Older adults' prevention and communication to beat anxiety: 
the diminishing utility of proactive coping actions

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Abstract
This study aims to investigate older adults’ psychological reactions when facing changes in daily life caused by the COVID-19 pandemic and anti-epidemic measures. Specifically, this study investigated the impacts of communication types (i.e., electronic and face-to-face communication) and frequency during the pandemic and the kinds of proactive coping actions taken by older adults on their anxiety. A total of 43,019 respondents were included in this study by merging two longitudinal databases. One is the seventh wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) conducted in 2017, and the other is the COVID-19 Survey of SHARE, which was conducted between June and August 2020. This study found that one third of older adults reported anxiety symptoms during the COVID-19 pandemic and one fifth reported increased anxiety than before the pandemic. Anxiety symptoms seem somewhat prevalent among older adults during the COVID-19 pandemic. During the pandemic, the more kinds of proactive coping actions taken by older adults, the more likely they felt anxious. As the pandemic continues and develops, taking proactive coping actions might no longer alleviate anxiety in older adults, showing a diminishing utility. In addition, face to face communication was found to decrease the likelihood of anxiety symptoms in older adults, whereas the opposite impact of electronic communication was found. For older adults, contacting others by electronic means may increase their anxiety feeling during the COVID-19 pandemic.

Keywords Older adults · Proactive coping actions · Anxiety · Electronic communication

1 Introduction
The outbreak of the COVID-19 pandemic caused the world to panic. At the beginning of the pandemic, it was uncertain how the coronavirus transmits and how to effectively cure it. The only certain things were the rapidly increasing numbers of confirmed cases and deaths of infection around the world. These uncertainties and risk of infection induced a considerable extent of mental stress in the population, older adults in particular. Multiple studies have reported that older adults with chronic diseases were more sensitive to the COVID-19 virus and have a higher likelihood to get very sick and a higher mortality rate than other age groups [1, 2]. Also, people with chronic diseases were found to be more likely to suffer severe psychological distress in the COVID-19 pandemic [3, 4].

Meanwhile, measures to curb the transmission of the COVID-19 virus have greatly changed older adults’ daily life, and obviously, these changes would last long-term. Social distancing is an effective way to prevent the spread of the COVID-19 virus [5], specific actions including closing public facilities and self-quarantine. These actions encourage the use of technology (e.g. mobile phone and Internet) to allow people to get in touch electronically instead of physically. However, older adults have difficulties in adapting to electronic communication technologies. As a result, older adults might have to either reduce social communication, or change the way of communication. In addition to social distancing, individually proactive coping actions, such as wearing a mask and staying six feet away from others, have significantly changed the way older adults live. These...
changes may bring unfamiliar and unpleasant experiences to them because of departing from normal life [6]. Facing these changes in daily life caused by the COVID-19 pandemic and anti-epidemic measures, the questions of whether and how would older adults’ psychological state change are crucial.

Studies conducted during the initial stage of the pandemic have shown that older adults experienced less negative emotions (e.g. anxiety and psychological distress) than younger adults (e.g. [7–13]). Two studies conducted in Spain in the period from March to April 2020 found that people over the age of 60 seemed to have less psychological distress than people aged under 60 [8, 9]. Fernández et al. analysed the data of 4,408 adults aged between 18 and 92 years old in Argentina, collected from 1 April to 17 April 2020, after the government implemented compulsory social distancing measures [10]. They found that older adults (> 65 years) were associated with better mental health during periods of social distancing [10]. In an online survey on the relationship between proactive coping actions and COVID-19 pandemic-related stress, Pearman et al. [12] analysed the data of 515 American adults between the ages of 20 and 79 years collected from 20 March to 19 April 2020. They found that older adults were more willing to take proactive coping actions, and the adoption of proactive coping actions caused more positive effects on mental health among older adults (> 60 years) than among younger adults [12]. Meanwhile, Wang et al. surveyed 1,599 Chinese adults aged between 18 and 84 years and reported that proactive coping actions associated with less psychological distress [13]. These findings depicted an unexpected picture where older adults were more resilient to anxiety and psychological distress than younger adults and anti-epidemic measures, such as social distancing and taking protective actions, would mitigate older adults’ anxiety.

However, two caveats should be noted when generalising these findings to the whole population. These findings were based on data during the first few months of the COVID-19 pandemic. With the development of the pandemic, it remains unclear how longer-lasting changes caused by anti-epidemic measures influence older adults’ anxiety. Besides, the above studies collected data online and involved a limited sample size. The method excluded older adults who could not access the Internet and may fail to capture the heterogeneity among older population. Therefore, this study aims to answer the following research questions: How do changes in communication type and frequency influence older adults’ anxiety? Whether and how does taking protective actions mitigate their anxiety? In an attempt to investigate general psychological reactions during the COVID-19 pandemic, it should be noted that anxiety in this study refers to anxiety symptoms rather than diagnosed anxiety disorder. The data supporting this study were collected between June and August 2020 through telephone-administered interviews, involving 43,109 respondents aged above 55 across 27 European countries.

2 Literature review

Anxiety symptoms seem prevalent in the older population, with an incidence ranging from 15 to 52.3% in community samples [14]. Generally, younger adults experience more anxiety than older adults [15]. Uncontrollability and unpredictability of an aversive event significantly contribute to the early development of anxiety [16]. From the evolutionary perspective, anxiety is an adaptive emotion, which functionally alerts individuals to potential danger and directs their attention on reactions against threats [17]. For example, anxiety symptoms and anxiety disorder were positively associated with health care service utilisation (for a review, see [18]). However, more attention had been paid on the negative impact of anxiety on older adults’ functioning and well-being. Anxiety often coexists with depression and probably evolves into a mental disorder [19]. Beurs et al. [20] found that older adults who reported anxiety symptoms were less likely to take part in physical activities, and they were also inclined to feel lonely, dissatisfied with life, and perceived poor health.

In the face of the COVID-19 pandemic, it is necessary to understand people’s psychological states, especially the at-risk population. A comprehensive review of 17 studies on older adults’ anxiety during the pandemic was conducted, available in Appendix A. Most of these studies conducted in the first few months of the pandemic and drew a consistent conclusion that older adults showed a higher level of resilience to negative emotions than younger adults. Zhao et al. [7] investigated the anxiety levels of the general public and found that Chinese older adults aged over 50 years reported a lower level of anxiety than younger adults. Furthermore, in a longitudinal study, Kivi et al. [11] analysed the data of 1071 Swedish adults aged between 60 and 71 years collected from 26 March to 2 April 2020. They reported that well-being remained stable in 2020 and also found no negative impact of the COVID-19 pandemic on well-being across a five-year period [11].

One possible explanation for the protective effect of ageing on mental health is that although older adults are physically fragile, they are better at managing their emotions [21] and have long-term experience compared to younger adults, which helped them to alleviate psychological distress during the initial outbreak of the COVID-19 pandemic. Carstensen et al. investigated people’s experienced emotions across a week and found that older adults aged above 60 less frequently experienced negative emotions than younger adults (Carstensen et al. 2000). During the first two months of the COVID-19 pandemic, Hamm et al. [22] investigated the mental health of
73 older adults with an average age of 69 years and found that most old adults with pre-existing major depressive disorder showed resilience.

The assessment of social communication might be a greater factor affecting psychological distress, compared to changes in the frequency of social communication. In a longitudinal study among Dutch older adults, van Tilburg et al. analysed the data of 1679 older adults aged 65–102 collected from 4 May to 26 May 2020 [23]. They found no link between changes in the frequency of social communication and changes in well-being during the COVID-19 pandemic [23]. Comparably, in a longitudinal study among Swiss older adults, Macdonald and Hülür [24] analysed the data of 99 people over 65 collected from 27 March to 24 April 2020, and found that satisfaction with communication is the most important factor in mitigating the psychological distress during the COVID-19 pandemic.

With the development of the COVID-19 pandemic, the number of infections and deaths increased. It is unknown whether older adults’ resilience to anxiety would sustain. Pearman et al. [12] found that anxiety about the developing COVID-19 pandemic was associated with more COVID-19 pandemic stress for older adults relative to younger adults. Equally, Kivi et al. [11] found that during the COVID-19 pandemic, older adults fear that their well-being will be affected, and this fear further worsens mental health. Further, van Tilburg et al. investigated the mental health of 1679 Dutch older adults aged 65–102 years in May 2020 and found no impact on well-being from proactive coping actions [23]. It seems that the impact of taking proactive coping actions on alleviating psychological distress might be waning. Besides, during the social distancing, older adults might have to stay in touch with others via electronic technologies. Two cross-sectional studies conducted on the general population during the first 2 months of the COVID-19 pandemic showed that frequent exposure to pandemic-related information or news in the media was positively correlated with anxiety severity [25, 26]. Thus, older adults might experience anxiety due to communication through electronic technology. However, there is a lack of research on the difference between face-to-face communication and electronic communication in the psychological distress of older adults. Furthermore, many of the samples size of older people surveyed about psychological distress during the COVID-19 pandemic were relatively small (N=626, > 60 years old, 21 studies, as shown in Appendix A).

3 Methods

3.1 Data

Our analyses are based on the data from the seventh wave of the SHARE [27] and the COVID-19 Survey of SHARE [28]. The data of the seventh wave were collected in 2017 by face-to-face computer-assisted personal interviewing and provide standardised information on respondents aged 50 and older across 27 European countries [27]. The data of the COVID-19 survey were collected from June to August 2020 by telephone-administered interviews due to the COVID-19 pandemic and provided standardised information on respondents aged 50 and older across 27 European countries [28]. In addition, partners, including those younger than 50 years, were also surveyed if they lived in the same household.

3.2 Dependent variables

Dependent variables include anxiety and increased anxiety. Anxiety refers to the psychological state during the pandemic, and increased anxiety refers to changes in anxiety compared with the time before the pandemic. Anxiety was measured using the following question in the COVID-19 survey: In the last month, have you felt nervous, anxious, or on edge? (response options: yes/no). Further, if the respondent answered “yes”, increased anxiety would be measured using the following question: Has that been more so, less so, or about the same as before the outbreak of COVID-19? (response options: more so/about the same/less so).

3.3 Independent variables

This study includes three independent variables, the kinds of proactive coping actions taken by respondents, face-to-face communication frequency and electronic communication frequency. First of all, anxiety might be alleviated by taking proactive coping actions during the COVID-19 pandemic [29, 30]. The kinds of proactive coping actions taken by respondents were constructed based on the following six items in the COVID-19 survey: always or often wearing face masks outside the home, always or often staying distanced from others outside the home, washing hands more frequently, using special sanitiser, covering coughs and sneezes, and taking drugs for coronavirus prevention. Thus, the kinds of proactive coping actions were recorded, ranging from zero to six.

Two communication means during the COVID-19 pandemic were investigated: face-to-face and electronic communication. The communication frequency of two means was, respectively, measured by two questions: Since the outbreak of COVID-19, how often did you have personal communication (face to face) with the following people (i.e. children, parents, relatives, and non-relatives like neighbours, friends, or colleagues) from outside your home? How often did you have personal communication (face to face) with the following people from outside your home?
We firstly merged the survey data collected in wave 8 with the data of the activities module collected in wave 7 and obtained preliminary data containing 45,444 cases. Further, 1651 cases were excluded due to incomplete responses on the CASP-12 scale in wave 7. In addition, since not all respondents answered each question, final data included in the anxiety analysis encompassed 43,019 respondents. Since only a few respondents reported to feel less anxious (than before the outbreak of the COVID-19 pandemic) across levels of most categorical predictors, we excluded 285 respondents answered “less so” amongst respondents (N=13,734) who reported anxiety since the outbreak of the COVID-19 pandemic. Moreover, due to non-responses for certain questions, 12,762 respondents were finally included in the analysis of increased anxiety. Thus, increased anxiety included two levels, increased anxiety and about the same.

All analyses were conducted using R (version 4.0.3). Descriptive statistics were calculated for demographics and main variables. Pearson’s Chi-square test was used to measure associations between categorical predictors (i.e. age, gender, coronavirus involvement, proactive coping actions, and loneliness) and dependent variables (i.e. anxiety and increased anxiety). Since continuous predictors (i.e. face-to-face communication frequency, electronic communication frequency, and quality of life) violated the assumption of normal distribution for the point biserial correlation test, univariate logistic regression analysis was used to determine associations between these continuous predictors and dependent variables. Logistic regression models were constructed to determine specific effects of predictors on anxiety and increased anxiety. Assumption validations for logistic regression models were analysed. The Chi-square goodness-of-fit test was used to determine the fit of regression models. The Nagelkerke pseudo-$R^2$ was calculated as the effect size of logistic regression models.

## 3.4 Covariates

The study includes four covariates, *age*, *gender*, *loneliness*, *quality of life*, and *coronavirus involvement*, which might influence older adults’ anxiety level. Loneliness was constructed based on the following question in the COVID-19 survey: How much of the time do you feel lonely? Often, some of the time, or hardly ever or never? Quality of life was measured by the CASP-12 scale in the seventh wave of the SHARE [27], and the CASP-12 is a revised version of CASP-19 [31]. The scale aims to measure the quality of life of older adults from the perspective of needs satisfaction, using four subscales: control, autonomy, pleasure, and self-realisation. Control denotes the ability to actively influence one’s surroundings [32]. Autonomy is suggested as the right for self-governing, which describes a state that one’s behaviour is coordinated with his/her desire [33]. Pleasure and self-realisation express “the active and reflexive processes of being human” [31]. The score of quality of life ranges from 12 to 48. The higher the score, the more satisfied with the life. Coronavirus involvement refers to what degree the respondent or his/her surroundings were involved in the pandemic. We measured the coronavirus involvement around older adults based on four questions in the COVID-19 survey: (i) Since the outbreak of COVID-19, did you or anyone close to you experience symptoms that you would attribute to the COVID illness, such as cough, fever, or difficulty breathing? (response options: yes/no); (ii) Have you or anyone close to you been tested for the coronavirus and the result was positive, meaning that the person had COVID-19? (response options: yes/no); (iii) Have you or anyone close to you been hospitalised due to an infection from the coronavirus? (response options: yes/no); (iv) Has anyone close to you died due to an infection from the coronavirus? (response options: yes/no). For each question, we converted “yes” to 1; thus, the score of coronavirus involvement ranged from zero to four. The higher the score, the more serious situation older adults were involved in.

## 3.5 Data analysis

We firstly merged the survey data collected in wave 8 (N=52,310) with the data of the activities module collected in wave 7 (N=77,261) and obtained preliminary data containing 45,444 cases. Further, 1651 cases were excluded due to incomplete responses on the CASP-12 scale in wave 7. In addition, since not all respondents answered each question, final data included in the anxiety analysis encompassed 43,019 respondents. Since only a few respondents reported to feel less anxious (than before the outbreak of the COVID-19 pandemic) across levels of most categorical predictors (shown in Table 1), we excluded 285 respondents answered “less so” amongst respondents (N=13,734) who reported anxiety since the outbreak of the COVID-19 pandemic. Moreover, due to non-responses for certain questions, 12,762 respondents were finally included in the analysis of increased anxiety. Thus, increased anxiety included two levels, increased anxiety and about the same.

### Table 1 Fewer than 10 respondents answered “less so” in the measurement of increased anxiety

| Category                                     | Respondents answered “less so” |
|----------------------------------------------|-------------------------------|
| Age categories younger than 55              | 2                             |
| Coronavirus involvement = 2                 | 7                             |
| Coronavirus involvement = 3                 | 5                             |
| Coronavirus involvement = 4                 | 4                             |
| Proactive coping actions = 0                | 5                             |
| Proactive coping actions = 1                | 7                             |
aged younger than 55 years and women. Also, the odds of feeling anxious decreased by the self-reported quality of life. Unexpectedly, results indicated that the more actions respondents took to prevent being affected by the coronavirus, the more often they felt anxious. The odds of feeling anxious for respondents who adopted six kinds of preventable actions were 2.72 times than those who had not adopted any preventable actions. Regarding effects of communication during the COVID-19 pandemic, the odds of feeling anxiety were 13% lower for each unit increase in face-to-face communication frequency outside the home; however, the odds were 8% higher for each unit increase in

Table 2 Multivariate logistic regression model for predicting anxiety during June–August 2020 (N = 43,019). Anxiety: yes (N = 13,040), no (N = 29,979)

| N (%) | Odds ratio | 95% CI Lower | 95% CI Upper |
|-------|------------|--------------|--------------|
| Constant | 1.465** | 1.112 | 1.927 |
| Age categories | | | | |
| Under 55 (ref.) | 935 (2.17)*** | 1 | | |
| 55–64 | 11,514 (26.76) | 0.913 | 0.786 | 1.061 |
| 65–74 | 16,819 (39.10) | 0.823* | 0.716 | 0.963 |
| 75–84 | 10,445 (24.28) | 0.834* | 0.717 | 0.971 |
| 85 or older | 3306 (7.68) | 0.754** | 0.639 | 0.891 |
| Gender | | | | |
| Female (ref.) | 25,257 (58.71)*** | 1 | | |
| male | 17,762 (41.29) | 0.696*** | 0.665 | 0.729 |
| Quality of life | | | | |
| M = 36.99 (SD = 6.27)*** | 0.952*** | 0.948 | 0.955 |
| Coronavirus involvement | | | | |
| Coronavirus involvement 0 (ref.) | 36,661 (85.22)*** | 1 | | |
| Coronavirus involvement 1 | 2497 (5.80) | 1.423*** | 1.299 | 1.557 |
| Coronavirus involvement 2 | 1833 (4.26) | 1.349*** | 1.212 | 1.498 |
| Coronavirus involvement 3 | 908 (2.11) | 1.448*** | 1.250 | 1.674 |
| Coronavirus involvement 4 | 1120 (2.60) | 1.794*** | 1.576 | 2.040 |
| Proactive actions | | | | |
| Proactive coping actions 0 (ref.) | 780 (1.81)*** | 1 | | |
| Proactive coping actions 1 | 1,185 (2.75) | 1.242* | 0.997 | 1.551 |
| Proactive coping actions 2 | 3,024 (7.03) | 1.405*** | 1.159 | 1.707 |
| Proactive coping actions 3 | 7,792 (18.11) | 1.834*** | 1.532 | 2.204 |
| Proactive coping actions 4 | 11,346 (26.37) | 1.711*** | 1.430 | 2.055 |
| Proactive coping actions 5 | 17,506 (40.69) | 2.000*** | 1.674 | 2.397 |
| Proactive coping actions 6 | 1386 (3.22) | 2.715*** | 2.204 | 3.354 |
| Face-to-face communication frequency | M = 2.31 (SD = 0.84)*** | 0.866*** | 0.843 | 0.889 |
| Electronic communication frequency | M = 3.20 (SD = 0.87)*** | 1.081*** | 1.053 | 1.110 |
| Loneliness | | | | |
| Hardly ever or never feel lonely (ref.) | 30,716 (71.40)*** | 1 | | |
| Feel lonely sometimes | 9169 (21.31) | 2.215*** | 2.104 | 2.331 |
| Often feel lonely | 3134 (7.29) | 4.691*** | 4.323 | 5.092 |

The presented model fits significantly better than an empty model, χ²(20) = 4491.50, p < 0.000. The analysis for the standard residuals showed that the data contained no outliers (Std. residual min = −2.04, Std. residual max = 2.34). The data also met the assumptions of independent errors (Durbin–Watson statistic = 1.84) and of collinearity (VIFs < 1.15).

CI Confidence interval for odds ratio, Ref. Reference category
* p < 0.05
** p < 0.01
*** p < 0.001
† p < 0.10

The asterisks near the percentages refer to the p-values of the Pearson’s chi-square tests; the asterisks near the standard deviance refer to the p-values of the univariate logistic regression analysis; and the asterisks near the odds ratios refer to the p-values of the odds ratios. Nagelkerke pseudo-\( R^2 = 0.14 \)
to the results for predicting anxiety reported in Table 2, pro-
active coping actions respondents took, the more anxious they
felt during the COVID-19 pandemic found that respondents who
took all six kinds of proactive coping actions were more likely to
feel more anxious.

Second, we found the opposite effects between face-to-
face and electronic communications on anxiety in older adults. The higher the frequency of face-to-face commu-
nication among older adults, the less likely they were to
feel anxious during the COVID-19 pandemic and the less
likely they were to feel increased anxiety than before the
outbreak of the pandemic, while the opposite impacts of
electronic communication frequency were found. There
are mainly two possible reasons. One possible reason is that changes in communication means caused by social
distancing may require some older adults to learn or adapt
to new technologies, such as the Internet, social media, or
e-mail. As we know, most of older adults have difficulties in acceptance and adaptation to a new technology,
due to their cognitive declines and younger users-centered
designs [36, 37]. A cross-sectional and population-based
survey involving 400 older respondents reported that more
than half of older adults started to learn new communica-
tion technologies due to this pandemic [38]. More impor-
tantly, those older adults have encountered multiple bar-
riers when adapting to a new technology, including lack
of interest, lack of access, and physical limitations; due to
these barriers, even, nearly one tenth older adults among

4.2 Increased anxiety

The results of the binomial logistic regression analysis
predicting increased anxiety than before the COVID-19
pandemic and relative descriptive statistics are shown in
Table 3. Notably, results showed several inconsistent effects
with Table 2. Firstly, age and gender were not found to sig-
nificantly impact the odds of increased anxiety caused by
the COVID-19 pandemic. In addition, the odds of increased
anxiety increased with the self-reported quality of life by 1.8% higher for each unit increase in CASP scores. Similar
to the results for predicting anxiety reported in Table 2, pro-
active actions and coronavirus involvement were also found
to increase the odds of increased anxiety. Besides, the fre-
cuency of face-to-face and electronic communication seems
to be more influential on the odds of increased anxiety than
on the odds of anxiety. Specifically, the odds of increased
anxiety were 36.2% higher for each unit increase in elec-
tronic communication frequency, while the odds were 20.0%
lower for each unit increase in face-to-face communication
frequency. Regarding loneliness, the impacts on the odds for
increased anxiety were seemingly lesser than on the odds of anxiety.

5 Discussion

5.1 Findings

This study mainly investigated older adults’ psychological
reactions to changes in daily life that caused by the COVID-
19 pandemic and anti-epidemic measures. Based on a large
sample across 27 European countries during June to August
2020, approximately one-third of respondents reported anx-
xiety and one-fifth of respondents reported that they were
more anxious during the COVID-19 pandemic than before the
outbreak of the pandemic. Certainly, it does not mean
that older adults who reported anxiety symptoms need tar-
geted psychological interventions; because appropriate
anxiety may adaptively motivate protective behaviours in
the face of this global health crisis. Several findings were
arrived.

First of all, 66% of respondents took at least four or five
proactive coping actions. Furthermore, the more proactive
coping actions respondents took, the more anxious they
felt during the COVID-19 pandemic. Respondents who
took more proactive coping actions were more likely to feel
increased anxiety than before the outbreak of the pandemic.
These findings seem contradictory with previous studies
during the first few months of the pandemic which sug-
gested that taking proactive coping actions would contrib-
ute to mitigating psychological distress [12, 13, 30]. The
possible reason is that as the development of the COVID-
19 pandemic, people may have found that taking proactive
coping actions is useless for improving the uncertain situa-
tion. Instead, the more proactive coping actions taken may
indicate the more serious the pandemic. A survey conducted
during the COVID-19 pandemic found that respondents who
took excessive personal hygiene measures were more anx-
ious [34]. Actually, from June to August 2020, the coro-
navirus was continuously spreading with the skyrocketing
numbers of infected cases and deaths [35]; also, no cure or
cure was available at that time. Thus, as the COVID-19
pandemic continues, the effect of proactive coping actions
in alleviating psychological distress seems to be diminishing
(as shown in Table 4). In addition, the respondents who took
all six kinds of proactive coping actions were more likely to
report anxiety; however, they were the least likely to report
increased anxiety than before the outbreak of the pandemic,
compared with those who took three to five proactive coping
actions (as shown in Fig. 1). The possible reason is that older
adults who took all six kinds of proactive coping actions
might be extremely anxious about the coronavirus and less
likely to feel more anxious.

Second, we found the opposite effects between face-to-
face and electronic communications on anxiety in older adults. The higher the frequency of face-to-face commu-
ication among older adults, the less likely they were to
feel anxious during the COVID-19 pandemic and the less
likely they were to feel increased anxiety than before the
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distancing may require some older adults to learn or adapt
to new technologies, such as the Internet, social media, or
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due to their cognitive declines and younger users-centered
designs [36, 37]. A cross-sectional and population-based
survey involving 400 older respondents reported that more
than half of older adults started to learn new communica-
tion technologies due to this pandemic [38]. More impor-
tantly, those older adults have encountered multiple bar-
riers when adapting to a new technology, including lack
of interest, lack of access, and physical limitations; due to
these barriers, even, nearly one tenth older adults among
Table 3  Multivariate logistic regression for predicting increased than versus before the outbreak of COVID-19 pandemic (N=12,762). Increased anxiety (N=9,295), about the same (N=3,467)

|                                | N (%) | Odds ratio | 95% CI       |
|--------------------------------|-------|------------|--------------|
|                                |       | Lower      | Upper        |
| **Constant**                   | 0.352*** | 0.215       | 0.578        |
| **Age categories**             |       |            |              |
| Under 55 (ref.)                | 293 (2.3)*** | 1           |              |
| 55–64                          | 3,431 (26.88) | 1.171       | 0.882 1.540  |
| 65–74                          | 4,734 (37.09) | 1.051       | 0.794 1.378  |
| 75–84                          | 3,237 (25.36) | 1.018       | 0.766 1.342  |
| 85 or older                    | 1,067 (8.36)  | 0.851       | 0.627 1.146  |
| **Gender**                     |       |            |              |
| Female (ref.)                  | 8,636 (67.67)*** | 1           |              |
| Male                           | 4,126 (32.33)  | 0.947       | 0.869 1.033  |
| **Quality of life**            |       |            |              |
|                             |       |            |              |
| M = 35.21 (SD = 6.43)***       | 1.025*** | 1.018 1.031 |
| **Corona involvement**         |       |            |              |
| Coronavirus involvement 0 (ref.) | 10,542 (82.60)*** | 1           |              |
| Coronavirus involvement 1      | 859 (6.73)     | 1.496***    | 1.258 1.788  |
| Coronavirus involvement 2      | 590 (4.62)    | 1.343**     | 1.096 1.656  |
| Coronavirus involvement 3      | 321 (2.52)    | 2.128***    | 1.566 2.954  |
| Coronavirus involvement 4      | 450 (3.53)    | 1.712***    | 1.341 2.212  |
| **Proactive coping actions**   |       |            |              |
| Proactive coping actions 0 (ref.) | 184 (1.44)*** | 1           |              |
| Proactive coping actions 1     | 310 (2.43)     | 1.199       | 0.820 1.751  |
| Proactive coping actions 2     | 829 (6.50)     | 1.290       | 0.924 1.798  |
| Proactive coping actions 3     | 2,434 (19.07)  | 1.710***    | 1.247 2.340  |
| Proactive coping actions 4     | 3,021 (23.67)  | 1.633**     | 1.192 2.233  |
| Proactive coping actions 5     | 5,454 (42.74)  | 1.881***    | 1.377 2.565  |
| Proactive coping actions 6     | 530 (4.15)     | 1.375+      | 0.959 1.973  |
| **Face-to-face communication frequency** | M = 2.34 (SD = 0.82) *** | 0.796** 0.758 0.836 |
| **Electronic communication frequency** | M = 3.25 (SD = 0.87) *** | 1.362*** 1.300 1.429 |
| **Loneliness**                 |       |            |              |
| Hardly ever or never feel lonely (ref.) | 6,902 (54.08) + | 1           |              |
| Feel lonely sometimes           | 3,900 (30.56)  | 1.143**     | 1.042 1.254  |
| Often feel lonely               | 1,960 (15.36)  | 1.387***    | 1.226 1.570  |

The presented model fits significantly better than an empty model, χ²(20) = 553.69, p < 0.000. Although the relation between increased anxiety and loneliness was slightly significant, χ²(2) = 4.68, p = 0.096, including loneliness in the model significantly improved the fit of the model, F (2.12743) = 28.96, p < 0.000. The analysis for the standard residuals showed that the data contained no outliers (Std. residual min = -2.43, Std. residual max = 1.56). The data also met the assumptions of independent errors (Durbin–Watson statistic = 1.85) and of collinearity (VIFs < 1.17).

CI: Confidence interval for odds ratio, Ref: Reference category

* p < 0.05
** p < 0.01
*** p < 0.001
+ p < 0.10

The asterisks near the percentages refer to the p-values of the chi-square tests; the asterisks near the standard deviance refer to the p-values of the univariate logistic regression analysis; and the asterisks near the odds ratios refer to the p-values of the odds ratios. Nagelkerke pseudo-R² = 0.062
them stopped to use technology [38]. It can be speculated that some older adults have to overcome these barriers to adapt to changes in communication means. Thus, barriers in adaptation to new technology might cause psychological stress in older adults. In addition, electronic communication might have constantly reminded them that they were in a crisis and might have made them realise that they were alienated from others during the COVID-19 pandemic. The other possible reason is that older adults who contact others in electronic ways during the COVID-19 pandemic might be exposed to a large amount of pandemic-related information or news mixed with falsehoods and conspiracy theories. Previous studies have shown that frequent exposure to pandemic-related information and news during the COVID-19 pandemic caused an increase in anxiety level [25, 26]. Further, misinformation that rapidly spread online might lead older adults to incorrectly overestimate the risk of the COVID-19 pandemic [39]. Meanwhile, this finding may indicate that during the COVID-19 pandemic, electronic communication might not be a substitute for face-to-face communication among older adults [40].

Further, we found that the older the respondents among older adults, the less likely they were to feel anxious during the COVID-19 pandemic. This finding confirmed findings from studies conducted in the first few months of the pandemic in Argentina [10], Spain [8, 9, 41], Israel [42], China [7, 43, 44], Iran [26], and the UK [45, 46]. This finding may indicate that older adults might have better emotional regulation and more experience in coping with crises than younger adults. In consistency with previous studies [3, 30], respondents with more suspected infections and confirmed cases in their surroundings were more likely to be anxious during the COVID-19 pandemic. Besides, these findings also implied that loneliness may contribute to older adults’ anxiety during the pandemic. Older women were more likely to be anxious than older men during the pandemic.

5.2 Implications

This study has three implications. First, the study conducted from June to August 2020 offered different insights into how does taking proactive coping actions influence older adults’ anxiety, compared with studies conducted in the first few months of the pandemic (see Appendix A). To some extent, all of these studies including this one jointly uncovered older adults’ dynamic psychological reactions to taking proactive coping actions, with the development of the COVID-19 pandemic (see Table 4). Second, according to data involving
43,109 respondents across 27 European countries, anxiety symptoms are somewhat prevalent among older adults, with 30.0% of older adults reporting anxiety and 21.6% reporting increased anxiety in comparison with the period before the outbreak of the COVID-19 pandemic. Given that anxiety symptoms in older adults would increase their vulnerability to health misinformation about the COVID-19 [47, 48], policymakers and related organisations should be aware of the hazard of the COVID-19 misinformation to older adults in anxious state. Third, the study suggests that face-to-face communication contributes to alleviating anxiety, whereas electronic communication increased anxiety. For some older adults, they may have to overcome difficulties in learning a new technology to adapt to changes in communication means caused by the practice of social distancing. More attention should be paid on older adults’ difficulties in adapting to digital life, in particular under the COVID-19 pandemic.

5.3 Limitations

Two limitations should be noted. First, this study measured older adults’ anxiety using two blunt questions, which failed to measure to what degree older adults feel anxious as well as specific dimensions of anxiety. As a result, some older adults might have inaccurately reported anxiety. Also, the measurement prevented us to uncover the underlying reason why older adults feel anxious. In future work, more specific scales for measuring anxiety should be used. Second, we could not give causal inference using the data. For example, we were unable to conclude that taking proactive coping actions would cause anxiety during the COVID-19 pandemic. The trend of the effect of taking proactive coping actions on older adults’ anxiety is speculated based on previous studies during the COVID-19 pandemic. Such conclusion may need a further longitudinal study manipulating the numbers of proactive coping actions taken by subjects and repeatedly test the anxiety level of older adults.

6 Conclusion

This study examined older adults’ anxiety through a large survey in European countries. Three major findings were derived. First, as the COVID-19 pandemic developed, taking more proactive coping actions was associated with a higher frequency of anxiety symptoms in older adults. Second, the more frequent face-to-face communication and less frequent electronic communication of older adults during the COVID-19 pandemic, the less likely it was for them to feel anxious. Thus, for older adults, electronic communication might not be a substitute for face-to-face communication during the COVID-19 pandemic. Third, although older adults’ anxiety did not increase with age, their anxiety did show a notable increase during the COVID-19 pandemic compared to before the outbreak of the pandemic. This implies that older adults might be an at-risk group not only in terms of mortality, but also in terms of the increase in anxiety.

Appendix A

See Table 5.
| Study | Country | Design       | Data sources                  | Period                              | Group          | Middle-aged adults | Younger adults | Dependent variable                                                                 |
|-------|---------|--------------|-------------------------------|-------------------------------------|----------------|-------------------|----------------|----------------------------------------------------------------------------------|
| [49]  | UK      | Longitudinal | An online survey              | 2020/4/23 to 2020/4/30             | Older adults   | 2,633            | ≥ 70            | 11,326 N/A N/A 35–69 3,493 N/A N/A 16–34 The General Health Questionnaire (GHQ-12) |
| [29]  | China   | Longitudinal | An online survey              | 2020/1/31 to 2020/2/2 (initial outbreak) | Middle-aged adults | N= 1,210, General population, range (12–59) | N=861, General population, range (12–59) | The Impact of Event Scale-Revised (IES-R); The Depression, Anxiety and Stress Scale (DASS-21) |
| [7]   | China   | Cross-sectional | An online survey              | 2020/2/4 to 2020/4/6              | Middle-aged adults | 77 N/A           | ≥ 50            | 651 N/A N/A 31–50 1275 N/A N/A 13–30 The Beck Anxiety Inventory (BAI)          |
| [50]  | China   | Cross-sectional | An online survey              | 2020/1/31 to 2020/2/10            | Middle-aged adults | N=52,730; N=36 N/A N/A 61–76 589 N/A N/A 30–60 435 N/A N/A 13–29 The COVID-19 Peritraumatic Distress Index (CPDI) |
| [51]  | China   | Cross-sectional | An online survey              | 2020/1/31 to 2020/2/2             | Middle-aged adults | 103 N/A          | ≥ 60            | 69.85 5.26 N/A N/A N/A N/A N/A N/A The Fear of COVID-19 Scale (FCV-19S); The Patient Health Questionnaire (PHQ-9); The Generalised Anxiety Disorder Scale (GAD-7); The Athens Insomnia Scale (AIS); The Intolerance of Uncertainty Scale (IUS-12); The De Jong Gierveld Loneliness Scale (JGLS) |
| [52]  | Greece  | Cross-sectional | An online survey              | A period of three days, three weeks after a national lockdown | Middle-aged adults | 103 N/A          | ≥ 60            | 69.85 5.26 N/A N/A N/A N/A N/A The Fear of COVID-19 Scale (FCV-19S); The Patient Health Questionnaire (PHQ-9); The Generalised Anxiety Disorder Scale (GAD-7); The Athens Insomnia Scale (AIS); The Intolerance of Uncertainty Scale (IUS-12); The De Jong Gierveld Loneliness Scale (JGLS) |
| Study | Country | Design         | Data sources             | Period                          | Group                      | Dependent variable                                      |
|-------|---------|----------------|--------------------------|---------------------------------|-----------------------------|----------------------------------------------------------|
|       |         | Longitudinal   | An online survey         | 2019/4/1 to 2019/11/1           | Older adults                | Well-being; Loneliness                                   |
| [24]  | Switzerland |                |                          |                                 | Middle-aged adults          | Positive affect (PA); Negative affect (NA); Loneliness   |
|       |         |                |                          | 2020/3/27 to 2020/4/24          | Younger adults              |                                                          |
|       |         | Cross-sectional| An online survey         | 2020/3/18 to 2020/3/22          |                             | The Depression, Anxiety and Stress Scale (DASS-21)      |
| [3]   | Italy   |                |                          |                                 |                             |                                                          |
|       |         | Cross-sectional| Questionnaires were randomly distributed among the general population and various associations that work with older people | N/A                            | The Depression, Anxiety and Stress Scale (DASS-21)      |
| [4]   | Spain   |                |                          | N/A                            |                             |                                                          |
|       |         | Cross-sectional| An online survey         | 2020/3/29 to 2020/4/5           |                             | The Hamilton Anxiety Scale; The Beck Depression Inventory; The Presence of Acute Stress |

| Study | Country | Design         | Data sources             | Period                          | Group                      | Dependent variable                                      |
|-------|---------|----------------|--------------------------|---------------------------------|-----------------------------|----------------------------------------------------------|
|       |         | Longitudinal   | An online survey         | 2019/4/1 to 2019/11/1           | Older adults                | Well-being; Loneliness                                   |
| [24]  | Switzerland |                |                          |                                 | Middle-aged adults          | Positive affect (PA); Negative affect (NA); Loneliness   |
|       |         |                |                          | 2020/3/27 to 2020/4/24          | Younger adults              |                                                          |
|       |         | Cross-sectional| An online survey         | 2020/3/18 to 2020/3/22          |                             | The Depression, Anxiety and Stress Scale (DASS-21)      |
| [3]   | Italy   |                |                          |                                 |                             |                                                          |
|       |         | Cross-sectional| Questionnaires were randomly distributed among the general population and various associations that work with older people | N/A                            | The Depression, Anxiety and Stress Scale (DASS-21)      |
| [4]   | Spain   |                |                          | N/A                            |                             |                                                          |
|       |         | Cross-sectional| An online survey         | 2020/3/29 to 2020/4/5           |                             | The Hamilton Anxiety Scale; The Beck Depression Inventory; The Presence of Acute Stress |

| Study | Country | Design         | Data sources             | Period                          | Group                      | Dependent variable                                      |
|-------|---------|----------------|--------------------------|---------------------------------|-----------------------------|----------------------------------------------------------|
|       |         | Longitudinal   | An online survey         | 2019/4/1 to 2019/11/1           | Older adults                | Well-being; Loneliness                                   |
| [24]  | Switzerland |                |                          |                                 | Middle-aged adults          | Positive affect (PA); Negative affect (NA); Loneliness   |
|       |         |                |                          | 2020/3/27 to 2020/4/24          | Younger adults              |                                                          |
|       |         | Cross-sectional| An online survey         | 2020/3/18 to 2020/3/22          |                             | The Depression, Anxiety and Stress Scale (DASS-21)      |
| [3]   | Italy   |                |                          |                                 |                             |                                                          |
|       |         | Cross-sectional| Questionnaires were randomly distributed among the general population and various associations that work with older people | N/A                            | The Depression, Anxiety and Stress Scale (DASS-21)      |
| [4]   | Spain   |                |                          | N/A                            |                             |                                                          |
|       |         | Cross-sectional| An online survey         | 2020/3/29 to 2020/4/5           |                             | The Hamilton Anxiety Scale; The Beck Depression Inventory; The Presence of Acute Stress |

Table 5 (continued)
| Study | Country | Design | Data sources | Period          | Group          | Dependent variable                                                                 |
|-------|---------|--------|--------------|-----------------|----------------|-------------------------------------------------------------------------------------|
|       |         |        |              |                 | Older adults   | Middle-aged adults | Younger adults |                                            |
|       |         |        |              |                 | $N$  | $M$   | SD  | Range | $N$  | $M$   | SD  | Range | $N$  | $M$   | SD  | Range |
| [9]   | Spain   | Cross-sectional | An online survey | 2020/3/21 to 2020/3/28 | 203 | N/A  | N/A  | 60–80 | 2,054 | N/A  | N/A  | 40–59 | 1,230 | N/A  | N/A  | 18–39 | The Patient Health Questionnaire (PHQ-2); The Generalised Anxiety Disorder Scale (GAD-2); The Post-traumatic Stress Disorder Checklist-Reduced version (PCL-C-2) |
| [10]  | Argentina | Cross-sectional | An online survey | 2020/4/1 to 2020/4/17 | 171 | N/A  | N/A  | 65–92 | 559  | N/A  | N/A  | 30–64 | 62   | N/A  | N/A  | 18–29 | The Brief Symptom Inventory (BSI-53) |
| [11]  | Sweden  | Longitudinal | Data from the longitudinal Health, Aging and Retirement Transitions in Sweden Questionnaire | 2015–2019 | 5,913 | N/A  | N/A  | 60–66 | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | Wellbeing (life satisfaction, financial satisfaction, self-rated health, loneliness) |
|       |         |        |              | 2020/3/26 to 2020/4/2 | 1,071 | 68.1 | 2    | 60–71 | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | N/A  | Wellbeing (life satisfaction, financial satisfaction, self-rated health, loneliness) |
| [12]  | USA     | Cross-sectional | An online survey | 2020/3/20 to 2020/4/19 | $N = 515$, $M = 39.48$, $SD = 11.85$, range = 20–79 | COVID-19-related stress |
| [13]  | China   | Cross-sectional | An online survey | 2020/1/31 to 2020/2/2 | N/A  | N/A  | N/A  | N/A  | 129  | N/A  | N/A  | 40–50 | 1081 | N/A  | N/A  | 12–40.2 | The Impact of Event Scale-Revised (IES-R) The Depression, Anxiety and Stress Scale (DASS-21) |
Table 5 (continued)

| Study | Country | Design       | Data sources                      | Period                        | Group                  | N | M   | SD | Range | N  | M   | SD | Range | N  | M   | SD | Range | Dependent variable                                                                 |
|-------|---------|--------------|-----------------------------------|-------------------------------|------------------------|---|-----|----|--------|----|-----|----|--------|----------------------------------------|---------------------------------------------|
| [22]  | USA     | Cross-sectional | A semi-structured qualitative interview | 2020/4/1 to 2020/4/23       | Older adults             | 73 | 69  | N/A| > 60   | N/A | N/A | N/A | N/A   | N/A | N/A | N/A | N/A   | The Patient Health Questionnaire (PHQ-9); The Patient-Reported Outcomes Measurement Information System Anxiety Scale |
|       |         |              |                                   |                               | Middle-aged adults       | N/A| N/A | N/A| N/A   | N/A | N/A | N/A | N/A   | N/A | N/A | N/A | N/A   | Loneliness; Mental health Social loneliness; Emotional loneliness; Mental health |
| [23]  | Netherlands | Longitudinal | An online survey                  | 2019/10/1 and 2019/11/1       | Younger adults            | N/A| N/A | N/A| N/A   | N/A | N/A | N/A | N/A   | N/A | N/A | N/A | N/A   | The Chinese version of WHO-Five Well-Being Index (WHO-5); The Chinese version of Generalised Anxiety Disorder Scale (GAD-7) |
|       |         |              |                                   | 2020/5/4 to 2020/5/26         |                        | 1679 | 73  | N/A| 65–102 | N/A | N/A | N/A | N/A   | N/A | N/A | N/A | N/A   | Loneliness; Social loneliness; Emotional loneliness; Mental health |
| [25]  | China   | Cross-sectional | An online survey                  | 2020/1/31 to 2020/2/2         |                        | 222 | N/A | N/A| 50–85  | N/A | N/A | N/A | N/A   | 2,037| N/A | N/A | 31–50  | The Kessler 6 Psychological Distress Scale (K6); The Hospital Anxiety Depression Scale (HADS) |
| [26]  | Iran    | Cross-sectional | An online survey                  | 2020/3/1 to 2020/3/9          |                        | 480 | N/A | N/A| > 50   | 5016| N/A | N/A | 31–50  | 5,258| N/A | N/A | 20–30  | The anxiety subscale questions of the DASS-21 |
| [30]  | China   | Cross-sectional | An online survey                  | 2020/2/1 to 2020/2/4          |                        | 152 | N/A | N/A| > 50   | 725 | N/A | N/A | 31–50  | 722 | N/A | N/A | 18–30  | The Kessler 6 Psychological Distress Scale (K6); The Hospital Anxiety Depression Scale (HADS) |
| [45]  | UK      | Cross-sectional | An online survey                  | 2020/4/30 to 2020/7/8         |                        | 7,127| 70.6| 7.4 | 50–100 | N/A | N/A | N/A | N/A   | N/A | N/A | N/A | N/A   | The Hospital Anxiety Depression Scale (HADS) |
| Study | Country | Design   | Data sources       | Period                      | Group           | Dependent variable                                                                 |
|-------|---------|----------|--------------------|-----------------------------|-----------------|-------------------------------------------------------------------------------------|
|       |         |          |                    |                             | Older adults    | Middle-aged adults                                                                   |
| [41]  | Spain   | Cross-sectional | An online survey | N/A                         | N=4,399, M=47   | The Patient Health Questionnaire (PHQ-9); The Generalised Anxiety Disorder (GAD-7) |
| [42]  | Israel  | Cross-sectional | An online survey  | 2020/3/15 to 2020/4/1       | N=1,059, M=46.21±16.49, range = 18–100 | Loneliness levels; The Patient Health Questionnaire (PHQ-9); The Generalised Anxiety Disorder (GAD-7) |
| [43]  | China   | Cross-sectional | An online survey  | N/A                         | N=1,074; M=33.54; SD = 11.13; range = 14–68 | The Beck Anxiety Inventory (BAI); The Beck Depression Inventory (BDI); The Warwick Edinburgh Mental Wellbeing Scale (WEM-WBS) |
| [44]  | China   | Cross-sectional | An online survey  | 2020/2/14 to 2020/3/4       | 216 N/A N/A 50–70 1340 N/A N/A 30–50 681 N/A N/A 18–30 | The Zung’s Self-Rating Depression Scale (SDS); The Zung’s Self-rating Anxiety Scale (SAS); The Pittsburgh Sleep Quality Index (PSQI); The Impact of Event Scale-Revised (IES-R) |
| Study | Country | Design | Data sources | Period | Group | N  | M  | SD | Range | Group | N  | M  | SD | Range | Group | N  | M  | SD | Range |
|-------|---------|--------|--------------|--------|-------|----|----|----|-------|-------|----|----|----|-------|-------|----|----|----|-------|
| [46]  | UK      | Longitudinal | An online survey | 2020/3/31 to 2020/4/9 (wave 1) | Older adults | 594 | N/A | N/A | ≥ 60 | Middle-aged adults | 1637 | N/A | N/A | 30–59 | Younger adults | 846 | N/A | N/A | 18–29 |
|       |         |        |              | 2020/4/10 to 2020/4/27 (wave 2) | | | N=2742 (Quota sampling methodology: 18–24 years: 12%; 25–34: 17%; 35–44: 18%; 45–54: 18%; 55–64: 15%; ≥ 65: 20%) |
|       |         |        |              | 2020/4/28 to 2020/5/11 (wave 3) | | | N=2,604 (Quota sampling methodology: 18–24 years: 12%; 25–34: 17%; 35–44: 18%; 45–54: 18%; 55–64: 15%; ≥ 65: 20%) |
| [53]  | Western and Northern Europe | Longitudinal | Multiple data sources | 2020/3/1 to 2020/7/1 | | 40,403 | N/A | N/A | ≥ 60 | | 99,754 | N/A | N/A | 30–59 | | 22,619 | N/A | N/A | < 30 |
| [54]  | UK      | Longitudinal | Data from the UK Household Longitudinal Study and incorporates the former British Household Panel Study | 2017/1/5 to 2019/5/24 (wave 9) | | 3,569 | N/A | N/A | 65–96 | | 7,568 | N/A | N/A | 35–64 | | 3,166 | N/A | N/A | 18–34 |
|       |         |        |              | An online survey | 2020/4 | | 3,569 | N/A | N/A | 65–96 | | 7,568 | N/A | N/A | 35–64 | | 3,166 | N/A | N/A | 18–34 |
|       |         |        |              | 2020/5 | | 3,569 | N/A | N/A | 65–96 | | 7,568 | N/A | N/A | 35–64 | | 3,166 | N/A | N/A | 18–34 |
|       |         |        |              | 2020/6 | | 3,569 | N/A | N/A | 65–96 | | 7,568 | N/A | N/A | 35–64 | | 3,166 | N/A | N/A | 18–34 |

| Dependent variable |
|--------------------|
| Suicidal history; The Patient Health Questionnaire (PHQ-9); The Generalised Anxiety Disorder (GAD-7); Feelings of defeat; Mental well-being |
| Worries; Anxiety; Precautionary behaviours; Loneliness |
| The General Health Questionnaire (GHQ-12) |
| Study | Country | Design | Data sources | Period | Group | N   | M   | SD  | Range | M   | SD  | Range | M   | SD  | Range |
|-------|---------|--------|--------------|--------|-------|-----|-----|-----|-------|-----|-----|-------|-----|-----|-------|
| [55]  | Ireland| Cross-sectional | An online survey | 2020/3/31 to 2020/4/5 | Older adults | 127 | N/A | N/A | 65–88 | Middle-aged adults | 598 | N/A | N/A | 35–64 | Younger adults | 316 | N/A | N/A | 18–34 |
|        |         |         |              |        |       |     |     |     |       |                  |     |     |       |     |     |       |
|        |         |         |              |        |       |     |     |     |       |                  |     |     |       |     |     |       |
| [34]  | Cyprus  | Cross-sectional | An online survey | 2020/4/3 to 2020/4/9 | Older adults | 63  | N/A | N/A | ≥ 60 | Middle-aged adults | 519 | N/A | N/A | 40–59 | Younger adults | 1,061 | N/A | N/A | 18–39 |
| [40]  | N/A     | Cross-sectional | Surveys were completed by phone, the Internet, or paper and pencil | 2020/5 to 2020/6 | Older adults | 226 | 77.28 | 6.23 | ≥ 70 | Middle-aged adults | N/A | N/A | N/A | N/A | Younger adults | N/A | N/A | N/A | N/A |
| [56]  | USA     | Cross-sectional | An online survey | 2020/3/23 to 2020/3/31 | Older adults | 156 | N/A | N/A | 65–81 | Middle-aged adults | N/A | N/A | N/A | N/A | Younger adults | 146 | N/A | N/A | 18–35 |
| [57]  | China   | Cross-sectional | An online survey | 2020/3/4 to 2020/4/10 | Older adults | N= 1,134, M = 31.01, SD = 6.81, range = 18–59 | Middle-aged adults | N/A | N/A | N/A | N/A | Younger adults | N/A | N/A | N/A | N/A |
| [58]  | USA     | Longitudinal | A phone interview | 2019/6 to 2019/10 (time 1) | Older adults | 120 | 74.68 | 7.13 | ≥ 60 | Middle-aged adults | N/A | N/A | N/A | N/A | Younger adults | N/A | N/A | N/A | N/A |

- The Patient Health Questionnaire (PHQ-9);
- The Generalised Anxiety Disorder (GAD-7);
- The Positive Emotions Scale;
- The Negative Emotions Scale;
- The COVID-19 Risk Perception Scale;
- The COVID-19 Worries Scale;
- The COVID-19 Behavior Changes Scale;
- The Kessler 6 Psychological Distress Scale (K6);
- The Patient Health Questionnaire (PHQ-8);
- The University of California, Los Angeles Loneliness Scale.
| Study | Country       | Design          | Data sources                                                                 | Period                                      | Group                             | Dependent variable                                                                 |
|-------|---------------|-----------------|------------------------------------------------------------------------------|---------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------|
|       |               |                 |                                                                              |                                             | Older adults                      | Middle-aged adults                                                                | Younger adults                     |                                                                                     |
| [58]  | USA           | Longitudinal    | A phone interview                                                          | 2020/4/21 to 2020/5/21 (time 2)            | 94                                | 75.2 | 6.86 | ≥ 60 | N/A | N/A | N/A | N/A | N/A | The Patient Health Questionnaire (PHQ-8); The University of California, Los Angeles Loneliness Scale |
| [59]  | Italy         | Cross-sectional | An online survey                                                           | 2020/4/10 to 2020/4/13                     | 91                                | N/A | N/A | 58–75 | 164 | N/A | N/A | 38–57 | 245 | N/A | N/A | The Kessler 10 Psychological Distress Scale (K10) |
| [60]  | Canada and USA| Cross-sectional | An online survey                                                           | 2020/3 to 2020/8                           | 262                                | N/A | N/A | 60–91 | 342 | N/A | N/A | 40–59 | 424 | N/A | N/A | Daily affect                                                                                     |
| [61]  | China         | Cross-sectional | Data from retrospective, single-centre case series of the consecutive hospitalised patients | 2020/1/1 to 2020/2/3                      | N = 138, M = 56                     | N/A | N/A | 60–91 | 342 | N/A | N/A | 40–59 | 424 | N/A | N/A | The clinical outcomes (i.e. discharges, mortality, length of stay) |
| [62]  | USA           | Cross-sectional | An online survey                                                           | 2020/3/2 to 2020/3/23                     | 825                                | N/A | N/A | ≥ 60  | N/A | N/A | N/A | N/A | N/A | The Perceived Stress Scale; The Positive and Negative Affect Scale (PANAS) |
| [63]  | USA           | Cross-sectional | An online survey                                                           | 2020/3/22 to 2020/3/24                    | 714                                | N/A | N/A | ≥ 60  | N/A | N/A | N/A | N/A | N/A | The Perceived Stress Scale; The Negative Affect portion of the Positive and Negative Affect Scale (PANAS) |
| [64]  | China         | Cross-sectional | An online survey                                                           | 2020/2/25 to 2020/3/3                     | i = 6,666, range = 35–50          | N/A | N/A | N/A  | N/A | N/A | N/A | N/A | N/A | Post-Traumatic Stress Disorder Checklist-civilian version (PCL-C) |
Data availability
The data sets obtained in this study are available from the Survey of Health, Ageing and Retirement in Europe (SHARE).

Authors’ contributions
JL, JZ, HX, and ZZ contributed to the study design. HX analysed the data. JL wrote the manuscript. HX and JZ revised the article. All authors proofread and approved the submitted version of the article.

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Conflicts of interest
The authors declare that there is no conflict of interest.

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