Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
The effect of age, gender, income, work, and physical activity on mental health during coronavirus disease (COVID-19) lockdown in Austria

Christoph Pieh,⁎, Sanja Budimir, Thomas Probst

Abstract

Background: The impact of Coronavirus disease (COVID-19) and the governmental restrictions on mental health have been reported for different countries. This study evaluated mental health during COVID-19 lockdown in Austria and the effect of age, gender, income, work, and physical activity.

Methods: An online survey was performed through Qualtrics® after four weeks of lockdown in Austria to recruit a representative sample regarding gender, age, education, and region. Indicators of mental health were quality of life (WHO-QOL BREF), well-being (WHO-5), depression (PHQ-9), anxiety (GAD-7), stress (PSS-10), and sleep quality (ISI).

Results: In total, N = 1005 individuals were included (53% women). 21% scored above the cut off ≥10 points (PHQ-9) for moderate depressive symptoms, 119% scored above the cut-off ≥10 points (GAD-7) for moderate anxiety symptoms, and 16% above the cut-off ≥15 points (ISI) for clinical insomnia. ANOVAs, Bonferroni-corrected post-hoc tests, and t-tests showed highest mental health problems in adults under 35 years, women, people with no work, and low income (all p-values < .05). Comparisons with a large Austrian sample recruited within the ATHIS 2014 study showed increases of depression and decreases of quality of life in times of COVID-19 as compared to before COVID-19.

Conclusions: Depressive symptoms (21%) and anxiety symptoms (19%) are higher during COVID-19 compared to previous epidemiological data. 16% rated over the cut-off for moderate or severe clinical insomnia. The COVID-19 pandemic and lockdown seems particularly stressful for younger adults (<35 years), women, people without work, and low income.

1. Introduction

The Coronavirus disease 2019 (COVID-19) pandemic and the governmental restrictions impact our daily life in most parts of the world. Although restrictions are effective to prevent the uncontrolled spreading of COVID-19 [1], they might negatively affect mental health [2]. It is common for individuals to feel stressed and worried in times of pandemics, with fears of falling ill or dying, being socially excluded in quarantine, or losing their work [3].

There is a rapidly increasing number of publications on mental health in the pandemic and the governmental restrictions, respectively. Many of them are statements or comments and report alarming implications on emotional and social functioning [4] or an increased vulnerability for mental health problems and suicidal behavior [5].

So far, there are a few empirical studies with regard to the effect of the pandemic on mental health, some are already published as final papers and others are available as preprints. Ahmad et al. [6] reported 25% suffering from anxiety in India, whereby work situation, income, gender, and relationship status were correlated with mental health. A large Italian study including 18,147 individuals found 37% with post-traumatic stress symptoms, 17.3% with depression, 20.8% with anxiety, 7.3% with insomnia, 21.8% with high stress, and 22.9% with adjustment disorder [7] whereby women and younger age were risk factors for worse mental health. In Portugal, 7.6% suffered from severe depression symptoms, 9.1% from severe anxiety symptoms, 9.3% from severe stress symptoms, and 12.4% from severe obsessive-compulsive symptoms [8] with having work and being more physical active protecting from mental health problems. In Brazil, mild to moderate peritraumatic distress was found in 52% of the participants and severe distress in 18.8% [9]. In Japan, 10.18% with moderate to severe depression and 11.4% to moderate to severe anxiety, whereby younger age and unemployment were risk factors. Wang et al. [11] found higher mean scores for PTSD symptoms and more than half of the participants rated the psychological impact of the outbreak as moderate or severe with an increase of 16.5% in moderate to severe depressive symptoms and 28.8% in moderate to severe anxiety symptoms. Huang & Zhao [12] reported a higher prevalence of general anxiety disorder (GAD), especially in the younger population. However, the cut-off score for GAD was set to a GAD-7 score higher or equal 9 points, which might lead to an overestimation of GAD. Patients with GAD have an average sum score of 14 points [13], higher or equal 9 points corresponds with mild (5–9) or moderate (10–14) anxiety symptoms [14]. Another study...

⁎ Corresponding author at: Department for Psychotherapy and Biopsychosocial Health, Danube University Krems, Austria.
E-mail address: Christoph.pieh@donau-uni.ac.at (C. Pieh).

https://doi.org/10.1016/j.jpsychores.2020.110186
Received 8 May 2020; Received in revised form 24 June 2020; Accepted 26 June 2020
0022-3999/ © 2020 Published by Elsevier Inc.
from Spain measured levels of anxiety, stress, and depression during COVID-19 and found lower levels of depression [15] compared to the Chinese study mentioned above [11]. Interestingly, they reported higher mean levels of stress, anxiety, and depression in younger adults [16]. These results are in line with an study from India, which also found high scores for depression, anxiety and stress in younger adults [18]. Besides younger individuals, infected individuals, individuals with pre-existing mental health problems might be other groups more vulnerable to mental health burden due to COVID-19 [4].

In Austria, measures against COVID-19 became obligatory on 16th of March 2020 (COVID-19 lockdown). To summarize entering public places was strictly prohibited and only in some exceptions allowed (see methods). The aim of this study was to evaluate mental health in a representative adult sample in Austria after 4 weeks of lockdown considering relevant influencing factors such as age [15], gender [19], income, and job situation [20].

2. Methods

2.1. Study design

An online survey was performed with Qualtrics® [21] to measure mental health during the COVID-19 restrictions in Austria. The survey started after 4 weeks of quarantine in Austria and was performed for two weeks (until April 30th, 2020). This measurement point was selected because the scales used relate to the last two or four weeks.

2.2. Governmental restriction during the survey

In Austria, measures against COVID-19 became obligatory on 16th of March 2020 (COVID-19 lockdown). There were only the following five exceptions of the ban to enter public places. Activities to avert an impending crisis. Also, children seem to suffer heavenly. Over 80% of parents noticed a perceived change in their children's emotional state and behavior, with more difficulties in concentrating (76.6%), boredom (52%), followed by irritability, restlessness, nervousness, or feelings of loneliness. That was shown by a study on 1143 parents in Italy and Spain, in which results were slightly higher for Spain compared to Italy [18]. Besides younger individuals, infected individuals, individuals with pre-existing mental health problems might be other groups more vulnerable to mental health burden due to COVID-19 [4].

In Austria, measures against COVID-19 became obligatory on 16th of March 2020 (COVID-19 lockdown). To summarize entering public places was strictly prohibited and only in some exceptions allowed (see methods). The aim of this study was to evaluate mental health in a representative adult sample in Austria after 4 weeks of lockdown considering relevant influencing factors such as age [15], gender [19], income, and job situation [20].

2.3. Study sample

A representative sample according to age, gender, education, and region for Austria was recruited through Qualtrics panel. Participants were contacted by Qualtrics project team who organized and coordinated data collection. We aimed for a representative sample size of at least 1000 participants. After recruiting the majority within the first few days, we focused on the harder to reach niche segments (e.g. older respondents). Demographic characteristics of the study sample (N = 1005) are presented in Table 1.

| Variable | n | % |
|----------|---|---|
| Gender   |   |   |
| Women    | 530 | 52.7 |
| Men      | 475 | 47.3 |
| Age      |   |   |
| 18–24    | 118 | 11.7 |
| 25–34    | 166 | 16.5 |
| 35–44    | 185 | 18.4 |
| 45–54    | 222 | 22.1 |
| 55–64    | 181 | 18.0 |
| 65+      | 133 | 13.2 |
| Region   |   |   |
| Burgenland | 35 | 3.5 |
| Lower Austria | 187 | 18.6 |
| Vienna   | 218 | 21.7 |
| Carinthia | 66  | 6.6 |
| Styria    | 149 | 14.8 |
| Upper Austria | 172 | 17.1 |
| Salzburg  | 63  | 6.3 |
| Tyrol     | 77  | 7.7 |
| Vorarlberg | 38  | 3.8 |
| Education |   |   |
| No school education | 1 | 0.1 |
| Secondary School | 26 | 2.6 |
| Apprenticeship | 321 | 31.9 |
| High School | 288 | 28.7 |
| University | 369 | 36.7 |

n: frequencies; %: percent.

2.5. Quality of life (WHO-QOL BREF)

The WHOQOL-BREF [22] provides a reliable, valid, and brief assessment of quality-of-life. The 26 items self-rating questionnaire measures physical health, psychological health, social relationships, and environment during the past two weeks. WHOQOL-BREF has good to excellent psychometric properties of reliability and performs well in preliminary tests of validity [23].

General norms for the WHOQOL-BREF domains were found to be 73.5 (SD = 18.1) for the Physical health domain, 70.6 (14.0) for Psychological wellbeing, 71.5 (18.2) for Social relationships, and 75.1 (13.0) for the Environment domain [24]. Cronbach’s alpha for the examined psychological domain was α = 0.86 in the current sample.

2.6. WHO-5 well-being

Well-being was measured with the WHO-5 questionnaire [25]. It measures well-being with five self-rating items rated on six-point Likert scales with higher score indicating higher well-being. The WHO-5 has good psychometric properties [26,27]. The raw score therefore theoretically ranges from 0 (absence of well-being) to 25 (maximal well-being). Because scales measuring health-related quality of life are conventionally translated to a percentage scale from 0 (absent) to 100 (maximal), it is recommended to multiply the raw score by 4 [27]. Cronbach’s alpha was α = 0.90 in the current sample.

2.7. Perceived stress (PSS-10)

Stress-levels were assessed with the reliable and valid PSS-10 including 10 items on a five-point scale ranging from 0 to 4 [28]. Participants are asked to rate their stress-level over the last month. Cronbach’s alpha was α = 0.89 in the current sample.

2.8. Depressive symptoms (PHQ-9)

Depressive symptoms were measured with the depression module of the Patient Health Questionnaire, the PHQ-9 [29], with 9 self-rating
items on a four point scale, from 0 to 3. Cut-off points are for mild depression, 10 for moderate depression and at least 15 for severe levels of depression [30]. The 10-point cut-off was used in the present study to define clinically relevant depression. Cronbach’s alpha was α = 0.89 in the current sample. Additionally, the PHQ-8 score was calculated [31] in order to be able to compare the PHQ-8 of the present study with the PHQ-8 of the Austrian Health Interview Survey 2014 (ATHIS) [32]. Cronbach’s Alpha for the PHQ-8 was α = 0.88 in the current sample. The 10-point cut-off was used for the PHQ-8 as well [31].

2.9. Anxiety (GAD-7)

Anxiety symptoms were measured with Generalized Anxiety Disorder 7 scale (GAD-7) [14]. The GAD-7 is a validated [33] instrument which measures anxiety with 7 self-rating items on a four point scale, from 0 to 3. Cut-off points are 5 for mild, 10 for moderate and 15 for severe anxiety symptom levels. The 10-point cut-off was used in the current study to define clinically relevant anxiety. Cronbach’s alpha was α = 0.90 in the current sample.

2.10. Sleep quality (ISI)

The Insomnia Severity Index (ISI) is a self-reported 7-item on a four point scale (from 0 to 4) questionnaire measuring sleep quality and insomnia with an excellent internal consistency (Cronbach α of 0.90 and 0.91) [34]. A cut-off score of 10 was optimal (86.1% sensitivity and 87.7% specificity) for detecting insomnia cases in the community sample. The total score categories are 1) no clinically significant insomnia (< 7 points), 2) subthreshold insomnia (8–14 points), 3) clinical insomnia (moderate severity) (15–21 points), and 4) clinical insomnia (severe) (22–28 points). The 15-point cut-off score was applied in the present study to define clinically relevant insomnia. Cronbach’s alpha was α = 0.84 in the current sample.

2.11. Statistical analysis

All data were analyzed using SPSS version 24 (IBM Corp, Armonk, NY, USA). Descriptive statistics were conducted to describe the demographic characteristics, scales mean values, and the prevalence of mental health burden stratified by gender, age, income, work, and physical activity reported in the representative Austrian sample. ANOVAs (mental health scales as dependent variables and age group, work, net income, and physical activity as between-subject variable), and Bonferroni-corrected post-hoc tests were performed to compare the impact on mental health in different age, work, net income, and physical activity groups. t-tests were calculated to compare differences on mental health scales between gender. As effect size measure, η² was used to categorize small (η² = 0.01), medium (η² = 0.06), and large (η² = 0.14) effects for ANOVAs; Hedges’g was calculated for gender (small effect: 0.2 to 0.5, medium effect: 0.5 to 0.8, large effect: > 0.8). Moreover, t-tests were calculated to compare the results for the PHQ-8 and the WHOQOL-BREF psychological domain of the present study with the results of these scales found in the ATHIS 2014 survey with 15,771 participants [32]. Chi-squared tests were performed to investigate differences between symptom severity categories and age, gender, income, work, physical activity, and sample (current sample vs. ATHIS 2014 sample). P-values of less than 0.05 were considered statistically significant (2-sided tests).

2.12. Ethical consideration

This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Danube University Krems, Austria (Ethical number: EK GZ 26/2018–2021). All participants gave electronic informed consent for participation and completing the questionnaires. Data was collected anonymous without IP addresses or GPS tracking and this procedure was approved by the data protection officer of the Danube-University Krems.
Table 3

Number of participants exceeding the cut-off score for moderate depression/anxiety/insomnia, measures of psychological health, wellbeing and stress by age.

| Age | PHQ-9 score ≤ 10 | PHQ-9 score > 10 | GAD-7 score ≤ 10 | GAD-7 score > 10 | ISI score ≤ 15 | ISI score > 15 | Total | Statistic |
|-----|-----------------|-----------------|-----------------|-----------------|----------------|----------------|-------|-----------|
| 18-24 | 80 (67.8) | 38 (32.2) | 96 (81.4) | 22 (18.6) | 118 (100) | 22 (18.6) | 158 (15.7) | χ²(5) = 48.02; p < .001 |
| 25-34 | 110 (66.3) | 56 (33.7) | 136 (81.9) | 30 (18.1) | 166 (100) | 30 (18.1) | 191 (15.0) | χ²(5) = 21.63; p = .001 |
| 35-44 | 148 (80.0) | 37 (20.0) | 159 (85.9) | 26 (14.1) | 185 (100) | 26 (14.1) | 158 (15.7) | χ²(5) = 17.93; p = .003 |
| 45-54 | 178 (80.2) | 44 (19.8) | 177 (79.7) | 45 (20.3) | 222 (100) | 45 (20.3) | 187 (15.7) | χ²(5) = 17.93; p = .003 |
| 55-64 | 152 (84.0) | 29 (16.0) | 152 (84.0) | 29 (16.0) | 181 (100) | 29 (16.0) | 181 (100) | χ²(5) = 17.93; p = .003 |
| 65+  | 126 (94.7) | 7 (5.3) | 127 (95.5) | 6 (4.5) | 133 (100) | 6 (4.5) | 133 (100) | χ²(5) = 17.93; p = .003 |

PHQ-9 M 8.25 7.89 6.07 6.21 5.16 3.74 6.19 F(5; 1004) = 14.37; p < .001; η² = 0.067
PHQ-9 SD 5.96 5.78 5.05 5.54 4.80 3.95 5.40
GAD-7 M 7.26 7.07 6.06 5.92 4.91 3.85 5.84 F(5; 1004) = 11.27; p < .001; η² = 0.053
GAD-7 SD 4.93 4.78 4.42 4.87 4.36 3.97 4.70
ISI M 8.59 9.72 8.34 8.77 7.86 6.11 8.31 F(5; 1004) = 6.75; p < .001; η² = 0.033
ISI SD 5.80 5.89 5.55 5.77 5.88 4.51 5.70
WHOQOL BREF (psychological domain) M 65.72 67.35 69.84 68.28 72.83 75.08 69.83 F(5; 1004) = 5.16; p < .001; η² = 0.025
WHOQOL BREF (psychological domain) SD 20.32 19.12 17.60 20.60 16.65 15.82 15.05
WHOQOL BREF (psychological domain) M 13.63 14.20 15.08 14.66 15.65 17.18 15.05 F(5; 1004) = 7.51; p < .001; η² = 0.036
WHOQOL BREF (psychological domain) SD 4.91 5.26 5.00 5.88 5.46 4.97 5.40
WHOQOL BREF (psychological domain) M 19.25 17.89 16.24 16.07 14.05 12.73 15.97 F(5; 1004) = 15.24; p < .001; η² = 0.071
WHOQOL BREF (psychological domain) SD 6.80 7.05 7.04 7.78 7.37 6.80 7.47

p: p-values (2-tailed); n: frequencies; M: mean score; SD: standard deviation; χ²: Chi-square; F: F-test; ISI: Insomnia Severity Index, GAD-7 (Generalized Anxiety Disorder 7 scale); PHQ-9: Patient Health Questionnaire 9 scale; PSS-10: Perceived Stress Scale 10; WHO-5: Well-being questionnaire of the World Health Organization (WHO); WHO-QOL BREF: Quality of Life questionnaire of the World Health Organization (WHO);
3. Results

In total \( N = 1005 \) participated in the study (Women: \( N = 530; 52.7\% \)). For the characteristics of the study sample, see Table 1.

Results for mean scores (M) and standard deviation (SD) for the PHQ-9, GAD-7, ISI, WHO-QOL BREF (psychological domain), WHO-5, as well as PSS-10 and number of participants below/above the cut-off score for moderate depression/anxiety/insomnia between women and men are presented in Table 2. Women were more burdened than men.

Results for mean scores (M) and standard deviation (SD) for the PHQ-9, GAD-7, ISI, WHO-QOL BREF (psychological domain), WHO-5, and PSS-10 between age groups as well as number of participants below/above the cut-off score for moderate depression/anxiety/insomnia stratified by age groups are given in Table 3. Post-hoc tests can be found in the supplement. To summarize the post-hoc tests, low income was associated with less mental health in all scales considering cut-offs as well as mean scores.

Results for mean scores (M) and standard deviation (SD) for the PHQ-9, GAD-7, ISI, WHO-QOL BREF (psychological domain), WHO-5, and PSS-10 between physical activity groups as well as number of participants below/above the cut-off score for moderate depression/anxiety/insomnia stratified by physical activity groups are given in Table 4. Post-hoc tests can be found in the supplement. To summarize the post-hoc tests, more physical activity was related to better mental health in almost all scales (except ISI) considering cut-offs as well as mean scores.

Table 7 shows the comparisons between our sample and the ATHIS 2014 sample with regard to PHQ-8 and WHOQOL-BREF (psychological domain). It can be seen that mental health burden was significantly higher now than 2014 in Austria.

4. Discussion

The current study explored mental health four weeks after the COVID-19 lockdown in Austria. There are two major findings of this study. First, the COVID-19 pandemic, as well as the lockdown, seems to have a major impact on mental health. Second, young adults (< 35 years), women, people without work as well as with low income are significantly more burdened, physical activity has a positive association with mental health.

The impact of the current situation on mental health is also evident when examining the number of participants scoring above established cut-offs for depression, anxiety, and insomnia. In the current study, 19% scored 10 points or higher on the GAD-7. Previous representative population studies from Germany found that 5% scored above the same cut-off (greater-equal 10 points) in 2008 [33] or 6% in 2017 [35]. In addition, 21% of the participants in the present study showed

### Table 4
Number of participants exceeding the cut-off score for moderate depression/anxiety/insomnia, measures of psychological health, wellbeing and stress by work.

| Work          | No | No, but before the lockdown I did | Yes, Home-Office | Yes | Yes, reduced hours | Retired | Total | Statistic |
|---------------|----|----------------------------------|------------------|----|-------------------|---------|-------|-----------|
| **PHQ-9 score** |    |                                   |                  |    |                    |         |       |           |
| n (%)         |    |                                   |                  |    |                    |         |       |           |
| < 10          | 114 (65.1) | 68 (72.3)                       | 209 (78.9)       | 167 (86.1) | 80 (78.4) | 156 (89.1) | 794 (79.0) | \( \chi^2 (5) = 39.52; p < .001 \) |
| \( \geq 10 \) | 61 (34.9)  | 26 (27.7)                       | 56 (21.1)        | 27 (13.9) | 22 (21.6) | 19 (10.9) | 21 (21.0)  | \( \chi^2 (5) = 15.04; p = .01 \) |
| **GAD-7 score** |    |                                   |                  |    |                    |         |       |           |
| n (%)         |    |                                   |                  |    |                    |         |       |           |
| < 10          | 128 (73.1) | 73 (77.7)                       | 214 (80.8)       | 162 (83.5) | 82 (80.4) | 155 (88.6) | 814 (81.0) | \( \chi^2 (5) = 14.83; p = .01 \) |
| \( \geq 10 \) | 47 (26.9)  | 21 (22.3)                       | 51 (19.2)        | 32 (16.5) | 20 (19.6) | 20 (11.4) | 19 (10.9)  | \( \chi^2 (5) = 15.04; p = .01 \) |
| **ISI score** |    |                                   |                  |    |                    |         |       |           |
| n (%)         |    |                                   |                  |    |                    |         |       |           |
| \( \geq 15 \) | 134 (76.6) | 77 (81.9)                       | 225 (88.7)       | 166 (85.6) | 82 (80.4) | 153 (87.4) | 847 (84.3) | \( \chi^2 (5) = 14.83; p = .01 \) |
| **PHQ-9**     |    |                                   |                  |    |                    |         |       |           |
| M             | 8.14 | 6.97                            | 6.14             | 5.42 | 6.19              | 4.74    | 6.19  | \( F(5; 1004) = 8.58; p < .001; \eta^2 = 0.041 \) |
| SD            | 7.60 | 6.65                           | 7.20             | 6.30 | 6.91              | 5.40    |       |           |
| **GAD-7**     |    |                                   |                  |    |                    |         |       |           |
| M             | 4.99 | 4.76                           | 4.66             | 4.48 | 4.66              | 4.29    | 4.70  | \( F(5; 1004) = 6.67; p < .001; \eta^2 = 0.032 \) |
| SD            | 5.75 | 5.26                           | 5.33             | 5.03 | 5.23              | 4.35    | 5.84  |           |
| **ISI**       |    |                                   |                  |    |                    |         |       |           |
| M             | 9.75 | 8.69                           | 7.63             | 8.60 | 8.22              | 7.42    | 8.31  | \( F(5; 1004) = 4.09; p = .001; \eta^2 = 0.020 \) |
| SD            | 5.30 | 5.46                           | 5.42             | 5.58 | 5.72              | 5.50    | 5.70  |           |
| **WHOQOL BREF** | (psychological domain) |    |                                   |                  |    |                    |         |       |           |
| M             | 65.4 | 67.25                          | 71.51            | 71.78 | 70.56            | 72.38  | 69.83 | \( F(5; 1004) = 6.00; p < .001; \eta^2 = 0.029 \) |
| **WHO-5**     |    |                                   |                  |    |                    |         |       |           |
| M             | 12.6 | 14.70                          | 15.20            | 15.45 | 15.58            | 16.15  | 15.05 | \( F(5; 1004) = 6.43; p < .001; \eta^2 = 0.031 \) |
| **PSS-10**    |    |                                   |                  |    |                    |         |       |           |
| M             | 5.56 | 5.72                           | 5.25             | 4.81 | 5.04              | 5.71    | 5.40  | \( F(5; 1004) = 9.67; p < .001; \eta^2 = 0.046 \) |
| SD            | 7.60 | 7.84                           | 7.21             | 6.44 | 7.49              | 7.67    | 7.47  |           |

p: p-values (2-tailed); n: frequencies; M: mean score; SD: standard deviation; \( \chi^2 \): Chi-square; F: F-test; ISI: Insomnia Severity Index, GAD-7 (Generalized Anxiety Disorder 7 scale); PHQ-9: Patient Health Questionnaire 9 scale; PSS-10: Perceived Stress Scale 10; WHO-5: Well-being questionnaire of the World Health Organization (WHO); WHO-QOL BREF: Quality of Life questionnaire of the World Health Organization (WHO);
Table 5
Number of participants exceeding the cut-off score for moderate depression/anxiety/insomnia, measures of psychological health, wellbeing and stress by income.

|                      | Total | Statistic   |
|----------------------|-------|-------------|
| Net income           |       |             |
| < € 1,000,-          | 45 (63.4) | 177 (75.3) | 239 (78.6) | 166 (84.7) | 167 (83.9) | 794 (79.0) | $\chi^2 (4) = 19.12; p = .001$ |
| ≥ € 1,000,- to € 2,000,- | 26 (36.6) | 58 (24.7) | 65 (21.4) | 39 (15.3) | 32 (16.1) | 211 (21.0) | $\chi^2 (4) = 13.15; p = .01$ |
| ≥ € 2,000,- to € 3,000,- | 49 (69.0) | 182 (77.4) | 250 (82.2) | 170 (86.7) | 163 (81.9) | 814 (81.0) | $\chi^2 (4) = 13.35; p = .01$ |
| ≥ € 3,000,- to € 4,000,- | 22 (31.0) | 53 (22.6) | 54 (17.8) | 26 (13.3) | 36 (18.1) | 191 (19.0) | $\chi^2 (4) = 13.35; p = .01$ |
| > € 4,000,-          | 21 (29.4) | 45 (18.4) | 45 (15.9) | 25 (12.8) | 24 (12.4) | 171 (17.0) | $\chi^2 (4) = 13.35; p = .01$ |
| Total                | 71 (100) | 235 (100) | 304 (100) | 196 (100) | 199 (100) | 1005 (100) | $\chi^2 (4) = 13.35; p = .01$ |

|                     | M     | SD    | F(4; 1004) | $\eta^2 = 0.031$ |
|---------------------|-------|-------|------------|------------------|
| PHQ-9 score n (%)   | 8.34  | 6.18  | 8.04       | < .001           |
| GAD-7 score n (%)   | 7.62  | 5.17  | 4.25       | < .001           |
| ISI score n (%)     | 9.65  | 5.92  | 4.65       | < .001           |
| WHOQOL BREF (psychological domain) | 63.00 | 68.64 | 13.63      | < .001           |
| WHO-5               | 12.99 | 14.82 | 9.16       | < .001           |
| PSS-10              | 8.47  | 6.98  | 5.21       | < .001           |

p: p-values (2-tailed); n: frequencies; M: mean score; SD: standard deviation; $\chi^2$: Chi-square; F: F-test; ISI: Insomnia Severity Index, GAD-7 (Generalized Anxiety Disorder 7 scale); PHQ-9: Patient Health Questionnaire 9 scale; PSS-10: Perceived Stress Scale 10; WHO-5: Well-being questionnaire of the World Health Organization (WHO); WHO-QOL BREF: Quality of Life questionnaire of the World Health Organization (WHO).
Table 6
Number of participants exceeding the cut-off score for moderate depression/anxiety/insomnia, measures of psychological health, wellbeing and stress by physical activity.

| Days of physical activity | 0     | 1     | 2     | 3     | 4 or more |
|--------------------------|-------|-------|-------|-------|-----------|
| **PHQ-9 score n (%)**    |       |       |       |       |           |
| < 10                     | M     | SD    | M     | SD    |           |
| ≥10                      | M     | SD    | M     | SD    |           |
| **GAD-7 score n (%)**    |       |       |       |       |           |
| < 10                     | M     | SD    | M     | SD    |           |
| ≥10                      | M     | SD    | M     | SD    |           |
| **ISI score n (%)**      |       |       |       |       |           |
| < 15                     | M     | SD    | M     | SD    |           |
| ≥15                      | M     | SD    | M     | SD    |           |
| **WHOQOL BREF (psychological domain)** | M     | SD    | M     | SD    |           |
| < 10                     | M     | SD    | M     | SD    |           |
| ≥10                      | M     | SD    | M     | SD    |           |

| Sample | ATHIS 2014 | Sample of current study |
|--------|------------|--------------------------|
| N = 15,771 | N = 1005 |
| **PHQ-8 score n (%)** |       |       |       |       |           |
| < 10 | 15,185 (96.3) | 805 (80.1) | χ²(1) = 554.19; p < .001 |
| ≥10 | 586 (3.7)  | 200 (19.9) |
| **PHQ-8** |       |       |       |       |           |
| M | 2.53 | 5.93 |
| SD | 3.02 | 5.00 |
| **WHOQOL BREF psychological domain** |       |       |       |       |           |
| M | 76.55 | 69.83 |
| SD | 14.04 | 18.70 |

p: p-values (2-tailed); n: frequencies; M: mean score; SD: standard deviation, χ²: Chi-square; F: F-test; ISI: Insomnia Severity Index, GAD-7 (Generalized Anxiety Disorder 7 scale); PHQ-9: Patient Health Questionnaire 9 scale; PSS-10: Perceived Stress Scale 10; WHO-5: Well-being questionnaire of the World Health Organization (WHO); WHO-QOL BREF: Quality of Life questionnaire of the World Health Organization (WHO).

depressive symptoms (above the cut-off greater-equal 10 points) on the PHQ-9. Comparable representative population studies found that 4% scored above this cut-off in 2006 [36], or 6% in 2013 [37], and again 4% in an Austrian sample in 2014 (but measured with the PHQ-8) [32]. The prevalence rate for depression during COVID-19 is comparable to the ATHIS 2014 sample (76.6 vs. current sample: 69.8) with a small to medium effect size [32]. However, data for the ATHIS 2014 study [32] was collected years ago and the sample was different to ours so that a comparison is only possible to a limited extend. Similarly, well-being (WHO-5) was lower compared to a study from Denmark published in 2003 (presented in percent, not as raw score: 15.05 × 4 = 60.2 vs. 68.7 reported by Beck et al. [40]. The stress-level (PSS-10: 16.0) is comparable with a COVID-19 study including 41 countries showing a mean PSS-10 score of 17.4 [41]. However, stress-level was especially in the younger age groups higher than in studies from pre-corona times [42]. Klein et al. [42] found an average score of 12.7 in 20–39 years old adults compared to 19.3 (age 18–24), 17.9 (age 25–34), and 16.2 (age 35–44) in the current study. Average insomnia symptoms (ISI mean score 8.3) are below clinical insomnia (greater-equal 15), but slightly above the cut-off for sub-threshold insomnia (greater-equal 8 points).

As expected, gender showed an impact on mental health in the current study. Differences in mental disorders are among the most

Table 7
Comparisons of the current sample during COVID-19 with the sample of the Austrian Health Interview Survey 2014 (ATHIS) [32] in the PHQ-8 and the psychological domain of the WHO-QOL BREF.

| Sample | ATHIS 2014 N = 15,771 | Sample of current study N = 1005 |
|--------|------------------------|----------------------------------|
| **PHQ-9 score n (%)** |       |       |       |       |           |
| < 10 | 15,185 (96.3) | 805 (80.1) | χ²(1) = 554.19; p < .001 |
| ≥10 | 586 (3.7)  | 200 (19.9) |
| **PHQ-8** |       |       |       |       |           |
| M | 2.53 | 5.93 |
| SD | 3.02 | 5.00 |
| **WHOQOL BREF psychological domain** |       |       |       |       |           |
| M | 76.55 | 69.83 |
| SD | 14.04 | 18.70 |

p: p-values (2-tailed); n: frequencies; M: mean score; SD: standard deviation, χ²: Chi-square; F: F-test; PHQ-8: Patient Health Questionnaire 9 scale; PSS-10: Perceived Stress Scale 10; WHO-5: Well-being questionnaire of the World Health Organization (WHO); WHO-QOL BREF: Quality of Life questionnaire of the World Health Organization (WHO).
intriguing and stable findings in psychiatry [19]. Women were scoring worse in every tested scale compared to men. For example, 25% of women scored above the PHQ-9 cut-off greater-equal 10 points for depressive symptoms and 16% of men. Thus, women scored significantly higher now compared to the ATHS 2014 study, when 5.1% of women and 3.4% of men in Austria were clinically relevant depressed according to the PHQ-8 cut-off greater-equal 10 points [43]. Moreover, mental quality of life was lower (67 vs. 73) in women compared to men. In line with previous studies [44] well-being was lower for women than for men (14.5 vs. 15.6).

Noteworthy, there was a clear age-related effect in all tested mental health scales. These results are alarming and should be considered in more detail. In each tested mental health aspect, the younger adult groups (< 35 years) showed the worst scores (depending on the scaling higher or lower score) and the older people (65+ years) the best. These results are reverse to a previous studies before COVID-19 in Austria as mental health was decreasing with age [32]. In this previous study, psychological health (measured with the WHO-QOL BREF) decreased from 77.9 (age 15–30) to 69.6 (> 75 years) [32]. The PHQ-9 is generally stable throughout all periods of adulthood according to a large survey of 15,847 participants [45]. However, in the current study the youngest age group (18-24 years) showed twice as high scores in the PHQ-9 compared to the oldest (65+ years) (8.3 vs. 3.7). Over 30% of people below 35 years show depressive symptoms, compared to 5% in those being 65+ years old. Similar effects were found for anxiety: A study on the GAD-7 showed similar scores for every age group with lowest scores for the youngest age group [33]. These findings are reversed to the current ones, were the youngest group (18–24) again showed the highest scores (7.3 compared to 3.9 for the 65+): 25% of adults under 35 years score above the GAD-7 cut-off for at least moderate anxiety symptoms, only 7% in people 65+. Interestingly, the older adults seem to be handling this exceptional situation better than the younger ones. In every measurement, the scores get better with every age category. There might be various explanations for these findings, such as more uncertain working conditions and therefore serious financial problems for younger people. The lockdown might also lead to larger restriction for younger than for older people. However, these results seem robust and are in line with several other COVID-19 studies cited in the introduction [12,15,16].

Our results are in line with previous findings on job situation and mental health. People with mild to moderate mental illness, such as anxiety or depression, are twice as likely to be unemployed [46]. Unemployed rates for people with a severe mental disorder are five times as high as for people without a mental disorder [46]. In connection to these findings, a reduction in household income is associated with increased risk for incident mental disorders [47].

Association between physical activity and mental health as found in the current study is well known [48]. Increased duration and greater intensity of physical activity were both associated with further reduction in prevalence of depression in men [49]. Such results were found for adults (e.g. [50,51]) as well as in children and adolescents [48].

When interpreting the results, the following limitations have to be considered. Although the sample is representative for age, gender, education, and region, it is not representative for combinations of these variables, e.g. age interlocked with gender. This cross-sectional study allows no causal conclusions. Two measurement points (before vs. in COVID-19 lockdown) would have been more adequate to study changes in mental health. Furthermore, there is a potential bias since the sample was actively recruited and the sample size is small. Other interesting and probably influencing demographics (such as number of migrants) were not assessed. Moreover, the online survey was based only on self-rating tests. Although valid and widely used, people are often biased when they report on their own experiences [52]. Using screening questionnaires to estimate prevalence can overestimate prevalence: For example, if 20% of patients had a score above the cut-off ≥ 10 points in the PHQ-9, plausible estimates of true disorder prevalence would range from 6% to 17% when adjusted with the formula recommended from [53]: Prevalence = (%above cut-off + specificity - 1) / (sensitivity + specificity - 1). Although a representative sample according to age, gender, education, and income was recruited, the sample size is rather small, and the generalizability is questionable. A clinician assessment necessary to make statements about psychiatric disorders such as the Structured Clinical Interview was missing, which makes the interpretation of the results vague. Furthermore, the current results were compared to previous studies, in general some years earlier and from different countries. It is unclear, which effect is explained by the current situation.

To sum these first findings up, there is a major increase of mental health problems in the general population compared to pre-corona studies. Doubtless, the effect of the pandemic cannot be estimated at this time, especially the long-term effects. However, the prevalence of moderate to severe depressive and anxiety symptoms is higher compared to several previous studies [32–36]. Also insomnia symptoms seem more prevalent compared to previous studies [38], whereas psychological health and well-being are lower [32,40]. Especially young adults, women, people with low income, without a job, and those being physically inactive, are burdened in the current situation. As already recommended from other authors [54], timely psychological support should be offered to counteract this development.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jspychores.2020.110186.

References

[1] B. Nussbaumer-Streit, V. Mayr, A.I. Dobrescu, A. Chapman, E. Persad, I. Klerings, G. Wagner, U. Siebert, C. Christof, C. Zachariah, G. Garlebacher. Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review, Cochrane Database Syst. Rev. (2020), https://doi.org/10.1002/14651858.CD013574.
[2] S.K. Brooks, R.K. Webster, L.E. Smith, L. Woodland, S. Wessely, N. Greenberg, G.J. Rubin, The psychological impact of quarantine and how to reduce it: rapid review of the evidence, Lancet 395 (2020) 912–920, https://doi.org/10.1016/S0140-6736(20)30460-8.
[3] IFRC, IFRC, https://media.ifrc.org/ Ifrc, (2020).
[4] B. Pfefferbaum, C.S. North, Mental Health and the Covid-19 Pandemic, N. Engl. J. Med. 0 (2020), https://doi.org/10.1056/NEJMp2008171 null.
[5] D. Gunnell, L. Appleby, E. Arensman, K. Hawton, A. John, N. Kapur, M. Khan, R.C. O’Connor, J. Pickers, L. Appleby, E. Arensman, E.D. Caine, L.F. Chan, S.-S. Chang, Y.-Y. Chen, H. Christensen, R. Dandona, M. Eddleston, A. Erlangsen, D. Gunnell, J. Harkavy-Friedman, K. Hawton, A. John, N. Kapur, M. Khan, O.J. Kirtley, D. Kripke, F. Konradsen, S. Liu, S. McManus, L. Meldrum, M. Miller, P. Moran, J. Morrissey, C. Moutier, T. Nierderkrontenthaler, M. Nordentoft, R.C. O’Connor, S. O’Neill, A. Page, M.R. Phillips, J. Pickris, S. Platt, M. Pomplili, P. Qin, M. Rezaeiann, M. Silverman, S. Sinyour, S. Stack, E. Townsend, G. Turecki, L. Vijayakumar, P.S. Yip, Suicide risk and prevention during the COVID-19 pandemic, Lancet Psychiatry (2020), https://doi.org/10.1016/S2215-0366(20)30171-1
[6] S22150366(20)301711.
[7] A. Ahmad, I. Rahman, M. Agarwal, FACTORS Influencing Mental Health During Covid-19 outbreak: An Exploratory Survey Among Indian Population, Psychiatry and Clinical Psychology (2020), https://doi.org/10.1016/j.pscychresns.2020.05.03.0081380.
[8] R. Rossi, V. Succi, D. Tavelli, S. Mensi, C. Nicoi, F. Pacitti, A. Di Marco, A. Rossi, A. Siracusano, G. Di Lorenzo, COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy. An N = 18147 web-based survey, Psych. Clin. Psychol. (2020), https://doi.org/10.1016/j.spcp.2020.04.09.0075802.
[9] F.S. Moreira, S. Ferreira, B. Couto, M. Machado-Sousa, M. Fernandez, C. Raposo-Lima, N. Souza, M. Pico-Perez, P. Morgado, Protective Elements of Mental Health Status during the COVID-19 Outbreak in the Portuguese Population, Psychiatry and Clinical Psychology (2020), https://doi.org/10.1016/j.psychresns.2020.08.0671.
[10] K.S. Zhang, Y. Wang, A. Afshar-Jahanshahi, J. Jia, V.G. Haenel Schmitt, First Study on Mental Distress in Men during the COVID-19 Crisis, Psychiatry and Clinical Psychology (2020), https://doi.org/10.1016/j.psychresns.2020.04.08.07589.
[11] S. Ueda, A. Stickley, H. Suzki, T. Matsubayashi, Mental Health Status of the General Population during the COVID-19 Pandemic: A Cross-Sectional National Survey in Japan, Psychiatry and Clinical Psychology (2020), https://doi.org/10.1016/j.psychresns.2020.04.08.082453.
[12] C. Wang, R. Pan, X. Wan, Y. Tan, L. Xu, C.S. Ho, R.C. Ho, Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China, Int. J.
[27] C.W. Topp, S.D. Østergaard, S. Søndergaard, P. Bech, The WHO-5 well-being index: WHO, Wellbeing Measures in Primary Health Care/The Depcare Project, (1998).

[25] A. Riecher-Rössler, Sex and gender differences in mental disorders, Lancet Psychiatry 4 (2017) 8–9, https://doi.org/10.1016/S2215-0366(16)30348-0.

[24] K. Kroenke, T. Strine, R. Spitzer, J. Williams, J. Berry, A. Mokdad, The PHQ-8 as a measure of current depression in the general population, JAMA. 282 (1999) 1737, https://doi.org/10.1001/jama.282.18.17377.

[23] K. Kroenke, R.L. Spitzer, The PHQ-9: a new depression diagnostic and severity measure, Psychiatr. Ann. 32 (2002) 509–515, https://doi.org/10.3928/0048-5713-20020901-06.

[22] R.L. Spitzer,Validation and utility of a self-report version of PRIME-MD:The PHQ primary care study, JAMA. 282 (1999) 1737, https://doi.org/10.1001/jama.282.18.17377.

[21] K. Kroenke, R.L. Spitzer, The PHQ-9: a systematic review of the literature, Psychother. Psychosom. 84 (2015) 167–176, https://doi.org/10.1024/1016-1027/84/4.

[20] M. Orgilés, A. Morales, E. Delvecchio, C. Mazzeschi, J.P. Espada, Immediate psychological effects of the COVID-19 quarantine in youth from Italy and Spain, Psychiatry and Clinical Psychology, 2020, https://doi.org/10.1016/j.pccp.2020.102076.

[19] J. Sareen, T.O. Afifi, K.A. McClearn, G.J.G. Asmundson, Relationship between COVID-19 em uma amostra no norte da Espanha, Cad Saúde Pública. 9 (2020).

[18] K. Wölfling, M.E. Beutel, The German version of the perceived stress scale – psychological effects of the COVID-19 quarantine in youth from Italy and Spain, Psychiatry and Clinical Psychology, 2020, https://doi.org/10.1016/j.pccp.2020.102076.

[17] B. Löwe, O. Decker, S. Müller, E. Brähler, D. Schellberg, W. Herzog, P.Y. Herzberg, A. Maercker, J. van Os, M. Preitaig, L. Salvador-Carulla, R. Simon, H.-C. Steinhausen, The size and burden of mental disorders and other disorders of the brain in Europe 2010, Eur. Neuropsychopharmacol. 21 (2011) 655–679, https://doi.org/10.1016/j.euroneuro.2011.07.018.

[16] P. Bech, L.R. Olsen, M. Kjoller, N.K. Rasmussen, Measuring well-being rather than the absence of distress symptoms: a comparison of the SF-36 mental health subscale and the WHO-five well-being scale, Int. J. Methods Psychiatr. Res. 12 (2003) 85–91, https://doi.org/10.1002/mpr.145.

[15] R.S.G. Limcaoco, E.M. Mateos, J.M. Fernandez, C. Roncero, Anxiety, Worry and Depression questionnaire-9 scores against age in the general population: data from the National Health and Nutrition Examination Survey, Front. Psychiatry. 9 (2018) 390, https://doi.org/10.3389/fpsyt.2018.00390.

[14] OECD, Fit Mind, Fit Job: From Evidence to Practice in Mental Health and Work, OECD, (2015), https://doi.org/10.1787/9789264228263-en.

[13] R.-D. Kocalevent, A. Hinz, E. Brähler, Standardization of the depression screener GAD-7, based on a large German general population sample, J. Affect. Disord. 210 (2017) 338–344, https://doi.org/10.1016/j.jad.2016.12.012.

[12] C. Pieh, et al. Journal of Psychosomatic Research 136 (2020) 110186

[11] 9

[10] J. Krenke, T. Strine, R. Spitzer, J. Williams, J. Berry, A. Mokdad, The PHQ-8 as a measure of current depression in the general population, J. Affect. Disord. 28 (2006) 266–274, https://doi.org/10.1016/j.jad.2005.07.003.

[9] C. Pieh, A. Klein, E. Brähler, G. Glasemer, T. Luck, S.G. Riedel-Heller, K. Wirkner, A. Hilbert, Psychometric evaluation of the generalized anxiety disorder screener GAD-7, based on a large German general population sample, J. Affect. Disord. 210 (2017) 338–344, https://doi.org/10.1016/j.jad.2016.12.012.

[8] H.U. Wittchen, J. Rehm, A. Gustavsson, M. Svensson, B. Jönsson, J. Olsen, A. Allgulander, J. Alonso, C. Faravelli, L. Fratiglioni, P. Jemmum, R. Lieb, A. Maercker, J. van Os, M. Preitaig, L. Salvador-Carulla, R. Simon, H.-C. Steinhausen, The size and burden of mental disorders and other disorders of the brain in Europe 2010, Eur. Neuropsychopharmacol. 21 (2011) 655–679, https://doi.org/10.1016/j.euroneuro.2011.07.018.

[7] A. Hinz, A. Mehrten, R.-D. Kocalevent, E. Brähler, T. Forthmann, S. Singer, T. Schulte, Assessment of depression severity with the PHQ-9 in cancer patients and in the general population, BMC Psychiatry. 16 (2016) 22, https://doi.org/10.1186/s12888-016-0785-9.

[6] B. Löwe, O. Decker, S. Müller, E. Brähler, D. Schellberg, W. Herzog, P.Y. Herzberg, A. Maercker, J. van Os, M. Preitaig, L. Salvador-Carulla, R. Simon, H.-C. Steinhausen, The size and burden of mental disorders and other disorders of the brain in Europe 2010, Eur. Neuropsychopharmacol. 21 (2011) 655–679, https://doi.org/10.1016/j.euroneuro.2011.07.018.

[5] M. Devaux, F. Sassi, Social disparities in hazardous alcohol use: self-report bias may lead to incorrect estimates, Eur. J. Publ. Health 26 (2016) 872–876, https://doi.org/10.1093/eurpub/ckv074.

[4] D. Currier, R. Lindner, M.J. Spittal, S. Cvetkovski, J. Pirkis, D.R. English, Physical activity and mental health in children and adolescents: a review of reviews, Br. J. Sports Med. 45 (2011) 886–895, https://doi.org/10.1136/bjsports-2011-090185.

[3] R.S. Rimoldi, J. Huppert, The relationship between psychological well-being and educational achievements in the general population: data from the National Health and Nutrition Examination Survey, Front. Psychiatry. 9 (2018) 390, https://doi.org/10.3389/fpsyt.2018.00390.

[2] S.J.H. Biddle, M. Asare, Physical activity and mental health in children and adolescents: a review of reviews, Br. J. Sports Med. 45 (2011) 886–895, https://doi.org/10.1136/bjsports-2011-090185.

[1] K. Wölfling, M.E. Beutel, The German version of the perceived stress scale – psychological effects of the COVID-19 quarantine in youth from Italy and Spain, Psychiatry and Clinical Psychology, 2020, https://doi.org/10.1016/j.pccp.2020.102076.