

Problematic Social Media Use and Suicidal Behavior in Early Adolescence: Beyond Screen Time

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Abstract

The primary aim of this study was to examine the relationships that problematic social media use (PSMU) and time spent on social media have with suicidal ideation, suicide attempt, and suicidal cognitions in early adolescence. The sample included 657 adolescents ($M_{age} = 12.7$, $SD = 0.7$; 49.2% female, 49.5% male, 1.2% non-binary) who, at the time of the study, were enrolled in year one of compulsory secondary education in Spain. The associations between PSMU and time spent on social media and suicidal ideation and suicide attempts were examined using logistic regression models. Polynomial regression with response surface analysis was used to explore the relationship between PSMU, time spent on social media, and suicide cognitions. Higher levels of PSMU were significantly associated with both suicidal ideation and suicide attempts. The relationship between time spent on social media and these two variables, while positive, was not statistically significant. Surface analysis indicated that the risk of suicide cognitions is higher when PSMU is high, irrespective of time spent daily on social media. These findings underscore the importance of focusing on young people's social media experiences and engagement through these platforms rather than simply the amount of time they spend each day. Universal prevention programs are needed to teach young people strategies for healthy use of social media. These programs should also provide parents with evidence-based guidelines that can help them manage their child's use of these platforms.

Keywords: suicide; youth suicide; suicide prevention; problematic social media use; social media.

Uso problemático de redes sociales y conducta suicida en la adolescencia temprana: Más allá del tiempo de pantalla

Resumen

El objetivo principal de este estudio fue examinar la relación entre el uso problemático de las redes sociales (PSMU) y el tiempo promedio de uso diario de redes sociales (DSMU) con la ideación suicida, los intentos de suicidio y las cogniciones suicidas en la adolescencia temprana. La muestra estuvo compuesta por 657 adolescentes ($M_{edad} = 12,7$ años; $DT = 0,7$; 49,2% chicas, 49,5% chicos y 1,2% no binario) que cursaban 1º de Educación Secundaria Obligatoria en España. Las asociaciones entre el PSMU, el DSMU, la ideación suicida y el intento de suicidio se analizaron mediante modelos de regresión logística. Para explorar la relación entre el PSMU, el DSMU y las creencias suicidas se utilizó la regresión polinómica con análisis de superficie de respuesta. Se encontró una relación estadísticamente significativa entre el PSMU y la ideación suicida, así como con las tentativas de suicidio, mientras que el DSMU no mostró una asociación estadísticamente significativa con estas variables. El análisis de superficie indicó que niveles más elevados de creencias suicidas se asociaron con mayores niveles de PSMU, con independencia del DSMU. Estos hallazgos subrayan la importancia de centrarse en la forma en que los jóvenes se relacionan con las redes sociales y en la calidad de su experiencia en estas plataformas, más que únicamente en la cantidad de tiempo que pasan utilizándolas. Se recomienda implementar programas preventivos universales para educar a los adolescentes en el uso saludable de las redes sociales, integrando también a los padres mediante pautas claras y basadas en la evidencia para supervisar y gestionar el uso de estas plataformas.

Palabras clave: suicidio; adolescencia; prevención del suicidio; uso problemático de las redes sociales; redes sociales.

Suicide is a major public health concern worldwide and represents the fourth leading cause of death among individuals aged 15–29 years (World Health Organization [WHO], 2021). In Spain, recent national data suggest a growing burden of suicidal behavior in the general population. A nationwide registry-based study reported more than 23,000 suicide deaths and over 73,000 hospitalizations due to non-fatal intentional self-harm between 2018 and 2023. While suicide mortality showed a modest increase during this period, hospitalizations for self-harm increased substantially, particularly among women (López-Cuadrado et al., 2025).

Although these figures refer to the general population, adolescence, defined as the period between 10 and 19 years of age (World Health Organization, 2025), represents a particularly sensitive developmental stage for the emergence of suicidal thoughts and behaviors. Although suicide is relatively rare in childhood, rates increase from puberty through early adulthood. Meta-analytic studies estimate a pooled suicide rate of approximately 3.8 per 100,000 individuals among youth aged 10–19 years across countries, sexes, and age groups (Glenn et al., 2020).

Epidemiological studies indicate that suicidal ideation affects a substantial proportion of adolescents worldwide. For example, a large U.S. national survey estimated a lifetime prevalence of suicidal ideation of 12.1% and suicide attempts of 4.1% among adolescents (Nock et al., 2013). Similarly, a large meta-analysis including more than 680,000 children and adolescents reported a global lifetime prevalence of suicidal ideation of approximately 18% and suicide attempts of around 6% (Lim et al., 2019). These behaviors represent important indicators of psychological vulnerability and constitute major risk factors for future suicidal behavior. Importantly, suicidal behavior occurs in all societies and affects both sexes, although consistent gender differences have been observed. Girls tend to report higher rates of suicidal ideation, suicide planning, and suicide attempts, whereas suicide mortality is substantially higher among boys, often between three and four times greater (Miranda-Mendizabal et al., 2019). Although comparisons of adolescent suicide mortality rates across countries must be interpreted with caution due to potential misclassification or underreporting, recent epidemiological studies indicate heterogeneous trends across regions. In many Southern European countries, suicide mortality among adolescents has declined over recent decades (Bertuccio et al., 2024). However, this pattern contrasts with increases observed in countries such as the United Kingdom, Ireland, Portugal, and several nations in Central and Eastern Europe. Similarly, rising suicide rates have been reported in the United States, large parts of Central America and Latin America, Oceania, Japan, and other regions of Asia (Bertuccio et al., 2024).

Particularly concerning are the increases observed in some high-income countries with well-established suicide prevention policies. For example, in the United Kingdom suicide mortality has increased annually by approximately 2.5% among men since 2005 and by 8.5% among women since 2012. Similarly, in the United States suicide rates increased annually by 3.8% among males between 2009 and 2020 and by 6.7% among females between 2007 and 2017, followed by a period of stabilization (Bertuccio et al., 2024). These trends have occurred alongside

a broader rise in mental health problems, suicidal ideation, and suicidal behaviors among adolescents (Brent, 2023).

Among the multiple factors proposed to explain the increase in suicidal behaviors during adolescence, increasing attention has been directed toward the potential impact of digital environments, particularly the excessive and problematic use of social media and the Internet (Brent, 2023).

Social Media Use and Suicidal Behavior

Social media can be broadly defined as “Internet-based channels that allow users to opportunistically interact and selectively self-present, either in real time or asynchronously, with both broad and narrow audiences who derive value from user-generated content and the perception of interaction with others” (Young et al., 2024). Social media platforms have become an integral part of adolescents’ daily lives (Kids Online Health and Safety Task Force, 2024). While these platforms provide opportunities for communication, social support, and identity development, growing evidence suggests that certain patterns of engagement may also be associated with negative mental health outcomes (Boer et al., 2021; Espada et al., 2024; Varona et al., 2024).

A distinction is often made between daily social media use (DSMU)—typically measured as the amount of time spent on social media—and problematic social media use (PSMU), which refers to maladaptive patterns of engagement characterized by diminished control over use, excessive preoccupation with online interactions, and continued use despite negative consequences (Machimbarrena et al., 2023). Numerous cross-sectional and longitudinal studies (Mojtabai, 2024; Montag et al., 2024) have demonstrated a close association between the frequent and problematic use of social media and mental health problems among adolescents. Specifically, young people who engage in excessive and problematic use of social media are more likely to present both internalizing (Boer et al., 2021; Riehm et al., 2019) and externalizing behavior problems (Boer et al., 2020; Thorell et al., 2024), as well as poorer school grades and lower life satisfaction (Van den Eijnden et al., 2018). A relationship has also been identified between excessive social media use and negative experiences such as bullying, victimization at school, cyberbullying, and persistent feelings of sadness and hopelessness (Young et al., 2024). Although some empirical studies suggest that girls may be more vulnerable to the psychological effects of social media due to higher levels of rumination and social comparison processes (Nesi & Prinstein, 2015; Underwood & Ehrenreich, 2017), findings in the literature are not entirely consistent. For example, Boer et al. (2021) found that the longitudinal associations between problematic social media use and mental health outcomes were similar for boys and girls.

Importantly, emerging research suggests that problematic social media use may also be associated with suicidal ideation and suicidal behaviors among adolescents (Macrynika et al., 2021; Young et al., 2024). From a theoretical perspective, several psychological mechanisms may help to explain this association. Problematic patterns of engagement have been conceptualized as reflecting difficulties in self-regulation and impaired behavioral control (Montag et al., 2021, 2024). These patterns are often linked to maladaptive emotion regulation

strategies, impulsivity, rumination, and cognitive preoccupation (Hormes et al., 2014; Lannin et al., 2025; Varona et al., 2024)—processes that have been consistently associated with heightened suicide risk (García-Ormaza et al., 2025; Tabares et al., 2025). In addition, specific features of social media environments may increase adolescents' exposure to suicide-relevant stressors, including social comparison, cyberbullying, and suicide-related content (Kircaburun et al., 2019; Shannon et al., 2025; Sinyor et al., 2021).

Suicide Cognitions as a Vulnerability Factor

Beyond suicidal ideation and suicidal behavior as suicide-related outcomes, an additional and conceptually distinct level of suicide-related vulnerability concerns underlying cognitive processes. Within the framework of fluid vulnerability theory (FVT), suicide risk is conceptualized as the dynamic interplay between relatively stable baseline vulnerability and time-limited acute suicidal states (Rudd, 2006). Central to this model are suicide cognitions, understood as a maladaptive belief system composed of enduring suicide-related beliefs and schemas that lower the threshold for the activation of acute suicidal episodes. Importantly, suicide cognitions are conceptually and empirically distinct from suicidal ideation as a state marker and may be present even in the absence of current or past suicidal thoughts or behaviors (Bryan et al., 2022). During adolescence, this form of cognitive vulnerability has been shown to be associated with both suicidal ideation and an increased risk of suicidal behavior (Muela et al., 2024; Tabares et al., 2025).

Although a growing body of research has examined associations between social media use and suicide-related outcomes such as suicidal ideation and behavior, prior studies have not examined social media use in relation to suicide-related cognitive vulnerability as conceptualized within FVT, particularly in community samples of early adolescents. Moreover, relatively few studies have simultaneously examined daily social media use (DSMU) and problematic social media use (PSMU) in relation to suicide-related outcomes. Distinguishing between these two dimensions of social media engagement may provide a more nuanced understanding of how different patterns of use relate to suicide vulnerability during early adolescence.

The Present Study

Early adolescence represents a particularly sensitive developmental period characterized by important cognitive, emotional, and social changes (Aliri et al., 2019; Schriber & Guyer, 2016). In the Spanish educational system, year one of compulsory secondary education (1° ESO) typically corresponds to the beginning of this developmental stage and coincides with a major school transition, from primary to secondary education, which may involve important changes in peer relationships, school environment, and digital media use. Although most social media platforms formally restrict access to users aged 13 years and older, younger adolescents frequently use these platforms. Recent estimates indicate that approximately 95% of adolescents and 40% of children aged 8–12 years report using some form of social media (Kids Online Health and Safety Task Force, 2024). In Spain, the average age of acquisition of the first personal smartphone is estimated to be around 10–11 years, indicating that many children are exposed to digital

environments well before the age at which most platforms formally allow access (Espada et al., 2024). This early exposure coincides with the developmental period in which suicidal ideation, suicidal behaviors, and non-suicidal self-harm may begin to emerge (Muela et al., 2024).

Despite growing interest in the relationship between social media use and adolescent mental health, important questions remain regarding how different patterns of social media engagement relate to suicide-related outcomes during early adolescence. In particular, previous research has often examined daily social media use (DSMU)—typically operationalized as time spent on social media—or problematic social media use (PSMU) separately. However, these two dimensions capture different aspects of engagement. DSMU reflects the overall level of exposure to social networking platforms, whereas PSMU reflects maladaptive patterns of engagement characterized by diminished control over use, cognitive preoccupation, and continued use despite negative consequences (Machimbarrena et al., 2023; Montag et al., 2021, 2024).

Distinguishing between these dimensions may provide a more nuanced understanding of how social media engagement relates to suicide-related vulnerability. In addition to suicidal ideation and suicide attempts, suicide-related cognitive vulnerability represents an important outcome. Within the framework of fluid vulnerability theory (FVT), suicide risk is conceptualized as the interaction between stable vulnerability factors and acute suicidal states (Rudd, 2006). Central to this model are suicide cognitions, understood as maladaptive belief systems that may lower the threshold for the emergence of suicidal crises and may be present even in the absence of current suicidal ideation (Bryan et al., 2022).

To examine how different patterns of social media engagement relate to suicide-related outcomes, the present study employed response surface analysis (RSA). Unlike traditional regression models, which estimate independent associations between variables and outcomes, RSA allows the examination of how different combinations of two variables jointly relate to an outcome variable. In this study, RSA was used to examine how congruent and incongruent combinations of PSMU and DSMU are associated with suicide cognitions.

The aims of this study were:

1. To examine the associations between problematic social media use (PSMU) and daily social media use (DSMU) and three suicide-related outcomes: suicidal ideation, suicide attempts, and suicide cognitions.
2. To examine how different configurations of PSMU and DSMU are associated with suicide cognitions using response surface analysis.

The study hypotheses were as follows:

H1. Higher levels of PSMU and DSMU will be associated with higher levels of suicidal ideation, suicide attempts, and suicide cognitions.

H2. Along the line of congruence ($PSMU = DSMU$), higher levels of both variables will be associated with higher levels of suicide cognitions.

H3. Along the line of incongruence ($PSMU \neq DSMU$):

- H3a. Suicide cognitions will be higher when PSMU exceeds DSMU (high PSMU combined with relatively low DSMU).
- H3b. Suicide cognitions will be lower when DSMU exceeds PSMU (high DSMU combined with relatively low PSMU).

Method

Participants

A total of 791 students were invited to participate in the study. The final sample was comprised of 657 adolescents aged between 12 and 15 years ($M = 12.7$, $SD = 0.7$; 49.2% female, 49.5% male, 1.2% non-binary) who at the time of the study were enrolled in year 1 of compulsory secondary education. Participants were recruited using a convenience sampling approach from 12 schools in the Basque Country (northern Spain) that agreed to participate in the study. To ensure representation of different educational contexts, participating schools were selected considering the Educational Complexity Index (ICE) developed by the Basque Government Department of Education. This index incorporates several contextual indicators, including socioeconomic characteristics, percentage of students receiving financial support, proportion of students of foreign origin, and other educational variables. The participating schools represented different levels of educational complexity. According to information provided by the schools, the majority of students were of Spanish nationality.

Instruments

Suicidal Ideation

Suicidal ideation was assessed using two items from the self-report version of the Self-Injurious Thoughts and Behaviors Interview-Revised (SITBI-R; Fox et al., 2020). The first item (yes or no response options) asked "Have you ever had thoughts of killing yourself". Those who answered yes to this question were then asked "When did you most recently have thoughts of killing yourself", with the following response options: "more than one year ago", "within the past year", "within the past 6 months", and "within the past month". For the purposes of the analyses, suicidal ideation was coded as a binary lifetime variable indicating the presence (1) or absence (0) of suicidal thoughts. No composite or summed score was computed. The SITBI-R has shown good reliability and validity for the assessment of suicidal thoughts and behaviors in adolescent population (Fox et al., 2020).

Suicide Attempt

Suicide attempt was assessed using three items from the self-report version of the Self-Injurious Thoughts and Behaviors Interview-Revised (SITBI-R; Fox et al., 2020). The first item (yes or no response options) asked "Have you ever tried to kill yourself? In other words, have you ever purposefully hurt yourself with some intent to die?". Those who answered yes to this question were then asked to respond to a further two items. First, "When was the most recent time that you tried to kill yourself: "more than one year ago", "within the past year", "within the past 6 months", and "within the past month". And second, "What method(s) did you use?". For the purposes of the analyses, suicide attempts were coded as a binary lifetime variable indicating the presence (1) or absence (0) of suicide attempts.

Suicide Cognitions

This was assessed using the Spanish version of the Suicide Cognitions Scale-Revised (SCS-R; Muela et al., 2024), a

16-item self-report questionnaire designed to measure a range of beliefs, attitudes, expectations, and perceptions associated with the emergence of suicidal thoughts and behaviors (e.g., "Nothing can help solve my problems"). Respondents indicate on a 5-point Likert-type scale the degree to which they agree or disagree with each item statement (range 0, *strongly disagree* to 4, *strongly agree*). Item responses are summed to provide an overall metric of the suicidal belief system, with higher scores indicating increased vulnerability to suicidal thoughts and behaviors. In the present sample, internal consistency of scale scores was .94 (Cronbach's alpha).

Intensity of Social Media Use

This variable was measured using a single item: "Think about what you do on a normal day. How much time do you spend on social media (TikTok, Instagram, BeReal, etc.)?". Response categories were: "0 = No use", "1 = Less than 30 min", "2 = 30 min to 1 h", "3 = 1–2 h", "4 = 2–3 h", and "5 = More than 3 h".

Problematic Social Media Use

Problematic social media use was measured using the Problematic Social Networking Site Use Scale (PSNUS; Machimbarrena et al., 2023). This instrument assesses key aspects of dysregulated social media engagement: diminished control over usage, preference for social interaction through social media rather than face-to-face encounters, cognitive preoccupation, mood regulation through online engagement, and resulting negative consequences. The 15-item scale uses a six-point Likert-type format (0 = "strongly disagree" to 5 = "strongly agree"). The composite score derived from these responses provides a comprehensive assessment of problematic use of social media with higher scores indicating greater difficulty in maintaining healthy boundaries with social networking platforms. The scale demonstrated excellent internal consistency ($\alpha = .93$) in the current sample.

Owning a Smartphone and Age of Acquisition

Smartphone ownership was assessed using a single item asking participants to indicate whether they owned a smartphone, and if so, to specify how old they were when they first acquired one. Response options for those who answered yes were: "1 = Yes, I was younger than 10", "2 = Yes, I was 10", "3 = Yes, I was 11", "4 = Yes, I was 12", and "5 = Yes, I was 13 or older". This variable was included for descriptive purposes in order to characterize participants' digital context and their level of early exposure to smartphones, which has been identified as an increasingly common feature of contemporary adolescent digital environments.

Procedure

We first contacted the schools to explain the purposes of the study, request their collaboration, and obtain approval to recruit students. Subsequently, a letter was sent to the students' parents explaining the nature of the research and inviting them to grant permission for their child to participate in the study. In addition to obtaining informed consent from the parents or legal guardians of all participating minors, assent was also obtained from the students themselves prior to any data collection.

The questionnaires were administered at each participant's school during normal attendance hours. Each student completed the questionnaire using an identification code assigned by the school. This procedure ensured that responses were confidential for the research team, as researchers had no access to students' personal identifying information and had no direct contact with the participants. Students were informed prior to completing the questionnaire that their responses would be treated confidentially; however, if responses indicated potential suicide risk, the corresponding identification code could be communicated to the school so that appropriate school professionals could identify the student and activate the relevant support procedures in accordance with the school's suicide prevention protocol. In the event that current suicidal thoughts with plan or intent, or recent suicidal behavior (within the past month), were detected during the assessment, the participant's parents or legal guardians were informed to ensure that an adult was aware of the risk and could take steps to safeguard the young person's well-being.

During and after the administration of the instruments, school staff responsible for students' emotional well-being (e.g., typically a school psychologist) were available to respond to any distress or emotional needs that might arise. All these safety measures (i.e., access to psychological support for the student and feedback to parents about any identified risks) were communicated to parents or legal guardians during the initial contact prior to study enrollment and again before administering the instruments. Previous research indicates that assessing suicidal thoughts and behaviors in adolescents through survey-based research does not produce iatrogenic effects, supporting the feasibility and safety of this type of assessment in youth populations (McGuire et al., 2026).

The study was approved by the Ethics Committee for Research on Human Beings of the University of the Basque Country (approval code: act 004/2024).

Data Analysis

Prior to the main analyses, patterns of missing data were examined. The proportion of missing values ranged from 0% for age to 35.8% for problematic social media use. A statistical test of missing completely at random (MCAR) indicated that the data were not MCAR ($p < .001$). Given this pattern, analyses were conducted using available data for each model.

We began by performing descriptive and correlational analyses to explore the characteristics of variables and the initial level of relationships between them. Next, the impact of PSMU and DSMU on suicidal ideation and suicide attempt was examined using logistic regression models. Finally, we examined the association between PSMU and DSMU and suicide cognitions using polynomial regression with response surface analysis (RSA). RSA is an analytical approach that allows the examination of how different combinations of two variables relate to an outcome variable (Edwards, 2002). In contrast to traditional regression models that estimate independent additive associations, RSA makes it possible to evaluate whether congruent configurations (i.e., similar levels of PSMU and DSMU) or incongruent configurations (i.e., one variable higher than the other) are associated with different levels of the outcome. This approach therefore allows a more nuanced examination of how problematic patterns of social media engagement and overall exposure time jointly relate to suicide cognitions. To facilitate interpretation of the quadratic model, a three-dimensional response surface plot was generated to visualize the relationship between PSMU, DSMU, and suicide cognitions.

A sensitivity power analysis was conducted for the quadratic RSA model ($u = 5$ predictors, $\alpha = .05$). Given the effective sample size ($v = 340$), the observed effect size ($R^2 = .25$; $f^2 = .33$) corresponded to statistical power ≈ 1.00 . In addition, the minimum detectable effect with 80% power was $R^2 = .036$, indicating that the study had sufficient sensitivity to detect small effects.

All analyses were conducted using R (version 4.4.2; R Core Team, 2024). Missing data patterns were examined using the *MissMech* package (Jamshidian et al., 2014). Polynomial regression and response surface visualization were performed using base R functions together with the *car* (Fox & Weisberg, 2019) and *rgl* (Adler et al., 2023) packages.

Results

Descriptive Statistics and Correlation Analysis of Variables

Suicide ideation was reported by 11.9% of the total sample (88.5% in the past year). The proportion of girls reporting suicide thoughts was higher (13.6%) than among boys (9.9%), although the difference was not statistically significant (Pearson $\chi^2(1) = 2.26$; $p = .132$; Cramer's $V = 0.06$). A suicide attempt was reported by 4.1% of participants, more commonly by girls

Table 1. Descriptive statistics for the study variables

Variable	Total (<i>n</i> = 657)	Girls (<i>n</i> = 323)	Boys (<i>n</i> = 325)	Non-binary (<i>n</i> = 8)
Suicide ideation (%)	11.9	13.6	9.9	25
Suicide attempt (%)	4.1	5.3	2.8	12.5
Suicide cognitions (mean score, SD)	10.95 (12.82)	12.28 (13.46)	9.34 (11.56)	26.25 (28.69)
Problematic social media use (mean score, SD)	10.78 (12.79)	10.36 (12.39)	10.94 (12.80)	19.43 (21.80)
Daily social media use (%)				
No use	6.4	4.7	8.1	12.5
Less than 30 min	11.2	10.2	12.3	12.5
30 min to 1 h	28.2	32.8	23.7	12.5
1–2 h	28.6	27.7	29.9	25
2–3 h	13.9	12.8	15.2	12.5
More than 3 h	11.7	11.9	10.9	25
Owns a smartphone (%)	97.1	97.9	96.2	100

Note. Gender not indicated by one participant.

(5.3%) than boys (2.8%), although this difference was not significant ($\chi^2(1) = 2.30$; $p = .130$; Cramer's $V = 0.06$). Regarding suicide cognitions, mean scores were significantly higher ($t = 2.76$; $p = .006$; $d = 0.23$) among girls ($M = 12.28$, $SD = 13.46$) compared with boys ($M = 9.34$, $SD = 11.56$).

Regarding screen time (see Table 1), the majority of adolescents (56.8%) spent between 30 minutes and 2 hours daily on social media ($M = 2.67$, $SD = 1.35$). However, girls spent more time using social media ($M = 2.69$, $SD = 1.29$) than boys ($M = 2.65$, $SD = 1.39$); this difference was not statistically significant ($t = 0.39$, $p = .699$, $d = 0.10$).

With respect to PSMU, the sample's mean score was 10.8 ($SD = 12.8$), with a non-significant difference between boys and girls ($M = 10.36$ and $M = 10.94$, respectively; $t = -0.47$; $p = .636$; $d = 0.10$). However, adolescents who spent more than 3 hours daily on social media scored significantly higher on the measure of PSMU ($t = -4.03$; $p = .001$; $d = 0.40$).

Finally, almost all the adolescents in our sample (97.1%) owned a smartphone. The proportion of girls with a smartphone was slightly higher than among boys (97.9% vs. 96.2%, respectively), although this difference was not significant ($\chi^2(1) = 1.07$, $p = .301$, Cramer's $V = 0.05$). It should be noted that 70% of the sample had acquired a smartphone before they were 12, with the percentage rising to 95.6% by 12 years of age.

Suicidal ideation was positively correlated with both suicide attempt ($r = 0.56$, $p = .001$) and suicide cognitions ($r = 0.49$, $p = .001$). Suicide attempt and suicide cognitions were also positively correlated ($r = 0.41$, $p = .001$).

Table 2. Results of the correlation analysis

	1.	2.	3.	4.	5.	6.
1. Suicide ideation	--					
2. Suicide attempt	0.56***	--				
3. Suicide cognitions	0.49***	0.41***	--			
4. Problematic social media use	0.21***	0.15**	0.49***	--		
5. Daily social media use	0.14**	0.09	0.16**	0.26***	--	
6. Age when acquiring first smartphone	-0.03	0.02	-0.05	-0.12*	-0.34***	--

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Regarding use of social media (see Table 2), suicidal ideation showed a weak but significant positive correlation with PSMU ($r = 0.21$, $p = .001$) and a much smaller positive correlation with DSMU ($r = 0.14$, $p = .007$). Suicide cognitions were more strongly correlated with PSMU ($r = 0.49$, $p = .001$) than with DSMU ($r = 0.16$, $p = .002$).

Participant age for first smartphone ownership showed a weak but significant negative correlation with PSMU ($r = -0.12$, $p = .020$), and a stronger negative relationship with DSMU ($r = -0.34$, $p = .001$). No significant relationships were found between age at first smartphone ownership and the suicide-related variables (ideation, attempts, cognitions).

Association of PSMU and DSMU with Suicide Ideation and Suicide Attempt

PSMU was significantly associated with suicidal ideation ($OR = 1.04$, $p = .0001$), indicating that higher scores on the

measure of PSMU were associated with a greater likelihood of suicidal ideation (see Table 3). A positive trend toward an increased likelihood of suicidal ideation was also observed for DSMU ($OR = 1.28$), although this association did not reach statistical significance ($p = .08$). Multicollinearity diagnostics indicated no evidence of problematic collinearity between the variables, with values within acceptable ranges (tolerance = 0.98; VIF = 1.02).

Table 3. Results of the logistic regression models (B coefficients, standard errors, odds ratios, and 95% confidence intervals) examining the association of PSMU and DSMU with suicide ideation and suicide attempt

		95% CI for Odds Ratio		
		Lower bound	Odds Ratio	Upper bound
Suicidal Ideation				
Intercept	-3.27*** (0.49)	0.01	0.04	0.08
PSMU	0.04*** (0.01)	1.02	1.04	1.07
DSMU	0.25 (0.14)	0.98	1.28	1.68
Suicide Attempt				
Intercept	-4.77** (0.94)	0.01	0.01	0.05
PSMU	0.04* (0.02)	1.01	1.04	1.08
DSMU	0.35 (0.23)	0.91	1.41	2.19

Note. PSMU = problematic social media use; DSMU = daily social media use; * $p < .05$, ** $p < .01$, *** $p < .001$.

Regarding suicide attempts, PSMU was again significantly associated with suicide attempts in the adjusted model ($OR = 1.04$, $p = .02$). A positive trend toward a higher likelihood of suicide attempts was also observed for DSMU ($OR = 1.41$), although this association did not reach statistical significance ($p = .14$). Multicollinearity diagnostics again indicated no evidence of problematic collinearity between the variables (PSMU: tolerance = 0.97, VIF = 1.03; DSMU: tolerance = 0.97, VIF = 1.03).

Association of PSMU and DSMU with Suicide Cognitions

Polynomial regression with response surface analysis was used to examine linear and non-linear relationships, including quadratic terms and interactions between the variables (see Table 4). The quadratic model showed a significant overall fit ($F(5, 340) = 22.1$, $p = .0001$) and explained approximately 24.5% of the variance in suicide cognitions ($R^2 = 0.25$, adjusted $R^2 = 0.24$).

A positive and statistically significant relationship ($\beta = 0.521$, $p = .001$) was observed between PSMU and suicide cognitions, such that each increment in PSMU is associated with an increase in suicide cognitions. However, no significant association was found between DSMU and suicide cognitions ($\beta = 0.556$, $p = .727$), suggesting that the total time spent on social media is not a determining factor in this regard. It should be noted that neither of the quadratic terms (PSMU²: $p = .164$; DSMU²: $p = .522$) nor the interaction term (PSMU * DSMU: $p = .177$) were significant, indicating the absence of non-linear relationships or specific combinations between the variables.

Finally, we generated a three-dimensional response surface plot (see Figure 1). The X axis corresponds to values of PSMU, the Y axis to DSMU, and the Z axis to suicide cognition scores. The extreme points method (Edwards, 2002) was used to select four

Table 4 Polynomial regression and response surface coefficients for the association of PSMU and DSMU with suicide cognitions

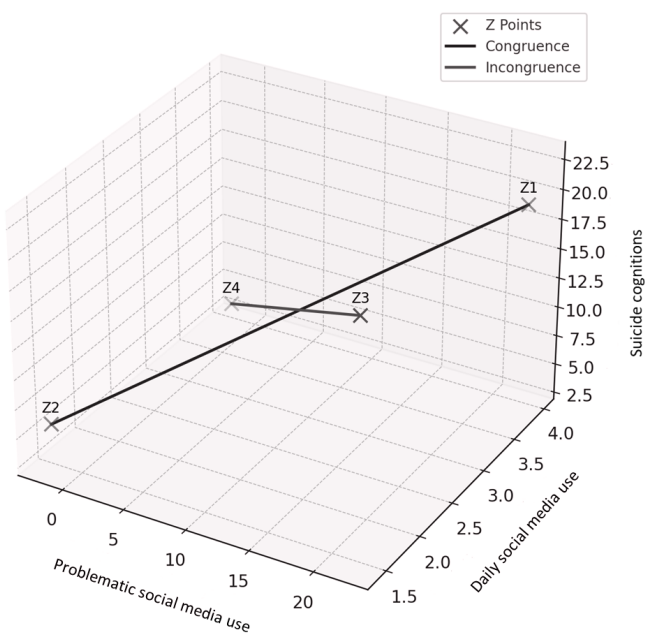
	Suicide Cognitions			
	Estimate	Standard error	p value	95% CI
Polynomial regression coefficients				
b0 - Intercept	4.51	2.18	0.039	[0.23, 8.80]
b1 - PSMU	0.52	0.16	0.001	[0.21, 0.83]
b2 - DSMU	0.56	1.59	0.727	[-2.58, 3.69]
b3 - PSMU ²	-0.01	0.01	0.164	[-0.01, 0.003]
b4 - PSMU × DSMU	0.04	0.03	0.177	[-0.02, 0.10]
b5 - DSMU ²	-0.19	0.29	0.522	[-0.76, 0.38]
Response surface parameters				
a1 - slope along LOC (X = Y)	-1.01	0.33	0.01	[-1.67, -0.35]
a2 - curvature along LOC (X = Y)	0.08	0.07	0.29	[-0.07, 0.22]
a3 - slope along LOIC (X = -Y)	0.24	0.33	0.48	[-0.42, 0.89]
a4 - curvature along LOIC (X = -Y)	0.14	0.07	0.06	[-0.01, 0.28]
Variance explained				
R ²	0.245			
ΔR ²	0.234			

Note. Standardized coefficients are presented. Age and gender were controlled for throughout the analyses. PSMU = problematic social media use; DSMU = daily social media use; LOC: line of congruence; LOIC: line of incongruence.

points along the lines of congruence and incongruence, located at positive and negative standard deviations from the mean. These points were labeled Z1 (22.37, 3.98, 19.10), Z2 (-1.92, 1.42, 5.90), Z3 (22.37, 1.42, 22.56), and Z4 (-1.92, 3.98, 3.29).

The observed values indicated that the risk of suicide cognitions is greater when PSMU is high, even if average time spent on social media is low (Z3). By contrast, a high value of DSMU combined with low PSMU (Z4) is not associated with a high risk.

Figure 1. Three-dimensional surface plot representing the relationship between PSMU, DSMU, and suicide cognitions.



Discussion

The present study aimed to examine the associations between problematic social media use (PSMU) and daily social media use (DSMU) and three suicide-related outcomes in early adolescence: suicidal ideation, suicide attempts, and suicide-related cognitions. In addition, response surface analysis was used to explore how different configurations of problematic engagement and time-based social media use jointly relate to suicide cognitions.

Overall, the results indicate that problematic social media use was consistently associated with suicidal ideation, suicide attempts, and suicide-related cognitions, whereas time spent on social media was not significantly associated with these outcomes. Furthermore, the response surface analysis suggested that suicide cognitions were elevated primarily in configurations characterized by high levels of problematic engagement, regardless of overall exposure time.

Although the present study used a community sample, suicidal ideation and suicide attempts were reported by a non-negligible proportion of adolescents. Specifically, 11.9% of participants reported lifetime suicidal ideation and 4.1% reported having attempted suicide. These figures are consistent with epidemiological evidence indicating that suicidal thoughts and behaviors represent a significant public health concern during adolescence (Bertuccio et al., 2024; Lim et al., 2019), and they highlight the importance of implementing preventive strategies early in adolescence.

The results of the study indicate that problematic social media use was significantly associated with both suicidal ideation and suicide attempts. In the logistic regression models, PSMU showed a positive and statistically significant association with both outcomes, supporting the first hypothesis of the study. This finding is consistent with previous research highlighting the negative impact of PSMU on mental health and personal well-being among adolescents (Montag et al.,

2024). In contrast, daily time spent on social media showed a weaker association and did not reach statistical significance in the regression models for either suicidal ideation or suicide attempts. This finding contrasts with studies reporting a positive association between greater social media use and suicidal ideation in community samples of adolescents (Coyne et al., 2021; Young et al., 2024). However, it is consistent with findings from Young et al. (2024), who did not observe a significant relationship between frequent social media use and suicide attempts in a community sample. Taken together, these results suggest that problematic patterns of engagement with social media may be more relevant to suicide-related outcomes than the amount of time adolescents spend on these platforms.

The inconsistent findings across studies regarding time spent on social media and suicide-related outcomes may have several possible explanations. First, time-based measures capture the quantity of social media use but provide limited information about the qualitative aspects of online engagement (Hamilton et al., 2024). Adolescents may spend similar amounts of time on social media while engaging in very different types of activities, some of which may be protective (e.g., social support and peer connection) and others potentially harmful (e.g., social comparison, exposure to negative content, or cyberbullying) (Varona et al., 2024). Second, differences in measurement approaches across studies—such as the use of self-reported screen time, platform-specific measures, or composite indicators—may contribute to inconsistent results (Keles et al., 2020). Finally, adolescents' individual vulnerability factors, including pre-existing mental health difficulties (Miranda-Mendizabal et al., 2019) or patterns of problematic engagement (Machimbarrena et al., 2023), may moderate the relationship between social media use and suicide-related outcomes.

A positive association was also observed between PSMU and suicide cognitions. However, and contrary to what we hypothesized, there was no significant relationship between daily screen time and suicide cognitions. It is important to note that suicide cognitions reflect an underlying cognitive vulnerability to suicidal behavior rather than the presence of suicidal ideation or behavior itself. In this sense, the present findings suggest that problematic patterns of social media engagement may be linked not only to acute suicidal outcomes but also to broader cognitive vulnerability to suicidal crises. This interpretation is consistent with previous studies emphasizing that qualitative aspects of social media engagement may be more relevant to adolescent mental health than simple exposure time (Hamilton et al., 2024; Swedo et al., 2021).

The response surface analysis provided additional insights into the relationship between problematic and time-based social media use and suicide cognitions. The results showed that suicide cognitions were higher when problematic social media use was high, regardless of the average daily time spent on social media. In particular, the analysis revealed that high PSMU combined with relatively low DSMU was associated with the greatest risk of suicide cognitions, whereas high DSMU combined with low PSMU was not associated with elevated risk. These findings partially support the hypotheses related to the congruence and incongruence lines of the response surface. Importantly, this analytic approach provides information that cannot be obtained from traditional regression models alone. While standard regression analyses estimate the independent

effects of PSMU and DSMU, response surface analysis allows examination of how specific configurations of these variables jointly relate to suicide-related cognitive vulnerability. In particular, this approach makes it possible to distinguish between situations in which both indicators are high, both are low, or one is high while the other is low, thereby revealing asymmetric patterns of risk that would otherwise remain undetected.

These findings reinforce the evidence that factors such as loss of control over social media use, excessive priority given to these platforms, continued use despite negative consequences, and the functional impairment associated with such behaviors (Montag et al., 2021) play a central role in explaining suicide risk beyond the amount of time adolescents spend on social media. Furthermore, considering that suicide cognitions have been shown to be stronger predictors of suicidal behavior than traditional indicators such as suicidal ideation (Bryan et al., 2022), these results have important implications for suicide prevention strategies. Suicide cognitions not only discriminate between adolescents who attempt suicide and those who do not (Muela et al., 2024), but they also identify individuals who deny suicidal ideation while still presenting significant risk (Bryan et al., 2022).

In the present study, smartphone ownership was nearly universal, reflecting the extent to which digital technologies are embedded in adolescents' daily lives. Although the age at which adolescents first acquired a smartphone was not directly associated with suicidal ideation or suicide attempts, earlier access was related to more problematic patterns of social media use. This finding suggests that prevention efforts may benefit from focusing less on access per se and more on fostering healthy and regulated patterns of digital engagement, taking into account individual and contextual factors such as the nature of online experiences and exposure to potentially harmful content. It is also possible that early access to smartphones may exert indirect effects on suicide-related outcomes through problematic patterns of social media use that develop over time. Because the present study used a cross-sectional design, it was not possible to examine potential temporal pathways between early smartphone access, problematic social media use, and suicidal outcomes. Future longitudinal studies may help clarify whether earlier digital exposure contributes to suicide risk indirectly through maladaptive patterns of online engagement.

In circumstances of high vulnerability, and especially when there are warning signs for suicidal behavior (e.g., intense mental distress, hopelessness, lack of connectedness or the perception of being a burden on others), the problematic use of social media could heighten the risk of suicide among adolescents. It is therefore essential that young people cultivate the skills needed to develop awareness of these risks, to create a protective environment around themselves, and above all, to learn to ask for help when needed (Muela et al., 2021).

In our view, schools play a key role in promoting programs aimed at preventing suicidal ideation, suicidal behavior, and explicitly addressing the appropriate use of social media. Parents also need access to clear, evidence-based guidelines that can help them manage their child's use of these platforms, especially in contexts related to suicide ideation. Not allowing younger children to have convenient access to a smartphone or to own one is crucial here, as is setting limits on screen time

(Kids Online Health and Safety Task Force, 2024). In the present analysis, we found that those adolescents who acquired a smartphone at a younger age scored higher on PSMU, underscoring the need to establish clear limits around device access. Moreover, previous studies have shown that spending more than three hours per day on social media is associated with more problematic use of these platforms and poorer mental health indicators (Riehm et al., 2019). Consistent with these trends, we observed similar patterns: adolescents who reported more than three hours of daily social media use also scored higher on PSMU. Finally, we also consider that legislative changes are needed to oblige platform developers to design safer online environments that protect young people and other vulnerable individuals.

Although the present study does not assess age-based thresholds for social media use, the observed associations are consistent with existing international guidelines that emphasize caution regarding early access to social media platforms, particularly during early adolescence (Montag et al., 2024; Rega et al., 2023). Additionally, it is essential that adolescents are taught the safe and appropriate use of social media and learn how to prevent risk factors for suicidal behavior, such as cyberbullying victimization, online grooming, or exposure to age-inappropriate content.

From a prevention and public health perspective, these findings underscore the relevance of considering social media use in community-based prevention strategies addressing suicide-related outcomes among adolescents (Brent, 2023), as well as the need to implement universal, community-based approaches that extend beyond clinical settings. Consistent with recent epidemiological evidence, suicidal ideation and suicide attempts were present in a non-negligible proportion of adolescents (Bertuccio et al., 2024). Given that a substantial proportion of suicide attempts during adolescence may go undetected by health care systems (Muela et al., 2024), preventive efforts should be implemented broadly within school and community contexts to reach adolescents who may be experiencing vulnerability outside the scope of clinical attention.

Strengths and Limitations

The present study has two main limitations. First, the cross-sectional design prevents us from establishing the temporal or predictive relationships between the variables analyzed. Future longitudinal studies are therefore needed to examine how these variables evolve over time and to better understand their potential predictive associations. Second, the sample was drawn from a specific geographical area, and thus it is unclear to what extent the results may be extrapolated to different social and cultural contexts. Replicating the present analysis in other regions and countries is therefore necessary to corroborate the findings across diverse cultural contexts.

Conclusions

This study found that problematic social media use (PSMU) was associated with suicidal ideation, suicide attempts, and suicide-related cognitions in early adolescence. These findings highlight the importance of considering adolescents' social media experiences and patterns of engagement rather than

focusing exclusively on time spent online. From a practical perspective, the results underscore the relevance of school-based universal prevention initiatives aimed at promoting healthy social media use and strengthening digital literacy. Such initiatives may help adolescents develop more reflective and balanced online habits, while also increasing awareness of potential risks related to early smartphone access, cyberbullying, and exposure to age-inappropriate content. Future longitudinal research is needed to better understand the temporal dynamics between problematic social media use and suicide-related outcomes.

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Conflict of interest

No conflict of interest to declare.

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