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Child Abuse & Neglect

journal homepage: www.elsevier.com/locate/chiabuneg

Epidemiology of online sexual solicitation and interaction of minors with adults: A longitudinal study

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ARTICLE INFO

Keywords:

Online grooming
Sexual solicitation
Sexualized interaction
Adolescents
Health-related quality of life

ABSTRACT

Background: There have been very few longitudinal studies on online sexual solicitation and the online interaction between minors and adults. Still less evidence exists on the relationship of these problems with minors' Health-Related Quality of Life (HRQoL).

Objective: This study aimed to analyze the point prevalence, period prevalence (prevalence over time) and incidence (new cases over time) of online sexual solicitation and interactions between minors and adults throughout three consecutive time periods and to compare the HRQoL among categories of victims (non-victims, new victims, ceased victims, intermittent victims, and stable victims).

Participants and setting: The participants were 1029 Spanish students (43 % boys, 57 % girls), aged 12–15 years.

Methods: A longitudinal study was conducted over a 13-month period, with measurements taken at three time points.

Results: For sexual solicitation, the point prevalence was 11.3 % at wave 1 (W1), 11.9 % at wave 2 (W2), and 16.1 % at wave 3 (W3). For sexualized interactions, prevalence rates were 4.8 %, 7 %, and 7.1 %, respectively. However, throughout the study, almost 23 % of minors reported some sexual solicitation and 14 % reported some sexual interaction. In this same period of time, the incidence of new cases was 1 in 10. Being a victim during W1 meant that in W3, there was almost twice the risk of having a low HRQoL. In general, those who were not victims of either solicitation or sexualized interactions with adults presented better HRQoL than those who experienced victimization.

Conclusions: This study presents the magnitude and seriousness of the problem and discusses the practical implications.

1. Introduction

The advancement of information and communication technologies has promoted the use of alternative forms of communication

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<https://doi.org/10.1016/j.chiabu.2022.105759>

Received 28 December 2021; Received in revised form 25 May 2022; Accepted 17 June 2022

Available online 24 June 2022

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and interaction. Data indicate that 80 % of European adolescents between the ages of 9 and 16 use their smartphones to connect to the Internet and to their social networks daily (Smahel et al., 2020). However, this widespread use of technology among minors has also led to the emergence of and increases in other forms of abuse, such as online sexual solicitations and interactions between adults and minors, which endanger and affect the well-being of children and their families worldwide.

Adult sexual solicitation of a minor can be defined as “online requests to engage in sexual activities or sexual talk or give personal sexual information that were unwanted or, whether wanted or not, were made by an adult” (Mitchell, Finkelhor, & Wolak, 2007, p. 532). These, along with sexual interactions between adults and minors (e.g., sex via webcam, sexual conversations, sending sexual photos or videos, or meeting offline for sexual contact), are booming phenomena that raise enormous social concern (de Santisteban & Gámez-Guadix, 2017; Gámez-Guadix & Mateos-Pérez, 2019). Although this study focuses on online sexual solicitation and interactions between minors and adults, according to the scientific literature, these types of sexualized behaviors are sometimes part of a more global process of child grooming—the seduction and/or manipulation of minors carried out by an adult (Broome, Izura, & Davies, 2020; Gámez-Guadix, Almendros, Calvete, & De Santisteban, 2018; Ringenberg, Seigfried-Spellar, Rayz, & Rogers, 2022). When this occurs, the adult manipulates the child into developing a feeling of attachment to the abuser, who displays an expectation of trust and intimacy, concealing primarily sexual intentions (Kloess, Hamilton-Giachritsis, & Beech, 2019).

The existing data indicate that online sexual solicitation and interactions with adults affect many children and adolescents. To date, there is no clear agreement on the prevalence of the problem, but the available data are worrisome. A meta-analysis by Madigan et al. (2018) indicated that 11.5 % of minors (12–16 years old) from different countries had received requests of a sexual nature in the online context, whereas a retrospective study by Greene-Colozzi, Winters, Blasko, and Jeglic (2020) noted that as minors, 23 % of the participants remembered having had a long and intimate conversation with an unknown adult in an online chat that was followed by a pattern of online grooming. In general, the prevalence rates vary across studies due to the wide varieties of measurement instruments, criteria, and ways of conceptualizing the online sexual abuse of children (Bennett & O'Donohue, 2014; Madigan et al., 2018; Whittle, Hamilton-Giachritsis, Beech, & Collings, 2013).

In the Spanish context, there was a modification of the penal code with the approval of Royal Decree 1/2015 (RD 1/2015). Online child grooming is defined as online sexual contact by any person with a child under 16 years of age to arrange a meeting with him/her in order to commit a sexual crime. This sexual contact could also include asking the child for pornographic material in which any minor is depicted. In general, as a criterion for the classification as a victim of online sexual abuse, recent studies have used the occurrence of at least one online sexual solicitation by an adult or a sexual interaction with an adult; this is a common cut-off point that is consistent with the law and the severity of the problem (de Santisteban & Gámez-Guadix, 2017; Gámez-Guadix, De Santisteban, & Alcazar, 2017; Gámez-Guadix et al., 2018). In this regard, previous research has suggested a high prevalence of this problem among minors in Spain. For instance, one study found that 12.6 % of minors reported sexual requests and 7.9 % reported sexualized interactions (Gámez-Guadix et al., 2017). Other studies have found online grooming prevalence rates of between 16.6 % and 17.2 % (Machimbarrena et al., 2018; Montiel, Carbonell, & Pereda, 2016). To assess this problem, several studies have used Gámez-Guadix et al.'s (2017) Questionnaire for Online Sexual Solicitation and Interaction of Minors with Adults, which has provided a comparable framework across studies.

Regarding differences by sex, studies in several countries (Mitchell, Jones, Finkelhor, & Wolak, 2014; Sklenarova, Schulz, Schuhmann, Osterheider, & Neutze, 2018; Wachs, Jiskrova, Vazsonyi, Wolf, & Junger, 2016), including Spain (Gámez-Guadix, Román, Mateos, & de Santisteban, 2021; Machimbarrena et al., 2018; Montiel et al., 2016), have reported a higher prevalence of victimization in girls, both at a general level and with regard to sexual solicitation or interactions. Specifically, according to de Santisteban and Gámez-Guadix (2017), in Spain, 15.6 % of girls and 9.3 % of boys reported sexual solicitation and 8.2 % of girls and 7.4 % of boys reported sexual interactions with adults.

Online sexual solicitation and interaction with adults in adolescence is a relatively recent phenomenon. Hence, most of the studies in the scientific literature are cross-sectional, and very few longitudinal studies have been conducted. Of the few longitudinal studies in Spain, those by Gámez-Guadix and Mateos-Pérez (2019) and de Santisteban and Gámez-Guadix (2018) have shown the stability over time of adults' sexual solicitation of and interactions with minors. In turn, Calvete, Fernández-González, et al. (2021) indicated that sexual solicitation by adults predicted an increase in sexualized interactions with adults one year later. In general, the scarcity of longitudinal studies has meant that there is no epidemiological evidence of this problem over time; that is, there have been no indicators such as period prevalence (the number of cases of an event during a period of time) or incidence (new cases in a given population in a given period) of this problem (Hernández-Aguado & Lumbreras, 2018).

Additionally, it should be noted that for minors, the consequences of online sexual victimization are especially serious. Some studies have linked this type of victimization to symptoms of depression and anxiety (de Santisteban & Gámez-Guadix, 2018; Ståhl & Dennhag, 2020) as well as increased perceived loneliness and lower life satisfaction (Festl, Reer, & Quandt, 2019). According to Mitchell, Finkelhor, and Wolak (2001), 25 % of young people reported that these experiences were extremely distressing or frightening. However, to date, no studies have linked these experiences with health-related quality of life (HRQoL).

HRQoL is a dynamic and multidimensional concept that includes dimensions related to physical health, psychological well-being, peer relationships, the level of independence, and the perception of aspects of the environment that are relevant to that person (Wallander & Koot, 2016). HRQoL has also been evaluated by multiple instruments according to the singularities of its definition, but, in all of them, it is defined as a global construct of perceived well-being that is sensitive to both health and the psychosocial problems of adolescence, such as violence in any of its manifestations (González-Cabrera et al., 2019, 2021; Lin, Lin, & Fan, 2013; Ortega-Barón et al., 2020; Wallander & Koot, 2016).

In this context, the objectives of the present study were as follows. First, we aimed to analyze the point and period prevalence, incidence, and stability of scores of online sexual solicitation and interaction with adults at three separate time points (wave 1 [W1],

wave 2 [W2], and wave 3 [W3]). These analyses also took into account the sex of the victims and the types of victimization separately (sexual solicitation vs. sexualized interactions). Second, we aimed to compare the HRQoL among the different categories of victims of this type of online abuse (non-victims, new victims, ceased victims, intermittent victims, and stable victims) at the three measurements points over the 13-month study.

Regarding the first objective, we hypothesized that the prevalence at any given time would be between 15 % and 20 %, in line with other Spanish studies conducted among similar age groups (Gámez-Guadix et al., 2021; Montiel et al., 2016). Concerning the second objective, it was hypothesized that in W3, adolescents who were victims (those who had received requests of a sexual nature and/or interacted sexually with adults), especially stable victims, would present lower HRQoL scores than non-victimized adolescents, following the trend of previous studies indicating greater psychological distress when victimization stabilized over time (González-Cabrera et al., 2021; Hellfeldt, Gill, & Johansson, 2016; Ortega-Barón et al., 2020).

2. Method

2.1. Design and participants

A prospective study was carried out over 13 months among students between 12 and 15 years old. Measurements were taken at three time points W1 (December 2017), W2 (May 2018), and W3 (January 2019). The number of participants was 2421 in W1, 1979 (81.7 %) in W2, and 2172 (89.7 %) in W3. Finally, 1029 participants (42.5 % of the original sample) responses were matched across all three waves (43 % boys and 57 % girls). In W1, the mean age was 13.34 ± 0.96 years; in W2, 13.60 ± 0.94 years; and in W3, 14.20 ± 0.77 years. Incidental non-probabilistic sampling was carried out. The adolescents came from an educational foundation with schools throughout Spain. Fourteen secondary schools from seven Spanish regions (Aragón, Castilla y León, Castilla la Mancha, Comunidad de Madrid, Comunidad Valenciana, Comunidad del País Vasco, and Principado de Asturias) agreed to participate in the study.

2.2. Instruments

To assess the prevalence of online sexual solicitation and interactions, this study used the Questionnaire for Online Sexual Solicitation and Interaction of Minors with Adults (Gámez-Guadix et al., 2017). This questionnaire evaluates, through two dimensions with five items each, part of the process of online grooming of a minor by an adult. The first dimension concerns sexual solicitation (e.g., "I have been asked to have cybersex with an adult, for example, via a webcam"). The second dimension examines sexualized interactions (e.g., "I have sent an adult photos or videos with sexual content of me"). The response for each item is given on a 4-point Likert scale, with options ranging from 0 (*never*) to 3 (*6 or more times*). The total score for each dimension ranges from 0 to 15". Additionally, the minors are asked with how many people over 18 years of age these behaviors have occurred (none, with one person, with two or three people, with four or five people, or with six or more people). The Cronbach alpha coefficient for this study was 0.88 for the sexual solicitation dimension and 0.60 for the sexualized interaction dimension in W1; 0.90 and 0.86, respectively, in W2; and 0.93 and 0.90, respectively, in W3.

To evaluate HRQoL, we used the Spanish version of the KIDSCREEN-10 (The Kidscreen Group Europe, 2016) for children and adolescents aged 8 to 18 years. This version of the scale is an overall assessment of HRQoL and presents 10 items concerning physical and psychological well-being, social support, and relationships with parents, among others (e.g., "Have you felt sad?" and "Have you felt fit and well?"). The response for each item is rated on a 5-point Likert scale (1 = *never/not at all/poor*; 5 = *always/extremely/excellent*). The development of the KIDSCREEN was based on the probabilistic partial credit model, which belongs to the family of Rasch models. The partial credit model attempts to explain the actual behavior of the responders in the testing situation by the estimated person parameter and the location of the item-response-category thresholds. The partial credit model assumes all items of a scale to be the indicators of a single unidimensional latent trait. In the case of the KIDSCREEN-10, the direct scores are transformed, resulting in a dimension with a mean of around 50 (SD = 10) due to the standardization of the T-value. Scores closer to that value indicate higher HRQoL. The instrument has demonstrated adequate internal reliability and validity and has been validated using a Spanish sample (The Kidscreen Group Europe, 2016). The Cronbach alpha coefficient for this study was 0.80 for W1, 0.81 for W2, and 0.81 for W3.

2.3. Evaluation criteria

To dichotomize the variables, a minor was considered to be a victim of sexual solicitation if they reported a score other than 0 ("never") (i.e., if they scored 1 or higher in any item of the dimension). The same criterion was used for the dimension of sexual interactions, in line with other studies (de Santisteban & Gámez-Guadix, 2017; Machimbarrena et al., 2018; Wachs, Karsten, & Ching-Ching, 2012). This criterion also relates to the current Spanish penal code (Royal Decree 1/2015) and the classification of these conducts as a crime when committed by an adult to a minor under 16 years of age.

HRQoL was considered low when a participant reported a score below one standard deviation from the mean obtained in the sample at that time. In W1, a value of ≤ 39.23 was considered; in W2, ≤ 39.39 ; and in W3, ≤ 38.06 . Scores higher than these values at each time point were considered indicators of adequate HRQoL.

Following the work of Hellfeldt et al. (2016) and Smith, Talamelli, Cowie, and Naylor (2004), we took into account sexual solicitation and interactions jointly and calculated the following possible categories of victims: (a) non-victims were adolescents who did not report victimization; (b) new victims were those who first reported victimization in W2 or W3; (c) ceased victims were those who

were victims in W1 and/or W2 but not in W3; (d) intermittent victims were those who were victims in W1 and W3 but not in W2; and (e) stable victims were those who were victims in all three waves. Each category was exclusive (i.e., participants could only be present in a single category of those mentioned).

2.4. Procedure

The questionnaires were distributed in an online format using Qualtrics®. The participants responded in computer classrooms at their schools under a tutor's supervision. The time required to complete the questionnaires ranged from 5 to 10 min. The Research Ethics Committee of [masked for review] (Ref. 231/17) endorsed the investigation, and we obtained the permission of the educational centers and institutions that participated in the study. An information and consent procedure was established for legal guardians who authorized the participation of minors. In addition, all participants had the option to withdraw from the study at any point. Participation was voluntary, anonymous, and disinterested (neither the participants nor their families received any compensation).

2.5. Statistical analysis

The Statistical Package for the Social Sciences (SPSS, version 23) program was used for: (a) analysis of frequencies, arithmetic means, and standard deviations; (b) analysis of point and period prevalence and incidence; (c) chi-square calculation and analysis of adjusted standardized residuals; (d) McNemar test to examine whether prevalence rates changed between waves; (e) Spearman correlation coefficients; (f) analysis of variance with Games-Howell post-hoc comparisons; and (g) repeated-measures analysis of variance with correction of degrees of freedom with Greenhouse-Geisser (GG) adjustment for total scores of solicitation and sexualized interactions. Additionally, the Epidat 3.1 (Xunta de Galicia & Organización Panamericana de la Salud, 2006) program was used to calculate prevalence ratios (PRs) and relative risks (RR). Values of $p < .05$ were considered significant.

3. Results

3.1. Prevalence for all three waves of victimization

Taking into account sexual solicitation and sexual interactions between minors and adults conjointly, the point prevalence was 12.9 % in W1 ($n = 131$; 16.5 % boys, 83.5 % girls; $\chi^2_{(11021)} = 36.81$; $p < .001$); 14 % in W2 ($n = 142$; 13.2 % boys, 86.8 % girls; $\chi^2_{(11018)} = 49.76$; $p < .001$); and 18.6 % in W3 ($n = 188$; 26.8 % boys, 73.2 % girls; $\chi^2_{(11016)} = 20.65$; $p < .001$).

Table 1 shows the prevalence of victimization for sexual solicitation and sexualized interactions separately. There were significant increases in the prevalence of sexual solicitation between W1 and W3 (McNemar test = 18.32; $p < .001$) and between W2 and W3 (McNemar test = 14.11; $p < .001$), although there was no difference between W1 and W2 ($p = .590$). Girls reported a higher prevalence than boys for this form of sexual victimization (W1, $\chi^2_{(11021)} = 36.81$ and $p < .001$; W2, $\chi^2_{(11018)} = 49.76$ and $p < .001$; W3, $\chi^2_{(11016)} = 20.65$ and $p < .001$). Regarding sexualized interactions with adults, increases in prevalence were observed between W1 and W2 (McNemar test = 6.05; $p = .018$), between W2 and W3 (McNemar test = 17.52; $p < .001$), and between W1 and W3 (McNemar test = 6.53; $p = .014$). In terms of sex differences, in both W1 and W2, girls reported a higher prevalence than boys for sexualized interactions with adults (W1, $\chi^2_{(11022)} = 4.23$ and $p = .040$; W2, $\chi^2_{(11012)} = 16.73$ and $p < .001$). However, in W3, the difference between sexes was non-significant ($\chi^2_{(11015)} = 1.40$; $p = .237$).

Table 2 shows the reported prevalence of either sexual solicitation or sexualized interactions. The most common sexual solicitation behavior in all three waves was “an adult asked me questions about explicit sexual content through the Internet or a mobile device”. This type of requests was more common among girls (88.9 % in W1, 85.1 % in W2, and 74.5 % in W3) than among boys (11.1 % in W1, 14.9 % in W2, and 25.5 % in W3) at each of the three measurement points (W1, $\chi^2_{(11025)} = 31.82$, $p < .001$; W2, $\chi^2_{(11019)} = 33.55$, $p < .001$; W3, $\chi^2_{(11020)} = 14.89$; $p < .001$). Regarding sexualized interactions, the behavior with the highest prevalence was “I talked about sexual things with an adult on the Internet”. This type of interaction was also more prevalent among girls (76 % in W1, 82.6 % in W2, and 60.9 % in W3) than among boys (24 % in W1, 17.4 % in W2, and 39.1 % in W3). There was a significant difference between sexes in W2 only ($\chi^2_{(11016)} = 12.90$; $p < .001$); in W1, there was a trend ($\chi^2_{(11023)} = 3.71$; $p = .054$), and in W3, the difference was nonsignificant ($\chi^2_{(11021)} = 0.30$; $p = .588$).

In W1, 5.9 % of respondents admitted to having experienced this type of requests and/or interaction with one person, 2.4 % with

Table 1
Prevalence of victims depending on the type of online grooming (sexual solicitation and interaction) in the three times.

Type of victimization/ time	Wave 1			Wave 2			Wave 3		
	Total f(%)	Boys f(%)	Girls f(%)	Total f(%)	Boys f(%)	Girls f(%)	Total f(%)	Boys f(%)	Girls f(%)
Sexual solicitation	115 (11.3 %)	19 (1.9 %)	96 (9.4 %)	121 (11.9 %)	16 (1.6 %)	105 (10.3 %)	164 (16.1 %)	44 (4.3 %)	120 (11.8 %)
Sexualized interactions	49 (4.8 %)	14 (1.4 %)	35 (3.4 %)	71 (7 %)	14 (1.4 %)	57 (5.6 %)	72 (7.1 %)	26 (2.6 %)	46 (4.5 %)

Note: f = frequency, % = percentage. The percentages are calculated based on the total sample ($n = 1029$).

Table 2
Prevalence of the types of sexual solicitation and interaction received in the three times ($n = 1029$).

Type devictimization/time	W1 <i>f</i> (%)	W2 <i>f</i> (%)	W3 <i>f</i> (%)
Sexual solicitation			
An adult asked me for pictures or videos of myself with sexual content.	55 (5.4)	65 (6.4)	106 (10.4)
An adult asked me questions about explicit sexual content.	72 (7.0)	94 (9.2)	106 (10.4)
I have been asked to have cybersex with an adult (e.g., via a webcam).	19 (1.9)	32 (3.1)	49 (4.8)
An adult asked me to have offline sex over the Internet.	37 (3.6)	48 (4.7)	46 (4.5)
An adult sent me photos or videos of himself/herself with sexual content.	64 (6.3)	71 (7)	103 (10.1)
Sexualized interactions			
I have sent an adult photos or videos with sexual content of me.	7 (0.7)	23 (2.3)	21 (2.1)
I have maintained a flirtatious relationship with an adult online.	15 (1.5)	32 (3.1)	45 (4.4)
I talked about sexual things with an adult on the Internet.	25 (2.4)	46 (4.5)	46 (4.5)
I've met an adult I had previously met on the Internet in person.	13 (1.3)	23 (2.3)	26 (2.6)
We have met offline to have sexual contact.	6 (0.6)	19 (1.9)	18 (1.8)

Note: *f* = frequency, % = percentage.

two or three people, 0.3 % with four or five people, and 0.4 % with more than five people. In W2, 5.4 % admitted to having received requests from and/or having interacted sexually with one person, 3 % with two or three people, 0.9 % with four or five people, and 0.6 % with more than five people. In W3, 8.1 % of respondents reported having experienced sexual solicitation and/or interaction with only one person, 4.6 % with two or three people, 0.9 % with four or five people, and 1.2 % with more than five people.

Table 3 shows the prevalence of victimization by sexual solicitation and/or interaction according to the categories of victims in the three periods. The highest prevalence was found among new victims (14 %), followed by stable victims (6.7 %). Regarding the participants' sexes, significant differences were found according to the categories of victims ($\chi^2_{(4|1029)} = 45.59; p < .001$); specifically, the analysis of standardized residuals revealed significantly higher-than-expected proportions of boys who were not victims and of girls who were stable victims.

3.2. Period prevalence and incidence of victimization

The period prevalence was 22.9 % for sexual solicitation and 13.7 % for sexual interaction. This means that during the 13-month study, 23 out of every 100 children reported being sexually solicited online by an adult and 14 out of every 100 reported some form of online sexual interaction with an adult. For boys, the period prevalence was 13.3 % for sexual solicitation and 9.7 % for sexual interaction, while for girls, it was 30.1 % for sexual solicitation and 16.7 % for sexual interaction. During the 13 months of the study, the incidence was 11.7 % for sexual solicitation and 8.9 % for sexual interaction; that is, almost 12 out of 100 participants and 9 out of 100 participants were new cases of sexual solicitation and interaction, respectively, in W2 or W3. For boys, the incidence was 9 % for sexual solicitation and 6.5 % for sexual interaction, while for girls, it was 13.8 % for sexual solicitation and 10.7 % for sexual interaction.

3.3. Stability of online sexual solicitation and interaction and HRQoL

There was a slight, albeit statistically significant, increase in the total scores regarding sexual solicitation and interaction over time, including the sex variable as an intra-subject factor for sexual solicitation ($GG-\epsilon_{1,008} = 4.534; p = .017; \eta^2 = 0.004$) and for sexualized interactions ($GG-\epsilon_{1,008} = 6.295; p = .012; \eta^2 = 0.006$). In both dimensions, there were significant differences between the three waves, with an upward trend as time progressed ($p = .012$). In general, there were also changes in HRQoL between the three times points ($GG-\epsilon_{1,027} = 10.746; p = .001; \eta^2 = 0.010$). HRQoL increased only between W1 and W2 ($p = .004$); HRQoL decreased between W2 and W3 ($p < .001$) and overall between W1 and W3 ($p = .050$).

Table 3
Prevalence of categories of victims for sexual solicitation and/or sexualized interaction ($n = 1029$).

Victim based on the three times	Total	Boys	Girls	χ^2
W1-W2-W3	<i>f</i> (%)	<i>f</i> (%)	<i>f</i> (%)	(<i>p</i>)
Non-victims	754 (73.3)	361 (35.1) ^a	393 (38.2) ^b	45.59 (<.001)
New victims	144 (14)	52 (5.1)	92 (8.9)	
Ceased victims	46 (4.4)	15 (1.4)	31 (3)	
Intermittent victims	16 (1.6)	8 (0.8)	8 (0.8)	
Stable victims	69 (6.7)	6 (0.6) ^a	63 (6.1) ^b	

Note: *f* = frequency, % = percentage, χ^2 = Chi-square, *p* = significance.

^a Adjusted standardized residuals ≤ 1.96 .

^b Adjusted standardized residuals > 1.96 . Each participant can only be in one category.

3.4. Differences in HRQoL according to victim type and study time

Table 4 presents the comparisons of HRQoL between the different categories of victims over the three periods. Consistently, those who were not victims indicated higher HRQoL than those who were new or stable victims.

3.5. Association between online sexual solicitation and interaction and HRQoL

The Spearman correlations between the dimensions of sexual solicitations, sexual interactions, and HRQoL at each time wave can be seen in Table 5.

Regarding the association between sexual solicitation/interaction and HRQoL, the prevalence ratios (PRs) were as follows: in W1, PR = 2.56 [1.80–3.63]; in W2, PR = 2.52 [1.87–3.40]; and in W3, PR = 2.15 [1.56–2.94]. This implies, for example, that low HRQoL was 2.56 times more prevalent for victims who reported having received requests and/or interacted sexually with adults on the Internet during W1 than for those who were not victims. The relative risk (RR) between being a victim in W1 and having a low HRQoL in W3 was 1.95 [1.38–2.76]; that is, victims in W1 were almost twice at risk to have low HRQoL in W3 compared to those who were not victims in W1. Accordingly, the incidence of low HRQoL among those exposed (victims) was 24.4 %, compared to 12.5 % among the unexposed (not victims). The RR between being a victim in W2 and having low HRQoL at W3 was 1.94 [1.38–2.73].

4. Discussion

This study provides empirical evidence of the prevalence and incidence of adult online sexual solicitation toward minors and sexualized interactions between minors and adults over time. In addition, it explores the relationship between these types of online sexual victimization and the decline in victims' HRQoL through a longitudinal perspective.

In W1 and W2 (during the same school year), the prevalence rates of sexual solicitation and interactions were slightly lower than those reported by other studies in Spain (de Santisteban & Gámez-Guadix, 2017; Gámez-Guadix et al., 2017; Gámez-Guadix et al., 2018; Machimbarrena et al., 2018). On the other hand, the prevalence increased significantly in W3 (during the next school year); this is in line with the results of recent studies, such as that by Gámez-Guadix et al. (2021), which indicated a 19 % prevalence of solicitation and a 13 % prevalence of sexual interactions. With that being said, the initial hypothesis (that these forms of online sexual victimization would be in the range of results from previous studies) was confirmed, especially in the Spanish context, showing the reality of a frequent problem among young people.

Furthermore, between W1 and W3, there was an increase of almost 6 % in solicitation behaviors and/or interactions reported by minors. This may be due, in part, to the adolescents' own biological development and life situations that occur during the transition from early to middle adolescence, as well as changing levels of interest in sexuality (Alfaro González et al., 2015; Salmela-Aro, 2011). In addition, Spanish minors are increasingly active on the Internet and spend more and more time online, with social networks being a preferred use. In this regard, the latest report in Spain among a representative sample showed that 95 % of adolescents aged 11–18 had mobile phones with Internet connection (Andrade, Guadix, Rial, & Suarez, 2021). Parental online mediation is particularly important in this context, and the most recent data suggest that levels of parental control over Internet use are low in terms of both restriction and supervision. They are higher for girls and during the compulsory education stage (typically between the ages of 12 and 16) (Andrade et al., 2021; Díaz-López et al., 2021). In any case, these data suggest the need to establish preventive actions for these behaviors—especially primary prevention (Calvete, Cortazar, et al., 2021) and other actions that can indirectly protect minors, such as adequate privacy control and profile settings (Ortega-Barón, González-Cabrera, Machimbarrena, & Montiel, 2021). In the future, educational initiatives aimed at families will be essential to provide the skills and tools to conduct adequate parental mediation.

The period prevalence and incidence of victimization through online sexual solicitation and interaction cannot be compared with other previous studies, as this is a singular contribution of this manuscript to the epidemiology of this problem. It is a particularly worrisome fact that, over a period of 13 months, almost 23 % of the minors reported being sexually solicited by adults and almost 14 % reported having interacted sexually with adults. In addition, it is worrying that throughout the study, there was an increase of

Table 4
Differences in the KIDSCREEN-10 as a function of type of victim and the study time (n = 1029).

Type of victim	KD-10 W1		KD-10 W2		KD-10 W3	
	M (SD)		M (SD)		M (SD)	
Non-victims ^a (n = 754)	48.28	(8.02)	49.24	(8.36)	47.72	(8.73)
New victims ^b (n = 144)	45.93	(7.82)	45.44	(8.82)	45.06	(8.86)
Ceased victims ^c (n = 46)	45.13	(6.47)	44.70	(6.57)	45.11	(8.19)
Intermittent victims ^d (n = 16)	40.71	(7.73)	39.60	(6.01)	43.42	(9.31)
Stable victims ^e (n = 69)	42.11	(6.55)	42.86	(6.82)	42.20	(6.34)
F	F(4, 1029) = 15.35		F(1, 1029) = 20.50		F(1, 1029) = 9.62	
p	p < .001		p < .001		p < .001	
η ²	η ² = 0.057		η ² = 0.074		η ² = 0.036	
Post hoc (G-H)	a > b > e		a > b > d		a > b; a > e	

Note: KD-10 (KIDSCREEN-10); M = arithmetic mean; SD = standard deviation; p = significance; F = Fisher's F; η² = eta squared; Post hoc (G-H) = Games-Howell post-hoc test. a = non-victims; b = new victims; c = ceased victims; d = intermittent victims; e = stable victims.

Table 5
Spearman's bivariate correlations between sexual solicitations and interactions and Kidscreen-10 as a function of study wave ($n = 1029$)

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Sexual solicitation W1	–								
2. Sexual solicitation W2	.61**	–							
3. Sexual solicitation W3	.49**	.50**	–						
4. Sexual Interactions W1	.41**	.30**	.24**	–					
5. Sexual Interactions W2	.34**	.52**	.28**	.30**	–				
6. Sexual Interactions W3	.21**	.24**	.41**	.30**	.25**	–			
7. Kidscreen-10 (HRQoL W1)	–.21**	–.16**	–.20**	–.15**	–.13**	–.17**	–		
8. Kidscreen-10 (HRQoL W2)	–.22**	–.22**	–.24**	–.16**	–.17**	–.19**	.62**	–	
9. Kidscreen-10 (HRQoL W3)	–.19**	–.18**	–.20**	–.12**	–.12**	–.15**	.54**	.56**	–

Note: HRQoL = Health-related quality of life.

** Significant at $p < .001$.

approximately 10 % in new victims of sexual solicitation or interaction. In this line, the greater use of technology by young Spaniards is an opportunity but also a risk, as previous studies have shown (Gómez, Harris, Barreiro, Isorna, & Rial, 2017).

Concerning differences between sexes, a higher prevalence of victimization was found among girls, in line with several previous studies (Gámez-Guadix et al., 2021; Machimbarrena et al., 2018; Montiel et al., 2016). In fact, this higher prevalence among girls is also common in traditional offline sexual victimization in Spain (Pereda, Abad, & Guílera, 2016). However, during W3, no significant differences in sexual interactions were observed as a function of sex. This result coincides with the results obtained by de Santisteban and Gámez-Guadix (2018), but it differs from those in the study by Calvete, Fernández-González, et al. (2021), in which it was indicated that, although girls received more sexual solicitations, they participated actively to a lesser extent than boys in sexualized interactions with adults. The absence of significant differences based on sex in W3 may be related to the results of Andrade et al. (2021), which showed that parental supervision and restraint actions are especially central in girls aged 12–16 years; this may be a protective factor, even if only partially. Conversely, the lack of similar attention to boys could also be a possible explanation for the increase in behaviors in W3.

The data from this study describe an important relationship between the three waves in relation to sexual solicitation and interaction, in line with other studies (Calvete, Fernández-González, et al., 2021; de Santisteban & Gámez-Guadix, 2018; Gámez-Guadix & Mateos-Pérez, 2019). Along the same lines, it was also observed that as the age of the minors increased, so did the prevalence of this problem; this is also in line with other previous works (Calvete, Fernández-González, et al., 2021; de Santisteban & Gámez-Guadix, 2017). Thus, this result shows that this form of online sexual victimization increases over time, potentially due to the increasingly frequent use of technology (Andrade et al., 2021; Instituto Nacional de Estadística [National Institute of Statistics], 2020; Smahel et al., 2020) and/or greater sexual exploration in later adolescence compared to younger ages (Alfaro González et al., 2015).

Concerning the second objective, a significant association was revealed between sexual solicitation and interaction with adults and lower HRQoL in the three waves. These results are also not comparable with previous studies, but they are in line with other cross-sectional studies that have shown greater discomfort and psychological distress in victims who experienced this type of abuse (Festl et al., 2019; Mitchell et al., 2001; Speed, 2021). In addition, in line with other problems, such as bullying (González-Cabrera et al., 2021) and online partner abuse (Ortega-Barón et al., 2020), we also observed a deterioration of HRQoL in victims of online sexual solicitation and interaction over time. As hypothesized, adolescents who were never victims during the study reported significantly higher levels of HRQoL than new victims and stable victims, primarily. It is important to note that intermittent victims had an HRQoL score one standard deviation below the mean (implying that HRQoL was affected) in the three waves of the study. This suggests that people who experience some victimization over time experience particular difficulties in returning to an adequate quality of life. In this sense, it has been proposed that victimization experiences can lead to the development of maladaptive schemas related to the way victims feel about themselves and how they perceive relationships with others (Hankin et al., 2016); this, in turn, plays an important role in continued victimization, as in the case of peer victimization (Calvete, Fernández-González, González-Cabrera, & Gámez-Guadix, 2018).

The present study demonstrates some strengths, such as being the first work, to our knowledge, to address online sexual solicitation and interaction in a three-wave longitudinal study from an epidemiological perspective. However, it also presents some limitations that must be taken into account. The first is that only self-reported measures were used to obtain the study data. Future research should incorporate interviews and/or other additional sources of information to provide a complete a more complete viewpoint of the problem. The procedure used may also have influenced the students' response, as the teacher and the rest of the students were in class while the study was being carried out. This may have biased the responses and influenced the revelation of these problems. Additionally, this study evaluated only online sexual solicitation and interactions. Future research might examine previous trauma or participants' experiences of childhood sexual abuse to better understand the low HRQoL; additionally, future studies might assess whether this abuse was committed repeatedly by the same person or by different people over time. Furthermore, the present study's sample was large (especially for a longitudinal study), but it was not representative of its reference population, so the data should be extrapolated with caution. In addition, the sample the sample only consisted of Spanish participants, which may also be a limitation for other cultural contexts that have different laws and protocols of action and intervention regarding online grooming, solicitation, and/or sexual interaction between adults and minors. In this study, the identities of the victims were not known, so no action protocol or psychological intervention could be established. However, the schools were informed of the problems in the classrooms, and actions

were carried out as part of the tutorial action program. Additionally, participants in W2 and W3 were not asked whether the solicitation behaviors and/or sexual interactions were performed by the same adult as in the previous wave (or if they were different). This is a variable of interest for future research, as it could be examined whether online victimization maintained by the same abuser could lead to more psychological consequences for the victim. Future studies might also relate online sexual solicitation and interaction with the online grooming process that some of the victims may experience.

In conclusion, the present study describes the prevalence, incidence, and stability of Spanish adolescent victimization of online sexual solicitation and interaction with adults as well as the impact on the HRQoL of those minors who were victims at any point during the study. Considering the high percentages of new and stable victims and their decreases in HRQoL over time, minors need to understand the seriousness of this type of online abuse and turn to adults for help in handling this type of situation. The prevention of the risks associated with Internet use requires taking into account multiple individual variables but also family, cultural, and economic variables, among others (Rial, Golpe, Isorna, Braña, & Gómez, 2018). This is especially important because victims' low HRQoL affects their well-being and places them in a position of great vulnerability to continue being victimized. In this regard, schools should include prevention programs to prevent this type of behavior through online risk education and provide recommendations on how to stay safe. Recent studies have indicated that interventions, even brief ones, may be effective in reducing the likelihood that adolescents will respond to sexual solicitations by sharing sexual material about themselves with adults (Calvete, Cortazar, et al., 2021; Wurtele, 2017).

Funding

This study was funded by the Ministry of Science and Innovation [RTI2018-094212-B-I00: (CIBER-AACC)] and by the Universidad Internacional de la Rioja in its Own Research Plan [Grupo Ciberpsicología triennium 2017–2020 and biennium 2020–2022].

Declaration of competing interest

There are no financial, work, or other relationships that may constitute a conflict of interest concerning this work.

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