



# Prevalence estimates and nature of online child sexual exploitation and abuse: a systematic review and meta-analysis

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## Summary

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See Online for appendix

**Background** Online child sexual exploitation and abuse (OCSEA) is a global health issue. The aim of this global systematic review and meta-analysis was to better understand the prevalence and nature of OCSEA on a global scale.

**Methods** Comprehensive literature searches were done in six UN languages (Arabic, Chinese, English, French, Russian, and Spanish) and multiple databases, for records published between Jan 1, 2010, and Sept 30, 2023. Studies were evaluated independently by two different authors for inclusion according to eligibility criteria. Eligible studies included children younger than 18 years or adults retrospectively reporting OCSEA. Studies used general population samples and were representative at the national and sub-national level. Risk of bias in prevalence studies was assessed and a synthesis of the findings produced. A random-effects model was conducted for meta-analysis of studies to calculate prevalence estimates with 95% CIs for past year recall and lifetime recall of four OCSEA subtypes and overall OCSEA (from studies that measured at least three different sub-types within the same sample). This study was pre-registered with Open Science Framework ([osf.io/6vux2](https://osf.io/6vux2)).

**Findings** Of the 47 097 records derived from literature searches, 86 records reporting on 123 studies were included in this systematic review and meta-analysis. Pooled mean prevalence for past year recall of OCSEA subtypes was estimated: online solicitation (12.5% [95% CI 10.5–14.7]); non-consensual taking, sharing, and exposure to sexual images and videos (12.6% [9.7–16.2]); online sexual exploitation (4.7% [2.9–7.3]); and sexual extortion (3.5% [1.9–6.4]). The mean prevalence of past-year recall for overall OCSEA was 8.1% (4.9–13.0). Heterogeneity of individual estimates was high, influenced by research design factors including the method of data collection and variability in definitions used.

**Interpretation** Heterogeneity in prevalence estimates identified across studies and regions indicates that more research is required to draw stronger conclusions about the scale of OCSEA. However, the findings of this study are of great relevance to policy makers, practitioners, and researchers to make informed decisions about allocating resources and designing effective prevention and response programmes to protect children worldwide.

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## Introduction

Online child sexual exploitation and abuse (OCSEA) refers to a range of types of sexually abusive and exploitative behaviours that occur either online or through the use of information and communication technologies (ICTs). These behaviours include online solicitation, online grooming, exposure to pornography, unwanted or pressured sexting (non-consensual receiving or forwarding sexually explicit messages, photographs, or videos), image-based abuse, sexual extortion, and sexual exploitation, which are increasingly identified in research and epidemiological reports.<sup>1–3</sup>

OCSEA is considered an urgent public health issue that is escalating facilitated by the so-called triple-A-engine of accessibility, affordability, and anonymity.<sup>4–6</sup> According to the US National Center for Missing & Exploited Children's CyberTipline,<sup>7</sup> over 36.2 million

reports of suspected OCSEA images and videos were received in 2023, showing an increase of 13% compared with 2022 and 23% compared with 2021.

The fast-paced development of social media and other virtual contexts enable new technological modalities and types of abuse to emerge, which makes estimating the full extent of these crimes extremely challenging. Moreover, the fragmentation of the associated data and conceptual inconsistencies and ambiguities reveal a lack of consensus about the definition of OCSEA and its various forms. Operationalising OCSEA key concepts in the studies and measuring them are particularly apparent in the case of image-based abuse. Limited ability to determine whether the images and videos were coerced by adults or peers or exemplify behaviour consistent with adolescent sexual development and risk-taking complicates the clear categorisation of sexual abuse.<sup>8</sup>

## Research in context

### Evidence before this study

The evaluation of the global scale and nature of online child sexual exploitation and abuse (OCSEA) is challenging. The research on online child victimisation is still in its infancy and requires constant review of terminology and screening tools to address the fast-paced development of social media and other information and communication technologies. From the literature database searches for this systematic review (March 1, 2023, to Nov 23, 2023) only three previous narrative reviews exist and only one previous meta-analysis has explored two types of OCSEA (unwanted online exposure to sexually explicit materials and unwanted online sexual solicitation) from four high-income regions only (western Europe, central Europe, North America, and east Asia). Several reviews on technology-facilitated victimisation were identified. The previous reviews reporting on OCSEA were focused on the typology of selected forms of online victimisation or the role of the internet in facilitating online child abuse. The only previous meta-analysis on the global prevalence of OCSEA was published in 2018 and synthesised evidence from 14 studies published between 2004 and 2014, examining the prevalence of the unwanted online exposure and solicitation of a sexual nature among youth.

### Added value of this study

To our knowledge, this study is the first systematic review and meta-analysis to provide mean prevalence estimates of

children younger than 18 years who have experienced different forms of OCSEA on a global scale. Our findings highlight a need for more prevalence data, specifically in regions where the evidence is either scarce or non-existent (ie, North Africa and the Middle East and South Asia). Prevalence estimates for online solicitation and non-consensual taking, sharing, and exposure to sexual images and videos were the most frequently reported subtypes of OCSEA. A small number of studies reported prevalence estimates of multiple types of OCSEA among the same sample, as well as online sexual exploitation and sexual extortion, which is an area for future concentrated research efforts.

### Implications of all the available evidence

To address the evolving nature of OCSEA, researchers often develop their own measures based on the existing instruments and concepts, which introduces new variables operationalised in relation to the umbrella constructs, and consequently leads to interstudy variability and potential bias. Further work on strengthening the data foundations of OCSEA prevalence data is needed, including developing standardised instruments and minimum standards for reporting prevalence estimates. Additionally, the study findings point to the increased need for safety by design within online environments, supported by regulation, education, and preventative efforts.

Additionally, taking, sharing, and exposure to sexual content have been often presented along other forms of OCSEA, including online solicitation, cyber grooming, sexual extortion, livestreamed sexual imagery, online sexual harassment, exposure to pornography, and pressured or non-consensual sexting,<sup>3,9-10</sup> which affects the efforts to isolate specific behaviours and estimate their prevalence.

Another conceptual barrier in calculating prevalence rates for selected types of OCSEA relates to the interchangeable use of terms and outcome measures in relation to variables with different definitional elements. For example, online grooming and online solicitation were often found to be incorrectly considered and assessed as the same type of offense.<sup>11,12</sup>

The previous reviews reporting on OCSEA were focused on the typologies of selected forms of online victimisation<sup>13</sup> or the role of the internet in facilitating online child abuse.<sup>14</sup> The most rigorous assessment of OCSEA prevalence to date is the meta-analysis synthesising evidence from 14 studies published between 2004 and 2014.<sup>15</sup> This meta-analysis examined the scale of unwanted online exposure (ie, accidental or unplanned exposure to sexual images and videos) and solicitation of a sexual nature (ie, requests to engage in unwanted sexual activities, sexual talk, or to provide sexual

information) among youth. The authors found that 20·3% of minors were exposed to unwanted sexual content online and 11·5% received requests of a sexual nature. However, this review did not consider other forms of OCSEA and provided prevalence estimates for North America and Europe only. These considerations, combined with an increased number of relevant reports since 2014, warrant an updated global systematic review and meta-analysis.

The main objective of this systematic review and meta-analysis was to determine the prevalence and nature of OCSEA globally, based on the existing nationally and sub-nationally representative studies. The second objective of this review was to estimate and compare the prevalence of OCSEA by sex and region.

## Methods

### Search strategy and selection criteria

For this systematic review and meta-analysis, searches were conducted on March 1, 2023, and Nov 23, 2023. The search strategy included the intersection of terms indicating both offline and online sexual victimisation to capture studies that were wider than just OCSEA but that might have asked questions and produced a prevalence estimate for some type of OCSEA—eg, sexual harassment and online child abuse (appendix pp 4–5). We searched

PubMed, MEDLINE, Global Health, PsycINFO, Embase, Web of Science, Sociological abstracts (Proquest), CINAHL, ERIC, Criminal Justice Abstract, Google Scholar, and key journals in the field of child protection. Key grey literature sources included research by international non-governmental organisations, UN agencies and community-based organizations, and research reports from national government sources. Relevant language specific databases were also searched (appendix pp 2–4).

Studies were included if they were published in one of the six official UN languages (Arabic, Chinese, English, French, Russian, and Spanish) between Jan 1, 2010, and Sept 30, 2023; they reported the prevalence of OCSEA; they used general population samples, representative at the national or sub-national level; they included a measure of OCSEA; prevalence estimates were collected using traditional sampling methods, or other methodological approaches of prevalence estimation (eg, Multiple Systems Estimation); OCSEA was self-reported either by a child younger than 18 years or an adult retrospectively, or reported by parents or others in a position of responsibility; and the sample size was at least 100.

Studies were excluded if non-disaggregated data for children or adult experiences as children (eg, making it impossible to determine findings for children younger than 18 years) were provided; estimates were derived from particular subpopulations that might not generalise to the general population (eg, patients with psychiatric disorders, people with convictions, the LGBTQ+ community, children living in foster homes, and samples that exclusively comprised of victims of OCSEA); or data were collected in a controlled study, randomised controlled trial, or qualitative study.

Screening was conducted by two reviewers for each UN language independently, using the Covidence software package. Following initial screening of titles and abstracts and removal of duplicates, the two reviewers conducted full-text reviews of studies meeting the eligibility criteria; any discrepancies were resolved by an additional team member. All studies were examined for duplicate cohorts before confirming the final list of studies for meta-analysis.

A minimum of two authors independently extracted data from each of the selected studies with a data extraction tool that had been piloted by all language teams (appendix p 6). Modifications were agreed on and shared with the other authors. Studies with insufficient data (eg, non-disaggregated data) were excluded. As per protocol, interstudy variables were defined to categorise studies by the inclusion criteria, including sample representativeness, subtype of OCSEA (eg, online solicitation and unwanted sexting), and type of child sexual violence (eg, contact vs non-contact). Contact sexual violence against children includes rape and sexual assault. Non-contact sexual violence against children

refers to any form of verbal or non-verbal non-physical conduct, whether isolated or persistent, that involves unwanted references to the body, sexual organs, or sexuality of the child, including conduct facilitated via technology. We used Hoy and colleagues<sup>16</sup> risk of bias tool to assess methodological features of included studies. This checklist includes nine questions evaluating internal validity (ie, case definition used, source of data, quality of instruments, uniformity of the mode of data collection, and the numerators and denominators for the parameter of interest) and external validity (ie, representativeness of general and target population, sample selection method, and non-response bias). The response options for each of the nine items were limited to a choice of low risk (score 0) or high risk (score 1). Based on the total score of all nine items, the risk of bias for each study was graded as low (score 0–3), moderate (4–5), or high (6–9). The protocol for this systematic review and meta-analysis was developed following the PRISMA-P standards<sup>17</sup> and has been registered on Open Science Framework ([osf.io/6vux2](https://osf.io/6vux2)). We adhered to PRISMA<sup>18</sup> for reporting the results.

#### Data analysis

This review presents four main subtypes of OCSEA (table 1), the grouping of which was developed both by examining all the classifications of types of OCSEA as identified in the included studies and by drawing from existing literature on the topic and existing conceptual models.<sup>19,20</sup> Results were grouped according to the OCSEA subtype. Prevalence estimates of overall OCSEA were also identified from studies that measured at least three different sub-types within the same sample. The definition of OCSEA and each of its subtypes includes only unwanted, forced, or non-consensual exposure to technology-facilitated abuse (eg, sexts sent via SMS or unwanted exposure to pornography) and does not include accidental exposure or intentional use of sexual content. Prevalence was estimated separately for past year recall and for lifetime (childhood) recall for each of the subtypes and for overall OCSEA.

Meta-analyses were carried out using R software (version 4.2.2; tidyverse\_2.0.0, meta\_7.0–0, readxl\_1.4.2, and Hmisc\_5.0–1) and the pooled prevalence estimates and their 95% CIs were determined using a random effects model; thus, these represent estimates of the mean of the assumed underlying prevalence distribution, rather than an estimate of a single unknown population prevalence, as would be the case with a fixed-effects model. The analysis was performed by a senior statistician (NA) and cross-checked by the second author (AK) for accuracy. Separate analyses were run for each of the subtypes and overall OCSEA, disaggregated by the recall period and the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) world regions. For studies that reported biological sex (male and female) breakdown and had sufficient data for conducting the

	OCSEA subtypes	Description
Online solicitation	Online grooming; online solicitation; online sexual harassment; pressure to obtain images; voluntarily provided images in a statutorily impermissible relationship; unwanted, non-consensual, or pressured sexting; unwanted sexual talk (subtype informed by Finkelhor et al) <sup>1</sup>	This subtype covers a range of unwanted or pressured sexual interactions and activities; these can include casual sexual inquiries via mobile phone or internet and long-lasting sexual conversations that can lead to exchange of sexual pictures or videos; it is important to note that the different types of online solicitation often come from peers as well as adult perpetrators
Non-consensual taking, sharing, and exposure to sexual images and videos	Non-consensual images or videos taken and distributed by an adult or another child or young person; forced or unwanted exposure to pornographic content (adult content or CSAM [subtype informed by Finkelhor et al and E-Safety Commissioner]) <sup>1,20</sup>	Non-consensual image or video taking refers to having sexual images taken when a child was unconscious, intoxicated, distracted, or unable to consent; it could also include deepfake images in which a child's head or likeness is imposed on a sexual image of someone else; this subgroup also includes any unwanted exposure of a child to pornographic materials (eg, forcing a child to watch nude videos or pictures or sending a child a link to pornographic websites); please note that unwanted exposure to sexual content occurs frequently while surfing or scrolling through social media; this type of exposure might not be a precursor to a request for reciprocity
Online sexual exploitation	Commercial sexual talk, commercial sexual images, other commercial sexual activity, sexual coercion (subtype informed by Finkelhor et al and Laird et al) <sup>21</sup>	Sex acts are exchanged for the child or young person's unmet needs, via the provision of monetary or non-monetary resources (eg, food, clothes, shelter, affection, protection, belonging, gifts, or anything else of perceived value to the young person or child) online or offline
Sexual extortion	Sextortion, sexual extortion, sexual blackmail (subtype informed by E-Safety Commissioner) <sup>20</sup>	Sexual extortion is a form of blackmail that involves threatening to share an individual's intimate image or video online unless they comply with specific demands, such as to obtain money, gift cards, other items of monetary worth, additional pictures, or other sexual activities

CSAM=child sexual abuse material. OCSEA=Online Child Sexual Exploitation and Abuse.

**Table 1: Description of the subtypes of OCSEA included in the study**

analysis (n=50), prevalence for each outcome, recall period, and region were also estimated. Sensitivity analyses were conducted by removing studies with duplicate cohorts or those that did not report their analytical sample size, before confirming the final list of studies for meta-analysis (data not shown).

Heterogeneity across studies in each analysis was assessed using the  $I^2$  statistic and the between-study variance was examined using  $\tau^2$ . 95% prediction intervals (PIs) were reported for each subtype of OCSEA and geographical location. 95% PIs were presented to estimate the expected range of true effects in similar future studies.<sup>21</sup> Given a high variability across study settings investigating OCSEA prevalence, PIs allow better understanding of the variation and uncertainty of the estimates.<sup>21</sup> Subgroup analyses were conducted to assess sources of heterogeneity (ie, by performing separate analyses for specific types of OCSEA and GBD regions).

### Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

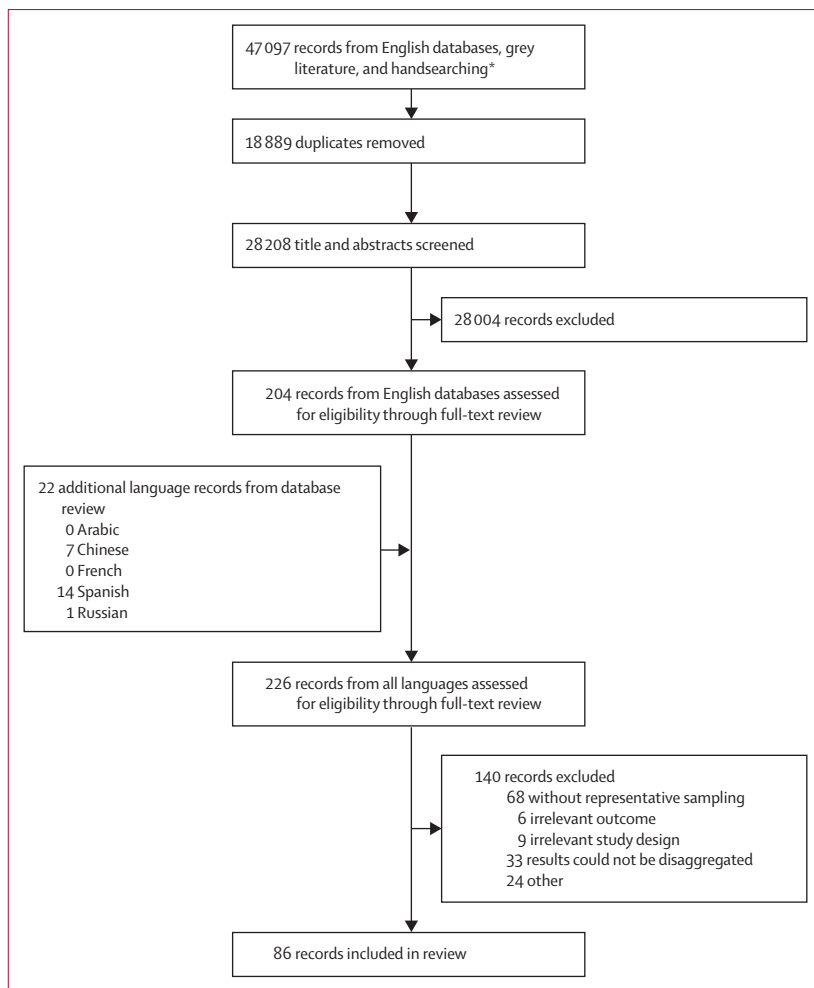
### Results

Our searches retrieved 47 097 records (figure). After removing duplicates, the titles and abstracts of 28 208 records were screened for eligibility, 226 of which

were screened at the full-text stage. Reasons for exclusion included insufficient research data (eg, non-disaggregated results or non-representative sampling) or irrelevant study design or outcome. In total, 86 records reporting on 123 studies and 57 countries met all inclusion criteria and were selected for further analysis. Eligible records were published between 2011 and 2023 and included studies were conducted between 2006 and 2021 (appendix pp 31–38).

In total, 82 (95%) records reported on cross-sectional studies and the remaining four (5%) records reported on longitudinal studies. In total, 60 (70%) records used nationally representative sampling, followed by 13 (15%) city-level sampling, and 13 (15%) sub-nationally representative sampling. Sample sizes varied, ranging from 213 to 49 728. 71 (83%) records relied on child report and eight (9%) on adult victim recall; five (6%) records had a combination of child and caregiver reporting and two (2%) records included parent or guardian respondents. 50 (58%) of the 86 records reported data on online victimisation by sex. Most of the included records were found to be of low risk of bias (99%) and only one (1%) showed moderate risk of bias. Issues with validity and reliability of measures used, as well as the increased likelihood of non-response bias, were the main sources of bias (appendix pp 39–42).

The pooled mean prevalence estimates of four subtypes of OCSEA were assessed in 82 of the 86 included records



**Figure: Prisma flow diagram of systematic review**

\*We searched 10 English databases, 23 databases in the other five UN languages, 38 grey literature sources, and 4 key journals in the field of child protection (appendix pp 2–4).

reporting on 342 010 participants: 205 357 for lifetime recall; 198 867 for past-year recall (table 2). The mean prevalence of overall OCSEA was 8.1% (95% CI 4.9–13.0;  $I^2=99.5\%$ ; 15 studies) for past-year recall and 16.6% (14.4–19.0;  $I^2=75.0\%$ ; two studies) for lifetime childhood experiences. For past year, two of four region estimates (South-East Asia and Eastern sub-Saharan Africa) were relatively well represented (5–6 studies; appendix p 8); with the highest mean prevalence found in Eastern sub-Saharan Africa (10.4% [6.4–16.3]), followed by South-East Asia (4.9% [1.9–12.1]). For lifetime recall, only two region estimates were produced for North America (15.6% [14.2–17.0] and Western Europe (18.9% [16.0–22.1]; appendix p 7).

In studies reporting online solicitation, prevalence was estimated for past-year online solicitation at 12.5% (95% CI 10.5–14.7;  $I^2=99.0\%$ ; 50 studies) and child lifetime exposure to online solicitation at 11.5% (7.2–18.0;  $I^2=99.6\%$ ; 22 studies). The regional subgroup analysis for

past-year exposure to online solicitation (appendix p 14) showed a relatively higher mean prevalence for Western Europe (13.5% [95% CI 10.7–16.8]; 15 studies) and South-East Asia (13.6% [9.3–19.4]; seven studies) than for Central Europe (9.4% [6.4–13.5]; seven studies), and North America (9.1% [4.5–17.6]; six studies). Other regions were either underrepresented (Australasia, Central Latin America, Eastern Europe, Eastern sub-Saharan Africa, Southern sub-Saharan Africa, and Western sub-Saharan Africa); or not reported at all (East Asia, North Africa and the Middle East, and South Asia). Regional subgroup analysis of child lifetime exposure to online solicitation was possible for Western Europe (20.8% [13.3–31.1]; seven studies) and North America (5.6% [2.1–14.0]; eight studies), that had a larger number of studies, whereas estimates for other regions were based on very low numbers of studies (appendix p 11).

For studies reporting the past-year mean prevalence of non-consensual taking, sharing, and exposure to sexual images and videos the estimated prevalence was 12.6% ([95% CI 9.7–16.2];  $I^2=99.5\%$ ). Three of the 14 region estimates (Central Europe, South-East Asia, and Western Europe) were relatively well represented (7–25 studies; appendix p 20); with the highest mean prevalence found in Central Europe (24.3% [16.8–33.8]), followed by Western Europe (18.1% [13.3–24.0]) and South-East Asia (3.4% [1.4–8.2]). The lifetime prevalence of experience of non-consensual taking, sharing, and exposure to sexual images and videos was 4.0% (2.3–6.9;  $I^2=99.4\%$ ). Nine geographical regions were represented, but only East Asia (1.3% [0.5–3.6]; four studies), and Western Europe (6.9% [1.7–24.0]; five studies) were relatively well covered by data (appendix p 17).

From studies reporting online sexual exploitation, past-year recall prevalence was estimated at 4.7% ([95% CI 2.9–7.3];  $I^2=93.7\%$ ). Two of the four region estimates (Eastern sub-Saharan Africa and South-East Asia) were relatively well supported by data (appendix p 25). Children living in Eastern sub-Saharan Africa (6.8% [4.6–10]; five studies) were more likely to experience online sexual exploitation than those in South-East Asia (2.5% [0.8–7.1]; six studies). The lifetime prevalence of global online sexual exploitation was 7.3% (2.2–21.8;  $I^2=99.1$ ). Three geographical regions were represented, but the estimates were based on a single study per region (appendix p 23).

From studies reporting on sexual extortion, past-year recall prevalence was 3.5% (95% CI 1.9–6.4;  $I^2=94.6\%$ ); based on 12 studies from three regions. Of those three geographical locations, only South-East Asia (2.2% [0.7–6.8]; six studies) and Eastern sub-Saharan Africa (5.1% [3.4–7.7]; five studies) were reasonably represented (appendix p 30). Prevalence of lifetime sexual extortion of 5.1% (4.0–7.2;  $I^2=93.1$  4.0) was estimated based on five studies from three GBD regions (appendix p 27).

	Prevalence estimates				Heterogeneity		
	Studies (n)	Incidents (n)	Observations (n)	Pooled prevalence (95% CI)	$\tau^2$	95% prediction interval	$I^2$
<b>Past year recall</b>							
Online solicitation	50	13 364	112 852	12.5 (10.5–14.7)	0.48	3.4–36.6	99.0%
Non-consensual taking, sharing, and exposure to sexual images and videos	73	17 717	146 868	12.6 (9.7–16.2)	1.64	1.1–65.2	99.5%
Online sexual exploitation	15	1277	21 155	4.7 (2.9–7.3)	0.87	0.6–28.1	93.7%
Sexual extortion	12	652	12 552	3.5 (1.9–6.4)	1.21	0.3–31.9	94.6%
<b>Lifetime recall (childhood)</b>							
Online solicitation	22	25 732	136 331	11.5 (7.2–18.0)	1.55	0.9–64.9	99.6%
Non-consensual taking, sharing, and exposure to sexual images and videos	20	2873	78 819	4.0 (2.3–6.9)	1.78	0.2–42.2	99.4%
Online sexual exploitation	3	480	5894	7.3 (2.2–21.8)	1.23	0.0–100.0	99.1%
Sexual extortion	5	612	11 862	5.1 (4.0–7.2)	0.16	1.3–17.8	93.1%

OCSEA=Online Child Sexual Exploitation and Abuse.

**Table 2: Effect estimates from meta-analysis of the OCSEA prevalence and heterogeneity, by subtype and recall period**

	Studies (n)	Male			Female		
		Incidence (n)	Observations (n)	Pooled prevalence (95% CI)	Incidence (n)	Observations (n)	Pooled prevalence (95% CI)
<b>Past year recall</b>							
Online solicitation	22	3371	40 165	9.9 (7.1–13.7)	5287	41 290	13.2 (9.2–18.5)
Non-consensual taking, sharing, and exposure to sexual images and videos	15	2790	38 693	6.6 (3.0–13.8)	1659	34 897	4.4 (1.9–9.8)
Online sexual exploitation	4	228	4751	5.0 (3.1–8.1)	349	4832	6.9 (5.2–9.2)
Sexual extortion	2	67	1040	6.4 (5.1–8.1)	56	951	5.6 (3.3–9.3)
<b>Lifetime recall (childhood)</b>							
Online solicitation	12	8359	58 901	9.8 (5.3–17.3)	18 968	79 050	17.2 (8.6–31.3)
Non-consensual taking, sharing, and exposure to sexual images and videos	14	1370	34 083	3.3 (1.7–6.3)	781	35 246	2.3 (1.4–3.7)
Online sexual exploitation	1	8	820	..	38	1762	..
Sexual extortion	2	173	3597	3.3 (1.1–7.9)	210	4553	4.7 (3.8–5.7)

OCSEA=Online Child Sexual Exploitation and Abuse.

**Table 3: Effect estimates from meta-analysis of the OCSEA prevalence, by sex, subtype and recall period**

In total, 11 studies provided complete data stratified by sex (past-year recall), suggesting that more females (8.7% [95% CI 4.6–16.0];  $I^2=99.0\%$ ) than males (7.5% [3.7–14.5];  $I^2=98.7\%$ ) were affected by overall OCSEA (appendix pp 9–10). Four regions were represented by these reports, with only South-East Asia sufficiently represented (five studies), estimating a similar level of exposure for males (4.3% [1.2–14.1]) and females (4.3% [1.6–11.3]). Insufficient data were reported for the lifetime exposure (two studies; appendix p 7). Heterogeneity measures are described in the appendix (p 44).

Mean prevalence estimates of online solicitation by sex were based on results from 22 studies for past-year recall and 12 studies for lifetime recall. The prevalence estimates for studies reporting past-year experiences of online

solicitation were 9.9% (95% CI 7.1–13.7) for males and 13.2% (9.2–18.5) for females (table 3). The regional subgroup analysis showed a relatively large number of studies for Western Europe (10.3% [6.9–15.0]; eight studies), with other regions under-represented (appendix pp 15–16). For lifetime exposure to online solicitation, an average prevalence of 9.8% (5.3–17.3) was estimated for males and 17.2% (8.6–31.3) for females (table 3). Six regions were represented; however, only a small number of studies ( $\leq 4$ ) in each of those regions were included in the analysis (appendix pp 12–13).

For studies reporting exposure to the non-consensual taking, sharing, or exposure to sexual images and videos, the past-year mean prevalence was 6.6% (95% CI 3.0–13.8) for males and 4.4% (1.9–9.8) for females

(table 3). However, the small number of studies for all nine regions covered indicates uncertainty around the estimate accuracy (appendix pp 22–23). For lifetime exposure to this OCSEA subtype the average prevalence was estimated as 3.3% (95% CI 1.7–6.3) for males and 2.3% (1.4–3.7) for females (table 3). Eight GBD regions were covered by the data, but all under-represented by studies (appendix pp 18–19).

Pooled prevalence of past-year and lifetime online sexual exploitation and sexual extortion by sex and GBD region are shown in table 3 and the appendix (pp 24–26, 28–30). References of studies included in this systematic review and meta-analysis are shown in the appendix (pp 45–50).

### Discussion

The number of studies on the prevalence of OCSEA has increased substantially over the past decade. This review provides the most up-to-date synthesis of evidence, indicating that one in 12 children globally have been subjected to at least one form of online sexual exploitation or abuse in the past year. Image-based abuse and online solicitation were found to be the most prevalent types of online child victimisation, affecting one in eight children worldwide on average. Few sources reported prevalence of online sexual exploitation and sexual extortion, reducing the certainty of prevalence estimates and indicating the need for more research efforts with the focus on those harms.

Prevalence of online solicitation in the past year was most prevalent in African regions, ranging between 18% (Western sub-Saharan Africa) and 25% (Southern sub-Saharan Africa). As internet accessibility is lower in these African regions than other world regions, they represent potential hotspots for growing OCSEA victimisation in the future. However, estimates for African regions are based on a small number of studies, particularly for Western sub-Saharan Africa, which raises uncertainty about their coverage for the region. Eastern sub-Saharan and Southern sub-Saharan Africa regions are exclusively covered by the Disrupting Harm initiative that made substantial efforts to collect nationally representative data.<sup>2</sup> South-East Asia and North America were found to be relatively well represented by the existing evidence on online solicitation, showing particularly high prevalence rates in the Philippines.<sup>22</sup> This finding is consistent with numerous reports on OCSEA from that location.<sup>6,23</sup> Conversely, East Asia, North Africa and the Middle East, and South Asia are lacking prevalence data; these regions constitute a large percentage of the global population of children so there is an urgent need for research at a national level in these regions.<sup>24</sup>

Results from the surveys measuring different forms of image-based and video-based abuse indicated that Central Europe, Eastern Europe, and Western Europe regions report some of the highest prevalence estimates of this type of abuse, followed by Australasia, Central

Latin America and Southern Latin America, South-East Asia, and Western Africa (past-year recall). These findings appear to be partially consistent with the most recent data from key detection and content takedown organisations (eg, Canadian Centre for Child Protection, The Internet Watch Foundation, INHOPE, and National Center for Missing & Exploited Children).<sup>7,25–27</sup> These organisations reported over 36 million reports and notices of Child Sexual Abuse Material (CSAM), showing that an exponentially large number of people view and share this abusive content globally. According to these organisations' findings, South Asia and South-East Asia have the largest number of CSAM reports; these regions also hold 54% of the world population. When standardised by population size, North America and Western Europe are in the top three regions (after North Africa and the Middle East) for highest CSAM rate. Our results do not seem to reflect the same extent of exposure to image-based abuse in the North America region, which might be related to methodological constraints and non-disclosure. We also identified few sources of data for South Asia and North Africa and the Middle East, constituting another barrier to draw any strong conclusions about the prevalence of image-based abuse in these regions.

There is still only a small number of studies reporting sexual extortion and online sexual exploitation at the national level. However, these forms of abuse are becoming more apparent and distinctive from other online sexual crimes (eg, online sexual solicitation and image-based abuse). Sexual extortion and online sexual exploitation specifically indicate monetary or non-monetary (eg, gifts) offers in exchange for sexual images, videos, or sexual acts and the use of threats to obtain money or engage children in sexual activities. Guidance released by The National Crime Agency's Child Exploitation and Online Protection Education team specifically focused on financially motivated sexual extortion.<sup>28</sup> This guidance details various characteristics of the abuse, including explicit blackmail and threat to extort money or more sexual materials. The growing research on sexual extortion supports the efforts to differentiate this form of violence from other online harms, highlighting its increasing occurrence.<sup>28,29</sup> Although sexual extortion could be categorised as a form of online sexual exploitation, we conceptualised online sexual extortion as a distinctive category of abuse that captures a commercial aspect of online crimes that include the provision of monetary or non-monetary resources to the victims; as informed by previous literature.<sup>1,22</sup>

There appears to be no significant difference between the experiences of girls and boys with respect to online sexual victimisation from representative surveys. This finding differs from previous studies, which have highlighted that girls might experience child sexual exploitation and abuse more than boys.<sup>30,31</sup> There are

several issues to consider when interpreting this finding. Many of the studies with data providing prevalence separately for boys and girls (nine of 11) come from a survey designed by the Disrupting Harm initiative,<sup>2</sup> which found that “girls and boys are experiencing online sexual exploitation and abuse in fairly equal proportions”.<sup>2</sup> It is possible that changes in the online environments have increased the victimisation rates for boys, or that our previous conceptualisations of sex differences in contact child sexual exploitation and abuse do not hold true for online environments. It is also possible that additional forms of violence that display sex differences are captured in OCSEA (eg, forms of bullying and online aggression) through questions about image exposure and non-consensual image taking. It is not yet clear whether the range of sex-based dynamics are being captured by the questionnaires in this new field of measurement; more studies are needed before we can conclusively say that sex rates are similar or different for online sexual exploitation and abuse compared with contact sexual exploitation and abuse, and why they might differ.

Our analyses suggest a high degree of heterogeneity in estimates provided, even when estimates were disaggregated by sex subtype of OCSEA, and world region. This generally high variability in meta-analysed estimates potentially limits the reliability and accuracy of the pooled estimates. This heterogeneity could be explained by the influence of different contexts, methodological features, and subtypes of OCSEA. Differences in child characteristics (eg, sex and age) might also have contributed to the variation, as well as inconsistency in definitions and measures used that limited our ability to compare studies. Studies in the field do not gather motives of behaviours towards victims (eg, to humiliate or hurt, or for sexual gratification), which could allow for grouping conceptually different behaviours together. Furthermore, large unaccounted heterogeneity and differing definitions of OCSEA might have affected the study findings in terms of overestimating or underestimating the prevalence. For example, using different descriptions of exposure to pornographic content as variables or using terms such as sexual harassment and grooming interchangeably could lead to misinterpretations.

This study has several limitations. The data used in this systematic review were predominantly drawn from data from various surveys, which reported estimates at the regional, national, or subnational level. Although the traditional survey methods appear to be the most common methods of prevalence estimation of OCSEA victimisation, they have limitations when attempting to measure the prevalence of so-called hidden victims (ie, individuals difficult to access). Child sexual exploitation and abuse is often reported retrospectively (ie, months or years after it occurred), therefore most survey research relies on recollection (and is thus prone to recall bias) and gives limited findings on the temporal pattern of OCSEA.

Retrospective reporting, combined with respondents' reluctance to disclose information, might lead to underestimating the prevalence rates. Similarly, meta-analysis approaches, particularly the widely used random-effects model, have some limitations (eg, sensitivity to small sample sizes, assumptions about normally distributed effects, challenges with heterogeneity estimation, and susceptibility to publication bias). Such weaknesses can result in imprecise effect size estimates and wider CIs.<sup>32</sup> As the field grows with more studies and a shift towards country-level estimates, alternative analytical approaches might become more suitable. Although the survey-based data can be considered as being at substantial risk of bias, we have used strict inclusion criteria to ensure that the studies considered met minimum standards for data collection and analysis.

Furthermore, prevalence estimates of image-based abuse using past-year recall were found to be higher than for lifetime exposure, which might be due to the type of respondents or the cohort effect. Studies assessing lifetime experiences of OCSEA included both youth and adult respondents, which could confound age with cohort effects, such as limited access to internet in childhood or different types of abuse experienced by earlier cohorts. New ways to account for cohort bias related to technology should be explored through methodological research.

A wide range of emerging technological modalities of abuse have been captured by the literature included in this systematic review and meta-analysis. Inconsistencies in the definitions and measures used constituted a challenge in terms of comparability and estimation of the overall OCSEA prevalence.

This systematic review did not report data on race or ethnicity as many included studies either omitted these characteristics (eg, due to local restrictions) or reported them only as demographic details. Additionally, the surveys did not disaggregate prevalence estimates by these characteristics. To prevent potential misinterpretation, we chose not to include them.

Finally, this study did not involve people with lived experiences of OCSEA, whose contribution could greatly benefit the quality, relevance, and impact of this study.

Despite these limitations, this review provides a comprehensive synthesis of various available quantitative data sources, identified from extensive searches across several academic databases and grey literature repositories. The searches were not restricted to the English language, which mitigated language bias and allowed the identification of additional records to extend the analysis on the global prevalence of OCSEA beyond North America and Europe presented in the previous meta-analysis.<sup>19</sup> Although potential bias cannot be completely prevented, it can be minimised by using meta-analytic methods to examine independent studies for the purpose of integrating their findings. Nevertheless, prevalence data on OCSEA victimisation



presented in this research should be interpreted in the context of these limitations.

Actionable insights and recommendations can be made for future research, policy, and practice. For research, more work needs to be done in this area of measurement, including testing survey instruments, developing standardised instruments, establishing minimum standards for reporting prevalence estimates, understanding reporting behavioural patterns, and developing ways to ethically implement surveys in jurisdictions with very different child protection systems. Additionally, it is crucial to ensure that studies have a common definition of OCSEA and temporal patterns and disaggregation of data on age and identity of the perpetrator to improve consistency and comparability across research findings.

These data highlight that OCSEA is prevalent in every country where it is measured—pointing to the need for increased legislation and primary prevention efforts to keep children safe. The findings also point to the range of ways in which OCSEA can occur, with specific implications for improving safety by design and regulation of online environments to ensure they are safe for children.

The data also point to opportunities for preventative approaches, including education on OCSEA to better inform children, young people, parents, carers, and teachers. To target prevention effectively, greater consensus should be attained about the definitions of online behaviours that constitute sexual offending, which, in turn, will enhance data quality and comparability across studies and regions. Finally, we call for more detailed research and a synthesis of data, with the focus on age and identity of perpetrators to further inform policy and practice.

#### Contributors

DF, XF, and JR conceptualised, designed, and oversaw the systematic review. XF, AK, JR, and ML contributed to the process of screening, data extraction, and methodological assessment. DF, XF, and AK supported both the design and running of the statistical analysis. AK conducted the meta-analyses. DF is the lead author and guarantor. AK provided the first draft of the manuscript, including tables and figures, data interpretation, and writing. DF, XF, AK, and NA have accessed and verified data. All authors had complete access to all the data in this article, approved the final manuscript, and share final responsibility to submit for publication. For the names and contributions of the Into the Light Index Study Group, see the appendix (p 51).

#### Declaration of interests

We declare no competing interests.

#### Data sharing

This meta-analysis did not require the collection of new data, but rather the analysis of previously published data. Details of our meta-analysis process are available on request to the corresponding author.

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