



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.

# Problematic use of the Internet in low- and middle-income countries before and during the COVID-19 pandemic: a scoping review

Biljana Gjoneska<sup>1</sup>, Marc N Potenza<sup>2,3,4,5</sup>, Julia Jones<sup>6,\*</sup>,  
Célia MD Sales<sup>7,8</sup>, Georgi Hranov<sup>9</sup> and Zsolt Demetrovics<sup>10,11,\*</sup>



People from low- and middle-income countries (LMICs) represent large portions of the world population, often occupy less favorable living conditions, and typically suffer greater health risks, yet frequently receive little research and global health attention. The present study reviews emerging evidence on problematic use of the Internet (PUI) in LMICs prior/during the COVID-19 pandemic. Analyzed studies mainly focused on general properties of PUI in university students, problematic gaming in youth, or problematic use of social media in adults, registering higher prevalence estimates, as compared with earlier reports. Research mainly focused on initially affected regions and COVID-exposed populations. Overall, unfavorable circumstances, including poor social support, family relationships, and lifestyle tendencies/habits, may present potential risk for PUI in LMICs, likely exacerbated during the pandemic.

## Addresses

<sup>1</sup> Macedonian Academy of Sciences and Arts, Krste Misirkov 2, 1000 Skopje, North Macedonia

<sup>2</sup> Department of Psychiatry and Child Study Center, Yale University School of Medicine, New Haven, CT 06511, United States

<sup>3</sup> Department of Neuroscience and Wu Tsai Institute, Yale University, New Haven, CT 06510, United States

<sup>4</sup> Connecticut Mental Health Centre, New Haven, CT 06519, United States

<sup>5</sup> Connecticut Council on Problem Gambling, Wethersfield, CT 06109, United States

<sup>6</sup> Centre for Research in Public Health and Community Care, University of Hertfordshire, Hatfield AL10 9AB, United Kingdom

<sup>7</sup> Centre for Psychology, University of Porto, R. Alfredo Allen, 4200-135 Porto, Portugal

<sup>8</sup> Faculty of Psychology and Education Sciences, University of Porto, R. Alfredo Allen, 4200-135 Porto, Portugal

<sup>9</sup> Military Medical Academy, Sofia, Bulgaria

<sup>10</sup> Centre of Excellence in Responsible Gaming, University of Gibraltar, Gibraltar, Gibraltar

<sup>11</sup> Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary

## Corresponding authors:

Biljana Gjoneska ([biljanagjoneska@manu.edu.mk](mailto:biljanagjoneska@manu.edu.mk)),  
Zsolt Demetrovics ([zsolt.demetrovics@unigib.edu.gi](mailto:zsolt.demetrovics@unigib.edu.gi))

\* Twitter account: [@JJonesatherts](https://twitter.com/JJonesatherts), [@Demetrovics](https://twitter.com/Demetrovics)

Current Opinion in Behavioral Sciences 2022, 48:101208

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

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

Available online 29 July 2022

<https://doi.org/10.1016/j.cobeha.2022.101208>

2352-1546/© 2022 The Authors. Published by Elsevier Ltd.

## Introduction

The largest [1] and fastest-growing [2] portion of the world population currently comprises 84.3% of all people and resides in low- and middle-income countries (LMICs) [3]. In comparison with high-income countries, people in LMICs typically occupy less favorable living conditions and live in societies with lower levels of wealth, health, and education [4]. As a result, they are more likely to experience mental health problems during a global health crisis, yet they receive relatively few global health resources [5•]. The risk for mental health concerns and increased use of the Internet during the COVID-19 pandemic may be more pronounced in vulnerable populations and manifested as excessive, maladaptive, or problematic use of the Internet (PUI). Disease-related anxieties and fears, economic insecurities, and financial losses, as well the desire to reduce emotional distress during the pandemic, may all contribute to increased risk for PUI in vulnerable populations, regardless of the country or world region [6••,7].

To date, comparatively little is known about the mental health of people in LMICs as most psychological research has been conducted on narrow populations from

Figure 1

SEARCH CRITERIA	SEARCHED TERMS
Problematic Use	"addict*" OR "problem*" OR "dependence" OR "disorder" OR "obsession" OR "compulsion" OR "use"
Internet activity	"internet" OR "cyber" OR "virtual" OR "online" OR "gaming" OR "gambling" OR "social media" OR "chat" OR "cybersex" OR "cyberbullying"
Low-income & Middle-income Countries <sup>1</sup>	"low-income" OR "middle-income" OR "Africa" OR "Asia" OR "Latin America" OR "Afghanistan" OR "Albania" OR "Algeria" OR "Armenia" OR "American Samoa" OR "Angola" OR "Azerbaijan" OR "Burundi" OR "Benin" OR "Burkina Faso" OR "Bangladesh" OR "Bulgaria" OR "Bosnia and Herzegovina" OR "Belarus" OR "Belize" OR "Bolivia" OR "Brazil" OR "Bhutan" OR "Botswana" OR "Central African Republic" OR "India" OR "Ivory Coast" OR "Cameroon" OR "China" OR "Congo" OR "Colombia" OR "Comoros" OR "Cabo Verde" OR "Costa Rica" OR "Cuba" OR "Djibouti" OR "dominica*" OR "Ecuador" OR "Egypt" OR "Eritrea" OR "Ethiopia" OR "Eswatini" OR "Fiji" OR "Micronesia" OR "Gabon" OR "Gaza" OR "Georgia" OR "Ghana" OR "Guinea" OR "Gambia" OR "Guinea" OR "Grenada" OR "Guatemala" OR "Guyana" OR "Honduras" OR "Haiti" OR "Indonesia" OR "Iran" OR "Iraq" OR "Jamaica" OR "Jordan" OR "Kazakhstan" OR "Kenya" OR "Kyrgyz*" OR "Kosovo" OR "Cambodia" OR "Lao PDR" OR "Lebanon" OR "Liberia" OR "Libya" OR "St. Lucia" OR "Sri Lanka" OR "Lesotho" OR "Morocco" OR "Moldova" OR "Madagascar" OR "Maldives" OR "Mexico" OR "Marshall Islands" OR "Macedonia" OR "Mali" OR "Myanmar" OR "Montenegro" OR "Mongolia" OR "Mozambique" OR "Maurit*" OR "Malawi" OR "Malaysia" OR "Namibia" OR "Niger" OR "Nigeria" OR "Nicaragua" OR "Nepal" OR "Pakistan" OR "Panama" OR "Peru" OR "Philippines" OR "Papua New Guinea" OR "Korea" OR "Paraguay" OR "Romania" OR "Russia" OR "Rwanda" OR "Sudan" OR "Senegal" OR "Solomon Islands" OR "Sierra Leone" OR "El Salvador" OR "Samoa" OR "Somalia" OR "Serbia" OR "South Africa" OR "São Tomé and Príncipe" OR "Suriname" OR "Syria*" OR "Chad" OR "Tanzania" OR "Togo" OR "Thailand" OR "Tajikistan" OR "Turkmenistan" OR "Timor" OR "Tonga" OR "Tunisia" OR "Turkey" OR "Tuvalu" OR "Uganda" OR "Ukraine" OR "Uzbekistan" OR "St. Vincent" OR "Vietnam" OR "Vanuatu" OR "Yemen" OR "Zambia" OR "Zimbabwe"
Publication dates	January 2018 - December 2021

Current Opinion in Behavioral Sciences

Conceptual framework of the search strategy and criteria for selection of relevant articles on PUI in LMICs in the period preceding or coinciding with the COVID-19 pandemic (2018–2021). The *search strategy* included original research studies, published two years prior and two years into the pandemic. The *search criteria* included a combination of terms or phrases pertaining to the topics of interest: problematic use, Internet activity, and low- or middle-income countries. The *search procedure* was conducted via two academic databases, covering literature in the matching areas of interest from both the biomedical and the psychological domain (PubMed and APA PsycInfo). The list of LMICs (low-income, lower–middle-, and upper–middle-income countries) is based upon the latest criteria and classifications by the World Bank. Data Source: World Bank Data Help Desk; URL: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.

countries with established research infrastructures and abundant resources, often referred to as Western, educated, industrialized, rich, and democratic countries and populations [8]. This potentially generates an imbalanced global perspective that lacks sufficient insight into the circumstances of the less-developed countries.

The present article aims to contribute to fill this knowledge gap and reviews recent data on PUI in LMICs during the period that preceded or coincided with the COVID-19 pandemic, summarizing studies published between 2018 and 2021. Specifically, we aim to provide a broad overview on PUI-related areas of investigation, frequently employed measures and explored populations, and countries or regions in LMICs for the appointed periods.

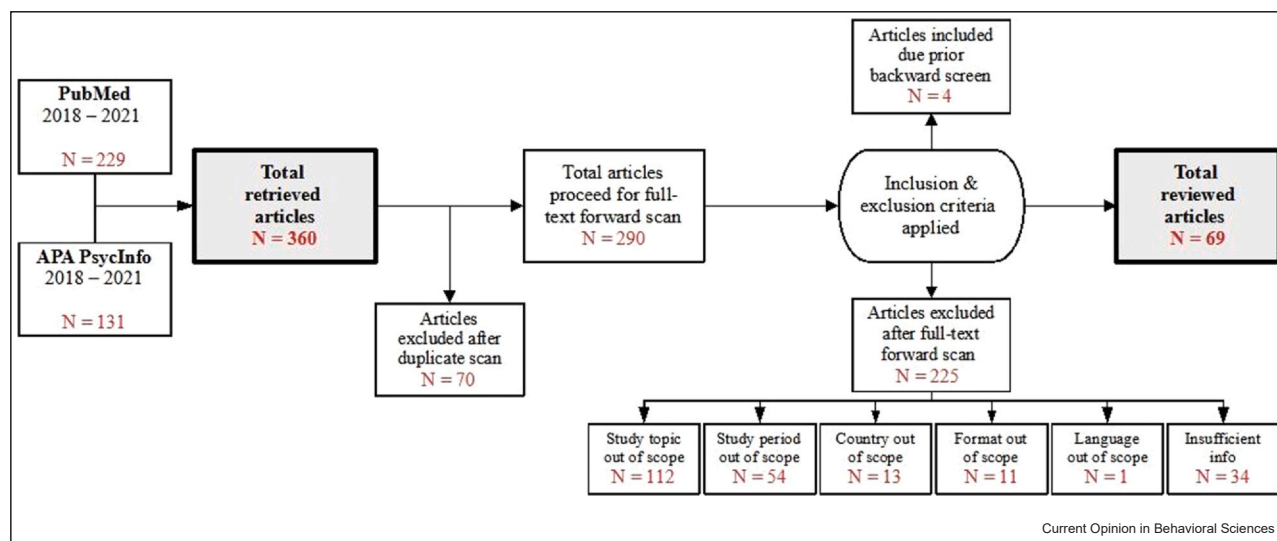
The findings presented in this review stem from original research articles and are considered with respect to more comprehensive articles (reviews and meta-analyses) on more general topics (such as mental health, PUI, COVID-19, LMICs, and regions), thus providing more complete coverage.

**Methods**

A broader collection of related studies was retrieved with a search strategy (see Figure 1) that was designed to include articles in accordance with the following criteria:

- a) The search was conducted via specialized academic databases, covering literature in the matching areas of interest from both biomedical and psychological domains (PubMed and APA PsycInfo).

Figure 2



A flow diagram depicting selection of relevant studies on PUI in LMICs in the period preceding or coinciding with the COVID-19 pandemic (2018–2021). Reports on problematic gambling in LMICs were excluded from the final review since they predominantly explored on-site, rather than online gambling. The diagram was informed by the standards for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIS). Data Source: PRISMA, 2020. URL: <http://www.prisma-statement.org/>.

- The period of publication spanned between 2018 and 2021, covering studies from two years prior and two years into the COVID-19 pandemic.
- The studies of interest originated from low-income, lower-middle-income, and upper-middle-income countries (in accordance with the latest classifications by the World Bank).
- The searched keywords were terms and phrases that pertain to the topics of interest: problematic use, Internet activity, and low-income or middle-income countries. The search was performed by the title of the original research articles.

The broader collection of retrieved studies was then reduced to the most relevant studies (see Figure 2), after exclusion of articles in accordance with the following criteria:

- Duplicates, or articles with similar reports (regarding used samples and methods) in different academic outlets.
- Studies on topics that were outside the specific scope of interest.
- Studies from countries that were outside the target list.
- Studies conducted outside the target period and/or studies published in languages other than EN.
- Studies with insufficient data regarding the study period and the methodologies used.

The organization of work throughout the selection process was conducted in two phases. In Phase 1, the initial selection was performed by the first author (BG) and supervised by the last author (ZD) on the basis of search criteria that were previously agreed upon by all authors (Figure 1). In Phase 2, the prefinalized selection, informed by international standards for review studies and meta-analyses (Figure 2), was reviewed separately by the remainder of the authors (MNP, JJ, CMDS, and GH). The individual evaluations sought to promote unbiased feedback and objective reporting of the results. Four additional studies were identified in this process, and included in the final selection as relevant for the current review (Figure 2). Ultimately, 69 studies were reviewed, and findings were organized according to most frequently researched topics (PUI in general, problematic gaming, or problematic use of social media), investigated populations, frequently employed measures, reported prevalence estimates, potential risk factors (see Table 1 for a summary of studies and findings), and geographical regions (see Table 2 for the global distribution of studies). Reports on problematic gambling in LMICs were excluded from the final review since they predominantly explored on-site, rather than online, gambling.

## Results and discussion

PUI is a relatively recent phenomenon, and many LMICs still lack resources or policies to properly understand or address PUI [9]. The need for a broader outlook and more general understanding of PUI in

Table 1

Summary of reviewed studies and reported findings on PUI in LMICs in the period preceding or coinciding with the pandemic [10-14,16,19-28,30-91].

PUI	PERIOD <sup>2</sup>	GENERAL	GAMING	SOCIAL MEDIA	
POPULATION <sup>1</sup>	Children	BEFORE 2 studies Cai et al. 2021a [20] Cao et al. 2022 [56]	No matches found	No matches found	
		DURING 4 studies Dong et al. 2020 [19]	Chen et al. 2021 [13]	Fung et al. 2021 [12] Chen et al. 2021 [13]	
	Adolescents	BEFORE 13 studies Cam & Ustuner, 2020 [57]; Chi et al. 2020 [58] Popadić et al. 2020 [59]; Iqbal et al. 2021 [60] Nguyen et al. 2021 [61]; Karki et al. 2021 [62]; Kaya & Dalgıç, 2021 [63]	Mafei & Enea, 2020 [64]; Yu et al. 2020 [40] Areshthanab et al. 2021 [23]; Yu et al. 2021a [65] Yu et al. 2021b [66]; Yu et al. 2022 [24]	No matches found	
		DURING 5 studies Dong et al. 2020 [19]; Li et al. 2021a [38] Rakhmawati et al. 2021 [10]; Saralioğlu et al. 2020 [67]	Cuong et al. 2021 [22]	No matches found	
	Young adults	BEFORE 17 studies Arafa et al. 2019a [68]; Jahan et al. 2019 [69]; Akhter et al. 2020 [70] Asrese & Muche, 2020 [71]; Hassan et al. 2020 [72]; Mboya et al. 2020 [73] Salama, 2020 [74]; Sharma et al. 2020 [75]; Khazaei et al. 2021 [32]; Mohanty et al. 2021 [11]; Shan et al. 2021 [79]; Zenebe et al. 2021 [80]; Al Shawi et al. 2022 [77]; Wang et al. 2022 [76]; Ozarici & Cangül Söğüt, 2022 [78]	Yu et al. 2019 [81]	Basu et al. 2021 [30]	
		DURING 11 studies Cai et al. 2021b [31]; Condiri-Meza et al. 2021 [34]; Fernandes et al. 2021 [44] Lamy et al. 2021 [51]; Sayeed et al. 2021 [42]; Shehata & Abdeldaim et al. 2021 [33] Xie et al. 2021 [48]; Zhao et al. 2021 [50]	No matches found	Sayeed et al. 2020 [43]; Fernandes et al. 2021 [44] Lamy et al. 2021 [51]; Sayeed et al. 2021 [42]; Shehata & Abdeldaim et al. 2021 [33]	
	Adults	BEFORE 3 studies Arafa et al. 2019b [82] Singh et al. 2019 [35]	Shao et al., 2021 [83]	No matches found	
		DURING 16 studies Islam et al. 2020 [53]; Jovic et al. 2020 [84] Siste et al. 2020 [52]; Sun et al. 2020 [85] Abir et al. 2021 [54]; Huang et al. 2021 [49] Li et al. 2021b [86]; Zhou et al. 2021 [39]	No matches found	Lee et al. 2020 [36]; Ni et al. 2020 [37] Zhang et al. 2020 [26]; Guelmami et al. 2021 [55] Lugito et al. 2021 [28]; Luo et al. 2021 [47] Mahmood et al. 2021 [27]; Rizwan et al. 2021 [45]	
	MEASURES	Time spent online <sup>3</sup>	BEFORE 3 studies Arafa et al. 2019b [82]; Karki et al. 2021 [62]; Popadić et al. 2020 [59]	No matches found	No matches found
			DURING 13 studies Zhou et al. 2021 [39]; Ni et al. 2020 [37]; Jovic et al. 2020 [84] Huang et al. 2021 [49]; Hosen et al. 2021 [51]; Islam et al. 2020 [53] Abir et al. 2021 [54]	No matches found	Lee et al. 2020 [36]; Lugito et al. 2020 [28] Ni et al. 2020 [37]; Luo et al. 2021 [47] Zhang et al., 2020 [26]; Rizwan et al. 2021 [45]
Most frequently used scales		BEFORE 20 studies IAT (Young, 1998a) [14] Singh et al. 2019 [35]; Asrese & Muche, 2020 [71]; Cam & Ustuner, 2020 [57] Hussain et al. 2020 [72]; Mboya et al., 2020 [73]; Salama, 2020 [74] Sun et al. 2020 [85]; Cai et al. 2021a [20]; Kaya & Dalgıç, 2021 [63] Khazaei et al., 2021 [32]; Mohanty et al., 2021 [11]; Zenebe et al., 2021 [80] Al Shawi et al., 2022 [77]; Wang et al. 2022 [76]	DSM-5 checklist (APA, 2013) [21] Yu et al. 2019 [81]; Yu et al. 2020 [40] Shao et al. 2021 [83]; Yu et al. 2021a [65] Yu et al. 2021b [66]; Yu et al., 2022 [24]	BSMAS (Andreassen, 2016) [25] No matches found	
		DURING 12 studies IAT (Young, 1998a) [14] Dong et al. 2020 [19]; Sayeed et al. 2020 [43]; Cai et al. 2021b [31] Condiri-Meza et al. 2021 [34]; Guelmami et al. 2021 [55]; Li et al. 2021a [38] Li et al. 2021b [86]; Shehata & Abdeldaim et al. 2021 [33]; Zhao et al. 2021 [50]	DSM-5 checklist (APA, 2013) [21] No matches found	BSMAS (Andreassen, 2016) [25] Fung et al. 2021 [12] Luo et al., 2021 [47] Sujarwoto et al. 2021 [41]	
Other used scales		BEFORE 8 studies YDQ (Young, 1998b) [87]; CIUS (Meerkerk et al. 2009) [16] Chi et al. 2020 [58]; Cao et al. 2022 [56] Arafa et al. 2019a [68] [68] GPIUS2 (Caplan, 2010) [88] CIAS (Chen et al., 2003) [13] Sharma et al. 2020 [75] Shan et al. 2021 [79]	IGD-20 (Pontes et al. 2014) [89] Mafei & Enea, 2020 [64] Areshthanab et al. 2021 [23] IGCS (King & Delfabbro, 2016) [90] Yu et al. 2019 [81]	SMUQ (Xanidis & Brignell, 2016) [91] Basu et al. 2021 [30]	
		DURING 5 studies YDQ (Young, 1998b) [87]; CIUS (Meerkerk et al., 2009) [16] Xie et al., 2021 [48] Fernandes et al., 2021 [44] GPIUS2 (Caplan, 2010) [88] CIAS (Chen et al., 2003) [13] Sayeed et al., 2020 [43] No matches found	IGD-20 (Pontes et al., 2014) [89] Cuong et al., 2021 [22]	SMUQ (Xanidis & Brignell, 2016) [91] Fernandes et al., 2021 [44]	
Prevalence estimates <sup>4</sup>		BEFORE IAT score ≥ 50 Prevalence estimates: 33.04% (mean); 29.40 (median) 14.0% Singh et al. 2019 [35] 20.0% Cai et al. 2021a [20] 21.1% Cam & Ustuner, 2020 [57] 23.0% Al Shawi et al., 2022 [77] 27.1% Hassan et al. 2020 [72] 29.4% Zenebe et al. 2021 [80] 31.0% Mboya et al. 2020 [73] 34.8% Asrese & Muche, 2020 [71] 46.8% Sun et al. 2020 [85] 47.5% Salama, 2020 [74] 68.8% Khazaei et al. 2021 [32]	DSM-5 ≥ 5 Prevalence: 18.38% (mean); 3.5 (median) 11.7% Yu et al. 2019 [81] 13.1% Yu et al. 2022 [24] 13.5% Yu et al. 2021a [65] 13.6% Yu et al. 2020 [40] 40.0% Yu et al. 2021b [66]	BSMAS score ≥ 24 Prevalences: N/A 6.8% Luo et al., 2021 [47]	
		DURING IAT score ≥ 50 Prevalence estimates: 36.79% (mean); 33.60 (median) 14.7% Condiri-Meza et al. 2021 [34] 23.3% Cai et al. 2021b [31] 28.4% Zhao et al. 2021 [50] 31.2% Li et al. 2021a [38] 36.0% Dong et al. 2020 [19] 36.7% Li et al. 2021b [86] 43.8% Sayeed et al. 2020 [43] 80.2% Shehata & Abdeldaim et al. 2021 [33]	DSM-5 ≥ 5 Prevalence estimates: N/A No matches found	BSMAS score ≥ 24 Prevalence estimates: N/A No matches found	
Potential risk factors <sup>5</sup>		BEFORE / DURING COVID-19 Demographic characteristics Predominantly males (Dong et al. 2020 [19]; Condiri-Meza et al. 2021 [34]; Kaya & Dalgıç, 2021 [63]; Sayeed et al. 2021 [42]; Shan et al. 2021 [79]; Sharma et al. 2020 [75]) at younger age (Arafa et al. 2019b [82]; Islam et al., 2020 [53]; Kaya & Dalgıç, 2021 [63]) with lower level of education and/or poor academic performance (Asrese & Muche, 2020 [71]; Chi et al. 2020 [58]; Shehata & Abdeldaim et al. 2021 [33]). Personality features / Coping styles Low self-esteem (Arafa et al. 2019b [82]; Asrese & Muche, 2020 [71]; Cam & Ustuner, 2020 [57]), negative coping styles (Shan et al. 2021 [79]) with boredom, loneliness and depression, especially during the pandemic, due to increased isolation and decreased social interaction (Dong et al. 2020 [19]; Sayeed et al. 2021 [42]). Parenting strategies / Social surroundings Inadequate mediation strategies by mothers for safe internet practices of children (Iqbal et al. 2021 [60]); poor relationships with family and friends (Asrese & Muche, 2020 [71]) expressed as detachment and isolation during the pandemic (Li et al. 2021b [86]; Zhou et al. 2021 [39]). Lifestyle tendencies / habits Lack of physical activity and avoidance of household chores (Islam et al. 2020 [53]; Hosen et al. 2021 [51]; Sharma et al. 2020 [75]); increased use of alcohol, cigarettes, online games or networking sites with prolonged exposure to mis/disinformation and distressing content (Guelmami et al., 2021 [55]); decreased sleep quality and/or quantity (Jahan et al. 2019 [69]; Singh et al. 2019 [35]; Wang et al. 2022 [76]; Shehata & Abdeldaim et al., 2021 [33]; Hosen et al., 2021 [51]).	Demographic characteristics Predominantly males (Shao et al. 2021 [83]), adolescents (Mafei & Enea, 2020 [64]; Areshthanab et al. 2021 [23]; Cuong et al. 2021 [22]; Yu et al. 2022 [24]). Personality features/ Coping styles Low self-control (Yu et al. 2019 [81]), high impulsivity (Yu et al. 2021b [66]), pronounced loneliness and depression (Yu et al. 2020 [40]), poor social support and relationship adaptation (Yu et al. 2022 [24]). Parenting strategies / Social surroundings Lack of (or undisciplined) parental supervision with overly permissive mediation strategies for internet use of children (Mafei & Enea, 2020 [64]; Cuong et al. 2021 [22]); inadequate parenting style of mothers (Areshthanab et al. 2021 [23]) and/or dysfunctional parent-child relationships., lower parental education, lack of social support. Lifestyle tendencies / habits Insomnia (Yu et al. 2020 [40]).	Demographic characteristics Females (Zhang et al. 2020 [26]), males (Luo et al. [36] 2021) or both (Rizwan et al. 2021 [45]). Personality features / Coping styles Emotional distress and hyper-arousal (Lee et al. 2020 [36]; Lamy et al. 2021 [46]; Lugito et al. 2021 [28]; Luo et al. 2021 [47]), depression (Fung et al., 2021 [12]; Sayeed et al. 2020 [43]), perceived threat (Mahmood et al. 2021 [27]), perceived weight stigma (Fung et al. 2021 [12]). Parenting strategies / Social surrounding Dysfunctional romantic and/or domestic relationships (Sayeed et al. 2020 [43]). Lifestyle tendencies / habits Increased consumption of news on internet (Ni et al. 2020 [37]); prolonged exposure to social media; poor sleep quality with sleep disturbances (Basu et al. 2021 [30]).	

GPIUS2= Generalized Problematic Internet Use Scale 2; IGD = Internet Gaming Disorder Test; SMUQ = Social Media Use Questionnaire; YDQ = Young Diagnostic Questionnaire; CIAS = Chinese Internet Addiction Scale; IGCS = Internet Gaming Cognition Scale. Referencing styles: Alphabetical and numerical. Referencing order: Where applicable, the studies are ordered by the year of publication (primary criteria), the alphabetical order of the first author's name (secondary criteria), and the sequential order in the bibliography (tertiary criteria).

<sup>1</sup>The population categories reflect a combination of age and the manner in which the cohorts were defined in each study. In general, children are youth attending elementary school (aged approximately 7–10 years), adolescents are youth attending middle or high school (aged approximately

11–17 years), young adults attending universities or colleges (aged approximately 18–25 years), while other adults are aged approximately 26 years or higher.

<sup>2</sup>The *before/during* period refers to the years that *preceded* (2018–2019) or *coincided* (2020–2021) with the COVID-19 pandemic.

<sup>3</sup>The *time spent online* was measured as an average number of hours per day for the corresponding PUI activity.

<sup>4</sup>The *prevalence estimates* were measured with frequently used scales, while the conventional cutoff scores pertain to frequently used criteria. In studies relying on different criteria, the prevalence rates for the conventional cutoff scores among healthy individuals were extracted from the information provided in the articles.

<sup>5</sup>The summaries highlight frequently reported risk factors across reviewed studies for each of the PUI types.

LMICs is reflected in the fact that most studies focused on exploring the general properties and correlates of PUI ( $n = 46$ ). A smaller number of studies explored specific characteristics of problematic use of social media ( $n = 14$ ) and problematic gaming ( $n = 9$ ) in LMICs (see [Table 1](#): ‘Gaming’ and ‘Social media’ columns, 1–8 rows).

With one notable exception that provided qualitative evidence [10], the remainder of the reviewed studies were quantitative, reporting findings that were based on survey methodologies and statistical analyses. Also, three longitudinal studies [11–13•] presented exceptions to the overwhelming body of cross-sectional research. The sample sizes varied considerably across studies, ranging between 200 and 20 000 participants, with an average size of around 2000 and a median size of approximately 750 participants per study. The most frequently represented populations also differed across research topics, depending on whether studies explored PUI in general, problematic gaming, or problematic use of social media. For more information regarding the study topics and types, methodologies, populations, and findings, please see the following sections of this paper.

### An overview of problematic use of the Internet in low- and middle-income countries

Generalized PUI was mainly assessed using convenience samples, with half of the studies (23 of 46 publications) surveying young adults attending universities or colleges (participants aged approximately 18–25 years). Approximately half of the studies investigating generalized PUI (22 of 46 studies) utilized the Internet Addiction Test (IAT) [14], a 20-item survey with 0–5-point Likert-type responses and 0–100 score range. The IAT was used to quantify self-reported preoccupation and compulsive use of the Internet, as well as behavioral problems, emotional changes, and diminished functionality due to Internet use. The measure has been reported to have relatively “high internal consistency reliability within homogenous samples ( $\alpha = 0.90$ – $0.93$ ), test–retest reliability ( $\rho = 0.83$ ), and a relatively simple factor structure of between one and two dimensions” [15•]. However, lately, the IAT has been subject to academic criticism regarding its psychometric properties. Some of the identified issues pertain to potentially redundant or outdated items, an unstable factor structure, arbitrary cutoff scores, and possible lack of universal

validity [15•], so research may shift toward newer scales with better psychometric properties, such as the Compulsive Internet Use Scale (CIUS) [16]. However, this trend is still not evident in the latest research on PUI across LMICs. A considerable number of studies relied on IAT, while others relied on the average number of daily hours spent on the Internet as a rough estimation of PUI. Only a small group of studies relied on more targeted instruments (see [Table 1](#) for the lists of assessment instruments that were used most frequently).

A frequently used cutoff score ( $\geq 50$ ) for the IAT was considered for PUI in the present review (even though cutoff scores often differed across studies and the prevalence rates varied accordingly). Wherever applicable, the prevalence rate for the conventional cutoff score in healthy (control) individuals was extracted from the original report, to calculate an average prevalence estimate for PUI among the general population in LMICs. The final average rates (34.6%) and median prevalence estimates (31.0%) were retrieved on the basis of reports from 19 studies. The average prevalence rate in particular was considerably higher than earlier estimates, obtained from large samples with 89 281 participants [17] and 693 306 participants [18••] in 31 nations (6.0% and 7.0% accordingly). Such a discrepancy may reflect contextual factors, such as the time period and region. Namely, earlier meta-analyses relied on studies that were published in earlier time periods, considerably before the onset of the COVID-19 pandemic (1996–2012 and 1996–2018, respectively). On the other hand, the present review scopes evidence for the period shortly preceding and coinciding with the COVID-19 pandemic (2018–2021), which is marked by a global expansion of Internet use. Regarding the regional analysis, earlier studies have indicated that the prevalence estimates are likely higher in Eastern regions (10.9% and 8.9%, respectively) [17,18••] and societies with disadvantaged living conditions or dissatisfied populations [17]. Considerable [17,18••] differences in prevalence estimates between the present and the two referenced studies may also be technical in nature and attributable to the frequently used conventional cutoff score (IAT  $\geq 50$ ) being more inclusive than a stricter one (IAT  $\geq 60$ ) [18••]. In addition, several articles in the present review utilized the IAT to assess generalized PUI in children and adolescents [19,20], despite the IAT having been developed for assessing PUI in young and healthy



2.47% from a comprehensive meta-analysis [18••]. Moreover, studies on problematic gaming have largely focused on parent–child relationships, examining roles of parenting styles or Internet mediation strategies on gaming behaviors in children and adolescents. Poor family relations and poor parental education, dysfunctional families, lack of parental supervision, and overly permissive maternal mediation strategies for Internet use of children were recurring determinants associated with problematic gaming [22–24].

Problematic use of social media has been explored in different populations (mainly adults and young adults), in multiple ways (mainly via quantity of social media use and the Bergen Social Media Addiction Scale (BSMAS) [25]), and in different contexts (mainly the COVID-19 pandemic). Hence, it is difficult to identify common patterns and draw general conclusions (see Table 1). Nonetheless, the use of social media may have been beneficial during the COVID-19 pandemic, possibly serving as a corrective force that enabled more efficient health communication with safe and timely delivery of information that was provided by close and reliable sources [26]. Protective behaviors and self-efficacy of people may have increased as a result [27], while feelings of impending threat, anxiety, and depression decreased in some instances [28]. However, a larger body of research conducted during the same period describes the opposite (positive) relationship between the increased use of social media (usually more than 2–3 hours/day) and associated concerns among youth [12•,13•] and adults (see the next section for more details).

### Problematic use of the Internet in low- and middle-income countries during the COVID-19 pandemic

Research conducted during the COVID-19 pandemic mainly stems from initially affected regions, with most studies (21 of 35) conducted in East Asia. In fact, the intensity of research of PUI in East-Asian countries nearly doubled in the years coinciding with the pandemic (2020–2021), as compared with the years that preceded the pandemic (2018–2019). This was not the case with the rest-of-the-world regions (see Table 2). China was a regional leader in research on the subject, exploring multiple PUI behaviors in different contextual settings and populations during the pandemic. Overall, prevalence estimates of PUI types in Eastern countries were higher than those previously reported. There is recent evidence to suggest that the prevalence estimates in Southeast Asia are higher than in other jurisdictions, but the findings stem from a single meta-analysis performed on nonrepresentative populations [29]. Hence, the present review may provide a more nuanced and better understanding of the situation in regions that were initially affected by the pandemic.

In addition to citizens from affected regions, other populations exposed early to the virus also received

considerable scholarly attention. These included medical and nursing students [11,30–34], medical residents, and doctors and nurses, among others [35–37]. However, the list of comorbidities frequently associated with PUI during the pandemic appears similar for medical and general populations. The problems ranged from amplified levels of stress and pronounced traumatic experiences, including depression [19,36–43], anxiety [12•,31,37,44–47], or post-traumatic stress disorder [48] (in which case, the link with PUI was established due to increased exposure to distressing content and disinformation on the Internet), to problems associated with instant gratification and stimulation such as substance use [49] and attention-deficit/hyperactivity [50] disorders.

Across different research topics and contexts, findings suggest that PUI behaviors link to various potential risk factors, broadly categorized as demographic characteristics, personality features, coping styles, parenting strategies, social surroundings, and lifestyle tendencies/habits (see Table 1, section ‘Findings’). Importantly, poor lifestyle tendencies/habits, living conditions, and negative coping styles appear implicated across different types of PUI and LMICs. For instance, poor quantity and quality of sleep (characterized by insufficient sleep hours or disorganized sleeping patterns with inadequate or irregular sleeping periods, and manifested as daytime sleepiness or even insomnia) was repeatedly described as a possible cause or a consequence of PUI during the pandemic [35,51,52]. Lack of physical activities (e.g. exercise and outdoor recreation) [53] and physical discomfort (e.g. headaches, back pains, and finger numbness) were also associated with PUI [54]. Prolonged exposure to inaccurate or distressing content on the Internet was also associated with PUI [30,55]. Regarding negative coping styles, feelings of boredom, isolation, and loneliness, coupled with a lack of social or emotional support from family and friends during long periods of quarantine and lockdown, were often associated with general and the specific forms of PUI [24,44,55].

### Limitations

In line with journal aims, the present review focused on recent studies (conducted in the period around the COVID-19 pandemic) and aimed to present findings in a condensed format (offering a snapshot of PUI in LMICs). To achieve this end, the authors performed targeted searches by article titles in bibliographic databases with matching areas of interest. Future studies could benefit from expanded searches covering longer periods (e.g. last five or ten years of research), and extending across different article fields (e.g. keywords, title, abstract, body of text, or combinations thereof), as well as additional academic databases (e.g. Web of Science or Scopus). In essence, the present review scopes the existing evidence



and synthesizes recent findings, thus serving as a useful precursor for future reviews that could systematically assess the quality and quantity of accumulated knowledge and propose viable solutions.

## Conclusions

The present study provides evidence on PUI in LMICs shortly before, and during, the COVID-19 pandemic. The articles reviewed mainly focused on the generalized PUI in university students, problematic gaming among children and adolescents, or problematic use of social media in adults, with most reporting higher-than-average prevalence estimates, as compared with earlier studies. Research covering PUI during the COVID-19 pandemic nearly doubled in the initially affected geographical regions and populations that were first exposed to the novel coronavirus. Overall, unfavorable conditions associated with poor lifestyle tendencies/habits, social support, and family relationships may represent risk factors for PUI in LMICs before and during the pandemic.

This paper reviews a modest body of knowledge from less-represented countries, thus contributing to a more comprehensive and balanced view of PUI across different geopolitical, social, and cultural contexts. The summary of findings may inform and inspire future research and policy strategies across concerned regions, countries, or populations, to mitigate PUI.

## Editorial disclosure statement

Given his role as Guest Editor, Marc Potenza had no involvement in the peer-review of this article and has no access to information regarding its peer-review. Full responsibility for the editorial process for this article was delegated to Naomi Fineberg.

## Conflict of interest statement

MNP reports no conflicts of interest with respect to the content of this manuscript. MNP has consulted for and advised Game Day Data, the Addiction Policy Forum, AXA, Idorsia and Opiant/Lakelight Therapeutics; has been involved in a patent application with Yale University and Novartis; received research support from the Veteran's Administration, Mohegan Sun Casino and the National Center for Responsible Gaming (now the International Center for Responsible Gaming); participated in surveys, mailings, or telephone consultations related to drug addiction, impulse-control disorders, or other health topics; consulted for law offices, the federal public defender's office and gambling entities on issues related to impulse-control and addictive disorders; provided clinical care in the Connecticut Department of Mental Health and Addiction Services Problem Gambling Services Program; performed grant reviews for the National Institutes of Health and other agencies; edited journals and journal sections; given academic

lectures in grand rounds, CME events, and other clinical/scientific venues; and generated books or chapters for publishers of mental health texts.

ZD reports no conflicts of interest with respect to the content of this manuscript. ZD's contribution was supported by the Hungarian National Research, Development and Innovation Office (KKP126835; K128614; K134807). The 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. ZD has been member of a WHO advisory group on the public health consequences of addictive behaviors. In this capacity he has been eligible for travel support from WHO or the host center to attend advisory group meetings but have not been remunerated for their work. However, these funding aren't related to this study and the funding institution had no role or any influence on this publication.

The other authors (BG, JJ, CMDS and GH) report no disclosures. The views presented in this manuscript represent those of the authors and not necessarily those of the funding agencies.

## Data Availability

No data were used for the research described in the article.

## Acknowledgements

The publication of this work is kindly supported by the Hungarian National Consortium (Electronic Information Service National Programme, EISZ). ZD's contribution was supported by the Hungarian National Research, Development and Innovation Office (KKP126835; K128614; K134807). MNP was supported by the Connecticut Council on Problem Gambling, Children and Screens, and the National Institute of Mental Health RF1 MH128614.

## 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. Our World in Data: Population by income level, 1960 to 2020. Global Change Data Lab; 2022. Available from: (<https://ourworldindata.org/grapher/population-by-income-level>).
2. United Nations: World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100. World Population Prospects; 2017. Available from: (<https://www.un.org/sw/desa/world-population-projected-reach-98-billion-2050-and-112-billion-2100>).

3. The World Bank: World Bank country and lending groups. World Bank Data Help Desk; 2021. Available from: (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>).
4. United Nations Development Programme: Human Development Index (HDI). Human Development Reports; 2019. Available from: (<https://hdr.undp.org/en/indicators/137506>).
5. Kola L: **Global mental health and COVID-19**. *Lancet Psychiatry* 2020, **7**:655-657, [https://doi.org/10.1016/S2215-0366\(20\)30235-2](https://doi.org/10.1016/S2215-0366(20)30235-2).  
A commentary paper that raises awareness on the disrupted global delivery of mental health services during COVID-19 pandemic, with unequal distribution in LIMCs.
6. Gjonjeska B, Potenza MN, Jones J, Corazza O, Hall N, Sales CMD, Grünblatt E, Martinotti G, Burkauskas J, Werling AM, et al.: **Problematic use of the internet during the COVID-19 pandemic: good practices and mental health recommendations**. *Compr Psychiatry* 2022, **112**:152279, <https://doi.org/10.1016/j.comppsy.2021.152279>.  
A narrative review by experts of the European Network for Problematic Use of the Internet (EU COST PUI), that summarizes evidence for the impact of PUI on the mental health, and provides recommendations for affected individuals and the general population.
7. Király O, Potenza MN, Stein DJ, King DL, Hodgins DC, Saunders JB, Griffiths MD, Gjonjeska B, Billieux J, Brand M, et al.: **Preventing problematic internet use during the COVID-19 pandemic: consensus guidance**. *Compr Psychiatry* 2020, **100**:152180, <https://doi.org/10.1016/j.comppsy.2020.152180>
8. Henrich J, Heine SJ, Norenzayan A: **The weirdest people in the world?** *Behav Brain Sci* 2010, **33**:61-83, <https://doi.org/10.1017/S0140525X0999152X>
9. Gjonjeska B, Jones J, Vella AM, Bonanno P, Flora K, Fontalba-Navas A, Hall N, Ignjatova L, Kirtava Z, Moreno Sanjuán D, et al.: **Citizen consultation on problematic usage of the internet: ethical considerations and empirical insights from six countries**. *Front Public Health* 2021, **9**:587459, <https://doi.org/10.3389/fpubh.2021.587459>
10. Rakhmawati W, Kosasih CE, Widiastih R, Suryani S, Arifin H: **Internet addiction among male adolescents in Indonesia: a qualitative study**. *Am J Mens Health* (3) 2021, **15**, <https://doi.org/10.1177/15579883211029459>
11. Mohanty R, Dey P, Hebbar NYR, Singh HN: **Effect of internet use on medical students before and after 4g internet service in India: a comparative study**. *Encephale* 2021, **47**:189-194, <https://doi.org/10.1016/j.encep.2020.10.001>
12. Fung XCC, Siu AMH, Potenza MN, O'Brien KS, Latner JD, Chen C-Y, Chen I-H, Lin C-Y: **Problematic use of internet-related activities and perceived weight stigma in schoolchildren: a longitudinal study across different epidemic periods of COVID-19 in China**. *Front Psychiatry* 2021, **12**:675839, <https://doi.org/10.3389/fpsy.2021.675839>.  
A longitudinal study that investigates the direct effect of school suspensions and associated lockdowns on problematic Internet behaviors of school-aged children during the pandemic. Comparing data from periods preceding or coinciding with the COVID-19 pandemic, it shows that problematic use of smartphones may have increased during the pandemic.
13. Chen C-Y, Chen I-H, Hou W-L, Potenza MN, O'Brien KS, Lin C-Y, Latner JD: **The relationship between children's problematic internet-related behaviors and psychological distress during the onset of the COVID-19 pandemic: a longitudinal study**. *J Addict Med* (2) 2021, **16**:e73-e80, <https://doi.org/10.1097/ADM.0000000000000845>.  
A longitudinal study that investigates problematic smartphone use and problematic gaming, as well as their relationship with psychological distress in school-aged children during the pandemic. It shows that problematic use of the smartphones (but not gaming) may have exacerbated psychological distress during the pandemic.
14. Young KS: **Caught in the Net: How to Recognize the Signs of Internet Addiction — and A Winning Strategy for Recovery**. John Wiley & Sons; 1998.
15. Tiego J, Lochner C, Ioannidis K, Brand M, Stein DJ, Yücel M, Grant JE, Chamberlain SR: **Measurement of the problematic usage of the Internet unidimensional quasitrait continuum with item response theory**. *Psychol Assess* 2021, **33**:652-671, <https://doi.org/10.1037/pas0000870>.  
Original research that summarizes latest criticism on IAT as a widely used scale for assessment of PUI in LIMCs, and proposes a refined version of the instrument.
16. Meerkerk G-J, Van Den Eijnden RJJM, Vermulst AA, Garretsen HFL: **The Compulsive Internet Use Scale (CIUS): some psychometric properties**. *Cyberpsychol Behav* 2009, **12**:1-6, <https://doi.org/10.1089/cpb.2008.0181>
17. Cheng C, Li AY: **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, <https://doi.org/10.1089/cyber.2014.0317>
18. 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, <https://doi.org/10.1016/j.neubiorev.2020.08.013>.  
The largest systematic review and meta-analysis to date, analyzing 113 epidemiologic studies with 693 306 subjects from 31 nations, to estimate the worldwide prevalence of generalized Internet addiction (7.02%) and Internet gaming disorder (2.47%).
19. Dong H, Yang F, Lu X, Hao W: **Internet addiction and related psychological factors among children and adolescents in China during the coronavirus disease 2019 (COVID-19) epidemic**. *Front Psychiatry* 2020, **11**:00751, <https://doi.org/10.3389/fpsy.2020.00751>
20. Cai J, Wang Y, Wang F, Lu J, Li L, Zhou X: **The association of parent-child communication with internet addiction in left-behind children in China: a cross-sectional study**. *Int J Public Health* 2021, **66**:630700, <https://doi.org/10.3389/ijph.2021.630700>
21. American Psychiatric Association: **Diagnostic and Statistical Manual of Mental Disorders, DSM-5**. American Psychiatric Publishing; 2013.
22. Cuong VM, Assanangkornchai S, Wichaidit W, Minh Hanh VT, My Hanh HT: **Associations between gaming disorder, parent-child relationship, parental supervision, and discipline styles: findings from a school-based survey during the COVID-19 pandemic in Vietnam**. *J Behav Addict* 2021, **10**:722-730, <https://doi.org/10.1556/2006.2021.00064>
23. Areshtanab HN, Fathollahpour F, Bostanabad MA, Ebrahimi H, Hosseinzadeh M, Fooladi MM: **Internet gaming disorder and its relationship with behavioral disorder and mother's parenting styles in primary school students according to gender in Iran**. *BMC Psychol* 2021, **9**:110, <https://doi.org/10.1186/s40359-021-00616-4>
24. Yu Y, Peng L, Mo PKH, Yang X, Cai Y, Ma L, She R, Lau JTF: **Association between relationship adaptation and Internet gaming disorder among first-year secondary school students in China: mediation effects via social support and loneliness**. *Addict Behav* 2022, **125**:107166, <https://doi.org/10.1016/j.addbeh.2021.107166>
25. Andreassen CS, Billieux J, Griffiths MD, Kuss DJ, Demetrovics Z, Mazzoni E, Pallesen S: **The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: a large-scale cross-sectional study**. *Psychol Addict Behav* 2016, **30**:252-262, <https://doi.org/10.1037/adb0000160>
26. Zhang SX, Graf-Vlachy L, Looi KH, Su R, Li J: **Social media use as a predictor of handwashing during a pandemic: evidence from COVID-19 in Malaysia**. *Epidemiol Infect* 2020, **148**:e261, <https://doi.org/10.1017/S0950268820002575>
27. Mahmood QK, Jafree SR, Mukhtar S, Fischer F: **Social media use, self-efficacy, perceived threat, and preventive behavior in times of COVID-19: results of a cross-sectional study in Pakistan**. *Front Psychol* 2021, **12**:562042, <https://doi.org/10.3389/fpsyg.2021.562042>
28. Lugito NPH, Damay V, Chyntyta H, Sugianto N: **Social media exposure and mental health problems during coronavirus disease 2019 pandemic in Indonesia**. *J Educ Health Promot* 2021, **10**:200, [https://doi.org/10.4103/jehp.jehp\\_1032\\_20](https://doi.org/10.4103/jehp.jehp_1032_20)

29. Chia DXY, Ng CWL, Kandasami G, Seow MYL, Choo CC, Chew PKH, Lee C, Zhang MWB: **Prevalence of internet addiction and gaming disorders in Southeast Asia: a meta-analysis.** *Int J Environ Res Public Health* 2020, **17**:E2582, <https://doi.org/10.3390/ijerph17072582>
30. Basu S, Sharma R, Sharma P, Sharma N: **Addiction-like behavior associated with social media usage in undergraduate students of a government medical college in Delhi, India.** *Indian J Psychiatry* 2021, **63**:35-40, [https://doi.org/10.4103/psychiatry.IndianJPsychiatry\\_153\\_20](https://doi.org/10.4103/psychiatry.IndianJPsychiatry_153_20)
31. Cai H, Xi H-T, Zhu Q, Wang Z, Han L, Liu S, Bai W, Zhao Y-J, Chen L, Ge Z-M, et al.: **Prevalence of problematic internet use and its association with quality of life among undergraduate nursing students in the later stage of COVID-19 pandemic era in China.** *Am J Addict* 2021, **30**:585-592, <https://doi.org/10.1111/ajad.13216>
32. Khazaie H, Lebni JY, Abbas J, Mahaki B, Chaboksavar F, Kianipour N, Toghrol R, Ziapour A: **Internet addiction status and related factors among medical students: a cross-sectional study in Western Iran.** *Int Q Community Health Educ* 2021, **Jun 15**, <https://doi.org/10.1177/0272684X211025438>
33. Shehata WM, Abdeldaim DE: **Internet addiction among medical and non-medical students during COVID-19 pandemic, Tanta University, Egypt.** *Environ Sci Pollut Res Int* 2021, **28**:59945-59952, <https://doi.org/10.1007/s11356-021-14961-9>
34. Condori-Meza IB, Dávila-Cabanillas LA, Challapa-Mamani MR, Pinedo-Soria A, Torres RR, Yalle J, Rojas-Humpire R, Huancahuire-Vega S: **Problematic internet use associated with symptomatic dry eye disease in medical students from Peru.** *Clin Ophthalmol* 2021, **15**:4357-4365, <https://doi.org/10.2147/OPTH.S334156>
35. Singh LK, Suchandra KHH, Pattajoshi A, Mamidipalli SS, Kamal H, Singh S, Sachacher B, Mehta V: **Internet addiction and daytime sleepiness among professionals in India: a web-based survey.** *Indian J Psychiatry* 2019, **61**:265-269, [https://doi.org/10.4103/psychiatry.IndianJPsychiatry\\_412\\_18](https://doi.org/10.4103/psychiatry.IndianJPsychiatry_412_18)
36. Lee Y, Yang BX, Liu Q, Luo D, Kang L, Yang F, Ma S, Lu W, Chen-Li D, Rosenblat JD, et al.: **Synergistic effect of social media use and psychological distress on depression in China during the COVID-19 epidemic.** *Psychiatry Clin Neurosci* 2020, **74**:552-554, <https://doi.org/10.1111/pcn.13101>
37. Ni MY, Yang L, Leung CMC, Li N, Yao XI, Wang Y, Leung GM, Cowling BJ, Liao Q: **Mental health, risk factors, and social media use during the COVID-19 epidemic and cordon sanitaire among the community and health professionals in Wuhan, China: cross-sectional survey.** *JMIR Ment Health* 2020, **7**:e19009, <https://doi.org/10.2196/19009>
38. Li Z-L, Liu R, He F, Li S-Y, Zhao Y-J, Zhang W-Y, Zhang Y, Cheung T, Jackson T, Tang Y-L, et al.: **Prevalence of internet addiction disorder and its correlates among clinically stable adolescents with psychiatric disorders in China during the COVID-19 outbreak.** *Front Psychiatry* 2021, **12**:686177, <https://doi.org/10.3389/fpsy.2021.686177>
39. Zhou Y, Wang R, Liu L, Ding T, Huo L, Qi L, Xiong J, Yan J, Zeng L, Yang J, et al.: **The impact of lockdown policy on depressive symptoms among pregnant women in China: mediating effects of internet use and family support.** *Glob Health Res Policy* 2021, **6**:11, <https://doi.org/10.1186/s41256-021-00193-4>
40. Yu Y, Yang X, Wang S, Wang H, Chang R, Tsamag L, Zhang S, Xu C, Yu X, Cai Y, et al.: **Serial multiple mediation of the association between internet gaming disorder and suicidal ideation by insomnia and depression in adolescents in Shanghai, China.** *BMC Psychiatry* 2020, **20**:460, <https://doi.org/10.1186/s12888-020-02870-z>
41. Sujarwoto S, Saputri RAM, Yumarni T: **Social media addiction and mental health among university students during the COVID-19 pandemic in Indonesia.** *Int J Ment Health Addict* 2021, **Jul 1**:1-15, <https://doi.org/10.1007/s11469-021-00582-3> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8247617/>.
42. Sayeed A, Rahman MH, Hassan MN, Christopher E, Kundu S, Banna MHA, 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, <https://doi.org/10.1016/j.childyouth.2020.105771>
43. Sayeed A, Hassan MN, Rahman MH, El Hayek S, Banna MHA, Mallick T, Hasan A-R, Meem AE, Kundu S: **Facebook addiction associated with internet activity, depression and behavioral factors among university students of Bangladesh: a cross-sectional study.** *Child Youth Serv Rev* 2020, **118**:105424, <https://doi.org/10.1016/j.childyouth.2020.105424>
44. Fernandes B, Uzun B, Aydin C, Tan-Mansukhani R, Vallejo A, Saldaña-Gutiérrez A, Nanda Biswas U, Essau CA: **Internet use during COVID-19 lockdown among young people in low- and middle-income countries: role of psychological wellbeing.** *Addict Behav Rep* 2021, **14**:100379, <https://doi.org/10.1016/j.abrep.2021.100379>
45. Rizwan M, Ahmad T, Qi X, Murad MA, Baig M, Sagga AK, Tariq S, Baig F, Naz R, Hui J: **Social media use, psychological distress and knowledge, attitude, and practices regarding the COVID-19 among a sample of the population of Pakistan.** *Front Med* 2021, **8**:754121, <https://doi.org/10.3389/fmed.2021.754121>
46. Larnyo E, Dai B, Nutakor JA, Ampon-Wireko S, Appiah R, Larnyo A, Akey-Torku B, Nkrumah ENK: **Assessing the impact of social media use on everyday emotion in health crises: a study of international students in China during COVID-19.** *Healthcare* 2021, **9**:1011, <https://doi.org/10.3390/healthcare9081011>
47. Luo T, Chen W, Liao Y: **Social media use in China before and during COVID-19: preliminary results from an online retrospective survey.** *J Psychiatr Res* 2021, **140**:35-38, <https://doi.org/10.1016/j.jpsychires.2021.05.057>
48. Xie X, Zhu K, Xue Q, Zhou Y, Liu Q, Wu H, Wan Z, Zhang J, Meng H, Zhu B, et al.: **Problematic internet use was associated with psychological problems among university students during COVID-19 outbreak in China.** *Front Public Health* 2021, **9**:675380, <https://doi.org/10.3389/fpubh.2021.675380>
49. Huang Q, Chen X, Huang S, Shao T, Liao Z, Lin S, Li Y, Qi J, Cai Y, Shen H: **Substance and Internet use during the COVID-19 pandemic in China.** *Transl Psychiatry* 2021, **11**:491, <https://doi.org/10.1038/s41398-021-01614-1>
50. Zhao Y, Jiang Z, Guo S, Wu P, Lu Q, Xu Y, Liu L, Su S, Shi L, Que J, et al.: **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**:220-227, <https://doi.org/10.1016/j.jad.2021.02.078>
51. Hosen I, Al Mamun F, Mamun MA: **The role of sociodemographics, behavioral factors, and internet use behaviors in students' psychological health amid COVID-19 pandemic in Bangladesh.** *Health Sci Rep* 2021, **4**:e398, <https://doi.org/10.1002/hsr2.398>
52. Siste K, Hanafi E, Sen LT, Christian H, Adrian A, Siswidiani LP, Limawan AP, Murtani BJ, Suwanto C: **The impact of physical distancing and associated factors towards internet addiction among adults in Indonesia during COVID-19 pandemic: a nationwide web-based study.** *Front Psychiatry* 2020, **11**:580977, <https://doi.org/10.3389/fpsy.2020.580977>
53. Islam MS, Sujan MSH, Tasnim R, Ferdous MZ, Masud JHB, Kundu S, Mosaddek ASM, Choudhuri MSK, Kircaburun K, Griffiths MD: **Problematic internet use among young and adult population in Bangladesh: correlates with lifestyle and online activities during the COVID-19 pandemic.** *Addict Behav Rep* 2020, **12**:100311, <https://doi.org/10.1016/j.abrep.2020.100311>
54. Abir T, Osuagwu UL, Nur-A Yazdani DM, Mamun AA, Kakon K, Salamah AA, Zainol NR, Khanam M, Agho KE: **Internet use impact on physical health during COVID-19 lockdown in Bangladesh: a web-based cross-sectional study.** *Int J Environ Res Public Health* 2021, **18**:10728, <https://doi.org/10.3390/ijerph182010728>
55. Guelmami N, Ben Khalifa M, Chalghaf N, Kong JD, Amayra T, Wu J, Azaiez F, Bragazzi NL: **Development of the 12-item Social Media Disinformation Scale and its association with social media addiction and mental health related to COVID-19 in Tunisia: survey-based pilot case study.** *JMIR Form Res* 2021, **5**:e27280, <https://doi.org/10.2196/27280>

56. Cao Q, An J, Yang Y, Peng P, Xu S, Xu X, Xiang H: **Correlation among psychological resilience, loneliness, and internet addiction among left-behind children in China: a cross-sectional study.** *Curr Psychol* 2022, **41**:4566-4573, <https://doi.org/10.1007/s12144-020-00970-3>
57. Cam HH, Ustuner Top F: **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, <https://doi.org/10.1097/JAN.0000000000000365>
58. Chi X, Hong X, Chen X: **Profiles and sociodemographic correlates of Internet addiction in early adolescents in southern China.** *Addict Behav* 2020, **106**:106385, <https://doi.org/10.1016/j.addbeh.2020.106385>
59. Popadić D, Pavlović Z, Kuzmanović D: **Intensive and excessive Internet use: different predictors operating among adolescents.** *Psihologija* 2020, **53**:273-290 2021-12-22 02:08:20.
60. Iqbal S, Zakar R, Fischer F: **Predictors of parental mediation in teenagers' internet use: a cross-sectional study of female caregivers in Lahore, Pakistan.** *BMC Public Health* 2021, **21**:317.
61. Nguyen CTT, Yang H-J, Lee GT, Nguyen LTK, Kuo S-Y: **Relationships of excessive internet use with depression, anxiety, and sleep quality among high school students in northern Vietnam.** *J Pediatr Nurs* 2021, **62**:e91-e97, <https://doi.org/10.1016/j.pedn.2021.07.019>
62. Karki K, Singh DR, Maharjan D, KC S, Shrestha S, Thapa DK: **Internet addiction and sleep quality among adolescents in a peri-urban setting in Nepal: a cross-sectional school-based survey.** *PLoS One* 2021, **16**:e0246940.
63. Kaya A, Dalgıç AI: **How does internet addiction affect adolescent lifestyles? Results from a school-based study in the Mediterranean region of Turkey.** *J Pediatr Nurs* 2021, **59**:e38-e43, <https://doi.org/10.1016/j.pedn.2021.01.021>
64. Maftei A, Enea V: **Symptoms of internet gaming disorder and parenting styles in Romanian adolescents.** *Psihologija* 2020, **53**:307-318, <https://doi.org/10.2298/PSI190808008M>
65. Yu Y, Mo PK-H, Zhang J, Li J, Lau JT-F: **Impulsivity, self-control, interpersonal influences, and maladaptive cognitions as factors of internet gaming disorder among adolescents in China: cross-sectional mediation study.** *J Med Internet Res* 2021, **23**:e26810, <https://doi.org/10.2196/26810>
66. Yu Y, Li J-B, Lau JTF: **Awareness and potential impacts of the medicalization of internet gaming disorder: cross-sectional survey among adolescents in China.** *J Med Internet Res* 2021, **23**:e22393, <https://doi.org/10.2196/22393>
67. Sarıalioğlu A, Atay T, Arkan D: **Determining the relationship between loneliness and internet addiction among adolescents during the COVID-19 pandemic in Turkey.** *J Pediatr Nurs* 2021, **63**:117-124, <https://doi.org/10.1016/j.pedn.2021.11.011>
68. Arafa A, Saif SA, Ramadan A, Rashed T, Ahmed S, Taha M: **Problematic internet use: a cross-sectional study on a model from university students in Egypt.** *Int J Adolesc Med Health* 2019, **33**:20190031.
69. Jahan SM, Hossain SR, Sayeed UB, Wahab A, Rahman T, Hossain A: **Association between internet addiction and sleep quality among students: a cross-sectional study in Bangladesh.** *Sleep Biol Rhythm* 2019, **17**:323-329.
70. Akhter MS, Islam MH, Momen MN: **Problematic Internet use among university students of Bangladesh: the predictive role of age, gender, and loneliness.** *J Hum Behav Soc Environ* 2020, **30**:1082-1093, <https://doi.org/10.1080/10911359.2020.1784346>
71. Asrese K, Muhe H: **Online activities as risk factors for Problematic internet use among students in Bahir Dar University, North West Ethiopia: a hierarchical regression model.** *PLoS One* 2020, **15**:e0238804.
72. Hassan T, Alam MM, Wahab A, Hawlader MD: **Prevalence and associated factors of internet addiction among young adults in Bangladesh.** *J Egypt Public Health Assoc* 2020, **95**:3.
73. Mboya IB, Leyaro BJ, Kongo A, Mkombe C, Kyando E, George J: **Internet addiction and associated factors among medical and allied health sciences students in northern Tanzania: a cross-sectional study.** *BMC Psychol* 2020, **8**:73.
74. Salama B: **Prevalence and associated factors of Internet addiction among undergraduate students at Al-Beheira Governorate, Egypt.** *Int J Public Health* 2020, **65**:905-910.
75. 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.
76. Wang Q, Liu Y, Wang B, An Y, Wang H, Zhang Y, Mati K: **Problematic internet use and subjective sleep quality among college students in China: results from a pilot study.** *J Am Coll Health* (2) 2022, **70**:552-560, <https://doi.org/10.1080/07448481.2020.1756831>
77. Al Shawi AF, Hameed AK, Shalal AI, Abd Kareem SS, Majeed MA, Humidy ST: **Internet addiction and its relationship to gender, depression and anxiety among medical students in Anbar Governorate-West of Iraq.** *Int Q Community Health Educ* (3) 2022, **42**:253-256, <https://doi.org/10.1177/0272684X20985708>
78. Özarıncı E, Cangöl Söğüt S: **The relationship between internet addiction and risky health behaviors in university students: a cross-sectional study in Turkey.** *Perspect Psychiatr Care* (1) 2022, **58**:214-220, <https://doi.org/10.1111/ppc.12872>
79. Shan X, Ou Y, Ding Y, Yan H, Chen J, Zhao J, Guo W: **Associations between internet addiction and gender, anxiety, coping styles and acceptance in university freshmen in South China.** *Front Psychiatry* 2021, **12**:558080, <https://doi.org/10.3389/fpsy.2021.558080>
80. Zenebe Y, Kunno K, Mekonnen M, Bewuket A, Birkie M, Necho M, Seid M, Tsegaw M, Akele B: **Prevalence and associated factors of internet addiction among undergraduate university students in Ethiopia: a community university-based cross-sectional study.** *BMC Psychol* 2021, **9**:4, <https://doi.org/10.1186/s40359-020-00508-z>
81. Yu Y, Mo PK-H, Zhang J, Li J, Lau JT-F: **Validation of the Chinese version of the revised internet gaming cognition scale among adolescents in China: maladaptive cognitions as potential determinants of internet gaming disorder.** *Int J Environ Res Public Health* 2019, **17**:E290, <https://doi.org/10.3390/ijerph17010290>
82. Arafa A, Mahmoud O, Abu Salem E: **Excessive Internet use and self-esteem among Internet users in Egypt.** *Int J Ment Health* 2019, **48**:95-105, <https://doi.org/10.1080/00207411.2019.1611167>
83. Shao T, Chen X, Huang S, Liao Z, Lin S, Qi J, Cai Y, Huang Q, Shen H: **The recognition of gaming disorder in China: a case series of 223 patients.** *PeerJ* 2021, **9**:e10827, <https://doi.org/10.7717/peerj.10827>
84. Jovic J, Pantovic-Stefanovic M, Mitkovic-Voncina M, Dunjic-Kostic B, Mihajlovic G, Milovanovic S, Ivkovic M, Fiorillo A, Latas M: **Internet use during coronavirus disease of 2019 pandemic: psychiatric history and sociodemographics as predictors.** *Indian J Psychiatry* 2020, **62**:S383-S390, [https://doi.org/10.4103/psychiatry.IndianJPsychiatry\\_1036\\_20](https://doi.org/10.4103/psychiatry.IndianJPsychiatry_1036_20)
85. Sun Y, Li Y, Bao Y, Meng S, Sun Y, Schumann G, Kosten T, Strang J, Lu L, Shi J: **Brief report: increased addictive internet and substance use behavior during the COVID-19 pandemic in China.** *Am J Addict* 2020, **29**:268-270, <https://doi.org/10.1111/ajad.13066>
86. Li Y-Y, Sun Y, Meng S-Q, Bao Y-P, Cheng J-L, Chang X-W, Ran M-S, Sun Y-K, Kosten T, Strang J, et al.: **Internet addiction increases in the general population during COVID-19: evidence from China.** *Am J Addict* 2021, **30**:389-397, <https://doi.org/10.1111/ajad.13156>.

A large-scale, cross-sectional study (on 20 472 participants from China), investigating PUI in the early period of the COVID-19 pandemic (March–April, 2020). The results suggest relatively high prevalence estimates (36.7%) and identify potential risk factors including poor social support and perceived impact on the mental health due to the threat from the COVID-19 pandemic.

87. Young KS: **Internet addiction: the emergence of a new clinical disorder.** *Cyberpsychol Behav* 1998, **1**:237-244, <https://doi.org/10.1089/cpb.1998.1.237>
88. Caplan SE: **Theory and measurement of generalized problematic Internet use: a two-step approach.** *Comput Hum Behav* 2010, **26**:1089-1097, <https://doi.org/10.1016/j.chb.2010.03.012>
89. Pontes HM, Király O, Demetrovics Z, Griffiths MD: **The conceptualisation and measurement of DSM-5 internet gaming disorder: the development of the IGD-20 test.** *PLoS One* 2014, **9**:e110137, <https://doi.org/10.1371/journal.pone.0110137>
90. King DL, Delfabbro PH: **The cognitive psychopathology of internet gaming disorder in adolescence.** *J Abnorm Child Psychol* 2016, **44**:1635-1645, <https://doi.org/10.1007/s10802-016-0135-y>
91. Xanidis N, Brignell CM: **The association between the use of social network sites, sleep quality and cognitive function during the day.** *Comput Hum Behav* 2016, **55**:121-126, <https://doi.org/10.1016/j.chb.2015.09.004>