



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.



Letter to the editor



The association of health behaviors and mental health during COVID-19

It has been previously reported that the COVID-19 pandemic and governmental restrictions to combat the spreading of the virus, are associated with an increase in mental health symptoms in the general population [1]. Health behavior has an important influence on physical and mental health. The COVID-19 pandemic and the associated restrictions negatively impacted health behaviors, such as a decrease in physical activity and an increase in smartphone usage [2].

This study evaluated the association of health behaviors with the prevalence of mental health indicators in the Austrian general population after two years of the COVID-19 pandemic.

An online survey ($N = 1031$, 50.3% females) was conducted on a representative population sample according to age, gender, region, and educational level from April 19 to 26, 2022 in Austria. The study was conducted following the Declaration of Helsinki and the American Association for Public Opinion Research (AAPOR) reporting guideline. It was approved by the Ethics Committee of the University for Continuing Education Krems, Austria (Ethical number: EK GZ 26/2018–2021). All participants gave electronic informed consent prior to participation.

Health behaviors (smartphone-use, physical activity) and mental health indicators (depressive symptoms (PHQ-9 [3]), anxiety symptoms (GAD-7 [4]), sleep quality (ISI [5]), alcohol abuse (CAGE [6]),

disordered eating (SCOFF [7]) and stress (PSS-10 [8])) were assessed. SPSS version 26 (IBM Corp, Armonk, NY, USA) was used to perform chi-squared tests for univariate analyses and p -values < 0.05 (2-sided) were considered statistically significant. Multivariable logistic regression was applied to adjust the data for smartphone usage (4 categories) and physical activity (two categories: physically inactive vs. physically active). Adjusted odds ratios (OR) and their 95% confidence intervals (CIs) were estimated to assess statistical uncertainty.

The prevalence of depressive symptoms (PHQ-9 ≥ 11 in 14- to 17-year-old and ≥ 10 in ≥ 18 -year-olds) ranged from 16% (< 1 h smartphone usage/d) to 48% (≥ 5 h smartphone usage/d) and from 44% (no physical activity) to 21% (one day of physical activity per week). Similarly, the prevalence of anxiety symptoms (GAD-7 ≥ 11 in 14- to 17-year-old and ≥ 10 in ≥ 18 -year-olds) ranged from 8% (< 1 h smartphone usage/d) to 29% (≥ 5 h smartphone usage/d) and from 25% (no physical activity) to 12% (one day of physical activity per week; Supplementary Table 1). Depressive symptoms, anxiety symptoms, insomnia, alcohol abuse, disordered eating and stress were positively correlated with smartphone usage ($p < 0.05$; Supplementary Table 1). Odds ratios (ORs) for ≥ 5 h vs. < 1 h smartphone usage/d ranged from 2.5 to 8.0 (Fig. 1). According to multivariable analyses (Fig. 1), physical inactivity was

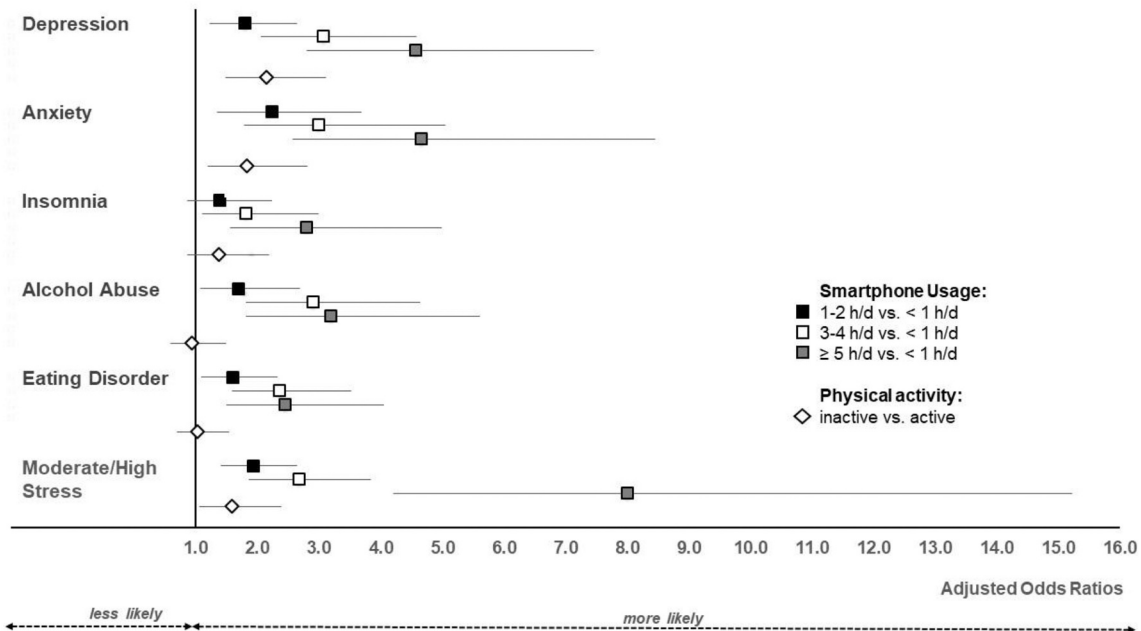


Fig. 1. Adjusted odds ratios and their 95% confidence intervals for smartphone usage and physical activity.

<https://doi.org/10.1016/j.genhospsych.2022.06.001>

Received 30 May 2022; Received in revised form 1 June 2022; Accepted 3 June 2022

Available online 7 June 2022

0163-8343/© 2022 Elsevier Inc. All rights reserved.

associated with greater likelihood of depression, anxiety, and stress (aORs from 1.6 to 2.2) compared to being physically active at least one day per week for ≥ 1 h. No statistically significant differences were observed for insomnia, alcohol abuse, or disordered eating (Fig. 1).

Overall, the incidence of depressive or anxiety symptoms was three to four times higher among heavy smartphone users (≥ 5 h/d) compared to those using their smartphone <1 h/d. In contrast, the prevalence of depressive or anxiety symptoms was reduced half among those who exercised at least once a week compared to those who did not exercise.

Several prior cross-sectional and longitudinal studies point to a negative association between smartphone usage and psychological well-being [9]. Smartphone use, however, has had potential benefits, as it has turned out to be a medium to circumvent the measures of physical distancing. The use of smartphone applications also holds great potential to offer immediate access to evidence-based mental health care [10]. The present study underscores the need for appropriate approaches to facilitate responsible smartphone usage, to mitigate multiple health problems, as well as the need to develop and test better methods of promoting physical activity.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.genhosppsych.2022.06.001>.

Author contributions

EH, CP: conceptualization and methodology. EH: formal analysis. EH: investigation. EH: data curation. EH and AG: writing—original draft preparation. RD, TP and CP: writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding

Open Access Funding by the University of Continuing Education Krems.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Declaration of Competing Interest

The authors declare that the research was conducted without any

commercial or financial relationships construed as a potential conflict of interest.

Data availability

Data will be made available on request.

References

- [1] Pieh C, Probst T, Budimir S, Humer E. Diminished well-being persists beyond the end of the COVID-19 lockdown. *Gen Hosp Psychiatry* 2021;70:137–8. <https://doi.org/10.1016/j.genhosppsych.2021.01.004>.
- [2] Sañudo B, Fennell C, Sánchez-Oliver AJ. Objectively-assessed physical activity, sedentary behavior, smartphone use, and sleep patterns pre- and during-COVID-19 quarantine in young adults from Spain. *Sustainability* 2020;12:5890. <https://doi.org/10.3390/su12155890>.
- [3] Spitzer RL. Validation and utility of a self-report version of PRIME-MD The PHQ primary care study. *JAMA* 1999;282:1737. <https://doi.org/10.1001/jama.282.18.1737>.
- [4] Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med* 2006;166:1092. <https://doi.org/10.1001/archinte.166.10.1092>.
- [5] Morin CM, Belleville G, Bélanger L, Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* 2011;34:601–8. <https://doi.org/10.1093/sleep/34.5.601>.
- [6] Dhalla S, Kopec JA. The CAGE questionnaire for alcohol misuse: a review of reliability and validity studies. *CIM* 2007;30:33. <https://doi.org/10.25011/cim.v30i1.447>.
- [7] Morgan JF, Reid F, Lacey JH. The SCOFF questionnaire: assessment of a new screening tool for eating disorders. *BMJ* 1999;319:1467–8. <https://doi.org/10.1136/bmj.319.7223.1467>.
- [8] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24:385. <https://doi.org/10.2307/2136404>.
- [9] Abi-Jaoude E, Naylor KT, Pignatiello A. Smartphones, social media use and youth mental health. *CMAJ* 2020;192:E136–41. <https://doi.org/10.1503/cmaj.190434>.
- [10] Torous J, Huffman J. Mobile mental health: bridging psychiatry and neurology through engaging innovations. *Gen Hosp Psychiatry* 2022;75:90–1. <https://doi.org/10.1016/j.genhosppsych.2021.05.008>.

Elke Humer^{*}, Afsaneh Gächter, Rachel Dale, Thomas Probst, Christoph Pieh
Department for Psychosomatic Medicine and Psychotherapy, University for Continuing Education Krems, 3500 Krems, Austria

^{*} Corresponding author at: Department for Psychosomatic Medicine and Psychotherapy, University for Continuing Education Krems, Dr.-Karl-Dorrek-Straße 30, 3500 Krems, Austria.
E-mail address: Elke.Humer@donau-uni.ac.at (E. Humer).