Condomless sex in Internet-based sex work: systematic review and meta-analysis

Sexo sem preservativo no trabalho sexual baseado na Internet: revisão sistemática e meta-análise

Sexo sin condón en el trabajo sexual basado en Internet: revisión sistemática y metanálisis

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Abstract

Objective: Meta-analyze the proportion of condomless sex traded on the Internet according to the offer on websites advertising sex work and demand in customer forums; and to examine the relationship between condomless sex and the type of sex, target-group, gender and actors involved. Methodology: Data was collected from PubMed, Scielo, Google Scholar and ScienceDirect from the inception of each database to 06 March 2020, in English, Spanish and Portuguese. The effect size was the proportion itself, and the dispersion was measured under 95% confidence intervals. Results: From 2041 articles, 16 studies met the inclusion criteria of the systematic review with 10,190 recruited individuals and 20,363 prostitution advertisements. The estimate of condomless sex trade was 0.25 (95%CI=0.17–0.34). The heterosexual-oral subgroup (0.35; 95%CI=0.18–0.52; p<0.001) and the clients (0.31; 95%CI=0.20–0.59; p=0.037) showed a significant increase in the proportion. Conclusion: The condomless sex trade was reported in one quarter of the population. Heterosexuals who practice oral sex and clients are the main predictors of condomless sex in the Internet-based sex work.

Keywords: Condom Use; Internet; Social Media; Sexual Behavior; Sex Work.

Resumo

Objetivo: Meta-analisar a proporção de sexo sem preservativo negociado na Internet de acordo com a oferta em sites que anunciam trabalho sexual e a demanda em fóruns de clientes; e examinar a relação entre sexo sem preservativo e o tipo de sexo, grupo-alvo, gênero e atores envolvidos. Metodologia: Os dados foram coletados no PubMed, Scielo, Google Scholar e ScienceDirect desde o início de cada banco de dados até 06 de março de 2020, em inglês, espanhol e português. O tamanho do efeito foi a própria proporção, e a dispersão foi medida em intervalos de confiança de 95%. Resultados: De 2.041 artigos, 16 estudos atenderam aos critérios de inclusão da revisão sistemática com 10.190 indivíduos recrutados e 20.363 anúncios de prostituição. A estimativa do comércio sexual sem preservativo foi de 0,25 (IC de 95% = 0,17–0,34). O subgrupo heterossexual-oral (0,35; IC95% = 0,18–0,52; p <0,001) e os clientes (0,31; IC95% = 0,20–0,59; p = 0,037) apresentaram aumento significativo na proporção. Conclusão: O comércio de sexo sem preservativo foi relatado em um quarto da população. Heterossexuais que praticam sexo oral e clientes são os principais preditores de sexo sem preservativo no trabalho sexual pela Internet.

Palavras-chave: Uso de preservativo; Internet; Mídia social; Comportamento sexual; Trabalho sexual.

Resumen

Objetivo: Meta analizar la proporción de sexo sin condón que se comercializa en Internet de acuerdo con la oferta en sitios web que publicitan el trabajo sexual y la demanda en foros de clientes; y examinar la relación entre el sexo sin condón y el tipo de sexo, grupo objetivo, género y actores involucrados. Metodología: Los datos se obtuvieron de PubMed, Scielo, Google Scholar y ScienceDirect desde el inicio de cada base de datos hasta el 6 de marzo de 2020, en inglés, español y portugués. El tamaño del efecto fue la proporción en sí y la dispersión se midió en intervalos de confianza del 95%. Resultados: De 2041 artículos, 16 estudios cumplieron los criterios de inclusión de la revisión sistemática con 10.190 personas reclutadas y 20.363 anuncios de prostitución. La estimación del comercio sexual sin condón fue de 0,25 (IC del 95% = 0,17–0,34). El subgrupo heterosexual-oral (0,35; IC del 95% = 0,18–0,52; p <0,001) y los clientes (0,31; IC del 95% = 0,20–0,59; p = 0,037) mostraron un aumento significativo en la proporción. Conclusión: El comercio sexual sin condón se informó en una cuarta parte de la población. Los heterosexuales que practican sexo oral y los clientes son los principales predictores del sexo sin condón en el trabajo sexual basado en Internet.

Palabras clave: Uso de condón; Internet; Medios de comunicación social; Comportamiento sexual; Trabajo sexual.

1. Introduction

Digital communication has had a profound impact on the way individuals organize their lives, conduct relationships, and carry out business transactions. Sex work is part of this digital society and sex is increasingly commercialized on websites (Sanders et al., 2016). However, the online trade can have a detrimental economic effect on sex work, as there is greater competition and a wage penalty for condom use (Adriaenssens & Hendrickx, 2012; Sanders et al., 2017; DeAngelo et al., 2019). Recent research has reported the condomless sex trade advertised on the internet (Blackwell & Dziegielewski, 2013; Kille et al., 2017; Mimiaga et al., 2009) and the active role of clients in demand (Parsons et al., 2001; Vartabedian, 2017).

Risks related to sex work tend to affect more people than those directly involved in interactions. The sex trade remains an important contributor to the transmission of HIV and other sexually transmitted infections (STI) in early, advanced and regressive epidemics (Shannon et al., 2014, 2018), but its social and behavioral factors remain poorly understood, limiting the impact of STI prevention initiatives.

Systematic reviews and meta-analyses in the context of sex work focus on the HIV index (Baral et al., 2012; Oldenburg et al., 2015; Operario et al., 2008; Malta et al., 2010; Paz-Bailey et al., 2016) or evaluation/characterization of strategies for HIV prevention and minimization of risk behaviors (Chow et al., 2015a; Footer et al., 2016; Herbst et al., 2007; Okafor et al., 2017; Shushtari et al., 2018).

Six systematic review studies have characterized the behavioral factors of this population group, two in Asia (Chow et al., 2015b; Tan & Melendez-Torres, 2016), two in Africa (Scorgie et al., 2012), one in Europe (Platt et al., 2013), and a global review with meta-analysis on the proportion of female sex workers who had anal sex (Owen et al., 2020). As far as we could investigate in academic search systems containing database of life sciences (such as PubMed, Google Scholar and Science Direct), no meta-analyses were found that specifically addressed the sexual trade Internet-based, or used all genders and actors involved in the sex trade.

Thus, in order to fill this knowledge gap, the aim of this paper is twofold: (1) Meta-analyze the proportion of condomless sex traded on the Internet according to the offer on

websites advertising sex work and demand in customer forums; (2) to examine the relationship between the condomless sex and the type of sex (anal, vaginal, oral), target audience (heterosexual, homosexual), gender (woman, man, transsexual) and actors involved (clients, sex workers).

2. Methods

Both the systematic review and meta-analysis were guided through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). The meta-analysis study combines information from several studies to obtain an average estimate (Nyaga, Arbyn, & Aerts, 2014). Since this study was a review of published studies, ethical approval was not required.

2.1 Search Strategy and Selection Criteria

This review triangulates information and data obtained from searching peer-reviewed reports published in English, Spanish and Portuguese in key databases: PubMed (MEDLINE), ScienceDirect, SciELO, and Google Scholar. A multilingual combination of terms related to sex work, condom use, Internet and commercials was used to identify the studies (Table 1). The following search terms were used in combination and connected with "AND".

Table 1. Search strategy used in the systematic review.

Sex work terms	("sex work" OR "sex worker" OR "prostitution" OR "sex industry" OR "escort" OR "gay for pay")
Condom use-related terms	("condom use" OR "non-condom use" OR "condom non-use" OR "unprotected sex" OR "unsafe sex" OR "condom refusal" OR "condom negotiation", "condom utilization")
Internet-based terms	("internet" OR "internet-based" OR "internet-using" OR "internet sample" OR "internet-active" OR "online" OR "online platforms" OR "forums" OR "virtual" OR "digital" OR "technology" OR "cyber")
Commercial terms	("commercial" OR "trade" OR "market" OR "advertisement" OR "announcement" OR "client" OR "sex purchasers" OR "customer")

Note: Search strategies in Spanish and Portuguese are available from the corresponding author. Source: Authors.

We included quantitative studies that examined communications published in ads for sex workers and customer forums; and studies that used these sex trade cyberspaces as a

means of recruiting for interviews. Non-primary research (e.g., commentaries), studies without full-text sources available (e.g., abstracts), duplicate articles; qualitative studies; articles that did not report original research or analysis and studies in which condom use were not analyzed as outcomes were excluded. The search was supplemented with additional sources, including qualitative/ethnographic peer-reviewed research where quantitative evidence was limited.

Two reviewers (TSP and MAA-S) screened the identified titles/abstracts for possible inclusion, and disagreements were resolved by discussion. In the next step, the researchers independently assessed the full text of potentially eligible studies. The authors minimized publication bias across studies by including additional articles, after scanning reference lists of previously included articles.

2.2 Study Quality Assessment

We assessed methodologic quality using a modified version of the Newcastle-Ottawa Quality Assessment Scale (Wass et al., 2019) for cross-sectional, appraising the following characteristics: 1) the first section assesses the methodological quality of each study and weighs a maximum of five stars; 2) the second section considers comparability of the study and takes 2 stars; and 3) the remaining section assess outcomes with related statistical analysis. The mean score of two authors were taken for final decision.

2.3 Screening and Data Extraction

The search strategy above was completed on Mar. 06, 2020. TSP and MAA-S did initial screening and TSP extracted relevant data and information from each study (i.e., country, study design, population, condom use outcomes) and relevant reports.

2.4 Meta-analysis

We applied a meta-analysis of proportions with the following specifications. The effect size was the proportion itself, and the dispersion was measured under exact 95% confidence intervals. The estimations were calculated by study, by group and overall. In order to stabilize the variances between studies, we calculated the pooled estimates after Freeman-Tukey Double Arcsine transformation. Under the assumption that the effect size shall vary

from study to study due to different study designs, target population and type of sexual activity, we selected a random effects model with the method of DerSimonian and Laird. Weights were applied according to the sample size of each study.

The results were presented in a forest plot. Heterogeneity between and within studies was calculated under inverse-variance. We estimated p values for heterogeneity between groups and the I-squared statistics as a measure of the overall fraction of heterogeneity. The precision of estimates for each study was evaluated by bubble plots. Publication bias was investigated with funnel plots. The Egger's test was used to quantify small study effects.

Heterogeneity between studies was further investigated and adjusted by a meta-regression approach, and p values were adjusted by using Monte Carlo simulation with 10000 random permutations. After that, we obtained the tau-squared statistics to estimate between-study variance, and the adjusted R-squared so as to select the best-fit model. We applied the statistical software components "metaprop" (S457781) and "metapreg" (S458693).

A Bayesian approach was used as a sensitivity analysis. We compared the predicted proportion and 95% confidence intervals of the meta-regression with the posterior mean value and 95% credible intervals under the Metropolis-Hastings algorithm as well as Gibbs sampling. All estimations were performed in Stata (College Station, Texas, USA), version 15.1

3. Results

3.1 Eligible studies

According to the search strategy, 2041 records were identified. After the titles and abstracts were screened, 1998 were rejected due to the reasons listed in Figure 1. After careful full-text screening, 16 articles proved eligible for inclusion in this review.

Figure 1. Flowchart for selection of articles.
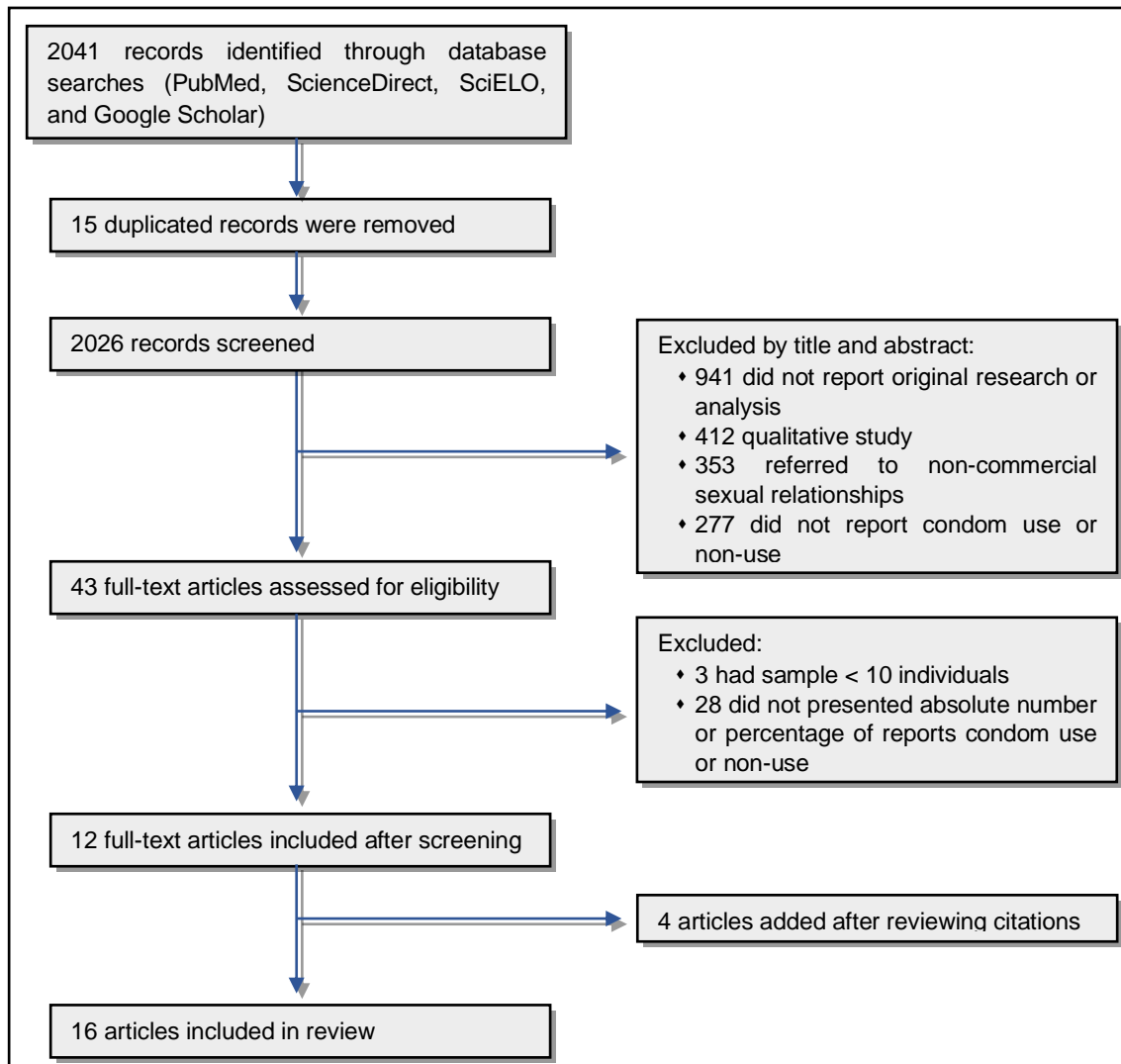
Source: Authors.

3.2 Study Quality Assessment

Table 2 shows the quality indexes of the studies, assessing the risk of bias. Seven studies were of good quality, three were satisfactory and six were of unsatisfactory quality. The loss of quality of studies, in general, is due to convenience sampling, non-recruitment and lack of multivariate analysis.

Table 2. Risk of bias assessment for cross-sectional studies – Newcastle-Ottawa Scale (adaptation).

Study	Selection				Comparability based on design and analysis	Outcome		Score (range, 0-10)
	Sample representativeness	Sample size calculation	Non-response rate	Exposure assessment		Assessment of outcome	Statistical test	
Bond et al., 2019			*	**	**	*	*	7 (Good)
Peyró-Outeiriño et al., 2018				**	*	*		4 (Unsatisfactory)
Kille et al., 2017				**	*	*		4 (Unsatisfactory)
Milrod & Monto, 2016			*	**	**	*	*	7 (Good)
Grov et al., 2015			*	**	**	*	*	7 (Good)
Grov et al., 2014			*	**	**	*	*	7 (Good)
Grov et al., 2013			*	**	**	*	*	7 (Good)
Blackwell & Dziegielewski, 2013				**	**	*	*	6 (Satisfactory)
Adriaenssens & Hendrickx, 2012				**	**	*	*	6 (Satisfactory)
Milrod & Monto, 2012			*	**	*	*		5 (Satisfactory)
Cunningham & Kendall, 2011			*	**	**	*	*	7 (Good)
Cunningham & Kendall, 2010			*	**	**	*	*	7 (Good)
Ashford, 2009				**		*		3 (Unsatisfactory)
Bimbi & Parsons, 2005				**	*	*		4 (Unsatisfactory)
Pruitt, 2005				**		*		3 (Unsatisfactory)
Parsons, Koken & Bimbi, 2004				**		*		3 (Unsatisfactory)

Source: Authors.

3.3 Systematic Review

These studies enrolled 10,190 recruited individuals, among them, 8,037 sex workers (5,010 women and 3,027 men) and 2,153 clients (all men). Studies that did not recruit participants involved 20,363 sex work advertisements (announced by 20,170 women, 187 men, and 6 trans sex workers) published on websites. All the studies presented sampling by accessibility or by convenience. The majority (12/16) of the included studies originated from USA. Since some studies worked with different samples (Bimbi & Parsons, 2005; Bond et al., 2019; Parsons et al., 2004; Peyró-Outeiriño et al., 2018), genders (Kille et al., 2017), countries (Adriaenssens & Hendrickx, 2012), or type of sex (Adriaenssens & Hendrickx, 2012; Bimbi & Parsons, 2005; Cunningham & Kendall, 2011, 2010; Milrod & Monto, 2012, 2016), for a better analysis of the specifics, we divided the studies into sub-groups. Study characteristics are described in Table 3.

**Table 3.** Study characteristics and details of the references.

Year	Authors	Journal	Legend of studies Subgroups	Country	Sample	Gender	Target group	Recruited	Type of sex
2019	Bond et al.	Sexuality Research and Social Policy	Bond, 2019 (a)	USA	368 sex workers	men	homosexual	yes	anal
			Bond, 2019 (b)	USA	404 clients	men	homosexual	yes	anal
2018	Peyró-Outeiriño et al.	Comunitania	Peyró-Outeiriño, 2018 (a)	Spain	73 sex workers	women	heterosexual	no	oral
			Peyró-Outeiriño, 2018 (b)	Spain	257 advertisements	women	heterosexual	no	oral
2017	Kille *et al*.	Journal of Medical Internet Research	Kille, 2017 (a)	Canada	45 advertisements	women	heterosexual	no	oral
			Kille, 2017 (b)	Canada	24 advertisements	men	heterosexual	no	oral
			Kille, 2017 (c)	Canada	6 advertisements	trans	heterosexual	no	oral
2016	Milrod & Monto	Archives of Sexual Behavior	Milrod, 2016 (a)	USA	584 clients	men	heterosexual	yes	oral
			Milrod, 2016 (b)	USA	584 clients	men	heterosexual	yes	vaginal
2015	Grov et al.	Culture, Health & Sexuality	Grov, 2015	USA	359 sex workers	men	homosexual	yes	anal
2014	Grov et al.	Sexuality Research and Social Policy	Grov, 2014	USA	418 sex workers	men	homosexual	yes	anal
2013	Grov et al.	Journal of Sex Research	Grov, 2013	USA	495 clients	men	homosexual	yes	anal
2013	Blackwell & Dziegielewski	Journal of Social Service Research	Blackwell, 2013	USA	163 advertisements	men	homosexual	yes	anal
2012	Adriaenssens & Hendrickx	Sociology of Health & Illness	Adriaenssens, 2012 (a)	Belgium	4092 advertisements	women	heterosexual	yes	vaginal
			Adriaenssens, 2012 (b)	Belgium	302 advertisements	women	heterosexual	yes	anal
			Adriaenssens, 2012 (c)	Belgium	4066 advertisements	women	heterosexual	yes	oral
			Adriaenssens, 2012 (d)	The Netherlands	15439 advertisements	women	heterosexual	yes	vaginal
			Adriaenssens, 2012 (e)	The Netherlands	990 advertisements	women	heterosexual	no	anal
			Adriaenssens, 2012 (f)	The Netherlands	15776 advertisements	women	heterosexual	no	oral
2012	Milrod & Monto	Deviant Behavior	Milrod, 2012 (a)	USA	576 clients	men	heterosexual	yes	vaginal
			Milrod, 2012 (b)	USA	576 clients	men	heterosexual	yes	oral
2011	Cunningham & Kendall	Sexually Transmitted Infections	Cunningham, 2011 (a)	USA	2432 sex work	women	heterosexual	yes	vaginal
			Cunningham, 2011 (b)	USA	2457 sex work	women	heterosexual	yes	anal
			Cunningham, 2011 (c)	USA	2401 sex work	women	heterosexual	yes	oral
2010	Cunningham & Kendall	Journal of Urban Economics	Cunningham, 2010 (a)	USA	2457 sex work	women	heterosexual	yes	vaginal
			Cunningham, 2010 (b)	USA	2480 sex work	women	heterosexual	yes	anal
			Cunningham, 2010 (c)	USA	2427 sex work	women	heterosexual	yes	oral
2009	Ashford	The Journal of Criminal Law	Ashford, 2009	UK	526 sex work	men	homosexual	yes	anal
2005	Bimbi & Parsons	Journal of Gay & Lesbian Psychotherapy	Bimbi, 2005 (a)	USA	48 sex work	men	homosexual	yes	oral
			Bimbi, 2005 (b)	USA	48 sex work	men	homosexual	yes	anal
			Bimbi, 2005 (c)	USA	48 clients	men	homosexual	yes	anal
2005	Pruitt	Sociological Focus	Pruitt, 2005	USA	1262 sex work	men	homosexual	no	anal
2004	Parsons et al.	AIDS Care	Parsons, 2004 (a)	USA	46 sex work	men	homosexual	yes	anal
			Parsons, 2004 (b)	USA	46 clients	men	homosexual	yes	anal

Source: Authors.

3.4 Meta-analysis

The condomless sex trade estimates varied substantially between studies. In general, 0.25 (95% CI 0.17 – 0.34) of the sample involved in the Internet-based sex trade reported condomless sex (Figure 2). Therefore, we created five categories: heterosexual-anal, heterosexual-vaginal, heterosexual-oral, homosexual-anal and homosexual-oral.

Figure 2. Forest plot of data for proportion of condomless sex in the Internet-based trade by target group and type of sex.
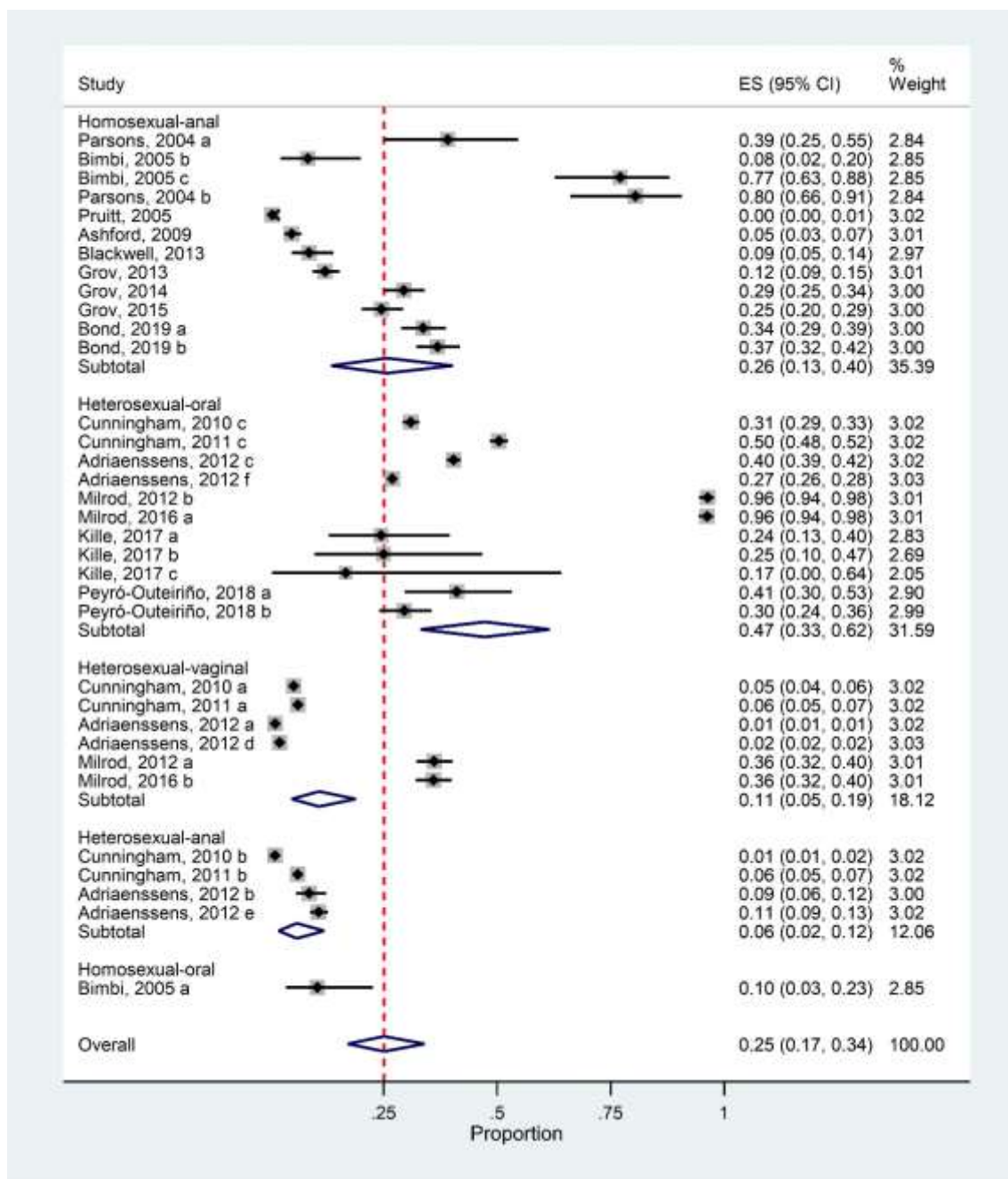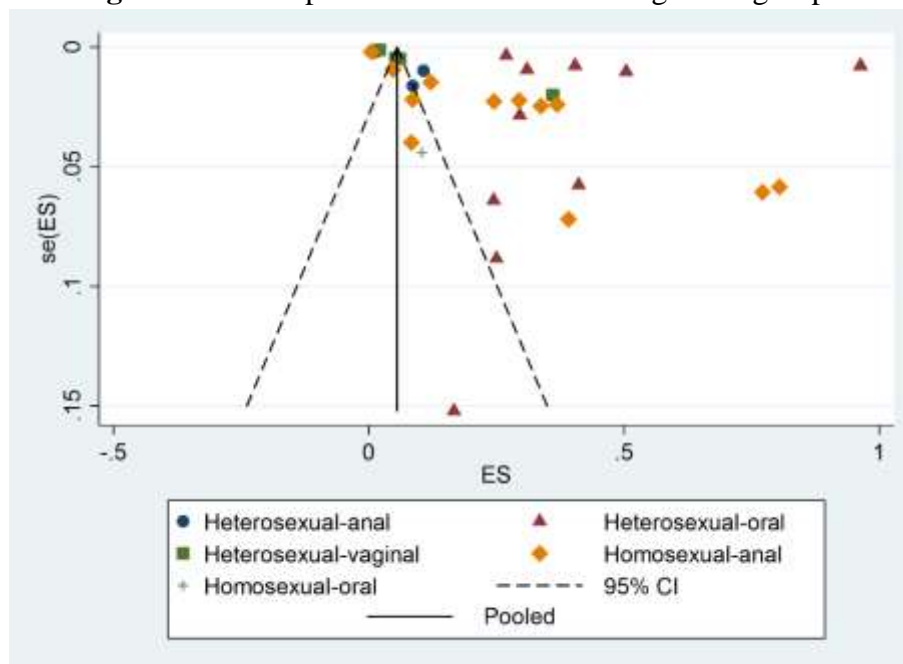

Source: Authors.

Studies that provide data among the subset of heterosexual individuals who practice oral sex had the highest joint estimate (0.47; 95% CI 0.33 – 0.62), followed by homosexual-anal (0.23; 95% CI 0.05, 13 – 0.40) and heterosexual-vaginal (0.11; 95% CI 0.05 – 0.19) (Figure 2).

A high level of heterogeneity was observed (I-squared over 95%, $p < 0.001$). In order to provide an introductory exploration of the heterogeneity between studies, we performed funnel plots as well as the Egger's test (Figure 3). The funnel plots and the Egger's test point to asymmetry amongst studies, which can be due not only to publication bias, but also irregularities concerning the collection of data in each study or heterogeneity by itself. In fact, a considerable level of heterogeneity shall be foreseen due to differences in sexual behavior (as well as in reporting sexual behavior) amongst countries, target groups and types of sexual intercourse.

Figure 3. Funnel plot of the studies according to subgroups.

Note: Egger's test for small study effects: p value = 0.004
Source: Authors.

Due to the heterogeneity, we proceeded with a meta-regression for the effect size according to the combined variable which included the target group (homosexual, heterosexual) and the type of sex (anal, oral and vaginal). We also added two variables as predictors: the first, indicating whether the individuals were recruited or not. The second, concerning the stratum where each sample came from: advertisement, clients, sex workers (Table 4).

Table 4. Meta-regression for the effect size under Frequentist and Bayesian analyses with predictive margins, mean values and coefficients.

Effect size	Proportion – univariate model (combined group: sex and target)								Proportion – multivariate model (+ type of sample and recruitment strategies)						
	Frequentist analysis						Bayesian analysis		Frequentist analysis					Bayesian analysis	
	Coef.	95% CI	p *	p †	Margin	95% CI	Mean	95% CRI	Coef.	95% CI	p	Margin	95% CI	Mean	95% CRI
Target group – type of sex															
Heterosexual-anal	(reference)				0.07	-0.17 – 0.30	0.07	-0.19 – 0.30	(reference)			0.15	0.01 – 0.29	(reference)	
Heterosexual-oral	0.38	0,09 – 0.66	0.011	0.004	0.45	0.30 – 0.59	0.43	0.29 – 0.58	0.35	0.18 – 0.52	<0.001	0.50	0.30 – 0.59	0.33	0.21 – 0.43
Heterosexual-vaginal	0.78	- 0.23 – 0.39	0.615	0.902	0.14	-0.05 – 0.33	0.15	-0.05 – 0.34	-0.05	-0.23 – 0.14	0.614	0.11	-0.05 – 0.33	-0.06	-0.21 – 0.10
Homosexual-anal	0.22	- 0.06 – 0.51	0.112	0.224	0.29	0.16 – 0.43	0.30	0.14 – 0.43	0.06	-0.11 – 0.24	0.472	0.21	0.16 – 0.43	0.08	-0.06 – 0.22
Homosexual-oral	0.04	- 0.05 – 0.59	0.888	0.999	0.10	-0.36 – 0.57	0.11	-0.39 – 0.58	-0.01	-0.43 – 0.42	0.982	0.15	-0.36 – 0.57	-0.01	-0.36 – 0.32
Sample															
Advertisement									(reference)			0.22	0.05 – 0.39	(reference)	
Client									0.31	0.20 – 0.59	0.037	0.53	0.39 – 0.67	0.37	0.08 – 0.67
Sex work									-0.03	- 0.28 – 0.22	0.793	0.19	0.09 – 0.28	0.01	-0.24 – 0.26
Recruit															
No									(reference)			0.20	0.05 – 0.35	(reference)	
Yes									0.12	-0.12 – 0.36	0.297	0.33	0.23 – 0.43	0.11	-014 – 0.35

Note: * Unadjusted; † Adjusted by using Monte Carlo simulation with 10000 random permutations
Source: Authors.

In the first model (Table 3), without the two additional predictors, the tau-squared = 0.056 estimated the between-study variance and the R-squared = 19% reflected the proportion of between-study variance explained by the model. Compared to the heterosexual-anal category, only the heterosexual-oral category presented a significant increase in the proportion of condomless sexual intercourse trade (p = 0.011). In order to evaluate the robustness of the results, we repeated the meta-regression, this time under a Monte Carlo random permutation (10000 times) and the adjusted p-value for the same comparison was still significant (p = 0.004).

Under a meta-regression analysis, we calculated the predicted proportions (with 95% CIs) for condomless sexual trade according to the combined categories. The highest predicted values for condomless sexual trade occurred amongst heterosexual individuals under oral sex and homosexual individuals under anal intercourse (Table 3).

We proceeded with the extended meta-regression, having included two additional predictors (Table 4). The between-study variance (tau squared) decreased to 0.017 and the R-squared (proportion of between-study variance explained) increased to 73.43%. Compared to the heterosexual-anal subgroup, only the heterosexual-oral subgroup presented a significant increase in the proportion of condomless sex trade (p < 0.001). Also, compared to the sample (Figure 4) collected from advertisements, the sample collected from clients presented a significant increase in the proportion of condomless sex trade (p = 0.037). Being or not recruited to the study did not present significant influence the results (p = 0.297).

Figure 4. Meta-regression for the proportion (with 95% confidence intervals) of condomless sex trade according to the combined group (target and type of sex) and the type of the sample.
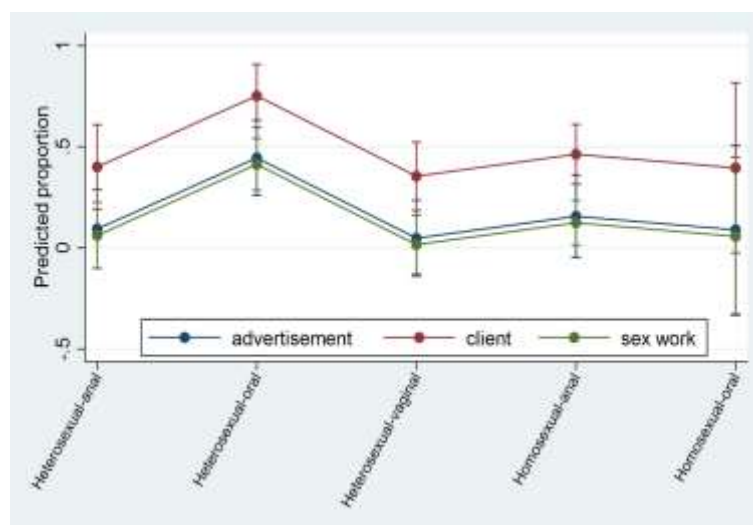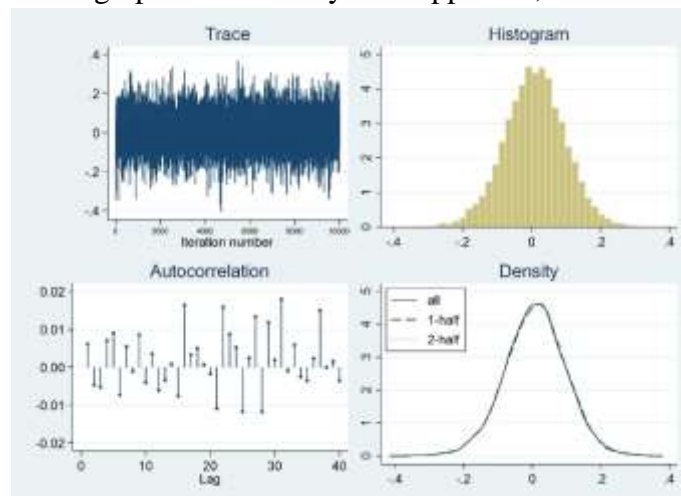

Source: Authors.

As a sensitivity analysis, we performed a Bayesian meta-analysis of several models with the following specifications: random-walk Metropolis-Hastings sampling algorithm and Gibbs sampling; size of Markov Chains Monte Carlo = 10000, burn-in period = 2500, normal prior (0, 10) for the proportion and inverse gamma (0.01, 0.01) for the standard errors.

The posterior value of the overall proportion was 0.27 and the 95% credible intervals were 0.18 – 0.36. We also estimated the posterior values (plus de 95% credible intervals according to the target group and type of sex. The proportions for each group were like the frequentist analysis (0.07, 0.43, 0.15, 0.30 and 0.11, respectively). Both models presented an acceptance rate over 0.43, a mean efficiency around 0.20, and the postestimation diagnostics displayed appropriate convergence and lack of significant autocorrelation. Using a Gibbs sampling improved the mean efficiency to 0.92 but reached the same values for the posterior estimations (Table 3).

Finally, we provided a Bayesian multivariate model with the combined group adjusted by the sample strata (advertisement, clients and sex work) and according to the presence or absence of recruitment. Again, when compared to the heterosexual-anal group, the heterosexual-oral group presented an increase in the mean proportion of condomless sex trade. Also, when compared to the advertisement strata, the clients presented an increase in the proportion, whereas the sex workers presented similar levels (Table 3). The postestimation diagnostics presented graphics with a satisfactory display concerning convergence of trace plots, normally distributed histograms, well-split kernel plots and lack of significant autocorrelation (Figure 5).

Figure 5. Postestimation graphics of the Bayesian approach, with convergence diagnostics.

Source: Authors.

4. Discussion

To our knowledge, this is the first systematic review of the literature with meta-regression on sexual behavior associated with individuals involved in commercialized and/or advertised sex on the internet. For greater robustness of the study, we included Bayesian methods in the analysis. Evidence suggests that sex workers and clients practice safer sex most of the time.

About 25% of the people reported the condomless sex trade. Studies on the use of the Internet to facilitate informal sexual practices have recently been associated with an increased rate of syphilis infection among homosexual and bisexual men in the United States and the United Kingdom (Ashton et al., 2003; Klausner et al. 2000). As well as, the active role of clients in the search for condomless sex trade on the internet (Parsons et al., 2001).

In the meta-regression analysis with the subgroups related to the target group and type of sex, the highest values of predicted proportion occurred amongst heterosexual individuals under oral sex and homosexual individuals under anal intercourse. In the extended analysis (with the frequentist as well as with the Bayesian approach), when compared to the heterosexual-anal subgroup, only the heterosexual-oral subgroup showed a significant increase in the proportion of sexual activity without a condom.

Although condomless oral sex is less infectious compared to condomless vaginal or anal sex, it can transmit several serious infections, including chlamydia, gonorrhea, genital herpes and even syphilis. In addition, Hawkins (2001) reports that condomless oral sex poses a risk for HIV transmission. Due to the frequency with which oral sex has been unsafely practiced and given the fact that those most at risk of contracting HIV generally tend to rely on protection when practicing anal or vaginal sex, we can speculate that this negligence may contribute to increase in the incidence of new HIV infections.

A study conducted on the PunterNet.com website, from 1999 to 2009, revealed a steady increase in the incidence of condomless oral sex during that period, going from <20% to more than 50% of all transactions (Muravyev & Talavera, 2018). There is an underestimation of the risk involved in condomless oral sex, especially among heterosexual partners, a behavior that has already been reported in other studies related (Earle & Sharp, 2016; Monto, 2001; Read et al., 2012; Wallace et al., 1997) or unrelated (Brondani et al., 2019; Gerbert et al., 1997; Halpern-Felsher et al., 2005) to commercialized sex.

Sex workers are commonly engaged in sex without a condom to increase their earnings (Adriaenssens & Hendrickx, 2012; Arunachalam & Shah, 2013; DeAngelo et al.,

2019). The insertion of a financial prize in sex without a condom is driven by customer demand (Chapman et al., 2008; Huang et al., 2015; Mamabolo, 2017). In the extended meta-regression model, it was possible to highlight the role of clients in demand for sex without a condom. If customers value sex without a condom, trade forces (premium prices) will result in sex workers offering sex without a condom in order to maximize their earning potential (George et al., 2019).

4.1 Limitations

Our analysis is based on data collected from the Internet that can potentially represent or under-represent different trade segments (for example, street sex work versus brothels).

In addition, with regard to the quality of the articles selected, only 2/3 of the studies were assessed as satisfactory or with good quality, and this was mainly due to the enrollment strategy, which was a convenience sampling in the majority of studies. However, this is a typical problem in studies of hidden populations, such as sex workers, for which random sampling is virtually impossible (Heckathorn, 1997).

4.2 Social policy implications

The theme addressed in this study is an important public health concern, given the high global prevalence of HIV and other STIs among sex workers (Shannon, 2014, 2018). To deal with these indices, there were many campaigns and interventions (Bisschop et al., 2015; Cunningham & Shah, 2018; Immordino & Russo, 2015). However, there is still little systematic evidence of its effectiveness (Footer et al., 2016). The failure of these campaigns and interventions to enhance the use of condoms in commercial relationships can be due to several reasons, including the fact that they are not reaching the main group or because they are based on an incomplete understanding of how infections are transmitted.

The findings of this meta-analysis underline the understanding that education about safe sexual practices should be directed not only at the group that offers commercial sex, but also at those who consume it. In addition, the evidence shows us that the risks involved in all types of sexual intercourse, regardless of sexual orientation, must be reinforced.

5. Conclusion

Condomless sex trade was reported in a quarter of the population. Evidence suggests that heterosexual individuals who practice oral sex and clients are the main predictors of condomless sex trade on the Internet-based. It is believed that as the Internet continues to grow, more sex workers are likely to advertise services via the Internet.

These findings indicate a need for effective public health campaign and sexual education about all the risks involved in any condomless sex trade. Future health promotion strategies may consider current codes and client's preferences for approaches related to the reality of sex workers. Public health initiatives must reflect and incorporate this knowledge.

To further clarify the proportion of sex trade without a condom in Internet-based sex work, there is a need for high-quality studies conducted in different regions of the world and among individuals of different cultures, gender and sexual orientation.

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