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.

Available online at www.sciencedirect.com

ScienceDirect

Current Opinion in Behavioral Sciences

Prevalence of problematic Internet use during the coronavirus disease 2019 pandemic

Julius Burkauskas[1], Julija Gecaite-Stonciene[1], Zsolt Demetrovics[2,3,*], Mark D Griffiths[4,*] and Orsolya Király[3]

The present paper reviews recent studies on problematic Internet use (PIU) prevalence before and during the coronavirus disease 2019 (COVID-19) pandemic. Several pre-pandemic meta-analyses reported PIU prevalence estimates ranging from 6% to 9.7%. Experts in the field of online addictions speculated that PIU would increase during the pandemic because of increased time spent on the Internet. However, it is still unclear if increased time on the Internet resulted in higher PIU prevalence estimates during the pandemic. Prevalence estimates differed greatly across studies during the COVID-19 pandemic. Possible inconsistencies are outlined together with future directions for PIU prevalence studies.

Addresses
[1] Laboratory of Behavioral Medicine, Neuroscience Institute, Lithuanian University of Health Sciences, Palanga, Lithuania
[2] Centre of Excellence in Responsible Gaming, University of Gibraltar, Gibraltar
[3] Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary
[4] International Gaming Research Unit, Psychology Department, Nottingham Trent University, Nottingham, United Kingdom

Corresponding author:
Zsolt Demetrovics (zsolt.demetrovics@unigib.edu.gi)
* Twitter account: @Demetrovics, @DrMarkGriffiths

Current Opinion in Behavioral Sciences 2022, **46**:101179

This review comes from a themed issue on **Internet Addiction**

Edited by **Naomi Fineberg** and **Marc Potenza**

For complete overview of the section, please refer to the article collection, "Internet Addiction"

Available online 15th June 2022

https://doi.org/10.1016/j.cobeha.2022.101179

Introduction

The introduction of the Internet and global digitalisation has revolutionised the ways people interact with the world, and its use has become an essential activity in most individuals' lives. Nevertheless, Internet use can also pose a threat on various areas of a minority of individuals' lives due to its potentially addictive features (e.g. accessibility, anonymity, convenience, etc.) and/or the online activities themselves (e.g. gaming, gambling, social media use, etc.) [1]. The first studies highlighting the addictive potential of the Internet date from the mid-1990s [1–3]. Continued dedicated research on problematic Internet use (PIU) has raised awareness of the potential negative effects of Internet use on individuals' mental health [4], which led to a great burden on health systems worldwide in terms of people's health and societal costs of PIU [5].

Currently, PIU is considered as a behavioural addiction because its use can result in dependence-like symptoms and does involve the ingestion of a psychoactive substance [1,6]. PIU is a term covering a wide range of problematic online behaviours including excessive social media use, gaming, gambling, streaming, pornography viewing, and impulsive buying [4], as well as newer behaviours such as cyberhoarding and cyberchondria [7•]. However, the term 'Internet addiction' itself has been criticised and some scholars have suggested it should be replaced with the term 'addictions to the specific Internet-related activities' [8]. The World Health Organisation's 11th revision of the *International Classification of Diseases* (ICD-11) now recognises three disorders that can primarily be engaged in online, namely gaming disorder, gambling disorder and compulsive sexual behaviour disorder [9]. The introduction of these diagnoses is considered an important step forward, as researchers now have a more precise way of defining, assessing, and studying such disorders worldwide [10].

There appears to have been an increase in Internet use globally due to the coronavirus disease 2019 (COVID-19) pandemic given that individuals have had to work and/or be educated from home due to measures implemented to inhibit the spread of the virus (e.g. lockdowns, quarantines, self-isolation, etc.). As pandemic-related circumstances led to the apparent increased use of the Internet, experts raised concerns over the possibility of increased PIU, including but not limited to problematic gaming, gambling, and pornography use [11••,12••–14]. The concern was raised that as a behavioural addiction, PIU prevalence could significantly increase during the pandemic, similar to substance use addictions and other behavioural addictions [15,16]. Increase in general Internet use might have its own positive and negative consequences. Positive consequences include the capacity to work and/or be educated from

home, while the major negative consequence is the negative impact on mental health status [11,17]. Moreover, financial hardship [18] and isolation [19] may also have contributed to an increase in time spent online as it might have been used as coping mechanism to deal with the negative psychosocial consequences of the pandemic. Therefore, the aim of this short review was to overview the prevalence estimates of PIU among young adults before and during COVID-19 pandemic.

The inconsistency of problematic Internet use prevalence estimates

The prevalence estimates of PIU significantly differ across studies. During 2021, several studies estimating the prevalence rates of PIU worldwide were published. The data for the studies discussed further in this paragraph were collected in 2019 (i.e. pre-pandemic). When examining these recent studies in more detail, there is still a great discrepancy in the prevalence estimates, even when using the same screening instrument to assess PIU, most noticeably, the Internet Addiction Test (IAT, cutoff score ≥50) [3]. For instance, Guo et al. [20] carried out a study with 30581 Chinese university students and reported a PIU prevalence estimate of 8.4%. Another Chinese study [21] comprising 1956 adolescent school students reported a PIU prevalence estimate of 14.5%. In a recent Ethiopian cross-sectional study [22], a PIU prevalence estimate of 19.4% was reported among 761 university students. A similar PIU estimate (20.7%) was reported by Dib et al. [23] among 1810 Lebanese adolescents attending a private school. A Turkish study of 1558 high school students reported a PIU prevalence estimate of 21.1% [24]. However, one Indian study [25] reported a prevalence estimate of 47.0% among 470 nursing students. All of the aforementioned recent studies used the same instrument (IAT) and cutoff score (i.e. ≥50) but still produced inconsistent results which might be attributed — at least partially — to methodological and cultural differences as well as the nonrepresentativeness of the different types of cohorts sampled.

Moreover, different screening instruments and different threshold levels were used in other recent studies. For example, a cross-sectional Hungarian study by Kotyuk et al. [26] comprising 3003 adolescents and young adults reported a PIU prevalence estimate of 13.3%. Here, the study utilised the Problematic Internet Usage Questionnaire (PIUQ) with a cutoff score of ≥15. A cross-sectional Nepalese study by Sharma et al. [27] comprising 166 medical students reported a PIU prevalence estimate of 31.9% using the Generalized Problematic Internet Use Scale-2 with the cutoff score of ≥40. In addition to the different screening instruments used in these studies, geographical and cultural differences may have also accounted for the variances in PIU prevalence estimate scores.

First, one of the most important aspects to consider when interpreting prevalence estimates of PIU is the sample heterogeneity and the relative lack of consistency in terms of the diagnostic criteria for PIU. Second, all of these studies relied on self-report screening instruments, which has been shown to inherently overestimate prevalence rates when a condition is rare [28]. Third, an aspect worth noting with regards to differences in PIU prevalence is that the majority of studies used convenience samples. Convenience sampling is considered appropriate for descriptive analyses and explorations of potential associations. However, it is not valid for measures of uncertainty such as confidence intervals around prevalence estimates [29]. Consequently, careful consideration is needed when comparing prevalence estimates that have used different sampling methods. Fourth, there are also social, cultural, and demographic differences in Internet access, use, and attitudes in different studies that may result in these discrepancies in PIU prevalence estimates. Since PIU has been regarded as heterogeneous construct [8], the prevalence of PIU might also depend on the preferred type of online activity. In some countries, restrictions can potentially be imposed to control specific online activities, such as Internet gambling which may affect the general prevalence of PIU. Moreover, the dynamics of change in the level of propensity to use of the Internet in European countries are well documented, as a recent analysis showed high levels of diversity (with even further increases during the period from 2010 until 2019) and the highest changes recorded in Northern European countries [30]. However, the current literature lacks explanation regarding cross-cultural differences in terms of PIU. Therefore, further research on cultural variations and the nature of PIU in relation to prevalence estimates is recommended [4].

A recent meta-analysis examined data comprising 700,000 individuals from 113 epidemiological studies in 31 nations, and reported that 7.0% of the population may have PIU [31••]. Similarly, analysis conducted in 2014 [32] also including data from 31 nations (N = 89 281) and reported a PIU prevalence estimate of 6.0%. In addition, a recent meta-analysis comprising 1818 healthcare professionals reported a slightly higher PIU prevalence estimate of 9.7% suggesting that specific professions might have an increased vulnerability to PIU [33•].

Prevalence of problematic Internet use during the coronavirus disease 2019 pandemic

Similar to the pre-COVID-19 pandemic studies, recently reported PIU prevalence estimates during the pandemic significantly differ, ranging from 4% to 43.8% [34••–43]. Considering these inconsistencies, it is assumed that cultural differences may also play a role in prevalence estimate discrepancies. These differences also largely

depend on the screening instruments employed. For example, a Japanese study by Oka et al. [40] used the Compulsive Internet Use Scale (CIUS, a cutoff score of ≥29) and reported the prevalence of PIU to be 8%. However, a Spanish study by Romero-Rodriguez et al. [37] comprising 1013 university students reported a prevalence estimate of 12% (IAT, a cutoff score ≥50).

A Chinese cross-sectional study by Zhao et al. [38] comprising 11 254 university students estimated the PIU prevalence rate to be 28.4%. The data for the studies of Guo et al. [20] (prevalence estimate of PIU 8.4% among university students) and Wang et al. [21] (prevalence estimate of PIU 14.5% among adolescents) were collected in 2019, while Zhao et al. [38] collected data at the peak of the COVID-19 pandemic in 2020. All three studies assessed PIU with the IAT using a cutoff score of ≥50. However, the studies of Guo et al. [20] and Wang et al. [21] were the only ones that used a multistage random sampling method to recruit study participants, whereas Zhao et al. [38] used an online convenience sampling method. This might explain — at least partly — the discrepancy between the results. The most recent meta-analysis [31•] found that nonrepresentative samples tend to have higher rates of PIU than representative samples (10.63% versus 6.06%). However, general sample representativeness was not found to significantly explain variance in the rate of PIU [31•]. In addition, the increase in prevalence might also be attributed to possible lockdown restrictions. Furthermore, even in the two studies which were completed in the same country during the same year (2019), there was a 6% discrepancy in PIU prevalence estimates (although one study comprised adolescents and other cohort was older and comprised university students).

Some PIU prevalence estimates during the COVID-19 pandemic in Europe are relatively lower than those of Asian countries, although some are similar. Two Hungarian studies [39,42] estimated the PIU prevalence rate to be 3.9% (n = 485 hospital staff members) and 5.2% (N = 1817 high school teachers) using the PIUQ (with a cutoff score of ≥42). A Swiss study by Mohler-Kuo et al. [41] comprising 1627 young adults and 1146 children and adolescents estimated the PIU prevalence rate to be 21.3% for young adults and 30.1% for children and adolescents (CIUS-Short Form, cutoff score of ≥13).

However, to the best of the present authors' knowledge there are only two longitudinal studies. Oka et al. reported a PIU prevalence increase of 1.6 times during the pandemic among both adults and young people [40]. Another longitudinal study by Nakayama et al. [34••] assessing Internet use among junior high school students after long-term school closure due to the COVID-19 pandemic confirmed these findings. This study examined changes of PIU prevalence estimates from 2018 to 2020, suggesting a slight increase from 4.6% to 5.2% which supports the findings of Oka et al. (although the reported increase was not statistically significant).

Summarising the aforementioned studies, large inconsistencies are observed in PIU prevalence estimates. Consequently, the true prevalence rate of PIU during the COVID-19 pandemic is not known. The main determining factor regarding the apparent increased time individuals have spent on the Internet in the past two years has been the COVID-19 pandemic, which is now also cited as the main contributory factor in a number of reported mental health problems (e.g. increased depression, anxiety, stress, etc.) [44–46]. Children, adolescents, and adults have had to use the Internet more intensively than ever before. However, increase in Internet use might not necessarily be problematic for mental health or PIU severity. There is evidence indicating that the purpose and motivation of Internet use are more important for determining psychological well-being and severity of PIU [47] than the actual time spent online. Therefore, the prevalence of PIU may not be directly associated with the amount of time spent online but may be attributable to the context of PIU activity (e.g. time spent using social media versus online shopping), which is especially true in gaming disorder (e.g. a recent study showed that comorbid psychiatric symptoms and playing to escape were associated with problematic use rather than the time spent gaming [48]). However, PIU severity could possibly be linked to the severity of avoidant coping to real-life situations caused by the COVID-19 pandemic [49]. In this regard, it is expected that mental health problems (e.g. depression and anxiety) might mediate the relationship between the amount of time spent online and PIU severity. Furthermore, if these symptoms increased temporally due to the COVID-19 pandemic, a decrease in PIU prevalence estimates would be expected after the pandemic is over. While the studies discussed mostly focused on young adults, this is especially true for adolescents who are vulnerable group in terms of PIU risk. However, they might be the ones who overcome PIU faster than the other cohorts and age groups [50]. However, a recent meta-analysis [31•] did not consider age influence on PIU due to inconsistent reports or lack of reports of age. Future studies and meta-analyses should explore how PIU affects different age groups before, during, and after the COVID-19 pandemic.

However, an increase in time spent online was also reported before the COVID-19 pandemic. Therefore, the increased amount of time spent online observed during the pandemic might be independent from the pandemic itself. Another point to consider is the time that PIU takes to develop. For example, in the ICD-11 [9], for a diagnosis of gaming disorder (a specific subtype of PIU), it should be present for 12 months. It is also possible that

pandemic-associated increases in PIU will be seen in future studies if PIU takes up to a year to develop.

Conclusion

There is no doubt that the COVID-19 pandemic has posed a threat to mental health among millions of individuals worldwide, as the psychological impacts of this pandemic have been extensively reported in scientific literature during the past two years [44–46]. PIU can be a serious psychological issue threatening individuals' well-being and their level of everyday functioning [4,11••,12••]. Nevertheless, the assessment of PIU prevalence remains challenging, as there is still great methodological and cultural heterogeneity. Consequently, the prevalence estimates of PIU differ significantly worldwide. Even though some recent studies suggest increased prevalence estimates in PIU during the COVID-19 pandemic in comparison to the pre-pandemic period, more methodologically rigorous studies are needed to address the psychodiagnostic evaluation and cultural differences. It should also be noted that the research outlined here only examined studies examining generalized PIU rather than specific forms of problematic online use (e.g. Internet gaming disorder and social media disorder). Future studies, and particularly meta-analyses, are needed to consider age, gender, sample representativeness, geographical location, and methodological differences (especially in terms of online behaviour type and screening method used) in analysing PIU prevalence before, during, and after the COVID-19 pandemic.

Author contributions

JB and ZD took part in conceptualization and planning. JB, JGS, OK and MDG wrote the first draft. All authors commented and revised the manuscript, read, and approved the submitted version. All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest statement

JB served as a consultant for Cogstate, Ltd and Cronos in the past several years. JGS worked as a consultant for FACITtrans for the last four years. ELTE Eötvös Loránd University receives funding from the Szerencsejáték Ltd. to maintain a telephone helpline service for problematic gambling. ZD has also been involved in research on responsible gambling funded by Szerencsejáték Ltd. and the Gambling Supervision Board and provided educational materials for the Szerencsejáték Ltd's responsible gambling program. The University of Gibraltar receives funding from the Gibraltar Gambling Care Foundation. However, these fundings are not related to this study and the funding institution had no role or any influence on this publication. ZD and MDG have been members of a WHO advisory group on the public health consequences of addictive behaviours. In this capacity, they have been eligible for travel support from WHO or the host centre to attend advisory group meetings but have not been remunerated for their work. However, this funding is not related to this study and the funding institution had no role in the study design or the collection, analysis, and interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. MDG's university has received research funding from *Norsk Tipping* (the gambling operator owned by the Norwegian Government). MDG has also received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling and gambling treatment from Gamble Aware (formerly the Responsible Gambling Trust), a charitable body which funds its research program based on donations from the gambling industry. MDG regularly undertakes consultancy for various gaming companies in the area of social responsibility, player protection, and harm minimisation in gambling.

Data Availability

No data were used for this review article.

Acknowledgements

This publication is based upon work from COST Action CA16207 "European Network for Problematic Usage of the Internet", supported by COST (European Cooperation in Science and Technology), www.cost.eu. ZD's contribution was also supported by the Hungarian National Research, Development and Innovation Office (KKP126835; K128614; K134807). OK was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences and by the ÚNKP-21-5 New National Excellence Program of the Ministry for Innovation and Technology from the source of the National Research, Development and Innovation Fund.

References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest.

1. Griffiths M: **Technological addictions**. *Clin Psychol Forum* 1995, **76**:14-19.

2. Brenner V: **Psychology of computer use: XLVII. Parameters of internet use, abuse and addiction: the first 90 days of the internet usage survey**. *Psychol Rep* 1997, **80**:879882.

3. Young KS: **Internet Addiction Test (IAT)**. Stoelting; 2016.

4. Fineberg NA, Demetrovics Z, Stein DJ, Ioannidis K, Potenza MN, Grünblatt E, Brand M, Billieux J, Carmi L, King DL, Grant JE, *et al.*: **Manifesto for a European research network into problematic usage of the internet**. *Eur Neuropsychopharmacol* 2018, **28**:12321246.

5. World Health Organization: **Public Health Implications of Excessive Use of the Internet, Computers, Smartphones and Similar Electronic Devices: Meeting Report**. Main Meeting Hall, Foundation for Promotion of Cancer Research, National Cancer Research Centre, Tokyo, Japan, 27–29 August 2014. World Health Organization; 2015.

6. Spada MM: **An overview of problematic internet use**. *Addict Behav* 2014, **39**:3-6.

7. • Vismara M, Caricasole V, Varinelli A, Fineberg NA: **13 — Cyberchondria, cyberhoarding, and other compulsive online disorders**. In *Mental Health in a Digital World*. Edited by Stein DJ, Fineberg NA, Chamberlain SR. Academic Press; 2022:261-283.
Detailed description of new types of problematic online behaviour such as cyberchondria and cyberhoarding. The chapter discusses the available knowledge about these problematic online behaviors, focussing on the clinical aspects to better understand their assessment, diagnosis, and treatment.

8. Starcevic V, Aboujaoude E: **Internet addiction: reappraisal of an increasingly inadequate concept**. *CNS Spectr* 2017, **22**:7-13.

9. World Health Organisation: **ICD-11 Mortality and Morbidity Statistics. Mental, Behavioural or Neurodevelopmental Disorders**. Available at ⟨https://icd.who.int/browse11/l-m/en⟩ Accessed 28 December 2021.

10. Billieux J, Stein DJ, Castro-Calvo J, Higushi S, King DL: **Rationale for and usefulness of the inclusion of gaming disorder in the ICD-11**. *World Psychiatry* 2021, **20**:198.

11. •• Gjoneska B, Potenza MN, Jones J, Corazza O, Hall N, Sales CMD, Grünblatt E, Martinotti G, Burkauskas J, Werling AM, Walitza S, *et al.*: **Problematic use of the internet during the Covid19 pandemic: good practices and mental health recommendations**. *Compr Psychiatry* 2022, **112**:152279.
Narrative review summarizing information on the extent of PIU during the pandemic, specifically addressing the issues of online gaming, online gambling, and online pornography viewing. Guidance for mental health professionals and those affected by PIU, as well as for the general public are outlined.

12. •• Király O, Potenza MN, Stein DJ, King DL, Hodgins DC, Saunders JB, Griffiths MD, Gjoneska B, Billieux J, Brand M, Abbott MW, *et al.*: **Preventing problematic internet use during the covid19 pandemic: consensus guidance**. *Compr Psychiatry* 2020, **100**:152180.
Experts in the field of online addiction provide consensus guidance and practical recommendations that may help to diminish the risks of PIU posed by COVID-19 pandemic.

13. Mestre-Bach G, Blycker GR, Potenza MN: **Pornography use in the setting of the Covid-19 pandemic**. *J Behav Addict* 2020, **9**:181-183.

14. King DL, Delfabbro PH, Billieux J, Potenza MN: **Problematic online gaming and the Covid-19 pandemic**. *J Behav Addict* 2020, **9**:184-186.

15. Dores AR, Carvalho IP, Burkauskas J, Simonato P, De Luca I, Mooney R, Ioannidis K, GomezMartinez M, Demetrovics Z, Ábel KE: **Exercise and use of enhancement drugs at the time of the Covid-19 pandemic: a multicultural study on coping strategies during self-isolation and related risks**. *Front Psychiatry* 2021, **12**:165.

16. Masaeli N, Farhadi H: **Prevalence of internet-based addictive behaviors during Covid-19 pandemic: a systematic review**. *J Addict Dis* 2021, **39**:468-488.

17. Li YY, Sun Y, Meng SQ, Bao YP, Cheng JL, Chang XW, Ran MS, Sun YK, Kosten T, Strang J: **Internet addiction increases in the general population during Covid-19: evidence from China**. *Am J Addict* 2021, **30**:389-397.

18. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, Agha M, Agha R: **The socioeconomic implications of the coronavirus pandemic (Covid-19): a review**. *Int J Surg* 2020, **78**:185-193.

19. Mucci F, Mucci N, Diolaiuti F: **Lockdown and isolation: psychological aspects of Covid-19 pandemic in the general population**. *Clin Neuropsychiatry* 2020, **17**:63-64.

20. Guo L, Shi G, Du X, Wang W, Guo Y, Lu C: **Associations of emotional and behavioral problems with internet use among Chinese young adults: the role of academic performance**. *J Affect Disord* 2021, **287**:214-221.

21. Wang Q, Mati K, Cai Y: **The link between problematic internet use, problematic gaming, and psychological distress: does sleep quality matter?** *BMC Psychiatry* 2021, **21**:1-11.

22. Mengistu N, Tarekegn D, Bayisa Y, Yimer S, Madoro D, Assefa DG, Zeleke ED, Molla W, Wudneh A, Shumye S, Duko B: **Prevalence and factors associated with problematic internet use among Ethiopian undergraduate university students in 2019**. *J Addict* 2021, **2021**:6041607.

23. Dib JE, Haddad C, Sacre H, Akel M, Salameh P, Obeid S, Hallit S: **Factors associated with problematic internet use among a large sample of Lebanese adolescents**. *BMC Pediatr* 2021, **21**:1-12.

24. Cam HH, Top FU: **Prevalence and risk factors of problematic internet use and its relationships to the self-esteem and health-related quality of life: data from a high-school survey in Giresun province, Turkey**. *J Addict Nurs* 2020, **31**:253-260.

25. Thirusangu S, Kumar A, Yadav A, Kumari A, Mishra A, Shakya S, Patel T: **A comparative study to assess the level of internet addiction among B.Sc. Nursing and GNM students at Rama College of Nursing Kanpur with a view to develop information booklet**. *Asian J Nurs Educ Res* 2020, **10**:351-359.

26. Kotyuk E, Magi A, Eisinger A, Király O, Vereczkei A, Barta C, Griffiths MD, Székely A, Kökönyei G, Farkas J: **Co-occurrences of substance use and other potentially addictive behaviors: epidemiological results from the psychological and genetic factors of the addictive behaviors (PGA) study**. *J Behav Addict* 2020, **9**:272-288.

27. Sharma P, Shakya R, Singh S, Balhara YPS: **An online survey of problematic internet use and its correlates among undergraduate medical students of Nepal**. *Neurol Psychiatry Brain Res* 2020, **37**:95-99.

28. Maráz A, Király O, Demetrovics Z: **Commentary on: are we overpathologizing everyday life? A tenable blueprint for behavioral addiction research. The diagnostic pitfalls of surveys: If you score positive on a test of addiction, you still have a good chance not to be addicted**. *J Behav Addict* 2015, **4**:151-154.

29. Pierce M, McManus S, Jessop C, John A, Hotopf M, Ford T, Hatch S, Wessely S, Abel KM: **Says who? The significance of sampling in mental health surveys during COVID-19**. *Lancet Psychiatry* 2020, **7**:567-568.

30. Oesterreich M: **Dynamics of changes in the level of propensity to use the internet in European Union countries in 2010-2019**. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu* 2020, **64**:102-117.

31. •• Pan Y-C, Chiu Y-C, Lin Y-H: **Systematic review and meta-analysis of epidemiology of internet addiction**. *Neurosci Biobehav Rev* 2020, **118**:612-622.
Most up-to-date meta-analysis concerning PIU prevalence worldwide.

32. Cheng C, Li AY-l: **Internet addiction prevalence and quality of (real) life: a meta-analysis of 31 nations across seven world regions**. *Cyberpsychol Behav Soc Netw* 2014, **17**:755-760.

33. • Buneviciene I, Bunevicius A: **Prevalence of internet addiction in healthcare professionals: systematic review and meta-analysis**. *Int J Soc Psychiatry* 2020, **67**:483-491.
Recent meta-analysis of PIU prevalence among healthcare professionals.

34. •• Nakayama H, Matsuzaki T, Mihara S, Kitayuguchi T, Higuchi S: **Change of internet use and bedtime among junior high school students after long-term school closure due to the coronavirus disease 2019 pandemic**. *Children* 2021, **8**:480.
Longitudinal study examining changes of PIU prevalence estimates from 2018 to 2020, suggesting only a slight increase.

35. Xia Y, Fan Y, Liu T-H, Ma Z: **Problematic internet use among residential college students during the Covid-19 lockdown: a social network analysis approach**. *J Behav Addict* (2) 2021, **10**:253-262 ([Online ahead of print]).

36. Klavina A, Veliks V, Zusa-Rodke A, Porozovs J, Aniscenko A, Bebrisa-Fedotova L: **The associations between problematic**

internet use, healthy lifestyle behaviors and health complaints in adolescents. *Front Educ* 2021, **6**:673563.

37. Romero-Rodríguez J-M, Marín-Marín J-A, Hinojo-Lucena F-J, Gómez-García G: **An explanatory model of problematic internet use of southern Spanish university students**. *Soc Sci Comput Rev* 2021, 0894439321998650.

38. Zhao Y, Jiang Z, Guo S, Wu P, Lu Q, Xu Y, Liu L, Su S, Shi L, Que J: **Association of symptoms of attention deficit and hyperactivity with problematic internet use among university students in Wuhan, China during the Covid-19 pandemic**. *J Affect Disord* 2021, **286**:220227.

39. Toth G, Kapus K, Hesszenberger D, Pohl M, Kosa G, Kiss J, Pusch G, Fejes E, Tibold A, Feher G: **Internet addiction and burnout in a single hospital: is there any association?** *Int J Environ Res Public Health* 2021, **18**:615.

40. Oka T, Hamamura T, Miyake Y, Kobayashi N, Honjo M, Kawato M, Kubo T, Chiba T: **Prevalence and risk factors of internet gaming disorder and problematic internet use before and during the COVID-19 pandemic: A large online survey of Japanese adults**. *J. Psychiatr. Res.* 2021, **142**:218-225.

41. Mohler-Kuo M, Dzemaili S, Foster S, Werlen L, Walitza S: **Stress and mental health among children/adolescents, their parents, and young adults during the first Covid-19 lockdown in Switzerland**. *Int J Environ Res Public Health* 2021, **18**:4668.

42. Tóth G, Kapus K, Hesszenberger D, Pohl M, Kósa G, Kiss J, Pausch G, Fejes É, Tibold A, Feher G: **Prevalence and risk factors of internet addiction among Hungarian high school teachers**. *Life* 2021, **11**:194.

43. Sayeed A, Rahman MH, Hassan MN, Christopher E, Kundu S, Al Banna MH, Hasan A-R, Mallick T, Meem AE, Hasan MT: **Problematic internet use associated with depression, health, and internet-use behaviors among university students of Bangladesh: a cross-sectional study**. *Child Youth Serv Rev* 2021, **120**:105771.

44. Hampshire A, Hellyer PJ, Soreq E, Mehta MA, Ioannidis K, Trender W, Grant JE, Chamberlain SR: **Associations between dimensions of behaviour, personality traits, and mental-health during the Covid-19 pandemic in the United Kingdom**. *Nat Commun* 2021, **12**:1-15.

45. Gecaite-Stonciene J, Saudargiene A, Pranckeviciene A, Liaugaudaite V, Griskova-Bulanova I, Simkute D, Naginiene R, Dainauskas LL, Ceidaite G, Burkauskas J: **Impulsivity mediates associations between problematic internet use, anxiety, and depressive symptoms in students: a cross-sectional Covid-19 study**. *Front Psychiatry* 2021, **12**:17.

46. Zhou J, Liu L, Xue P, Yang X, Tang X: **Mental health response to the Covid-19 outbreak in China**. *Am J Psychiatry* 2020, **177**:574-575.

47. Coyne SM, Rogers AA, Zurcher JD, Stockdale L, Booth M: **Does time spent using social media impact mental health?: an eight year longitudinal study**. *Comput Hum Behav* 2020, **104**:106160.

48. Király O, Tóth D, Urbán R, Demetrovics Z, Maraz A: **Intense video gaming is not essentially problematic**. *Psychol Addict Behav* 2017, **31**:807.

49. Mota DCB, Silva YV, Costa TAF, Aguiar MHC, Marques MEM, Monaquezi RM: **Mental health and internet use by university students: coping strategies in the context of Covid-19**. *Ciênc Saúde Coletiva* 2021, **26**:2159-2170.

50. Masten AS, Motti-Stefanidi F: **Multisystem resilience for children and youth in disaster: reflections in the context of Covid-19**. *Advers Resil Sci* 2020, **1**:95-106.