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The Prevalence and Predictors of Problematic Mobile Phone Use: a 14-Country Empirical Survey

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Abstract

This study examined (a) differences in estimates of Problematic Mobile Phone Use (PMPU) in adults across 14 countries worldwide and (b) whether personality and psychopathology variables predict PMPU. A sample of 7531 adults (69.6% women; mean age 25.7, SD = 9.9) completed an online survey about PMPU, defense mechanisms, coping strategies, self-esteem, pathological personality traits, and depressive symptoms. The overall mean PMPU score was 104.3 (range 27–270) and 28.1% of the participants self-reported PMPU. Women had significantly higher PMPU overall. Consistent predictors of increased PMPU in the overall sample were younger age, female gender, more hours spent on mobile phone, coping strategies, immature and autistic defenses, depression, and six personality disorders. Significant differences across countries were found in means, self-reported rates, and predictors of PMPU (hours spent, dependent personality, depression, and immature defense were common). Findings pave the way for evidence-based prevention and policy efforts at the public health level.

The undisputable benefits of mobile phone use have recently been counterbalanced by a growing concern about the implications of their excessive use (Lopez-Fernandez, 2021). Although still not a distinct diagnostic category, there is a growing debate about whether excessive smartphone use can be considered problematic and can fulfill criteria of addictive behavior (Billieux et al., 2015; Harris et al., 2020; Panova & Carbonell, 2018). A recent review has suggested that excessive smartphone use has been associated with psychiatric, cognitive, emotional, medical, and brain changes (see review by Wacks & Weinstein, 2021) and contrasts largely older arguments that there is scarce evidence supporting

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excessive smartphone use as an addictive behavior (Billieux et al., 2015; Panova & Carbonell, 2018). By this mean, excessive smartphone use could be considered as a variant of the technology-mediated addictive behaviors (Wolf & Wolf, 2020) and has been considered as a public health concern by the World Health Organization (2015).

The term PMPU was coined by Billieux (2012) to describe one's inability to control the use of the mobile phone, which results in negative consequences in daily life. Although a clear cut-off point to determine problematic use has not yet been defined, and scholars argue about the criteria of PMPU (Harris et al., 2020), Billieux's (2012) definition clearly takes into consideration the resultant detrimental implications. The interchangeable use of terms such as problematic, deregulated, or addictive, intensive or excessive or compulsive use, dependence or overattachment, smart/mobile phone (over)use (Elhai et al., 2017; Panova et al., 2020) reflects the heterogeneity of the phenomenon (e.g., Billieux et al., 2015). Accumulated evidence has indicated association of excessive or problematic mobile phone use (PMPU) with a wide range of negative consequences in emotional and physical health, professional and social performance, and daily life in general, such as financial problems, risky driving, bedtime procrastination, sleep problems, anxiety, perceived stress, and depressive symptoms (see reviews Busch & McCarthy, 2021; Sohn et al., 2019).

Prevalence Rates

Research on PMPU started almost two decades ago (e.g., Bianchi & Phillips, 2005), and since then, studies have been conducted in adolescents and adults, with university students comprising most of the adult samples (see review of 290 studies on PMPU by Thomée, 2018). Jenaro et al's (2007) study showed that 10.4% of the participants from Spain aged $18 - 32$ could be diagnosed as pathological cell phone users. Recent studies (from 2011 to 2017) have shown that the estimated PMPU prevalence rates may be higher and vary widely (Billieux et al., 2015), ranging from 14.0 to 31.2% (median prevalence rate 23.3%) (see review Sohn et al., 2019).

Despite the recent increased attention, only a couple of large cross-cultural studies have been conducted so far. Lopez-Fernandez and colleagues have conducted the largest cross-cultural survey so far in 2775 young adults from 10 European countries (Lopez-Fernandez et al., 2017). Participants from the Northern and Southern regions reported the highest perceived dependence on mobile phones, whereas the lowest was in the Eastern region. Highly dependent mobile phone users came from Belgium (3.9%), UK (3.5%), and France (3.4%). In their cross-cultural survey, Panova et al. (2020) included participants from non-European countries. They examined cross-cultural differences in 1709 students coming from Spain, the USA, and Colombia on smartphone use and its relationship with anxiety and depression. They found that 56.6% could be labelled as having "occasional problems with mobile phone use" and 7.7% as having "frequent problems with mobile phone use." Spain had the lowest scores on problematic use of the mobile phone compared to the US and the Colombian samples, as well as the lowest scores on anxiety. Large cross-cultural studies are necessary to provide insights to the diverse prevalence rates and contributing factors of PMPU. Besides, the study of countries other than the USA and China that are the most frequently studied (Busch & McCarthy, 2021*) need to be included.*

Factors Associated with PMPU

Available studies have demonstrated a wide range of demographic variables and psychological variables as risk or protective factors for PMPU. In their review, Busch and McCarthy (2021) indicated female gender, young age, and high education to be antecedents of PMPU. A factor that has consistently been associated with problematic media use is personality (Eichenberg et al., 2021). Studies have also shown association between PMPU and low self-esteem (Fischer-Grote et al., 2019; Wolf & Wolf, 2020). However, Carvalho et al. (2018) review has shown that there are few studies focusing on pathological personality traits and their relationship with problematic smartphone use, and unfortunately pathological personality traits have been limited to those of the five-factor model of personality, such as extraversion and neuroticism (Eichenberg et al., 2021). Marengo et al. (2020) meta-analysis found problematic smartphone use to be associated with conscientiousness, agreeableness, and neuroticism. Carvalho et al. (2018) suggested that more research needs to be conducted taking into account several personality pathological traits. The study by Verseillié et al. (2020) has examined the ten pathological personality traits of the DSM-IV using the Personality Diagnostic Questionnaire 4+(PDQ4+) in relationship to the problematic Facebook and Twitter use. Given that studies have shown evidence of overlap between pathological smartphone and Internet use (Carvalho et al., 2018; Elhai et al., 2020), and very few studies have shown association with specific personality disorders, such as narcissistic (Servidio et al., 2021) and obsessive–compulsive disorder (Alavi et al., 2020; Wickord and Quaiser-Pohl, 2022), we examined the relationship between PMPU and all ten personality disorders. Psychopathology symptoms, such as depression and anxiety (Busch and McCarthy, 2021; Panova et al., 2020; Pera, 2020; Thomée, 2018; Wolf & Wolf, 2020) have also been repeatedly associated with PMPU.

Billieux et al. (2015) have recently proposed an empirically based theoretical framework for PMPU, in which at least three potentially simultaneous pathways can lead to PMPU, i.e., excessive reassurance, impulsivity-antisociality, and extraversion; these could be symptoms of personality disorders. Inconsistent findings on prevalence rates and contributing factors could be a result of methodological differences (use of different assessment instruments and cut-off scores to classify problematic users) (Harris et al., 2020; Laconi, et al., 2014; López-Fernández et al., 2012) and lack of theoretical background (Billieux et al., 2015). Therefore, studies are necessary to explore similarities and differences among several large samples worldwide. Harris et al (2020) have specifically discussed the difficulty in comparing the findings of different studies due to use of diverse scales (78 in number) measuring the same (or similar) constructs. The main objective of this study was to (a) compare estimates of prevalence rates of problematic mobile phone use (PMPU) in adults across 14 countries worldwide, and (b) explore the relationships of PMPU with sociodemographic, personality-related variables (defense, coping, and self-esteem), and psychopathological symptoms (pathological personality traits and depressive symptoms). The study aspires to shed light on the association of PMPU with related variables, which could further contribute to extend current theoretical knowledge and improve theoretical frameworks**.**

Material and Methods

Participants and Procedure

Participants were recruited through a website dedicated to the study, which was available online for 6 months. Only participants aged of 18 and over were recruited. Data was obtained through

a convenience and snowball sampling procedure by each site investigator. They administered the questionnaire link to their students, colleagues, friends, and acquaintances through email and social media. The invitees were then kindly asked to spread the survey to their own contacts. Information about the aim of the study and an informed consent statement (e.g., anonymity and confidentiality, data manipulation, withdrawal) were provided at the first page of the questionnaire and prior to data collection. Participants who did not give their informed consent, did not complete 10% of the scales or of the items, were excluded, leaving a sample of 7726 participants. Then, participants who did not own a mobile phone were excluded ($n = 195$, 2.5%). The sample that was included in all subsequent analyses enumerated 7531 participants and came from Italy ($N = 869$), France ($N = 782$), Colombia ($N = 307$), Peru ($N = 422$), Ecuador ($N = 296$) and Chile ($N = 381$), Brazil ($N = 971$), Finland ($N = 251$), Turkey ($N = 393$), Romania ($N = 581$), Greece ($N = 1036$), Iran ($N = 242$), United Arab Emirates ($N = 663$), and Pakistan ($N = 333$). The detailed demographics of the overall sample and in each site are presented in Table 1. This study is in conformity with the 1964 Helsinki declaration and its later amendments and received the approval from the ethics committee of one of the participating universities [omitted for blind review].

Measures

Participants responded to a number of sociodemographic variables (e.g., gender, age, professional status, educational level, and marital situation), phone use-related questions (e.g., hours spent on mobile per day), and validated questionnaires related to the study variables (see below). The survey questionnaire was translated into each country's language (Italian, French, Portuguese, Finnish, Turkish, Greek, Romanian, Persian, Arabic, and Urdu) and back-translated into English to achieve conceptual equivalence in each of the target countries, consistently to the guidelines described by Efstathiou (2019). If there were translated versions of the instruments in the target language, they were used in the present study.

Measures on Phone Use

The Mobile Phone Problem Use Scale (MPPUS; Bianchi & Phillips, 2005) was used to study problematic mobile phone use (PMPU). It was selected among those measuring problematic use (and not related constructs), owed to its very good psychometric properties (see Harris et al., 2020). It comprised of 27 items rated on a 10-point scale (1 = Not at all true to 10 = Extremely true). Total scores range from 27 to 270, and higher scores indicate more problematic mobile phone use. Cronbach alpha for the overall sample was 0.92.

A single item was also used to assess self-perceived problematic mobile phone use (SPMPU): "In your opinion, according to your online behavior over the past year, do you feel that you have a problematic mobile phone use?". Rated on a 4-point scale (No, Rather No, Rather Yes, Yes), the items received a score from 0 to 3. A score higher than 3 was used as a cut-off score to discriminate self-assessed problematic users.

Personality Measures

The Defense Style Questionnaire-28 (DSQ-28; Saint-Martin et al., 2013), comprised of 28 items rated on a 4-point scale from 1 (Totally agree) to 4 (Totally disagree), was used to assess defense styles. Total scores ranged from 28 to 112. Cronbach alpha for the overall sample was 0.81.

Table 1 Descriptive statistics (means and standard deviations or percentages) of the sociodemographic variables for the whole sample and each sample separately

	Total (n=7531)	Brazil (n=971)	Chile (n=385)	Colombia (n=307)	Ecuador (n=296)	Peru (n=422)	Iran (n=242)	Pakistan (n=333)	UAE (n=663)	Finland (n=251)	France (n=782)	Greece (n=1036)	Italy (n=869)	Romania (n=581)	Turkey (n=393)
Age range	18–86	18–86	18–76	18–76	18–76	18–76	18–76	18–76	18–76	18–76	18–76	18–76	18–76	18–76	18–76
Mean age (SD)	25.7 (9.9)	39.3 (13.6)	23.8 (8.7)	24 (6.5)	22.1 (6.5)	22.2 (6.6)	22.8 (7)	23 (7.5)	21.8 (5.6)	24.4 (8.2)	23.3 (6.1)	27.4 (10)	23 (6.2)	23.3 (7.6)	21.9 (6.2)
Gender n (%)															
Men	2292 (30.4)	254 (26.2)	259 (26.3)	205 (22.7)	258 (29.1)	297 (29.9)	220 (26.4)	154 (25)	307 (24.3)	216 (25.1)	372 (28.4)	313 (19.3)	649 (44)	354 (29.8)	262 (26.1)
Women	5239 (69.6)	717 (73.8)	724 (73.7)	697 (77.3)	628 (70.9)	695 (70.1)	612 (73.6)	463 (75)	954 (75.7)	646 (74.9)	936 (71.6)	1305 (80.7)	827 (56)	832 (70.2)	743 (73.9)
Professional situation															
Students	5104 (67.8)	371 (38.2)	757 (77.0)	728 (80.7)	744 (84)	784 (79)	712 (85.6)	517 (83.8)	1028 (81.5)	719 (83.4)	1009 (77.1)	915 (56.6)	1130 (76.6)	994 (83.8)	868 (86.4)
Active	2027 (26.9)	515 (53)	135 (13.7)	155 (17.2)	127 (14.3)	184 (18.5)	99 (11.9)	85 (13.8)	218 (17.3)	128 (14.8)	243 (18.6)	577 (35.7)	287 (19.4)	177 (14.9)	112 (11.1)
Inactive	400 (5.3)	85 (8.8)	91 (9.3)	19 (2.1)	15 (1.7)	24 (2.4)	21 (2.5)	15 (2.4)	15 (1.2)	15 (1.7)	56 (4.3)	126 (7.8)	59 (4)	15 (1.3)	25 (2.5)
Educational level															
<university	1122 (14.9)	48 (4.9)	53 (5.4)	37 (4.1)	26 (2.9)	26 (2.6)	29 (3.5)	26 (4.2)	120 (9.5)	183 (21.2)	86 (6.6)	26 (1.6)	401 (27.2)	349 (29.4)	26 (2.6)
<Master's	3791 (50.3)	152 (15.7)	595 (60.5)	618 (68.5)	613 (69.2)	719 (72.5)	493 (59.3)	342 (55.4)	779 (61.8)	418 (48.5)	850 (65)	385 (23.8)	725 (49.1)	450 (37.9)	732 (72.8)
<Ph.D	1684 (22.4)	222 (22.9)	251 (25.5)	177 (19.6)	177 (20)	177 (17.8)	233 (28)	178 (28.8)	292 (23.2)	189 (21.9)	260 (19.9)	929 (57.4)	276 (18.7)	273 (23)	177 (17.6)
>Ph.D	870 (11.6)	549 (56.5)	61 (6.2)	47 (5.2)	47 (5.3)	47 (4.7)	54 (6.5)	47 (7.6)	47 (3.7)	47 (5.5)	54 (4.1)	252 (15.6)	51 (3.5)	91 (7.7)	47 (4.7)
Other or missing	64 (0.8)	0 (0)	23 (2.3)	23 (2.5)	23 (2.6)	23 (2.3)	23 (2.8)	24 (3.9)	23 (1.8)	25 (2.9)	58 (4.4)	26 (1.6)	23 (1.6)	23 (1.9)	23 (2.3)
Marital situation															

Table 1 (continued)

	Total (n=7531)	Brazil (n=971)	Chile (n=385)	Colombia (n=307)	Ecuador (n=296)	Peru (n=422)	Iran (n=242)	Pakistan (n=333)	UAE (n=663)	Finland (n=251)	France (n=782)	Greece (n=1036)	Italy (n=869)	Romania (n=581)	Turkey (n=393)
Single	4983 (66.2)	454 (46.8)	784 (79.8)	763 (84.6)	776 (87.6)	842 (84.9)	710 (85.3)	528 (85.6)	1117 (88.6)	652 (75.6)	905 (69.2)	985 (60.9)	1091 (73.9)	765 (64.5)	916 (91.1)
In a relationship	2548 (33.8)	517 (53.2)	199 (20.2)	139 (15.4)	110 (12.4)	150 (15.1)	122 (14.7)	89 (14.4)	144 (11.4)	210 (24.4)	403 (30.8)	633 (39.1)	385 (26.1)	421 (35.5)	89 (8.9)
Phone use															
Classic	613 (8.1)	12 (1.2)	15 (3.9)	18 (5.9)	23 (7.8)	43 (10.2)	23 (9.5)	329 (98.4)	15 (2.3)	2 (0.8)	87 (11.1)	31 (3.0)	6 (0.7)	8 (1.4)	1 (0.3)
Smartphone	6918 (91.9)	959 (98.8)	370 (96.1)	289 (94.1)	273 (92.2)	379 (89.8)	219 (90.5)	4 (1.2)	648 (97.7)	249 (99.2)	695 (88.9)	1005 (97.0)	863 (99.3)	573 (98.6)	392 (99.7)
Hours per day	5.5 (3.8)	4.8 (3.4)	5.4 (3.7)	6.1 (4.3)	5.6 (3.9)	5.6 (4.2)	5.1 (3.9)	4.9 (3.7)	6.3 (4.1)	4.6 (3.4)	4 (3.4)	4.7 (3.3)	5.7 (3.7)	5.5 (3.7)	4.9 (3.3)

UAE United Arab Emirates

The Brief Coping Orientation to Problems Experienced Inventory (COPE; Carver, 1997), comprised of 28 items rated on a 4-point scale from 1 (Not at all) to 4 (Very much), was used to assess coping strategies. Items are allocated in 14 subscales of two items each (self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame). Subscale scores range from 2 to 8, and higher scores indicate higher frequency of use. Cronbach alpha for the overall sample was 0.85.

The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), comprised of 10 items rated from 1 (Totally disagree) to 4 (Totally agree), was used to assess self-esteem. Total scores range from 0 to 40. Scores lower than 25 indicate very low self-esteem, between 25 and 30 low self-esteem, 31–34 average self-esteem, 35–39 high self-esteem, and > 39 very high self-esteem (Chabrol et al., 2004). Cronbach alpha for the overall sample was 0.81.

Psychopathology Measures

The Center for Epidemiologic Studies-Depression Scale (CESD-10; Radloff, 1977) was used to assess depressive symptoms in the past week. It includes 10 items (three items on depressed affect, five items on somatic symptoms, and two on positive affect) rated on a 4-point scale (0 = Rarely or never, 3 = Most of the time or every time (5 to 7 days). Items 5 and 8, which are positive affect statements, are reverse scored. The total score is produced by summing all items and ranges from 0 to 30. Scores equal or higher than 10 indicate depressive symptomatology (Andresen et al., 1994). Cronbach alpha for the overall sample was 0.78.

The Personality Diagnostic Questionnaire 4 + (PDQ-4 +; Hyler, 1994), comprised of 99 True or False items, rated 1 or 0, was used to assess pathological personality traits, according to three clusters: Cluster A (paranoid, schizoid, and schizotypal), Cluster B (antisocial, borderline, histrionic, and narcissistic), and Cluster C (avoidant, dependent, and obsessional-compulsive). Several cut-off points have been proposed (Laconi et al., 2015). In the present study, the threshold of 30 was used (Bouvard, et al., 2011). Cronbach alpha for the overall sample was 0.92.

Data Analysis

Internal consistency was examined with Cronbach' alpha. Differences in PMPU (measured with the Mobile Phone Problem Use Scale) across gender and country were explored using independent samples t test or ANOVA, respectively, whereas differences on SPMPU (self-reported problematic mobile phone use) across gender and country were explored using chi-square. Pearson r was used to examine relationships between MPPUS and the study variables. The statistically significant variables were entered in hierarchical regressions analyses (stepwise method), which were performed to identify unique predictors of PMPU for the whole sample and each sample separately. The following variables were entered in blocks 1, 2, and 3 respectively: sociodemographic variables (i.e., gender, age, professional status, educational level, marital situation, hours spent on mobile phone per day), personality variables (self-esteem, defense mechanisms, adaptive/maladaptive coping), and psychopathology variables (10 personality disorders) and depression. Due to multiple comparisons (i.e., differences across countries), the p value 0.001 was used to partially correct the elevated type I error. SPSS 21.0 was used to perform all analyses and the significance level was set on $p < 0.05$.

Results

Descriptive Results

Most participants owned a smartphone (91.9%), and they spent on average 5.51 (SD = 3.8) hours during a normal weekday. Only Pakistan participants owed a classic mobile phone in a higher percent than that of the smartphone. Colombian participants had the highest mean hours of phone use (6.1) and French participants had the lowest (4.0). Descriptive statistics of the demographic variables for each sample are presented in Table 1.

The overall mean MPPUS score (measuring PMPU) was 104.3 (SD = 42.1), and 28.1% of the participants reported self-perceived problematic use (Table 2). Significant mean MPPUS differences were found among the 14 samples ($F_{(13, 7517)} = 80.717$, $p < 0.001$) with the samples from Pakistan (132.9) and UAE (132.9) having the highest mean scores and the French (80.7) and Italian (89.2) samples having the lowest scores. However, Chile (58.7%), Iran (57.0%), Colombia (52.1%), and Ecuador (48.3%) reported the highest percent of self-assessed problematic mobile phone use (SPMPU), whereas Pakistan (0.0%) and UAE (13.3%) the lowest.

Gender Differences

Gender differences across countries can be seen in Table 3. Overall MPPUS mean score was significantly higher among women (106.6) than among men (98.2) ($t = -6.814$, $p < 0.001$). All European countries, except Turkey, and all Middle East counties (except Pakistan) had higher mean scores among women, with Finland and Italy having statistically significant differences across gender. However, South America countries had higher mean scores among men (except Brazil), though not statistically significant (Peru had higher, but not statistically significant, mean scores compared to those of the women). In the total sample, perceived problematic mobile phone use (SPMPU), as self-reported, was again higher among women than among men (71.1% vs. 28.9%; $\chi^2 = 4.505$, $p = 0.034$), though not significant (p value exceeded 0.001). Only Iran reported significantly higher self-perceived rates of SPMPU.

Predictors of MMPUS

In the overall sample, problematic mobile phone use (PMPU), as assessed with the MPPUS, positively correlated with all study variables, with low coefficients ranging from $r = 0.063$ for self-esteem to $r = 0.39$ for dependent personality traits ($p < 0.001$), and they were entered in the regression analyses. Two variables consistently and significantly correlated with PMPU in all samples (though the sizes of the correlations were low): borderline traits (from 0.09, $p < 0.05$ to 0.45, $p < 0.001$) and immature defense mechanisms (from 0.13, $p < 0.01$ to 0.42, $p < 0.001$).

The hierarchical linear regression analyses, explaining the contribution of a number of predictors in PMPU for the whole and for each sample, are presented in Table 4. Regression analyses showed that for the overall sample, the model explained 31.7% of the variance in the PMPU [$R^2 = 0.242$; $F_{(8, 2105)} = 83.99$, $p < 0.001$], whereas for the countries R^2 ranged between 0.034 (Turkey) and 0.377 (Colombia). Applying a conservative alpha significance level, only results in $p < 0.001$ will be taken into consideration. In the total sample, PMPU was predicted by (a) hours of using the phone daily, (b) age, (c) female

Table 2 Descriptive statistics and differences by country (ANOVA or χ^2) in Mobile Phone Problem Use Scale (MPPUS) and self-reported problematic mobile phone use (SPMPU)

	Total (n=7531)	Brazil (n=971)	Chile (n=385)	Colombia (n=307)	Ecuador (n=296)	Peru (n=422)	Iran (n=242)	Pakistan (n=333)	UAE (n=663)	Finland (n=251)	France (n=782)	Greece (n=1036)	Italy (n=869)	Romania (n=581)	Turkey (n=393)	$F(p)/\chi^2(p)$
MPPUS	104.3 (42.1)	105.6 (42.1)	108.9 (41.1)	114.7 (39.3)	109.5 (39.8)	93.7 (42.4)	118.5 (48.4)	132.9 (18.2)	132.9 (46.7)	93.8 (37.4)	80.7 (34.0)	103.0 (34.4)	89.2 (37.7)	101.6 (46.2)	109.1 (40.0)	80.72 (.000)
SPMPU	2113 (28.1%)	308 (31.7%)	226 (58.7%)	160 (52.1%)	143 (48.3%)	158 (37.4%)	138 (57.0%)	0 (0.0%)	88 (13.3%)	45 (17.9%)	148 (18.9%)	190 (18.3%)	179 (20.6%)	192 (33.0%)	138 (35.1%)	788.77 (.000)

MMPUS scores are means and standard deviations, whereas numbers for self-reported PMPU are frequencies and percentages; *MPPUS*, Mobile Phone Problem Use Scale; *SPMPU*, Self-reported problematic mobile phone use (response to a self-assessed item of problematic mobile phone use); *UAE*, United Arab Emirates; MPPUS range of scores: 27–270

Table 3 Differences in problematic mobile phone use assessments (MPPUS and SPMPU) across gender (*t* tests and χ^2)

		Total (n = 7531)	Brazil (n = 971)	Chile (n = 385)	Colombia (n = 307)	Ecuador (n = 296)	Peru (n = 422)	Iran (n = 242)	Pakistan (n = 333)	UAE (n = 663)	Finland (n = 251)	France (n = 782)	Greece (n = 1036)	Italy (n = 869)	Romania (n = 581)	Turkey (n = 393)
MPPUS	Men	98.2 (42.2)	101.8 (42.4)	112.2 (40.3)	115.7 (36.9)	111.7 (36)	99 (40.7)	112.1 (47.3)	133.8 (25)	129.6 (48.8)	76.2 (27)	76.6 (32.1)	98.7 (34.2)	85.6 (38.4)	97.5 (43.9)	112.3 (40.6)
	Women	106.6 (41.9)	107 (41.9)	107.6 (40.1)	114.5 (39.9)	108.2 (42)	90.5 (43.2)	121.9 (48.8)	132.6 (16.3)	133.9 (46)	100.1 (38.6)	82.7 (34.7)	103.8 (34.4)	94.1 (36.2)	103.8 (47.2)	107.8 (39.7)
	t (*p*)	−6.814 (.000)	−1.707 (.088)	1.019 (.309)	.195 (.845)	.744 (.458)	1.999 (.046)	−1.515 (.131)	.357 (.722)	−.994 (.321)	−4.649 (.000)	−2.343 (.019)	−1.767 (.078)	−3.300 (.001)	−1.569 (.117)	1.006 (.315)
SPMPU	Men	611 (28.9%)	69 (22.4%)	64 (28.3%)	26 (16.3%)	53 (37.1%)	65 (41.1%)	34 (24.6%)	61 (18.3%)	24 (27.3%)	4 (8.9%)	42 (28.4%)	33 (17.4%)	89 (49.7%)	73 (38%)	35 (25.4%)
	Women	1502 (71.1%)	239 (77.6%)	162 (71.7%)	134 (83.8%)	90 (62.9%)	93 (58.9%)	104 (75.4%)	272 (81.7%)	64 (72.7%)	41 (91.1%)	106 (71.6%)	157 (82.6%)	90 (50.3%)	119 (62%)	103 (74.6%)
	χ^2 (*p*)	4.505 (.034)	3.295 (.070)	.000 (.997)	.630 (.427)	.023 (.881)	1.289 (.256)	15.496 (.000)	—	.603 (.438)	8.571 (.003)	1.237 (.266)	.313 (.576)	5.638 (.018)	1.065 (.302)	.872 (.351)

In the first panel numbers (MMPUS scores) are means and standard deviations, whereas in the second panel, numbers are frequencies and percentages. *MPPUS*, Mobile Phone Problem Use Scale; *SPMPU*, Self-reported problematic mobile phone use (response to a self-assessed item of problematic mobile phone use); *UAE*, United Arab Emirates; MPPUS range of scores: 27–270

gender, (c) schizotypal personality disorder (Cluster A traits), (d) antisocial, histrionic, and narcissistic personality disorder (Cluster B traits), (e) avoidant and dependent personality disorder (Cluster C traits), (f) depression, (g) both adaptive and maladaptive coping, and (h) immature and autistic defense styles.

Similarities were observed across the 14 countries, and the following variables with coefficients significant in $p < 0.001$ were consistent predictors in a number of countries: (a) hours of phone daily use in 11 countries (all except Ecuador, Pakistan, and UAE); (b) Cluster C dependent personality in 5 (Brazil, Colombia, France, Greece, and Romania); (c) depression in 5, and (d) immature defense style in 3 (UAE, France, and Greece). A number of other variables were predictors in two countries: age (inversely) in Brazil and Greece, Cluster A schizoid personality (inversely) in Peru and Romania, Cluster B histrionic in Colombia and France, and narcissistic personality disorder in UAE and Finland, Cluster C obsessive–compulsive personality in Iran and UAE, adaptive coping in Brazil and Greece, and maladaptive coping in Chile and Peru. Furthermore, denial (inversely) was a predictor of PMPU in Brazil, self-esteem in Colombia, marital situation (single) in Pakistan, and neurotic defense style in Colombia).

Discussion

The main objective of this study was to explore and compare the prevalence of problematic mobile phone use (PMPU) among adult users across 14 different countries around the world, and to assess the relationship of PMPU with sociodemographic, personality-related variables, and psychopathological symptoms.

Prevalence Rates and Gender Differences

The overall self-reported prevalence rate (28.1%) of the perceived problematic mobile phone use (SPMPU) is within the rates already have been reported (14.0 to 31.2%; Wolf & Wolf, 2020) and slightly higher than the median prevalence rate (23.3%) (see review by Sohn et al., 2019). Comparisons across countries revealed that PMPU, as assessed with MPPUS, was less prevalent in the European region (France and Italy had the lowest scores) in comparison to all other regions; Asian and Middle East countries had the highest PMPU. This finding is in line with the study by Panova et al. (2020) who found the US and Colombian samples having highest scores on problematic use of the mobile phone compared to Spain. Olson's et al. (2021) meta-analysis of 81 studies in 24 countries published between 2014 and 2020 also found the highest scores in China and Saudi Arabia and the lowest scores in Germany and France. Mean hours of use found in the present study was lower than what has been found in a university student sample (Kaya et al., 2021). Cross-cultural assumptions could be made. Highest PMPU rates in the so-called collectivistic countries (i.e., non-western countries), characterized by cultural tightness and interdependence, may be a cause of keeping frequent contact with family and closed ones (Olson et al., 2021). The finding that problematic use is predicted by social uses of phone, such as engaging in social networking, chatting, and messaging (Lopez-Fernandez et al., 2017), corroborates this assumption. Women had higher mean PMPU scores than men in six out of 14 countries with two out of the six European countries (i.e., Finland and Italy) having statistically significant higher score; women in Brazil, Iran, France, and UAE also had higher PMPU score compared to men, though not significant. Moreover, female gender was a significant predictor of PMPU in Finland. Being female has been associated with PMPU in

Table 4 Regression analyses for problematic mobile phone use (PMPU) as assessed with Mobile Phone Problem Use Scale (MPPUS) (standardized β coefficients are presented)

	Total (n=7531)	Brazil (n=971)	Chile (n=385)	Colombia (n=307)	Ecuador (n=296)	Peru (n=422)	Iran (n=242)	Pakistan (n=333)	UAE (n=663)	Finland (n=251)	France (n=782)	Greece (n=1036)	Italy (n=869)	Romania (n=581)	Turkey (n=393)
Gender	.054***		-.121**			-.077*				.166**					
Age	-.038***	-.182***	-.096*							-.158**	-.073*	-.093***	-.040	-.034	
Professional status															
Educational level			-.054												
Marital situation	-.016					-.091*	-.099*	-.188***						-.061	
Hours per day	.188***	.196***	.211***	.249***		.194***	.337***			.332***	.294***	.275***	.205***	.215***	.156**
Cluster A traits															
Paranoid								-.127*							
Schizoid	-.048**					-.168***						-.071**		-.143***	
Schizotypal	-.072***			-.122*						.178**			.101**		.128**
Cluster B traits															
Antisocial	.059***					.146**									
Borderline								.178**							
Histrionic	.071***	.063*		.178***	.166**	.153**					.127***				
Narcissistic	.086***	.070*		.150**					.162***	.223***				.103**	
Cluster C traits															
Avoidant	.057***		.136**			.141**									
Dependent	.146***	.206***		.187***	.154**			.174**			.195***	.198***	.073*	.188***	
O.C							.199***		.221***						
Depression	.083***		.136*		.207***	.169**	.118*			.214***	.156***	.169***	.161***	.114*	
Coping															
Adaptive	.047***	.124***						.125*				.107***	.091*		
Maladaptive	.113***		.195***	.095	.130*	.181***	.079		.118**	.096	.005	.041	.006	.075	
Defense															
Mature	-.034**	-.022				-.115**	-.138*				-.065	-.020		-.060	
Neurotic	.023*	.070*		.173***			.144*				.034				

Table 4 (continued)

	Total (n=7531)	Brazil (n=971)	Chile (n=385)	Colombia (n=307)	Ecuador (n=296)	Peru (n=422)	Iran (n=242)	Pakistan (n=333)	UAE (n=663)	Finland (n=251)	France (n=782)	Greece (n=1036)	Italy (n=869)	Romania (n=581)	Turkey (n=393)
Immature	.091***	.078*	.101*	.110*		.126*	.187**		.178***	.112	.140***	.134***	.091*	.189***	
Denial		-.111***													
Autistic	.068***	.020			.164**	.056	.107		.073			.086**	.082*	.087*	
Self-esteem	.022			.159***									-.037		
Adjusted R^2	.317***	.331***	.312***	.377***	.309***	.422***	.452***	.108***	.250***	.383***	.324***	.361***	.247***	.376***	.034***

O.C., obsessive–compulsive; *UAE*, United Arab Emirates; *p* < .05; **p* < .01; ****p* < .001

European (Lopez-Fernandez et al., 2017), Asian (Indian, e.g., Nayak, 2018; Korean, e.g., Park et al., 2021; Bangladeshi, e.g., Islam et al., 2021), and South American samples (Brazilian, e.g., Laurence et al., 2020). In their review of 293 studies, Busch and McCarthy (2021) found that females are more prone to problematic smartphone use than men. The more frequent use of mobile phone for social reasons by women than men (who use it more frequently for instrumental reasons) (Busch & McCarthy, 2021; Lopez-Fernandez et al., 2017) may explain these gender differences. Furthermore, it has been suggested that women experience more social anxiety, have higher emotional intelligence, and gossip more on phone than men (Nayak, 2018).

Relationship with Sociodemographic, Personality-Related Variables, and Psychopathological Symptoms

Not surprisingly, from the sociodemographic variables, hours spent during a normal weekday was a consistent predictor in nearly all but three samples. This finding converged with others (Gokce & Ozer, 2021; Lopez-Fernandez et al., 2017) in revealing that increased use of cell phones is associated with higher scores on the Problematic Mobile Phone Use Scale. In line with the expectations (Busch & McCarthy, 2021; Mitchell & Hussain, 2018), younger age was associated with PMPU. Increased time spend using phones has been associated with younger age and in turn with increased likelihood of problematic use (Mitchell & Hussain, 2018). The "digital natives" born after 1981 are more familial with technology and more dependent on their phone (Busch & McCarthy, 2021; Wickord and Quaiser-Pohl, 2022). Other authors have suggested that younger age is associated with increased PMPU because youngers have poorer impulse control (Chóliz, 2012) .

In the total sample, predictably, PMPU correlated positively with maladaptive coping strategies, immature and autistic defenses, and somewhat surprisingly, with adaptive coping strategies. Maladaptive coping was predictor of PMPU in two samples and immature coping strategies in three samples. Like the present findings, Vally et al. (2020) in young adult residents in the United Arab Emirates found problematic Internet use to be predicted positively by maladaptive coping, the immature, and autistic fantasy defenses, as well as, by the mature defenses and negatively by adaptive coping. It seems plausible that people, who experience difficulties and distress in real-life encounters, try to cope with maladaptive ways, such as avoiding or denying the situation, distracting themselves, and thus resorting in PMPU (Gorday & Bardeen, 2022). Understandably immature (e.g., splitting, acting out, idealization, passive aggression) and autistic defense mechanisms (i.e., autistic fantasy and isolation) were predictors of PMPU. The unexpected positive association of PMPU with adaptive coping may be explained by the fact that potentially shy, lonely, or anxious people consider beneficial the over-engagement of the mobile phone use as it may offer chances of communication (Billieux et al., 2015), emotional support, or a safe offline environment (Gorday & Bardeen, 2022). It could be that for a proportion of people, PMPU may be the only way out to overcome anxiety or other stressful situations or personality deficiencies (low self-esteem).

Abundant research evidence (Kaya et al., 2021; Panova et al., 2020; Pera, 2020; Wolf & Wolf, 2020) and two reviews (Elhai et al., 2017; Yang et al., 2020) have shown depression to be associated with PMPU, which was also shown in this study; depression was a significant predictor of PMPU in five samples. Which is the cause, and which is the consequence remains a matter of much debate (Kaya et al., 2021). Nearly all personality traits significantly correlated with PMPU, and most of them were either positive predictors (antisocial, histrionic, narcissistic, avoidant, and dependent) or negative predictors (schizoid, schizotypal) of PMPU in the overall sample. However, only the dependent (Cluster C) was

consistent predictor in five samples, whereas the schizoid (inversely) (Cluster A), the histrionic, the narcissistic (Cluster B), and the obsessive–compulsive personality disorders (Cluster C) were predictors of PMPU in two countries. Alavi et al (2020) have found that dependent personality disorder increased 3.1-fold the likelihood of mobile phone addiction, and Direktör and Nuri (2019) found dependent personality beliefs to be significant predictors of smart phone addiction. It seems that suffering from dependent personality disorder, which is related to an intense fear of loneliness and/or abandonment and need to rely on others or substitutes (such as various addictions), is associated with increased probability of PMPU. Also reasonably enough, narcissistic personality disorder has been associated with problematic smartphone use (Servidio et al., 2021; Zerach, 2021), vulnerable narcissism (i.e., being shy, inhibited, and anxious) has been associated with "phubbing" (phone snubbing) (Grieve & March, 2021), and grandiose narcissism (i.e., being bold, extraverted, assertive, and overconfident) has been associated with problematic Facebook or other social media use (Casale & Banchi, 2020). Excessive phone use has also been associated with obsessive–compulsive symptoms (Kempf et al., 2020; Wickord and Quaiser-Pohl, 2022). Histrionic personality belief has been found to affect the need for social approval and desire for being liked, and the latter two, in turn, positively affected problematic social media use (Savci et al., 2021). These finding provide support of Billieux et al's (2015) theoretical model. First of all, features could co-exist and simultaneously result in PMPU, and secondly, features described by the three pathways could well be primary or secondary symptoms of Cluster B and C personality disorders. As an illustration, excessive reassurance seeking (first pathway) could be well related to dependent personality and depression, whereas impulsive-antisocial pathway could be related to antisocial personality disorder (Mitchell et al., 2018).

Although in the bivariate correlations, low self-esteem was associated with PMPU, it failed to enter into the regression model. However, it was a significant predictor of PMPU only for Colombia (as it was for problematic Internet use; Laconi et al., submitted). Whereas the review by Wacks & Weinstein (2021) has shown excessive smartphone use to be associated with low self-esteem (among other variables), Elhai et al.'s review (2017) concluded that self-esteem was inconsistently related to PMPU, and when associations were found, the effects were small to medium.

Limitations

Some limitations of this study should be reported. This is a cross-sectional study which disqualifies any causal inferences. The convenience sampling method may have decreased the representativeness of the samples (e.g., mostly women, young, well-educated) and may have affected the generalizability of the findings. The online recruitment and the self-report format of the questionnaire may have resulted in selection bias and social desirability, respectively. The specific use of the smartphone could have affected PMPU, which should be the aim of a future study. Other individual and contextual factors (e.g., social support) should be further studied. The use of the specific scales, particularly as others may be more widely used (e.g., the Smartphone Addiction Scale-SAS; Kowon et al., 2013), may have limited comparisons and the generalizability of the findings. The use of one item to subjectively measure self-perceived problematic mobile phone may have provided inaccurate and underestimated rates (compared to logged measurements; Parry et al., 2021). Finally, the analyses involved many comparisons, particularly of overlapping constructs, which may have biased the findings. Although $p < 0.001$ was used to partially control for multiple comparisons across countries, type I error might still be elevated.

Conclusions and Implications

To authors' knowledge, this is the largest cross-country study on PMPU among adults so far. The relationship between PMPU, personality-related variables, and psychopathology symptoms brings a new piece of evidence of the risk factors of PMPU and extends current theoretical knowledge. These results should be confirmed in other studies, particularly longitudinal ones, which could potentially clarify whether PMPU is a consequence of pre-existing mental health problems or a risk factor for future mental health problems. Since problematic Internet use has been predicted by the same variables (i.e., Clusters B and C personality traits, immature and autistic fantasy defense mechanisms, non-adaptive coping strategies, and depressive symptoms) in a French sample (Laconi et al., 2017), research should differentiate unique profiles between problematic Internet and mobile phone use, potentially by taking into consideration specific uses of both. Moreover, cross-cultural research could clarify culture-specific variables and provide explanations in each cultural context.

PMPU is an evolving public health concern and as such, it should be a priority by healthcare providers and policy makers. The establishment of a commonly accepted definition and validated diagnostic criteria of PMPU are initially needed. Research should further differentiate sufferers from non-sufferers. Acknowledging the association of PMPU with a number of risk factors could help healthcare providers, parents, and others being involved, to limit problematic engagement of people from various sociocultural contexts. Furthermore, recognizing pathological profiles (personality traits, disorders etc.) that are related to PMPU, could help clinicians develop effective interventions.

Declarations

Ethics Approval All procedures followed were in accordance with the ethical standards of the Ethics Committee of the University of Timisoara in Romania (number UVT8170/16.04.2018) and with the Helsinki Declaration of 1975, as revised in 2000.

Consent to Participate Informed consent was obtained from all participants for being included in the study.

Conflict of Interest The authors declare no competing interests.

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