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Loneliness moderates the predictive effect of the trait-state FoMO pathway on problematic social media use

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ABSTRACT

Fear of missing out (FoMO) and loneliness have been identified as significant contributors to problematic social media use (PSMU). However, no prior research has examined the interplay between trait FoMO, state FoMO, the moderating role of loneliness, and their combined influence on PSMU within a unified model. The present study addressed this gap by testing a moderated-mediation model to investigate how trait FoMO, state FoMO, and loneliness jointly impact PSMU. A cross-sectional online survey was conducted with 356 participants (55.6 % female; M_{age} = 21.7 years, SD_{age} = 3.55) who completed the Trait-FoMO Scale, State-FoMO Scale, UCLA Loneliness Scale (Short Version), and the Bergen Social Media Addiction Scale. The results showed that females scored higher for PSMU than males, while age had no significant effect. Moderated-mediation analyses indicated that both trait-FoMO and state-FoMO were positively associated with PSMU. Moreover, state-FoMO partially mediated the relationship between trait-FoMO and PSMU, with loneliness moderating this pathway. More specifically, the association between trait-FoMO and state-FoMO was weaker at higher levels of loneliness but stronger when loneliness levels were low. These findings highlight FoMO as a major risk factor for PSMU, as well as emphasizing the importance of addressing loneliness in prevention and intervention efforts. This integrated model provides valuable insights for designing targeted strategies to mitigate the adverse effects of FoMO and loneliness on social media use.

1. Introduction

The rapid proliferation of social media platforms has profoundly reshaped how individuals establish new social connections, communicate, and consume different kinds of information (e.g., Montag et al., 2024; Moretta et al., 2022). While these platforms offer many benefits, such as facilitating social interaction and fostering a sense of belonging, they can also pose significant psychological risks for a minority of individuals (Griffiths, 2022). Among these risks, problematic social media use (PSMU) has emerged as a pressing concern (Kuss & Griffiths, 2017). PSMU, characterised by excessive and maladaptive engagement with social media, can disrupt daily functioning and well-being, potentially leading to what has been described as a behavioural addiction (Dou et al., 2023; Gori et al., 2023; Malik et al., 2024; Servidio et al., 2022).

In Italy (where the present study was conducted), 73 % of the population (approximately 43 million individuals), actively use social media, with use equally distributed between males and females (We Are Social, 2024). The average time spent on social media platforms is

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steadily increasing, with *TikTok* being the most popular (32 h and 12 min per month), followed by *YouTube* (18 h and 15 min), and *Facebook* (16 h and 37 min). Regarding the symptoms of PSMU, the results of a study conducted by Svicher et al. (2021) found that the main central node identified was related to impaired self-regulation, characterized by challenges among individuals controlling their social media use, failed attempts to refrain from using social media, and persistent obsessive thoughts about going online. Importantly, these central nodes exhibited strong interconnections, underscoring a pathway of core symptoms potentially linked to dysfunctions in the reflective-inhibitory prefrontal brain system, which plays a crucial role in actively suppressing behavioural responses (He et al., 2017).

Research has identified several different risk factors for developing PSMU. One of the most important appears to be the fear of missing out (FoMO). FoMO has been defined as the pervasive apprehension that others might be having rewarding experiences from which the individual is absent (Przybylski et al., 2013). Related to this is self-determination theory (SDT; Ryan & Deci, 2000) which emphasizes that human motivation is driven by the fulfilment of three basic psychological needs: *autonomy* (the need by individuals to feel in control of their actions and decisions), *competence* (the need by individuals to feel effective and capable in their activities), and *relatedness* (the need by individuals to feel connected to others and maintain meaningful relationships). When these needs are unmet, individuals experience low levels of self-motivation and well-being increasing the risk of FoMO (Dou et al., 2023). Addressing these personal and social needs can help mitigate the negative effects of FoMO and promote better psychological well-being (Przybylski et al., 2013).

Individuals experiencing high levels of FoMO are more likely to engage compulsively with social media, exacerbating their risk of maladaptive use of social media platforms (Servidio et al., 2024; Soraci et al., 2025; Yoosefi et al., 2025). FoMO has largely been studied as a unitary construct, although recent research suggests there are two main latent dimensions (i.e., trait-FoMO and state-FoMO). Trait-FoMO reflects a relatively stable personality characteristic comprising a persistent concern about being excluded, stemming from a deep-seated worry of being left out of other people's activities. In contrast, state-FoMO is the combination of online communication and subsequent interactions, serving as a coping mechanism for the feeling of being inundated by continuous communication and information about the activities of others who share the same social groups (Wegmann et al., 2017). In other words, state-FoMO is a more situational and transient experience related to online activities. Trait-FoMO, characterized by concern over missing out on information or communication, contributes to feelings of online disconnection and displacement.

Another potential risk factor for PSMU is loneliness (Bonfanti et al., 2023; Yin et al., 2023). Loneliness is defined as an individual's sense of alienation and exclusion, which results in feeling disconnected and unaccepted by others (Hawkley & Cacioppo, 2010). Individuals experiencing high levels of both trait- and state-FoMO and loneliness tend to be more actively engaged with social media applications (Wegmann et al., 2017; Yin et al., 2023). Moreover, loneliness and FoMO may be especially prevalent among adolescents and young adults. Prior studies have indicated that prolonged loneliness can significantly impact an individual's psychophysical health (Bonfanti et al., 2023; Hutten et al., 2021). More specifically, individuals who experience loneliness often develop problematic and dysfunctional behavioural patterns in their use of the internet and social media sites (Rajesh & Rangaiah, 2020).

Loneliness, frequently associated with increased vulnerability to maladaptive social media use (Wegmann & Brand, 2019), has been proposed as a potential moderator in these relationships (Ho, 2021). The moderation hypothesis might reflect the role of gratification in the initial stages of internet-use disorders, where the emotional and cognitive responses to situational triggers (state-FoMO) translate stable vulnerabilities (trait-FoMO) into maladaptive social media use. Additionally, when compensatory mechanisms become increasingly important, negative consequences, including loneliness, can emerge. More specifically, when loneliness is low, gratification-based mechanisms dominate (Elhai et al., 2020; Reer et al., 2019; Twenge et al., 2019), leading to a stronger association between trait-FoMO and state-FoMO. Conversely, when loneliness is high, compensatory mechanisms may reduce the motivational impact of trait-FoMO, weakening its association with state-FoMO.

Within the framework of the Interaction of Person-Affect-Cognition-Execution (I-PACE) model, trait-FoMO has been identified as a predisposing factor for PSMU because it heightens the motivation to engage with social media to alleviate FoMO-related anxiety (Brand et al., 2016,2019). Missing out on important information on specific topics drives individuals to constantly update their social media profiles, and these behaviours increase levels of both trait and general FoMO, as well as leading to feelings of online disconnection and displacement (Wegmann et al., 2017). Although the I-PACE model was specifically designed to explain the development of internet-related disorders, this model has been applied to explain other behavioural addictions (e.g., problematic smartphone use, PSMU). It emphasizes the interaction between personality traits (e.g., trait-FoMO), affect and cognition (e.g., loneliness, state-FoMO), and execution processes (e.g., compulsive or habitual use, leading to PSMU). Based on the I-PACE model, recent studies have included state-FoMO as a mediating variable (Hussain et al., 2024; Wegmann et al., 2017; Yoosefi et al., 2025). Therefore, state-FoMO has been identified as a specific cognitive factor that mediates the relationship between the core characteristics of an individual and the risk of internet-related disorders, such as PSMU (Yoosefi et al., 2025).

Few studies have explored the effects of different dimensions of FoMO (e.g., trait and state) on PSMU, suggesting, for example, that both trait-FoMO and state-FoMO are positively associated with problematic smartphone use. Wegmann et al. (2017) found that state-FoMO was associated with internet-communication disorder (ICD) compared to trait-FoMO. More specifically, state-FoMO was one of the mediators of the relationship between psychopathological symptoms and ICD. Additionally, the results of a study conducted by Montag et al. (2023) suggested that the trait facets of FoMO, when considered in general (without focusing on the online context), exhibited weaker associations with problematic social networking site use tendencies compared to the state (online) FoMO variable. This finding underlines the importance of distinguishing between trait-FoMO, which is more relevant to exploring individual differences, from state-FoMO when is related to the online context.

Although previous studies have investigated the indirect effects of trait-FoMO on problematic internet-related disorders through the mediating role of state-FoMO, no previous studies have investigated the effect of specific moderators in this relationship. Therefore, the present study addressed the mechanisms underlying the progression from trait-FoMO to state-FoMO, with a particular focus on the role of loneliness as a potential moderator and PSMU as a dependent variable.

1.1. The present study

The extant literature highlights the role of FoMO as a significant driver of PSMU, with trait-FoMO reflecting a stable predisposition of fearing exclusion, and state-FoMO representing momentary experiences triggered by situational factors. The present study addresses a critical gap by exploring the dynamic interplay between trait-FoMO, state-FoMO, and loneliness (as a moderator) in shaping PSMU. Therefore, the present study examined the mechanisms through which FoMO, and loneliness interact to influence PSMU, contributing to a deeper understanding of psychological vulnerabilities associated with PSMU.

In sum, and grounded in the theoretical framework of the I-PACE model, the present study examined how individual differences in trait-FoMO may influence PSMU through state-FoMO, with loneliness serving as a key moderating variable, controlling for age and sex (Fig. 1).

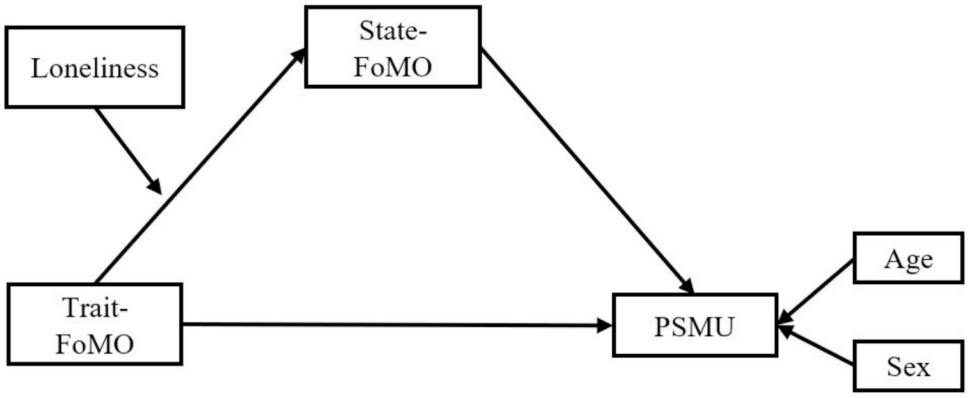

Fig. 1. *The research model. Note.* FoMO = Fear of missing out. PSMU = Problematic social media use.

Based on the literature review, it was hypothesized that trait-FoMO, as a stable individual predisposition, would positively associate with PSMU (H_1), and state-FoMO (H_2), representing situational and momentary experiences of FoMO. It was also hypothesized that, in turn, state-FoMO, would mediate the relationship between trait-FoMO and PSMU (H_3), and that loneliness would moderate the association between trait-FoMO and state-FoMO (H_4). Additionally, age and sex were included as control variables because it has been showed that being of young age (e.g., Gori et al., 2024) and being female (e.g., Kuss & Griffiths, 2017) are risk factors for PSMU (e.g., Meynadier et al., 2025).

2. Method

2.1. Participants and procedure

A cross-sectional online survey was conducted using a convenience sample of 356 young adult Italian university students (55.6 % females) aged 18–35 years (M = 21.72 years, SD = 3.55). Regarding their educational profile, 53.7 % were studying sciences, 33,4% economic and social sciences, 9.8 % human sciences, and 3.1 % medical sciences. Regarding social media use, 95 % of the participants had at least three or four social media accounts. On average, the participants spent less than one hour per day on *Facebook* (M = 0.55, SD = 0.99), more than one hour per day on *Instagram* (M = 1.90, SD = 1.39), and more than one hour a day on *TikTok* (M = 1.39, SD = 1.53).

The data were collected online between February 2024 and July 2024. Participants were recruited on the university campus, with each data collection session scheduled before the beginning of lectures to minimise class disruption. The inclusion criteria were: (i) having at least one social media account; (ii) being aged between 18 and 35 years; and (iii) having proficiency in the Italian language. Before data collection, all participants were thoroughly informed about the study's objectives and procedures. It was emphasized that participation was anonymous, voluntary, and without financial or academic incentives. A member of the research team then displayed a PowerPoint slide that included a short link to the online questionnaire. Participants were invited to copy the survey link, hosted on the *LimeSurvey* platform, provide informed consent, and complete the survey. Moreover, to mitigate any perception of obligation, individuals were also informed verbally and in writing on a PowerPoint slide (when the information about the study was being presented) that completing the survey was entirely voluntary. Those who chose not to participate were not required to provide any justification and were free to engage in other activities during the survey administration period. The study received approval from the University of Calabria Ethics Committee (n. 0288248/2024).

2.2. Measures

Demographics characteristics. The survey included questions relating to sex, age, education level, number of different social media accounts, and daily time spent on various social media platforms (e.g., *Facebook, Instagram,* and *TikTok*).

State Fear of Missing Out Inventory (SFoMO). The eight-item SFoMO (Holte, 2023) was used to assess the fear of missing out on a rewarding experience. An example item is "*I fear I am absent from a special moment*". Participants are asked to answer on a six-point Likert-type scale from *Strongly disagree* (1) to *Strongly agree* (6). The total score ranges from 8 to 48 and higher scores indicate a higher state fear of missing out. Because the original scale was in English, a back-translation approach was used to adapt it to the Italian context (International Test Commission, 2017). In the present study, the internal consistency was excellent (α = 0.93, ω = 0.93), and its one-factor solution was confirmed: robust χ^2 (17, N = 356) = 36.07, $p < 0.01$, comparative fit index (CFI) = 0.988, Tucker-Lewis fit index (TLI) = 0.980, root mean square error of approximation (RMSEA) = 0.064, 90 % CI [0.035, 0.093], and standardized root mean square residual (SRMR) = 0.025.

Fear of Missing Out Scale (FoMOS). The 10-item FoMOS (Przybylski et al., 2013; Italian version: Casale & Fioravanti, 2020) was used to assess the trait-fear of missing out. An example item is "*I worry when I find out that my friends are having fun without me*". Participants are asked to answer on a five-point Likert-type scale ranging from *Not at all true for me* (1) to *Extremely true for me* (5). The total score ranges from 5 to 50 and higher scores indicate a greater fear of missing out. In the present study, the internal consistency was very good (α = 0.89, ω = 0.89).

Bergen Social Media Addiction Scale (BSMAS). The six-item BSMAS (Andreassen et al., 2016; Italian version: Monacis et al., 2017) was used to assess PSMU. An example item is "*You use social media in order to forget about personal problems*". Participants are asked to answer on a five-point Likert-type scale ranging from *Never* (1) to *Very often* (5). The total score ranges from 6 to 30 and higher scores indicate a higher risk of PSMU. In the present study, the internal consistency was good (α = 0.79, ω = 0.80).

University of California, Los Angeles, Loneliness Scale-Version 3 Short version (UCLA-LS-SV). The three-item UCLA-LS3 (Russell, 1996; Italian version: Bottaro et al., 2023) was used to assess global and prolonged (dispositional) perceived sense of loneliness. An example item is "*How often do you feel that you lack companionship?*". Participants are asked to answer on a four-point Likert-type scale ranging from *Never* (1) to *Always* (4). The total score ranges from 3 to 12 and higher scores indicate a greater feeling of loneliness. In the present study, the internal consistency was very good (α = 0.82, ω = 0.83).

2.3. Data analyses

Data analyses were performed using the R statistical analysis with the support of RStudio software (Posit team, 2024), mediation package (Tingley et al., 2014), and lavaan package (Rosseel, 2012). First, descriptive statistics and bivariate Pearson correlations were computed for the main variables of the study (e.g., trait and state-FoMO, loneliness, PSMU, age and sex [dummy coded 1 = Female, 2 = Male). Reliability tests (Cronbach alpha and McDonalds omega) were also performed. No missing data were in the dataset because the online surveys could not be submitted unless all questions were answered. The Mardia's skewness index (72.86, $p < 0.001$) and kurtosis ($p = 0.155$) suggested that the data did not fully meet the assumption of multivariate normality. Therefore, a bootstrapping approach was applied. Multicollinearity was assessed using the variance inflation factor (VIF) and tolerance values for each independent variable considered in the analysis. VIF values ranged from 1.25 (BSMAS) to 2.77 (state-FoMO), remaining below the commonly recommended threshold of 10, suggesting that multicollinearity was not a problem for the current data (Field & Iles, 2016). Tolerance values ranged from 0.36 (state-FoMO) to 0.80 (BSMAS), confirming no multicollinearity concerns. A paired *t*-test was conducted to compare the mean levels of state-FoMO and trait-FoMO in relation to PSMU severity given that the variables were assessed within the same participants.

Finally, the model in Fig. 1 was tested. More specifically, mediation analysis was conducted using a two-step method (Preacher & Hayes, 2008): (i) the independent variable was regressed on the mediator variable; and (ii) the dependent variable was regressed on both the independent variable and the mediator. A bootstrapping test with 5,000 samples, as described by Tingley et al. (2014), was employed. For moderation analysis, the approach of Aiken et al. (2010) was followed. The independent variable (X) and the moderator (Z) were mean-centred to reduce multicollinearity. Then, an interaction term (XZ) was computed as the product of the centred variables. In the final step, the dependent variable was regressed on the centred independent variable (X), the centred moderator (Z), and their interaction term (XZ).

3. Results

Table 1 shows the results of the descriptive statistics and Pearson correlations for the study variables. As expected, all the main variables (e.g., trait and state-FoMO, loneliness and PSMU) were positively correlated, except for age which was negatively correlated with the main variables. Females were more likely than males to report higher levels of trait and state-FoMO, loneliness, and PSMU. The paired *t*-tests showed that in comparison to trait-FoMO ($t[355] = 16.31$, $p < .001$, $d = 0.86$, 95 % CI[5.56, 7.09]), state-FoMO ($t[355] = 23.36$, $p < .001$, $d = 1.23$, 95 % CI[9.99, 11.82]), was significantly more related to PSMU severity.

A path analysis was performed to test the research model using age and sex as covariates. As shown in Table 2, the moderated mediation analysis indicated a significant overall model (F [3,352] = 213.5, $p < 0.001$). The explained variance of the overall model was, adj$R^2 = 0.64$. The direct association between trait-FoMO and PSMU was significant ($p < 0.001$) after controlling for trait-FoMO, loneliness, and their interaction. The conditional indirect effect of trait-FoMO on PSMU via state-FoMO was significant among participants with low (one SD below the mean), medium (mean value), and high (one SD above the mean) levels of the moderator. The index of moderated mediation was significant indicating a moderated mediation effect (see Table 2). Fig. 2 shows the results of the moderated mediation analysis.

The indirect effect of trait-FoMO on PSMU through state-FoMO was significant across all levels of loneliness (Table 2). Loneliness moderated

Table 2
Testing the moderated mediation of trait-FoMO on PSMU.

	b	*SE*	*t*	*p*	95 % CI
Path *a*: Trait-FoMO → State-FoMO	0.87	0.04	19.18	0.001	[0.78, 0.96]
Path *b*: State-FoMO → PSMU	0.13	0.04	3.49	0.001	[0.06, 0.20]
Path c': Trait-FoMO → PSMU (direct effect)	0.14	0.05	2.81	0.01	[0.03, 0.23]
Interaction: Trait-FoMO x Loneliness → State-FoMO	−0.06	0.01	−3.96	0.001	[-0.09, −0.03]
Conditional Indirect Effects: FoMO → PSMU					
Trait-FoMO → State-FoMO → PSMU					
Loneliness:					
Low (one SD below mean = -2.269)	0.12	0.04			[0.05, 0.20]
Medium (mean = 2.17)	0.11	0.03			[0.05, 0.17]
High (one SD above mean = 2.269)	0.09	0.03			[0.04, 0.15]
Index of Moderated Mediation	−0.01	0.00			[-0.01, −0.00]

Note. FoMO = Fear of missing out. PSMU = Problematic social media use.

Table 1
Means, standard deviations, and correlations of the study variables with 95 % confidence intervals (N = 356).

Variable	*M*	*SD*	1	2	3	4	5
1. Trait-FoMO	22.05	7.74					
2. State-FoMO	26.62	9.61	0.77*** 0[.73, 0.81]				
3. Loneliness	7.16	2.27	0.48*** 0[.39, 0.55]	0.53*** 0[.45, 0.60]			
4. PSMU	15.72	5.03	0.41*** 0[.32, 0.49]	0.41*** 0[.32, 0.50]	0.31** 0[.21, 0.40]		
5. Age	21.72	3.55	−0.14** [-0.24, −0.04]	−0.21*** [-0.30, −0.10]	−0.03 [-0.14, 0.07]	−0.08 [-0.18, 0.03]	
6. Sex			−0.14** [-0.24, −0.03]	−0.16** [-0.26, −0.06]	−0.42*** [-0.51, −0.34]	−0.12* [-0.22, −0.02]	−0.01 [-0.11, 0.10]

Note. FoMO = Fear of missing out. PSMU = Problematic social media use. Values in square brackets [LL, UL] indicate the 95 % confidence interval for each correlation. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. Sex is a point bi-serial correlation (coded as a dummy variable 1 = Female, 2 = Male).

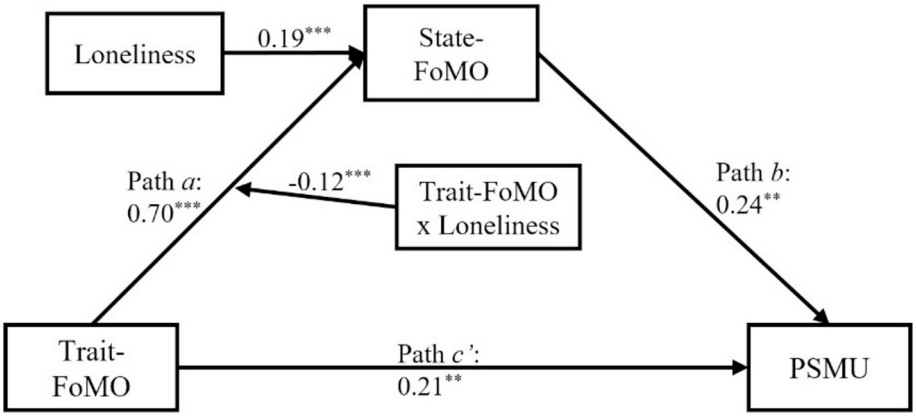

Fig. 2. *Moderated mediation model controlling for age and sex. All coefficients are standardised. Age and sex were excluded from the model as they were not significant. Note.* FoMO = Fear of missing out. PSMU = Problematic social media use. $^{**}p < 0.01$. $^{***}p < 0.001$.

this relationship because the effect of trait-FoMO on state-FoMO was strongest at low loneliness levels (b = 0.12, *SE* = 0.04, 95 % CI [0.05, 0.20]), moderate at average loneliness levels (b = 0.11, *SE* = 0.03, 95 % CI [0.05, 0.17]), and weakest at high loneliness levels (b = 0.09, *SE* = 0.03, 95 % CI [0.04, 0.15]). These results suggest that loneliness moderated the relationship between trait-FoMO and state-FoMO by reducing the strength of this connection at higher loneliness levels. More specifically, when loneliness levels were high, the influence of trait-FoMO on state-FoMO was lower, suggesting that loneliness buffers the relationship between trait-FoMO and state-FoMO, reducing the extent to which trait-FoMO translates into momentary experiences of state-FoMO. Moreover, to illustrate the moderation effect pattern, the relationship between trait-FoMO and state-FoMO was plotted in the value at 1SD above, at the mean, and 1SD below for loneliness (Fig. 3).

4. Discussion

The present study offers new insights into the relationship between trait-FoMO, state-FoMO, and loneliness, and their roles in contributing to the risk of PSMU. More specifically, consistent with prior research (Montag et al., 2023; Yoosefi et al., 2025), trait-FoMO (supporting H_1) and state-FoMO (supporting H_2) were both directly associated with PSMU. Moreover, state-FoMO partially mediated the relationship between trait-FoMO and PSMU (partially supporting H_3). Finally, loneliness moderated the relationship between trait-FoMO and state-FoMO (supporting H_4). A significant association was observed between sex and PSMU severity (females exhibited a greater propensity for PSMU symptoms), but not between age and PSMU severity. This result is consistent with prior studies suggesting increased PSMU risk among females (e.g., Andreassen et al., 2016; Hussain et al., 2024; Yoosefi et al., 2025). This difference should be further explored in future studies because other studies (e.g., see Huang, (2022) for a *meta*-analytic review) have shown mixed results. The mixed findings regarding the association between sex and PSMU severity may stem from variability in measurement tools, cultural and contextual differences, age-related factors, platform-specific use patterns, methodological inconsistencies, and the influence of mediating or moderating variables (e.g., self-esteem, FoMO). Additionally, publication bias and limited cross-cultural research may contribute to inconsistencies across studies.

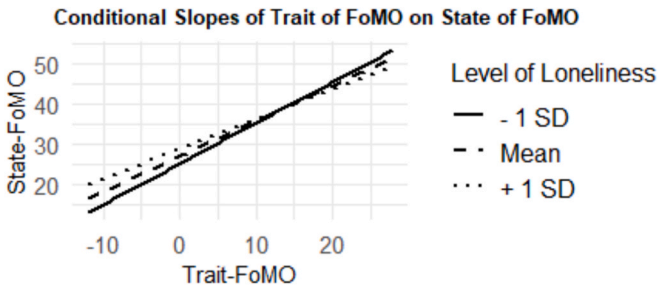

Fig. 3. The conditional effects of loneliness on the relationship between trait-FoMO and state-FoMO.

Results from previous research suggest that females are more inclined than males to spend time on social media for entertainment and gossip (Wu et al., 2024), as well as engaging in parasocial relationships (Li et al., 2025) which may increase the risk of developing PSMU (Su et al., 2020). For some females, these motivations to use social media may be a coping mechanism to alleviate everyday stress. However, such behaviour can result in a vicious cycle, where social media becomes both a coping mechanism and a source of distress, in itself. Moreover, according to the results of a recent study, loneliness had a stronger influence for females (compared to males) on subsequent problematic digital technology use, aligning with research indicating that they may use different coping strategies or rely on digital platforms for emotional support (Zhao et al., 2024). Females may prefer to use social media as a dysfunctional coping strategy to alleviate feelings of loneliness, seeking connection and validation through online interactions. However, this reliance could lead to maladaptive use patterns, further intensifying symptoms of PSMU.

The finding that trait-FoMO was positively associated with PSMU aligns with a growing body of evidence (Alshakhsi et al., 2023; Hussain et al., 2024; Montag et al., 2023; Servidio et al., 2024; Soraci et al., 2025). According to the I-PACE model, trait-FoMO is considered a predisposing factor for the development of PSMU (Wegmann et al., 2017). Individuals with high trait-FoMO often worry about missing out on rewarding experiences or online social interactions that others might be enjoying (Holte, 2023). High trait-FoMO drives individuals to engage in frequent social media use to stay updated and maintain connections (Yoosefi et al., 2025). Over time, this persistent need for reassurance and validation can lead to excessive social media use and consequently the development of PSMU (Soraci et al., 2025).

Similarly, the positive association between trait-FoMO and state-FoMO supports previous findings (e.g., Balta et al., 2020; Yoosefi et al., 2025) and aligns with the theoretical consideration of the I-PACE model. Trait-FoMO, as a chronic sensitivity to missing out, predisposes individuals to greater reactivity in situations that trigger state-FoMO, such as social media use (Montag et al., 2023). This relationship underscores the trait-state continuum, where enduring characteristics influence momentary experiences. Consequently, although social media platforms are often used for recreation, vulnerable individuals with high trait-FoMO may quickly escalate their social media use to problematic levels (Balta et al., 2020; Yoosefi et al., 2025). Additionally, the indirect effect of trait-FoMO on PSMU through state-FoMO is consistent with

previous research (Wegmann et al., 2017; Yoosefi et al., 2025), further supporting the idea that the person component (trait-FoMO) influences the cognitive component (state-FoMO), thereby increasing the risk of PSMU.

Loneliness was positively associated with PSMU, but the finding that loneliness moderated the relationship between trait-FoMO and state-FoMO is particularly noteworthy. More specifically, the indirect effect was stronger when loneliness levels were low, although the moderating effects were significant across low, medium, and high levels of loneliness. These results highlight how different levels of loneliness can influence the trait-state FoMO relationship, consistent with longitudinal findings (Bonfanti et al., 2023). Bonfanti et al. (2023) suggested that individuals experiencing lower levels of loneliness may paradoxically have heightened fears of social exclusion, reflecting unmet needs for social relatedness, a core tenet of the SDT (Ryan & Deci, 2000).

From an SDT perspective, FoMO may be understood as a manifestation of unmet psychological needs, particularly relatedness. More specifically, when loneliness is low, individuals may perceive themselves as being closer to fulfilling their relatedness needs, making the fear of exclusion or missing out on social opportunities more salient and emotionally impactful. This heightened sensitivity could amplify the transition from trait-FoMO to state-FoMO because individuals seek reassurance through immediate social media engagement. Conversely, individuals experiencing high levels of loneliness might face a threshold where feelings of social exclusion are consequently so pervasive that they reduce the motivational drive to engage in compensatory behaviours, such as monitoring social media for inclusion cues. This could explain the weaker association between trait-FoMO and state-FoMO under high-loneliness conditions because these individuals may become detached rather than driven to connect. Overall, loneliness acts as a psychological vulnerability mechanism that exacerbates the dynamics leading to PSMU, making it a significant risk factor, and there are studies that support these findings (e.g., Elhai et al., 2020; Ho, 2021; Reer et al., 2019; Twenge et al., 2019).

Conversely, prolonged isolation may lead to psychological exhaustion (Caplan, 2010), diminishing interest in activities requiring social or emotional engagement. This disengagement may reduce both state-FoMO, related to immediate experiences, and trait-FoMO, representing a more enduring vulnerability (Elhai et al., 2020). Therefore, loneliness appears to act as a 'buffer', modulating the intensity of situational responses and reducing the likelihood that personal vulnerabilities result in problematic behaviours. It may also dampen interest in activities typically associated with immediate gratification (Reer et al., 2019). This phenomenon aligns with prior research showing how social isolation can impact cognitive and emotional functioning, underscoring the role of contextual factors in shaping individual behaviours (Twenge et al., 2019).

4.1. Limitations and future research

While the present study provides valuable insights into the relationships between trait-FoMO, state-FoMO, loneliness as moderator, and PSMU, several limitations should be acknowledged. First, the cross-sectional design limits the ability to infer causal relationships between the studied variables. Although the findings align with the theoretical framework of the I-PACE model and the results of a previous longitudinal study (Bonfanti et al., 2023), additional longitudinal studies are needed to establish causal pathways and explore temporal dynamics in the interplay between trait-FoMO, state-FoMO, loneliness, and PSMU. More specifically, longitudinal studies can differentiate between the stable, enduring (trait) aspects of FoMO and its situational (state) fluctuations, thereby capturing the temporal dynamics that cross-sectional studies are unable to delineate. Moreover, by examining loneliness as a potential moderator, such longitudinal designs could identify how fluctuations in loneliness might influence the impact of both trait and state-FoMO on PSMU over time. Such an approach is crucial for understanding the evolving interplay between these variables and for establishing the existence of robust causal pathways.

Second, the reliance on self-reported data may have introduced response biases, such as social desirability or recall bias, potentially influencing the accuracy of participants' responses. Future research could benefit from incorporating objective behavioural measures, such as the amount of daily time spent on social media platforms, to complement self-reports and provide a more comprehensive understanding of PSMU.

Third, the sample's cultural and demographic characteristics may limit the generalizability of these findings. Cultural norms, social media habits, and attitudes toward loneliness and FoMO could influence the observed relationships. Future research should explore diverse cultural and demographic contexts to validate the present study's findings. Additionally, while loneliness was identified as a moderator in the relationship between trait-FoMO and state-FoMO, the study did not differentiate between various types or dimensions of loneliness (e.g., social versus emotional loneliness). Future research could investigate how specific forms of loneliness uniquely interact with the different dimensions of FoMO and PSMU.

Finally, the study primarily focused on the role of FoMO and loneliness in PSMU, but other individual and contextual factors, such as personality traits, coping styles, or offline social support, may also play important roles. Future research could explore these additional variables with PSMU to provide a more nuanced understanding of its development and maintenance.

5. Conclusion

The findings of the present study suggest that personality traits such as trait-FoMO may be a risk factor for the problematic use of social media applications. In addition, state-FoMO, which is related to the fear of missing out on online experiences, might increase the probability of PSMU. These results emphasize the interplay between stable personality traits and situational cognitive responses in driving problematic behaviours.

Additionally, loneliness was both a risk variable of state-FoMO and a moderator in the relationship between trait-FoMO and state-FoMO. This finding underscores the complex role of loneliness, suggesting that its varying levels can either exacerbate or inhibit the effects of FoMO on situational experiences. Importantly, the study highlights how context and individual differences jointly shape vulnerability to problematic social media use. Overall, the study contributes to a growing body of evidence regarding the psychological mechanisms associated with PSMU and underscores the importance of addressing both trait-level vulnerabilities and situational triggers in prevention and intervention efforts.

Author Agreement

All authors have seen and approved the final version of the manuscript. The paper is original, and it is not under consideration for publication elsewhere.

Compliance with Ethical Standards

Informed consent was obtained from all participants included in the study.

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CRediT authorship contribution statement

Rocco Servidio: Writing – original draft, Methodology, Formal analysis, Conceptualization. **Francesco Craig:** Writing – original draft. **Paolo Soraci:** Writing – original draft, Methodology, Conceptualization. **Stefano Boca:** Formal analysis, Data curation. **Renato Pisanti:** Writing – original draft. **Zsolt Demetrovics:** Writing – review & editing, Supervision. **Mark D. Griffiths:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

References

Aiken, L. S., West, S. G., & Reno, R. R. (2010). *Multiple regression: Testing and interpreting interactions* (Reprinted). *SAGE*.

Alshakhsi, S., Babiker, A., Montag, C., & Ali, R. (2023). On the association between personality, fear of missing out (FoMO) and problematic social media use tendencies in European and Arabian samples. *Acta Psychologica, 240*, Article 104026. https://doi.org/10.1016/j.actpsy.2023.104026

Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors, 30*(2), 252–262. https://doi.org/10.1037/adb0000160

Balta, S., Emirtekin, E., Kircaburun, K., & Griffiths, M. D. (2020). Neuroticism, trait fear of missing out, and phubbing: The mediating role of state fear of missing out and problematic Instagram use. *International Journal of Mental Health and Addiction, 18*(3), 628–639. https://doi.org/10.1007/s11469-018-9959-8

Bonfanti, R. C., Salerno, L., Ruggieri, S., & Lo Coco, G. (2023). Interplay between fear of missing out and loneliness: A three-wave panel study during the COVID-19 pandemic. *Cyberpsychology, Behavior, and Social Networking, 26*(6), 447–452. https://doi.org/10.1089/cyber.2022.0182

Bottaro, R., Valenti, G. D., & Faraci, P. (2023). Assessment of an epidemic urgency: Psychometric evidence for the UCLA loneliness scale. *Psychology Research and Behavior Management, 16*, 2843–2855. https://doi.org/10.2147/PRBM.S406523

Brand, M., Wegmann, E., Stark, R., Müller, A., Wölfling, K., Robbins, T. W., & Potenza, M. N. (2019). The Interaction of Person-Affect-Cognition-Execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond internet-use disorders, and specification of the process character of addictive behaviors. *Neuroscience & Biobehavioral Reviews, 104*, 1–10. https://doi.org/10.1016/j.neubiorev.2019.06.032

Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience & Biobehavioral Reviews, 71*, 252–266. https://doi.org/10.1016/j.neubiorev.2016.08.033

Casale, S., & Fioravanti, G. (2020). Factor structure and psychometric properties of the Italian version of the fear of missing out scale in emerging adults and adolescents. *Addictive Behaviors, 102*, Article 106179. https://doi.org/10.1016/j.addbeh.2019.106179

Caplan, S. E. (2010). Theory and measurement of generalized problematic internet use: A two-step approach. *Computers in Human Behavior, 26*(5), 1089–1097. https://doi.org/10.1016/j.chb.2010.03.012

Dou, F., Li, Q., Li, X., Li, Q., & Wang, M. (2023). Impact of perceived social support on fear of missing out (FoMO): A moderated mediation model. *Current Psychology, 42*(1), 63–72. https://doi.org/10.1007/s12144-021-01404-4

Elhai, J. D., Yang, H., Fang, J., Bai, X., & Hall, B. J. (2020). Depression and anxiety symptoms are related to problematic smartphone use severity in Chinese young adults: Fear of missing out as a mediator. *Addictive Behaviors, 101*, Article 105962. https://doi.org/10.1016/j.addbeh.2019.04.020

Field, A., & Iles, J. (2016). *An adventure in statistics: The reality enigma*. SAGE.

Gori, A., Topino, E., Gioia, F., & Casale, S. (2024). Problematic social media use in young adults: A mixed serial–parallel mediation model involving alexithymia, defense mechanisms, and fear of missing out. *Cyberpsychology, Behavior, and Social Networking, 27*(5), 340–346. https://doi.org/10.1089/cyber.2023.0386

Gori, A., Topino, E., & Griffiths, M. D. (2023). The associations between attachment, self-esteem, fear of missing out, daily time expenditure, and problematic social media use: A path analysis model. *Addictive Behaviors, 141*, Article 107633. https://doi.org/10.1016/j.addbeh.2023.107633

Griffiths, M. D. (2022). Disorders due to addictive behaviors: Further issues, debates, and controversies: Commentary to the debate: "Behavioral addictions in the ICD-11". *Journal of Behavioral Addictions, 11*(2), 180–185. https://doi.org/10.1556/2006.2022.00025

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine, 40*(2), 218–227. https://doi.org/10.1007/s12160-010-9210-8

He, Q., Turel, O., & Bechara, A. (2017). Brain anatomy alterations associated with Social Networking Site (SNS) addiction. *Scientific Reports, 7*(1), 45064. https://doi.org/10.1038/srep45064

Ho, T. T. Q. (2021). Facebook addiction and depression: Loneliness as a moderator and poor sleep quality as a mediator. *Telematics and Informatics, 61*, Article 101617. https://doi.org/10.1016/j.tele.2021.101617

Holte, A. J. (2023). The State Fear of Missing Out Inventory: Development and validation. *Telematics and Informatics Reports, 10*, Article 100055. https://doi.org/10.1016/j.teler.2023.100055

Huang, C. (2022). A meta-analysis of the problematic social media use and mental health. *International Journal of Social Psychiatry, 68*(1), 12–33. https://doi.org/10.1177/0020764020978434

Hussain, Z., Elhai, J. D., Montag, C., Wegmann, E., & Rozgonjuk, D. (2024). The role of trait and state fear of missing out on problematic social networking site use and problematic smartphone use severity. *Emerging Trends in Drugs, Addictions, and Health, 4*, Article 100140. https://doi.org/10.1016/j.etdah.2023.100140

Hutten, E., Jongen, E. M. M., Verboon, P., Bos, A. E. R., Smeekens, S., & Cillessen, A. H. N. (2021). Trajectories of loneliness and psychosocial functioning. *Frontiers in Psychology, 12*, Article 689913. https://doi.org/10.3389/fpsyg.2021.689913

International Test Commission (2017). *The ITC guidelines for translating and adapting tests (Second ed.)*. https://www.intestcom.org/files/guideline_test_adaptation_2ed.pdf.

Kuss, D., & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International Journal of Environmental Research and Public Health, 14*(3), 311. https://doi.org/10.3390/ijerph14030311

Li, Q., Chen, T., Zhang, S., Gu, C., & Zhou, Z. (2025). The mediating role of intentional self-regulation in the constructive and pathological compensation processes of problematic social networking use. *Addictive Behaviors, 160*, Article 108188. https://doi.org/10.1016/j.addbeh.2024.108188

Malik, L., Shahnawaz, M. G., Rehman, U., Pragyendu, Uniyal, R., & Griffiths, M. D. (2024). Mediating roles of fear of missing out and boredom proneness on psychological distress and social media addiction among Indian adolescents, *9*, 224-234. *Journal of Technology in Behavioral Science*. Advance online publication. doi: 10.1007/s41347-023-00323-4.

Meynadier, J., Malouff, J. M., Schutte, N. S., Loi, N. M., & Griffiths, M. D. (2025). Relationships between social media addiction, social media use metacognitions, depression, anxiety, fear of missing out, loneliness, and mindfulness. *International Journal of Mental Health and Addiction. Advance Online Publication*. https://doi.org/10.1007/s11469-024-01440-8

Monacis, L., de Palo, V., Griffiths, M. D., & Sinatra, M. (2017). Social networking addiction, attachment style, and validation of the Italian version of the Bergen Social Media Addiction Scale. *Journal of Behavioral Addictions, 6*(2), 178–186. https://doi.org/10.1556/2006.6.2017.023

Montag, C., Demetrovics, Z., Elhai, J. D., Grant, D., Koning, I., Rumpf, H.-J., Spada, M., Throuvala, M., & Van Den Eijnden, R. (2024). Problematic social media use in childhood and adolescence. *Addictive Behaviors, 153*, Article 107980. https://doi.org/10.1016/j.addbeh.2024.107980

Montag, C., Müller, M., Pontes, H. M., & Elhai, J. D. (2023). On fear of missing out, social networks use disorder tendencies and meaning in life. *BMC Psychology, 11*(1), 358. https://doi.org/10.1186/s40359-023-01342-9

Moretta, T., Buodo, G., Demetrovics, Z., & Potenza, M. N. (2022). Tracing 20 years of research on problematic use of the internet and social media: Theoretical models, assessment tools, and an agenda for future work. *Comprehensive Psychiatry, 112*, Article 152286. https://doi.org/10.1016/j.comppsych.2021.152286

Posit Team (2024). *RStudio: Integrated Development Environment for R*. Posit Software, PBC. http://www.posit.co/.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Przybylski, A. K., Murayama, K., DeHaan, C. R., & Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior, 29*(4), 1841–1848. https://doi.org/10.1016/j.chb.2013.02.014

Rajesh, T., & Rangaiah, D. B. (2020). Facebook addiction and personality. *Heliyon, 6*(1), Article e03184. https://doi.org/10.1016/j.heliyon.2020.e03184

Reer, F., Tang, W. Y., & Quandt, T. (2019). Psychosocial well-being and social media engagement: The mediating roles of social comparison orientation and fear of missing out. *New Media & Society, 21*(7), 1486–1505. https://doi.org/10.1177/1461444818823719

Rosseel, Y. (2012). lavaan: An *R* package for structural equation modeling. *Journal of Statistical Software, 48*(2). https://doi.org/10.18637/jss.v048.i02

Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment, 66*(1), 20–40. https://doi.org/10.1207/s15327752jpa6601_2

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Servidio, R., Koronczai, B., Griffiths, M. D., & Demetrovics, Z. (2022). Problematic smartphone use and problematic social media use: The predictive role of self-construal and the mediating effect of fear of missing out. *Frontiers in Public Health, 10*, Article 814468. https://doi.org/10.3389/fpubh.2022.814468

Servidio, R., Soraci, P., Griffiths, M. D., Boca, S., & Demetrovics, Z. (2024). Fear of missing out and problematic social media use: A serial mediation model of social comparison and self-esteem. *Addictive Behaviors Reports, 19*, Article 100536. https://doi.org/10.1016/j.abrep.2024.100536

Soraci, P., Demetrovics, Z., Bevan, N., Pisanti, R., Servidio, R., Di Bernardo, C., Chini, E., & Griffiths, M. D. (2025). FoMO and psychological distress mediate the relationship between life satisfaction, problematic smartphone use, and problematic social media use. *International Journal of Mental Health and Addiction. Advance online publication.*. https://doi.org/10.1007/s11469-024-01432-8

Su, W., Han, X., Yu, H., Wu, Y., & Potenza, M. N. (2020). Do men become addicted to internet gaming and women to social media? A meta-analysis examining gender-related differences in specific internet addiction. *Computers in Human Behavior, 113*, Article 106480. https://doi.org/10.1016/j.chb.2020.106480

Svicher, A., Fioravanti, G., & Casale, S. (2021). Identifying the central symptoms of problematic social networking sites use through network analysis. *Journal of Behavioral Addictions, 10*(3), 767–778. https://doi.org/10.1556/2006.2021.00053

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). mediation: *R* package for causal mediation analysis. *Journal of Statistical Software, 59*(5), 1–38. https://doi.org/10.18637/jss.v059.i05

Twenge, J. M., Martin, G. N., & Spitzberg, B. H. (2019). Trends in U.S. adolescents' media use, 1976–2016: The rise of digital media, the decline of TV, and the (near) demise of print. *Psychology of Popular Media Culture, 8*(4), 329–345. https://doi.org/10.1037/ppm0000203

We Are Social (2024). *Digital 2024*. https://indd.adobe.com/view/8892459e-f0f4-4cfd-bf47-f5da5728a5b5?allowFullscreen=true.

Wegmann, E., & Brand, M. (2019). A narrative overview about psychosocial characteristics as risk factors of a problematic social networks use. *Current Addiction Reports, 6*(4), 402–409. https://doi.org/10.1007/s40429-019-00286-8

Wegmann, E., Oberst, U., Stodt, B., & Brand, M. (2017). Online-specific fear of missing out and Internet-use expectancies contribute to symptoms of internet-communication disorder. *Addictive Behaviors Reports, 5*, 33–42. https://doi.org/10.1016/j.abrep.2017.04.001

Wu, W., Huang, L., & Yang, F. (2024). Social anxiety and problematic social media use: A systematic review and meta-analysis. *Addictive Behaviors, 153*, Article 107995. https://doi.org/10.1016/j.addbeh.2024.107995

Yin, Y., Cai, X., Ouyang, M., Li, S., Li, X., & Wang, P. (2023). FoMO and the brain: Loneliness and problematic social networking site use mediate the association between the topology of the resting-state EEG brain network and fear of missing out. *Computers in Human Behavior, 141*, Article 107624. https://doi.org/10.1016/j.chb.2022.107624

Yoosefi, A., Shakiba, S., Hassanabadi, H., Dolatshahi, B., Griffiths, M. D., Izanloo, B., & Maleki, F. (2025). Psychological distress, interpersonal sensitivity, and trait-FoMO with problematic use of social media: The mediating roles of boredom and state-FoMO. *International Journal of Mental Health and Addiction. Advance online publication.*. https://doi.org/10.1007/s11469-024-01418-6

Zhao, C., Ding, H., Du, M., Yu, Y., Chen, J. H., Wu, A.-M.-S., Wang, D. B., Du, M., Chen, Y., Luo, Q., Yin, X., Chen, B., Lu, P., Lau, J. T. F., & Zhang, G. (2024). The vicious cycle between loneliness and problematic smartphone use among adolescents: A random intercept cross-lagged panel model. *Journal of Youth and Adolescence, 53*(6), 1428–1440. https://doi.org/10.1007/s10964-024-01974-z