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Non-Suicidal Self-Injury, Impulsivity, and Addiction to Social Networks and the Internet in Adolescents

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Título: Autolesión no suicida, Impulsividad y Adicción a las Redes Sociales e Internet en Adolescentes.
Resumen: La impulsividad y la adicción a las redes sociales e internet son dos importantes factores de riesgo asociados a la autolesión no suicida (NSSI) en adolescentes. El presente estudio, de enfoque cuantitativo y transversal, exploró las relaciones específicas entre estos constructos teniendo en cuenta la influencia del sexo. Para ello se utilizaron la Escala de Autoinforme Evaluación Funcional de la Automutilación (FASM) para evaluar la NSSI, la Escala de Riesgo de Adicción a las Redes Sociales e Internet para Adolescentes (ERAR-SI) para medir la adicción digital, y la Escala de Impulsividad de Barratt (BIS-11) para analizar la impulsividad. La muestra estuvo compuesta por 516 adolescentes de entre 11 y 21 años (49.2% mujeres). Se realizaron diferentes análisis estadísticos, como estadísticos descriptivos, correlaciones, regresión logística jerárquica y análisis de ecuaciones estructurales (análisis de trayectorias y análisis multigrupo). Los resultados indicaron relaciones significativas entre las NSSI y la impulsividad y la adicción digital, y NSSI y edad y sexo, siendo la impulsividad motora, las conductas frikis y el sexo femenino variables predictoras significativas. Pese a las limitaciones presentes, estos hallazgos subrayan la relevancia del sexo en la conducta de autolesión y aportan información valiosa para desarrollar intervenciones específicas dirigidas a adolescentes.
Palabras clave: Autolesión no suicida. Impulsividad. Redes sociales. Internet. Adolescentes.

Abstract: Impulsivity and addiction to social networks and the internet are two important risk factors associated with non-suicidal self-injury (NSSI) in adolescents. This quantitative, cross-sectional study explored the specific relationships between these constructs, giving consideration to the influence of sex. For this purpose, the Functional Self-Report Assessment of Self-Mutilation Scale (FASM) was used to assess NSSI, the Internet and Social Network Addiction Risk Scale for Adolescents (ERAR-SI) to measure digital addiction, and the Barratt Impulsivity Scale (BIS-11) to analyze impulsivity. The sample consisted of 516 participants (49.2% of whom were female) aged 11–21 years old. Several statistical analyses were conducted, including calculation of the sample's main descriptive statistics, correlations, hierarchical logistic regression and structural equation analyses (path analysis and multigroup analysis). The results indicate significant relationships between NSSI and impulsivity and digital addiction and between NSSI and age and sex, with motor impulsivity, freaky behaviors and female sex being significant predictor variables. Although this study has certain limitations, these findings highlight the relevance of gender to self-injurious behavior and provide valuable information that can be used to develop specific NSSI interventions aimed at adolescents.
Keywords: Non-suicidal self-injury. Impulsivity. Social networks. Internet. Adolescents.

Introduction

Non-suicidal self-injury (NSSI) behaviors constitute a serious public health issue and a source of growing concern in the mental health field. According to the *DSM-5-TR* (American Psychiatric Association, 2013), NSSI is characterized by intentional, self-inflicted damage to the body's surface without suicidal intent. Such behaviors, including cutting, burning, or hitting oneself, are typically linked to negative emotions, social challenges, or functional impairment. In contrast to suicidal behavior, potentially self-injurious behaviors are not accompanied by an intent to die (Campo-Arias, 2022; Hamza et al., 2015; Nock, 2010; Nock et al., 2006).

Several studies have reported an increase in the incidence of NSSI among adolescents. However, the secrecy surrounding these behaviors, differing definitions of the NSSI construct, and methodological variations in its detection make it difficult to determine its prevalence: there is considerable variability between studies and countries, with studies finding prevalence ranging from 4% to 45%, higher frequency among girls than boys, and higher frequency in clinical samples than in community samples (Faura-García et al., 2021; De Luca et al, 2023; Duarte et al, 2021; González-Arrimada et al, 2023; Lurigio et al, 2024; Vázquez et al, 2023). Studies on the prevalence of self-harm in the Spanish population are scarce, with resulting data indicating prevalences ranging from 10.3% (Carrasco et al., 2023) to half of the studied sample (Calvete et al., 2015). Other reports indicate that its incidence has multiplied by 6.91 in the last five years (Fundación ANAR, 2023). In most studies involving adolescents and young people, not only is NSSI more common among girls than boys, but the methods used also vary by gender: girls tend to select methods such as cutting or puncturing, whereas boys primarily select burning, biting, or hitting (Calvete et al., 2015; Campo-Arias, 2022; Fleta Zaragozano, 2017).

Non-suicidal self-injury behaviors constitute a complex and multicausal phenomenon (Nock, 2010) that involves numerous risk factors. These include child abuse, depression, anxiety, substance use or abuse, personality traits, physical or mental health problems, impulsivity, inappropriate use of the internet and social networks, being girl, being between 15 and 25 years old, being subject to peer victimization, residing in institutions or care centers, belonging to alternative groups, biographical stress and trauma in childhood, and family conflicts (Fleta Zaragozano, 2017; McEvoy et al., 2023; Schmidt et al., 2023; Young et al., 2014). These behaviors are also influenced by various motivations, including seeking support or understanding, seeking to alleviate or

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avoid emotional distress, communicating suffering or distress to others, self-punishment, perceived self-control, or a desire to end feelings of emptiness (Fleta Zaragozano, 2017; Greenberg et al., 2022; Klonsky, 2007; Pinto Loria, 2022). The mechanisms of action (e.g., self-regulation, intra- or interpersonal positive and negative reinforcement, coping strategy, decreased pain sensitivity, contagion, or social modeling via internet or social networks) can also vary depending on variables such as personal and contextual factors, lived experiences, and coping or self-regulation strategies, among others (De Luca et al. 2023; Fleta Zaragozano, 2017; López-Martínez & Carretero, 2022; Lurigio et al., 2024, Nock et al., 2006). This enormous complexity makes research such as that conducted in the current study essential for improving the effectiveness of current interventions designed to address and eliminate NSSI behaviors (Carrasco et al., 2023).

Impulsivity and addiction to social networks and the internet are two important risk factors associated with NSSI among adolescents. As an intrapersonal vulnerability factor that is characterized by a tendency to act on urges without considering consequences, impulsivity appears to be a common factor in the initiation and maintenance of self-harming behaviors (Cassels et al. 2020; Lockwood et al., 2020; Moore et al., 2023; Pérez & Mayorga, 2023; Whiteside & Lynam, 2001). Empirical evidence suggests a significant association between impulsivity and NSSI frequency, severity, and methods (Costa et al., 2021). The tendency toward impulsivity increases many self-destructive behaviors, including drug abuse or direct corporal self-injuries, which are often motivated by the desire to alleviate emotional distress (Hamza et al., 2015; Lockwood et al., 2020).

A metanalysis conducted by McHugh et al. (2019) showed significant connection between different facets of impulsivity (e.g., inhibitory control deficits, impulsive decision-making) and NSSI among adolescents. Impulsivity, as previously mentioned, is characterized by an inclination to act quickly and without prior reflection, poor self-control, difficulties postponing gratification (as well as a positive preference for immediate gratification), and a tendency to ignore possible long-term consequences; all this can have a significant impact on adolescents' psychological well-being (Pérez & Mayorga, 2023) and self-regulation. Both components (i.e., emotional dysregulation and a lack of well-being) have been identified as crucial elements in research on NSSI and suicidal ideation in adolescents (Mollà et al., 2015; Zetterqvist et al., 2013). An in-depth understanding of these facets of impulsivity is essential for the development of effective interventions and preventive strategies focused on adolescents who are prone to NSSI.

Information and communication technology (ICT) plays a significant role in the development and evolution of self-injurious conditions during adolescence (Gámez-Guadix et al., 2022; López-Martínez & Carretero, 2022). Excessive and poorly controlled use of the internet, including cybervictimization or exposure to some forms of online content, have been associated with self-injurious behavior in adolescents (Biernesser et al., 2020; Nesi et al., 2021; Sherr, 2022). Indeed, continuous access to social networks may increase one's exposure to bullying, negative comparisons, social pressure, and constant criticism, which can trigger feelings of anxiety, depression, and low self-esteem (López-Iglesias et al., 2023). These overwhelming emotions can lead to self-injurious behaviors. Social networks and the internet also open the window to membership in unconventional alternative youth groups, whose behavioral and cultural assets are associated with an increased risk of self-harm as a sign of identity and group belonging (Brown & Plener, 2017; López-Martínez & Carretero, 2022; Young et al., 2014). In this regard, problematic internet use in adolescents is significantly related with self-injury (Xiong et al., 2023).

In turn, impulsivity and addiction to social networks and the internet are also related to one another. Impulsivity tends to be an important factor in excessive and problematic use of the internet (Moral & Fernández, 2019) and mobile phones (Terroso et al., 2022). Thus, people who are addicted to the internet tend to exhibit lower inhibitory control and higher impulsivity than people without this addiction. Moreover, problematic and addictive use of mobile devices and the internet is related to poor sleep quality, higher levels of psychological stress, concentration difficulties due to irrelevant and unwanted thoughts, difficulty in cognitive–emotional regulation, deterioration of cognitive function, addiction to social networks, shyness, and low self-esteem (Li et al., 2020; Wacks & Weinstein, 2021), which can lead to self-harm (Xiong et al., 2023). Impulsivity and the problematic use of ICTs are both related to self-injury through sensation-seeking, a tendency to act without premeditation, a tendency to seek out risky situations (Greenberg et al., 2022; Pinto Loria, 2022), and negative emotions (Brown & Plener, 2017). Consequently, impulsivity may lead to the development and maintenance of self-injury via inappropriate use of the internet and social networks. Furthermore, some studies have found that online platforms and impulsivity may contribute to the prevalence and intensification of self-injurious behaviors and analyzed the mechanisms underlying this phenomenon (López-Martínez & Carretero, 2022).

Regarding the influence of gender on these variables, the literature shows a lack of clarity when considering differences in impulsivity (Greenberg et al., 2022; Wood et al., 2013) and misuse/abuse of social networks and the Internet (Durkee et al, 2012; Liu et al., 2013; Nesi et al., 2021; Rial et al., 2015), as well as girls' tendency to self-harm more than boys (Calvete et al., 2015; Gamez-Guadix et al., 2022; Gillies et al., 2018; Greenberg et al., 2022; Vázquez et al., 2023). Further research is needed to clarify these differences.

The aim of our study was threefold. First, we explored the interrelations between impulsivity factors, addiction to social networks and the internet, and NSSI in adolescents. Second, we analyzed how these factors affect non-suicidal self-harming behaviors in adolescents; this involved exploring the unique contributions of each factor and the dynamic by which impulsivity variables, as well as addiction to social

networks and the internet, affect self-injurious behaviors. Our third objective focused on examining how gender differences contribute to the relationships identified in this study. This involved assessing the ways in which gender influences the interplay between impulsivity, addiction to social networks and the internet, and non-suicidal self-harming behaviors in adolescents. Collectively, these objectives are intended to provide a comprehensive and nuanced understanding of the complex interplay between impulsivity, social media and internet addiction, and non-suicidal self-harming behaviors in adolescents, with a specific focus on gender-related dynamics.

In light of our literature review, we expected to find both significant connections between impulsivity factors and addiction to social networks and the internet, and between both these phenomena and non-suicide self-harming behaviors in adolescents. These expectations form the basis of our first hypothesis. Our second hypothesis is informed by the expectation that impulsivity factors and addiction to social networks and the internet uniquely contribute to non-suicidal self-harming behaviors in adolescents; however, our third hypothesis investigated the possibility that impulsivity leads to problematic use of social networking and the internet, and that both contribute to NSSI.

Finally, given the inconclusiveness of previous results regarding sex differences in impulsivity and problematic use of social networks and the internet, as well as the tendency of girls to exhibit NSSI more frequently than boys, we did not have definite expectations about the impact of sex moderation. This forms the basis of our primary research question.

Method

Participants

Our convenience (non-random) sample was composed of 516 young people and adolescents (50.8% boys) with a mean age of 14.89 years (*SD* = 1.93; range 11–21). The participants were students in compulsory secondary education and bachelor's degree programs in public and charter educational centers distributed throughout various areas of the Community of Madrid. All participants were from a middle-class social background without any reported sociocultural deprivation. Most participants were born in Spain (81.8%); only 16.5% came from other countries. Within the sample, 68.8% of participants lived with both parents, 12.2% lived with one parent, 8.5% lived in shared custody, and 7.2% lived in households with one parent and their current partner.

We found that 90.9% of the sampled young people reported having their own mobile phone. Of this group, 94.6% had an internet connection, with 92.1% of participants using this connection as their primary means of accessing social media and browsing the internet. Regarding the time dedicated to these activities, 27.8% of the sample spent two hours online daily, whereas 39.9% exceeded three hours of online activity.

Finally, of the 484 students who properly completed the NSSI test, 213 (44%) reported having experienced self-harm or having been self-injured at least once in the last 12 months.

Instruments

We used the Self-Report Scale Functional Assessment of Self-Mutilation (FASM; Lloyd et al., 1997; Spanish version, Calvete et al., 2015) to assess the methods, frequency, and function of self-injury among our sample over the 12 months preceding the study. This scale assesses the presence and frequency of various forms of self-injury (i.e., cutting or scratching oneself, hitting oneself, pulling out one's hair, getting a tattoo, picking at wounds, inserting subdermal objects, biting oneself, and scratching or rubbing one's skin until it bleeds). We excluded tattoos as a form of self-harm, and thus did not consider the results obtained for this item when calculating the self-harm score. The internal consistency (Cronbach's alpha) of the scale was .77 for the present sample. Self-injury was treated as a categorical variable (the presence or absence of self-injury). The presence category included all participants who reported at least one of the self-injurious behaviors of interest.

We used the Scale of Risk of Addiction to Social Networks and Internet for Adolescents (ERAR-SI; Peris et al., 2018) to assess the risk of internet addiction among our sample. This scale consists of 29 items with four related dimensions that assess internet addiction risk: (1) *symptoms of addiction* (i.e., addiction to online technologies; e.g., "I would be angry if I had to do without social networks"); (2) *social media use* (use of social networks for socio-virtual interrelationships; e.g., "I upload photos and/or videos to social networks"); (3) *freaky traits* (i.e., disproportionate and obsessive practice of an extravagant, weird, or eccentric hobby; e.g., spending excessive time on erotic and/or pornographic websites, playing virtual and/or role-playing games, or interacting with groups with common interests, including "joining interest groups"); and (4) *nomophobia* (i.e., the intense fear of being without a cell phone; e.g., "I feel more secure and less isolated knowing that I can communicate with someone at any moment"). The response format is a 4-point frequency-of-use scale ranging from 1 (*never or almost never*) to 4 (*almost always or always*) for each of the four dimensions and for the total scale. The results for this sample demonstrated acceptable internal consistency for the total scale (α = .88) and three of its four dimensions: symptoms of addiction (9 items, α = .74), social media use (8 items, α = .80) and nomophobia (6 items, α = .72); and low internal consistency for freaky traits-(6 items, α = .66).

The Barratt Impulsivity Scale (BIS 11; Patton et al., 1995, Spanish version, Martínez-Loredo et al., 2015) consists of 30 items that assess three different dimensions of impulsivity: the *cognitive* item assesses the subject's tendency to control at-

tention and make quick cognitive decisions, with a focus on deficits in cognitive inhibitory control (e.g., "I make up my mind quickly/My thoughts can have great speed," "I concentrate easily" [reverse scored]); the *motor* item assesses the subject's tendency to act without considering the possible physical or material consequences, with a focus on deficits in behavioral inhibitory control related to sensitivity, motivation to acquire rewards, and a propensity to act rashly (e.g., "I do things without thinking," "I act on impulse"); and the *non-planning* item, which measures the subject's tendency to act without prior planning (i.e., impulsiveness). The response format for this instrument is a 4-point frequency-of-use scale ranging from 1 (*never or almost never*) to 4 (*almost always or always*). In this study, we considered only motor (excluding Item 6; $\alpha = .71$) and cognitive (excluding items 16 and 27; $\alpha = .66$) impulsiveness.

We also requested that the participating students provided some sociodemographic information, including their sex (boy versus girl), age, grade, place of birth, and with whom they usually lived. Participants were asked about their possession of a mobile phone and their access to the internet, as well as their use of social networks and the time they spent on these platforms.

Procedure

The data were collected by two PhD students with previous training by means of a self-report questionnaire which the sampled students completed in their own classrooms in one session lasting one hour. All students received the same instructions on how to proceed. We obtained prior informed consent from parents or guardians of students between the ages of 11 and 15 years, and from the students themselves for those over the age of 16. Participants were also informed that their responses were anonymous and confidential. Similarly, they were assured that the results would be used only for research purposes. All students provided informed consent for their participation and filled out the questionnaire. Teachers were present and provided support to the project's research psychologists, who administered the questionnaires.

The boards of the participating secondary schools and the ethics committee of the UNED (Universidad Nacional de Educación a Distancia) approved the study, which was conducted in accordance with the ethical principles set out in the Declaration of Helsinki (World Medical Association, 2013).

Data Analysis

The study was quantitative and cross-sectional. Correlation and hierarchical logistic regression analyses were performed and main descriptive statistics were calculated to understand factors affecting self-harming behaviors in adolescents. We implemented hierarchical logistic regression in three steps, initially incorporating sex and age, followed by impulsivity variables, and ultimately introducing variables related to addiction to social networks and the internet. The hierarchical structure of the logistic regression revealed dynamic shifts in predictor effects. These preliminary results prompted mediation and moderation analyses by path analysis and multigroup analysis of invariance using a structural equation model (SEM). This was facilitated by IBM SPSS Statistics (version 25), JASP (version 0.18), and tools such as PROCESS and RStudio. These analyses provided a more nuanced understanding of the intricate relationships identified by the regression analysis. We explored the moderating effects of sex, and identified mediating variables that contributed to self-harming behaviors. Finally, we examined the invariance of the mediation model across sex, assessing the consistency of the identified processes. For the purposes of the analysis NSSI was included as a categorical variable (the presence or absence of self-injury).

Results

Basic Descriptive Statistics and Boys and Girls Differences for NSSI, Impulsivity, and Addiction to Social Networks and the Internet

The means and standard deviations by sex (boys and girls) for impulsivity and addiction to social networks and the internet are shown in Table 1. A multivariate analysis of variance (MANOVA) was conducted to analyze the effects of sex on the main variables. The MANOVA analysis found significant effects of impulsivity factors (Wilks' $\Lambda = .98$, $F = 4.09$, $p = .017$) and addiction to social networks (Wilks' $\Lambda = .75$, $F = 39.91$, $p = .001$). Tests of the between-subjects effect found a significant effect of sex ($p = <.01$) on motor impulsivity, symptoms of addiction, social media use, freaky traits and nomophobia. The effect size for all variables was low ($\eta 2$ ranging from .17 to .065). Girls scored significantly higher for motor impulsivity, symptoms of addiction, social media use and nomophobia; however, boys scored higher for freaky traits (see Table 1).

Prevalence was higher among girls (63.4%) than boys (36.6%). A chi-square test of independence was conducted to examine the relationship between sex and the occurrence of the specific behavior. The results revealed significant differences in occurrence of NSSI between boys and girls [$\chi^2(1, N = 484) = 28.95$, $p = .001$; V Cramer = .24].

Table 1
Basic descriptive statistics and effects by sex

	Total	Boys	Girls	*F*	*p*	η^2	Skewness	Kurtosis
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)					
Cognitive impulsivity	16.04 (2.37)	15.91 (2.37)	16.17 (2.36)	1.39	.238	.003	-.44	.35
Motor impulsivity	18.69 (4.42)	18.13 (4.06)	19.27 (4.70)	7.87	.005	.017	.51	.17
Symptoms of addiction	17.80 (4.73)	16.61 (4.70)	19.01 (4.46)	34.21	.001	.065	.58	.32
Social media-use	17.86 (4.87)	16.68 (4.79)	19.07 (4.67)	31.48	.001	.060	.35	-.22
Freaky traits	9.58 (2.98)	10.30 (3.03)	8.84 (2.74)	31.50	.001	.060	1.24	2.08
Nomophobia	11.90 (3.73)	11.28 (3.68)	12.53 (3.68)	14.21	.001	.028	.64	.04

Relations between NSSI, Impulsivity, and Addiction to Social Networks and the Internet

Table 2 shows Pearson's correlations and Rho Spearman correlations for sex (boys/girls) and self-injury. We found significant ($p \leq .01$) low-to-moderate correlations between self-injury and impulsivity factors. Moreover, we also found significant low-to-moderate correlations between self-injury and factors related to addiction to social networks and the internet. Female sex (girls) was significantly correlated with motor impulsivity ($p < .05$), self-injury, symptoms such as social media use and internet addiction (all correlations $p < .01$); male sex (boys) was significantly correlated with freaky traits ($p < .01$). Older adolescents exhibited more symptoms of addiction, freaky traits and self-injury ($p < .01$).

Table 2
Correlations Analysis

	1	2	3	4	5	6	7	8	9
1.Sex	1								
2. Age	.09*	1							
3. Cognitive impulsivity	.05	−.01	1						
4. Motor impulsivity	.11*	−.00	.22**	1					
5. Symptoms of addiction	.27**	.23**	.23**	.30**	1				
6. Social media-use	.24**	.06	.13**	.24**	.58**	1			
7. Freaky traits	-.28**	.21**	.08	.14**	.40**	.37**	1		
8. Nomophobia	.16**	.02	.12**	.23**	.54**	.20**	.28**	1	
9. Self-injury	.24**	.17**	.28**	.26**	.28**	.20**	.16**	.21**	1

Note. Rho Spearman for Sex (1 = *boys*, 2 = *girls*) and for Self-injury (1 = absence, 2 = presence)
*$p \leq .05$; **$p \leq .01$

Predicting NSSI by Sex, Age, Impulsivity, and Addiction to Social Networks and the Internet

We performed hierarchical logistic regression to assess the impact of sex, age, impulsivity, and factors relating to addiction to social networks and the internet on the likelihood that adolescents would engage in NSSI behaviors. Sex and age variables were entered at step 1; cognitive impulsivity and motor impulsivity at step 2; and finally, symptoms of addiction, social media use, freaky traits, and nomophobia at step 3. The logistic regression model was statistically significant for step 1, $\chi 2$ (2, N = 515) = 33.95, p = .0001; step 2, $\chi 2$ (4, N = 515) = 63.60, p = .0001, and step 3, $\chi 2$ (8, N = 515) = 86.08, p = .0001. By steps, the model explained (Nagelkerke R^2) 10%, 18%, and 24% of the variance in NSSI, respectively, and correctly classified 64.9% (76.9% no-self-injury, 49.5% self-injury) of cases for step 1; 65.4% (76.1% no-self-injury, 51.6% self-injury) of cases for step 2, and 66.8% (76.1% no-self-injury, 54.9% self-injury) of cases for step 3. The change in R^2 from the first step to the second and third was significant ($p < .05$). Table 3 presents coefficients and logistic regression statistics.

With regard to the final step of the model, three factors were significant predictors of self-injury: sex, motor impulsivity, and freaky traits. Motor impulsivity, freaky traits, and especially being girl were significantly associated with an increase in the likelihood of self-harming behaviors among the sampled adolescents. Age, cognitive impulsivity, symptoms of addiction, social network use, and nomophobia were not significantly associated with self-injury among the sampled adolescents. The *OR*s indicate that the probability of presenting self-injury increased 1.09 times for each point increase on the motor impulsivity scale. Likewise, being girl increased the probability 2.92 times, and exhibiting freaky traits increased the probability of self-injury 1.16 times.

Table 3
Hierarchical Regression Analyses Predicting Self-Injury by Sex, Age, Impulsivity, and Addiction to Social Networks and the Internet

Predictors	*B*	*SE*	Wald	Exp. (*B*)	95% *CI* (lower, upper)
Step1					
Constant	-4.08	.86	22.58**	.01	
Sex	.15	.05	8.83**	1.17	1.05, 1.30
Age	.97**	.20	22.51**	2.64	1.76, 3.94
Step 2					
Constant	-7.67	1.23	36.63*	.00	
Sex	.86	.21	16.62**	2.37	1.56, 3.60
Age	.17	.05	9.24**	1.18	1.06, 1.32
Cognitive impulsivity	.08	.04	3.70	1.09	.99, 1.19
Motor impulsivity	.11	.02	19.59**	1.21	1.06, 1.17
Step 3					
Constant	-8.58	1.34	1.04**	.00	
Sex	1.07	.26	16.89**	2.92	1.75, 4.87
Age	.11	.06	3.69	1.12	.99, 1.26
Cognitive impulsivity	.07	.05	2.05	1.07	.97, 1.18
Motor impulsivity	.09	.03	11.39*	1.09	1.03, 1.15
Symptoms addiction	.04	.03	1.87	1.04	.98, 1.11
Social use	-.02	.03	.86	.97	.91, 1.03
Freaky traits	.14	.05	8.94*	1.16	1.05, 1.27
Nomophobia	.04	.04	1.20	1.04	.96, 1.12

*p < .05; **p < .01

Moderating Effects and Mediation Moderation Analysis Across Sex

Based on the significant predictors identified in the preliminary analysis, we then explored the moderating effects of sex and mediating effects across sex. We explored the effects of sex and freaky traits as moderators. One interaction between sex and motor impulsivity was found to be statistically significant: B = .12, p = .010; 5000 bootstrapping 95% confidence interval (CI; lower = .029, upper = .22). This indicates that the strength of the relationship between motor impulsivity and self-injury tends to be stronger in girls than boys (Figure 1).

We analyzed a mediating model across boys and girls (Figure 2), which tested the mediating effect of freaky traits on the relationship between motor impulsivity and non-suicidal injury. The unconstrained model showed a perfect fit when the parameters were freely estimated, $\chi2(0, p = .00$, Root Mean Square Error of Approximation [RMSEA] = 0.00). Thus, the relationship between motor impulsivity and self-injury was significantly mediated by adolescents' freaky traits, a*b = .005, p = .002; 1000 bootstrapping 95% CI (lower = .002, upper = .10), with a significant total effect of motor impulsivity on self-injury, c = .058, p =.001; 1000 bootstrapping 95% CI (lower = .003, upper = .007). Motor impulsivity and freaky traits explained 9% of the variance of adolescents' self-injury (R^2 = .089). Thus, motor impulsivity tends to enhance freaky traits, which subsequently increase self-injuring behaviors among adolescents.

Figure 1
Moderating Relations of Sex Between Motor Impulsivity and Non-Suicidal Injury

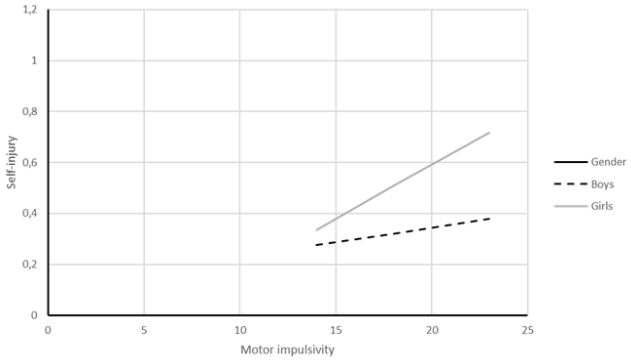
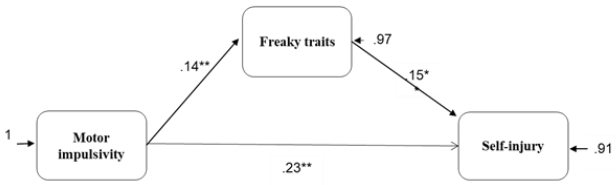


Figure 2
Mediating Relations with Standardized Parameters



To explore whether the proposed mediation model held equally for both boys and girls, we conducted a multigroup analysis across sex. The chi-square value for configural invariance (model base) was nonsignificant, suggesting that the general structure of the mediation model was comparable between boys and girls. Subsequent chi-square tests where loadings were equality constrained were also nonsignificant and did not increase significantly. Metric invariance was therefore supported, indicating that the strength of the associations in the mediation model did not significantly differ between boys and girls. Table 4 presents fit indices from the multigroup analysis of invariance across sex.

Table 4
Fit Indexes for Mediating Multigroup Analysis of Invariance Across Sex.

	AIB	BIC	*n*	X^2	*df*	*p*	$\Delta\chi^2$	Δdf	RMSEA
Model base	2859.27	2904.97	471	7.62	3	0.05		--	0.08
Model for boys	1472.72	1497.08	240	0.00	0	1.00	0.00	--	0.00
Model for girls	1384.92	1409.02	231	0.00	0	1.00	0.00	--	0.00
Constraint model	2859.27	2904.97	471	7.62	3	0.05	0.00	0	0.08

Discussion

Non-suicidal self-injury behaviors constitute a serious public health concern, with growing prevalence among adolescents. These behaviors constitute a complex and multicausal phenomenon (Nock, 2010) in which impulsivity (Cassels et al., 2020; Lockwood et al., 2020; McHugh et al., 2019; Moore et al., 2023; Pérez & Mayorga, 2023; Whiteside & Lynam, 2001) and addiction to social networks and the internet (Biernesser et al., 2020; Nesi et al., 2021; Sherr, 2022) have been identified as two important risk factors. Few existing studies analyze how both constructs together contribute to self-injurious behaviors in adolescents.

The primary aim of this study was to explore the interrelationships among impulsivity factors, addiction to social networks and the internet, and non-suicidal self-harming behaviors in adolescents. As we expected, the results indicated significant relationships between impulsivity factors and addiction to social networks and the internet, with the exceptions of cognitive impulsivity and freaky behaviors or *freaky traits*, according to the name of this dimension in the ERAR-SI scale (Peris et al., 2018), and that both impulsivity and addiction to social networks and the internet were significantly related to non-suicidal self-harming behaviors among the sampled adolescents. Consistent with previous studies, our findings indicate that impulsivity and problematic internet use are significantly related in adolescents (Greenberg et al., 2022; Meerkerk et al., 2010; Moral & Fernández, 2019), and NSSI is also related to both impulsivity (Cassels et al., 2020; McHugh et al., 2019; Moore et al., 2023; Pérez & Mayorga, 2023; Whiteside & Lynam, 2001) and problematic internet use (Biernesser et al., 2020; Nesi et al., 2021; Sherr, 2022). These results confirm our first hypothesis, as outlined above, and underscore the importance of considering the impact of technology on adolescent mental health, as well as the need to develop specific preventive strategies for such behaviors.

We also found significant connections between sex and age: for example, female sex was correlated with self-injury, motor impulsivity, addiction, and the use of social networks; in contrast, male sex was significantly correlated with freaky behaviors. Furthermore, older adolescents scored higher for symptoms of addiction, freaky behaviors, and self-injury. Regarding sex correlations, we found being girl to be significantly associated with NSSI, which is consistent with previous studies (Calvete et al., 2015; Gillies et al., 2018; Vázquez et al., 2023). The problematic use of social networks and the internet has also been associated with greater psychological consequences (consistent with NSSI and impulsivity) among girls than boys (Sánchez-Carbonell et al., 2008; Sánchez-Martínez & Otero, 2009); however, the results of various studies are inconclusive regarding the relationship between gender and problematic use of social networks and the internet. Indeed, some studies support a relationships between girls and problematic use (Durkee et al., 2012; Rial et al., 2015), whereas others support these same significant relationships for boys (Liu et al., 2013). A significant correlation between male sex and freaky behaviors is not specifically found in the literature; however, boys in early adolescence tend to score higher on many risk factors related to impulsive and risky behaviors, such as reward sensitivity, risk taking, and sensation seeking (Lockwood et al., 2020; Wood et al., 2013).

In terms of age, Beranuy et al. (2009) found that most problematic use of the internet occurs during adolescence, and after this period social networks and the internet tend to be used for more professional and less playful or social purposes. During late adolescence, boys and girls use social networks and the internet as part of their leisure and recreational activities, as a means of interaction and contact with their friends and peers, and as a way to build their social identities (Beranuy et al., 2009; Moral & Fernández, 2019; Sánchez-Carbonell et al., 2008; Sánchez-Martínez & Otero, 2009).

Beyond analyzing the interrelationships among variables, the second objective of this study involved exploring the unique contributions of each factor (impulsivity and variables relating to social network and internet use) to self-injurious behaviors. Taking all variables together as predictors of NSSI, only three were found to be significant: motor impulsivity, freaky behaviors, and in particular being a girl. The combination of these variables increased the probability of an individual presenting self-injurious behaviors by 5.17 times. As other studies have found, impulsivity is an important risk factor for NSSI (Hamza et al., 2015; Nock, 2010; Whiteside & Lynam, 2001) and predicts the occurrence of self-harmful or self-destructive behaviors (McHugh et al., 2019). It is unclear precisely why motor impulsivity rather than cognitive impulsivity makes a unique contribution to NSSI; however, consideration of the different facets of impulsivity may explain these results.

As McHugh et al. (2019) reported in their meta-analysis, a deficit in response behavioral inhibition (i.e., motor impulsivity) or a behavioral component of inhibitory control may explain why some people engage in self-harm and suicidal behavior, given that cognitive inhibition does not differentiate between young people exhibiting self-harm and suicidal behavior and control groups. Moreover, cognitive impulsivity, which is more closely related to attentional control and thought inhibition, appears to be associated with the rumination process and lack of control over ideas of self-harm or suicidal ideation (Rogers & Joiner, 2017). This also supports the notion that impulsivity is neither a homogenous nor a simple construct (Lockwood et al., 2020; McHugh et al., 2019; Whiteside & Lynam, 2001). However, further research using specific measures for cognitive and motor impulsivity is needed to clarify this point.

In addition to motor impulsivity, freaky behaviors or traits (rather than the other ERAR-SI dimensions: symptoms of addiction, social media use, and nomophobia) similarly make a unique contribution to NSSI. Although the internet and social networks have definite advantages (e.g., social support, peer acceptance, sense of belonging), virtual com-

munities are also places where people can search for or post self-harm content, or share information on how to cause physical self-harm from a place of anonymity, privacy, and a certain sense of normalcy (Gámez-Guadix et al., 2022; Jacob et al., 2017). In this sense, freaky behaviors (i.e., young people with behaviors perceived as unusual who disproportionately and obsessively practice an extravagant, rare, or eccentric hobby, such as spending excessive time on erotic and/or pornographic sites, or playing virtual and/or role-playing games, thereby connecting with groups with common interests) may facilitate the tendency to gain access to self-harm content and people who support it. Freaky behaviors may be related to other experiences, such as biographical stress, family conflicts, or trauma in childhood (Fleta Zaragozano, 2017; McEvoy et al., 2023; Young et al., 2014), which in turn may explain the association with NSSI.

The third factor contributing to NSSI among the sample was being a girl, a unique contribution that may be explained in various ways. For instance, girls experience greater psychosocial challenges (e.g., earlier pubertal changes, higher physical image standards, romance investment, higher expectations for good behavior and academic achievement) than boys (Negriff & Susman, 2011), as well as suffering a higher prevalence of emotional problems (e.g., anxiety, depression, eating disorders, borderline personality or neuroticism) compared with boys during adolescence (Matos et al., 2017) and facing greater difficulties related to self-regulation. These reasons, among others, may lead girls to NSSI as a way to address and cope with these challenges (Hamza et al., 2015, Lockwood et al., 2020; Skegg, 2005). These findings related to the unique contribution of specific predictors only partially confirm the expected results of our second hypothesis: only one factor of impulsivity (motor impulsivity) and one factor of social network addiction (freaky behaviors) made unique contributions to NSSI.

In addition to exploring the unique contributions of each factor, analysis of the dynamics among the variables of impulsivity and addiction to social networks and the internet, as well as their impact on self-injurious behaviors, showed a significant mediation of the relationship between motor impulsivity and non-suicidal injury by freaky behaviors (rather than symptoms of addiction, social media use, or nomophobia). In this sense, our third hypothesis was partially confirmed: such motor impulsivity (i.e., poor inhibitory control, deficient response behavioral inhibition) may promote the progression of NSSI through groups which share common interests, eccentric hobbies, role-playing games, or practices. The presence of motor impulsivity appears to be a marker of extremely poor control within groups exhibiting freaky behaviors, which may lead to NSSI in adolescents. Taken together, these findings suggest that interventions directed at strengthening impulse control and targeting the access tendencies of groups exhibiting freaky behaviors may concurrently prevent NSSI.

Contrary to our expectations (Moral & Fernandez, 2019), high motor impulsivity does not seem to impact internet misuse among adolescents in terms of symptoms of addiction and the misuse of social networks. Other factors can affect these relationships, such as the intensity of symptoms of addiction, the frequency of contact with social networks or the internet, social support, isolation, and coping strategies, among others (Brown & Plener, 2017; Nock, 2010), which may explain the differences between our results and those of previous studies. To our knowledge, no analysis of mediation of the relationship between motor impulsivity and NSSI by freaky behaviors has been conducted. In this regard, we cannot compare our results to those of previous studies.

The final objective of this study focused on examining how sex differences contribute to the relationships identified in the study, specifically the premise of our research question. Regarding this aim, our findings revealed the importance of sex differences in three primary ways: in terms of relationships among variables (i.e., correlations); in terms of contributions (i.e., being female made a significant unique contribution to NSSI); and moderation (i.e., the *relationship between motor impulsivity and self-injury tends to be stronger in girls than boys*). However, mediation was invariant for boys and girls, suggesting that the mechanism by which motor impulsivity potentially leads to NSSI is similar in boys and girls. Thus, beyond sex-invariant mediating relationships, as many studies have suggested (Beckman et al., 2019; Liu et al., 2013; Matos et al., 2017; Negriff & Susman, 2011), a gendered perspective must be considered when dealing with NSSI in adolescents.

It is important to consider the limitations of this study. First, data were collected via self-reporting. Incorporating different measures, such as observation, rating scales, or behavioral measures, might produce different results and capture different aspects of the variables assessed. For instance, self-reported measures of impulsivity have been weakly associated with self-harm, whereas neurocognitive measures of impulsivity and self-harm are associated with a medium-to-large effect size (McHugh et al., 2019). Second, the study design was based on a cross-sectional method, rather than longitudinal analyses. As this approach did not allow us to establish true causal relationships, the direction and mediating paths of variables should be approached with caution and primarily from a statistical perspective. In addition, longitudinal studies, such as the work of Lockwood et al. (2020), have shown how different aspects of impulsivity can predict the onset of self-harm (i.e., seeking sensation) and the maintenance of self-harm (i.e., premeditation) in different ways. Finally, participants in this study were taken from the general population, within which neither addiction nor pathological impulsivity are expected. Clinical levels of addiction or impulsivity would tend to strengthen relationships with NSSI. Therefore, the results of this study should be restricted to the characteristics of the participants evaluated. Future studies investigating how different age groups use social networks and the internet could provide more detailed results that may overcome the limitations and current scope of this study. In addition, they would make it possible to

analyze the evolution of the use of these technologies not only as a recreational activity, but also in terms of its impact on identity, social relationships, and related risk factors. Similarly, the relationship of NSSI to other variables such as life experiences and substance use behaviors should also be examined, while considering the effects of sex and age on these relationships.

Despite these limitations, this study contributes to a more comprehensive and nuanced understanding of the complex interplay between impulsivity, social media and internet addiction, and non-suicidal self-harming behaviors in the adolescent population, with a specific focus on gender-related dynamics. Understanding the specific roles of motor impulsivity and freaky behaviors provides valuable insights for targeted interventions with gender-sensitive strategies, focused on the control of impulsivity and access via internet and social networks to groups which exhibit freaky behaviors.

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