An Assessment of the Validity and Reliability of the Social-Media Addiction Screening Scale (S-MASS)

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ABSTRACT

Objective: The excessive use of social media can lead to addiction among many vulnerable individuals. Hence, the utilization of a valid and reliable screening test to assess social media addiction is warranted.

Materials and Methods: The Social-Media Addiction Screening Scale (S-MASS) is a newly developed, self-report screening scale containing 16 items that assess the three main components of behavioral addiction: giving priority, impaired control, and negative consequences. The S-MASS reliability was measured using Cronbach's alpha. An exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) were employed to assess the S-MASS factorial validity. A latent profile analysis (LPA) was also carried out to identify the classes of problematic social media users.

Results: In all, 5,068 participants aged ≥ 13 years were recruited from five high schools and an online survey. Cronbach's alpha for the S-MASS was 0.90 (95% CI: 0.89–0.90), indicating excellent test reliability. The EFA and CFA revealed a good factorial validity for the S-MASS. Based on the LPA, the participants were classed as "low-risk" (n = 1,227; 24.2%), "moderate-risk" (n = 2,757; 54.4%), and "high-risk" (n = 1,084; 21.4%) problematic social media users. The key differences between these classes were gender, age, necessity to use social media for work, self-perception of addiction, and time spent on social media.

Conclusion: The S-MASS is a valid and reliable screening scale for social media addiction. The criterion validity of the S-MASS should be evaluated once formal diagnostic criteria for social media addiction become available.

Keywords: Assessment; social media; addiction; screening; test (Siriraj Med J 2023; 75: 167-180)

INTRODUCTION

In recent years, there has been a dramatic increase in the use of social media, defined as forms of electronic communication through which users create online communities to share various types of contents. Using social media has become an essential part of the daily routines of many people. On average, people spend 2 hours 24 minutes daily on social networks, excluding other internet usage.[1] People are spending increasing amount of time gaining the benefits from the platforms while being exposed to the risks they bring.

Growing evidence suggests problematic social media use or social media addiction (SMA) can cause negative effects to vulnerable individuals similarly to those found in other behavioral addictions.[2-4] SMA is associated with several mental health conditions, including attention deficit hyperactivity disorder (ADHD), obsessive compulsive disorder (OCD), depression, and anxiety.[5-7] Hence, early SMA detection and intervention in people with SMA-especially those with comorbid psychiatric disorders-would yield improved patient outcomes.

To date, social media addiction has not yet been

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established as an official clinical diagnosis in DSM guidelines or ICD-11. Neither its clinical definition has arrived at a consensus.[2] The term is also used widely in non-clinical contexts.[8] However, its operational definition in clinical study is often derived from Griffith's six core components of behavioral addiction: salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse.[2,5]

ICD-11 also describes three key features of disorders due to addictive behaviors as 1) *impaired control*, a persistent pattern of repetitive behavior in which the individual exhibits impaired control over the behavior; 2) *increasing priority*, given to the behavior to the extent that it takes precedence over other life interests and daily activities; and 3) *negative consequences*, continuation, or escalation of the behavior despite negative consequences.[9] This research operationalized social media addiction using ICD-11 essential features of disorder due to addictive behaviors for the benefit of clinical relevancy.

The integration of factors is the likely explanation of social media addiction: dispositional, sociocultural and reinforcing behavior factors.[2] Neurological and personality factors are example of dispositional explanation. From neurological point of view, both chemical and behavioral addiction is explained through brain's reward systems.[2,10] While personality factors often refer to the big-five personalities and their correlations with social media addiction.[2,11] Sociocultural perspectives posit that certain family dynamics such as parental pressure influences SMA.[2,12] However, more research is yet to be done. Lastly, SMA is also explained through some learning theories such as operant conditioning, classical conditioning, and social learning.[2,12,13] For instance, positive outcomes from using social media, namely, entertainment and attention, are positive reinforcements that influence the same behavior (using social media) to be more likely to repeat.

Many previously validated SMA measurement tools (except for the Bergen Social Media Addiction Scale) were developed using small, homogeneous, and narrow age-range samples, which mostly comprised adolescents or young adults.[5,14-24,25-28,29-33] Moreover, approximately half of the tools were specifically designed for Facebook addiction, rather than SMA generally, and many lack a comprehensive factor-structure assessment (Table 1). In addition, only a few used standard statistical analyses to identify appropriate cut-off scores to differentiate problematic from normal social media use. Therefore, there is the need for a measurement tool that is applicable to social media use in general, which has been validated with a larger sample size and more-standardized analytical methods.

The aim of this study was to develop a new screening scale for the assessment of SMA-namely, the Social-Media Addiction Screening Scale (S-MASS). The authors based the development of the S-MASS on the operational definition of behavioral addiction by ICD-11, for the purpose of clinical diagnosis relevancy. The authors set out to comprehensively explore the reliability and validity of the S-MASS, based on a large-scale and heterogeneous sample with a wide age range, and to find an appropriate cut-off point to identify high-risk problematic social media users. Once the psychometric properties of this new screening instrument are established, S-MASS will be another useful tool for epidemiological and clinical studies of SMA.

MATERIALS AND METHODS

Participants

Participants were included if they were at least 13 years old, which is the minimum age required to register for most social networking sites. Participants needed to have used social media for at least 3 months preceding the study. Participants were randomly recruited from 2 sources: 1) five high schools in Bangkok; and 2) an online survey posted on the Facebook fan page of the Division of Child and Adolescent Psychiatry, Department of Psychiatry, Faculty of Medicine Siriraj Hospital, Mahidol University. Over a six-month study period, 5,437 participants were recruited. 369 participants were excluded due to incomplete S-MASS data.

Measures and Procedure

The S-MASS is a newly developed, 16-item, self-report questionnaire to assess the severity of SMA. The initial item pool was generated by the principal investigator. The final items were selected and reduced by the consensus of all investigators. The development of the S-MASS was theoretically based on three key features of ICD-11 behavioral addictions. Items in each domain were derived from the 9 criteria for Internet Gaming Disorder (IGD) that are outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5)[34], including preoccupation, withdrawal, tolerance, unsuccessful attempts to control, loss of interests, continued excessive use, deception, escape, and jeopardized function. The jeopardized function was extended beyond previously validated tools by also asking about disturbed functions in areas of life other than relationships. An item having to do with deceitful behavior was omitted from the final pool of items due to it having the least sensitivity among all criteria.[35]

A content validation process was then performed. All 16 S-MASS items were examined for their relevance,

TABLE 1. Comparison among measurements developed to assess social media addiction.

Year	Name of measurement	Country	No. of items	No. of participants	Participants	Age, years mean ± SD (range)	Cronbach's alpha coefficient
2010	Addictive Tendencies Scale (ATS)[14]	Australia	3	201	College students	19.1 ± 1.9 (17–24)	0.76
2011	Facebook Intrusion Questionnaire (FIQ)[15]	Australia	8	342	Undergraduate students	19.8 ± 1.8 (18–25)	0.85
2012	Bergen Facebook Addiction Scale (BFAS)[16]	Norway	6 18 (original)	423	College students	22.0 ± 4.0 (N/A)	0.83
2012	Social Networking Website Addiction Scale (SNWAS)[17]	USA	5	194	College students	–	0.86
2013	Facebook Dependence Questionnaire (FDQ)[18]	Peru	8	418	College students	20.1 ± 2.5 (N/A)	0.67
2013	Facebook Addiction Scale (FAS)[19]	Turkey	8	447	College students	21.6 ± 1.9 (18–30)	0.86
2013	Addictive Tendencies Toward Social Networking Sites[20]	China	20	316	Adults	26.6 ± 4.4 (18–40)	0.92
2015	Arabic Social Media Addiction Scale (SMAS)[21]	Kuwait	14	1,327	Undergraduate students	21.9 ± N/A (18–31)	0.61–0.75
2015	Bergen Facebook Addiction Scale – Thai Version (Thai-BFAS)[22]	Thailand	6	874	High school students (10^{th}–12^{th} grade)	16.7 ± 1.0 (N/A)	0.91
2016	Facebook Addiction Test (F-AT)[23]	Germany and Austria	7 (short) 20 (long)	1,019	Online survey	27.5 ± 9.1 (N/A)	0.92 (long)
2016	Social Media Disorder (SMD) Scale[24]	Netherlands 27 (long)	9 (short)	2,198	Online survey	14.05 ± 2.1 (10–17) 14.36 ± 2.2 (10–17)	0.76 (short) 0.90–0.92 (long)
2016	Bergen Social Media Addiction Scale (BSMAS)[5]	Norway Hungary	6 6	23,533 5,961	Online survey High school students (9^{th}–10^{th} grade)	35.8 ± 13.3 (16–88) 16.62 ± 0.96 (15–22)	0.88 0.85

TABLE 1. Comparison among measurements developed to assess social media addiction. (Continued)

Year	Name of measurement	Country	No. of items	No. of participants	Participants	Age, years mean ± SD (range)	Cronbach's alpha coefficient
2017	Bergen Social Media Addiction Scale – Italian version[25]	Italy	6	734	High school and college students	21.6 ± 3.9 (16–40)	0.88
2017	Bergen Social Media Addiction Scale – Persian version[26]	Iran	6	2,676	High school students	15.5 ± 1.2 (14–19)	0.86
2018	Chinese Social Media Addiction Scale (Liu & Ma, 2018)[27]	China	58 28	619	College students	20.4 ± 1.5 (18–25)	0.94
2018	Turkish Adaptation of the Social Media Disorder Scale in Adolescents[28]	Turkey	9	553	Adolescents	N/A (14–18)	0.83–0.86
2018	Cross-Sectional and Longitudinal Evaluation of the Social Network Use Disorder and Internet Gaming Disorder Criteria[29]	German	9	Study 1: 192 Study 2: 2,316	Phone interview and online survey Adults	Study 1 Female: 22 (21–24) Study 1 Male: 23 (21–27) Study 2 Female: 32 (25–27) Study 2 Male: 37 (27–53)	0.690–0.774
2019	Psychometric Testing of Three Chinese Online-Related Addictive Behavior Instruments among Hong Kong University Students[30]	China	6 (BSMAS)	307	University students	21.64 ± 8.11 (17–30)	0.819
2019	Cross-cultural validation of the Social Media Disorder scale[31]	China	9	903	College students	20.56 ± 2.75 (N/A)	0.753
2019	Spanish version of the Facebook Intrusion Questionnaire (FIQ-S)[32]	Spain	8	567	Adults	29.09 ± 12.03 (18–67)	0.9
2020	Social Networking Addiction Scale (SNAS)[33]	India	24	Study 1: 525 Study 3: 334	N/A	20.33 ± 1.70 (17-25)	N/A

Abbreviations: N/A, not available; SD, standard deviation

clarity, and simplicity by a total of eight experts consisting of two general psychiatrists, three child and adolescent psychiatrists, two clinical psychologists, and an expert in social media communication. Each expert rated each item using one-to-four Likert scale on three measures: relevance, clarity, and simplicity. Rating score of three or four by an expert was counted as one score, resulting in eight score points at most and zero point at least for each item. The score was converted into the item content validity index or I-CVI for each item (Max = 1.00, Min = 0.00). The content validity index for the whole scale was an average of all I-CVIs (Max = 1.00, Min = 0.00).

Focus group interviews were conducted with a group of ten high school students ages from fifteen to eighteen years old to ensure clarity of understanding by those completing the scale. Each student was given a printed copy of the scale. They were provided five minutes to go through the whole paper. Then, the investigators asked how students interpreted each item, one by one. The investigators took notes and used comments to adjust language to ensure each question item convey the intended meanings.

All items are scored on a four-point Likert scale ranging from 0 ("definitely not true") to 3 ("definitely true"). The total S-MASS score, obtained by summing the participants' responses, ranges from 0-48. The higher the S-MASS score is, the greater the likelihood that a participant is addicted to social media.

Statistical analysis

Data were analyzed using PASW Statistics for Windows (version 18; SPSS Inc., Chicago, Ill., USA). Cronbach's alpha was used to measure the internal consistency reliability. A Cronbach's alpha coefficient between 0.7 and 0.9 indicated acceptable reliability.[36] Content validity was measured using a content validity index (CVI) generated by an expert committee.

The sample of 5,068 subjects was randomly divided into two using the SPSS to produce two groups: one for an exploratory factor analysis (EFA; n = 2,534), and the other for a confirmatory factor analysis (CFA; n = 2,534). The EFA was performed using SPSS.

To test the three-factor model of the S-MASS, the CFA was performed with LISREL for Windows (version 9.10; Scientific Software International Inc., Skokie, Ill., USA). The model included three factors reflecting giving priority, impaired control, and negative consequences. The model's goodness-of-fit was assessed with the following indices: chi-square test of model fit, standardized root means square residual (SRMR), root mean square error of approximation (RMSEA), and comparative fit index (CFI). To indicate a good fit of the model, the CFI values had to be > 0.95, while the values for RMSEA and SRMR were required to be < .06 and < .08, respectively.[37]

Participants were classified into groups based on their S-MASS scores. The classification model was derived from latent profile analysis (LPA) or a Gaussian finite mixture model by expectation-maximization (EM) algorithm. *The R package mclust (R Foundation, Vienna, Austria) was also used in the classification process*. Bayesian Information Criterion (BIC), Bootstrap Likelihood Ratio Test (BLRT), Log- likelihood, and Integrated Complete-data Likelihood (ICL) were conducted as means to accurately reveal number of latent classes. A better model fit is reflected in lower BIC and AIC values, and higher log likelihood values. The BLRT was conducted to compare models' fitness. Models with significant changes in −2 log-likelihood implied greater fitness to the data.

A Kruskal–Wallis test, followed by a Dunn–Bonferroni post-hoc pairwise comparison, were used to compare the S-MASS scores among classes. Pearson's chi-squared test was used to compare the categorical variables of the classes. Spearman's rank correlation coefficient was also employed to measure the strengths of association between the average daily time spent on social media and the S-MASS scores. All tests of significance were two tailed, and a p-value < 0.05 was considered statistically significant.

Ethics

The study was approved by the Institutional Review Board of the Faculty of Medicine Siriraj Hospital (COA no. Si 701/2013). The Declaration of Helsinki was obliged by investigators throughout the study. Informed consents were obtained from all subjects prior to participating in the study. Parental consents were obtained in case of minorities under 18 years old.

RESULTS

Demographic statistics

Table 2 details the sociodemographic characteristics of the participants, the majority of whom were adolescents and young adults. Participants from each age group show different social media use patterns such as estimated hours of use per day (p<0.05). Younger participants had higher S-MASS scores than older participants (p < 0.001). Two-thirds of participants (66.8%) reported that it was necessary for them to use social media for their work or study. Interestingly, approximately 30% of participants stated that they perceived themselves to be addicted to social media. The five most popular social media platforms used were Facebook (87.9%),

TABLE 2. Sociodemographic characteristics of participants and Social Media Addiction Screening Scale (S-MASS) score.

Characteristics	n (%) mean ± SD	S-MASS score	*P*-value
Source of recruitment			
Total	5068 (100.0)	22.58 ± 9.67	
High schools	3672 (72.5)	23.17 ± 9.54	< 0.001
Online surveys	1396 (27.5)	21.05 ± 9.86	
Gender			
Male	2058 (41.0)	21.52 ± 9.30	< 0.001
Female	2963 (59.0)	23.28 ± 9.84	
Age [mean ± SD (range) = 19.93 ± 9.96 (13–75) yrs]			
13–17 yrs	3406 (69.8)	23.21 ± 9.50[a]	< 0.001
18–25 yrs	525 (10.8)	22.94 ± 9.60[a]	
26–45 yrs	760 (15.6)	20.78 ± 9.85[b]	
46 yrs and above	186 (3.8)	16.26 ± 8.39[c]	
Necessity to use social media for work			
Necessary	3029 (66.8)	22.95 ± 9.73	< 0.001
Not necessary	1503 (33.2)	21.62 ± 9.59	
Self-perception of addiction			
Not addicted	1092 (22.8)	14.65 ± 7.49[a]	< 0.001
Probably addicted	2245 (46.8)	21.90 ± 7.56[b]	
Addicted	1462 (30.5)	29.70 ± 8.68[c]	
Amount of time spent on social media (not including gaming)			
Weekdays [mean ± SD (range) = 3.23 ± 2.63 (0.08–18) hrs/day]			
Light use (< 2 hrs/day)	1148 (26.7)	17.87 ± 8.65[a]	< 0.001
Moderate use (2–4 hrs/day)	2264 (52.6)	22.92 ± 8.79[b]	
Heavy use (> 4 hrs/day)	892 (20.7)	27.80 ± 9.68[c]	
Weekends [mean ± SD (range) = 4.91 ± 4.12 (0.08–24) hrs/day]			
Light use (< 3 hrs/day)	1367 (31.7)	17.63 ± 8.66[a]	< 0.001
Moderate use (3–5 hrs/day)	1692 (39.2)	22.68 ± 8.38[b]	
Heavy use (> 5 hrs/day)	1255 (29.1)	27.65 ± 9.30[c]	
Average daily time spent [mean ± SD (range) = 3.68 ± 2.77 (0.08–19.71) hrs/day]			
Light use (< 3 hrs/day)	2126 (50.6)	19.38 ± 8.66[a]	< 0.001
Moderate use (3–5 hrs/day)	1203 (28.6)	24.06 ± 8.68[b]	
Heavy use (> 5 hrs/day)	876 (20.8)	28.31 ± 9.50[c]	

Note: Different superscript letters (a, b, c) in the same column reflect a significant (p-value < 0.05) difference between the means, while the same letter in one column reflects a non-significant difference between the means.

Line (79.2%), YouTube (77.0%), Google+ (38.7%), and Instagram (37.6%).

Correlation with time spent on social media

A moderately positive correlation was observed between average daily time spent on social media and S-MASS scores (rs^{38} = 0.412; $p < 0.001$). The heavy-use group (using social media for > 4 hours/day on weekdays, or for > 5 hours/day on weekends) had higher S-MASS scores than the light- and moderate-use groups ($p < 0.001$; Table 2).

Content validity

The calculated content validity index or CVI for the S-MASS relative to the relevance, clarity, and simplicity of all items were 0.992, 0.938, and 0.977, respectively. For items with item content validity index (I-CVI) less than 1.00, experts gave specific comments by identifying words which might be unclear to interpretation and suggested alternative words. Some experts also rewrote or rearranged questions as examples. Others pointed out double-barreled questions.

Reliability analysis

The S-MASS had excellent internal consistency, with a Cronbach's alpha coefficient of 0.90 (95% CI: 0.89–0.90). In an item analysis, all 16 S-MASS items had a corrected item-total correlation above 0.3, which confirmed that each of the 16 items was correlated with the overall scale. If deleted, no item had a Cronbach's alpha greater than 0.90; this suggested that no item disproportionately affected the overall reliability.

EFA

Prior to performing the EFA, the suitability of the data for the factor analysis was evaluated. Five factorability assessment criteria were applied. First, the correlation matrix revealed the presence of several (82.03%) coefficients of 0.30 or above, suggesting appropriate factorability. Second, the Kaiser–Meyer–Olkin measure of sampling adequacy was 0.943, which exceeded the recommended value of 0.6.[39] Third, Bartlett's test of sphericity achieved statistical significance (χ^{240} = 29,879.585; $p < 0.001$), supporting the factorability of the correlation matrix. Fourth, the diagonals of the anti-image correlation matrix were over 0.5, suggesting the inclusion of each item in the factor analysis. Finally, each item shares common variances with other items demonstrated by the communalities above 0.3 (Table 3). Given all of the above criteria were satisfied, all items of the S-MASS were included in the EFA.

A principal components analysis (PCA) revealed three components that the authors named "giving priority", "negative consequences", and "impaired control"; they had eigenvalues exceeding 1 and explained 39.53%, 7.38%, and 6.41% of the variance, respectively (Table 3). The promax rotation method with Kaiser normalization was chosen because the factor correlation matrix for all three factors exceeded 0.32, which indicated that the factors in the analysis were correlated. All 16 items had factor loadings greater than 0.4. In addition, the Cronbach's alphas for giving priority, negative consequences, and impaired control were 0.789, 0.770, and 0.803, respectively, indicating internal consistency of these three components (Table 3).

CFA

The three-factor model with the sixteen components as indicator variables was tested with a CFA. The analysis provided an acceptable fit to the data (χ^2 = 120.77, df = 62, $p < 0.001$; CFI = 0.99; RMSEA = 0.01; SRMR = 0.01). Factor loadings ranged from 0.32 to 0.74 (Table 4 and Fig 1). Item 9 and item 13 of the S-MASS had factor loadings less than 0.4 (0.37 and 0.32, respectively).

LPA

The LPA was performed on the sixteen items of the S-MASS, and according to the Bayesian Information Criterion (BIC) and integrated complete-data likelihood (ICL) criterion, the three-class solution was selected as the best-fitting model. The features of the three classes are presented in Fig 2. The three classes were named "low-risk" (S-MASS scores 0–15), "moderate-risk" (S-MASS scores 16–30), and "high-risk" (S-MASS scores 31–48), representing 24.2% (n = 1,227), 54.4% (n = 2,757), and 21.4% (n = 1,084) of social media users, respectively.

In the "high-risk" class, item 11— "I ignore or fail when people tell me to cut down my social media use"— showed elevated levels compared to the other items, as shown in Fig 2. Interestingly, 67.6% of the participants in the high-risk class believed that they were addicted to social media, whereas only 26.2% and 6.9% in the moderate-risk and low-risk classes, respectively, believed so (Table 5).

DISCUSSION

The purpose of the present study was to measure the psychometric properties of the S-MASS, a newly developed, 16-item, self-report questionnaire developed to screen for SMA. Results showed that the S-MASS has excellent internal consistency (Cronbach's alpha coefficient, α = 0.90). This indicated that all 16 items

TABLE 3. Exploratory factor analysis (EFA) of Social Media Addiction Screening Scale (S-MASS).

Questions	Loadings			Communality
	Factor 1: Giving priority	Factor 2: Negative consequences	Factor 3: Impaired control	
Since I started using social media…				
(15) My friends regularly see me online.	0.730			0.572
(14) I feel that social media is a part of my life that I can't lose.	0.686			0.564
(1) I use social media whenever I have a chance.	0.677			0.506
(7) I keep checking all the time to see if anyone has “liked” or commented on the pictures/ statuses I have posted.	0.613			0.435
(2) I use social media as soon as I wake up in the morning.	0.603			0.421
(13) I use social media to ease my stress.	0.596			0.393
(11) I ignore or fail when people tell me to cut down my social media use.		0.763		0.587
(16) People around me say I am addicted to social media.		0.705		0.580
(10) I use social media during circumstances when I should not use it (e.g., while in the classroom, doing daily activities, working, meeting with friends or colleagues, walking on the sidewalk, driving, etc.).		0.688		0.490
(12) I get agitated or irritable when I can’t use social media.		0.670		0.505
(8) I talk to people on social media more often than in real life.		0.645		0.420
(9) My social media use negatively impacts my life in some ways.		0.626		0.563
(5) I often spend more time using social media than I originally intended to.			0.799	0.647
(3) I spend all of my free time using social media.			0.791	0.653
(4) I have lost interest in other activities.			0.762	0.602
(6) I spend more time using social media now than I used to.			0.732	0.593
Eigen value	6.324	1.181	1.026	
Percentage of variance explained (total = 53.322)	39.528	7.384	6.410	
Cronbach’s alpha	0.789	0.770	0.803	

Extraction method: principal component analysis
Rotation method: Promax with Kaiser normalization
Factor loadings < 0.4 were suppressed

TABLE 4. Factor loadings, R2, and factor loading coefficient of Social Media Addiction Screening Scale (S-MASS).

Components	Factor loadings				R^2	Factor loading coefficient
	b	B	SE (b)	t		
Giving priority						
(1) I use social media whenever I have a chance. (PRE1)	0.53	0.61	0.02	31.44*	0.37	0.17
(2) I use social media as soon as I wake up in the morning. (PRE2)	0.62	0.57	0.02	28.93*	0.32	0.08
(7) I keep checking all the time to see if anyone has “liked” or commented on the pictures/statuses I have posted. (PRE3)	0.70	0.67	0.02	34.56*	0.45	0.20
(13) I use social media to ease my stress. (PRE4)	0.32	0.36	0.02	17.13*	0.13	0.03
(14) I feel that social media is a part of my life that I can't lose. (PRE5)	0.70	0.72	0.02	37.78*	0.52	0.25
(15) My friends regularly see me online. (PRE6)	0.63	0.65	0.02	34.51*	0.42	0.15
Negative consequences						
(8) I talk to people on social media more often than in real life. (IMP1)	0.58	0.63	0.02	31.62*	0.40	0.22
(9) My social media use negatively impacts my life in some ways. (IMP2)	0.37	0.40	0.02	17.94*	0.15	0.04
(10) I use social media during circumstances when I should not use it (e.g., while in the classroom, doing daily activities, working, meeting with friends or colleagues, walking on the sidewalk, driving, etc.). (IMP3)	0.51	0.53	0.02	26.00*	0.28	0.08
(11) I ignore or fail when people tell me to cut down my social media use. (IMP4)	0.63	0.68	0.02	33.31*	0.46	0.17
(12) I get agitated or irritable when I can’t use social media. (IMP5)	0.65	0.65	0.02	33.17*	0.42	0.14
(16) People around me say I am addicted to social media. (IMP6)	0.70	0.71	0.02	37.86*	0.50	0.17
Impaired control						
(3) I spend all of my free time using social media. (LOC1)	0.73	0.75	0.02	40.51*	0.57	0.31
(4) I have lost interest in other activities. (LOC2)	0.65	0.71	0.02	37.58*	0.50	0.25
(5) I often spend more time using social media than I originally intended to. (LOC3)	0.66	0.69	0.02	37.23*	0.48	0.18
(6) I spend more time using social media now than I used to. (LOC4)	0.74	0.79	0.02	40.82*	0.63	0.38

*p-value < 0.01

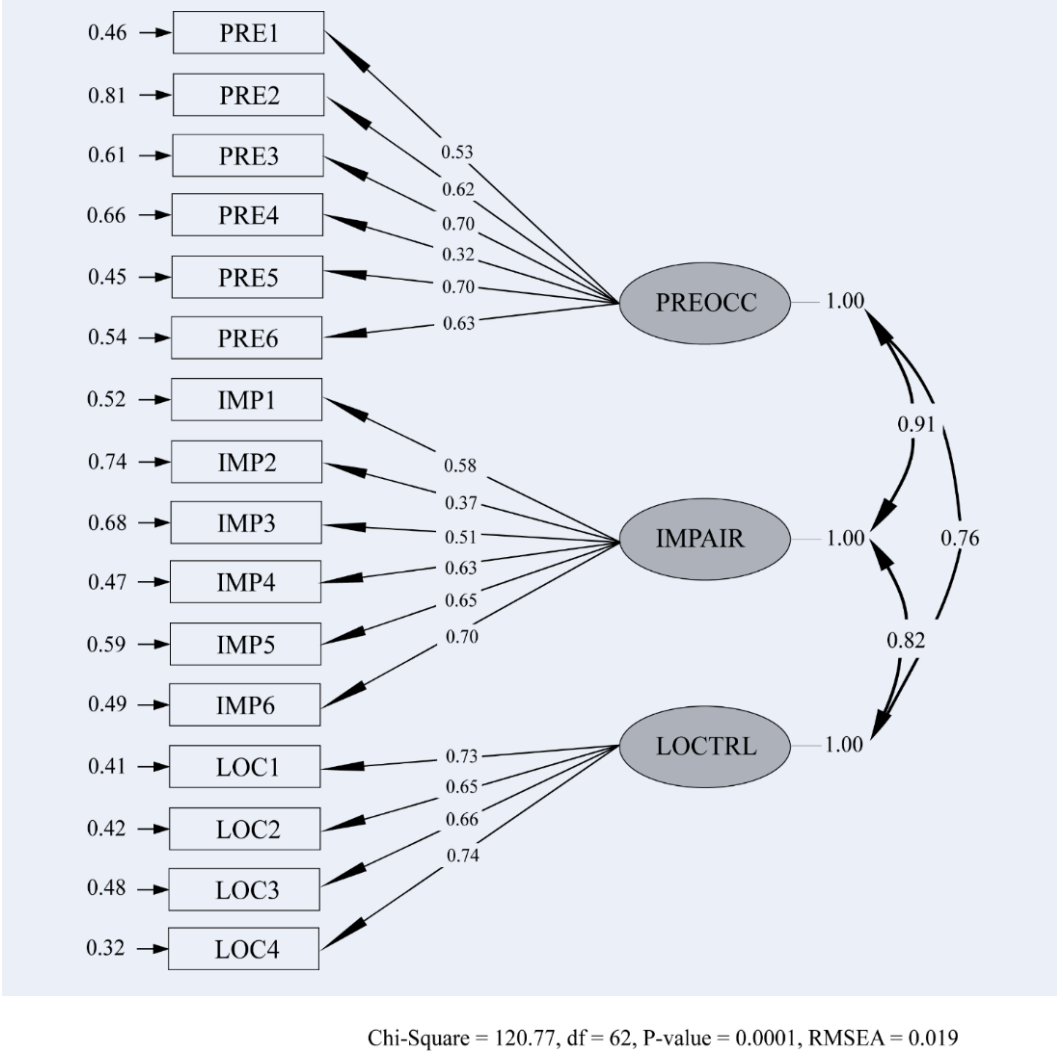

Fig 1. Factor loadings of Social-Media Addiction Screening Scale (S-MASS)

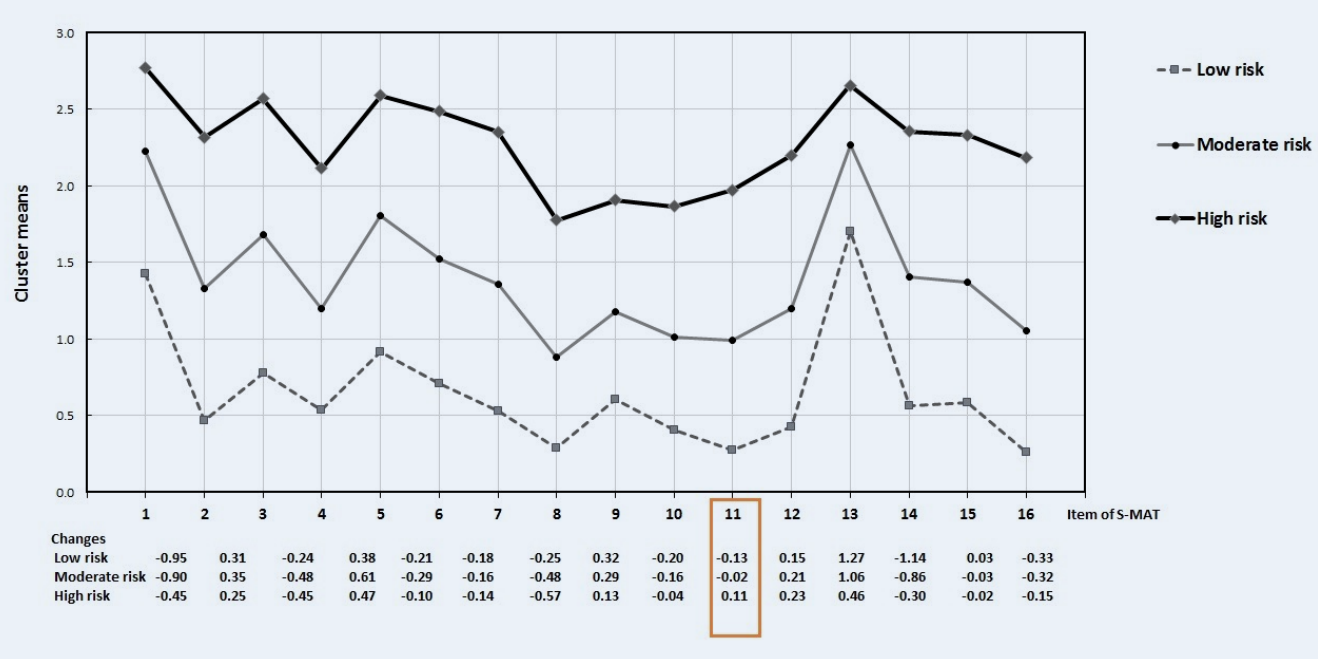

Fig 2. The three classes of social-media users obtained from the latent profile analysis

TABLE 5. Comparison of the three latent classes.

Characteristics	Total (n = 5,068)	Low-risk (n = 1,227)	Moderate-risk (n = 2,757)	High-risk (n = 1,084)	Overall test $\chi^2(df)$	*P*-value
Gender (Female); n (%)	2,963 (59.0)	687 (56.4)[a]	1557 (57.0)[a]	719 (67.2)[b]	37.77 (2)	< 0.001
Age (years) Median 16.00, min 13.00, max 75.00, SE 0.14: Mean (SD)	19.93 (9.96)	22.34 (11.91)[a]	19.49 (9.63)[b]	18.25 (7.55)[c]	34.30 (2)*	< 0.001
Necessity to use social media for work (Necessary); n (%)	3,029 (66.8)	715 (63.8)[a]	1,621 (66.3)[a]	693 (71.7)[b]	15.51 (2)	< 0.001
Self-perception of addiction n (%)						< 0.001
Probably addicted	2,245 (46.8)	452 (39.2)[a]	1,493 (57.0)[b]	300 (29.2)[c]	475.48 (2)	< 0.001
Addicted	1,462 (30.5)	80 (6.9)[a]	687 (26.2)[b]	695 (67.6)[c]	1,042.90 (2)	< 0.001
Amount of time spent on social media (not including gaming)						< 0.001
Weekdays (hrs/day) Median 2.50, min 0.08, max 18.00, SE 0.04: Mean (SD)	3.23 (2.63)	2.24 (1.97)[a]	3.16 (2.42)[b]	4.57 (3.20)[c]	526.81 (2)*	< 0.001
Weekends (hrs/day) Median 4.00, min 0.08, max 24.00, SE 0.06: Mean (SD)	4.91 (4.12)	3.05 (2.79)[a]	4.78 (3.60)[b]	7.41 (5.27)[c]	672.17 (2)*	< 0.001
Average daily time spent (hrs/day) Median 2.86, min 0.08, max 19.71, SE 0.04: Mean (SD)	3.68 (2.77)	2.46 (1.97)[a]	3.61 (2.51)[b]	5.28 (3.37)[c]	614.49 (2)*	< 0.001
Total Social Media Addiction Screening Scale (S-MASS) Score Median 22.00, min 0, max 48, SE 0.14: Mean (SD)	22.58 (9.67)	10.48 (3.72)[a]	22.51 (4.10)[b]	36.47 (4.52)[c]	4,133.80 (2)*	< 0.001

Note: Different superscript letters (a, b, c) in the same row reflect a significant (p-value < 0.05) difference between the means, while same superscript letters in one row reflect a non-significant difference between the means, according to the Pearson chi-square or (*) Kruskal–Wallis test, followed by a Tukey post-hoc pairwise comparison.

of the S-MASS measured the same problem, namely, social media addiction (SMA). The EFA using a PCA with promax rotation demonstrated that the S-MASS has good factorial validity as all items had loading factors above 0.4. The EFA also revealed that 3 factors were foundational to the S-MASS and covered the essential characteristics of behavioral addiction (giving priority, impaired control, and negative consequences). The CFA also confirmed the three-factor model of the S-MASS.

According to the LPA, three classes of social media users were identified, based on their risk of addiction: high risk, moderate risk, and low risk. Members of the high-risk class were likely to (i) be female, (ii) be younger, (iii) have necessary work-related use, (iv) perceive themselves as being addicted to social media, and (v) spend more than 5 hours daily on social media (Table 5). These risk factors will help clinicians accurately identify social media users who might be at risk for SMA. Interestingly, item 11 of the S-MASS ("I ignore or fail when people tell me to cut down my social media use") showed an elevated level in the high-risk class relative to the other items. This item may be helpful in distinguishing the high-risk class from the low-risk and medium-risk classes. Furthermore, 21.4% (n = 1,084) of participants belonged to the high-risk class, based on the LPA; this is consistent with the prevalence of social-networking-site addiction (29.5%) reported by Tang and Koh.[41] On the other hand, the high-risk class proportion found in our study is somewhat lower than the previously reported prevalence of Facebook addiction in Thailand (41.8%)[42] and much higher than the rate for the at-risk group of SMA in Hungary (4.5%).[43] The disparity in the prevalence of SMA among countries is probably due to differences in the measurement tools and the sample populations used by the various studies. Nevertheless, cultural influence might also contribute to the disparity found between countries.[44]

The study also discovered that the S-MASS score is moderately positively correlated with average daily time spent on social media ($rs^{38} = 0.412$; $p < 0.001$). In other words, the greater the amount of time spent on social media, the greater the risk of becoming addicted to social media. This finding may imply that the S-MASS can determine the severity of addiction.

Strengths of this study include its relatively large sample size, the heterogeneity of the participants, and the comprehensive assessment of S-MASS reliability and validity. Cut-off scores were also identified for three-level risk classification. This fulfills the gap in previous studies on assessment tools. More importantly, SMA manifests in a spectrum, not in binary categories. Having cut-points is beneficial for clinical practice. The diversity of sources from which the participants were recruited, especially the online survey, allowed us to recruit and enroll participants with relatively diverse sociodemographic backgrounds and a wider age range (13–75 years) than other studies (although the majority of participants were aged between 13 and 25 years; Table 1). The authors set out to develop the S-MASS for use in screening for SMA in general, not Facebook addiction only. S-MASS can, therefore, be applied to subgroups of social media users who interact with social networking sites other than Facebook.

Limitations

The present study has some limitations. First, results were based on a convenient sample, limiting the extent to which findings can be generalized to a broader population. Second, the S-MASS is a self-report questionnaire which is subject to several biases (such as social desirability and short-term recall). Third, the test-retest reliability was not evaluated to determine stability. Forth, the same cut-off might not be a one-size-fit-all since each age group shows different patterns of social media usage. Further studies to identify age-specific cut-offs are warranted. Finally, although a few forms of validity were tested in this study, other important types of validity should also be examined (e.g., concurrent, predictive, convergent, and discriminant validities).

Future studies

The S-MASS should be further validated—most notably, its criterion validity. This validation process can be undertaken after a formal diagnosis of SMA becomes available. In its present form, the S-MASS is best suited for use in epidemiologic studies. However, to test whether the S-MASS is sensitive to change after interventions is an interesting and worthwhile research pursuit. Once the S-MASS is proven to be adequately sensitive to change, it can also be used in clinical or interventional studies.

CONCLUSION

The Social-Media Addiction Screening Scale (S-MASS) is a psychometrically reliable and valid screening test for SMA. Two cut-offs are identified for risk classification. Further studies assessing the concurrent, predictive, convergent, and discriminant validity of the S-MASS in a more heterogeneous population are warranted. In addition, the criterion validity of the S-MASS to determine its sensitivity, specificity, and the appropriateness of the current recommended cut-off scores should be evaluated once formal diagnostic criteria for SMA become available.

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