.4–14.4)	31.0 (24.5–38.4)	13.3 (10.0-17.5)
Good-worsened	4.0 (3.7–4.4)	10.1 (7.0-14.4)	21.6 (17.9–25.9)	30.4 (26.6–34.6)
Good-same	66.2 (65.2–67.2)	6.2 (5.6–6.9)	24.6 (23.4–25.9)	15.7 (14.9–16.5)

Table 2 (continued)

	Respondent characteristics	Level of volunteering	Level of providing instrumental support	Level of receiving instrumental support
COVID-19 exposure				
on close ones				
Yes	16.3 (15.4–17.3)	9.0 (7.6–10.6)	29.2 (26.4–32.1)	21.4 (18.6–24.4)
No	83.7 (82.7–84.6)	4.7 (4.2–5.2)	19.2 (18.2–20.2)	22.9 (22.1–23.7)
on respondent				
Yes	3.2 (2.7–3.7)	9.0 (5.9–13.6)	21.2 (16.7–26.7)	22.7 (17.9–28.4)
No	96.8 (96.3–97.3)	5.3 (4.8–5.8)	20.8 (19.9–21.8)	22.7 (21.9–23.5)

Note: weighted data

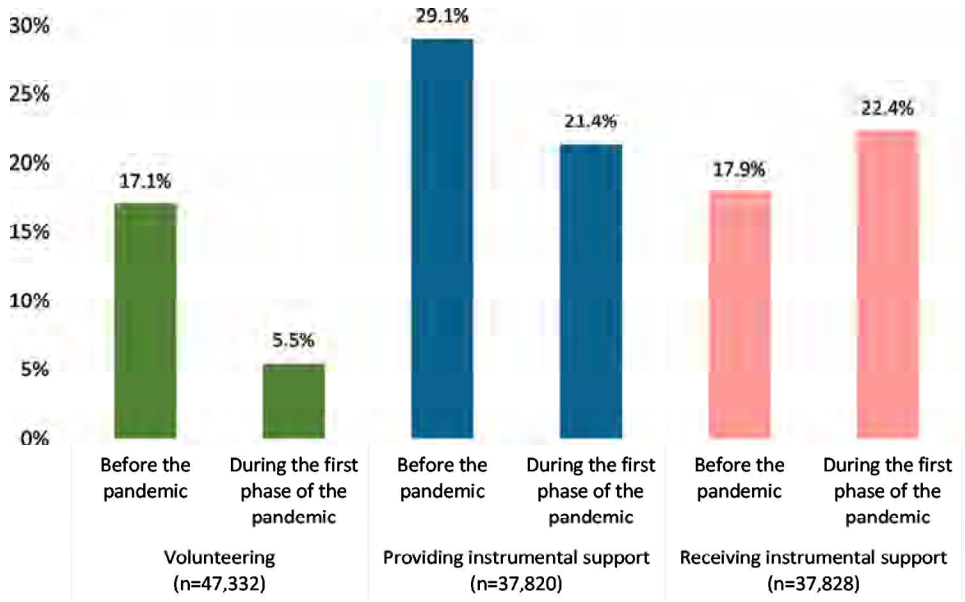

Fig. 1 Levels of volunteering, providing instrumental support, and receiving instrumental support before and during the first phase of the pandemic. Note: Weighted data

close ones were exposed to COVID-19. Older adults' engagement in support provision and volunteering is primarily driven by their altruistic values and belief in familial and social obligation [28, 29]. Therefore, when they perceive their close ones or other people in their community struggling due to the COVID-19 crisis, they provide help directly or by joining volunteer work.

On the country level, the stringency of the country's COVID-19 control policy (e.g., area lockdown and travel restrictions) might negatively affect social interaction, including volunteering and instrumental support exchange with people outside the household [30]. Unsurprisingly, we found a negative association between the stringency of the country's COVID-19 control policy and receiving instrumental support. Our finding suggests that when the COVID-19 restriction was more intense, the regular support providers who lived far away had fewer opportunities to support older adults. Hence, older adults were less likely to receive instrumental support.

However, we also found that older adults were more likely to provide instrumental support for people outside their households when the country's COVID-19 control policy was stricter. In this case, the strict COVID-19 policy may indicate other people's increased need for support, prompting support provision by older adults. Older Europeans' primary beneficiaries of instrumental support (outside the household) were their parents or children [10], who were likely to live close by [31]. Hence, lockdown restrictions may not negatively affect support provision because the support recipients live nearby. In addition, a study in Europe observed that mobility related to non-necessary (recreation, transport, and work) activities generally decreases with the increasing S-Index. Mobility related to necessary activity, such as going to the grocery or drugstore, was also decreasing but not as steep as non-necessary activity [32]. Thus, the COVID-19 restrictions might not prevent older adults from providing instrumental support outside the home if they consider it necessary.

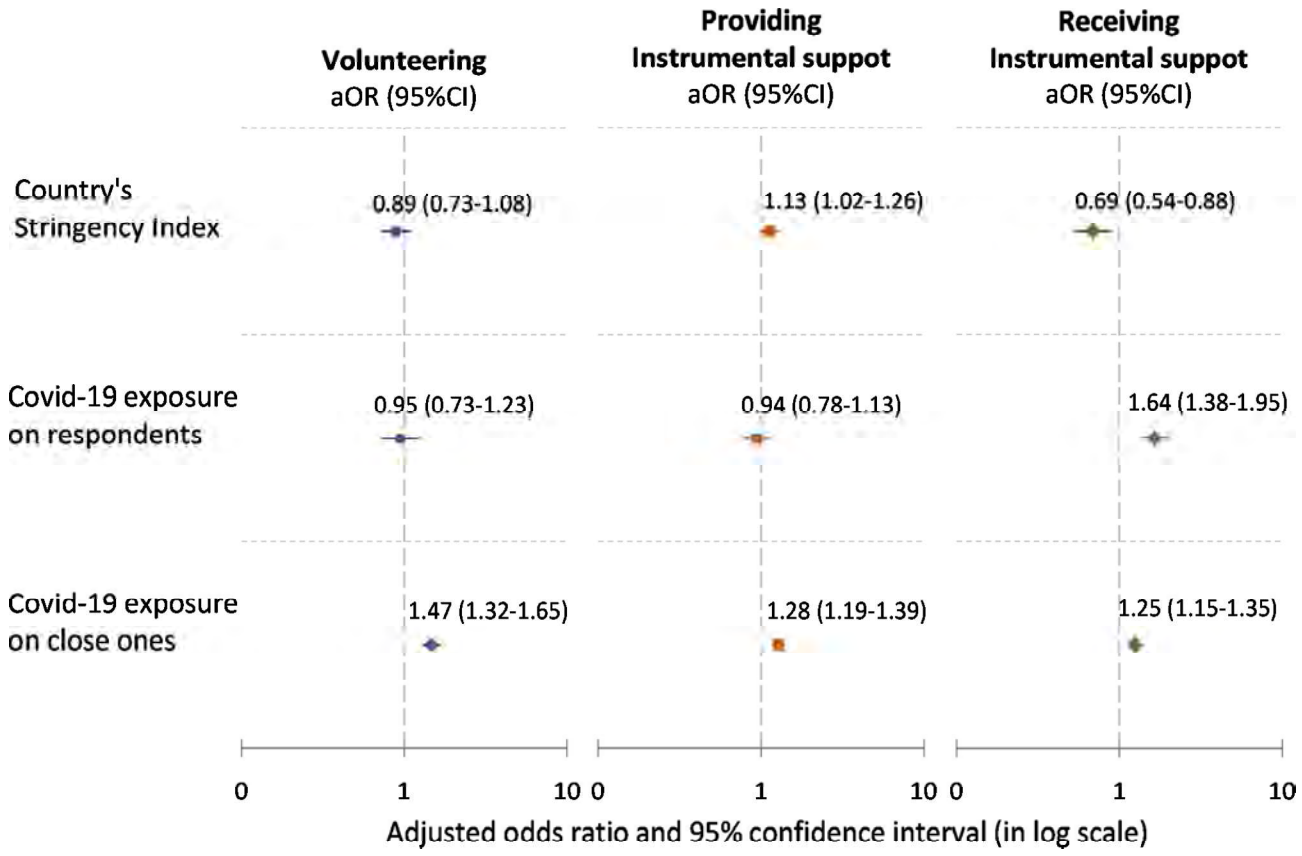

Fig. 2 Results from multilevel logistic regression analysis of volunteering (N = 45,669), providing support (N = 36,518), and receiving support (N = 36,526) during the first phase of the pandemic (adjusted odds ratio and its 95%CI). Notes: Each model was adjusted for sex, age, education level, employment status, household economic status, living alone, frequent contact, history of chronic conditions (heart attack, cancer, hip fracture, diabetes, and chronic lung disease), presence of new chronic conditions, changes in self-reported health, self-rated depression, self-reported anxiety, history of receiving home care before the pandemic, country's level of volunteering, providing instrumental support, or receiving instrumental support before the pandemic, and the country's total of COVID-19 cases per million

As for volunteering, unexpectedly, in the present study, the stringency of the country's COVID-19 control policy and individual COVID-19 exposure was not associated with the likelihood of volunteering. The possible explanation is that many volunteer organisations adapted to the pandemic control policies by transforming or complementing their volunteer activity with online activities [33]. As people could engage in virtual volunteering from their homes [34], the lockdown policy and their COVID-19 exposure status may have little to no effect on this activity. Unfortunately, in the SHARE questionnaire, there was no indication of the type of voluntary activity. Thus, we could not ascertain whether our findings resulted from a mixed association with different volunteering types.

Strengths and limitations

The current studies have several strengths. The SHARE data we used were collected per the standard design, interview method, instrument, and quality assurance procedure to ensure comparability across countries. Furthermore, we employed several analytical strategies. Multilevel logistic regression analyses used in the present study separated the contextual effect, i.e., country, from the individual-level effect. The country's level and the individual's history of volunteering, providing instrumental support, and receiving instrumental support were controlled for. These measures resulted in more valid estimates of the association between the variable of interest (individual exposure to COVID-19 and the stringency of the country's COVID-19 control policy) and older adults' volunteering, instrumental support provision and receipt during the first phase of the COVID-19 pandemic.

Despite the strengths, we acknowledged that this study also had limitations. Variables used in the present study were limited by their availability in the SHARE datasets. It may be disadvantageous to use a history of volunteering from Wave 7 and support receipt and provision from Wave 6. The SHARE Corona Survey 1 was conducted five years following Wave 6 or three years following Wave 7. During this wide time gap, older adults may

stop providing support or start receiving support [10, 35]. Also, many respondents aged 50–54 in 2020 did not have data before the pandemic as they were not eligible to participate in the previous waves. Thus, they had to be excluded from the analyses. As a result, our findings may not be representative of this age group.

COVID-19 exposure, support exchange, and volunteering data were collected simultaneously (in the SCS1). Thus, it is possible that some individuals reported instrumental support provisions that occurred before, after, or during their exposure to COVID-19. In the same vein, in calculating the country S-Index and total COVID-19 cases for the present analysis, we assumed that the reported engagement in volunteering and instrumental support receipt or provision occurred around the interview date. This assumption may not hold as the SHARE questions used a recall period of "since the COVID-19 outbreak". Also, the SHARE data used in this study were self-reported, which might be under or overreported.

While the results of this study should be interpreted with caution, they nevertheless add valuable information to the body of knowledge on solidarity and active ageing in Europe during the first phase of the pandemic. Future studies can build upon and extend this work in several ways. A well-designed longitudinal study with appropriate instruments is required to investigate the causal effect of COVID-19 restrictions on volunteering and support exchange. Future studies should include indicators of national wealth, social inequality, policies regarding social protection and volunteering in each country, and how those policies have changed due to the pandemic. A comprehensive analysis of those contextual factors is also necessary to determine their impact on the different types of support provision and volunteering during the pandemic.

Conclusion

The present study demonstrates that the COVID-19 pandemic affected European older adults' instrumental support receipt and participation in volunteer work and instrumental support provision. During the first phase of the pandemic, European older adults showed solidarity by participating in volunteer work and providing instrumental support in response to others' increased need for support due to COVID-19. They were also likely to receive instrumental support when they needed support due to COVID-19. The stringent country's COVID-19 control policies might prevent older adults from receiving instrumental support from outside their households. Interestingly, older adults were likely to provide instrumental support for people living nearby during the stricter COVID-19 control policies. These findings show that a significant share of older European adults could provide informal help for others, even during a crisis. Thus, volunteer organisations, with support from the government, should tailor volunteer programs for older adults. Therefore, they can give their optimum contribution to distribute help, especially during a crisis such as the COVID-19 pandemic.

Abbreviations

COVID-19	Coronavirus Disease 2019
ICC	Intraclass Correlation Coefficient
SCS	SHARE Corona Survey
SHARE	Survey of Health, Ageing and Retirement in Europe
S-Index	Stringency Index

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-023-17507-5.

Supplementary Material 1: Study samples selection; Descriptive estimates of country-level variables by country; Complete results of multilevel logistic regression analyses

Acknowledgements

This paper uses data from SHARE Waves 6, Wave 7, and SHARE Corona Survey 1 (DOIs: https://doi.org/10.6103/SHARE.w6.710 and https://doi.org/10.6103/SHARE.w7.711, and https://doi.org/10.6103/SHARE.w8ca.100), see [22] for methodological details. The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the US National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04–064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

Author contributions

SKL: Conceptualisation, Methodology, Formal analysis, Data Curation, Writing - Original Draft, Writing - Review & Editing. ME: Conceptualisation, Formal analysis, Writing - Review & Editing, Supervision. XdL: Conceptualisation, Methodology, Formal analysis, Writing - Review & Editing, Supervision. GM: Conceptualisation, Formal analysis, Writing - Review & Editing, Supervision, Funding acquisition. NN: Conceptualisation, Methodology, Formal analysis, Writing - Review & Editing, Supervision.

Funding

Research in this article is a part of the H2020 SHARE-COVID project (Grant agreement No. 101015924). The funding body was not involved in the conception, data retrieval, data analysis, or the results interpretation of this study.
Open access funding provided by Umea University.

Data availability

SHARE data is distributed by SHARE-ERIC (Survey of Health, Ageing and Retirement in Europe – European Research Infrastructure Consortium) and is freely available to the scientific community after registration. All data users are subject to European Union and national data protection laws and the SHARE Conditions of Use. More details on data access are available at http://www.share-project.org/data-access.html.

Declarations

Ethics approval and consent to participate

This study is based on secondary sources of data available in the public domain. The University of Mannheim's internal review board reviewed and approved SHARE for waves 1 to 4. The Ethics Council of the Max Planck Society conducts the ethics reviews for wave four onwards. Ethics approvals in each SHARE-participating country were obtained from the local ethics committees or institutional review boards. SHARE data is available for the scientific community and may only be used for scientific research. The secondary data analysis of SHARE data, such as in the present study, does not require further ethical approval. (https://share-eric.eu/fileadmin/user_upload/Ethics_Documentation/SHARE_ethics_approvals.pdf).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Centre for Demographic and Ageing Research, Umeå University, Umeå, Sweden
[2]Department of Epidemiology and Global Health, Umeå University, Umeå, Sweden
[3]Department of Social Work, Umeå University, Umeå, Sweden
[4]Umeå School of Business, Economics and Statistics, Umeå University, Umeå, Sweden
[5]Department of Geography, Umeå University, Umeå, Sweden
[6]School of Public Health and Community Medicine, Institute of Medicine, University of Gothenburg, Gothenburg, Sweden

Received: 5 May 2023 / Accepted: 16 December 2023
Published online: 05 January 2024

References

1. Armitage R, Nellums LB. COVID-19 and the consequences of isolating the elderly. The Lancet Public Health. 2020;5(5):e256. https://doi.org/10.1016/S2468-2667(20)30061-X.
2. Lachance EL. COVID-19 and its impact on volunteering: moving towards virtual volunteering. Leisure Sci. 2021;43(1–2):104–10. https://doi.org/10.1080/01490400.2020.1773990.
3. Carlsen HB, Toubøl J, Brincker B. On solidarity and volunteering during the COVID-19 crisis in Denmark: the impact of social networks and social media groups on the distribution of support. Eur Soc. 2021;23(sup1):122–S40. https://doi.org/10.1080/14616696.2020.1818270.
4. Wu JT, Leung K, Bushman M, Kishore N, Niehus R, de Salazar PM, et al. Estimating clinical severity of COVID-19 from the transmission dynamics in Wuhan, China. Nat Med. 2020;26(4):506–10. https://doi.org/10.1038/s41591-020-0822-7.
5. Centers for Disease Control Prevention. Severe outcomes among patients with Coronavirus Disease 2019 (COVID-19)—United States, February 12–March 16, 2020. Morbidity and Mortality Weekly Report; 2020.
6. European Centre for Disease Prevention and Control. Guidance on the provision of support for medically and socially vulnerable populations in EU/EEA countries and the United Kingdom during the COVID-19 pandemic, 3 July 2020. Stockholm: ECDC; 2020.
7. Kawachi I, Berkman LF. Social ties and mental health. J Urb Health. 2001;78(3):458–67. https://doi.org/10.1093/jurban/78.3.458.
8. Lestari SK, de Luna X, Eriksson M, Malmberg G, Ng N. A longitudinal study on social support, social participation, and older europeans' quality of life. SSM - Population Health. 2021;13:100747. https://doi.org/10.1016/j.ssmph.2021.100747.
9. Attias-Donfut C, Ogg J, Wolff F-C. Evolution of social support. In: Börsch-Supan A, Brugiavini A, Jürges H, Kapteyn A, Mackenbach J, Siegrist J, et al. editors. First results from the Survey of Health, Ageing and Retirement in Europe (2004–2007): starting the longitudinal dimension. Mannheim: Mannheim Research Institute for the Economics of Aging (MEA); 2008. pp. 174–81.
10. Lestari SK, de Luna X, Eriksson M, Malmberg G, Ng N. Changes in the provision of instrumental support by older adults in nine European countries during 2004–2015: a panel data analysis. BMC Geriatr. 2020;20(1):436. https://doi.org/10.1186/s12877-020-01785-4.
11. Eurofound. European quality of Life Survey 2016: quality of life, quality of public services, and quality of society. Luxembourg: Publications Office of the European Union; 2017.
12. Hank K, Buber I. Grandparents caring for their grandchildren: findings from the 2004 survey of health, ageing, and retirement in europe. J Fam Issues. 2008;30(1):53–73. https://doi.org/10.1177/0192513X08322627.
13. Strauss S. Multiple engagement: the relationship between informal caregiving and formal volunteering among Europe's 50 + population. Aging Soc. 2021;41(7):1562–86. https://doi.org/10.1017/S0144686X19001764.
14. Bergmann M, Wagner M. Impact of COVID-19 on informal caregiving and care receiving across Europe during the first phase of the pandemic. Front Public Health. 2021;9:590. https://doi.org/10.3389/fpubh.2021.673874.
15. Sin NL, Klaiber P, Wen JH, DeLongis A. Helping amid the pandemic: Daily affective and social implications of covid-19-related prosocial activities. Gerontologist. 2021;61(1):59–70. https://doi.org/10.1093/geront/gnaa140.
16. Mak HW, Fancourt D. Predictors of engaging in voluntary work during the COVID-19 pandemic: analyses of data from 31,890 adults in the UK. Perspect Public Health. 2021;1757913921994146. https://doi.org/10.1177/1757913921994146.
17. Siira E, Olaya-Contreras P, Yndigegn S, Wijk H, Rolandsson B, Wolf A. Older adults' provision of informal care and support to their peers – A cornerstone of Swedish society: demographic characteristics and experiences of social isolation. Scand J Caring Sci. 2021;00:1–14. https://doi.org/10.1111/scs.13063.
18. Bassoli E, Brugiavini A, Ferrari I. Care provision at the time of the COVID-19: Who suffers most? University Ca'Foscari of Venice. Dept of Economics Research Paper Series No. 2021;10. https://doi.org/10.2139/ssrn.3807762.
19. Börsch-Supan A. Survey of Health, Ageing and Retirement in Europe (SHARE). Wave 8. COVID-19 survey 1. 1.0.0. SHARE-ERIC; 2020. https://doi.org/10.6103/SHARE.w8ca.100.
20. Börsch-Supan A. Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 7. 7.1.1. ed: SHARE-ERIC. 2020. https://doi.org/10.6103/SHARE.w7.711.
21. Börsch-Supan A. Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 6. 7.1.0 ed: SHARE-ERIC; 2019 https://doi.org/10.6103/SHARE.w6.710.
22. Börsch-Supan A, Brandt M, Hunkler C, Kneip T, Korbmacher J, Malter F, et al. Data resource profile: the survey of health, ageing and retirement in europe (SHARE). Int J Epidemiol. 2013;42(4):992–1001. https://doi.org/10.1093/ije/dyt088.
23. Scherpenzeel A, Axt K, Bergmann M, Douhou S, Oepen A, Sand G, et al. Collecting survey data among the 50 + population during the COVID-19 outbreak: the Survey of Health, Ageing and Retirement in Europe (SHARE). Surv Res Methods. 2020;14(2). https://doi.org/10.18148/srm/2020.v14i2.7738.
24. Hale T, Angrist N, Goldszmidt R, Kira B, Petherick A, Phillips T, et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav. 2021;5(4):529–38. https://doi.org/10.1038/s41562-021-01079-8.
25. Ritchie H, Mathieu E, Rodés-Guirao L, Appel C, Giattino C, Ortiz-Ospina E et al. Coronavirus pandemic (COVID-19). Our World in Data. 2020.
26. Steele F, Module. (concepts): Multilevel models for binary responses. Volume 7. Center for multilevel modelling Bristol: LEMMA; 2009.
27. Brooke J, Clark M. Older people's early experience of household isolation and social distancing during COVID-19. J Clin Nurs. 2020;29:21–2. https://doi.org/10.1111/jocn.15485.
28. Omoto AM, Snyder M, Martino SC. Volunteerism and the life course: investigating age-related agendas for action. Basic Appl Soc Psychol. 2000;22(3):181–97. https://doi.org/10.1207/S15324834BASP2203_6.
29. Russell AR, Storti MAH, Handy F. Volunteer retirement and well-being: evidence from older adult volunteers. Int J Community Well-Being. 2022. https://doi.org/10.1007/s42413-021-00157-z.
30. Ekoh PC, Agbawodikeizu PU, Ejimkararonye C, George EO, Ezulike CD, Nnebe I. COVID-19 in rural Nigeria: diminishing social support for older people in Nigeria. Gerontol Geriatric Med. 2020;6:2333721420986301. https://doi.org/10.1177/2333721420986301.
31. Hank K. Proximity and contacts between older parents and their children: a European comparison. J Marriage Family. 2007;69. https://doi.org/10.1111/j.1741-3737.2006.00351.x. :157 – 73.
32. Bargain O, Aminjonov U. Trust and compliance to public health policies in times of COVID-19. J Public Econ. 2020;192:104316. https://doi.org/10.1016/j.jpubeco.2020.104316.

33. Mao G, Fernandes-Jesus M, Ntontis E, Drury J. What have we learned about COVID-19 volunteering in the UK? A rapid review of the literature. BMC Public Health. 2021;21(1):1470. https://doi.org/10.1186/s12889-021-11390-8.
34. Sun PC, Morrow-Howell N, Pawloski E, Helbach A. Older adults' attitudes toward virtual volunteering during the COVID-19 pandemic. J Appl Gerontol. 2021;40(9):953–7. https://doi.org/10.1177/07334648211006978.
35. Shaw BA, Krause N, Liang J, Bennett J. Tracking changes in social relations throughout late life. The Journals of Gerontology: Series B. 2007;62(2):90–S9. https://doi.org/10.1093/geronb/62.2.S90.

Publisher's Note

Aging & Mental Health

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/camh20

Do reductions of daily activities mediate the relationship between COVID-19 restrictions and mental ill-health among older persons in Europe?

Filip Fors Connolly, Jenny Olofsson & Maria Josefsson

To cite this article: Filip Fors Connolly, Jenny Olofsson & Maria Josefsson (14 Feb 2024): Do reductions of daily activities mediate the relationship between COVID-19 restrictions and mental ill-health among older persons in Europe?, Aging & Mental Health, DOI: 10.1080/13607863.2024.2313726

To link to this article: https://doi.org/10.1080/13607863.2024.2313726

AGING & MENTAL HEALTH
https://doi.org/10.1080/13607863.2024.2313726

Routledge
Taylor & Francis Group

Do reductions of daily activities mediate the relationship between COVID-19 restrictions and mental ill-health among older persons in Europe?

Filip Fors Connolly[a], Jenny Olofsson[b] and Maria Josefsson[b,c]

[a]Department of Sociology, Umeå University, Umeå, Sweden; [b]Centre for Demographic and Ageing Research, Umeå University, Umeå, Sweden; [c]Department of Statistics, USBE, Umeå University, Umeå, Sweden

ABSTRACT

Objective: Previous research has shown that daily activities are crucial for mental health among older people, and that such activities declined during the COVID-19 pandemic. While previous studies have confirmed a link between stringent restrictions and an increase in mental ill-health, the role of daily activities as a mediator in this relationship remains underexplored. We analyzed whether reductions in daily activities mediated the impact of these COVID-19 restrictions on mental ill-health during the pandemic's initial phase.

Methods: We used data from Wave 8 SHARE Corona Survey covering 41,409 respondents from 25 European countries and Israel as well as data on COVID-19 restrictions from the Oxford Government Response Tracker (OxCGRT). Multilevel regression and multilevel-mediation analysis were used to examine the relationships between restrictions, daily activities and mental ill-health.

Results: Reductions in walking and shopping showed a notably stronger association with increases in mental ill-health compared to social activities. Furthermore, declines in walking could account for about a quarter of the relationship between restrictions and increased mental ill-health, but the mediating effects of the other activates were negligible.

Conclusions: The study highlights the essential role of maintaining daily activities, particularly walking, to mitigate the negative psychological effects of pandemic-related restrictions among older populations in Europe.

ARTICLE HISTORY
Received 29 June 2023
Accepted 22 January 2024

KEYWORDS
Mental health; restrictions; COVID-19; ageing; Europe; SHARE

Introduction

The rapid outbreak of COVID-19 in 2020 led to a sharp decline in out-of-home daily activities among people worldwide (c.f. Fors Connolly et al., 2021). Previous research on daily activities during the COVID-19 pandemic has revealed substantial variations across countries (Mendolia et al., 2021; Santamaria et al., 2020), with these differences partly attributable to the stringency of governmental restrictions and the overall spread of the pandemic (Fors Connolly et al., 2021 Mendolia et al., 2021; Santamaria et al., 2020). Notably, studies have also found that these two factors are associated with mental ill-health, as people in countries with stricter restrictions and higher infection rates report larger increases in mental ill-health (Atzendorf & Gruber, 2022; García-Prado et al., 2022; Knox et al., 2022). In this study, we explore the connections between restrictions, daily activities, and mental ill-health, examining whether daily activities serve as a mediator in the relationship between restrictions and mental ill-health among older people in Europe. Several studies have explored potential factors contributing to a decline in well-being and mental health during the pandemic across age groups. These factors include changes in working conditions (Zoch et al., 2022), income reductions (Yue & Cowling, 2021), shifts in social capital (Sarmiento Prieto et al., 2023), alterations in creative activities (Kyriazos et al., 2021), yielding mixed results. However, no research has yet probed the role of daily activities as a mediator between pandemic restrictions and mental health specifically among the older population.

While the COVID-19 pandemic may have exacerbated mental health issues among older individuals due to challenges in accessing telemedicine and outpatient clinics, heightened anxiety about infection and inadequate care, and age-based discrimination fueled by media portrayals (Tsamakis et al., 2021), the impact of reduced daily activities also warrant considerations. Radwan et al. (2020) and Sepúlveda-Loyola et al. (2020) pointed to the possible negative long-term impact of stringent policy-mandated restrictions on older adults' health, as the reduction in social contact and fewer physical activities may have long-term negative consequences for both their physical and mental health. Hoffman et al. (2022) found that old age predicted a decline in physical activities during the COVID-19 pandemic in the US, which in turn was associated with a decline in physical functioning. However, possible effects of mental ill-health were absent from the analysis. Takiguchi et al., 2023 examined the link between decreased leisure activities and depressive symptoms in a Japanese sample. They found no association between reduced leisure activities and depression in the older segment of the sample (60–89). However, the findings are limited by a small sample size of only 122 individuals from this age group and the study's confinement to Japan. Additionally, the researchers did not explore the potential distinctions between reductions in different leisure activities in relation to mental health during the pandemic.

Research from non-pandemic settings suggests that social and physical activities play a crucial role in emotional well-being (Bergstad et al., 2012) and mental health (Morgan et al., 2007; Paluska & Schwenk, 2000).[1] Social activities, such as interacting

CONTACT Filip Fors Connolly filip.fors@umu.se
Supplemental data for this article can be accessed online at https://doi.org/10.1080/13607863.2024.2313726.

with friends, family members, and participating in group events or organizations, have consistently been found to be positively associated with subjective well-being and mental health. Social support is a crucial element of this relationship, as it has been shown to promote psychological resilience, reduce stress, and buffer against the negative effects of life events (Cohen & Wills, 1985; Thoits, 2011). Furthermore, engaging in social activities provides individuals with opportunities to develop and maintain social networks, which can contribute to increased self-esteem, feelings of belonging, which in turn may increase well-being and mental health (Diener & Seligman, 2002; Leary & Baumeister, 1995).

The benefits of physical activity for subjective well-being and mental health are well-established. Regular physical activity has been shown to reduce the risk of depression and anxiety, improve mood, enhance cognitive function, and increase overall life satisfaction (Paluska & Schwenk, 2000; Penedo & Dahn, 2005; Schuch et al., 2018). Several mechanisms have been proposed to explain the relationship between physical activity and subjective well-being and mental health. For instance, the release of endorphins and other neurotransmitters during exercise may improve mood and reduce feelings of stress and anxiety (Mead et al., 2009). Additionally, engaging in physical activity can provide opportunities for social interaction and support, which can further enhance subjective well-being and mental health (Eime et al., 2013).

Older adults may often face increased vulnerability to declines in daily activities as compared to younger individuals. For instance, while younger people might seamlessly transition to online substitutes for social activities, such as video chatting, this shift might be less straightforward for older adults. Additionally, the enhanced health benefits of physical activities for older individuals, as noted by Cunningham & O' Sullivan (2020), suggest that a reduction in physical activities during the pandemic could pose a more significant challenge for this age group than for younger people. However, interestingly, various studies have observed that older adults (at least in some countries) experienced a less noticeable increase in mental ill-health during the pandemic than their younger counterparts (Fields et al., 2022; Takiguchi et al., 2023). This could potentially be attributed to higher resilience among the older population (Fields et al., 2022). In addition, the unprecedented nature of the pandemic may have changed the impact of activity reduction on mental ill-health when compared to typical circumstances for older people. For example, reducing visits to relatives in non-pandemic circumstances might have adverse effects on the relationships with these relatives, which in turn could affect mental health negatively. However, during the pandemic, a reduction in visits to relatives might have been perceived as perfectly legitimate due to health concerns, thus mitigating potential negative effects on relationship quality and mental health. Furthermore, the experience of reducing participation in social gatherings, such as going to clubs, associations and religious ceremonies may have been more tolerable given that the majority of the elderly also had to curtail the same activities, fostering a sense of collective solidarity ('we are all in the same boat'). This shared experience could have altered the relationship between activity reduction and mental health during the pandemic compared to normal circumstances and especially so for older people. In support, Greig et al. (2022) observed a less pronounced correlation between loneliness and depressive symptoms among older individuals during the pandemic, as opposed to the year preceding it.

The present study

Since most prior research on the relationship between social and physical activities and well-being or mental health has been conducted in non-pandemic contexts, it remains an open question as to how these relationships may differ during the COVID-19 pandemic. Nonetheless, to form expectations regarding this relationship, we will use previous studies on the association between various activities and well-being as a reasonable foundation. Drawing on these non-pandemic findings, we would anticipate a decline in mental health during the pandemic if it hindered people's engagement in social and physical activities. Consequently, the first hypothesis we examine in this article is whether a reduction in social and physical activities during the initial phase of the COVID-19 pandemic is associated with an increase in mental ill-health among older individuals.

To operationalize our hypothesis using available data, we examine whether a reduction in walking, a common physical activity among older people, is associated with an increase in mental ill-health. We further test our hypothesis by focusing on two important social activities (meeting family members who do not live in the same household and attending social gatherings) to determine whether a decline in social activities are also related to mental ill-health. Additionally, we investigate if a reduction in shopping is associated with an increase in mental ill-health. Although shopping might not be classified as a social or physical activity, it could be a common activity that still holds moderate importance for the mental health of older individuals. While not focusing on the older population per se, a comprehensive study on the relationships between daily activities and momentary emotional well-being (Killingsworth and Gilbert, 2010) suggests that shopping is more enjoyable than more passive leisure activities such as watching TV, listening to the radio, and reading.

Our second and primary hypothesis is that activity reduction serves as a mediator between restrictions and mental health during the COVID-19 pandemic. Intriguingly, while numerous studies have explored the effects of restrictions on mental health (e.g. Atzendorf & Gruber et al., 2022), none have attempted to empirically establish daily activities as mediators in this relationship. Therefore, we anticipate that walking, shopping, and social activities would decrease as a result of stricter governmental restrictions, subsequently leading to increased mental ill-health among older individuals in Europe.

Data and methods

Study overview

The Survey of Health, Ageing and Retirement in Europe (SHARE) is a longitudinal, cross-sectional study of adults aged 50 and above living in 27 European countries and Israel (Börsch-Supan et al., 2013). To date, SHARE comprises nine survey waves, including two special COVID-19 waves. The data used in this study is drawn from the first SHARE Corona Survey (SCS1) (Börsch-Supan, 2022) conducted through computer-assisted telephone interviews (CATI) with 54,567 respondents from June to August 2020 (Scherpenzeel et al., 2020). The SCS1 samples was selected in each country and included a) regular SHARE panel members that was already interviewed in wave 8 and b) regular SHARE panel

members not been interviewed in wave 8 due to interruption of the field work caused by the COVID-19 outbreak (Bergmann & Bethmann, 2021; Scherpenzeel et al., 2020). The individual retention rate of the CATI sample in the participating countries range from 60% to 96%, and approximately half of all countries attained a retention rate over 80%[2] (Sand, 2021). The survey targeted the COVID-19 living situation of older persons during the pandemic and covered questions related to health and health behaviour; information on COVID-19 infections and quality of health care; changes in work and economic situation and social relationships. The full questionnaire is available at: Corona Questionnaire 1 (share-eric.eu).

Additionally, aggregated data on governmental policy responses were obtained from the Oxford COVID-19 Government Response Tracker (OxCGRT), a composite measure based on data on country-specific responses to the COVID-19 pandemic, such as school and workplace closures and travel restrictions. (Hale et al., 2021). We obtained data on confirmed COVID-19 cases and death for all countries from the COVID-19 Data Repository by the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University, maintained by Our World in Data (www.ourworldindata.org/covid-cases). The data provided daily information on confirmed COVID-19 cases and deaths for each country.

Our study sample consisted of 44,410 eligible respondents aged 50 years or older who had left their homes at least once since the COVID-19 pandemic began (Figure 1). Participants from Malta ($n = 474$) were excluded from the dataset due to the lack of official country-level data on governmental restrictions during the pandemic. Following the removal of respondents due to item non-response on activity measures ($n = 2,267$) and mental health measures ($n = 260$), the final analytical sample size comprised 41,409 respondents from 26 countries: Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Czech Republic, Poland, Luxembourg, Hungary, Portugal, Slovenia, Estonia, Croatia, Lithuania, Bulgaria, Cyprus, Finland, Latvia, Romania, Slovakia, and Israel as the only non-European country.

Measures

Measurements of mental ill-health

In Wave 8, the SHARE Corona Survey assessed changes of mental health through the following questions: 'In the last month, have you been sad or depressed?' (yes/no); 'In the last month, have you felt nervous, anxious, or on edge?' (yes/no); 'Have you had trouble sleeping recently?' (yes/no); and 'How much of the time do you feel lonely?' (Often, some of the time, or hardly ever/never) Respondents who answered 'no' or hardly never/never were coded as zero. Those who answered 'yes' to questions about sadness/depression, anxiety and sleep problem were followed up with the question: 'Has that been more so, less so or about the same as before the outbreak of Corona?' To capture changes in mental ill-health, we dichotomized the variables into 'more so' (1) and 'less so/about the same' (0). We created an additive index by combining all variables, including self-reported changes in sadness/depression, anxiety, sleep problems, and feelings of loneliness. The reliability of this index, as measured by Cronbach's alpha, varied from 0.48 in Denmark to 0.77 in Slovakia, with an average value of 0.66 across all countries (alpha values for all countries are displayed in Appendix Table A1). Although this value is slightly below the conventional cut-off of 0.7, it was deemed acceptable considering that the index was based on only four binary indicators, as opposed to continuous variables.

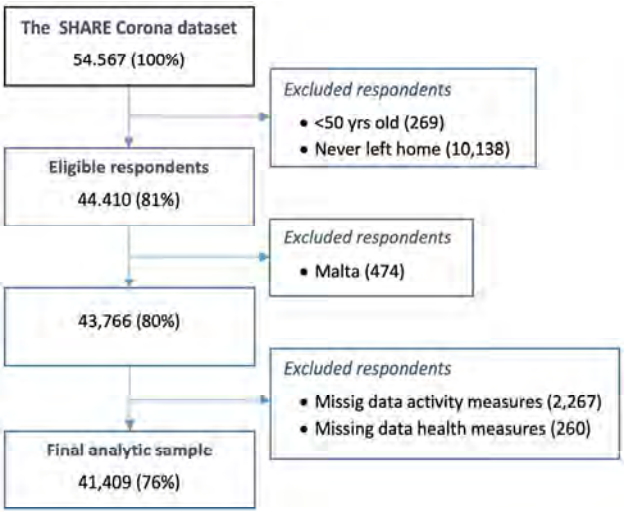

Figure 1. Sample selection flowchart.

Measurements of activity reduction

Reduction of daily activities was measured through four variables: 'Going shopping', 'Going out for a walk', 'Meeting with more than five people from outside your household' and 'Visiting other family members'. Respondents were asked to indicate the extent to which they adjusted their daily activities since the outbreak of the Corona pandemic, compared to before the outbreak. The activities were dichotomized into two values: respondents who reported 'Not anymore' or 'Less often' were coded as 1, indicating a reduction in activity, while those who reported 'About the same' or 'More often' were coded as 0.

Governmental restrictions

The Oxford COVID-19 Government Response Tracker (OxCGRT) is a stringency index on the country level that measures the strictness of COVID-19 restrictions on a scale from 0 to 100, with 100 representing the highest level of stringency (Hale et al., 2021). We calculated mean values for all countries between 1 March and 31 July 2020, which corresponds to the period when COVID-19 broke out and the timeframe of the first SHARE Corona Survey fieldwork.

Covariates

At an individual level age is grouped into two categories: 50–69 years and 70 years and older. Employment status when the pandemic broke out is measured as 1 'Employed/self-employed' 0 'Not employed'. Household size was dichotomized into 1 'Single household' 0 'Living with two or more persons in a household'. The respondent's health status was measured with two variables: health before pandemic outbreak (1 'Good health', 0 'Fair/poor health') and health change after pandemic outbreak (1 'Improved/about the same' 0 'Worsened').

At the country level, given that both confirmed cases and deaths can serve as indicators of the overall spread of COVID-19 (Mendolia et al., 2021), we calculated an infection rate measure for all countries by combining the reported cases and deaths (for more information see Fors Connolly et al., 2021).

Analytical approach

In order to examine the associations between (i) levels of stringency and activity reductions, and (ii) activity reductions and increased mental ill-health, we conducted multilevel logistic regression (using a probit link) and multilevel regression, respectively. In a final step, multilevel-mediation analyses were carried out to examine the mediating effects of activity reductions in the association between increased mental ill-health and stringency levels.

For each association in (i) and (ii), both a *simple unadjusted* and a *fully covariate adjusted* model were fitted. Moreover, in all models, countries were included as random intercepts (level 2-units), to take into account country-specific differences. The simple models did not include any explanatory variables and only included stringency and/or activity reductions. Specifically, in step (i), a multilevel logistic regression model was fitted for each activity separately to assess the association between stringency and the activity. In (ii), to assess the association between the different activities and mental ill-health, one multilevel regression model was fitted (including all activities). The fully covariate adjusted models were fitted in a similar way, although they also included the explanatory variables: sex, age, employment status, household composition, subjective pre-pandemic health, as fixed additive predictors at the individual-level (level 1-units), and infection rate was included as a fixed predictor at country level (level 2-unit).

Multilevel-mediation analyses were carried out to examine the mediating effects of activity reductions (separate models for each activity) in the association between increased mental ill-health and stringency levels. For an activity to be identified as a mediator, it must satisfy two conditions; i) the variable is significantly correlated with stringency levels, and ii) the variable is significantly correlated with the mental ill health when adjusting for the confounding factors in the multilevel model. Similarly, both a simple unadjusted and a fully covariate adjusted model were fitted. The latter, including the same set of covariates (as well as the other activities when regressing mental ill-health on the activities) and countries as random intercepts. A nonparametric bootstrap method was used to generate a sampling distribution and test the statistical significance of the mediation effects (i.e. the total effect, the direct effect, and the mediating effect). Confidence intervals were estimated based on results from $N = 1{,}000$ samples. The mediation results are presented as (i) the indirect or mediating effect of activity reduction (Walking, Shopping, People or Family) in the association between stringency levels and mental-ill health, (ii) the direct effect of stringency levels on mental ill-health while controlling for activity, and (iii) the total effect of stringency levels on mental ill-health, corresponding to the sum of the direct and the mediating effect.

All analyses were carried out using R 4.3.0 and the R-packages; lme4 (Bates et al., 2015), lmerTest (Kuznetsova et al., 2017) and mediation (Tingley et al., 2014).

Table 1. Descriptive statistics, data: Wave 8 SHARE Corona Survey.

Measures	Frequency (%)		
	Female $n = 23{,}351$	Male $n = 18{,}058$	Total $n = 41{,}409$
Reduction visiting family	19,959 (85.5)	14,838 (82.2)	34,797 (84.0)
Reduction meeting people	20,934 (90.0)	15,577 (86.3)	36,511 (88.2)
Reduction going shopping	17,275 (74.0)	11,271 (62.4)	28,546 (68.9)
Reduction going walking	11,436 (49.0)	7,751 (42.9)	19,187 (46.3)
Age ≥70 yrs	10,345 (44.3)	8,754 (48.4)	19,099 (46.1)
*Employed**	5,590 (24.0)	4,768 (26.4)	10,358 (25.0)
Single household	6,515 (27.9)	2,627 (14.6)	9,142 (22.1)
Fair/Poor prepand health	6,628 (28.4)	4,948 (27.4)	11,576 (28.0)

*Employment status when COVID-19 broke out.

Results

Descriptives

Table 1 summarizes descriptive statistics for the analytical sample. The sample comprises $N = 41{,}409$ subjects, of which 56 % women and nearly half of the respondents are 70 years or older. About one-quarter of the respondents were employed when COVID-19 broke out and the majority lived in a multi-person household. Regarding health, 28 % reported fair or poor health before the pandemic. A majority (over 60 %) of the respondents reduced their daily activities, except for going walking, where only 46% reduced their walking habits, during the pandemic.

The association between stringency and activity reduction – multilevel modeling

Separate multi-level models, both simple and fully covariate-adjusted, were fitted regressing each activity on stringency levels. Results from the simple models (see Appendix Table A2) show that levels of stringency are positively associated with activity reduction across all four activities. However, the only significant association is seen for walking ($\beta = 0.39$, $p < .001$), in contrast to meeting more than 5 people ($\beta = 0.11$, $p = .122$), meeting family members ($\beta = 0.08$, $p = .144$) and going shopping ($\beta = 0.02$, $p = .733$). For the fully adjusted models (see Table 2), the association between stringency and walking are similar to the simple model ($\beta = 0.41$, $p < .001$). The association of stringency on meeting more than 5 people and meeting other family members both display weak effects ($\beta = 0.04$, $p = .421$ and $\beta < 0.00$ $p = .986$, respectively). A small negative association was found for shopping on stringency (β=-0.11, $p = .03$).

The association between activity reduction and mental ill-health – multilevel modeling

The first hypothesis posited a relationship between a reduction in social and physical activities and increased mental ill-health in this cohort of older people during the COVID-19 pandemic. Hence, we begin by analyzing simple (unadjusted) separate models of associations between the four activities and mental ill-health (see Appendix, Table A3). Results show that a reduction in each of the four activities are related to increased mental ill-health (all $p < .001$). However, since each activity is substantially correlated with all other activities, we next run models controlling for all other activities as well as a series of other relevant control variables, i.e. a fully adjusted model (see Table 3). The results from this model show that all four activities continue to display statistically significant relationships with mental ill-health; however, their effects are more attenuated compared to those in the simple models. The strongest association is observed for shopping ($\beta = 0.04$, $p < .001$), followed by walking ($\beta = 0.03$, $p < .001$), meeting family members ($\beta = 0.02$, $p < .001$) and meeting more than five people ($\beta = 0.01$, $p = .014$). Moreover, among the control variables, pre-pandemic health displayed

Table 2. Regressing stringency on activities while adjusting for covariates and other activities.

	Walking			Shopping			People			Family		
	Coef	SE	*p*	Coef	SE	*p*	Coef	SE	*p*	Coef	SE	*p*
Intercept	−1.34	0.12	<.001	−1.16	0.06	<.001	−0.03	0.07	.675	−0.42	0.05	<.001
Activity:												
Walking	–			0.70	0.02	<.001	0.62	0.02	<.001	0.45	0.02	<.001
Shopping	0.71	0.02	<.001	–			0.41	0.02	<.001	0.41	0.02	<.001
People	0.47	0.03	<.001	0.72	0.02	<.001	–			1.24	0.02	<.001
Family	0.46	0.02	<.001	0.49	0.02	<.001	1.18	0.02	<.001	–		
Covariate:												
Infection rate	−0.10	0.12	.395	0.10	0.05	.053	0.14	0.06	.014	0.07	0.04	.086
Stringency	0.41	0.11	<.001	−0.11	0.05	.030	0.04	0.05	.421	0.00	0.04	.986
Gender	0.09	0.01	<.001	0.32	0.01	<.001	0.05	0.02	.013	0.03	0.02	.050
Age > 70	0.09	0.02	<.001	0.09	0.02	<.001	0.00	0.02	.872	0.12	0.02	<.001
Employed	−0.02	0.02	.252	−0.12	0.02	<.001	−0.47	0.02	<.001	0.08	0.02	<.001
Fair/poor prepand health	−0.33	0.02	<.001	−0.17	0.02	<.001	−0.02	0.02	.518	−0.11	0.02	<.001
Single husehold	0.11	0.02	<.001	−0.16	0.02	<.001	−0.07	0.02	.006	−0.15	0.02	<.001

Table 3. Regressing activities on mental ill-health while adjusting for covariates and other activities.

	Coef	SE	p
Intercept	0.032	0.008	<.001
Activity:			
Walking	0.032	0.003	<.001
Shopping	0.040	0.003	<.001
People	0.010	0.004	.014
Family	0.020	0.004	<.001
Covariates:			
Infection rate	0.026	0.005	<.001
Gender	0.057	0.002	<.001
Age > 70	−0.011	0.003	<.001
Employed	0.008	0.003	.008
Fair/poor prepand health	−0.080	0.003	<.001
Single Household	0.039	0.003	<.001

the strongest association, followed by gender and living in a single household (all $p < .001$). Age and being employed also display statistically significant associations with mental ill-health ($p < .008$). However, these associations are notably weaker ($\beta = -0.01$ and $\beta = 0.01$, respectively).

An additional hypothesis, based on previous research, was that physical activity (walking) and the two social activities (meeting more than 5 people and meeting family members) would predict mental ill-health better than shopping. However, this was not the case. In fact, the two social activities displayed weaker associations compared to walking and shopping. Although walking was more strongly associated with mental ill-health than the two social activities, the association was still somewhat weaker than the corresponding association between shopping and mental ill-health.

Stringency, activity reduction and mental ill-health – mediation results

Our second hypothesis was that activity reductions would act as mediators between stringency and mental ill-health during the COVID-19 pandemic. To investigate this, we run a series of multilevel-mediation models with restrictions as the independent variable, mental ill-health as the dependent variable (outcome) and each of the four activities as separate mediators. Note, of the included activity reductions only walking was formally identified as a mediator.

In the simple (unadjusted) models, with each activity as a separate mediator, we find that only walking of the four activities (partially) mediates the effect of restrictions on mental ill-health. As such, walking explains about 34% of the association between stringency and mental ill-health. The results show a significant total effect of stringency and mental ill-health (tot.eff = 0.016, CI: 0.003–0.028) and a significant mediating effect of walking (med.eff = 0.005, CI: 0.002–0.008). None of the other activities display any meaningful mediating effects (all CIs cover zero) and they explain less than 15% of the association between stringency and mental ill- health, i.e. shopping: 15%, People 1%, and Family <1% (see Appendix Table A4 a-d).

To draw more precise conclusions about the potential mediation role of walking, we now examine a fully adjusted mediation model, which accounts for each activity as well as the explanatory variables used in the previous analysis (see Figure 2 and Appendix Table A5 a-d). The results reveal that stringency continues to show a statistically significant association with mental ill-health (tot.eff = 0.016, CI: 0.006 − 0.025), and a significant indirect effect through reductions in walking (med.eff = 0.004, CI: 0.002 − 0.006). However, the effect moderately attenuates for the fully adjusted model compared to the unadjusted model. Suggesting that the control variables have a modest impact on the relationship between stringency, walking, and mental ill-health.

In sum, we found that reductions in daily activities, particularly walking and shopping, were associated with an increase in mental ill-health among older individuals during the initial phase of the COVID-19 pandemic. Surprisingly, the two social activities examined had relatively weak effects. Moreover, the results of the multilevel-mediation analysis provided partial support for our hypotheses. Walking emerged as a significant mediator in the relationship between governmental restrictions and mental ill-health, while other activities did not demonstrate any significant mediating effects.

General discussion

Prior research has demonstrated that stricter governmental restrictions are associated with a greater reduction in daily activities and increased mental ill-health among older individuals in Europe. However, to our knowledge, no studies have explored the reasons behind this relationship by examining daily activities as potential mediators. In this study, we investigated whether the effects of restrictions on mental ill-health were mediated by a decrease in daily activities during the initial

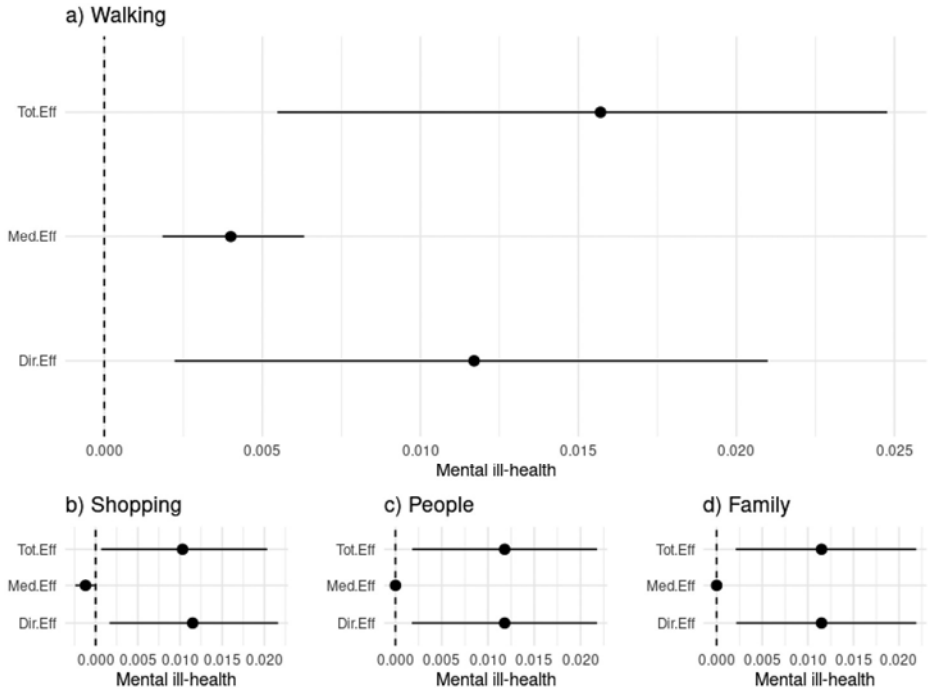

Figure 2. Mediation results from the fully adjusted model. The results are presented as (i) the indirect or mediating (med.Eff) of activity reduction (walking, shopping, people or family) in the association between stringency levels and mental-ill health, (ii) the direct effect (dir.Eff) of stringency levels on mental ill-health while controlling for activity, and (iii) the total effect (tot.Eff) of stringency levels on mental ill-health, corresponding to the sum of the direct and the mediating effect.

phase of the COVID-19 pandemic in Europe. Our findings revealed that self-reported reductions in walking, shopping, and social activities (such as meeting family members and attending social gatherings) were all independently associated with a self-reported increase in mental ill-health among older people in Europe. Furthermore, reductions in walking and shopping exhibited a notably stronger association with increases in mental ill-health compared to reductions in the two social activities.

In examining our primary results, our analysis revealed that a decrease in walking accounted for approximately one-quarter of the relationship between governmental restrictions and self-reported increases in mental ill-health. In contrast, reductions in shopping and social activities exhibited minimal mediating effects. These findings imply that one explanation for the association between restrictions and mental ill-health among older individuals in Europe, as identified in prior research, can be attributed to reductions in walking.

The lack of a mediating effect of shopping and social activities on mental well-being, together with the weak association between reduced social activities and mental health, is partly consistent with findings by Takiguchi et al. (2023). Their research revealed no significant relationship between a decline in leisure activities and depressive symptoms among the elderly in Japan during the first year of the COVID-19 pandemic.

It may still seem surprising that a reduction in social activities only showed a weak correlation with increasing mental health issues among older people in Europe, especially considering that social activities have been identified as crucial determinants of well-being in numerous past studies. Furthermore, previous studies have suggested that reducing social activities can be particularly detrimental to older people because social interactions are highly valued within this group, as reported by Zhaoyang et al., 2019. However, we propose several possible explanations for this result. First, people may have regarded reductions of social activities as a temporary situation during the pandemic, for this reason, it may have had a less effect on their well-being compared to in non-pandemic situations. Second, social cohesion may have been strong during the initial phase of the pandemic which may have given people a sense of connection with other people regardless of whether they actually interacted with other people in real life. Third, our measures of social activities (meeting family members and meeting more than five people) were not exhaustive, for instance, we were not able measure whether the participants reduced meeting their friends or neighbours. Fourth, taking part in social gatherings may be a relatively infrequent activity among older people and for this reason be less important for their well-being. Fifth, and finally, it may be that elderly people in Europe have effectively substituted face-to-face interactions with online communication platforms, such as Zoom. However, Litwin & Levinsky's research (2022) suggests that, throughout the first phase of the pandemic, there was no notable link between the frequency of electronic communication usage and depression levels among the elderly in Europe. In comparison, face-to-face contact appeared to be associated with lower instances of depression during the same period.

Why, then, did shopping and walking exhibit stronger associations with mental ill-health compared to meeting family members and attending social gatherings? One possible explanation is that both shopping and walking are activities performed more frequently, making reductions in these activities more noticeable in people's daily lives. Shopping may not be as enjoyable as socializing with loved ones, but it can still be a frequent and somewhat satisfying activity as indicated by previous studies on emotional well-being (c.f. Killingsworth & Gilbert, 2010). It can, therefore, play a significant role in promoting mental health among older people. In addition, both shopping and walking may often include various forms of social interactions. For instance, many people may have gone for walks with friends and family in countries with high restrictions during the pandemic. Regarding shopping, it is also

possible that the reduction in this activity may have had negative effects on mental health for reasons beyond the enjoyment of the activity itself. For example, individuals might have struggled to obtain goods such as their preferred food and other essential items, which could contribute to negative feelings.

A major strength of the study is the large sample size, inclusion of 26 countries and relatively representative samples in each country. However, we acknowledge several limitations. We were only able to study four different activities due to data limitation, hence other kinds of activities, like meeting friends or neighbors, may also have played an important role on mental health. Further, the relations we found between stringency, activity reduction and mental ill-health could potentially differ for older people in countries other than those included. Moreover, we used somewhat crude self-reported measures of both activity reduction and mental ill-health which may bias observed relationships toward zero. Last, we used a cross-sectional correlational research design. Hence, observed associations between stringency, activity reduction and mental health could potentially be explained by confounding factors (not accounted for in our analysis) or by reversed causality between activity reduction and mental health.

Based on the results of this study, we can derive several potential policy implications for addressing mental health of older individuals during periods of governmental restrictions, such as those imposed during the COVID-19 pandemic. Our findings indicate that a reduction in walking activities mediates a significant portion of the relationship between restrictions and increased mental ill-health among older people in Europe. As a result, policymakers should consider implementing measures that encourage and facilitate walking and other forms of physical activity, even during times of crisis or lockdown. This could include the development of safe outdoor spaces, such as parks and walking trails, as well as public health campaigns promoting the benefits of regular physical activity for mental well-being.

While the reduction of social activities was found to have a weaker association with mental ill-health among older people, it is still essential to consider alternative ways to maintain social connections during periods of restrictions. Policymakers could promote the use of technology for virtual communication, support the organization of safe and socially-distanced community events, or invest in initiatives that target social isolation and loneliness among older adults. However, it is important to take into account that use of digital technologies may actually increase social isolation for some groups of older people (Beaunoyer et al., 2020; Figueroa and Aguilera, 2020).

In light of the stronger association between shopping activities and mental ill-health compared to social activities, it is crucial to ensure that older adults have access to essential services such as grocery stores, pharmacies, and healthcare facilities during times of restrictions. Policymakers should consider implementing measures that enable safe access to these services, such as dedicated shopping hours for older people or delivery services for those unable to leave their homes.

Ultimately, the results of this study highlight the importance of maintaining daily activities, especially walking, for older individuals during periods of restrictions. By implementing targeted policies and interventions, we can help mitigate the negative impacts of such restrictions on mental health and well-being of older adults in Europe and beyond.

Notes

1. In our literature review, we do not draw a distinct line between subjective well-being and mental health, as these two constructs exhibit considerable overlap. This is particularly relevant in our study, as our operationalization of mental ill-health focuses on symptoms of depression and anxiety, which are frequently incorporated into measures of the affective component of subjective well-being.
2. For more information on sampling, monitoring and managing of fieldwork during the SHARE Corona Survey, see Bergmann& Börsch-Supan (2021) and Scherpenzeel et al. (2020).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethics approval

The ethical review board in Sweden has approved SHARE in general (Dnr 2012/373-31) and the specific COVID-19 Project (Dnr 2021-03581), which this study is part of.

Informed consent

Data used in our article involved human subjects who consented to participate in SHARE, see www.share-project.org

Funding

Research in this article is a part of the H2020 SHARE-COVID project (Grant agreement No. 101015924).

Data availability statement

This paper uses data from the Survey of Health, Ageing and Retirement in Europe (SHARE): Wave 8, release version 8.0.0, DOI: 10.6103/SHARE.w8.800 and Wave 8 COVID-19 Survey 1, release version 8.0.0 DOI: 10.6103/SHARE.w8ca.800, https://share-eric.eu/data/.

References

Atzendorf, J., & Gruber, S. (2022). Depression and loneliness of older adults in Europe and Israel after the first wave of covid-19. *European Journal of Ageing*, *19*(4), 849–861. https://doi.org/10.1007/s10433-021-00640-8

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using LME4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Beaunoyer, E., Dupéré, S., & Guitton, M. J. (2020). COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies. *Computers in Human Behavior*, *111*, 106424. https://doi.org/10.1016/j.chb.2020.106424

Bergmann, M., & Bethmann, A. (2021). Sampling for the first SHARE Corona Survey after the suspension of fieldwork in wave 8. In Bergmann, M. & Börsch-Supan, A. (Eds.). (2021). *SHARE Wave 8 Methodology: Collecting cross-national survey data in times of COVID-19*. MEA, Max Planck Institute for Social Law and Social Policy.

Bergmann, M., & Börsch-Supan, A. (2021). *SHARE wave 8 methodology: Collecting cross-national survey data in times of COVID-19*. MEA, Max Planck Institute for Social Law and Social Policy.

Bergstad, C. J., Gamble, A., Hagman, O., Polk, M., Gärling, T., Ettema, D., Friman, M., & Olsson, L. E. (2012). Influences of affect associated with routine out-of-home activities on subjective well-being. *Applied Research in Quality of Life*, *7*(1), 49–62. https://doi.org/10.1007/s11482-011-9143-9

Börsch-Supan, A. (2022). Survey of health, ageing and retirement in Europe (SHARE) wave 8. COVID-19 Survey 1. Release version: 8.0.0. SHARE-ERIC. https://doi.org/10.6103/SHARE.w8ca.800

Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S., & Zuber, S. (2013). Data resource profile: The survey of health, ageing and retirement in Europe (SHARE). *International Journal of Epidemiology*, *42*(4), 992–1001. https://doi.org/10.1093/ije/dyt088

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*(2), 310–357. https://doi.org/10.1037/0033-2909.98.2.310

Cunningham, C., & O' Sullivan, R. (2020). Why physical activity matters for older adults in a time of pandemic. *European Review of Aging and Physical Activity*, *17*(1), 4. https://doi.org/10.1186/s11556-020-00249-3

Diener, E., & Seligman, M. E. (2002). Very happy people. *Psychological Science*, *13*(1), 81–84. https://doi.org/10.1111/1467-9280.00415

Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: Informing development of a conceptual model of health through sport. *The International Journal of Behavioral Nutrition and Physical Activity*, *10*(1), 98. https://doi.org/10.1186/1479-5868-10-98

Fields, E. C., Kensinger, E. A., Garcia, S. M., Ford, J. H., & Cunningham, T. J. (2022). With age comes well-being: Older age associated with lower stress, negative affect, and depression throughout the COVID-19 pandemic. *Aging & Mental Health*, *26*(10), 2071–2079. https://doi.org/10.1080/13607863.2021.2010183

Figueroa, C. A., & Aguilera, A. (2020). The need for a mental health technology revolution in the COVID-19 pandemic. *Frontiers in Psychiatry*, *11*, 523–523. https://doi.org/10.3389/fpsyt.2020.00523

Fors Connolly,. F., Olofsson, J., Malmberg, G., & Stattin, M. (2021). Adjustment of daily activities to restrictions and reported spread of the COVID-19 pandemic across Europe. *Journal of Aging & Social Policy*, 1–23. https://doi.org/10.17617/2.3292885

García-Prado, A., González, P., & Rebollo-Sanz, Y. F. (2022). Lockdown strictness and mental health effects among older populations in Europe. *Economics and Human Biology*, *45*, 101116. https://doi.org/10.1016/j.ehb.2022.101116

Greig, F., Perera, G., Tsamakis, K., Stewart, R., Velayudhan, L., & Mueller, C. (2022). Loneliness in older adult mental health services during the COVID-19 pandemic and before: Associations with disability, functioning and pharmacotherapy. *International Journal of Geriatric Psychiatry*, *37*(1), 1–8. https://doi.org/10.1002/gps.5630

Hale, T., Angrist, N., Goldszmidt, R., Kira, B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas, L., Majumdar, S., & Tatlow, H. (2021). A global panel database of pandemic policies (Oxford COVID-19 government response tracker). *Nature Human Behaviour*, *5*(4), 529–538. https://doi.org/10.1038/s41562-021-01079-8

Hoffman, G. J., Malani, P. N., Solway, E., Kirch, M., Singer, D. C., & Kullgren, J. T. (2022). Changes in activity levels, physical functioning, and fall risk during the COVID-19 pandemic. *Journal of the American Geriatrics Society*, *70*(1), 49–59. https://doi.org/10.1111/jgs.17477

Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science (New York, N.Y.)*, *330*(6006), 932. https://doi.org/10.1126/science.1192439

Knox, L., Karantzas, G. C., Romano, D., Feeney, J. A., & Simpson, J. A. (2022). One year on: What we have learned about the psychological effects of COVID-19 social restrictions: A meta-analysis. *Current Opinion in Psychology*, *46*, 101315. https://doi.org/10.1016/j.copsyc.2022.101315

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Kyriazos, T., Galanakis, M., Karakasidou, E., & Stalikas, A. (2021). Early COVID-19 quarantine: A machine learning approach to model what differentiated the top 25% well-being scorers. *Personality and Individual Differences*, *181*, 110980. https://doi.org/10.1016/j.paid.2021.110980

Leary, M. R., & Baumeister, R. F. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Litwin, H., & Levinsky, M. (2022). Social networks and mental health change in older adults after the Covid-19 outbreak. *Aging & Mental Health*, *26*(5), 925–931. https://doi.org/10.1080/13607863.2021.1902468

Mead, G. E., Morley, W., Campbell, P., Greig, C. A., McMurdo, M., & Lawlor, D. A. (2009). Exercise for depression. *The Cochrane Database of Systematic Reviews*, *3*(3), CD004366. https://doi.org/10.1002/14651858.CD004366.pub4

Mendolia, S., Stavrunova, O., & Yerokhin, O. (2021). Determinants of the community mobility during the COVID-19 epidemic: The role of government regulations and information. *Journal of Economic Behavior & Organization*, *184*, 199–231. https://doi.org/10.1016/j.jebo.2021.01.023

Morgan, C., Burns, T., Fitzpatrick, R., Pinfold, V., & Priebe, S. (2007). Social exclusion and mental health: Conceptual and methodological review. *The British Journal of Psychiatry: The Journal of Mental Science*, *191*(6), 477–483. https://doi.org/10.1192/bjp.bp.106.034942

Paluska, S. A., & Schwenk, T. L. (2000). Physical activity and mental health: Current concepts. *Sports Medicine (Auckland, N.Z.)*, *29*(3), 167–180. https://doi.org/10.2165/00007256-200029030-00003

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, *18*(2), 189–193. https://doi.org/10.1097/00001504-200503000-00013

Radwan, E., Radwan, A., & Radwan, W. (2020). Challenges facing older adults during the COVID-19 outbreak. *European Journal of Environment and Public Health*, *5*(1), em0059. https://doi.org/10.29333/ejeph/8457

Sand, G. (2021). Monitoring and managing SHARE fieldwork in the first Corona Survey. In Bergmann, M. & Börsch-Supan, A. (Eds.) (2021). *SHARE Wave 8 Methodology: Collecting cross-national survey data in times of COVID-19*. MEA, Max Planck Institute for Social Law and Social Policy.

Santamaria, C., Sermi, F., Spyratos, S., Iacus, S. M., Annunziato, A., Tarchi, D., & Vespe, M. (2020). Measuring the impact of COVID-19 confinement measures on human mobility using mobile positioning data. A European regional analysis. *Safety Science*, *132*, 104925. https://doi.org/10.1016/j.ssci.2020.104925

Sarmiento Prieto, J. P., Castro-Correa, C., Arrieta, A., Jerath, M., & Arensburg, S. (2023). Relevance of social capital in preserving subjective well-being in the face of the COVID-19 pandemic. *Risk, Hazards & Crisis in Public Policy*, *14*(2) , 159–178. https://doi.org/10.1002/rhc3.12260

Scherpenzeel, A., Axt, K., Bergmann, M., Douhou, S., Oepen, A., Sand, G., Schuller, K., Stuck, S., Wagner, M., & Börsch-Supan, A. (2020). Collecting survey data among the 50+ population during the COVID-19 pandemic: The survey of health, ageing and retirement in Europe (SHARE). *Survey Research Methods*, *14*(2), 217–221.

Schuch, F. B., Vancampfort, D., Richards, J., Rosenbaum, S., Ward, P. B., & Stubbs, B. (2018). Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *Journal of Psychiatric Research*, *96*, 56–66.

Sepúlveda-Loyola, W., Rodríguez-Sánchez, I., Pérez-Rodriuez, P., Ganz, F., Torralba, R., Oliveira, D. V., & Rodríguez-Mañas, L. (2020). Impact of social isolation due to COVID-19 on health in older people: Mental and physical effects and recommendations. *Journal of Nutrition, Health and Ageing*, *5*(9), e256. https://doi.org/10.1007/s12603-020-1500-7

Takiguchi, Y., Matsui, Mie., Kikutani, M., & Ebina, K. (2023). The relationship between leisure activities and mental health: The impact of resilience and COVID-19. *Applied Psychology. Health and Well-Being*, *15*(1), 133–151. https://doi.org/10.1111/aphw.12394

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior*, *52*(2), 145–161. https://doi.org/10.1177/0022146510395592

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). Mediation: R package for causal mediation analysis.

Tsamakis, K., Tsiptsios, D., Ouranidis, A., Mueller, C., Schizas, D., Terniotis, C., Nikolakakis, N., Tyros, G., Kympouropoulos, S., Lazaris, A., Spandidos, D. A., Smyrnis, N., & Rizos, E. (2021). COVID-19 and its consequences on mental health. *Experimental and Therapeutic Medicine*, *21*(3), 244. https://doi.org/10.3892/etm.2021.9675

Yue, W., & Cowling, M. (2021). The Covid-19 lockdown in the United Kingdom and subjective well-being: Have the self-employed suffered more due to hours and income reductions? *International Small Business Journal: Researching Entrepreneurship*, *39*(2), 93–108. https://doi.org/10.1177/0266242620986763

Zhaoyang, R., Sliwinski, M. J., Martire, L. M., & Smyth, J. M. (2019). Social interactions and physical symptoms in daily life: quality matters for older adults, quantity matters for younger adults. *Psychology & Health*, *34*(7), 867–885. https://doi.org/10.1080/08870446.2019.1579908

Zoch, G., Bächmann, A., & Vicari, B. (2022). Reduced well-being during the COVID-19 pandemic – The role of working conditions. *Gender, Work & Organization*, *29*(6), 1969–1990. https://doi.org/10.1111/gwao.12777