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Problematic Media Use Measure – Short Form in a Polish Sample of Children: Adaptation, Validation, and Association with Parental Problematic Internet Use

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Abstract: Problematic Media Use (PMU) has become a global public health concern. Children are beginning to use digital media at increasingly younger ages, which has led to growing research interest in PMU during early developmental stages. The aim of the study was the Polish adaptation and validation of the PMUM-SF scale. Additionally, the prevalence of PMU among children aged 4–11 years was examined in a large, representative sample, along with its association with parental PIU. The study included 1,692 parents of children aged 4–11 years (respondents aged 18–70; M = 37.29; SD = 6.85), including 62.5% women, in a nationwide representative quantitative study. Confirmatory factor analysis supported a unidimensional model with acceptable fit [$\chi^2(27) = 429.916$; $p < 0.001$; RMSEA = 0.094; SRMR = 0.026; CFI = 0.966] and excellent reliability (McDonald's $\omega > 0.90$). Criterion validity was confirmed, and its interpretative utility was enhanced through standard-ten normalization. Approximately 30% of children scored at elevated, high, or extremely high levels of PMU. The child's PMUM-SF(PL) score was positively correlated with the parent's PIUQ-9 score ($r = 0.458$; $p < 0.001$). The PMUM-SF(PL) may support research and practice aimed at preventing dysregulated media use in childhood.

Keywords: problematic media use, children, internet addiction, scale validation, psychometric properties, parents, problematic internet use

1. Background

Portable devices with internet access have brought societies into the digital age. Adults use these devices daily and children can also use them anywhere and at any time. They can watch films, browse social media, surf the internet and play video games without parental supervision.[1]

Contemporary evidence suggests that a growing number of children, including those as young as two years old, own a screen device[2,3], while a significant proportion of children in the youngest age groups exceed the American Academy of Paediatrics' screen time recommendations.[4,5] This phenomenon has been observed in various regions of the world, including the United States[2], Asian countries,[6,7] the Middle East[8], and, to a lesser extent, Europe.[3,9,10]A systematic review by McArthur et al. (2022) suggests that these guidelines are adhered to by approximately one quarter of children under 2 years old and just over one third of children aged 2–5 years[11]. However, it is important to note that screen time alone does not determine dysregulated screen media use. Only disturbances in the child's functioning that accompany this use may indicate a problem.[12]

Screen-based devices include both stationary and portable categories and are used for a wide range of activities, such as gaming, listening to audiobooks, and engaging with social media. Their functionality does not always require internet access. In response to the increasing diversity of these uses and the need for a unified term describing their excessive use, the concept of problematic media use has been introduced (PMU). Childhood PMU, which is the focus of this study, is defined as the excessive use of various screen-based media devices (e.g. television, computers, video games, smartphones and tablets) that interfere with a child's social, behavioural or educational functioning.[12,13]

PMU in children and adolescents is associated with negative health outcomes, potentially resulting from excessive stimulation and displacement of activities necessary for healthy growth and development (e.g., sleep, social interactions, physical activity). As such, PMU is associated with behavioural, emotional, and physical health concerns.[14] The outcomes associated with PMU include decreased emotional skills and social behaviours,[15,16] poor self-regulation and aggressive behaviors,[17–21] attention problems and school difficulties,[22–24] and symptoms of attention deficit hyperactivity disorder, depression, and anxiety.[25–27] Research has also identified correlations between PMU and social anxiety, emotional health concerns, execution functioning impacts,[28–30]. Although the outcomes of PMU in children are similar to those in adolescents, it should be noted that the consequences

may be more serious for children, as PMU can worsen significantly during adolescence.[34] Furthermore, parental intervention in early childhood may be more effective than during adolescence. Therefore, early detection of PMU and preventive strategies targeting parents and caregivers are crucial for reducing the risk of PMU development.

Parental behaviours related to the use of new technologies are likely to contribute to the development of PMU in a child[12,37,38] Children, particularly in early childhood, identify with their parents, internalise the values and norms established within the family environment, and model parental behaviour. Parents play a central role in structuring children's daily routines, including organising time, selecting activities and regulating media use. Therefore, PMU in young children is closely associated with parental media use patterns.[39] As a result, when assessing and preventing PMU in young children, their parents should be involved. It is also important to emphasise that a generation who have had access to electronic media since childhood are now becoming parents. Having not experienced digital hygiene themselves, this generation must now face the challenge of raising their children in a digital world. According to a meta-analysis by Lozano-Blasco et al. (2022), the global prevalence of internet addiction among young adults was estimated at around 17.4%, with notably higher rates observed in Asian countries (over 25%) than in European countries (around 7%).[40] The authors noted that young adults are the most active internet users, spending an average of about three hours per day online for non-work purposes. Furthermore, problematic use is strongly associated with impulsivity, poor self-regulation and emotional distress. These data suggest that a substantial proportion of young parents may exhibit problematic patterns of media use themselves, which could impact their children's relationship with digital media.

Given the growing prevalence of the problem and its significant impact on the development and holistic health of the youngest users, relatively little research has been conducted in this area. A 2023 systematic review of PMU among children under 10 years of age found no such studies from Central Europe.[48] In Poland, as well as worldwide, research conducted among young screen device users focuses on adolescents,[49–53] concerns internet addiction,[50,52,53] and internet gaming disorder[51], without addressing problematic media use comprehensively. Only a few Polish studies address screen device use among the youngest children. For example, a study by Rowicka and Bujalski[3] examined parental perceptions of their children's (ages 0-6) use of mobile devices. They found that children typically first used a mobile device at an average age of two years and two months. Around one in ten children aged 4–6 own a smartphone, while 14% have their own tablet. Meanwhile, 75% of children using mobile devices have internet access. Alarmingly, children most often use screen devices

alone. Three-quarters of parents give a screen device as a reward, 80% give one when their children are bored, and two-thirds do so when children cry or are fussy. The rise of mobile internet devices among Polish children, coupled with parental motivations that permit unsupervised use, may contribute to unhealthy media use patterns.

A study by Wojtkowska et al.[54], which included a representative sample of Polish children and their parents, is particularly noteworthy. The children's online behaviors were analyzed in two age groups: 0–6 years (via parental reports) and 7–14 years (based on reports from both children and parents). Among the preschool group, almost half of parents (49.8%) subjectively assessed their children as being at risk of developing problematic media use patterns, with 29.5% considering the risk to be elevated, 13.3% considering it to be high, and 8.8% considering it to be very high. In addition to these subjective assessments, the risk of problematic media use (PMU) was objectified using a standardized psychometric test. This demonstrated that up to 30% of the children assessed were at an increased risk of developing PMU. Among primary school students aged 7–14, only 13.3% reported being at risk of PMU; this figure was much higher among their parents, at 66%. Interestingly, 30% of respondents were in the high-risk group in both the children's self-assessment and the parents' observational assessment.

These results suggest the following key conclusions: (1) Even one in three children may be at increased risk of problematic overuse of digital technologies before completing primary school; (2) children may be too optimistic about their online behavior, so observational data from parents should inform risk assessment, particularly for children under 12 years; and (3) reliable and valid psychometric tests are needed to objectively assess digital activity among children and minimize the influence of the assessor’s subjectivity on the result.

There are very few standardized tools available worldwide for parents to report problematic media use (PMU) among pre-school and early school-age children. This is an issue that needs to be addressed. [48,55] The most widely used and best-validated tool is the 'Problematic Media Use Measure for Children' (PMUM) and its shorter version, the PMUM-SF(. [55,56]

The PMUM is a parent-report measure of symptoms of problematic media use (based on criteria listed in the DSM-5 for gaming disorder) in children and encompasses mobile (e.g., phones, tablets, and laptops) and stationary (e.g., TVs, computers, and gaming consoles) devices. Both the 27-item and 9-item versions of the PMUM evidenced high internal consistency (Cronbach's $\alpha = .97$ and .93, respectively). Using the shortened version allows for

quick screening and is more convenient for parents, facilitating practical purposes as well as scientific research. Apart from the nine main items that constitute the psychometric test, the original test sheet of the PMUM-SF scale also includes one additional question. This question asks which types of screen media are the most problematic for the child: television, video games, mobile phones, tablets, handheld video game devices, computers/laptops, or others. Adaptations of the PMUM scale have been made in several languages, including Arabic (PMUM-SF),[59] Chinese (PMUM),[60] Spanish (both versions),[61] Italian (both versions),[62] French (PMUM),[63] and Portuguese (Brazilian PMUM).[64]

In Poland, the only available tool for assessing the severity of electronic media use problems among children and adolescents is the E-MOI, a series of tests developed by Wojtkowska et al.[65] However, the tests dedicated to the youngest age groups are very extensive, comprising 40 items. The time-consuming nature of completing this tool limits the inclusion of other variables in the study since long questionnaires tend to discourage respondents. Furthermore, the E-MOI is a national tool with no other language versions, making international comparisons impossible. Therefore, Poland and Central Europe need brief, cross-sectional instruments that enable rapid screening assessments and allow for meaningful comparisons between populations.

There are significant gaps in the literature on PMU among younger children, as most studies focus on PMU in adolescents and young adults.[40,66–68] PMU in early childhood has only recently gained attention, and relatively few studies have focused on children under 10 years of age.[48] Therefore, there is a clear need for further research in this area using appropriate measurement tools.

The primary aim of the study is the Polish adaptation and validation of the PMUM-SF scale to verify the tool's psychometric properties in accordance with the current high psychometric standards. However, in order to enhance the study's contribution to scientific advancement and to increase the article's international impact, this paper also aims to:

1. Extend the PMUM-SF through standardization of the instrument - to expand the scale's interpretative potential in scientific research and enable practitioners and individual users to interpret results by comparing raw scores obtained in measurement to a reference population in Poland. Such an approach allows for the assessment of whether an individual's result, relative to their peer group, indicates a low, average, or high level of PMU severity.

2. Describe the prevalence of PMU among a large and representative sample - to complement the current, still very limited and unclear knowledge regarding the extent of this phenomenon among children in Central-Eastern Europe.
3. To verify whenever parents' PMU is related to children PMU.

Achieving these goals will increase Poland's capacity to assess PMU among the youngest users of new technologies and enable global research comparisons with the first population in our part of Europe. Improving knowledge and the quality of measurements on the PMUM-SF scale will contribute to improving the quality of research and practices for preventing the early development of PMU in children.

2. Methods

2.1. Study procedure

All methods were carried out in accordance with relevant guidelines and regulations. The study was not a medical experiment on humans and did not involve the use of human tissue samples and was approved by the Bioethics Committee of the Pomeranian Medical University in Szczecin (KB.006.32.2024).

2.1.1. Measurement translation

The linguistic adaptation was carried out in three stages: Forward Translation, Back Translation, and Pretesting.

2.1.1.1. Forward Translation

The original English version of the PMUM-SF questionnaire was firstly translated into Polish by two psychologists with excellent knowledge of English and one English translator whose native language is Polish, who independently translated the original test from English into Polish. After which they jointly agreed on a common Polish version, ensuring the highest possible clarity, readability, and conceptual equivalence. To adapt the questionnaire to Polish language conditions, the term "screen media" was replaced with "e-media" (electronic media - commonly use in Poland to describe digital devices as well as digital activities). We added examples of screen-media activities to the questionnaire introduction. We also replaced the original response option "very often" with "often," which is typical for Polish 5-point scales (in 7-point scales, "very often" appears between 5 [often] and 7 [always]).

Furthermore, we supplemented the additional question (about devices used) by adding the response options ‘stationary game console’ and ‘none.’ To collect more precise information on how children use screen media, in line with current knowledge about online behaviors of children aged 4–11, we also added a second additional question concerning one the most frequently performed digital activity (social media; games; instant messaging; watching cartoons/series/movies; YouTube videos; listening to music; audiobooks/e-books; live streams; running a blog/vlog; creating and sharing other original content; searching for information and educational materials).

2.1.1.2. Pretesting

Pretesting of the Polish version of the PMUM-SF was conducted through six qualitative interviews with parents of children aged 4–11 years to assess the clarity of the questionnaire’s content and structure. Participants were recruited via social media. Five of the parents were female, and one was male. The recruited parents had children of the following ages: respondent 1 – 6, 7, 9, and 10 years; respondent 2 – 7 and 11 years; respondent 3 – 6 years; respondent 4 – 7 and 10 years; respondent 5 – 6 years; respondent 6 – 6 and 11 years. At the beginning of the interview, each respondent received a printed copy of the questionnaire to review. The interviewer then read each question aloud and asked whether the respondent had any concerns about it. If the answer was “yes,” the interviewer asked what the concerns referred to and how the question could be phrased in a better way. All nine core items comprising PMUM-SF scale were found to be clearly worded and easy to respond to. However, respondents reported difficulties in answering the additional questions. Parents reported that their children use screen devices in a very diverse manner, and the possibility of indicating only a single most frequently used device and a single most common activity does not fully reflect the way their children engage with digital devices. Based on this feedback, we modified the two additional behavioral questions. In the first question (concerning screen devices) instead of indicating a single response, we proposed rating the use of each device on a scale from 1 to 6, where: 1 = does not use; 2 = uses occasionally; 3 = uses regularly but does not abuse; 4 = somewhat abuses; 5 = definitely abuses; 6 = don’t know. In the second question, we retained the nine most common digital activities (digital games, social media, instant messaging, watching cartoons/series/movies, watching other video content including live streams, listening to music online, listening to audiobooks/reading e-books, running a blog/vlog, searching for information/learning) and, instead of choosing a single response, we

proposed rating the frequency of each activity on a scale from 1 to 6, where: 1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = very often; 6 = don't know.

The final Polish version of the test was additionally proofread by a Polish language specialist to detect potential punctuation, grammatical, and stylistic issues, and then moved to next step of the standardized translation.

2.1.1.3. Back Translation

The agreed Polish forward-translation was secondly back-translated into English by two others, independent psychologists, with excellent English proficiency. Following individual translation, a common back-translation was agreed upon and then compared with the original version to ensure their consistency. After the final conceptual changes were made, the back-translation, as well as propositions for replacing the original single behavioral question with two additional behavioral questions, was submitted to the original PMUM-SF author to obtain her approval and final agreement for the Polish validation.

2.1.2. Validation study

To determine the psychometric properties and normalize the translated questionnaire, a cross-sectional study was conducted between April 14 and 30, 2025, using the CAWI method and purposive sampling. The study was conducted by the specialised research agency Ogólnopolski Panel Badawczy, which provided fully completed questionnaires. The questionnaires were collected from parents of children aged 4–11 years. Given the considerable developmental differences among children in this age range, it was decided to collect questionnaires from at least 500 parents in each of three age groups: 4–6 years, 7–9 years, and 10–11 years, resulting in a minimum of 1,500 fully completed questionnaires. This sample size ensured representativeness for the Polish population. Representativeness was also maintained with respect to the child's gender and place of residence (voivodeship and urban–rural location). The inclusion criteria were as follows:

a) age 18 or older;

b) proficiency in the Polish language;

c) place of residence in Poland;

d) being a parent and primary caregiver of a child aged 4–11 years;

e) providing informed consent to participate in the study.

All methods were carried out in accordance with relevant guidelines and regulations. The study was not a medical experiment on humans and did not involve the use of human

tissue samples and was approved by the Bioethics Committee of the Pomeranian Medical University in Szczecin (KB.006.32.2024).

2.2. Research sample

A total of 1,692 fully completed questionnaires were obtained, with the following distribution:

a) 599 parents of children aged 4–6 years (301 parents of boys and 298 parents of girls),

b) 581 parents of children aged 7–9 years (297 parents of boys and 284 parents of girls),

c) 512 parents of children aged 10–11 years (255 parents of boys and 257 parents of girls).

All participants resided in Poland and were fluent in the Polish language. The characteristics of the study sample is presented in Table 1. For qualitative variables, the number (n) and percentage of participation in the subgroup (%) are given, while for quantitative variables, the arithmetic mean (M) and standard deviation from the mean (SD).

Table 1. Socio-demographic characteristics of study sample

Variable	n / M	% / SD
Parent Gender		
women	1057	62.5
men	635	37.5
Age: from 18 to 70 (median=37)	37.29	6.85
Place of residence		
rural area	603	35.6
town/city with up to 50,000 inhabitants	289	17.1
town/city with 50,000–150,000 inhabitants	293	17.3
town/city with 150,000–500,000 inhabitants	281	16.6
city with more than 500,000 inhabitants	226	13.4
Level of education		
primary / lower secondary	27	1.6
vocational	105	6.2
secondary	542	32.0
higher education – bachelor's degree	260	15.4
higher education – master's degree	758	44.8
Employment status		
not employed	115	6.8
unemployed	53	3.1
employed part-time / casual work	155	9.2
employed full-time	1356	80.1
disability pension / long-term sick leave	13	0.8
Self-assessment of the family's financial situation		

very poor	20	1.2
poor	81	4.8
average	697	41.2
good	749	44.3
very good	145	8.6
Child's age: from 4 to 11 (median = 8)	7.66	1.50
4–6 years	599	35.40
7–9 years	581	34.34
10–11 years	512	30.26
Child sex		
female	839	49.6
male	853	50.4
Does the child have siblings		
no, does not have	583	34.5
yes, both older and younger	182	10.8
yes, younger siblings	449	26.5
yes, older siblings	478	28.3

2.3. Measures

2.3.1. Problematic Media Use Measure for Children Short Form (PMUM-SF)

The Problematic Media Use Measure for Children – Short Form (PMUM-SF) developed by S. Domoff et al.[56] is a standardized, 9-item scale, with a one-factor structure, completed by parents/main caregivers of children aged 4-11. The items correspond to the diagnostic criteria for Internet Gaming Disorder as defined in the DSM-5, and are rated on a five-point scale ranging from 1 ("never") to 5 ("always"). A higher total score indicates more problematic media use. The original scale demonstrates excellent psychometrics, particularly for such a brief instrument (e.g. reliability, $\alpha = 0.93$).

2.3.2. E-MOI Electronic Media Overuse Inventory – Versions B0 and B1

Electronic Media Overuse Inventory (E-MOI), developed by Wojtkowska et al.[54], are the only Polish instruments designed to assess the phenomenon of electronic media overuse among children and adolescents aged 0–14 years.

The E-MOI version B0 is designed for observational assessment of children aged 0–6/7 years (prior to school entry) by their parents/main caregivers. The questionnaire consists of 40 items assessed on a scale from 1 – "does not describe us at all," to 7 – "describes us completely." The test consists of an overall score and five subscales: lack of e-media use control (expressions of children's desire for screen media usage, as well as signs of parental helplessness in the face of theme), early signs of e-media overuse (reflects the state in which a child can already operate electronic devices before reaching school age and shows a clear desire to have them), maladaptive home-use habits (unconstructive screen media habits at home, such as using screens during meals or to calm a child), harmful parental beliefs (about the harmlessness of e-media used by children under), positive protective behavior (family engagement in preventive practices and digital hygiene). After reversing the scoring for the positively protective behaviors subscale, higher total score reflects a greater severity of the problematic screen media usage. The general score demonstrated satisfactory reliability (Cronbach's $\alpha = 0.9$), as well as four negative subscales (Cronbach's α between > 0.7 to > 0.9), while single positive scale achieved slightly lower internal consistency (Cronbach's $\alpha > 0.6$).[54]

The E-MOI version B1 is a parent-report measure in which parents provide information about their child aged 6/7–14 years. The questionnaire consists of 40 items. Parents respond on a 7-point scale, indicating how well each of the 40 statements assessed on a scale from 1 – "does not describe him/her at all," to 7 – "describes him/her completely." The test items were divided into five subscales: e-media overuse (excessive frequency, duration, or cognitive preoccupation), addiction-like symptoms (based on Griffiths' components model of behavioral addiction (Griffiths, 2005), virtualisation (preference for online over offline activities and blurring of boundaries between real and virtual contexts), overusing of social media, and positive protective behaviors (engagement in preventive practices and digital hygiene). After reversing the scoring for the positively protective behaviors subscale, the overall score indicating the severity of electronic media overuse is obtained by summing the five subscale scores, while a higher total score reflects a greater severity of the problem. Total score and four negative subscales show Cronbach's $\alpha > 0.9$, indicating excellent reliability, while the fifth positive subscale has Cronbach's α slightly below 0.7.[54]

322 2.3.3. Nine-Item Problematic Internet Use Questionnaire (PIUQ-9)

323 To measure parental problematic Internet use, the Nine-Item Problematic Internet
324 Use Questionnaire (PIUQ-9) was used. It is a brief version of the 18-item Problematic Internet
325 Use Questionnaire.[69] The instrument consists of 9 items rated on a five-point scale ranging
326 from 1 ("never") to 5 ("always/almost always"). The total possible score ranges from 9 to 45,
327 with higher scores indicating more problematic Internet use. In the study, the Polish
328 adaptation developed by Laconi et al.[70] was used, demonstrating very good internal
329 consistency with a McDonald's omega of 0.89.
330
331 2.3.4. Sociodemographic Data Survey

332 The sociodemographic data survey asked about the parents' characteristics, including
333 age, place of residence, level of education, employment status, self-assessed financial
334 situation of the family, and relationship status. We also included questions about the child,
335 such as age, gender, type of care or education, whether the child has siblings, whether the
336 child is raised by both parents, and whether the parents live together.
337
338 2.4. Statistical analysis

339 Statistical analysis was conducted in the licensed IBM SPSS Statistics v. 29
340 package[71] and in the JASP package.[72] To verify the instrument's structure, Confirmatory
341 Factor Analysis (CFA) was conducted, using the lavaan package with the maximum
342 likelihood (ML) estimator. The strength of standardised factor loadings and model fit
343 indicators (chi-Square, CFI, SRMR and RMSEA - same as in the original study) were
344 assessed and then compared to the results obtained in the original pilot study. Scale reliability
345 (internal consistency) was calculated using McDonald's omega coefficient, while convergent
346 construct validity was based on correlations with additionally engaged standardised
347 instruments (E-MOI B0 and B1) using Pearson's correlation r coefficient. PMUM-SF(PL)
348 results have been also correlated with additional behavioral data using non-parametrical
349 Spearman's rho coefficient, due to ordinal scale of behavioral data. The Pearson correlation
350 coefficient was used to assess the association between the child's PMUM-SF(PL) score and
351 the parent's PIUQ-9 score. After obtaining appropriate psychometrics properties of the test,
352 10-point sten norms were developed for the Polish children population, taking into account
353 significant age differences. A p-value of <0.05 was considered to indicate full statistical
354 significance.
355

3. Results

3.1. PMUM-SF(PL) factorial structure and reliability.

The results of CFA supported a unidimensional structure of the instrument, with all items loading significantly and strongly onto the primary factor (see Table 2). The nine-item unidimensional solution exhibited excellent measurement reliability, as indicated by McDonald's omega (ω = .944).

Table 2. Confirmatory Factor Analyses - factor loadings.

PMUM items	Z-value	Std. Est	p-value	Std. Error	95%Confidence Interval	
					Lower	Upper
1.	30.450	0.667	< 0.001	0.023	0.666	0.757
2.	38.642	0.792	< 0.001	0.023	0.835	0.925
3.	41.519	0.831	< 0.001	0.023	0.923	1.015
4.	38.791	0.794	< 0.001	0.023	0.848	0.938
5.	42.300	0.840	< 0.001	0.022	0.884	0.970
6.	39.397	0.802	< 0.001	0.024	0.899	0.993
7.	43.059	0.850	< 0.001	0.022	0.909	0.996
8.	44.202	0.864	< 0.001	0.022	0.945	1.033
9.	39.398	0.803	< 0.001	0.022	0.836	0.924

The single-factor model demonstrated an adequate level of fit, with indices closely mirroring those reported in the original study[56], as shown in Table 3.

Table 3. Confirmatory Factor Analyses - model fit indices.

Goodness of fit indices	Original study	This study
$\chi 2$	$\chi 2$ (27) = 149.193; p<0.01	$\chi 2$ (27) = 429.916; p<0.001
CFI	0.961	0.966
SRMR	0.024	0.026
RMSEA	0.085	0.094

3.2. PMUM-SF(PL) criterion validity

The PMUM-SF score was significantly and positively correlated with all indicators of the frequency of using specific screen media and engaging in particular e-activities ($p < 0.001$). This finding supports the criterion validity of the PMUM-SF: the more children used screen media, the higher their caregivers scored on the test measure (Table 4).

Table 4. Spearman's correlations between PMUM-SF(PL) scores and behavioral data from the supplementary questions.

Screen media type	*rho*
Television	0.399
Tablet	0.373
Smartphone	0.478
Stationary game console	0.403
Portable game console	0.374
Laptop	0.376
Desktop computer	0.367
Screen media activities	*rho*
Plays games	0.389
Browses social media	0.438
Watch cartoons, TV series, or movies	0.150
Watches other content, e.g. themed channels, live streams, etc.	0.390
Uses online communicators	0.392
Listens to music	0.256
Listens to audiobooks or reads e-books	0.268
Runs a blog or vlog, creates and shares own content	0.411
Searches for information and educational materials	0.318

Criterion validity was further supported by strong correlations between PMUM-SF(PL) scores and results obtained with the E-MOI scales. As shown in Table 5 higher scores on the PMUM-SF(PL) were accompanied by higher parental ratings of their children on the

general scales of both E-MOI versions. Among children aged 4–6, the severity of problematic screen media use patterns measured by the PMUM-SF increased in line with higher levels of E-MOI B0 indicators such as lack of control over e-media use, early signs of overuse, maladaptive home-use habits, and parental beliefs that may increase the risk of developing e-addiction. The only exception was the scale of positive protective behaviors in the E-MOI B0, which did not correlate significantly with PMUM-SF scores ($p > .05$) - however, it is important to note that this scale demonstrated the lowest measurement reliability due to multiple factors interfering with self-report measurement.

For children aged 7–11 (E-MOI B1), higher PMUM-SF scores were strongly associated with greater e-media overuse, signs of e-media addiction, virtualization, social media overusing, and – less - also with decreases in positive protective behaviors observed in the child's environment (table 5).

Table 5. Pearson's correlations between PMUM-SF and E-MOI B0 and B1 scores.

	E-MOI B0, n=599					
PMUM-SF (PL)	General score	Lack of E-media Use Control	Early Signs of E-media Overuse	Maladaptive Home-use Habits	Harmful Parental Beliefs	Positive Protective Behaviors
	0.736*	0.739*	0.721*	0.605*	0.599*	0.043
	E-MOI B1, n=1093					
	General score	E-media Overuse	Addition-like Symptom	Virtualisation	Overusing of Social Media	Positive Protective Behavior
	0.728*	0.695*	0.813*	0.673*	0.532*	-0.119*

* $p < 0.001$

E-MOI B0 - Electronic Media Overuse Inventory Version B0 for children aged 0-6/7 years

E-MOI B1 - Electronic Media Overuse Inventory Version B1 for children aged 6/7 – 14 years

3.3. PMUM-SF(PL) normalization and results description

Child gender did not significantly differentiate PMUM-SF scores [t(df = 1690) = 0.571, p = 0.568]. However, PMUM-SF scores increased significantly with the age of the child being assessed (r = .111, p = .006). The mean scores for children aged 4, 5, and 6 years were lower than the overall mean PMUM-SF score in the full sample. Beginning at age 7, the mean scores in subsequent age cohorts were higher than the overall mean for the full sample of children aged 4–11 years (see Table 6).

Table 6. PMUM-SF(PL) scores by child age.

Child age	Minimum	Maximum	Mean	Std. deviation
4	9	41	17.70	7.84
5	9	38	17.65	7.76
6	9	42	19.93	7.83
7	9	41	20.62	8.66
8	9	41	21.76	8.87
9	9	43	22.19	7.79
10	9	40	21.82	8.04
11	9	42	21.73	8.85
All	9	43	20.49	8.38

In response to these differences, separate norms were developed for two age groups: 4–6 and 7–11 years. Table 7 presents the results of the norming analysis, while Table 8 provides the user-friendly normative tables. The absence of the lowest sten scores reflects the right-skewness of the distribution.

423 Table 7. Norming of PMUM-SF scores by child age.

children aged 4–6 years					**children aged 7-11 years**				
General score	Frequency	p-value	Z-score	STEN	General score	Frequency	p-value	Z-score	STEN
9	98	0.081	-1.393	3	9	121	0.055	-1.595	2
10	31	0.189	-0.879	4	10	46	0.132	-1.118	3
11	21	0.232	-0.729	4	11	19	0.162	-0.988	4
12	23	0.269	-0.614	4	12	23	0.181	-0.912	4
13	31	0.314	-0.482	5	13	30	0.205	-0.824	4
14	29	0.364	-0.345	5	14	25	0.230	-0.738	4
15	21	0.406	-0.236	5	15	25	0.253	-0.665	4
16	25	0.444	-0.138	5	16	28	0.277	-0.591	4
17	36	0.495	-0.010	5	17	40	0.308	-0.500	4
18	26	0.547	0.119	6	18	61	0.355	-0.373	5
19	24	0.589	0.225	6	19	42	0.402	-0.249	5
20	30	0.634	0.343	6	20	39	0.439	-0.154	5
21	17	0.673	0.449	6	21	43	0.476	-0.059	5
22	12	0.697	0.518	7	22	46	0.517	0.042	6
23	12	0.717	0.576	7	23	35	0.554	0.135	6
24	17	0.742	0.649	7	24	33	0.585	0.214	6
25	16	0.769	0.737	7	25	40	0.619	0.301	6
26	14	0.794	0.822	7	26	38	0.654	0.396	6
27	25	0.827	0.943	7	27	71	0.704	0.536	7
28	15	0.860	1.083	8	28	43	0.756	0.694	7
29	17	0.887	1.212	8	29	43	0.795	0.825	7
30	11	0.910	1.345	8	30	29	0.828	0.948	7
31	7	0.925	1.444	8	31	35	0.857	1.070	8
32	10	0.939	1.553	9	32	22	0.883	1.194	8
33	7	0.954	1.685	9	33	21	0.903	1.301	8
34	2	0.961	1.769	9	34	18	0.921	1.414	8
35	5	0.967	1.844	9	35	11	0.934	1.510	9
36	6	0.976	1.988	9	36	22	0.949	1.641	9
37	3	0.984	2.147	10	37	10	0.964	1.803	9
38	3	0.989	2.295	10	38	12	0.974	1.949	9
39	1	0.992	2.431	10	39	5	0.982	2.100	10
41	3	0.995	2.637	10	40	9	0.988	2.275	10
42	1	0.999	3.143	10	41	6	0.995	2.606	10
					43	1	0.999	3.315	10

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Table 8. Sten norms of the PMUM-SF for the population of Polish children aged 4–6 and 7–11 years.

STEN	Child's raw PMUM-SF(PL) score (ages 4–6)	Child's raw PMUM-SF(PL) score (ages 7-11)	score level
1			low
2		9	
3	9	10	
4	10 - 12	11 - 17	below average
5	13 - 17	18 - 21	average
6	18 - 21	22 - 26	above average
7	22 - 27	27 - 30	elevated
8	28 - 31	31 - 34	moderately high
9	32 - 36	35 - 38	high
10	37 - 45	39 - 45	very high

Among children aged 4–6 years, 16.4% obtained low scores (up to sten 3), 52.4% average scores (sten 4–6), and 31.2% elevated or high scores (sten 7 and above), including 2% who reached extremely high scores (sten 10). These results suggest that as many as one in three children in this age group may be at increased risk of problematic technology use.

Among children aged 7–11 years, 26.4% obtained low scores, 40.8% average scores, and 32.8% elevated or high scores, of which 2% were very high. This likewise points to considerable preventive needs.

A statistically significant positive correlation of moderate strength was found between the child's PMUM-SF(PL) score and the parent's PIUQ-9 score ($r = 0.458$; $p < 0.001$). This indicates that higher levels of problematic media use in children were accompanied by higher levels of problematic Internet use in parents.

4. Discussion

The identification of problematic use of screen media by preschool and early school-age children has gained importance in recent years due to the growing availability of mobile devices and changes in how young children spend their free time. In light of the rapid development of digital technologies, it is becoming increasingly urgent to provide researchers and practitioners with reliable and accurate screening tools to assess the risk of behavioral addiction related to new technologies in children. Until now, there were no tools available in Poland for such young children whose results could be compared with other populations, which significantly limited the provision of information to researchers about the prevalence of PMU in our part of Europe. This study presents the results of the cultural adaptation and psychometric evaluation of the Polish version of the Problematic Media Use Measure – Short Form (PMUM-SF), which is used to measure problematic screen media use by children aged 4–11 from their parents' perspective. The validation study results confirm that PMUM-SF(PL) is a tool with excellent internal consistency and satisfactory confirmed theoretical and criterion validity. The Polish adaptation exhibits the same 9-items and single-factor structure as the original, which proves its usefulness in Polish conditions, and encourages further cultural adaptations to deepen comparative, worldwide knowledge about the earliest manifestations of the risk of PMU in children and to intensify efforts to counteract them. A unique feature of this tool is its universal scope of content – it refers to the broadly understood use of screen media (phones, tablets, computers, consoles, television), without limiting itself to one type of digital activity. This scope allows for a comprehensive assessment of problematic media use patterns and their impact on the child's psychosocial functioning. Importantly, PMUM-SF is based on parental assessment rather than self-report, making it a particularly appropriate diagnostic tool for preschool and early school-age children.

This study also initiates the normalization of PMUM scores, enabling it to extend beyond purely quantitative scientific research and to support the detection of individual risk screening for the development of PMU in specific children, as well as further investigations conducted within a qualitative research paradigm. Owing to the availability of norms, Polish parents and specialists are able to assess the severity of PMU manifestations in their child to plan preventive and therapeutic interventions more accurately. In this way, the Polish version of the PMUM makes a significant contribution not only to the further development of scientific research but, above all, to practical application, representing real progress toward the early identification of emerging problems in children and the timely planning of remedial actions.

Also, an important element of the cultural adaptation of the PMUM-SF to Polish conditions was the expansion of the additional questions covering the intensity and patterns of screen media use. The PMUM-SF-PL not only remains consistent with the original, but also introduces qualitative added value, making it a particularly useful tool in the national diagnostic and research context.

In this study, the distribution of overall PMU severity among children was right-skewed, which is entirely expected in research on problematic behaviors within general populations. Despite the predominance of children with below-average problem severity, attention should be drawn to the proportion of scores above the mean, signaling an urgent need for educational, protective, and therapeutic interventions. This research, as well as others conducted in Europe[48,73,74] and worldwide populations[14–16] highlights that even ⅓ of children may be at significant risk of developing or already have problematic use that may impact their wellbeing or development.[14–16] Importantly, in our study, problematic media use in children was found to be associated with Internet addiction in parents. This finding aligns with the results of Gerçeker et al.[75] and highlights the role of the family environment in shaping patterns of media use in preschool and early school-age children (also consistent with Interactional Theory of Childhood PMU; Domoff et al., 2020[12]).

An unique additional value of our study is the normalization process. The results showed that over 30% of children aged 4–11 are at increased risk of developing PMU, and about 2% are at very high risk. These data are alarming and consistent with international observations[76] which indicates an increasing incidence of problematic screen behavior already in preschool children that needs to be addressed. At the same time, the lack of standardized data from Poland and Central and Eastern Europe to date, as indicated in the systematic review by Rega et al.[14] – confirms the validity and value of the study. The PMUM-SF(PL) greatly increases future possibilities to enrich the newest investigation from the data from our part of Europe.

While the majority of existing scales were designed for adolescents or young adults, the PMUM fulfills a gap for the priority age group - the youngest users, still the most vulnerable for technology influence, but as well as prevention.

As other research highlights, children with problematic media use are more likely to exhibit difficult behaviors, emotional health concerns, social skills concerns, poorer academic performance, and more severe depressive symptoms.[77,78] Sleep disorders are also a significant area of health consequences. As Merter, Şengül, and Akay[79] indicated, problematic screen media use by school-aged children is associated with a significant deterioration in sleep

514 quality, difficulty falling asleep, and reduced sleep time, which in turn can lead to cognitive
515 and emotional functioning problems[80]. In view of the above, it is worth emphasizing that the
516 PMUM-SF(PL) can serve as a practical screening tool to help identify children who require
517 further diagnosis or support in the area of healthy digital media use.
518
519 *Limitations and further research directions*
520 Despite the strengths of the study, several important limitations should be noted.
521 First, the tool relies on subjective parental reports, which may be subject to assessment bias
522 or the influence of socially desirable responses[81]. Also, because the measurement was
523 conducted through parents, the results are susceptible to bias resulting from the subjective
524 assessment of the observer. This study did not take into account numerous factors that could
525 potentially distort the assessment of a child's behavior from a parent's perspective (e.g., the
526 quality of the relationship between the child and the parent, the parent's communication style,
527 or parenting involvement). Second, it did not consider the child's potential online behavior
528 when not under direct parental observation at home (e.g., whether the child has access to
529 screen media at preschool, during extracurricular activities, or at friends' homes). Taking
530 these factors into account currently represents a very promising direction for further research
531 on the influence of external, non-home factors that could potentially disrupt the use patterns
532 of new technologies in the youngest users.[82] Future research should therefore place greater
533 emphasis on minimizing distortions associated with subjective assessments of child behavior.
534 In this context, a potentially fruitful direction would be to examine scores on the PMUM with
535 observations of child digital or social media use, or with the use of objective mobile device
536 measurement.
537
538 **5. Conclusions**
539 The Polish version of the PMUM-SF scale demonstrates appropriate psychometric
540 properties and can be recommended for use in scientific research as well as in clinical and
541 non-clinical practice to identify children aged 4–11 years at risk of problematic screen media
542 use. The adaptation of this tool fills an important diagnostic gap visible in the central and
543 eastern part of Europe and extends the possibilities of currently urgent multi-cultural studies
544 on the prevalence and side effects of excessive media use among young children. The results
545 also show that problematic screen media use, as measured by the PMUM-SF(PL), affects a
546 considerable proportion of children aged 4–11 and is associated with parents' problematic
547 Internet use. This underscores the need for preventive measures targeting the whole family.

Future research should include longitudinal designs and consider additional family and social variables to better understand the mechanisms underlying the development of problematic media use (PMU). In particular, analyses should take into account both the child and their family environment, including parental patterns of screen media use, as this may be important for informing prevention and intervention strategies appropriate to different stages of problem development.

Author contributions

Conceptualization, M.K.; methodology, M.K., A.W.; investigation, M.K., A.M.C.; formal analysis, A.W.; data curation, M.K.; writing—original draft preparation, M.K., A.W., I.R., K.R.; writing—review and editing, M.K., M.Sz., S.D., B.K.; supervision, M.K.; funding acquisition, M.K.

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Declarations

Competing interests

SED receives honoraria to present research on problematic media use at non-profit organizations, schools, and hospital/health systems. She has consulted with health systems and private practice clinics on problematic media use and mental health. In 2023, SED consulted with Pixel Digital Health, LLC, on their school-based prevention curriculum. She was on the board of the Smart Gen Society until May 2024.

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. The study was approved by the Bioethics Committee of the Pomeranian Medical University in Szczecin (KB.006.32.2024). The study was an anonymous survey. All study participants were adults and were informed about the purpose of the survey, the possibility of withdrawing from the survey at any stage, and the aggregate publication of the results obtained. Informed consent was obtained from all participants.

Additional Information

Data availability statement

The datasets generated and/or analysed during the current study are not publicly available because they are under a temporary embargo during the peer-review process but are available from the corresponding author on reasonable request.

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