



A quantitative analysis of factors related to adolescent cybervictimization in Spain: A multilevel logistic regression approach

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ABSTRACT

Building on ecological systems theory, this study seeks to explain cybervictimization as the result of interactions among microsystems (parents and close friends), mesosystems (the school environment), and potential vulnerability factors of adolescents. Internet addiction is proposed as a key risk factor that increases adolescents' likelihood of suffering cyberbullying. A multilevel logistic regression is performed using data from a nationally representative sample of school students in Spain aged 14–18 years ($n = 35,369$). The survey was carried out by the Spanish Government's Delegation for the National Plan on Drugs. Results show that high levels of Internet addiction and a lack of support from family and friends increase the probability of suffering cyberbullying. The association between being cyberbullied and Internet addiction is stronger when students lack support from family and friends. School factors such as academic grades and repetition as well as vulnerability factors such as parents' employment and immigrant status are also associated with higher cybervictimization levels. Implications for policymakers and public health managers are highlighted.

1. Introduction

Cyberbullying victimization (hereafter cybervictimization) has escalated in recent decades due to the growth of new technologies and social media (Brochado, Soares, & Fraga, 2017; Chen, Ho, & Lwin, 2017). Cybervictimization peaks between 12 and 15 years of age (Tokunaga, 2010). It can lead to severe emotional and mental health problems including depression and suicidal behaviors (Kowalski, Limber, & McCord, 2019). Therefore, it is crucial to identify the factors that affect the probability of suffering cybervictimization during adolescence.

Studies have extensively examined risk and preventive factors associated with cybervictimization in adolescence. However, gaps and inconsistencies persist (Chen et al., 2017; Zych, Farrington, & Ttofi, 2019). For example, further research is required to determine the primary vulnerability factors contributing to a high risk of cybervictimization. Examples of such factors include internet addiction, a lack of social support, and immigrant status. Knowledge of these factors can help tailor interventions to address situations of vulnerability. The

current study highlights the importance of internet addiction in understanding cybervictimization. The literature indicates that internet usage patterns affect cyberbullying involvement (Wachs, Junger, & Ruth-aychonee, 2015). Internet use is linked to both engaging in and suffering from cyberbullying, though the correlation may be stronger for the former (Walrave & Heirman, 2011). However, analysis of problematic internet use such as internet addiction is limited. Moreover, many studies lack a theoretical framework to anchor the discussion of risk and preventive factors (Camerini, Marciano, Carrara, & Schulz, 2020).

This study uses ecological systems theory (Bronfenbrenner, 1979, 1986) to conceive cybervictimization as a consequence of interactions between microsystems (parents and close friends), mesosystems (school environment), and potential vulnerability factors (parental employment and immigrant status) among adolescents (Albayrak, Yıldız, & Erol, 2016). Ecological systems theory posits that people are subject to different environmental influences (or systems) that affect their development. These systems surround individuals. They range from interactions with others to social or cultural belief systems. According to Bronfenbrenner (1979), an individual's development is better when

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there are strong supportive links between settings such as family, friends, and school and when systems share common values regarding developmental outcomes. Although studies have shown that parent and peer interactions (microsystems) with adolescents (attitude, feedback, connectedness, caring, etc.) are negatively associated with cybervictimization (Doty, Gower, Sieving, Plowman, & McMorris, 2018; Martínez, Murgui, García, & García, 2019), little is known about the role of close friends. An important unexplored question is whether these microsystems (i.e., support from family and best friends) play a role in the relationship between internet addiction and cybervictimization.

This study explores this gap by tackling the following two research questions: (1) Are internet addiction, support from family and best friends, the school environment, and adolescent vulnerability associated with cybervictimization? (2) How does the strength of the association between internet addiction and cybervictimization vary when adolescents have caring parents and a caring best friend? These research questions will be addressed by the hypotheses that are presented and justified in the review of the associated literature in the following section.

This study contributes to the existing research in three ways. First, it adopts a comprehensive approach to analysis in adolescence by simultaneously considering individual factors (internet addiction, immigrant status, and frequency of sporting activity), microsystem factors (parents and friends), and mesosystem factors (school environment). Several of these factors such as care from best friends, immigrant status, and frequency of sporting activity have scarcely been explored as potential contributors to adolescent cybervictimization. This study is the first to propose that the relationship between internet addiction and cybervictimization may be moderated by support from family and best friends. To complete this analysis, predicted probabilities of cybervictimization are simulated at varying levels of internet addiction. This approach is novel in the cyberbullying literature. Second, this study uses multilevel logistic regression. The literature rarely reports robust standard errors because most studies use logistic regression. Maximum likelihood estimates are unbiased and efficient if observations are independent and the likelihood function is properly specified. However, individuals are often clustered into groups. Therefore, the assumption of independent observations fails because responses within groups are more correlated than responses between groups. This situation is especially applicable to studies of adolescents clustered by school. The present study overcomes this limitation by providing alternative estimation methods to seek robust standard errors. Third, the data for this study came from two-stage cluster sampling of schools and classrooms. Sampling was stratified by Spanish province, school ownership, and type of education. This complex procedure provided a final sample of 35,369 students (from 863 schools and 1,726 classrooms). This sampling procedure and sample composition provided a larger and more representative sample than those used in most previous studies (Zhu, Huang, Evans, & Zhang, 2021).

2. Literature review

2.1. Adolescent cybervictimization: Internet addiction and social support

2.1.1. Internet addiction and cybervictimization

The Internet and social media have become part of the lives of adolescents in today's technology-oriented culture. The use of these technologies, combined with anonymity and emotional self-regulation issues, can result in idealized virtual personas (Estévez, Jauregui, Sanchez-Marcos, Lopez-Gonzalez, & Griffiths, 2017). This situation can lead to internal personal conflicts and conflicts with others (Soni & Kaur, 2020). Accordingly, spending excessive time on the Internet can result in addiction and can increase the risk of cyberbullying for both perpetrators and victims (Kormas, Critselis, Janikian, Kafetzis, & Tsitsika, 2011; Sampasa-Kanyinga & Hamilton, 2015; Wachs et al., 2015). Excessive internet use causes adverse psychological effects and interpersonal

conflicts (Soni & Kaur, 2020; Tural-Hesapçioğlu & Yesilova, 2020). This scenario creates a breeding ground for cybervictimization. For example, Şimşek, Şahin, and Evli (2019) found a positive association between cybervictimization and both internet addiction and internet usage. Similarly, Méndez, Jorquera, Esteban, and García-Fernández (2020) found that severely problematic internet use among Spanish students aged 12–16 years was associated with high levels of school violence. Based on these ideas, the following hypothesis is postulated:

H1: Adolescent internet addiction is positively associated with cybervictimization.

2.1.2. Social support and cybervictimization

Social support refers to the positive influence and protection that individuals receive from their relationships and interactions with others such as family and friends (Pichel, Feijóo, Isorna, Varela, & Rial, 2022). Family support, specifically secure parental attachment, has a positive impact on adolescents' development and protects them from engaging in harmful behaviors such as alcohol abuse, drug abuse, and crime (Escario, Giménez-Nadal, & Wilkinson, 2022; Pichel et al., 2022). Other factors related to family support such as a positive family environment (Guo, 2016), positive parental interaction (Chen et al., 2017), and parental involvement and supportive relationships are also linked to a lower risk of cybervictimization (Mehari et al., 2018).

Adolescents' perceptions of friends and peer support have been linked to cybervictimization (Papafrazteskakou, Kim, Longo, & Riser, 2011), particularly during the vulnerable stage of adolescence when friends exert a powerful influence (Bokhorst, Sumter, & Westenberg, 2010). Those who perceive strong peer support tend to experience lower levels of cyberbullying (Fridh, Lindström, & Rosvall, 2015). In contrast, a lack of perceived support increases the likelihood of becoming a cybervictim (Kowalski, Giumetti, Schroeder, & Lattanner, 2014). In fact, positive peer interactions act as a protective factor against cybervictimization (Zych et al., 2019). Although peer influence is important in adolescence, some studies of social support differentiate between close friends and other peer groups such as classmates. The effect of these relationships on internalizing problems such as depression differs depending on the closeness of the bond (Coyle, Malecki, & Emmons, 2021). Social support from classmates has a negative association with depression. This effect is even stronger when the support comes from close friends (Rueger, Malecki, Pyun, Aycock, & Coyle, 2016). Additionally, spending time with friends and having high-quality friendships can act as a protective factor, mitigating the negative impact of cybervictimization on adolescent adjustment (Espinoza, 2018). Cybervictims often lack close friends, unlike those who have not experienced cyberbullying. Hence, the perceived quality of peer support is crucial for adolescents' well-being. In sum, previous research suggests that support from both parents and best friends could help reduce the risk of cybervictimization (Wright, 2016). Based on this idea, the following hypotheses are proposed:

H2: Parental support perceived by adolescents is negatively associated with cybervictimization.

H3: Support from best friends perceived by adolescents is negatively associated with cybervictimization.

Social support can also influence internet addiction (Feene & Collins, 2015). Research has shown that close social support decreases addictive internet behavior (Mazzoni, Baiocco, Cannata, & Dimas, 2016) and cybervictimization (Wright, 2016). This support restores a sense of self-integrity, making people stronger, more resilient, and better able to overcome adversity (Feene & Collins, 2015; Sancho, Miguel, & Aldás, 2011). For example, Guo, Huang, Fu, Ma, Chen, and Wang (2021) found that high school students with internet addictive behavior experience lower access to support from friends, family, and significant others, with social support acting as a mediator between internet addiction and

quality of life. [Chu, Li, Wang, Zeng, and Lei \(2021\)](#) investigated the relationship between social support, internet addiction, and cyberbullying perpetration, finding that social support negatively predicts cyberbullying and that internet addiction mediates this relationship. However, there appear to be no studies of the relationship between internet addiction, social support, and cybervictimization. Therefore, social support from parents and best friends is expected to weaken the positive relationship between internet addiction and cybervictimization. Given the findings in the existing literature, analysis of whether the support and interactions of parents and close friends (social context) enhance or inhibit the relationship between internet addiction and the likelihood of cybervictimization is of interest. Therefore, the following research question is proposed:

RQ: Is the relationship between adolescent internet addiction and cybervictimization inhibited by social support?

2.2. Adolescent cybervictimization: School environment and potential vulnerability factors

Several factors related to adolescents' school context are directly linked to cybervictimization ([González-Cabrera, Machimbarrena, Ortega-Barón, & Álvarez-Bardón, 2020](#)). School ownership and management have been studied as potential antecedents of cybervictimization. Research on the relationship between school ownership and cybervictimization has failed to provide a consensus. Some studies have found a higher prevalence of cybervictimization in public schools ([Machimbarrena & Garaigordobil, 2017](#)), whereas others have found no significant differences ([González-Cabrera et al., 2020](#); [Vidourek & King, 2019](#)). Academic performance in terms of grades and grade repetition is also associated with cybervictimization. The literature suggests that cybervictimization is linked to short-term academic issues such as absenteeism, poor concentration, and negative academic performance ([Beran & Li, 2007](#); [Camerini et al., 2020](#); [Vidourek & King, 2019](#)). If these issues persist, they can result in grade repetition. In sum, the school environment and academic performance of adolescents may influence cybervictimization.

Previous research also suggests that cyberbullying victims are generally bullied because they do not conform to mainstream standards or values in some way ([Davis, Randall, Ambrose, & Orand, 2015](#)). Thus, the social status of adolescents may also be related to cybervictimization. Issues such as family profile, country of origin, and sporting activity may be important. In the case of the family, poor family management or parental unemployment, lower financial success, and lower parental educational level increase the risk of cybervictimization ([Ayoub, Gosling, Potter, Shanahan, & Roberts, 2018](#); [Camerini et al., 2020](#)). Children from such families are seen as potential targets by cyberbullies, and their personality traits may make them more likely to experience cybervictimization ([Bevilacqua et al., 2017](#)). Immigrant status is also an important factor in students' social context, particularly in relation to cyberbullying perpetration. First-generation and second-generation immigrants engage more in cyberbullying behaviors ([Llorent, Ortega-Ruiz, & Zych, 2016](#)). Conversely, immigrant status can also create a perception of differences and can lead to xenophobia. These issues may be associated with ethnic-based cybervictimization ([Rodríguez-Hidalgo, Calmaestra, Casas, & Ortega-Ruiz, 2019](#)). Lastly, this study considers adolescents' sporting activity. This cybervictimization-related factor has traditionally been neglected in studies of this topic. The relationship between sporting activity and cybervictimization is complex. Protective and risk factors are intertwined. Participation in sports can contribute to adolescents' well-being and social integration ([Benítez-Sillero, Armada Crespo, Ruiz Córdoba, & Raya-González, 2021](#); [Duman & Kuru, 2010](#)). However, it can elicit envy, and the use of social media platforms to target individuals may also increase vulnerability to cybervictimization ([Vveinhardt & Fominiene, 2020](#); [Mountjoy et al., 2016](#)). Further research is needed to understand the links between

sporting activity, social media use, and the risk of cybervictimization among adolescents. Based on these ideas, the following hypotheses are proposed:

H4: School ownership (private/public) and academic performance (low grades and repetition) are associated with adolescent cybervictimization.

H5: Potential vulnerability factors of adolescents (parents' education and employment, immigrant status, and sporting activity) are associated with cybervictimization.

The hypotheses and research questions of this study are summarized in [Fig. 1](#).

3. Method

3.1. Contextualization

This research was performed in Spain. In this Southwestern European country, the use of the Internet and social media by children is high. Current figures indicate that around 98 % of children aged between 10 and 15 years very often have access to the Internet, and more than 70 % have their own mobile device ([ONTSI, 2022](#)). In Spain, the use of social media is illegal for children aged less than 14 years without parental consent ([RD 1720/2007, December 21st, article 13](#)). The percentage of young social media users is high. Instagram (47.7 %), TikTok (37.7 %), and Snapchat (24.1 %) are the social media platforms that are most commonly used by this age group ([Statista, 2020](#)). This high level of usage highlights the need for specific regulations to protect children. Overall, the European strategy for a better Internet for kids (BIK+) indicates that Spain has a mid-to-high level of regulatory protection regarding children and internet use ([O'Neill, Dreyer, & Dinh, 2020](#)). Several specific national laws regulate the use of the Internet in Spain, particularly with regard to cyberbullying and the protection of children ([Cantera Espinosa, Vázquez Martínez, & Perez Tarrés, 2021](#)). The Spanish Civil Code focuses on bullying in different contexts.¹ Spanish Organic Law (OL 5/2000, January 12th) regulates cyberbullying perpetration by people aged between 14 and 17 years. Finally, the general Spanish Civil Code provides regulations for cyberbullies aged 17 years or older ([Mata, 2017](#)). Furthermore, the Spanish Data Protection Agency provides strategies for parents to monitor and control children's activity online while preserving privacy ([AEPD, 2020](#)). Examples include (i) safe search engines and exclusive content apps for children, (ii) parental control systems offered by operating systems and telephone operators, and (iii) parental control systems for TV, video streaming, and online gaming.

3.2. Measures and data

The analysis of cybervictimization predictors was performed using data from the Survey on Drug Use in the School Population in Spain (*Encuesta sobre Uso de Drogas en Enseñanzas Secundarias en España*; [ESTUDES, 2016](#)). This Spanish nationwide representative survey was carried out by the Spanish Center for the Monitoring of Drugs and Drug Addiction under the Government Delegation for the National Drug Plan. The Spanish Government Delegation for the National Plan on Drugs (GDNPD) works within the guidelines established by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). The

¹ Article 1903 of the Spanish Civil Code: "Parents are responsible for damages caused by children under their care... Persons or entities which own an educational center other than a center for higher education shall be liable for the damages caused by its underage students during the periods in which the latter are under the control or supervision of the center's teaching staff, or while conducting school, extracurricular or complementary activities."

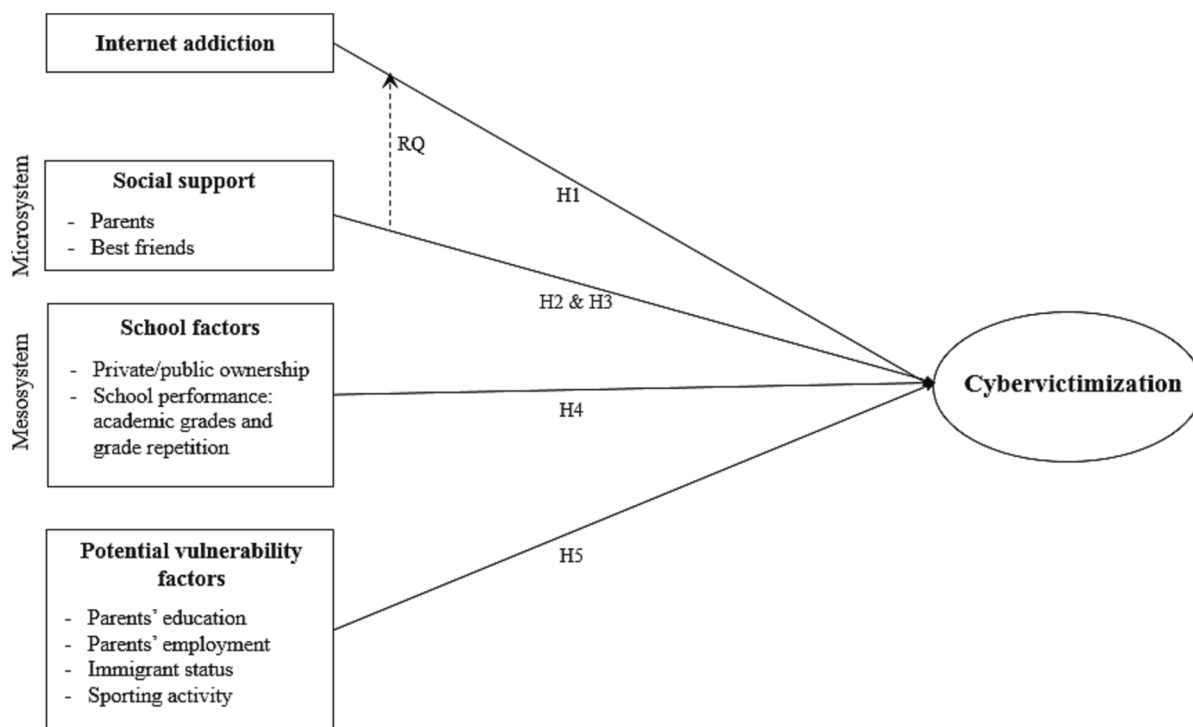


Fig. 1. Proposed theoretical model of adolescent cybervictimization.

GDNPD is approved by the EMCDDA and the Ministry of Health and Consumer Affairs. The survey interviewed students aged 14 to 18 years during a normal class. A two-stage sampling procedure was used for the random selection of schools as primary units and classes as final units. A total of 35,369 students were interviewed between November 18, 2016 and March 8, 2017.

The dichotomous dependent variable, *Cybervictimization*, was computed as the response to the following question: “Have you ever felt harassed, threatened, or believe that you have been bullied through the Internet?” (1 = yes; 0 = never or rarely). The key predictors in this study were internet addiction and having caring parents and a caring best friend. *Internet addiction* was measured as an index ranging from 0 to 56. This index was computed as the sum of 14 items ranging from 0 to 4. The items were similar to those of Young’s Internet Addiction Test (IAT; Young, 1998). Appendix A provides descriptive analysis of the responses to these 14 items. It also shows the overall Cronbach’s alpha and the Cronbach’s alpha value if each item was individually deleted. In all cases, these values are above 0.87, indicating good reliability of the index.

The two variables measuring care or social support were based on the same dichotomous scale. *Care from parents* measured how often students received care and affection from their parents. Students chose one of the following two options: 0 = never or rarely; 1 = always or almost always. *Care from friends* measured how often students received care and affection from their best friend (0 = never or rarely; 1 = always or almost always).

Several school factors were considered as predictors. *School ownership* was a dummy variable indicating whether the school was private or public (1 = private; 0 = public). Adolescent school performance was measured by the following items: (i) *Academic grades*, which measured the school grades achieved by the student (1 = outstanding; 2 = excellent; 3 = good; 4 = pass; and 5 = fail). This item was reverse-coded, so a greater value indicated a lower grade. (ii) *Repetition*, which measured whether the student had repeated an academic year (0 = no; 1 = one year; 2 = two or more years).

Several potential vulnerability factors of adolescents were considered. *Immigrant* status was measured as a dichotomous variable (1 = yes,

0 = no). Parents’ academic achievement was measured by two dummy variables: (i) *University mother* (1 = mother had university degree; 0 = mother did not have university degree) and (ii) *University father* (1 = father had university degree; 0 = father did not have university degree). Parental unemployment was measured using the following variable: *Unemployed parents* (0 = no unemployed parents; 1 = one unemployed parent; 2 = two unemployed parents). Lastly, adolescent sporting activity (frequency) was measured by the response to the following question: “During the last 12 months, how often have you done sports or exercise?” The five possible answers were *Never* (coded as 0); *1 to 3 days per year* (coded as 1); *1 to 3 days per month* (coded as 2); *1 to 4 days per week* (coded as 3); and *5 to 7 days per week* (coded as 4). Five dichotomous variables (*Sport frequency 0 to Sport frequency 4*, each taking the value 1 or 0) were computed to indicate adolescents’ responses. *Sport frequency 0* was the omitted category in further analysis.

Finally, characteristics such as the gender and age of the adolescent were controlled for with several variables. *Female* (1 = female; 0 = male) controlled for gender. Five dichotomous age variables (*Age14 to Age18*) indicated the respondent’s age. The variable *Age14* was used as the omitted category in the regression analyses. The statistical analysis procedures are explained in Appendix B.

4. Results

Table 1 offers descriptive analysis of the variables in the study. According to these figures, 6.5 % of students reported having felt harassed, threatened, or bullied on the Internet. This value is slightly below the range found in the literature, perhaps because the measure in this study placed being rarely bullied in the same category as not being bullied.

The internet addiction index had a mean of 19.59, around one-third of the maximum value. Approximately 90 % of students reported that they always or almost always received care and affection from their parents (90.2 %) and from their best friend (87.7 %). Regarding school factors, 31.1 % attended private schools. The average performance was 2.81 (between excellent = 2 and good = 3). Around a quarter (26.6 %) of students had repeated at least one academic year. Concerning vulnerability factors, 10.3 % of students were immigrants, around one-third of

Table 1
Descriptive analysis of variables.

Variable	M	SD	Min	Max	n
Cybervictimization	0.07	0.25	0	1	35,160
Internet addiction	19.59	10.44	0	56	32,140
Care from parents	0.90	0.30	0	1	33,838
Care from friends	0.88	0.33	0	1	33,821
School ownership (private school = 1)	0.31	0.46	0	1	35,369
School performance 1 (Academic grades)*	2.81	1.09	1	5	35,163
School performance 2 (Repetition)	0.34	0.60	0	2	35,157
Immigrant = 1	0.10	0.30	0	1	35,251
University mother	0.36	0.48	0	1	28,378
University father	0.32	0.47	0	1	26,559
Unemployed parents	0.14	0.38	0	2	32,955
Sport frequency 0 (never)	0.10	0.30	0	1	34,382
Sport frequency 1 (1–3 days per year)	0.05	0.21	0	1	34,382
Sport frequency 2 (1–3 days per month)	0.14	0.34	0	1	34,382
Sport frequency 3 (1–4 days per week)	0.56	0.50	0	1	34,382
Sport frequency 4 (5–7 days per week)	0.17	0.38	0	1	34,382
Gender (female = 1)	0.50	0.50	0	1	35,369
Age14	0.26	0.44	0	1	35,369
Age15	0.22	0.41	0	1	35,369
Age16	0.27	0.45	0	1	35,369
Age17	0.20	0.40	0	1	35,369
Age18	0.05	0.22	0	1	35,369

Note. * Reverse-coded (a higher value means a lower grade).

mothers and fathers had a university degree, and the unemployment index had a mean value of 0.14. Regarding frequency of sporting activity, 9.8 % of adolescents reported not doing sports at all, 4.6 % reported doing sports 1 to 3 days per year, 13.5 % reported doing sports 1 to 3 days per month, 55.5 % reported doing sports 1 to 4 days per week, and 16.6 % reported doing sports 5 to 7 days per week. Finally, there was a balance between girls and boys in the sample (50.1 % and 49.9 %, respectively). The breakdown among the participants who answered the age question was as follows: 25.8 % aged 14 years; 21.7 % aged 15 years; 27.2 % aged 16 years; 20.0 % aged 17 years; and 5.3 % aged 18 years.

The proposed model of cybervictimization was estimated by multilevel logistic regression. It is presented in Table 2. The results show a positive association of the dependent variable with internet addiction, poor school results, and having unemployed parents. The association with care from parents and friends and with immigrant status is negative. Consequently, the results support H1, H2, and H3. However, H4 is only supported in the case of school performance (low grades and repetition). Finally, H5 is only supported in the case of parents' employment and immigrant status. The estimate of the within-group or residual variance (σ^2) is 3.29. The estimate of the between-group or intercept variance (τ_{00}) is 0.06. The intraclass correlation coefficient estimate (ICC) is 0.02.

Regarding the research question, Fig. 2 shows the prediction of the average marginal probabilities of cybervictimization for the entire range of the internet addiction index. Fig. 3 and Fig. 4 show the same prediction for the two levels of Care from parents and Care from friends, respectively. The exact values of the variables are difficult to calculate. Therefore, Table 3 shows the average marginal probabilities of cybervictimization for six values along the x axis. These values correspond to the 1st, 20th, 40th, 60th, 80th, and 100th percentiles of the internet addiction index. This index ranges from a minimum of 0 to a maximum of 56. In the second to fifth rows of Table 3, the same predicted average marginal probabilities are shown for different values of two dichotomous variables: Care from parents and Care from friends.

Table 3 and Figs. 2 to 4 show a positive association between the probability of being cyberbullied and the level of internet addiction. In the first row of Table 3, this probability increases from 2.63 percentage points to 19.68 percentage points as the internet addiction percentile increases. Both types of social support reduce the probability of cybervictimization, which increases as the level of adolescent internet

Table 2
Multilevel logistic regression estimates.

Predictors	Cybervictimization		
	Odds ratio	CI	p
(Intercept)	0.03	0.02–0.04	<0.001
Internet addiction	1.04	1.04–1.05	<0.001
Care from parents	0.68	0.57–0.80	<0.001
Care from friends	0.56	0.47–0.66	<0.001
School ownership (private school = 1)	1.01	0.88–1.16	0.863
School performance 1 (Academic grades)*	1.07	1.01–1.14	0.019
School performance 2 (Repetition)	1.46	1.30–1.63	<0.001
Immigrant = 1	0.78	0.63–0.96	0.019
University mother	1.10	0.95–1.27	0.183
University father	0.98	0.84–1.14	0.777
Unemployed parents	1.21	1.05–1.40	0.008
Sport frequency 1 (1–3 days per year)	0.86	0.62–1.19	0.356
Sport frequency 2 (1–3 days per month)	0.98	0.78–1.25	0.900
Sport frequency 3 (1–4 days per week)	1.12	0.92–1.38	0.260
Sport frequency 4 (5–7 days per week)	1.12	0.88–1.43	0.373
Gender (Female)	2.03	1.79–2.31	<0.001
Age15	1.10	0.92–1.33	0.293
Age16	1.05	0.88–1.25	0.583
Age17	1.11	0.92–1.34	0.292
Age18	1.25	0.95–1.66	0.113
Random effects			
σ^2	3.29		
τ_{00} SCHOOL	0.06		
ICC	0.02		
N SCHOOL	811		
Observations	21,171		
Marginal R ² / Conditional R ²	0.115 / 0.131		

Note: The omitted groups are "Sporting frequency 0 (never)" and "Age14".

* Reverse-coded (a greater value means a lower grade).

addiction increases. The probability of cybervictimization when the internet addiction index takes the value 0 is greater for students without parental affection (3.65 percentage points) than for students with parental affection (2.50 percentage points). The probability of being cyberbullied when the internet addiction index rises to 56 increases more for students without parental care (21.9 percentage points, from 3.65 to 25.55) than for students with parental care (16.55 percentage points, from 2.50 to 19.05). Similarly, the likelihood of being cyberbullied is greater for students without best friend support (4.25 percentage points) than for students with best friend support (2.43 percentage points). Moreover, the probability of suffering cyberbullying increases more for students without best friend support (24.36 percentage points, from 4.25 to 28.61) than for students with a caring best friend (16.17 percentage points, from 2.43 to 18.6).

5. Discussion

According to the study's findings, the likelihood of suffering cyberbullying is significantly and positively associated with internet addiction. This result is in line with previous research (Méndez et al., 2020) and highlights the need for actions to reduce internet dependence among adolescents. Like actions to educate adolescents about the dangers of addictions such as tobacco and drugs (Borderías, Duarte, Escario, & Molina, 2015), measures are also needed to fight internet addiction among adolescents. The consequences of internet addiction include a greater probability of suffering not only cyberbullying but also depression and low self-esteem (Tural-Hesapçioğlu & Yesilova, 2020; Soni & Kaur, 2020). In addition, adolescents with internet addiction have impaired sleeping routines, fast for long periods, and neglect their studies or family obligations (Li, Feng, Liao, & Pan, 2020).

Regarding adolescents' perceptions of having caring parents and a caring best friend, the estimates show significant and negative associations for both predictors in all estimated models. Greater parental care and care from a best friend is associated with a lower likelihood of suffering cyberbullying during adolescence. The existence of

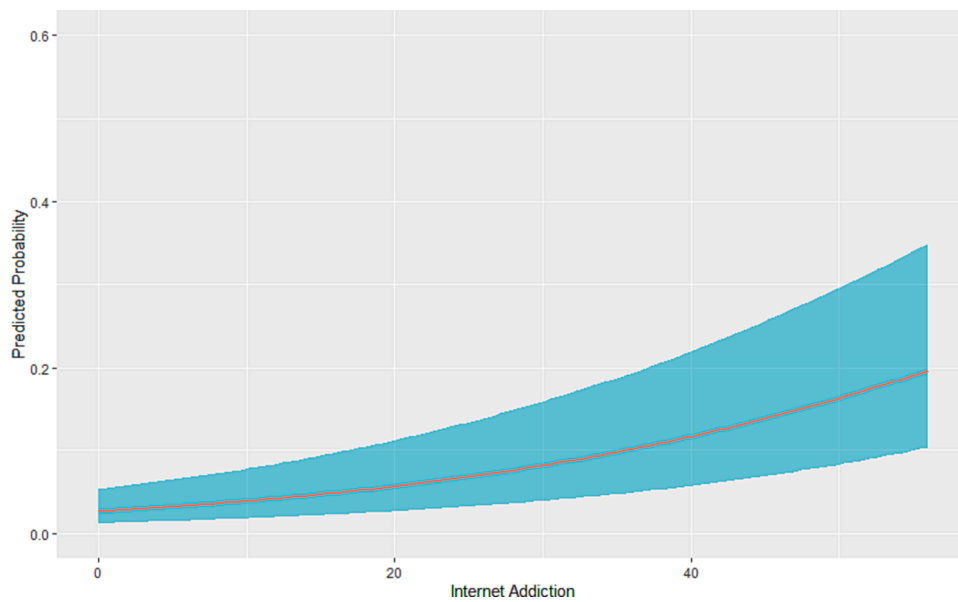


Fig. 2. Average marginal probability of cybervictimization by level of internet addiction.

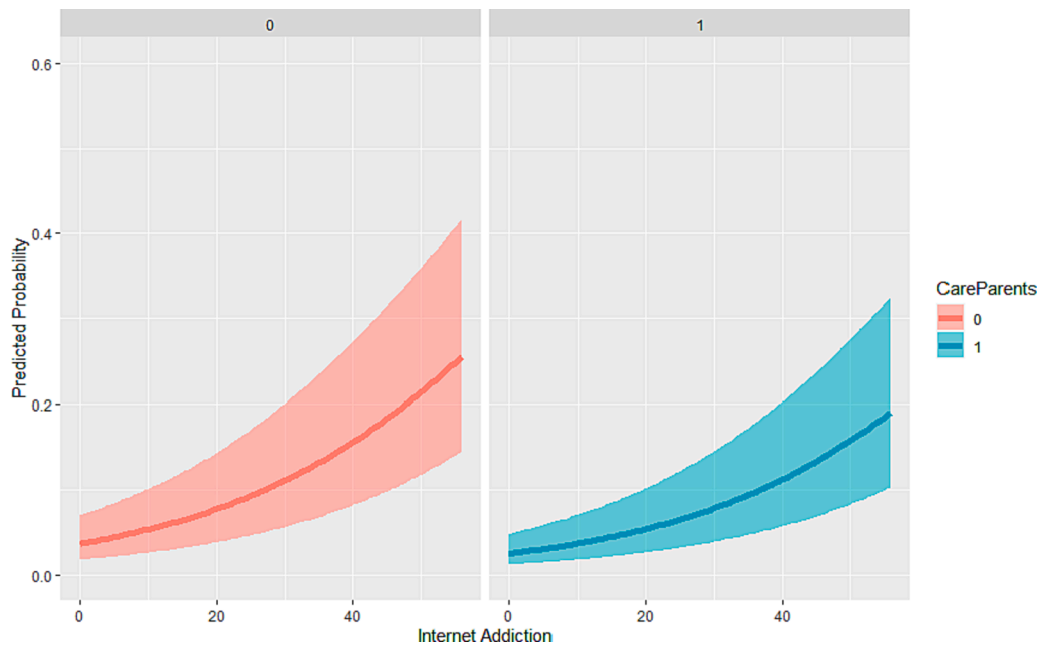


Fig. 3. Average marginal probability of cybervictimization by level of internet addiction and care from parents.

communication and support between parents and adolescents seems to be a key factor in adolescent development and appears to protect against internet addiction (Casaló & Escario, 2019; Xin et al., 2018) and cyberbullying perpetration and cybervictimization (Kowalski et al., 2014). Parents who are aware of the benefits of having a caring relationship with their children could improve this relationship to reduce the probability that their children suffer cyberbullying. This finding is consistent with the literature, which reports that a positive family environment is associated with a lower probability of cybervictimization (Chen et al., 2017; Guo, 2016; Mehari et al., 2018).

Previous studies suggest that peer support is a protective factor against cybervictimization (Guo, 2016; Kowalski et al., 2019). In line with these findings, the results of the current study show that the perception of being cared for by a best friend (not merely a peer) also reduces the likelihood of cybervictimization among adolescents. Zych

et al. (2019) found that peer support is one of the strongest protective factors against cyberbullying. Espinoza (2018) observed that a close friendship not only protects against becoming a victim of cyberbullying but also reduces the negative consequences of cyberbullying. In addition, adolescents who suffer cyberbullying are more likely to talk about it with a close friend than with their family or other peers. The enormous influence exerted by peers, especially close friends, during adolescence is crucial when developing actions to reduce internet addiction and cyberbullying.

The results therefore indicate that having parental care and affection from a close friend inhibits the relationship between internet addiction and cybervictimization. The perception of care from parents and close friends can support adolescents who have an internet addiction and who suffer from cyberbullying. These results are consistent with those of previous studies of the role of parental and peer support in reducing

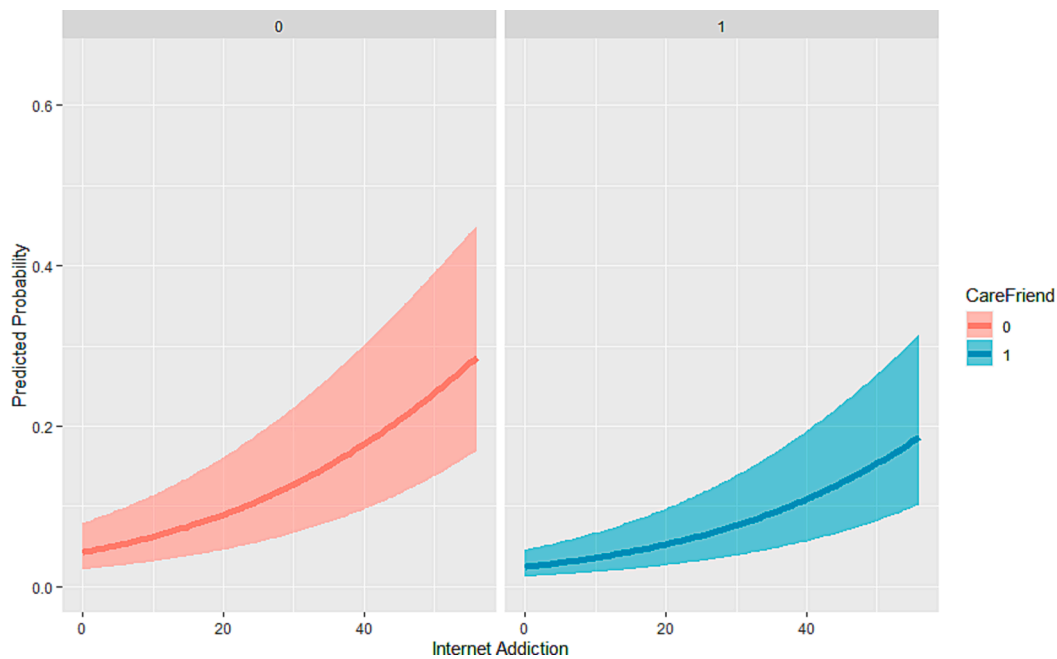


Fig. 4. Average marginal probability of cybervictimization by level of internet addiction and care from friends.

Table 3
Average marginal probability in percentage of cybervictimization by percentile of internet addiction.

	P 1	P 20	P 40	P 60	P 80	P 100
	IA =	IA =	IA =	IA =	IA =	IA =
	0	10.75	22.06	33.37	44.69	56
All	2.63	3.98	6.09	9.21	13.64	19.68
Care from parents = 0	3.65	5.49	8.34	12.44	18.11	25.55
Care from parents = 1	2.50	3.80	5.83	8.83	13.13	19.05
Care from friends = 0	4.25	6.37	9.62	14.25	20.54	28.61
Care from friends = 1	2.43	3.68	5.66	8.59	12.80	18.60

Note. P = percentile; IA = Internet addiction.

internet addiction (Guo et al., 2021; Soh, Chew, Koay, & Ang, 2018) and cybervictimization (Coyle et al., 2021; Hellfeldt, López-Romero, & Andershed, 2019; Holfeld & Baitz, 2020). Therefore, actions aimed at adolescents could seek to address the problems of internet addiction and cyberbullying together. The findings of Wang et al. (2020) may be of interest in this sense. They found that prosocial peer affiliation moderates the association between cybervictimization and the internet addiction of adolescents. This indirect effect was observed to be stronger for those with high prosocial peer affiliation. Prosocial peer affiliation involves establishing relationships between people who perform voluntary actions that benefit others. Among adolescents, such actions may include volunteering, mentoring peers with problems, and creating a positive school environment. Such actions could have dual benefits by decreasing adolescent addiction to the Internet while reducing the likelihood of becoming a victim of cyberbullying.

Regarding school factors, the findings reveal that the probability of suffering cyberbullying is not associated with school ownership. In contrast, the probability of being cyberbullied increases as grades fall and the number of grade repetitions increases. These results confirm that cybervictimization is positively associated with some school vulnerability factors. Consequently, the results support H4. Although the results do not provide evidence of an association between school ownership and cybervictimization (González-Cabrera et al., 2020; Vidourek & King,

2019), the results for factors related to adolescents' school performance are consistent with those of previous studies (Beran & Li, 2007; Camerini et al., 2020). Students with poorer academic performance (lower grades or grade repetition) are more prone to suffer cyberbullying, perhaps because of their lower self-confidence and other related problems (Cassidy, Faucher, & Jackson, 2017).

The analysis also examined several vulnerability factors of adolescents. The likelihood of suffering cyberbullying is negatively associated with being an immigrant. Contrary to previous research (Calmaestra, Rodríguez-Hidalgo, Mero-Delgado, & Solera, 2020; Llorent et al., 2016), there is evidence that immigrant students tend to be less cyberbullied. The importance of being an immigrant varies across countries. It may be less relevant in samples from other countries than in this sample, where immigrant students accounted for more than 10 % of the sample. The analysis of parental academic performance and parental unemployment provides both expected and unexpected results. According to previous research, parental unemployment is a risk factor for suffering cyberbullying (Camerini et al., 2020). However, the fact that an adolescent's father or mother has a university degree (parental academic achievement) unexpectedly seems to be unrelated to cybervictimization.

The novel vulnerability factor included in this study (sporting activity) seems not to be directly associated with cyberbullying. This result may explain why sporting activity has not been used in most cyberbullying studies (Kowalski et al., 2014). It is consistent with studies failing to show that doing sports reduces the possibility of suffering cyberbullying (Benítez-Sillero et al., 2021). However, according to past research, there may be a trade-off between the role of sports as a protective or risk factor for cybervictimization. Several studies have shown that sport can increase self-confidence, self-regulation, and integration with peers (Oaten & Cheng, 2006; Duman & Kuru, 2010). These positive outcomes could help reduce cybervictimization. However, sporting success can increase envy and jealousy among peers, thus attracting cybervictimization (Varjas, Talley, Meyers, Parris, & Cutts, 2010). In sum, cybervictimization seems to be associated significantly with only some vulnerability factors such as parental unemployment and immigrant status. Others such as parental education and sports activity are not found to be associated with cybervictimization.

Lastly, the results of the current study indicate that gender seems to be important in relation to cybervictimization. As in previous studies

(Hong et al., 2016; González-Cabrera et al., 2020), women are found to be more likely to suffer cyberbullying than men. Regarding the role of age in cybervictimization, the results suggest no direct or curvilinear relationship (as observed by González-Cabrera et al., 2020; Tokunaga, 2010). As in previous studies (Hong et al., 2016), there is no evidence that age increases or decreases the likelihood that an adolescent experiences cyberbullying.

5.1. Practical implications

Adolescents are unlikely to stop using the Internet and digital technology (Wright, 2016). Therefore, public administrations must develop strategies to cope with adolescents' exposure to cybervictimization. This study expands the focus on this issue by emphasizing prevention and intervention to help cyberbullying victims. Its findings could help public managers develop more effective and better-tailored public strategies to prevent or reduce the harmful consequences of cybervictimization.

According to this study, internet addiction significantly raises the risk of suffering cyberbullying among adolescents. This finding emphasizes the need for public strategies to reduce internet addiction. Informative school campaigns to reduce internet addiction among students could help reduce cybervictimization. These informative campaigns have proven effective in reducing the prevalence of other addictive behaviors such as smoking tobacco or marijuana (Borderías et al., 2015). Moreover, as some authors suggest (Barlés, Escario, & Galbe, 2014), these campaigns could be made more effective by targeting parents. Doing so could reduce cyberbullying victimization in several ways. For instance, parents could collaborate to reduce the internet addiction of their children. For this approach to work, it is essential for parents to be confident in their ability to influence adolescents. Therefore, they need to play an active role in knowing what their children do on the Internet and in making them aware of the time they spend online (Soh et al., 2018; Casalo & Escario, 2019).

Public institutions should focus on developing educational programs targeting a specific audience (i.e., adolescents) with age-appropriate information that enables them to make sensible and informed decisions about their use of the Internet (see Throuvala, Griffiths, Renoldson, & Kuss, 2019). One example is the use of peer programs in which schoolchildren are trained as activists to inform other students. Public institutions can also promote technology literacy programs for schoolchildren through conferences on the use of the Internet, social media, and online communication. They can also offer video-based programs to provide information and modify attitudes toward problematic use of the Internet and social media. Increasing publications on social media with private information and meeting strangers online have been consistently linked to cybervictimization (Athanasiou et al., 2018). Therefore, providing more information to adolescents about technological coping strategies such as using strict privacy settings on the Internet and frequently changing usernames and e-mail addresses may be helpful for individuals who have been cyberbullied (Tokunaga, 2010). However, research has shown that for many addictive behaviors such as alcohol, drugs, and cigarettes, education can create awareness about the negative consequences of behavior but cannot change it (Kubacki, Rundle-Thiele, Pang, & Buyucek, 2015). Hence, more recent strategies such as the use of social marketing may be more effective (Kubacki et al., 2015). Social marketing uses a mixture of methods to bring about changes in behavior. It uses not only education but also other tools such as segmentation, competition exchange, and elements of the marketing mix (product, price, place, and promotion). For more details on social marketing and cyberbullying interventions, see Spears, Taddeo, Barnes, Scrimgeour, Collin, Drennan, and Razzell (2015).

According to the present findings, the perception of social support from parents and best friends reduces not only the likelihood of cybervictimization but also the likelihood that an adolescent with internet addiction will suffer cyberbullying. Thus, detection of cybervictimization and strategies to prevent or reduce it should also focus on

adolescents' emotional support. Most strategies relate to parental monitoring of internet use and restrictive mediation such as control of time spent online or content filtering (Athanasiou et al., 2018). However, they should also focus on increasing emotional support from those who are important to adolescents. Adolescents who believe they have people who care for them might feel better equipped to cope with negative situations such as cyberbullying (Holt & Espelage, 2007). If these adolescents feel more confident in their abilities, they may also be able to deal with negative situations more effectively, instead of resorting to poor coping strategies such as substance use (Holt & Espelage, 2007).

Finally, knowledge of the profile of adolescents who are most at risk of suffering cyberbullying is immensely helpful for designing more effective campaigns. Besides the factors analyzed in this study, adolescents who have low academic performance, are immigrants, have parents in unemployment, and are women seem to be more at risk of suffering cyberbullying. Most of these factors usually relate to lower social status. Therefore, adolescents with these characteristics tend to be less accepted by peers because they do not conform to mainstream norms and values (Davis et al., 2015).

5.2. Limitations and future research

The limitations of this study offer opportunities for research in the future. First, the use of a dichotomous scale to measure cybervictimization may have generated an arbitrary cut-off point, leading to bias in the results (Camerini et al., 2020). However, the data used in this study were gathered from an existing survey by the Spanish Center for the Monitoring of Drugs and Drug Addiction, so the authors did not participate in developing the scales. Future research should use a multidimensional scale with a more continuous variable. The scale should also consider the potential multidimensionality of the concept, supported by a stronger theoretical framework. Second, although the use of this survey provided a large nationally representative sample ($n = 35,369$), the data only referred to Spain. This study used a strict measure for the dependent variable. Cyberbullying was considered to occur only when it was reported to be more frequent than rare. Hence, the prevalence in this study was lower than in other studies. This study should be replicated in other countries such as those in South America and the Middle East, especially considering the adolescent vulnerability factors specific to each country setting. Third, this study was based on cross-sectional survey data. Therefore, causality cannot be inferred. Longitudinal studies or experimental designs could be used to identify causal relationships between the factors discussed in this study and cybervictimization. Finally, although most of the proposed relationships were found to be statistically significant, future models could include other relevant variables related to adolescent vulnerability such as personality traits.

6. Conclusions

This study investigates the role of internet addiction, support from parents and close friends, school environment, and adolescent vulnerability factors in relation to the probability of suffering cyberbullying. The study is based on a nationwide representative sample of high school students in Spain. The findings highlight the significant role of internet addiction as a risk factor. They also show the protective effects of parental and close friend support in reducing the likelihood of experiencing cyberbullying. The results suggest that prevention measures should target both a reduction in internet addiction and an increase in emotional support for adolescents. School factors such as academic grades and repetition as well as vulnerability factors such as parents' employment and immigrant status are also associated with greater cybervictimization.

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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

The authors do not have permission to share data but data can be request to the Spanish Government (National Plan on Drugs) in: <http://www.pnsd.msbs.gob.es/profesionales/frmBuzonContacto.do>

Appendix A

Items measuring internet addiction of Spanish students (N, relative frequency, and Cronbach's alpha)

Items	n	Never	Rarely	Sometimes	Often	Very frequently	Cronbach's alpha if item deleted
1) How often have you found it difficult to stop using the Internet when you are online?	35,061	13.06 %	28.23 %	34.59 %	17.02 %	7.11 %	0.88
2) How often have you stayed on the Internet even though you wanted to stop?	35,055	29.67 %	25.14 %	23.85 %	14.78 %	6.56 %	0.88
3) How often have your parents or your friends told you that you should spend less time using the Internet?	34,776	21.81 %	24.89 %	25.63 %	17.46 %	10.21 %	0.88
4) How often do you prefer using the Internet instead of spending more time with others (parents, friends, etc.)?	34,837	33.51 %	35.74 %	20.97 %	6.84 %	2.93 %	0.89
5) How often do you lose sleep due to being online?	35,025	33.18 %	27.32 %	21.36 %	12.28 %	5.86 %	0.88
6) How often do you think about the Internet, even though you are not online?	35,000	38.84 %	33.75 %	18.25 %	6.60 %	2.56 %	0.88
7) How often do you wish you could go on the Internet?	35,011	16.10 %	31.06 %	32.50 %	15.46 %	4.87 %	0.88
8) How often do you think that you should reduce your Internet use?	34,957	19.07 %	26.50 %	32.18 %	16.24 %	6.01 %	0.89
9) How often do you think that you have stayed online longer than you intended?	34,932	39.08 %	29.43 %	20.23 %	8.22 %	3.04 %	0.88
10) How often do you intend to finish your work quickly to go on the Internet?	34,977	31.37 %	29.63 %	22.90 %	11.07 %	5.02 %	0.88
11) How often do you neglect your duties (homework, family, etc.) because you prefer to go on the Internet?	35,105	35.01 %	29.88 %	21.26 %	9.74 %	4.10 %	0.88
12) How often do you go on the Internet when you are down?	35,078	18.05 %	22.47 %	24.30 %	21.15 %	14.03 %	0.88
13) How often do you go on the Internet to forget your pains or negative thoughts?	34,913	25.53 %	21.87 %	21.48 %	17.67 %	13.45 %	0.88
14) How often do you feel nervous, frustrated, or irritated if you cannot use the Internet?	34,856	40.96 %	31.21 %	16.86 %	6.95 %	4.02 %	0.88
Overall Cronbach's alpha reliability index = 0.889							

Appendix B. Statistical analysis

As explained earlier, the use of logistic regression may have some caveats depending on the data structure. Maximum likelihood estimates provide unbiased and efficient estimates under the assumptions that the observations are independent and that the likelihood function is correctly specified. Regarding the first problem, in most survey designs, respondents are clustered. Therefore, the independence assumption does not hold because individual responses within a group are more correlated with one another than responses between groups. To deal with this issue, generalized linear multilevel models, an extension of generalized linear models, account for the fact that observations may be hierarchically clustered into one or more levels and provide robust standard errors. Multilevel models, also known as random coefficient models or mixed effects models, were used to study the association between cyberbullying and the predictors described earlier. In the data set used in this study, adolescents were nested within schools. Consequently, a random intercept at the school level was introduced. Not considering this unobserved heterogeneity at the cluster-level could underestimate standard errors and consequently lead to overoptimistic conclusions about the significance of the coefficients.

A common problem of logistic models is that estimated coefficients and exponentiated estimated coefficients, or odds ratios, are difficult to interpret. An estimated coefficient expresses the increment in the log-odds, or logit, when its associated predictor increases by one unit. Similarly, an odds ratio gives the factor by which the odds of the outcome change when the predictor increases by one unit. These quantitative variations in the logit or odds ratio do not have an intuitive interpretation. Therefore, numerous papers only mention whether predictors are significant, without commenting on the quantitative association between outcomes and predictors. Other studies, despite properly interpreting the odds ratios, do not provide an intuitive picture of the magnitude of the associations for readers. Sometimes, the interpretation is not always well communicated to the general audience (Lumley, Kronmal, & Ma, 2006).

To avoid these problems, it is advisable to report changes in the probability of suffering cyberbullying. However, probabilities are not linearly related with predictors, so the analysis of the variation requires extra work. A strategy that is sometimes useful in logistic regressions with few

predictors is to evaluate the marginal probability for several value sets of the predictors. This strategy is not suitable when there are many predictors with several values because the possible combinations of values for the predictors increase too much.² This strategy is also not appropriate in mixed effects logistic regression because it entails evaluating the probabilities by conditioning not only on the selected values for the predictors but also on the random effects values (or group membership). This strategy is quite narrow, given the small number of individuals in each group and consequently in the conditioned group.

An effective strategy could be to compute the average marginal probability,³ (i.e., the average of the predicted probabilities for all individuals in the sample) for several values of the predictor of interest (Doty et al., 2018). For a continuous or almost continuous predictor (i.e., internet addiction), the average marginal probability can be obtained several times by taking K values of the predictor of interest uniformly distributed between its minimum and its maximum and maintaining the values of the other predictors. That is, the sample data can be replicated K times, D_k ($k = 1, \dots, K$), and in each replicated sample, the predictor of interest, X_j , can be replaced by each of the k values calculated for the predictor. For each new data set, the predicted probabilities of suffering cyberbullying can be computed for all individuals. Their average, known as the average marginal probability, can then be computed. In this paper, $K = 100$ equally spaced values for the *Internet addiction* variable were used.

The graphical representation of the K values of the predictor of interest with their average marginal probabilities provides an illustration of the association between the probability of cyberbullying and the predictor of interest. Given a representative sample of the population, the change in the average marginal probability shown in this plot provides a good representation of the probability not only for the sample but also for the population. Moreover, taking $K = 100$ shows the average marginal probabilities for several percentiles of the predictor range in a table. In this study, the chosen percentiles were 1, 20, 40, 60, 80, and 100.

This analysis could be also performed by creating a distinction using a dichotomous predictor (i.e., *Care from parents* and *Care from friends*). In this case, K data replicates could be used as before to compute K average marginal probabilities, one for the k -th value of the continuous variable with the dichotomous predictor set to 0 in all replicated data. The same analysis could be performed by setting the dichotomous predictor to 1 in all replicates.

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² Another alternative is to evaluate the predictors at their means. However, this strategy is not theoretically plausible when there are variables that take the value of 1 or 0 to indicate whether a respondent has a fixed characteristic (e.g., *Female* and *Immigrant* in this case). The question is, what would it mean for such variables to take a value different from 0 or 1?

³ All statistical analyses were carried out using R software [version 4.0.5 (2021-03-31)]. To estimate the generalized linear multilevel models, the *lme4* package in R was used. The marginal probabilities were computed following the steps proposed at the following URL: <https://stats.idre.ucla.edu/r/dae/mixed-effects-logistic-regression/>.

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