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OBM Geriatrics

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Original Research

The Effects of Control Measures and Social Networks on Depression Among Older People During the SARS-CoV-2 Pandemic

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Academic Editor: Calogero Caruso

Special Issue: Depression in Older Adults

OBM Geriatrics
2022, volume 6, issue 4
doi:10.21926/obm.geriatr.2204217

Received: June 26, 2022
Accepted: December 15, 2022
Published: December 26, 2022

Abstract

This study examined the correlates of change in the depressed state among people aged 65 and older during the SARS-CoV-2 pandemic, particularly the effects of crucial pandemic-related variables. Data were drawn from the longitudinal Survey of Health, Ageing and Retirement in Europe (SHARE), including information obtained from two special pandemic-related telephone interviews (N = 18, 266). The analysis regressed depressed state soon after the outbreak (T1) and again a year later (T2), on four pandemic-related variables (infection status, the stringency of control measures, and two forms of social network contact during the pandemic: face-to-face contact and communication through electronic means), controlling for baseline depression and health, sociodemographic variables, personality traits, and social network characteristics. The main findings were threefold. First, the epidemic-control measures were found to increase the likelihood of a depressed state soon after the pandemic outbreak, but not in the longer run. This data suggests that respondents became more resilient about the pandemic and its effects over time. Second, interpersonal contact utilizing electronic media did not reduce depression rates in the long run and increased depressed state in the short run. Thus, as mandated by epidemic-control policy, the promotion of electronic contact instead of face-to-face contact constituted a mental health

risk factor. Third, face-to-face contact reduced the likelihood of change for the worse in the rate of depression among the respondents. This last finding underscores the need for older people to have close interpersonal contact, even in times of pandemic.

Keywords
Social networks; COVID-19; depression; non-pharmaceutical interventions; personality traits; SHARE

1. Introduction

Published reports indicated that the initial phase of the SARS-CoV-2 outbreak had harmful effects on the mental health of the population [1-4], particularly among older adults [5, 6]. Expanding upon one such study [7], the current inquiry considers both the short-term and long-term impact of the pandemic on depression. We examine, specifically, the effects of social networks on a depressed state shortly after the outbreak and then again, one year later. In addition, we consider the effect of epidemic-control measures that were variously implemented in different countries. Furthermore, we consider the role of personality traits in a post-pandemic depressed state. Thus, the present study adds to the extant knowledge and provides new relevant, and timely results.

1.1 Mental Health During the Pandemic

One key source of pandemic-related adverse mental health has been the implementation in most societies of non-pharmaceutical interventions, or epidemic-control measures, that were intended to limit the spread of the virus [8-10]. The unintended negative consequences of these measures on the mental health of individuals have been the focus of a few studies. For example, a study of adults aged 50 and older in the United States (U.S.) examined several waves of the U.S. Household Pulse Survey, in mid-2020. The data showed that three state containment measures—restaurant closures, bar closures, and stay-at-home orders—were associated with higher levels of depression and anxiety [11]. The study also found, however, that these associations were moderated by living arrangements and by gender. The author of the study concluded that the underlying dynamics of the containment measures may have been harmful to the mental health of older adults.

A study in Korea linked the imposition of quarantine to an increased risk of developing adverse psychological sequelae [12]. The analysis matched a sample of people undergoing SARS-CoV-2-related quarantine with a sample from the 2019 Korea Community Health Survey. Regressions controlling for confounders found that being in quarantine was related to a greater probability of having major depression. The quarantine sample was recruited online, however, and included relatively few older adult participants.

Four studies examined the association between control measures and depression using data from the Survey of Health, Ageing, and Retirement in Europe (SHARE), as well as additional macro data. Two of the studies found that the extent of the stringency of the epidemic control measures in some 25 European countries and Israel was related to an increased prevalence of feelings of sadness/depression [8, 13]. However, a third study based on this same database concluded that the stringency of such non-pharmaceutical interventions showed inconsistent associations with

depression and anxiety [14]. Interestingly, a fourth SHARE-based study found that the epidemic control measures were protective of mental health, or at least neutral [15].

Given the relative paucity of research on this topic thus far, and the mixed results that have emanated from them, we are as yet unable to pose a formal hypothesis about the expected association between the control measures and depression. Therefore, we ask a general research question in the current inquiry: Were epidemic control measures during the SARS-CoV-2 pandemic related to the subsequent experienced depressed state among older Europeans?

1.2 Social Network Ties and Mental Health During the Pandemic

It is well established in the literature that social relationships and/or social networks are related to mental health, in general [16-18], and to depression, in particular [19, 20]. A small but growing literature documents the dynamics of this association in the context of the SARS-CoV-2 pandemic. As in the previous case of epidemic control measures, however, the findings from this line of research are not consistent.

To illustrate, a randomized control trial of 155 adults aged 75 and older in Detroit and Portland sought to clarify the effect of social contacts on low mood, defined as feeling blue for three days or more in the previous week [21]. The investigators collected data on the contacts maintained before and during the current pandemic. The results indicated that in-person contact was related to less low mood, independent of the effect of the pandemic. But increased contact via calls and writing (e.g., email) during the pandemic did reduce the likelihood of feeling blue.

A study of adults aged 55-75, used data drawn from the English Longitudinal Study of Ageing to examine the association between Internet use and quality of life in mid-2020 [22], a period when epidemic control measures were enacted. The analysis found that increased use of the Internet was related to fewer depressive symptoms and greater quality of life. In particular, those who cited using the Internet for communication purposes (as opposed to information seeking, for example) obtained higher scores on a quality-of-life index.

Different results emerged from a study using the SHARE data [7]. That analysis examined the respective effects of face-to-face contact and electronic contact (e.g., video chats, etc.) on post-outbreak mental health change, controlling for a range of confounders. It was found that face-to-face contact with one's social ties, during the initial period of the pandemic, despite the epidemic control measures that were in force, reduced changes for the worse in depressed state and anxiety. In contrast, electronic contacts in this same period increased changes for the worse in these same mental health outcomes.

Based on these mixed findings, the current inquiry examines two research questions. First, we ask whether face-to-face contact with one's social network ties during the pandemic was related to the subsequent experienced depressed state. Second, we query whether electronic contacts with one's social network ties were similarly related to the experienced depressed state after the outbreak.

1.3 Personality Traits and Pandemic-Related Depressed State

Research substantiates the association that exists between the Big-5 personality traits (openness, conscientiousness, extraversion, agreeableness, and neuroticism) among older adults, on the one hand, and depression, on the other hand [23, 24]. Neuroticism is generally found to be associated

with a greater depressed state [25] while the other four personality traits are related, to varying degrees, to a lesser depressed state [26]. Whether these same associations were upheld during the SARS-CoV-2 pandemic, however, is yet to be determined. A few recent works have addressed this topic.

For example, a study of 502 people aged 20-77 in the U.S. examined personality traits and depression (among other topics) during the pandemic [27]. The analysis confirmed openness, conscientiousness, extraversion, and agreeableness were negatively correlated with depressive symptoms, while neuroticism was positively correlated. It must be noted, however, that the Internet-recruited sample in this study was not fully representative of the larger population, as it included mainly young adults. Moreover, it was cross-sectional.

A larger longitudinal study of adults aged 23-93 in the U.K., before and during the pandemic, examined the associations between personality traits and mental health deterioration, as measured by the General Health Questionnaire-12 [28]. The analysis found greater deterioration during the pandemic among those having greater extraversion and openness, and less deterioration among those with greater agreeableness. Neuroticism predicted worse mental health cross-sectionally, but it was unrelated to greater deterioration after the outbreak.

Another online survey, this time in Germany, examined a sample of persons aged 18-88 [29]. The study found that facets of three personality traits—neuroticism, extraversion, and openness—were strong predictors of psychological outcomes after considering sociodemographic variables. The authors suggest that the pandemic's mental health consequences "depend upon personality". Given the varied findings in this area from the literature, the current analysis controls for personality traits as potential confounders.

1.4 Sociodemographic Background, Health, and Pandemic-Related Depressed State

Age, gender, socioeconomic status, marital status, and health status in late life have all been found to be related to a depressed state in a wide range of studies [30-33]. Several of these same variables have been reported to be correlated with depression outcomes during the SARS-CoV-2 pandemic as well. For example, age [14], gender [11, 34], economic status, [35] and marital status [11, 34] were all variously related to post-outbreak depression in the studies cited. Health or disability was similarly related [36]. Consequently, these background and health variables are also controlled in the present study.

2. Materials and Methods

Our study examined changes in depressive status among older adults at two points during the SARS-CoV-2 pandemic. Data for the analyses were drawn from the SHARE survey, a biennial panel of adults aged 50 and over, and their spouses of any age, in 27 European countries and Israel [37]. In response to the SARS-CoV-2 outbreak in Europe, the SHARE survey team designed two supplemental rounds of telephone interviews among the members of its panel sample [38]. They were administered shortly after the initial outbreak (June 4–August 14, 2020), and then one year or more into the pandemic, (June 4–August 14, 2021). The interview lasted about 30 minutes. Respondents received explanations, at the outset, and assurances of anonymity. Data from the telephone surveys, (SHARE-Corona1 and SHARE-Corona2), combined with data from previous waves from SHARE provided the empirical basis for the present inquiry.

2.1 Sample

Our analysis concentrated on people who were aged 65 and older in the eighth wave of the SHARE panel (from October 2019 to March 2020). Baseline socio-demographic, health, and depressive-state measures were drawn from Wave 8 of the survey (Release 8.0.0.), as were the baseline social network variables. Personality traits were retrieved from SHARE Wave 7 (2017), the only wave for which such data were collected from the SHARE panel. The pandemic-related variables were taken from the first and second SHARE Corona Surveys (2020 and 2021; Release 8.0.0.). Finally, depressive-state indicators retrieved from the first and second SHARE Corona Surveys served as the outcome variables in the current analysis.

The sample was limited to respondents who had all the requisite data. It numbered some 18,266 men and women from 26 SHARE member countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, and Switzerland. Comparing the study sample with those who were not included revealed that the excluded panel members were a bit older, less educated, and more disabled. There were also more men in this group. We comment on these differences in the Discussion.

2.2 Variables

The principle aim of the present study was to examine the effect of pandemic-related social network variables and governmental epidemic control measures on depressed states among older people during the SARS-CoV-2 pandemic. The two SHARE Corona questionnaires each measured a self-diagnosed depressed state through a single item taken from the Euro-D Depression scale [39]. The probe asked: ‘In the last month, have you been sad or depressed? If the respondent asked for further clarification, the interviewer was instructed to say: 'by sad or depressed, we mean miserable, in low spirits, or blue'. The dichotomous response was re-coded in the present analysis as 0 = no, 1 = yes. Parallel pre-pandemic data on the depressed state, drawn from SHARE Wave 8, was entered as a baseline measure in the respective regression analyses. Therefore, the depression outcome in the current inquiry was essentially a measure of change in the depressed state at two points in time, very soon after the outbreak, and then again later during the pandemic.

The first pandemic-specific variable addressed was whether or not the respondent tested positive for the virus at each of the post-outbreak data collection points. The probe read “Have you or anyone close to you been tested for the Coronavirus and the result was positive, meaning that the person had the COVID disease?” In the present analysis, we utilized the response of the respondent only, regarding his or her infection status.

Two pandemic-specific network variables addressed the nature and extent of social ties that were maintained during the pandemic. We took into account both in-person social network contact and communication using electronic media, for example, video chats. Such electronic communication was the only means of interpersonal contact that was officially allowed, according to the requirements of social distancing that were enforced periodically in most countries at that time.

In-person contact was probed through the following query, ‘Since the outbreak of Corona, how often did you have personal contact, that is, face to face, with the following people from outside your home?’ (re-coded on a scale that ranged from 1 = never, to 5 = daily). The question was asked

separately about one's children, own parents, other relatives, and other non-relatives (that is, neighbors, friends, or colleagues). A corresponding set of questions asked about the frequency of 'contact by phone, email, or any other electronic means, with the same set of relationship categories and the same frequency options. For the present analysis, we calculated two composite pandemic-related network scores: 1) face-to-face contact and 2) electronic contact. Each such score was calculated as the overall mean of the respective contacts with each relationship category (1.00–5.00). Among respondents who had partial missing data, for example, those without children, we averaged only the frequencies of the reported relationship categories. The scores were recoded such that a higher score in each variable reflected more frequent contact. These pandemic-related network scores were calculated twice, once following the outbreak of the SARS-CoV-2 pandemic, and once about a year later.

Governmental epidemic control measures were taken into account utilizing the COVID-19 Government Response Stringency Index from the Oxford Coronavirus Government Response Tracker [40]. The index is a daily measure calculated based on nine response indicators (e.g., limits on gatherings, orders to shelter-in-place, and travel bans), on a scale that ranges from zero to 100; the higher the score, the stricter the extent of the epidemic controls in each country. In the current analysis, we calculated two separate country-level stringency variables. The first variable reflected the immediate post-outbreak period. Toward this end, we calculated the mean score of the stringency index by the country for the period that extended from March 1, 2020, to August 14th, 2020, the date that the interviews in the first SHARE Corona Survey ended. A similar method was employed by Voss et al, (2021). The second such variable measured the same for the corresponding period, one year later, namely, from March 1, 2021, to August 14th, 2021, the end of the second SHARE Corona Survey.

Pre-pandemic baseline confounders were also considered in the present analysis. They included: sociodemographic characteristics, a health measure, personality traits, and personal social network characteristics. Among the five sociodemographic variables, age was an interval variable, while gender (male = 0; female = 1) and marital status (no live-in partner = 0, live-in partner = 1) were dichotomous measures. Economic status was measured on a scale of 1-4, reflecting the respondents' perceived ability to make ends meet; the higher the score, the better one's financial capacity [41]. Education was coded using the SHARE-generated variable of the Internal Standard Classification of Education 1997 (ISCED97), (0–6). For the health variable, we used the number of reported difficulties in performing basic tasks of mobility and fine motor function (0–10). The higher the score on this variable, the worse one's health. All of these control variables were retrieved from SHARE Wave 8.

The personality traits were tapped using the brief version of the Big-Five Inventory that was implemented by SHARE in Wave 7 (2017). As noted in the Introduction, the five basic traits are (1) openness, (2) conscientiousness, (3) extraversion, (4) agreeableness, and (5) neuroticism. The questionnaire is composed of ten items that include two statements, one positive and one negative, for each of the five personality traits. The BFI-10 has obtained acceptable reliability in previous studies [42].

An example of the positively worded indicator of neuroticism is "I see myself as someone who gets nervous easily." The corresponding negative indicator of neuroticism is "I see myself as someone relaxed, and handles stress well." Respondents indicated the degree to which they agreed with each statement on a 5-point scale. SHARE has generated five corresponding personality trait

variables; the score on each such variable is the mean of the pair of respective items (one of which in each pair is reverse-coded). Test results for the pooled sample in SHARE revealed a strong congruency (c = 0.94) between the idealized Big-Five structure and the actual scores [43].

Finally, the baseline pre-pandemic personal social network was addressed utilizing a name generator that is employed in SHARE [44]. The tool asks respondents to cite up to six people with whom they discussed matters of importance in the past 12 months, and a seventh person who may have been important for any other reason. The number of persons cited is capped at seven. These "confidants" are considered to constitute the most intimate social ties that one maintains, (as opposed to the more general social contacts that one may have, such as with the cashier at the supermarket or a casual neighbor). SHARE adopted this approach to network delineation based upon the implementation of a similar name-generated inventory that was employed in the National Social life, Health, and Aging Project in the U.S. [45]. The inventory solicits additional relevant information on each cited confidant, as is explained in the next paragraph.

The additional data included the following information for each named confidant: contact frequency (a scale from 1 = never, to 7 = daily), the extent of emotional closeness (a scale from 1 = not very close, to 4 = extremely close), and geographic proximity (a scale from 1 = more than 500 kilometers away, to 8 = in the same household). Also, a global measure of satisfaction with one's social network or lack thereof, (it included those with no reported confidants), was tapped on a scale from 0-10, on which a higher score indicates greater satisfaction. As for contact frequency, respondents with no cited confidants were assigned the lowest score—one (never). From these data, we generated five measures of personal social network for use in the present study: network size (0-7), maximum contact frequency (0-7), maximum emotional closeness (0-4), greatest proximity (0-8), and network satisfaction (0-10).

2.3 Analysis

First, we performed univariate descriptions of the variables that were addressed in the current sample. Then, we examined the bivariate associations between the study variables and the dichotomous outcome measure—depressed state, using unadjusted logistic regressions. The logistic regressions present the odds ratios (OR). The depression outcome was regressed at two points: T1—soon after the outbreak of the pandemic, in 2020, and T2—about one year later.

In the main part of the analysis, we executed adjusted multivariate logistic regressions of the depression measure. In the first such procedure, we regressed the depressed state at T1 on the study variables, controlling for the baseline (pre-pandemic) depressed state. The results of that regression reflect, therefore, the predictors of change in a depressed state just after the initial outbreak of the pandemic. In the second multivariate procedure, we regressed the depressed state at T2 on the study variables, controlling for depression at baseline and T1. The results of the second regression, thus, reflect the predictors of change in a depressed state well into the course of the pandemic, after the stress of the initial outbreak had passed.

2.4 Ethics Statement

The Ethics Council of the Max Planck Society "confirmed the project to be compliant with relevant legal, especially statutory norms, as well as with research-ethical guidelines, e.g., the set of ethical principles regarding human experimentation developed for the medical community by the World

Medical Association." The full statement may be read at: (http://www.share-project.org/fileadmin/pdf_documentation/SHARE_ethics_approvals.pdf).

3. Results

3.1 Univariate Descriptions

Women constituted a majority of the respondents in the current study sample, some 58 percent (see Table 1). The average age was 74 years (see Table 2). Mean education was at the secondary school level. The average respondent in the sample managed pretty well, financially. Close to two-thirds of respondents had a live-in partner. Disability level was low, less than two on average. About 40 percent of respondents indicated that they had felt depressed in the previous month, in the period before the outbreak of SARS-CoV-2.

Table 1 Europeans aged 65+: Univariate description of categorical study variables (N = 18, 266).

VARIABLES		N	%
Baseline			
Depressed (W8)	No	11,046	60.47
	Yes	7,220	39.53
Gender	Men	7,609	41.66
	Women	10,657	58.34
Country	Austria	792	4.34
	Belgium	934	5.11
	Bulgaria	337	1.84
	Croatia	572	3.13
	Cyprus	211	1.16
	Czech Republic	1,103	6.04
	Denmark	713	3.90
	Estonia	1,540	8.43
	Finland	539	2.95
	France	935	5.12
	Germany	1,030	5.64
	Greece	1,165	6.38
	Hungary	271	1.48
	Israel	393	2.15
	Italy	1,028	5.63
	Latvia	368	2.01
	Lithuania	571	3.13
	Luxembourg	327	1.79
	Malta	337	1.84
	Poland	807	4.42
	Romania	568	3.11
	Slovakia	331	1.81

	Slovenia	1,200	6.57
	Spain	610	3.34
	Sweden	555	3.04
	Switzerland	1,029	5.63
Marital status	No live-in partner	6,103	35.56
	Live-in partner	11,060	64.44
Pandemic-related variables			
Depressed (T1)	No	13,662	74.79
	Yes	4,604	25.21
Depressed (T2)	No	12,661	69.31
	Yes	5,605	30.69
Infected			
T1	No	18,202	99.65
	Yes	64	0.35
T2	No	17,333	94.89
	Yes	933	5.11

Table 2 Univariate description of ordinal and count variables.

VARIABLES	Mean	SD	Range
Baseline			
Age	74.24	6.66	65-103
Education	2.95	1.44	0-6
Financial capacity	2.81	0.98	1-4
Mobility limitations	1.86	2.39	0-10
Personality traits			
Openness	3.33	0.94	1-5
Conscientiousness	4.14	0.79	1-5
Extraversion	3.50	0.93	1-5
Agreeableness	3.68	0.82	1-5
Neuroticism	2.64	1.02	1-5
Social network (W8)			
Size	2.69	1.62	0-7
Satisfaction	8.79	1.84	0-10
Emotional closeness	3.46	0.81	0-4
Contact Frequency	6.56	1.24	0-7
Proximity	6.77	1.91	0-8
Pandemic-related variables			
Social network			
Face-to-face contact T1	2.25	0.82	1-5
Electronic contact T1	3.18	0.86	1-5
Face-to-face contact T2	2.70	0.77	1-5
Electronic contact T2	3.14	0.87	1-5
Stringency index			

T1	60.37	7.33	47.69-75.08
T2	55.82	9.02	42.74-71.01

Table 2 reveals that the most frequently reported personality trait was conscientiousness, followed by agreeableness and extraversion, respectively. Neuroticism was the least noted trait. The pre-pandemic personal social network numbered close to three confidants, on average. Satisfaction with the network was high, as was maximum emotional closeness. The greatest extent of contact with the network was high, as was proximity.

Turning to the pandemic-related variables, we see in Table 1 that a depressed state was reported by only a quarter of the sample at T1. The frequency of those feeling depressed rose to almost 31 percent at T2, but it was still lower than in the pre-pandemic measurement among the same respondents. Regarding infection, we note that only a handful of respondents reported that they had tested positive for the virus in T1. However, the percentage of those testing positive at T2 rose to some five percent of the sample.

As for the other pandemic-related network variables, Table 2 shows that at T1, electronic contact with one's social network was more frequent than face-to-face contact. This trend continued at T2, although the relative frequency of face-to-face contact had risen somewhat by then. The table also shows that the stringency index at T1 was a bit greater than at T2.

3.2 Bivariate Associations with Post-Outbreak Depressed State

The unadjusted bivariate regressions revealed that all the study variables were significantly related to the depressed state at T1 (see Table 3). Older respondents, women, and those with more mobility limitations had a higher likelihood of feeling depressed. Those who were more highly educated, better well-off financially, and partnered were less likely to feel depressed. Baseline depression correlated highly with a depressed state at T1. All the personality variables were significant—neuroticism positively so, and all the rest negatively. In addition, all the background social network characteristics, except for size, were negatively related to depression at T1.

Table 3 Baseline and pandemic-related correlates of depression change among Europeans aged 65+ during the Covid-19 pandemic: Unadjusted logistic regressions.

	Depressed [a] T1			T2		
	OR	(SE)	[95% CI]	OR	(SE)	[95% CI]
VARIABLES						
Baseline						
Depressed (W8) [a]	4.174***	(0.150)	[3.889 -4.479]	3.996***	(0.135)	[3.740 -4.270]
Age	1.029***	(0.003)	[1.024 -1.034]	1.035***	(0.002)	[1.030 -1.039]
Gender (F) [a]	2.241***	(0.083)	[2.084 -2.410]	2.065***	(0.071)	[1.931 -2.208]
Education	0.856***	(0.010)	[0.836 -0.876]	0.870***	(0.010)	[0.851 -0.890]
Financial capacity	0.740***	(0.013)	[0.716 -0.766]	0.728***	(0.012)	[0.705 -0.752]
Marital status [a]	0.623***	(0.022)	[0.582 -0.667]	0.622***	(0.020)	[0.583 -0.664]
Mobility limitations	1.231***	(0.008)	[1.214 -1.247]	1.243***	(0.008)	[1.226 -1.259]
Personality traits						

Openness	0.963*	(0.017)	[0.930 -0.998]	0.954**	(0.016)	[0.923 -0.986]
Conscientiousness	0.912***	(0.019)	[0.875 -0.951]	0.872***	(0.018)	[0.838 -0.907]
Extraversion	0.865***	(0.016)	[0.834 -0.896]	0.847***	(0.015)	[0.819 -0.877]
Agreeableness	0.892***	(0.018)	[0.857 -0.929]	0.858***	(0.017)	[0.826 -0.891]
Neuroticism	1.550***	(0.027)	[1.499 -1.603]	1.518***	(0.025)	[1.471 -1.568]
Social network (W8)						
Size	0.998	(0.011)	[0.977 -1.019]	0.971**	(0.010)	[0.952 -0.990]
Satisfaction	0.941***	(0.008)	[0.925 -0.957]	0.942***	(0.008)	[0.927 -0.958]
Emotional closeness	0.892***	(0.018)	[0.858 -0.928]	0.904***	(0.017)	[0.870 -0.938]
Contact Frequency	0.934***	(0.012)	[0.911 -0.958]	0.943***	(0.012)	[0.920 -0.966]
Proximity	0.911***	(0.008)	[0.896 -0.926]	0.917***	(0.007)	[0.902 -0.931]
Pandemic-related variables						
Depressed (T1) [a]				5.983***	(0.221)	[5.566 -6.431]
Infected						
T1	2.629***	(0.660)	[1.607 -4.300]	1.548^{+}	(0.395)	[0.939 -2.552]
T2				1.251**	(0.088)	[1.090 -1.436]
Social network						
Face-to-face contact T1	0.902***	(0.019)	[0.865 -0.940]			
Electronic contact T1	1.071***	(0.021)	[1.030 -1.114]			
Face-to-face contact T2				0.881***	(0.018)	[0.846 -0.918]
Electronic contact T2				0.989	(0.018)	[0.954 -1.025]
Stringency index						
T1	1.020***	(0.002)	[1.015 -1.025]			
T2				1.000	(0.002)	[0.997 -1.004]

*** p < 0.001, ** p < 0.01, * p < 0.05, $^{+}$p < 0.1

[a]Reference categories: depressed (depressed); gender (women); marital status (partner in the household).

Among the pandemic-related variables, infection, electronic contact and the stringency of the control measures all increased the likelihood of feeling depressed at T1. Face-to-face contact, in contrast, reduced depression.

At T2, all the baseline variables were significant. Moreover, having been infected at T1, electronic contact at T2, and stringency at T2 were unrelated to the depressed-state outcome at T2. However, infection at T2 was, indeed, related to the depression outcome. Finally, depression at T1 was the strongest bivariate predictor of a depressed state at T2.

3.3 Multivariate Analysis

Table 4 presents the results of the logistic regressions. In the column marked T1, a dichotomous variable reflecting a depressed state shortly after the outbreak of the pandemic was regressed on the study variables. Looking at the baseline control variables we see, first, that those who were depressed at baseline were three times more likely to be depressed following the outbreak of the pandemic. In addition, the variables of age, female gender, and mobility disability were all predictors of a greater likelihood of depression at T1, while higher education and better financial capacity predicted a lower likelihood. As for the personality traits, neurotic respondents were more likely to be depressed and extraverts were less likely. Regarding the baseline social network ties, the table shows that the larger one's social network before the pandemic, the greater the likelihood of depression soon after the outbreak. In contrast, the greater one's satisfaction with the pre-pandemic social network and the closer one's proximity to it, the lower the likelihood of feeling depressed.

Table 4 Baseline and pandemic-related correlates of depression change among Europeans aged 65+ during the Covid-19 pandemic: Adjusted logistic regressions.

	Depressed [a]					
	T1			T2		
	OR	(SE)	[95% CI]	OR	(SE)	[95% CI]
VARIABLES						
Baseline						
Depressed (W8) [a]	3.040***	(0.117)	[2.820 - 3.277]	2.355***	(0.089)	[2.187 - 2.537]
Age	1.009**	(0.003)	[1.003 - 1.015]	1.015***	(0.003)	[1.009 - 1.020]
Gender (F) [a]	1.525***	(0.065)	[1.402 - 1.658]	1.348***	(0.056)	[1.242 - 1.462]
Education	0.967*	(0.014)	[0.940 - 0.994]	0.989	(0.014)	[0.962 - 1.017]
Financial capacity	0.894***	(0.018)	[0.859 - 0.931]	0.878***	(0.018)	[0.844 - 0.914]
Marital status [a]	0.963	(0.047)	[0.875 - 1.060]	0.973	(0.047)	[0.885 - 1.070]
Mobility limitations	1.120***	(0.009)	[1.103 - 1.138]	1.100***	(0.009)	[1.083 - 1.117]
Personality traits						
Openness	1.023	(0.021)	[0.982 - 1.065]	1.006	(0.020)	[0.967 - 1.046]
Conscientiousness	0.990	(0.024)	[0.944 - 1.038]	0.956+	(0.023)	[0.913 - 1.001]
Extraversion	0.956*	(0.020)	[0.917 - 0.997]	0.944**	(0.020)	[0.906 - 0.983]
Agreeableness	0.973	(0.023)	[0.929 - 1.018]	0.936**	(0.022)	[0.895 - 0.980]

Neuroticism	1.319***	(0.026)	[1.270 - 1.371]	1.214***	(0.023)	[1.169 - 1.261]
Social network (W8)						
Size	1.026*	(0.013)	[1.001 - 1.052]	0.987	(0.012)	[0.963 - 1.012]
Satisfaction	0.976	(0.015)	[0.947 - 1.006]	0.971+	(0.015)	[0.943 - 1.000]
Emotional closeness	1.026	(0.036)	[0.958 - 1.098]	1.056	(0.036)	[0.987 - 1.129]
Contact Frequency	1.031	(0.030)	[0.974 - 1.091]	1.044	(0.030)	[0.986 - 1.104]
Proximity	0.950**	(0.016)	[0.919 - 0.981]	0.967*	(0.016)	[0.936 - 0.999]
Pandemic-related variables						
Depressed (T1) [a]				3.743***	(0.149)	[3.461 - 4.047]
Infected						
T1	2.635***	(0.730)	[1.531 - 4.536]	1.055	(0.309)	[0.594 - 1.873]
T2				1.297**	(0.104)	[1.109 - 1.516]
Social network						
Face-to-face contact T1	0.897***	(0.021)	[0.857 - 0.939]			
Electronic contact T1	1.041+	(0.023)	[0.996 - 1.088]			
Face-to-face contact T2				0.977	(0.022)	[0.935 - 1.021]
Electronic contact T2				0.999	(0.002)	[0.995 - 1.003]
Stringency index						
T1	1.018***	(0.003)	[1.013 - 1.023]			
T2				0.999	(0.002)	[0.995 - 1.003]
Observations	18,266			18,266		
pseudo-R-squared	0.135			0.180		

*** p < 0.001, ** p < 0.01, * p < 0.05, +p < 0.1

a Reference categories: depressed (depressed); gender (women); marital status (partner in the household).

Turning to the pandemic-related predictors of a depressed state at T1, we see in Table 4 that those who tested positive were more than two and a half times more likely to be depressed soon

after the outbreak. The pandemic-specific network variables showed mixed trends. That is, greater face-to-face contact with one's social network lowered the likelihood of being depressed, while greater electronic contact increased the likelihood, albeit marginally.

Epidemic control measures had a positive association with the depression outcome at T1, meaning that the more stringent the measures were, the greater the likelihood of being depressed.

The column closest to the right side of the table shows the results of the logistic regression at T2. Here too, we see that baseline depression predicted depressed state more than a year into the pandemic, showing a more than two times greater likelihood. However, feeling depressed at T1 was an even stronger predictor of T2 depression, revealing an almost four times greater likelihood.

We note that at T2, all the baseline sociodemographic variables maintained the associations that were observed in T1, except for education which became non-significant. The personality traits also maintained the associations seen at T1, with the addition of the traits of agreeableness and, to a lesser degree, conscientiousness. That is, those who were more agreeable and/or more conscientious at baseline had a lesser probability of being depressed at T2. In contrast, the baseline social network variables lost their prior significance, except for the proximity variable which showed a negative association—the greater the proximity, the lesser the likelihood of experiencing depressed state at T2. Satisfaction with the network also showed a marginal negative association with T2's depressed state.

As for post-outbreak infection status, the table shows that infection at T1 did not predict depression at T2, but infection at T2 did. That is, respondents who tested positive shortly before T2 were almost a third more likely to feel depressed at the second data collection point. In addition, face-to-face contact with one's network at T2 predicted a lower probability of feeling depressed at T2, continuing the trend found at T1. However, electronic contact at T2 was not significant. Finally, the stringency scale of epidemic-control measures also lost its significance at T2.

4. Discussion

This study examined the effect of pandemic-related social network variables and governmental epidemic control measures on change in the depressed state among older people during the SARS-CoV-2 pandemic, taking into account several possible confounders that included sociodemographic background, health, personality, and pre-pandemic social network characteristics. Data were drawn from the SHARE panel and two supplemental telephone surveys that were administered shortly after the outbreak of the pandemic and then again, about one year later. First of note is that the percentage of those feeling depressed dropped significantly just after the outbreak, in comparison to the pre-pandemic data.

It could be that during a major crisis, like a pandemic, people are concerned more with the difficulties around them rather than with their own personal problems [7, 46]. However, the different rates of pre-pandemic and post-outbreak depression that were observed here might also stem from the nature of the respective questionnaires. The baseline data were gathered face-to-face, while the post-outbreak interview was carried out by telephone. The latter format might less encourage the disclosure of deep emotional feelings [47]. We note, also, that the rate of reported depression increased a bit a year into the pandemic, suggesting that the respondents may have gotten used to the pandemic situation and, hence, were able to focus once again on their personal woes.

Our first research question queried whether epidemic control measures during the SARS-CoV-2 pandemic were related to the subsequent experienced depressed state among older Europeans. The multivariate analysis showed a significant odds ratio at T1 for the stringency index, the scale that measured the extent of control measures that were enacted in each country. For every additional point of stringency (on a scale of 0-100), there was a 2 percent greater likelihood of feeling depressed, after controlling for the effects of all the other study variables. Thus, for the initial period that followed the outbreak, epidemic control measures were, indeed, risk factors for a depressed state.

This association was not upheld, however, about a year later. The multivariate regression results in the current analysis showed that stringency at T2 was unrelated to the depression outcome at T2, all things considered. (This finding was evident in the earlier bivariate analysis as well). What accounts for this discrepancy?

A published review of recent literature on the topic concludes that people may have become more resilient over time, as the pandemic continued [48]. This observation has backing from a few empirical studies as well. An analysis of Spanish community-dwelling older adults found, for example, that three and nine months after the lockdown, the respondents did not evidence higher emotional distress than during the lockdown [49]. Also, a study of adults aged 60 and older in the U.S. found that the respondents did not report greater psychological distress despite prolonged social distancing [50]. Finally, a study of the German older population similarly found resilience against the pandemic [51].

Our second and third research questions related to the two pandemic-related social relationship variables that were examined in the present analysis. The second question asked whether face-to-face contact with one's social network ties during the pandemic was related to a subsequent depressed state, while the third question asked the same concerning contacts through electronic means. Our analysis revealed that face-to-face contact reduced change for the worse in the depressed state at T1, as has been reported elsewhere [23], but also at T2, that is, over time. In contrast, electronic contact increased change for the worse in the depressed state at T1, albeit marginally, and it was unrelated to the depression outcome at T2.

These findings are significant because, ostensibly, face-to-face contact with one's social network was officially limited during the pandemic due to the implementation of social distancing. It seems, therefore, that those who abided less by the rules of lockdown were better off emotionally, in both the shorter and the longer run. The findings concerning electronic contact, on the other hand, are no less dramatic. Contact with one's close social ties through electronic means was widely promoted during the pandemic as the preferred means for keeping in touch. The results of this analysis show, however, that such contacts did not help reduce depression in the long run, and they may have even been detrimental in the short run.

Turning to the other variables in the analysis, we found that testing positive for the virus was predictive of a worse depressed state, but this was evident only in the short run. Specifically, infection at T1 was found to be unrelated to depression at T2. This finding adds further support to the resiliency hypothesis that was raised earlier. However, the small number of those testing positive at T1 in the current sample may have affected the result. Further research on this association is warranted.

As for the control variables, we discuss first the results concerning the personality traits. Our analysis confirmed that personality characteristics affect change in a depressed state during times

of pandemic. The present findings showed that neuroticism increased the likelihood of change for the worse in a depressed state, both in the short run and in the long run. Extraversion had the reverse effect, all things considered. Two additional personality traits decreased the likelihood of depression at T2 only: agreeableness and conscientiousness (and the latter only marginally so).

These findings are supported by those from a survey of some one thousand Canadian adults during the pandemic [52]. That study similarly found that neuroticism related negatively to mental health while extraversion related positively. Other studies report that neuroticism and extraversion variously moderated other variables that were related to mental health, anxiety, or stress [53-55]. Thus, although only addressed as control variables in the present study, our findings nevertheless underscore the importance of paying attention to personality traits in times of crisis, such as that caused by the SARS-CoV-2 pandemic. Further study in this area should have relevance for the treatment of depression in difficult times.

We note also that the baseline social network variables were only partially significant, after taking the other variables into account. Curiously, network size was related at T1 to a greater likelihood of change for the worse in the depressed state. This could be due to the initial epidemic control measures that limited interpersonal contact. The larger one's pre-pandemic social network, the more the close social ties that people were prevented (at least officially) from seeing close up. This may explain this particular finding. It also corresponds to the other significant baseline social network association with T1 depression, namely, the negative association of proximity. The closer the social network was geographically before the outbreak, the greater the facility of meeting with them after the outbreak and the lesser the change for the worse in the post-outbreak depressed state.

The proximity variable was also negative at T2, underscoring the importance of accessibility to one's confidants for one's mental health. The only other social network variable to show a significant association with the T2 depression outcome (and only marginally so) was satisfaction with one's social network; the greater the satisfaction, the less the likelihood of becoming depressed. The lack of additional associations between baseline social network characteristics and post-pandemic depression may be due to the simultaneous effects of the pandemic-related social network variables in the analysis.

A word should be said here about the lack of association between marital status (partner in the household) and the depression outcome in the multivariate analysis. The two variables were strongly related at the bivariate level. However, the negative effect of having a partner on feeling depressed in the bivariate analysis was captured by the proximity variable in the multivariate regression, insofar as the spouse or partner is generally the most proximate member of the social networks of older people.

Finally, we note that the other sociodemographic and health variables behaved in the current analysis as has been generally reported in the literature. The background risk factors for a depressed state are, thus, present in times of pandemic as well and should be addressed accordingly by policy planners and treatment professionals. We note, particularly, the risk that is presented by having experienced prior depression, whether before the outbreak or after it. Preventing mental health deterioration requires, therefore, keeping accurate records of mental health history and identifying those most at risk for a change for the worse in a depressed state, during times of pandemic.

A limitation of the present study was its use of a single self-diagnosed measure of a depressed state, rather than having a more complex depression assessment tool to consider. The inclusion of

this particular measure in the two SHARE Corona Surveys stemmed from the time constraints that were necessitated by the telephone-based interviews. A second limitation was that the analytical sample differed from the larger SHARE sample on a few sociodemographic background variables. Thus, the analytic sample did not fully represent the older populations in Europe and Israel. In studies of older adults, those who drop out over time are frequently more vulnerable [56]. However, this shortcoming in the current analysis was offset by the advantages of having a very large cross-country sample of the older population, pre-pandemic baseline data, and unique pandemic-related post-outbreak measures collected over time during the SARS-CoV-2 pandemic.

5. Conclusions

The key conclusions of the current inquiry are threefold. First, it appears that epidemic-control measures increased the likelihood of a depressed state among older Europeans soon after the outbreak of the pandemic, but this effect was not apparent in the longer run. Instead, respondents seemed to have become more resilient with the pandemic and its effects with time.

Second, interpersonal contact through electronic media, such as video chats and so on, did not reduce depression rates among the members of the study sample, in the long run. Moreover, such communication increased the depressed state in the period soon after the outbreak. This finding implies that even if deemed necessary to prevent the spread of the virus, the promotion of electronic contact instead of face-to-face contact constituted a mental health risk factor.

Third, face-to-face contact, although officially disallowed according to epidemic-control mandates, proved to reduce the likelihood of change for the worse in the rate of depression among the respondents. This finding underscores the compelling need for older people to have close interpersonal contact, even in times of pandemic. Our study showed that in-person contact reduced the risk of pandemic-related mental health deterioration over time.

Author Contributions

Howard Litwin conceived the study and wrote the paper. Bracha Erlich executed the statistical analyses and gave critical comments on the various drafts.

Funding

This paper uses data from SHARE waves 7, 8 and 9, (DOIs: 10.6103/SHARE.w7.800, 10.6103/SHARE.w8.800, 10.6103/SHARE.w8ca.800, 10.6103/SHARE.w9ca800). *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 U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C,*

RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

Competing Interests

The authors have declared that no competing interests exist.

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