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Problematic and non-problematic engagement in Online Sexual Activities across the lifespan

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ABSTRACT

During the last decade, the number of people using the Internet for sexual purposes has increased exponentially. However, most studies conducted so far have analysed Online Sexual Activity (OSA) of adolescents and young people, meaning that we have few information on how this phenomenon is expressed across the lifespan. The aim of this study was to analyse three aspects of OSA (prevalence of different OSAs, motives to engage in OSA, and excessive and problematic engagement in OSA) in a large sample of individuals in different developmental stages. A self-selected sample of 8040 individuals between 12 and 85 years old were recruited and completed an online survey. Participants were distributed into five age groups and compared (<18 years old, between 18 and 25, between 26 and 40, between 41 and 60, and >60). OSA was highly prevalent across all the developmental stages, including people older than 60 years old. Differences according to the age in the use of the Internet for sexual purposes were small-to-moderate, but we identified some age-related trends in different aspects of OSA. Finally, gender was important when it came to understanding these minor age differences. This study provides a preliminary foundation for identifying the unique characteristics of OSA across the lifespan.

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1. Introduction

During the last decade, the number of people using the Internet for sexual purposes has increased exponentially (Ogas & Gaddam, 2011). The availability of multiple devices allowing access to different sex-related activities from any location and 24/7 explains this popularity (Döring & Mohseni, 2018). The myriad of Online Sexual Activities (hereafter, OSAs) currently available may be classified into three categories depending on whether they are accompanied or not by subjective sexual arousal and whether they require contact with an online partner to be conducted (Shaughnessy, Byers, & Walsh, 2011). The first category (i.e., 'solitary-arousal activities') refers to OSAs that increase subjective sexual arousal and do not require contact with other users to be conducted, such as pornography use. The second category ('partnered-arousal activities') comprises OSAs oriented to increase subjective sexual desire and requiring contact with other users to be conducted, such as engaging in sexual contact through chat or webcam. The last category ('non-arousal activities') refers to OSAs that do not increase subjective sexual arousal and are typically conducted alone (e.g., look for sexual information online). This taxonomy of OSAs has been confirmed in later empirical studies (Wéry & Billieux, 2016), highlighting its usefulness when characterizing the wide variety of sexual activities available online.

Different studies have demonstrated that the use of the internet for sexual purposes has become extremely prevalent (Klein & Cooper, 2019; Regnerus, Gordon, & Price, 2016), emerging as one of the most popular sexual outlets among adolescents (Efrati & Gola, 2018), adults (Wéry & Billieux, 2016), and older adults (Ševčíková, Vašek, Blinka, Macháčková, & Ježek, 2020). Preliminary studies suggest that users' age

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constitutes an important aspect when explaining the engagement in OSAs. In particular, users' age seems to modulate aspects such as the prevalence of different OSAs (e.g., pornography use [Wolak, Mitchell, & Finkelhor, 2007] or having sexual chats [Daneback, Cooper, & Månsson, 2005]), motives fuelling the use of the Internet for sexual purposes (Castro-Calvo, Giménez-García, Gil-Llario, & Ballester-Arnal, 2018), or the incidence and characteristics of excessive and problematic engagement in OSAs (Ševčíková, Blinka, et al., 2020). Some studies propose that age differences in the use of the Internet for sexual purposes are the result of generational differences (i.e. the effect of 'birth cohorts'), whereas others suggest that these differences are largely due to individual dispositions changing across the lifespan ('aging effect') (Price, Patterson, Regnerus, & Walley, 2016). Separating the effect of the 'birth cohort' from the 'aging effect' is complex, and requires the availability of repeated cross-sectional data or longitudinal data from different birth cohorts (Price et al., 2016). An alternative to these complex and costly methodologies is to compare the OSA of individuals of different ages at a given point in time. This is the approach followed by the majority of studies, including this research. These studies are limited when it comes to distinguishing between the effect of the 'birth cohort' from the 'aging effect', but they provide a picture of the unique characteristics of OSA at different developmental stages (i.e., particular periods in the life sequence in which individuals share common biopsychosocial features). However, most studies conducted so far from this approach are limited by one or more of the following aspects: (a) the comparison between narrow age ranges (e.g., individuals between 11 and 13, 14–15, and 16–17 years old [Sabina, Wolak, & Finkelhor, 2008]) or between extremely broad ranges (e.g., participants older than 50 years old vs. between 18 and 49 [e.g., Ševčíková, Blinka, et al., 2020]) (b) the use of limited sample sizes (e.g., <150 participants [e.g., Ševčíková, Blinka, et al., 2020]); (c) the analysis of particular OSAs (e.g., use of chats or webcams for sexual purposes [Daneback et al., 2005]) instead of a more comprehensive variety of online sex-related activities; or (d) the analysis of specific aspects of OSA (typically, the prevalence of sex-related activities), overlooking other important areas (e.g., the motives fuelling OSA or its consequences). To address these limitations, in this study we analyse three different aspects of OSA (i.e., prevalence of different OSAs, motives to engage in OSA, and excessive and problematic engagement in OSA) in a sample of 8040 individuals between 12 and 85 years old distributed into five age groups: <18 years old, between 18 and 25, between 26 and 40, between 41 and 60, and >60.

1.1. Prevalence of OSA across the lifespan

In a cross-cultural study comparing the lifetime prevalence of different OSAs in four countries (Canada, Germany, Sweden, and the U. S.), Döring, Daneback, Shaughnessy, Grov, and Byers (2017) found that most participants (90%) used the Internet to obtain sexual education, 76% to access porn, and 31% to have sexual conversations with other users through chat/webcam. Comparing by gender, men reported significantly higher lifetime prevalence of pornography use than women (96% vs. 61%) and a similar prevalence for the remaining OSAs. These results are consistent with those reported in other studies. For instance, Anisimowicz and O'Sullivan (2017) found a prevalence of porn consumption of 88% in men and 67% in women residing in North America. In terms of time investment, men reported watching pornography for around 4.5 h per week (3.5 h in women). In a study conducted among 1557 Spanish college students, 59% of men and 24% of women reported having looked for online pornography; as for the use of the internet to participate in sexual chatrooms, 21% of men and 8.6% of women reported doing so (Ballester-Arnal, Castro-Calvo, Gil-Llario, & Gil-Juliá, 2016). These results are illustrative of one of the central conclusions around the role of gender in influencing engagement in OSA: that men are more likely than women to report engaging in OSA, spend more time doing so, and present a greater probability of problematic engagement (Wéry & Billieux, 2017). Gender also impacts on the preference for certain OSAs: whereas men tend to prefer solitary-arousal activities (typically, pornography), women seem to be more interested in partnered-arousal activities (e.g., sexual chats) or in non-arousal activities (Wéry & Billieux, 2017). These differences may be explained by the fact that mainstream porn is focused on male pleasure, pushes females' fantasies and desires into the background, and includes notable levels of violence towards women (Gorman, Monk-Turner, & Fish, 2010).

As for how the prevalence of these OSAs changes across the lifespan, traditional wisdom suggests that young people are more likely to use the Internet for sexual purposes than older people (Price et al., 2016). This belief is based on the view that accessibility to Information and Communication Technologies (ICTs) influences on the use of the Internet for sexual purposes: as young people tend to be more familiar with ICTs and are more digitally literate than older adults (aka 'digital divide' [Friemel, 2016]), the former will be more predisposed to use the Internet for sexual purposes. Therefore, it is expected that OSA consumption declines as people grow older. This is the main conclusion derived from the study by Price et al. (2016). In this research, authors employed data derived from the General Social Survey (a nationally representative, repeated, cross-sectional sample of 27,284 adults from the USA) to analyse trends in pornography consumption over a 40-year period (1973–2012). These researchers found that young adults (i.e., people between 18 and 26 years old) were more than twice as likely to report using pornography as adults aged 45–53 years old (both in men and women). Similarly, Miller, Raggatt, and McBain (2020) concluded that "pornography use tapers-off with age" after conducting a literature review of studies reporting the prevalence of men's pornography use. One of the limitations that these authors found when conducting their literature review was that "the majority of studies employed relatively young samples (e.g. convenience samples of university students)" (Miller et al., 2020, p. 520). As a case in point, average age of participants in the majority of the reviewed studies was below 25 years old.

The aforementioned conclusion (i.e., OSA consumption declines as people grow older) is inconsistent with the results obtained by recent studies, in which older adults used the Internet for sexual purposes as much as –or even more than– younger adults. As a case in point, Ševčíková, Blinka, et al. (2020) compared a sample of 158 subjects aged between 50 and 77 years old and 2322 between 18 and 49, finding that the former reported a similar frequency of pornography use and a higher frequency of use of chats and/or webcams for sexual purposes. Similarly, another research in which 800 Czech adults aged 50 or older reported on their pornography consumption found that around 82% of men confirmed doing so (Ševčíková, Vašek, et al., 2020). This figure was similar to that reported by Döring et al. (2017) and greater than that reported by Ballester-Arnal, Castro-Calvo, Gil-Llario, and Gil-Juliá (2016), both in samples of university students. In Czech adult women (Ševčíková, Vašek, et al., 2020), prevalence of pornography use was 32%, in this case, notable below that reported in college samples. These mixed findings suggest that age differences in the prevalence of OSAs may be mediated by gender. In line with this hypothesis, Daneback et al. (2005) found that the use of chats or webcams for sexual purposes steadily increased with age in women, but not in men: in women, this OSA reached its peak prevalence (37%) between 35 and 49 years old, whereas in men, peak prevalence (38%) was observed at an earlier age (between 18 and 28 years old). Finally, the use of the Internet to look for sexual education (i.e., non-arousal activity) across the lifespan seems to follow an inverted U-shape: in people between 12 and 24 years old, age is a positive predictor of online sexual information seeking (i.e., youth are more likely to search for sexual information online as they get older) (Nikkelen, van Oosten, & van den Borne, 2020); however, the prevalence of this OSA tend to decline after this age, especially in older people (Scandurra et al., 2021).

These mixed results suggest that the relationship between age and prevalence of OSA may be more complex than initially considered. However, there is a paucity of data on the interaction between age, gender, and prevalence of OSAs. In this research, we shed light on this

issue by comparing the prevalence of twelve OSAs across five developmental stages in a large sample of both men and women (1st study aim).

1.2. Motives for engaging in OSAs across the lifespan

Compared with the research efforts invested in exploring other aspects of sexuality, current knowledge about reasons and motives fueling the engagement in OSAs is limited. Even so, a recent systematic review identified seven motives behind the use of the Internet for sexual purposes (Castro-Calvo et al., 2018): (a) motives related to the structural characteristics of the medium (including anonymity and the belief that one's identity is concealed online, convenience of OSAs over offline sexual behaviors, and the chance to explore sexuality without safety concerns); (b) curiosity and sexual education (use of the Internet to satisfy sexual curiosity or to increase knowledge regarding sex and sexuality); (c) social enhancement and/or peer pressure (engagement in OSA as a form of social relationship enhancement or as a consequence of social pressure); (d) sexual arousal and pleasure seeking (engagement in OSAs to achieve sexual satisfaction and pleasure); (e) Online/offline sexuality enhancement (use of the Internet for meeting sexual/romantic partners or to achieve instant gratification of sexual desire through the interaction with other users); (f) anonymous fantasizing (use of the Internet to generate new and exciting sexual fantasies); and (g) mood management (use of OSA as a coping mechanism when users are confronted with unpleasant emotional states, stressors, or other psychological or physiological states that threaten their stability or their sense of control).

In their review, Castro-Calvo et al. (2018) concluded that the limited number of studies exploring the influence of age on motives fuelling OSA hindered the identification of potential differences in their relevance across the lifespan. However, they found a clear link between age and motives: whereas engagement in OSAs for educational purposes or anonymity lost importance with age, pleasure seeking motive and online/offline sexuality enhancement became more relevant. Based on these findings, they proposed that first episodes of OSA engagement (typically around 12–13 years old) were usually fuelled by social and educational motives (e.g., learning "how to have sex"), whereas pleasure seeking and online/offline sexuality enhancement became relevant during adolescence (remaining important in later developmental stages). They also proposed that structural characteristics of Internet sex (i.e., anonymity and accessibility) also fuelled the early engagement in these activities and remain important in explaining OSA in later stages. However, this theoretical proposal on the relevance of different motives for engaging in OSAs across the lifespan still requires empirical confirmation. For this reason, the second study aim was to compare the relevance of eight motives to engage in OSAs across five developmental stages in a large sample of both men and women.

1.3. Excessive and problematic engagement in OSAs across the lifespan

Consequences of the use of the Internet for sexual purposes (i.e., benefits and potential harms) has been a topic of considerable scientific and public debate (Döring, 2009). On the one hand, studies suggest that most OSA users do not experience any harmful outcome derived from their use of the Internet for sexual purposes (Ballester-Arnal, Castro-Calvo, Gil-Llario, & Giménez-García, 2014). On the contrary, OSA may contribute to fulfilment of sexual desires (Daneback, Ševčíková, Månsson, & Ross, 2013), compensate for the lack of knowledge about sexuality or receive support about sexual concerns (Smith, 2013), find romantic or sexual partners in safe environments (i.e., avoiding the risks of a face-to-face encounter) (Courtice and Shaughnessy, 2018), add variety to offline sexual relationships (Daneback, Træen, & Månsson, 2009), and distract from boredom and everyday problems (Hald & Malamuth, 2008). On the other hand, OSA could become problematic when carried out abusively in terms of frequency, severity, and functional impairment (Ballester-Arnal, Castro-Calvo et al., 2016; Wéry & Billieux, 2017). Excessive and problematic engagement in OSAs (also known as cybersex addiction, online sexual compulsivity, or Internet sex addiction) is characterized by symptoms such as: (a) loss of control over OSA, (b) persistent desire and/or unsuccessful efforts to stop, reduce, or control OSA; (c) use of OSAs as a coping mechanism; and (d) social, physical, and psychological consequences derived from the OSA (Wéry & Billieux, 2017). Excessive and problematic engagement in OSA may be classified as a subtype of Compulsive Sexual Behavior Disorder (CSBD) (Gola et al., 2020), an impulse control disorder characterized by a persistent failure to control intense and recurrent sexual impulses, urges, and/or thoughts, resulting in repetitive sexual behavior that causes a marked impairment in important areas of functioning (Castro-Calvo, Gil-Llario, Giménez-García, Gil-Juliá, & Ballester-Arnal, 2020; Kraus et al., 2018). The identification of this clinical condition is much more complex than simply attend to the time invested online for sexual purposes (Bőthe, Tóth-király, Potenza, Orosz, & Demetrovics, 2020); its diagnosis actually requires a more in-depth assessment of the nature and context of individual's online sexual problems, as well as a comprehensive knowledge on how this condition is manifested in different populations (e.g., in terms of symptoms and other pathological indicators).

As in other areas of internet sexuality, most studies exploring excessive and problematic engagement in OSA were conducted in young samples (e.g., adolescents [Ballester-Arnal, Giménez-García, Gil-Llario, & Castro-Calvo, 2016], young adults [Giordano & Cashwell, 2017], or middle-aged [Studer, Marmet, Wicki, & Gmel, 2019]). Therefore, our current knowledge on this issue is biased, and probably only representative of the expression of this condition in young people. Some preliminary research has found that age is inversely correlated with problematic engagement in OSA. In particular, Grubbs, Kraus, and Perry (2019) found that the risk that people define themselves as "addicted to pornography" tend to decrease with age. However, this conclusion is at odds with the results from the few studies exploring problematic OSA in older samples. One illustrative example is the study conducted by Ševčíková, Blinka, et al. (2020). In this research, authors found that older participants (i.e., subjects aged $\geq$50 years old) scored above the younger sample (subjects between 18 and 49 years old) in a scale assessing excessive and problematic engagement in OSA. Furthermore, they found that certain psychosocial circumstances associated to aging (such as retirement and the boredom resulting from the discontinuation of occupational activities) increased the risk of problematic engagement in OSAs, meaning that certain aspects that tend to appear as people grew older may increase the risk of suffering from this clinical condition. Unfortunately, this study did not explore the prevalence of older people qualifying for a diagnosis of excessive and problematic OSA engagement or the unique expression of different symptoms of this condition across the lifespan. Given these limitations and the very lack of relevant literature on this issue, the last aims of our study were: (a) to explore the prevalence and characteristics of excessive and problematic engagement in OSA across five developmental stages in a large sample of both men and women (3rd study aim) and (b) to analyse the interplay between the age, the type of OSA, and the motives behind OSA engagement when it comes to predict the risk of problematic OSA (4th study aim).

2. Methods

2.1. Participants and procedure

Data acquisition was conducted between 2016 and 2019 through a secured online platform designed *Ad Hoc* for this research (https://adiccionalsexo.uji.es/). Sampling objective was to assess OSA in a large sample of Spanish community members (see Giménez-García et al., [2020] for a characterization of the sexual behavior of Spanish people). Participants were enrolled utilizing a combination of active and passive recruitment strategies. Active recruitment included: (a) email blast through different institutions' listservs (universities, organizations,

etc.); (b) dissemination of the study on radios and newspapers websites; (c) posting banners on Facebook through the suggested publications marketing service; and (d) posting tear-off flyers in high-density spots (shopping centers, supermarkets, etc.). The study survey was also accessible through any search engine by combining terms such as "cybersex" OR "online sexual activity" AND "assessment" (in Spanish) (passive recruitment). Active recruitment strategies may allow the assessment of more diverse participants' profiles (non-OSA users, occasional users, etc.), whereas passive recruitment through the aforementioned searching terms may result in the assessment of a narrower participants' profile (typically, regular-OSA users, heavy-OSA users, and even problematic OSA users). The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the Jaume I University approved the study (P1.1B2012-49). Prior to enrolment, volunteer participants in the research were informed about the study aims (explicitly mentioning that they would be asked about their sexual behaviour). Those who agreed to participate and started the survey confirmed that: (a) they consented to participate (participants >18 years old) or (b) their legal guardians were informed about their intention to complete the survey and consented them to participate (participants <18 years old).

During the time the study was accessible, around 10,000 participants accessed the survey. Initial data derived from the online platform were screened to avoid duplicitous, inconsistent and/or fake responses. Only those participants who completed 80% of the survey were included in the study. After removals, a total of 8.040 participants were included in the final dataset. The average time to complete the study was 27.82 min (SD = 13.83) and participants did not receive compensation for participating.

2.2. Instruments

2.2.1. Sociodemographic characteristics

Participants were asked to report their gender (men/women), age, religious (*atheist/non-practicing believer/practicing believer*), and political ideology (Likert scale ranging from 0 [*left-wing extremist*] to 10 [*extreme right wing*]).

2.2.2. Offline sexual behavior

Participants completed a series of questions assessing basic aspects of their sexual behavior, such as: (1) whether they were engaged or not in a stable relationship (*yes/no*); (2) sexual orientation (*heterosexual/homosexual/bisexual*); (3) whether they had ever engaged or not in sexual intercourse with an opposite-sex or a same-sex partner (*yes/no*); (4) whether they had ever engaged in different sexual behaviors (masturbation [*yes/no*]/oral sex/vaginal intercourse/anal intercourse); and (5) frequency of sexual activity (including masturbation) (Likert scale ranging from 0 [*less than 6 times per year*] to 7 [*more than three times per week*]).

2.2.3. Online sexual behaviour: characteristics, motives and types of OSA

First, participants in the study self-reported whether they use the Internet for sexual purposes (*yes/no*). Those who answered positively, were asked about: (1) average time per week spent on OSAs in minutes (1 item); (2) devices employed to access OSAs (2 items); (3) motives to engage in OSAs (8 items); and (4) types of OSAs performed (12 items). Items comprising each scale were generated by the authors or extracted and adapted from previous studies (Castro-Calvo et al., 2018; Kvalem, Træen, Lewin, & Štulhofer, 2014; Shaughnessy, Byers, Clowater, & Kalinowski, 2014; Wéry & Billieux, 2016). All the items except those referring to the time spent online for sexual purposes were asked on a dichotomous scale (*yes/no*). Information on scales content and psychometric properties is reported in detail in the results section.

2.2.4. Excessive and problematic engagement in OSAs

Excessive and dysfunctional engagement in OSAs (i.e., cybersex addiction) was assessed through the Spanish version of the Internet Sex Screening Test (ISST, Ballester-Arnal, Gil-Llario, Gómez-Martínez, & Gil-Juliá, 2010). The ISST evaluates the degree to which online sexual behaviour is excessive, problematic, and associated with significant distress and impairment. Twenty-five items on a dichotomous scale (*true/false*) provide a total score ranging from 0 to 25. Internal consistency ($\alpha = 0.88$) and test-retest stability ($r = 0.82$) in a sample of college students between 18 and 25 years old was appropriate (Ballester-Arnal et al., 2010). In this study, internal consistency was excellent ($\alpha = 0.93$; $\omega = 0.93$).

Furthermore, participants answered three questions on Self-perceived problematic engagement in OSA: (1) Have you ever been worried about your cybersex consumption?; (2) Do you think you spend more time than advised online for sexual purposes?; and (3) Do you think that sex on the Internet interferes in some way in your life? The items were asked on a dichotomous scale (*yes/no*).

2.3. Data analysis

Participants were distributed into five groups according to their age: participants under 18 years old (early adolescents and adolescents), aged from 18 to 25 (young adults), from 26 to 40 (adults), from 41 to 60 (older adults), and over 60 years old (elderly). These age groups were chosen because of comparison purposes: previous studies conducted in Spain have explored OSA in people under 18 years old (Ballester-Arnal, Giménez-García et al., 2016; Castro-Calvo, Ballester-Arnal, Gil-Llario, & Giménez-García, 2016) and between 18 and 25 (Ballester-Arnal, Castro-Calvo et al., 2016); therefore, using these two age ranges ensured the availability of culturally matched data to compare the results from the present study. The remaining age groups were chosen because they represent typical developmental stages used in previous studies (e.g., Smith & Baltes, 1990). This approach is similar to that followed by Price et al. (2016) to compare pornography consumption in different age groups. Taking into account gender differences in the use of the Internet for sexual purposes (Ballester-Arnal, Castro-Calvo et al., 2016), all the study analyses were performed comparing men and women separately. All in all, in this study we compared our results across age groups but within gender.

Analysis were conducted using the SPSS statistic package (version 25.0). To compare participants' profile in each age group, we performed one-way analyses of variance (ANOVAs) for continuous variables and chi-square tests for categorical variables. Given our large sample size, differences according to the age were analysed on the basis of their effect sizes instead of their significance levels. Two effect size indices (Cohen's f for ANOVAs and Cramer's V for chi-square tests) were computed by using G*Power (version 3.1). For Cohen's f, effect sizes of about 0.10 were considered small, close to 0.25 moderate, and greater than 0.40 large (Cohen, 1988); for Cramer's V, these sizes corresponded to values of 0.10, 0.30, and 0.50 (Ellis, 2010).

As for the sociodemographic data, offline sexual behaviour, and basic online sexual behaviour (i.e., having engaged or not in OSAs, time spent online for sexual purposes, devices usually employed to access OSAs, and motives behind OSAs engagement), participants were compared at an item-level (i.e., percentages of positive responses). For the type of OSAs usually performed, besides these item-level comparisons, we also conducted an Exploratory Factor Analyses (EFA); through this method, we aimed to reduce the number of variables involved in data analysis and simplify interpretation of the results by identifying common categories or factors. FACTOR software (version 9.2) was employed to perform this EFA on the basis of the tetrachoric/polychoric correlation matrix; this method is recommended when modeling dichotomous data and the univariate distribution of ordinal items is asymmetric or has an excess of kurtosis (such in the scale employed to assess OSAs) (Ferrando & Lorenzo-Seva, 2017). We employed Parallel Analysis (PA) to determine the number of factors to retain. This analysis was also conducted on the basis of the polychoric correlation matrix

using optimal implementation function (Timmerman & Lorenzo-Seva, 2011). Following Gaskin and Happell's (2014) recommendations, factors were extracted through Principal Components Analysis (PCA), applying oblique rotation (Oblimin). Different reliability indexes were calculated for the resulting factors: in particular, we employed an R package (userfriendlyscience) (Peters, 2014) to estimate Ordinal Cronbach's alpha and Omega (scales comprising ≥3 items) or Spearman-Brown reliability (scales comprising only two items) (Eisinga, Grotenhuis, & Pelzer, 2013).

Then, we used different indicators for the analysis of excessive and problematic engagement in OSAs. First, we identified excessive and problematic OSA users according to their scores on the ISST (score ≥19) (Carnes, Delmonico, & Griffin, 2001). This cut-off score has been used in previous studies (Ballester-Arnal, Castro-Calvo et al., 2016; Ballester-Arnal, Giménez-García et al., 2016), but its sensitivity and specificity in identifying excessive and pathological engagement in OSAs has not been stablished yet. Thus, results derived from this classification should be consider tentative. We also compared participants according to different indicators of self-perceived severity perception. Finally, we employed the total score from the ISST as a dependent variable in a hierarchical linear regression (stepwise method) to analyse the predictive power of different independent variables over OSA severity (1st step, main effects), as well as the interaction between these variables and the age (2nd step, interaction effects).

3. Results

3.1. Participants characteristics

The study sample comprised 8040 participants distributed into five categories: the first (early adolescents and adolescents) and the last category (elderly) included less than 500 participants (n of 373 and 466 respectively), whereas category of young adults (n = 2739; 37.1%), adults (n = 2271; 30.7%) and older adults (n = 1540; 20.8%) comprised more than 1500 participants. Table 1 shows participants' characteristics. Except in the early adolescents and adolescents group (44.5% males; 55.5% females), most respondents were males (between 60% and 82.9% in the remaining age categories). These differences did not affect our results given that statistical analyses were performed independently for each men and women. Only minor differences emerged between groups regarding religious (V = 0.07) and political beliefs (V = 0.09).

As for offline sexual behaviour, small-to-moderate differences emerged in most aspects assessed (V and f > 0.08). Early adolescents, adolescents, and elderly showed the greater disparities, whereas middle-aged categories (i.e., young adults, adults, and older adults) displayed a very similar offline sexual behaviour. In early adolescents and adolescents, their offline sexual behaviour was characterized by greater sexual diversity (29% of non-heterosexuals) and a lower percentage of participants with a steady partner (30.3%) or reporting having had sexual intercourse (51.5%). Average frequency of sexual activity was also lower (around once a week) compared to those reported in the middle-aged categories (one to three times per week). On the contrary, only 7.4% of elderly participants reported a non-heterosexual sexual orientation, the majority had a steady partner (74.3%), and more than 90%

Table 1
Participants' characteristics according to the age group.

		Early adolescents and adolescents (n = 373) % or *M* (*SD*)	Young adults (n = 2739) % or *M* (*SD*)	Adults (n = 2271) % or *M* (*SD*)	Older adults (n = 1540) % or *M* (*SD*)	Elderly (n = 466) % or *M* (*SD*)	Inferential statistic	Effect size
Sociodemographic characteristics	Sex							
	Male	44.5%	60.0%	82.9%	79.2%	77.3%	χ^2 = 507.50***	V = 0.26
	Female	55.5%	40.0%	17.1%	20.8%	22.7%		
	Age	16.27 (0.95)	21.60 (2.10)	32.24 (4.27)	49.60 (5.71)	66.27 (4.19)	F = 23,012.23***	f = 0.96
	Religious beliefs							
	Atheist	49.2%	55.2%	44.3%	43.0%	49.7%	χ^2 = 130.82***	V = 0.07
	Practicing believer	17.6%	9.4%	13.8%	13.9%	16.1%		
	Non-practicing believer	33.2%	34.5%	41.4%	43.1%	34.2%		
	Political beliefs (from 0 [left-wing extremist] to 10 [extreme right wing])	5.09 (2.66)	4.64 (2.32)	5.15 (2.58)	4.88 (2.95)	4.27 (3.33)	F = 18.17***	f = 0.09
Offline sexual behaviour	Steady partner (yes)	30.3%	47.9%	65.6%	76.4%	74.3%	χ^2 = 470.22***	V = 0.19
	Sexual orientation							
	Heterosexual	71.0%	73.0%	80.8%	84.6%	92.6%	χ^2 = 161.74***	V = 0.11
	Bisexual	20.2%	16.0%	8.8%	8.4%	5.0%		
	Homosexual	8.8%	11.0%	10.5%	7.1%	2.4%		
	Lifetime sexual intercourse (yes)	51.5%	75.8%	85.8%	91.5%	92.0%	χ^2 = 161.74***	V = 0.11
	Same-sex sexual intercourse (yes)	13.1%	24.5%	25.5%	23.5%	13.9%	χ^2 = 43.11***	V = 0.08
	Sexual practices							
	Masturbation (yes)	65.7%	84.7%	81.3%	75.5%	65%	χ^2 = 169.41***	V = 0.15
	Oral sex (yes)	39.4%	72.8%	74.3%	71.4%	60.1%	χ^2 = 220.39***	V = 0.17
	Vaginal intercourse (yes)	35.1%	66.3%	71.8%	74%	72.1%	χ^2 = 234.25***	V = 0.18
	Anal intercourse (yes)	13.9%	36.8%	48.8%	46.9%	27%	χ^2 = 250.27***	V = 0.18
	Frequency of sexual activity (from 0 [< than 6 times per year] to 7 [> than 3 times per week])	4.72 (1.70)	5.33 (1.39)	5.47 (1.24)	5.12 (1.21)	4.56 (1.32)	F = 39.04***	f = 0.19

Note: ***p < .001.

reported having engaged in sexual intercourse. As a result, lifetime prevalence of partnered sexual behaviours was notable higher (60.1% for oral sex, 72.1% for vaginal intercourse, and 27% for anal sex).

3.2. General online sexual behaviour across the lifespan

Basic online sexual behaviour according to the gender and the age group is reported in Table 2. In males, most respondents used the Internet for sexual purposes, with small differences ($V = 0.17$) according to the age group. Average time spent online for sexual purposes ranged between 3.9 h per week in early adolescents and adolescents (233.67 min) and 7.1 h in adults (426.60 min) ($f = 0.13$). Regarding the devices usually employed to access OSA, a consistent pattern emerged: access to OSAs through the PC remained stable across the five age categories (ranging between 72.5% and 91.7%, $V = 0.082$), whereas percentage of participants reporting accessing through mobile devices linearly decreased from 82.6% (early adolescents and adolescents) to 18.10% (elderly) ($V = 0.31$).

In females, differences according to the age category were notable higher than that observed in males. Whereas more than 80% of early adolescents and adolescents, young adults and adults used the Internet for sexual purposes, this percentage decreased to 63% in older adults and to 34.6% in elderly. Differences according to the age in the time spent online for sexual purposes did not reach statistical significance ($f = 0.05$); however, participants in the elderly category only spent around 27 min per week (on average, 1h and 30 min less than participants in the other categories). As reported in males, early adolescents and adolescents preferred to engage in OSAs through mobile devices (68.4%), this figure systematically decreasing with age ($V = 0.25$).

3.3. Prevalence of specific OSAs across the lifespan (1st study aim)

Preferences for different types of OSAs according to the age are presented in Table 3 (males) and Table 4 (females). To simplify data presentation and analyses, we first performed an EFA on the whole sample to identify common categories behind different OSAs. To verify the applicability of the EFA to the 12-item scale assessing this aspect, the Kaiser-Meyer-Olkin index (KMO = 0.824), the Barlett's test of sphericity (χ^2 (66) = 12295.30, $p < .001$), and the determinant of the polychoric correlation matrix (0.0843) were tested. After PA of the polychoric correlation matrix, we estimated that the appropriate number of factors to be retained was three (eigenvalues >1.22). Factorial solution derived from the PCA revealed that this three-factor structure explained 65.33% of the total variance (factor 1 = 42.60%; factor 2 = 12.55%; factor 3 = 10.17%). Item distribution resonates well with previous classifications of OSAs (Shaughnessy et al., 2011; Wéry & Billieux, 2016), and internal consistency of the resulting factors was appropriate (α and ω between 0.77 and 0.88).

The first factor corresponded to 'non-arousal sexual activities' ("*getting sexuality information by visiting educational websites*" and "*reading erotic material online*"). In this factor, we observed moderate differences according to the age category in both males ($f = 0.15$) and females ($f = 0.21$), with young adult participants displaying the higher average score (M of 1.49 and 1.61 respectively) followed by early adolescents and adolescents (M of 1.33 and 1.53). At an item-level, the prevalence of both OSAs achieved its peak value in young adults (81.7% in males and 90.9% in females), progressively decreasing after this age.

The second factor grouped five items assessing 'partnered-arousal OSAs'. Small to moderate differences ($f_{males} = 0.16$; $f_{females} = 0.15$) emerged when we compared average scores according to the age group. In this case, respondents in the adult category obtained the higher average score ($M_{males} = 2.45$; $M_{females} = 1.92$). At an item-level, we observed the same pattern in the prevalence of the five OSAs included in this scale: i.e., the prevalence tended to increase until arriving to its peak in adults, progressively decreasing after this age until reaching its lower value in elderly. This tendency was equivalent in males and females. As an example, prevalence of "*having sex online via webcam*" increased from 32.4% to 44.9% (>12.5% in males) and from 23.7% to 32.3% (>8.6% in females) between early adolescents and adolescents and adults, and then progressively decreased to 22% and 5.6% in elderly.

The third factor grouped together five items assessing 'solitary-arousal OSAs'. In this case, older adults obtained the higher average score ($M_{males} = 2.11$; $M_{females} = 1.51$), and differences according to the age group reached a moderate effect size (f of 0.18 and 0.19 respectively). In males, the prevalence of pornography viewing varied in a narrow range between 92% and 98.2% ($V = 0.08$), meaning that this OSA was extremely popular across all the lifespan; in women, prevalence of this OSA ranged between 81.9% and 91% in all the age categories except in elderly (50%) ($V = 0.16$). For the remaining OSAs, a similar tendency in the prevalence across the lifespan was observed in both males and females: prevalence of OSAs included within this category systematically increased until arriving to its peak in older adults,

Table 2
Basic online sexual behaviour according to the age group and sex.

	Early adolescents and adolescents % or *M* (*SD*)	Young adults % or *M* (*SD*)	Adults % or *M* (*SD*)	Older adults % or *M* (*SD*)	Elderly % or *M* (*SD*)	Inferential statistic	Effect size
Males							
Use of the Internet for sexual purposes (yes)	97.3%	97.5%	98.1%	93.5%	85.0%	χ^2 = 119.98***	V = 0.174
Time online for sexual purposes (in minutes/week)	233.67 (365.55)	275.83 (442.27)	426.60 (592.15)	396.50 (545.35)	244.88 (732.19)	F = 17.58***	f = 0.135
Devices usually employed to access OSAs and places							
Personal computer	72.5%	84.3%	82.4%	86.0%	91.7%	χ^2 = 25.50***	V = 0.082
Mobile devices (smartphone, tablet, etc.).	82.6%	73.8%	70.7%	48.7%	18.10%	χ^2 = 378.51***	V = 0.316
Females							
Use of the Internet for sexual purposes (yes)	81.0%	82.6%	88.2%	63.0%	34.6%	χ^2 = 115.15***	V = 0.271
Time online for sexual purposes (in minutes/week)	140.62 (504.49)	108.83 (248.54)	137.90 (269.04)	133.40 (578.35)	27.22 (36.59)	F = 0.95	f = 0.055
Devices usually employed to access OSAs and places							
Personal computer	60.2%	69.1%	67.5%	73.3%	88.9%	χ^2 = 8.06	V = 0.080
Mobile devices (smartphone, tablet, etc.).	68.4%	64.4%	58.6%	30.2%	0%	χ^2 = 78.69***	V = 0.251

Note: *p < .05; **p < .01; ***p < .001.

Table 3
Types of OSAs according to the age group (males).

	Early adolescents and adolescents % or *M* (*SD*)	Young adults % or *M* (*SD*)	Adults % or *M* (*SD*)	Older adults % or *M* (*SD*)	Elderly % or *M* (*SD*)	Inferential statistic	Effect size
12-item scale on types of OSAs (α = .85; ω = .86) (range = 0–12)	4.57 (2.51)	5.3 (2.61)	5.75 (2.82)	5.15 (2.96)	4.16 (2.87)	$F = 19.66$***	$f = 0.143$
Non-arousal OSAs (Spearman-Brown reliability = .73) (range = 0–2)	1.33 (0,74)	1.41 (0,69)	1.21 (0.75)	1.18 (0.78)	1.0 0 (0.79)	$F = 22.89$***	$f = 0.154$
Getting sexuality information by visiting educational websites	77.8%	81.7%	69.1%	64.0%	52.9%	$\chi^2 = 126.91$***	$V = 0.184$
Reading erotic material online	55.1%	59.4%	52.5%	53.9%	48.5%	$\chi^2 = 17.34$***	$V = 0.068$
Partnered-arousal OSAs (α = .88; ω = .88) (range = 0–5)	1.75 (1.70)	2.19 (1.72)	2.45 (1.79)	1.87 (1.79)	1.43 (1.74)	$F = 25.31$***	$f = 0.160$
Flirting with other users online	50.0%	58.6%	60.0%	45.6%	32.8%	$\chi^2 = 86.62$***	$V = 0.155$
Sharing sexual fantasies online via text	41.7%	42.0%	48.1%	40.0%	26.4%	$\chi^2 = 40.82$***	$V = 0.105$
Having sex online via webcam (cybersex)	32.4%	42.5%	49.9%	31.1%	22.0%	$\chi^2 = 111.28$***	$V = 0.172$
Looking for romantic partners	24.1%	32.7%	37.0%	27.4%	27.9%	$\chi^2 = 27.49$***	$V = 0.086$
Looking for sexual partners	27.5%	43.4%	50.5%	42.6%	34.7%	$\chi^2 = 41.86$***	$V = 0.106$
Solitary-arousal OSAs (α = .77; ω = .79) (range = 0–5)	1.49 (0.83)	1.70 (0.92)	2.08 (1.14)	2.11 (1.23)	1.72 (1.09)	$F = 32.27$***	$f = 0.180$
Buying sex products in online sex shops	1.9%	6.6%	15.8%	18.2%	15.9%	$\chi^2 = 88.48$***	$V = 0.154$
Viewing pornographic pictures and/or movies	98.2%	97.9%	97.6%	96.7%	92.0%	$\chi^2 = 25.45$***	$V = 0.082$
Visiting contact sites	27.8%	41.9%	52.2%	50.4%	39.6%	$\chi^2 = 52.52$***	$V = 0.118$
Replying to sex ads	11.0%	12.8%	19.1%	23.7%	16.5%	$\chi^2 = 45.77$***	$V = 0.111$
Contacting sexual workers advertised online	11.9%	11.0%	23.6%	21.5%	9.5%	$\chi^2 = 90.97$***	$V = 0.156$

Note: *p < .05; **p < .01; ***p < .001.

subsequently decreasing in elderly (e.g., visiting contact sites systematically increased from early adolescents and adolescents to older adults [27.8%–52.2% in males; 13.4%–22.2% in females], and then decreased to 39.6% and 16.7% in elderly).

3.4. Motives to engage in OSAs (2nd study aim)

In males (Table 5), few differences emerged according to the age category in motives suggesting the use of OSAs for mood management ("*to distract myself, take a break, or pass the time when bored*"), mood enhancement ("*to improve my mood when I am sad, anxious, stressed, or angry*"), and/or emotional avoidance ("*to relieve stress and achieve relaxation*") (*V* between 0.04 and 0.17). Interestingly, the prevalence of elderly respondents reporting emotional avoidance behind OSA engagement was 26.9%, whereas in the remaining age categories, this figure varied in a narrow range between 54.6% and 62.4%. Similarly, small differences emerged according to the age category in the use of OSAs for romantic ("*to meet people to date*") or sexual purposes ("*to meet people to have offline sexual activity with*") (in both cases, $V = 0.07$), as well as for fantasizing ("*because it depicts things I cannot find in real life*") ($V = 0.10$). Even when differences were small, percentage of respondents reporting these motives was systematically higher for adults and older adults, and lower for early adolescents and adolescents. On the contrary, engagement in OSAs for sexual education ("*to learn about sex*") was more prevalent among early adolescents and adolescents and young adults (36.7% and 44.7% respectively), progressively decreasing with age ($V = 0.13$). Finally, differences according to the age group reached a moderate effect size ($V = 0.28$) when we assessed OSA as a form of achieving sexual arousal and pleasure ("*as an arousing visual aide to look at while masturbating*"). This motive was prevalent (>70%) in all the age groups except elderly (44.4%).

In females, the use of OSAs "*as an arousing visual aide to look at while masturbating*" was the most prevalent motive in all the age categories (between 53.4% and 69.2%) except for the elderly (27.8%) ($V = 0.14$). In the latter, the most prevalent motives were "*to learn about sex*" and "*to distract myself, take a break, or pass the time when bored*" (33.3%).

3.5. Excessive and problematic engagement in OSAs (3rd and 4th study aims)

First, participants were compared according to different indicators of excessive and problematic engagement in OSAs. As displayed in Table 6, we observed small-to-moderate differences according to the age category in the ISST average score ($f_{\text{males}} = 0.30$; $f_{\text{females}} = 0.19$): in particular, scores in this scale remained stable in early adolescents and adolescents and young adults (*M* of 10.06 and 10.15 in males; *M* of 6.05 and 5.58 in females), increased until reaching its peak value in adults (*M* of 11.91 and 6.35 respectively), and then progressively decreased with age (*M* of 5.76 and 1.92 in the elderly). In males, the proportion of participants qualifying as excessive and problematic OSAs users was below 3.8% in early adolescents and adolescents and young adults, ranged between 6.7% and 8.0% in adults and older adults and none of the participants in the elderly category displayed this profile. These differences reached a small effect size ($V = 0.10$). In females, the highest proportion of problematic OSAs users was observed in early adolescents and adolescents (1.8%), and this figure was below 1.4% in the remaining age categories.

Participants in the five age categories were also compared according to their self-perceived severity perception (Table 6). In males, a notable proportion of adults were worried about their OSA (60.4%) or considered that they spent too much time online for sexual purposes (62.8%); these figures decreased in the remaining age categories, especially in the elderly (22.6% and 29.1%), reaching a small to moderate effect size (*V* between 0.19 and 0.20). Similarly, an important proportion of adults

Table 4
Types of OSAs according to the age group (females).

	Early adolescents and adolescents % or *M* (*SD*)	Young adults % or *M* (*SD*)	Adults % or *M* (*SD*)	Older adults % or *M* (*SD*)	Elderly % or *M* (*SD*)	Inferential statistic	Effect size
12-item scale on types of OSAs (α = .85; ω = .86) (range = 0–12)	3.73 (1.82)	4.41 (2.07)	4.82 (2.27)	4.69 (2.67)	2.12 (1.22)	$F = 10.13$***	$f = 0.177$
Non-arousal OSAs (Spearman-Brown reliability = .73) (range = 0–2)	1.53 (0.61)	1.64 (0.55)	1.57 (0.63)	1.41 (0.67)	0.72 (0.67)	$F = 14.42$***	$f = 0..21$
Getting sexuality information by visiting educational websites	89.7%	90.9%	86.1%	75.0%	50.0%	$\chi^2 = 49.52$***	$V = 0.199$
Reading erotic material online	62.9%	73.4%	69.7%	65.2%	22.2%	$\chi^2 = 27.33$***	$V = 0.148$
Partnered-arousal OSAs (α = .88; ω = .88) (range = 0–5)	1.14 (1.31)	1.62 (1.51)	1.92 (1.58)	1.78 (1.78)	0.72 (1.07)	$F = 6.57$***	$f = 0.146$
Flirting with other users online	37.1%	53.0%	55.4%	46.1%	11.1%	$\chi^2 = 23.35$***	$V = 0.137$
Sharing sexual fantasies online via text	29.9%	38.6%	46.4%	39.7%	22.2%	$\chi^2 = 11.63$*	$V = 0.096$
Having sex online via webcam (cybersex)	23.7%	30.6%	32.3%	27.0%	5.6%	$\chi^2 = 8.29$	$V = 0.082$
Looking for romantic partners	18.6%	23.6%	34.6%	41.4%	22.2%	$\chi^2 = 28.02$***	$V = 0.150$
Looking for sexual partners	5.2%	16.4%	23.3%	25.4%	11.1%	$\chi^2 = 22.31$***	$V = 0.134$
Solitary-arousal OSAs (α = .77; ω = .79) (range = 0–5)	1.06 (0.69)	1.15 (0.66)	1.35 (0.79)	1.51 (1.04)	0.76 (0.66)	$F = 11.10$***	$f = 0.185$
Buying sex products in online sex shops	2.1%	5.3%	8.6%	23.5%	11.1%	$\chi^2 = 52.18$***	$V = 0.204$
Viewing pornographic pictures and/or movies	86.6%	88.4%	91.0%	81.9%	50.0%	$\chi^2 = 30.54$***	$V = 0.156$
Visiting contact sites	13.4%	16.8%	22.2%	34.2%	16.7%	$\chi^2 = 23.04$***	$V = 0.136$
Replying to sex ads	1.0%	2.7%	8.6%	10.5%	0%	$\chi^2 = 29.77$***	$V = 0.155$
Contacting sexual workers advertised online	3.1%	1.3%	4.9%	0.9%	0%	$\chi^2 = 13.44$**	$V = 0.104$

Note: *p < .05; **p < .01; ***p < .001.

(30.2%) thought that OSAs interfered in their life, compared to 19.9% in early adolescents and adolescents or 5.6% in elderly ($V = 0.12$). In females, 58% of early adolescents and adolescents were worried about their OSA, 11% considered they spent too much time, and 2.9% thought that OSA interfered in their life.

Finally, we performed hierarchical linear regressions to estimate the predictive power of different independent variables over excessive and problematic engagement in OSAs (i.e., ISST total score) (Table 7). Age was included as a predictor (first step) and as an interaction term (second step) to test its moderating effect on the relationship between the independent variables and the ISST. However, predictive power of the regression models did not significantly increase when age was introduced as an interaction term (+1% in men; −0.2% in women); furthermore, none of these interaction terms were significant, and so, they were excluded from the regression models. The results of the linear regressions (main effects) revealed significant models accounting for 42.6% of the variance of ISST scores in men and 43.9% in women. Age was a significant predictor of ISST scores in both men ($\beta = -0.068$) and women ($\beta = -0.091$): in particular, the risk of excessive and problematic engagement in OSAs decreased as people grew older.

4. Discussion & conclusions

The main aim of this study was to explore the engagement in OSAs across the lifespan. To address this aim, we analysed three different aspects of OSA (i.e., prevalence of different OSAs, motives to engage in OSA, and excessive and problematic engagement in OSA) in a sample of 8040 individuals between 12 and 85 years old distributed into five age groups. On the whole, this study found that: (a) OSA was highly prevalent across all the developmental stages (including people older than 60 years old); (b) differences according to the age in the use of the Internet for sexual purposes were small-to-moderate (i.e., smaller than expected); and (c) considering gender was important when it came to understanding these minor age differences.

The first aspect in which we observed consistent differences according to the age was the devices employed to access OSA (moderate effect sizes). In both males and females, the proportion of participants reporting the use of the personal computer to access OSA slightly increased with age, whereas the use of mobile devices (such as smartphones or tablets) linearly decreased (from 82.6% to 18.10% in men and 68.4% to 0% in women). As a result, young people employed PCs or mobile devices to access OSA to a similar extent, whereas older people mostly employed PCs. This finding explains contradictory results from empirical studies and data published by the industry (e.g., Pornhub). Empirical research conducted from a person-centered approach suggests that PCs remain the main way to access sexually explicit materials on the Internet (Kvalem et al., 2014); however, in its annual reports, Pornhub (i.e., one of the most popular pornographic websites) documented an increase in the proportion of users accessing pornography through mobile devices (from 49% in 2013 to 80.3% in 2018) (Pornhub, 2013, 2018). According to our results, it seems that the proliferation of new devices is changing the way that people access and interact sexually via the Internet, but only among young generations. This differential pattern has important implications, as the greater accessibility to online sex facilitated by the use of mobile technologies may led to an increased engagement in OSA (Wéry & Billieux, 2017).

As for the time spent online for sexual purposes, we found differences according to the age in men (small effect size) but not in women. In men, adults and older adults spent almost twice as long on the Internet for sexual purposes than early adolescents and adolescents, young adults, and elderly (about 7 h per week vs. 3–4 h). In women, time spent online for sexual purposes barely changed with age, except in elderly: whereas

Table 5
Motives to engage in OSAs according to the age group and sex.

	Early adolescents and adolescents % or *M* (*SD*)	Young adults % or *M* (*SD*)	Adults % or *M* (*SD*)	Older adults % or *M* (*SD*)	Elderly % or *M* (*SD*)	Inferential statistic	Effect size
Males							
To learn about sex (e.g., sexual positions)	36.7%	44.7%	35.9%	30.8%	25.0%	$\chi^2 = 59.87$***	$V = 0.126$
As an arousing visual aide to look at while masturbating	87.2%	85.7%	88.5%	73.8%	44.4%	$\chi^2 = 294.47$***	$V = 0.279$
To distract myself, take a break, or pass the time when bored	45.0%	56.0%	57.1%	57.0%	52.3%	$\chi^2 = 7.59$	$V = 0.045$
To relieve stress and achieve relaxation	62.4%	61.6%	62.4%	54.6%	26.9%	$\chi^2 = 108.38$***	$V = 0.169$
To improve my mood when I am sad, anxious, stressed, or angry	24.8%	26.6%	31.1%	30.5%	24.5%	$\chi^2 = 10.32$*	$V = 0.052$
To meet people to date	15.6%	17.4%	23.4%	18.0%	17.1%	$\chi^2 = 19.65$**	$V = 0.072$
To meet people to have offline sexual activities with (sexual partners)	11.9%	11.4%	16.9%	16.6%	14.8%	$\chi^2 = 19.42$**	$V = 0.072$
Because it depicts things I cannot find in real life	52.3%	46.2%	50.7%	51.9%	30.1%	$\chi^2 = 39.21$***	$V = 0.102$
Females							
To learn about sex (e.g., sexual positions)	50.0%	52.7%	54.9%	41.4%	33.3%	$\chi^2 = 8.87$	$V = 0.084$
As an arousing visual aide to look at while masturbating	56.1%	69.2%	64.9%	53.4%	27.8%	$\chi^2 = 27.15$***	$V = 0.147$
To distract myself, take a break, or pass the time when bored	43.9%	42.2%	41.0%	30.2%	33.3%	$\chi^2 = 6.85$	$V = 0.074$
To relieve stress and achieve relaxation	39.8%	45.3%	44.0%	25.0%	16.7%	$\chi^2 = 22.37$***	$V = 0.134$
To improve my mood when I am sad, anxious, stressed, or angry	14.3%	13.0%	20.9%	16.4%	11.1%	$\chi^2 = 9.90$*	$V = 0.089$
To meet people to date	5.1%	5.5%	10.8%	10.3%	16.7%	$\chi^2 = 13.45$**	$V = 0.104$
To meet people to have offline sexual activities with (sexual partners)	2.0%	3.7%	7.1%	11.2%	11.1%	$\chi^2 = 17.24$**	$V = 0.117$
Because it depicts things I cannot find in real life	25.5%	29.3%	34.7%	23.3%	11.1%	$\chi^2 = 9.35$	$V = 0.086$

Note: *p < .05; **p < .01; ***p < .001.

Table 6
Excessive and problematic engagement in OSAs according to the sex and age group.

	Early adolescents and adolescents % or *M* (*SD*)	Young adults % or *M* (*SD*)	Adults % or *M* (*SD*)	Older adults % or *M* (*SD*)	Elderly % or *M* (*SD*)	Inferential statistic	Effect size
Males							
Internet Sex Screening Test							
Total score (range = 0–25)	10.06 (3.92)	10.15 (4.36)	11.91 (4.60)	10.15 (5.13)	5.76 (3.71)	F=88.17***	$f = 0.30$
Excessive and problematic users	1%	3.8%	8.0%	6.7%	0.0%	$\chi^2 = 39.15$***	$V = 0.10$
Self-perceived excessive and problematic engagement in OSAs							
Have you ever been worried about your cybersex consumption? (yes)	65.8%	52.2%	60.4%	45.7%	22.6%	$\chi^2 = 137.53$***	$V = 0.19$
Do you think you spend more time than advised online for sexual purposes? (yes)	43.2%	42.0%	62.8%	53.0%	29.1%	$\chi^2 = 166.28$***	$V = 0.20$
Do you think that sex on the Internet interferes in some way in your life? (yes)[a]	19.9%	23.9%	30.2%	24.3%	5.6%	$\chi^2 = 146.51$***	$V = 0.12$
Females							
Internet Sex Screening Test							
Total score (range = 0–25)	6.05 (4.04)	5.58 (3.96)	6.35 (4.01)	4.79 (4.41)	1.92 (2.16)	F=12.42***	$f = 0.19$
Excessive and problematic users	1.8%	1.0%	1.4%	1.4%	0.0%	$\chi^2 = 1.07$	$V = 0.03$
Self-perceived excessive and problematic engagement in OSAs							
Have you ever been worried about your cybersex consumption? (yes)	57.1%	48.0%	41.3%	31.1%	16.7%	$\chi^2 = 30.98$***	$V = 0.15$
Do you think you spend more time than advised online for sexual purposes? (yes)	11.0%	8.6%	9%	7.5%	0.0%	$\chi^2 = 3.92$	$V = 0.05$
Do you think that sex on the Internet interferes in some way in your life? (yes)[a]	2.9%	6.3%	7.2%	2.8%	2.8%	$\chi^2 = 228.67$***	$V = 0.23$

Note: *p < .05; **p < .01; ***p < .001.

Table 7
Hierarchical linear regression models predicting excessive and problematic engagement in OSA (ISST Total score).

	Males			Females		
	β	R^2	*F*	β	R^2	*F*
Step 1 (main effects)		42.6%	159.44		43.9%	38.20
Age	-.068***			-.091***		
Time online for sexual purposes (in minutes/ week)	.073***			.048		
Non-arousal OSAs (range = 0–2)	-.014			-.018		
Partnered-arousal OSAs (range = 0–5)	.269***			.345***		
Solitary-arousal OSAs (range = 0–5)	.221***			.188***		
To learn about sex (e.g., sexual positions) (yes)	-.096***			.003		
As an arousing visual aide to look at while masturbating (yes)	.137***			.108**		
To distract myself, take a break, or pass the time when bored (yes)	.054**			.028		
To relieve stress and achieve relaxation (yes)	.065***			.179***		
To improve my mood when I am sad, anxious, stressed, or angry (yes)	.138***			.118**		
To meet people to date (yes)	.011			.024		
To meet people to have offline sexual activities with (sexual partners) (yes)	.066**			.011		
Because it depicts things I cannot find in real life (yes)	.182***			.148***		
Step 2 (main effects + interaction effects)		43.6%	86.88		43.7%	20.18

Note: *p < .05; **p < .01; ***p < .001.

weekly use remained stable around 2 h in the majority of age categories, elderly women spent less than 30 min per week online for sexual purposes. Most studies conducted so far exploring this issue have done so analyzing time online in general, not according to the age; given the differences found in our research according to the age, results from these studies may be biased when they comprise male samples and wide age ranges. For instance, Wéry and Billieux (2016) found that men between 18 and 72 years old (*M*age = 30) spent an average of 3 h per week in OSAs. Similarly, Blais-Lecours, Vaillancourt-Morel, Sabourin, and Godbout (2016) found that male users between 18 and 78 years old (*M*age = 25) spent around 1 h per week watching pornography. In light of our results, it is possible that these figures resulting from large age ranges but mainly sampling young adults were obscured by do not consider potential differences according to age, thus hindering their generalizability and interpretability.

One of the main study aims was to analyse the prevalence of multiple OSAs in different developmental stages, as well as the potential moderating effect of gender (1st study aim). On this matter, our study revealed that age was relevant when it came to understanding preference for different OSAs across the lifespan (small-to-moderate effect sizes). In both men and women, we found a consistent pattern characterized by: (a) during early developmental stages (i.e., early adolescence, adolescence, and young adulthood), non-arousal OSAs such as reading erotica online or the use of the Internet to find sexual education were extremely popular (prevalence between 77.8% and 81.7% in men and 89.7%–90.9% in women), together with certain solitary-OSAs aimed to achieve sexual satisfaction (e.g., pornography use); (b) later, during adulthood (between 26 and 40 years old), non-arousal OSAs became less relevant, solitary-OSAs remained stable, and partnered-arousal OSAs (mainly, the use of chats or webcams for sexual purposes) gained prominence until achieving their peak prevalence; (c) during middle adulthood (i.e., from 41 to 60 years old), solitary-arousal OSAs emerged as the most popular online sexual outlet, whereas partnered-arousal OSAs started to lose relevance; (d) finally, during late adulthood (>60 years old), the prevalence of all the OSAs assessed tended to decline (especially in women). These trends partially confirm some of the findings derived from previous studies, but also refute many well established beliefs on how sexuality is expressed online across the lifespan. For example, our findings are at odds with studies suggesting that OSA tend to systematically decline with age (Miller et al., 2020; Price et al., 2016). In our study, certain OSAs actually became more prevalent as people grow older (mainly during adulthood and middle adulthood). As in other areas of sexuality (Ševčíková & Sedláková, 2020), in our study we also appreciate a loss of interest for OSA during the final stages of life, but this decline occurred later than initially suggested and mediated by gender. As a case in point, prevalence of pornography consumption in men remained relatively stable across the lifespan (between 92% and 98.2%), whereas in women, prevalence of this OSA barely changed between 81.9% and 91% from early adolescence to middle-adulthood, but dramatically decreased to 50% in elderly. These results are congruent with studies suggesting that there is an important gender gap when it comes to analyse the impact of age on OSA (Wright, 2013; Wright, Bae, & Funk, 2013), meaning that the interplay between both aspects has a central role that warrants further research.

The second study aim was to compare motives fueling OSA engagement in different developmental stages, as well as the potential moderating effect of gender. Our results indicated that age barely modulated reasons behind the engagement in OSA across the lifespan, both in males and females (null or small effect sizes). Even so, we found some age-related trends: (a) the prevalence of motives suggesting the use of OSAs for mood management, mood enhancement, or emotional avoidance remained stable across most developmental stages; (b) the use of OSAs for romantic and/or sexual purposes was slightly higher for adults and older adults, and lower for early adolescents and adolescents; and (c) the prevalence of most motives tended to decline for elderly. These findings partially support recent literature review proposing that certain reasons behind the use of OSA are central during particular developmental stages (Castro-Calvo et al., 2018). However, certain trends documented in this review (e.g., the special relevance of sexual education motives during childhood and/or adolescence) were not confirmed by our research. The use of OSA as a form of achieving sexual arousal and pleasure (i.e., "*as an arousing visual aide to look at while masturbating*") was the most prevalent motive in all the age groups except in elderly. This finding is coherent with recent empirical studies (Bothe et al., 2020) and theoretical models proposing that OSA is mainly driven by hedonic motives (Grubbs, Braden, Kraus, Wilt, & Wright, 2017). However, in the elderly, the use of OSAs as a distractor was more commonly reported, suggesting that certain 'coping motives' became more relevant than hedonic motives later in life. This is not surprising,

given that coping motives (aka 'escapist motives') are related to certain life circumstances that tend to appear as people grow older (such as feelings of loneliness, boredom, and lower life satisfaction –typical when people get retired– or the lack of a committed relationship –e.g., when people become widowed–) (Weber et al., 2018).

The last study aims were to explore the prevalence and characteristics of excessive and problematic engagement in OSA across the lifespan (3rd aim), as well as the interplay between the age, different aspects of OSA engagement, and the risk of problematic OSA (4th aim). As for the severity of OSA engagement, results derived from the ISST revealed small-to-moderate differences according to the age category. First, we found that both the severity and the prevalence of problematic use increased with age until reaching its peak value in adults between 26 and 40 years old (8% in men; 1.4% in women). These figures are similar to those obtained in empirical studies comprising samples with an average age between 30 and 35 years old (e.g., Bőthe et al., 2020), but notably higher than those reported in studies with younger samples (Ballester-Arnal, Castro-Calvo et al., 2016). This finding suggests that adulthood may constitute a sensitive period in the development of problems with OSA, a conclusion that resonates with recent studies highlighting that hypersexuality/CSBD does not typically appear to produce sufficient distress and/or impairment to precipitate help-seeking until the third/fourth decade of life (Kafka, 2014). Supporting this point, we also found that the prevalence of men and women reporting having experienced interference derived from their OSA achieved its peak value during adulthood (30.2% in men; 7.2% in women). Second, we found that both the severity and the prevalence of people qualifying as problematic OSA users tended to decline with age, especially during late adulthood (none of them qualified as a problematic OSA user). Similarly, we also found that age was a significant predictor of OSA severity: as reported in previous studies (Grubbs et al., 2019), the risk of problematic engagement in OSAs decreased as people grew older. Finally, we found that age did not moderate the relationship between different aspects of OSA use (time online for sexual purposes, the type of OSA, and the motives behind OSA engagement) and the risk of problematic OSA.

Despite a number of interesting and novel findings, this study was limited in different ways. First, this was a cross-sectional research and therefore, it was limited when it comes to addressing whether the documented age-related trends were the result of the 'birth cohort' or the 'aging effect' (Price et al., 2016). Therefore, future research is needed to examine whether the findings derived from our study are attributable to the 'birth cohort', the 'aging effect', or the interaction between both aspects (as suggested in previous studies) (Price et al., 2016). At a methodological level, longitudinal studies comprising different birth cohorts would be preferable in future studies addressing this important aim. Second, we assessed gender trough a measure comprising only two categories (*male/female*). Even when popular, this type of scale is limited and does not represent the wide variety of gender expressions; therefore, we encourage the use of alternative measures capturing cisgender identities, but also transgender identities (Tate, Ledbetter, & Youssef, 2013). This is also applicable to the measurement of aspects such as sexual orientation (including more categories than the classical "hetero-/bi-/homo-sexual") or sexual behavior (including more hand-genital sexual behaviors, which may be important in same-sex sexual encounters). Despite our large sample size, our study sample was limited in different ways: (a) the number of participants in certain study subgroups (e.g., elderly females) was limited, (b) some of the age categories may have conflated different developmental stages (e.g., early adolescents and adolescents), (c) participants were self-selected (meaning that our sample was non-representative), and (d) certain recruitment strategies may lead to the overinclusion of participants with a high problematic OSA profile. These problems may have undermined to a certain extent the generalizability of our findings. Therefore, further research is needed to corroborate our findings and generate new evidence on the use of the Internet for sexual purposes across the lifespan.

Authors' contribution

RBA and MDGL contributed to study design, obtaining funding, and study supervision. RBA, MDGL, JCC, and ERP participated in recruiting participants and collecting data. RBA, JCC, and MGB, were involved in the analysis/interpretation of data and writing of the paper. All authors read and approved the final manuscript.

Declaration of competing interest

The authors declare no conflict of interest.

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