

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

Biljana Gjoneska¹, Marc N Potenza^{2,3,4,5}, Julia Jones^{6,*},
 Célia MD Sales^{7,8}, Georgi Hranov⁹ and Zsolt Demetrovics^{10,11,*}



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

¹ Macedonian Academy of Sciences and Arts, Krste Misirkov 2, 1000 Skopje, North Macedonia

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

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

⁴ Connecticut Mental Health Centre, New Haven, CT 06519, United States

⁵ Connecticut Council on Problem Gambling, Wethersfield, CT 06109, United States

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

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

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

⁹ Military Medical Academy, Sofia, Bulgaria

¹⁰ Centre of Excellence in Responsible Gaming, University of Gibraltar, Gibraltar, Gibraltar

¹¹ Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary

Corresponding authors:

Biljana Gjoneska (biljanagjoneska@manu.edu.mk),

Zsolt Demetrovics (zsolt.demetrovics@unigib.edu.gi)

* Twitter account: @JJonesatherts, @Demetrovics

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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

 AND	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 ¹	"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"
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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.

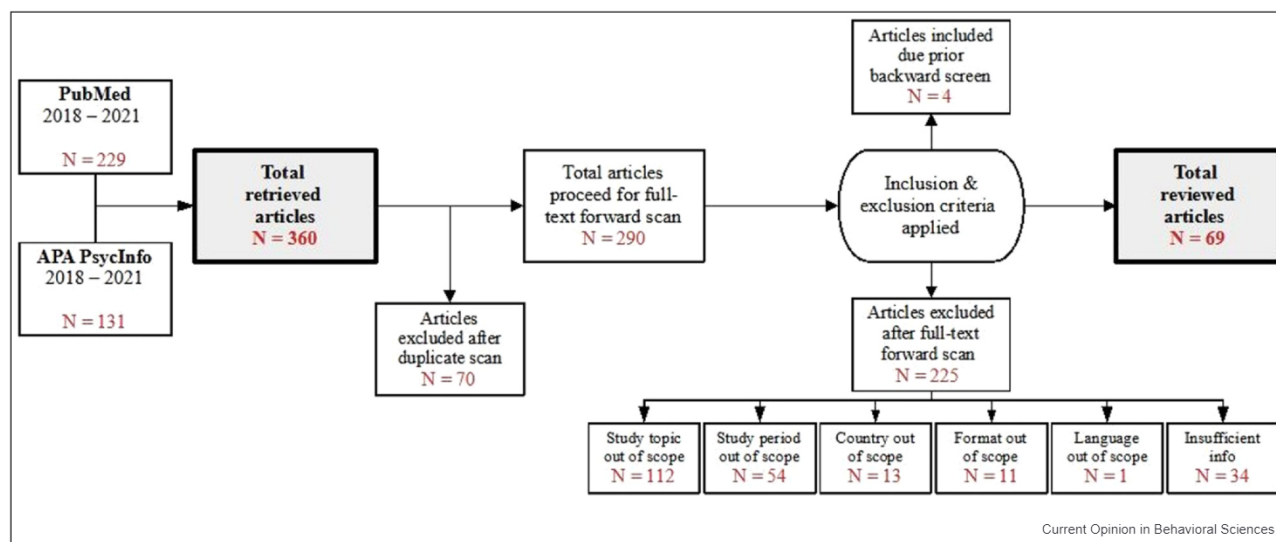
The findings presented in this review stem from original research articles and are considered with respect to more comprehensive articles (reviews and meta-analyses) on more general topics (such as mental health, PUI, COVID-19, LMICs, and regions), thus providing more complete coverage.

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:

- 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/>.

- b) The period of publication spanned between 2018 and 2021, covering studies from two years prior and two years into the COVID-19 pandemic.
- c) 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).
- d) 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:

- a) Duplicates, or articles with similar reports (regarding used samples and methods) in different academic outlets.
- b) Studies on topics that were outside the specific scope of interest.
- c) Studies from countries that were outside the target list.
- d) Studies conducted outside the target period and/or studies published in languages other than EN.
- e) 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 ²	GENERAL			GAMING		SOCIAL MEDIA	
POPULATION ¹	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 & Dalgic, 2021 [63]			Maftei & Enea, 2020 [64]; Yu et al. 2020 [40] Areshanab 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]; Saralioglu 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 [71]; Hassan et al. 2020 [72]; Mboya et al. 2020 [73] Salama, 2020 [74]; Sharma et al. 2020 [75]; Khazaie 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]; Özariç & Cangül Söğüt, 2022 [78]			Yu et al. 2019 [81]		Basu et al. 2021 [30]	
		DURING 11 studies	Cai et al. 2021b [31]; Condori-Meza et al. 2021 [34]; Fernandes et al. 2021 [44] Hosen 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 [46]; Sujaarwoto et al. 2021 [41]	
MEASURES	Time spent online ³	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 [49]; Hosen et al. 2021 [51]; Islam et al. 2020 [53]			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] Hassan et al. 2020 [72]; Mboya et al., 2020 [73]; Salama, 2020 [74] Sun et al. 2020 [85]; Cai et al. 2021a [20]; Kaya & Dalgic, 2021 [63] Khazaie 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] Condori-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] Sujaarwoto et al. 2021 [41]	
	Other used scales	BEFORE 8 studies	YDQ (Young, 1998b) [87] Chi et al. 2020 [58]; Cao et al. 2022 [56] GPIUS2 (Caplan, 2010) [88] Sharma et al. 2020 [75]	CIUS (Meerkkerk et al. 2009) [16] Arafa et al. 2019a [68] CIAS (Chen et al., 2003) [13] Shan et al. 2021 [79]		IGD-20 (Pontes et al. 2014) [89] Maftei & Enea, 2020 [68] Areshanab 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] Xie et al., 2021 [48] GPIUS2 (Caplan, 2010) [88] Sayeed et al., 2020 [43]	CIUS (Meerkkerk et al., 2009) [16] Fernandes et al., 2021 [44] CIAS (Chen et al., 2003) [13] 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]	
FINDINGS	Prevalence estimates ⁴	BEFORE	IAT score ≥ 50 Prevalence estimates: 33.04% (mean); 29.40 (median) 14.0% Singh et al. 2019 [35] 21.1% Cam & Ustuner, 2020 [57] 27.1% Hassan et al. 2020 [72] 31.0% Mboya et al. 2020 [73] 46.8% Sun et al. 2020 [85] 68.8% Khazaie 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% Condori-Meza et al. 2021 [34] 28.4% Zhao et al. 2021 [50] 36.0% Dong et al. 2020 [19] 43.8% Sayeed et al. 2020 [43]			DSM-5 ≥ 5 Prevalence estimates: N/A No matches found		BSMAS score ≥ 24 Prevalence estimates: N/A No matches found	
	Potential risk factors ⁵	BEFORE / DURING COVID-19	Demographic characteristics Predominantly males (Dong et al. 2020 [19]; Condori-Meza et al. 2021 [34]; Kaya & Dalgic, 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 & Dalgic, 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 (Maftei & Enea, 2020 [64]; Areshanab 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 (Maftei & Enea, 2020 [64]; Cuong et al. 2021 [22]); inadequate parenting style of mothers (Areshanab 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 s 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).

¹The 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.

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

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

⁴The *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.

⁵The 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 (≥ 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 ≥ 50) being more inclusive than a stricter one (IAT ≥ 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

Table 2

Cumulative number of original research articles on PUI in LMICs across different world regions, in the period preceding or coinciding with the COVID-19 pandemic [10-13,19,20,22-24,26-28,30-47,49-57,59-61,63-69,71-86*].

GEOGRAPHIC DISTRIBUTION OF RESEARCH ON PUI									
World regions ¹	Studies conducted before COVID-19 (2018-2019)				Studies conducted during COVID-19 (2020-2021)				
	Sum				Sum				
East Asia & Pacific						Dong et al. 2020 [19]	Lee et al. 2020 [36]		
						Ni et al. 2020 [37]	Siste et al. 2020 [52]		
						Sun et al. 2020 [85]	Zhang et al. 2020 [26]		
		Yu et al., 2019 [81]	Shao et al. 2021 [83]			Cai et al. 2021b [31]	Chen et al. 2021 [13]		
		Yu et al., 2020 [40]	Nguyen et al. 2021 [61]			Cuong et al. 2021 [22]	Fernandes et al. 2021 [44]		
		Cai et al, 2021a [20]	Yu et al. 2021a [65]			Fung et al. 2021 [12]	Huang et al. 2021 [49]		
		Kaya & Dalgıç, 2021 [63]	Yu et al. 2022 [24]			Larnyo et al. 2021 [46]	Li et al. 2021a [38]		
		Shan et al. 2021 [79]	Cao et al. 2022 [56]			Li et al. 2021b [86]	Lugito et al. 2021 [28]		
		Yu et al. 2021b [66]	Wang et al. 2022 [76]			Luo et al. 2021 [47]	Rakhmawati et al. 2021 [10]		
					Sujarwoto et al. 2021 [41]	Zhao et al. 2021 [50]			
					Zhou et al. 2021 [39]				
South Asia		Jahan et al. 2019 [69]	Singh et al, 2019 [35]			Islam et al. 2020 [53]	Sayeed et al. 2020 [43]		
		Hassan et al. 2020 [72]	Sharma et al. 2020 [75]			Abir et al. 2021 [54]	Fernandes et al. 2021 [44]		
		Basu et al. 2021 [30]	Iqbal et al. 2021 [60]			Hosen et al. 2021 [51]	Mahmood et al. 2021 [27]		
		Kaya & Dalgıç, 2021 [63]	Mohanty et al. 2021 [11]			Rizwan et al. 2021 [45]	Sayeed et al. 2021 [42]		
Europe & Central Asia									
		Cam & Ustuner, 2020 [57]	Maftci & Enea, 2020 [64]			Jovic et al. 2020 [84]			
		Popadić et al. 2020 [59]	Kaya & Dalgıç, 2021 [63]			Saralioglu et al. 2020 [67]			
		Özarıcı & Cangöl Söğüt, 2022 [78]							
Middle East & North Africa									
		Arafa et al. 2019a [68]	Arafa et al. 2019b [82]						
		Salama, 2020 [74]	Areshtanab et al. 2021 [23]			Guelmami et al. 2021 [55]			
		Khazaie et al., 2021 [32]	Al Shawi et al. 2022 [77]			Shehata & Abdeldaim et al. 2021 [33]			
Sub-Saharan Africa									
		Asrese & Muche, 2020 [71]							
		Mboya et al. 2020 [73]							
		Zenebe et al. 2021 [80]							
Latin America & Caribbean									
		No matches found							
						Condori-Meza et al. 2021[34]			
						Fernandes et al. 2021 [44]			

Data source: World Bank Data Help Desk; URL: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.

*The list of world regions is based upon the latest classifications by the World Bank.

adults. Younger and more vulnerable populations may be more susceptible to PUI behaviors, and this may in part explain the higher scores.

In this regard, research on problematic gaming has explored almost exclusively effects on younger populations, comprised of youth attending elementary school (aged approximately 7–10 years) or middle or high school (aged

approximately 11–17 years). Eight (of 10) studies focused on problematic gaming, and prevalence rates were frequently estimated using a nine-item checklist by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [21]. Overall, prevalence estimates of problematic gaming across five studies, ranged between 11.7% and 40.0%, while the average prevalence was estimated at 18.4%. This value is higher than an earlier estimate of

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.

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Data Availability

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

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