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Vélez-Gómez et al.

Prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in the homeless population of Medellín, Colombia: a cross-sectional study.

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Abstract

Background: Around the world, the prevalence of infections caused by *Chlamydia trachomatis (CT)* and *Neisseria gonorrhoeae (NG)* has been reported for the general population. However, there is little information on risk factors or the rates of infection in vulnerable populations, such as homeless individuals. Therefore, this study aimed to determine the prevalence of CT and NG in the homeless population in the city of Medellín, Colombia, using molecular diagnostic methods. It also intended to develop a demographic profile exploring associated factors and the dynamics of the social and sexual interactions of these people.

Methods: A sample of 500 homeless participants between 15 and 88 years of age was characterized in Medellín, Colombia. Urine samples were collected and analyzed for *C. trachomatis* or N. *gonorrhoeae* using qPCR detection to perform a cross-sectional study. Also, a p value <0.05 was considered statistically significant.

Results: The prevalence of CT infection was 19.2%, while that of NG was 22.6%. Furthermore, being a female was significantly correlated to CT infection p<0.05 (AOR 2.42, 95% CI: 1.31 - 4.47), whereas factors such as: sexual intercourse while having an STI p<0.05 (AOR 3.19, 95% CI: 1.48 - 6.85), having more than 11 sexual partners in the last 6 months p=0.04 (AOR 2.91, 95% CI: 1.04 - 8.09) and having daily intercourse p=0.05 (AOR 3.15, 95% CI: 1.02 - 9.74), were significantly associated with NG infection.

Conclusions: The prevalence of CT and NG was higher than that reported in the general population. Additionally, females had a higher percentage of infection compared to males.

Key words: Homeless Persons, Epidemiology, Molecular diagnostics, Public health, Infectious diseases, *Chlamydia trachomatis*, *Neisseria gonorrhoeae*.

Strengths and limitations of this study

- This research uses molecular techniques (qPCR) to evaluate urine samples to establish the prevalence of CT and NG in homeless populations of Medellín, Colombia.

- Risk factors associated with infection from CT and NG bacteria were established, and a demographic profile was developed with dynamics of social and sexual interaction.

- Samples and data collection were carried out in the institutions that provide care for the homeless population of Medellín by the mayor's office.

- This is the first study that has used a sample of 500 homeless individuals in order to determine the prevalence of NG and CT in Colombia.

- Every piece of data regarding sociodemographic profiles and sexual behaviors was collected through a primary source.

Introduction

Sexually Transmitted Infections (STIs) have proven to be a global public health problem, as they are one of the most common acute conditions that affect populations around the world. Moreover, they are known to afflict people of any socio-economic level, age, and sex who have had contact with an infected person's fluids via unprotected intercourse, blood transfusions or vertical transmission [1].

Furthermore, there are more than 30 infections that can be transmitted sexually: chlamydia, gonorrhea, trichomoniasis and syphilis being the four most common and curable. It is also estimated that around 376 million people contract one of these diseases annually that, if not diagnosed or treated in time, generate an economic burden both on an individual level and on health systems worldwide [2].

In that matter, *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) are the second and third causes of STIs in the world, respectively. CT is asymptomatic in 70% of women and 50% of men, and it is responsible in many cases for pelvic inflammatory disease (PID), ectopic pregnancy, endometritis, and infertility. NG infection is highly symptomatic in men, causing dysuria and purulent discharge, epididymitis, prostatitis, and infertility. Currently, there is an epidemiological alert due to the increase in antibiotic resistance of this microorganism [2].

Moreover, STIs caused by CT and NG have proven to be a serious public health problem. The most reported STI in Colombia is CT, with a prevalence of 2% in asymptomatic people and 7% to 9.8% in the general population with lower genital tract symptoms. Regarding NG, a prevalence of 1.5% to 3% has been reported in the general population. However, since these infections are not notifiable diseases, there is little data on the prevalence of these infections in high-risk populations, such as homeless persons [3].

A homeless person is defined as someone whose life takes place mainly on the street, as a physical-social space, where they solve their vital needs, builds affective relationships and socio-cultural mediations, structuring a lifestyle [4]. The last census of homeless persons in Medellín, Colombia, was carried out in 2019 by the National Administrative Department of Statistics (DANE) where 3,214 people were reported to live in this situation of which 14.8% were women and 85.2% were men [5].

Additionally, the homeless population is especially vulnerable to STIs, and its prevalence reaches up to 52.5% [6], which is alarming due to the constant increase of this vulnerable demographic. Therefore, this study aimed to determine the prevalence of CT and NG in the homeless population of Medellín, Colombia, using molecular diagnostic methods. It also intended to develop a demographic profile exploring associated factors and the dynamics of the social and sexual interactions of these people.

Materials and Methods

This is a cross-sectional quantitative study, which primarily utilized information from a survey of a homeless population between 15 and 88 years of age, who attended different institutions of the mayor's office in Medellín, Colombia, as well as a 30 ml urine sample to detect CT and NG.

Sampling methods and recruitment

The sample size was calculated using information from the census of persons living on the streets of Medellín in 2010 [7]. Considering a total homeless population of 3,381 persons, a sampling error of 5% and a confidence interval of 97%, a n = 413 was obtained, which was rounded up to 500.

The information in this study was gathered from November 2017 to May 2019 in the Medellín homeless care centers, which are frequented by about 1,836 persons each day [5], from which participants were randomly selected. The criteria for eligible participants were: 1) having ever engaged in sexual activity; 2) being a homeless individual. They signed an informed consent form; those under 18 years of age signed an assent form and were accompanied by the family defender from the institutions where they were being cared for.

Data collection

A structured survey conducted in Spanish was applied to each participant, and contained 89 questions pertaining to sociodemographics, sexual behaviors, consumption of psychoactive substances, educational aspects, and general knowledge of sexual health and STIs.

Sample collection and laboratory testing

Urine samples were obtained by self-collection, in a 30 ml sample bottle, collecting the first urination of the day or after at least four hours of urinary retention. In the laboratory, each sample was processed for DNA extraction, using the commercial QIAamp Viral RNA Mini Handbook (Qiagen, Germany). Nested PCR was performed to detect the cryptic plasmid and the MOMP gene from CT. This procedure was also used to detect the porin protein gene (por) and transferrin binding protein β subunit gene (tbp- β) from NG. PCR was considered positive when at least one of the amplicons was detected. In negative cases, qPCR was performed with the same primers, using the Luna Universal qPCR Mix kit (New England Biolabs, Ipswich, Massachusetts, USA). The molecular sensitivity of both PCRs was established with logarithmic dilutions from 10 ng / µl to 1.0 fg / µl of the cloned CT and NG DNA fragment and was defined as the minimum DNA concentration detected by the nested PCR. Analytical specificity was defined as the ability of the different CT and NG primers to exclusively identify the gene from the microorganism of interest with 100% identity, and was determined in silico using the National Center for Biotechnology Information database [8].

Statistical analyses

The data obtained in the questionnaire as well as the results of the qPCR for each participant were transferred to the statistical package SPSS version 24 (licensed by the University of Antioquia - Colombia). A general descriptive analysis was carried out, as well as a bivariate analysis, calculating the association between variables with chi-square tests (X^2), contemplating a p value <0.05 as a statistically significant association. The ratio of opportunities for infection by CT and NG was estimated by Odds Ratio (OR), with 95% confidence intervals. Finally, a binary logistic regression model was carried out in order to adjust the OR (AOR) with the potentially associated and statistically significant factors (p <0.05).

Patient and public involvement

Informative sessions were held in the homeless care centers of the mayor's office in Medellín, Colombia, to present the problem, raise awareness among the population, and explain the objectives of the study. During the development of the research, after the PCR detection, positive patients were remitted to the corresponding healthcare centers without any cost. At the end of the study, the research group presented the results to the homeless persons and to the local head of the department of health.

Results

Study Population Characteristics

Between November 2017 and May 2019, 500 individuals that met the inclusion criteria completed the survey conducted by a professional and provided urine samples for the detection of CT and NG. The characteristics of all subjects are shown in table 1.

Sexually transmitted infections

41.9% of the females and 38.9% of the males surveyed reported having an STI during their life (p = 0.535). Gonorrhea was the most common STI among men (23.3%), and syphilis among women (33.8%).

Furthermore, the relationship between sexual orientation along with gender identity and the presence of STIs in their lifetime presented the following data distribution: 37.9% of heterosexuals, 55.8% of bisexuals, 33.3% of gay men, 37.5% of lesbians and 60% of transgender persons. Among the latter group, 50% reported past syphilis infections.

Sex work was performed by 24.3% of women and 5.1% of men (p <0.001). A statistically significant difference was also observed between sexual orientation and

sex work (p <0.001), finding that it was performed by 5.7% of the heterosexual population, 6.3% of lesbian, 44.4% of gay men, 34.9% of the bisexual population and 100% of transgender people. In addition, 25.9% of those who performed sex work reported an STI in their lifetime. It was found that 13.1% of men and 0.7% of women paid for sexual services (p <0.001).

Prevalence of CT and NG by qPCR

The diagnosis of CT and NG was done by qPCR (Figure 1). The results show a 22.6% prevalence of NG infection (n = 113), and a 19.2% prevalence of CT infection (n = 96). Moreover, infection caused by a single agent was 14.6% (n = 73) for CT and 18% (n = 90) for NG. Coinfection occurred in 4.6% (n = 23). A statistically significant difference in CT prevalence was found between men and women (p = <0.001). On the contrary, for NG, this difference was not significant (p = 0.286).

Factors associated with CT and/or NG infection

Table 2 shows the results of different factors associated with CT infection. It is observed that the consumption of MDMA (ecstasy), toluene inhalants, and cocaine while having sex increases the chances of infection 2.37, 2.49, and 3.30 times respectively (p <0.05), in contrast with the people who did not consume these substances during intercourse.

Table 3 shows the results of different factors associated with an NG infection. Among the most relevant, it is observed that transgender people are 5.37 times more likely to contract the infection than the rest of the population, with a statistically significant difference (p = 0.004).

A binary logistic regression model was performed to adjust the OR of CT infection with the potential associated factors. Table 4 shows that the factor that significantly increased the chances of infection was being a woman (AOR = 2.42, 95% CI 1.31 - 4.47), (p = 0.00).

For NG, a binary logistic regression model was also performed (Table 4), finding that having intercourse while having an STI confers 3.19 times more chances of having an NG infection than those who avoid them. Another associated factor was having more than 11 sexual partners during the last 6 months (AOR 2.91, 95% CI 1.04 – 8.09), (p = 0.04) and having daily intercourse (AOR 3.15, 95% CI 1.02 – 9.74), (p = 0.05).

Discussion

STIs are a global public health problem, which is why it is important to study these infections in the general population and risk groups such as sex workers, users of psychoactive substances, and homeless persons [1]. In this cross-sectional study, we determined the prevalence of CT and NG in the homeless population of Medellín, Colombia using molecular diagnostic methods. We also developed a demographic profile exploring associated factors and the dynamics of the social and sexual interactions of the population.

Some variables such as substance use, income source and the distribution by age groups and sex, behaved similarly in the present study and in Colombia's census of homeless persons performed in 2019 [5]. The present study observed that the sample was predominantly composed of males (70.4%), and these results are comparable to those previously reported locally [9,10] and in other countries such as the United States (66.4% homeless males) [6] and Spain (90% homeless males) [11].

Several studies determined risk factors associated with STIs, such as domestic violence, use of psychoactive substances, a history of incarceration, multiple sexual partners, non-use of condoms, lack of education about STIs, feelings of affection towards the partner, and not prioritizing the well-being of their own or others [6,12,13]. Correspondingly, in this study, we found that 59.2% of the individuals

indicated that they did not use a condom in the three months prior to the survey, which was encountered more frequently when people had intercourse with a committed partner. This can be explained because according to the participants, there was trust or affection with their partner.

Another significant finding in this study was that MDMA and cocaine use was significantly associated with CT infection (p = 0.02). This can be attributed to the fact that being under the influence of psychoactive substances can lead homeless persons to engage in risky sexual behaviors [14]. Additionally, the most frequent STIs in the survey of the present study were syphilis (21.4%), gonorrhea (19.4%) and HIV (3.2%). Similar results were found both by national [10,13] and international [6,15,16] studies performed in homeless populations.

The prevalence found for NG and CT in the study population was 22.6% and 19.2% respectively; being higher than that reported in the general population (♀ CT: 4.2%, NG: 0.8% ; ♂ CT: 2.7%, NG: 0.6%) [1]. Also, in the present research, the coinfection between CT and NG was 4.6%, which was higher compared to other papers, where the coinfection prevalence varied from 1.7% in juvenile detention centers in the USA [17] to 2.9% in sex workers [18]. All of this can be explained due to the fact that, unlike other studies, the researched sample was composed exclusively by homeless persons. This population presents multiple and simultaneous high-risk behaviors [19] such as sex work, the lack of condom use, intercourse while consuming psychoactive substances, ignorance about STIs and multiple sexual partners. Also,

another study performed in the USA, found a lower prevalence on both CT (6.4%-6.7%) and NG 0.3%-3.2% in homeless persons [6]. This is due to the difference both in the quality of education in STI prevention and the government's social assistance programs focusing on preventive healthcare between Colombia (a developing country) and other highly developed nations [20].

The prevalence of CT and NG infection was higher in women (CT: 30.4% in women and 14.5% in men; NG 25.7% in women and 21.3% in men). This is consistent with the results reported by the World Health Organization and other researchers [1,21,22]. Similar studies confirm that the CT prevalence between women and men presents significant differences, where it was reported in 31.7% of women and 9.2% of men [23]. The higher prevalence in women is likely due to the predominance of asymptomatic infections [24], which contributes to lessening the search for treatment. On the other hand, there is a differential gene expression between men and women during the NG infection process, as well as differences in the pathogenic mechanisms used by this bacterium to infect the male and female epithelium, which define the evolution of the infection and the host's presentation of symptoms [25,26].

This research had limitations related with the recruitment of the sample. This was mainly due to the fact that the application of surveys and collection of urine samples was carried out solely in homeless shelters of Medellín by the mayor's office, accommodations that cover roughly 70% of the target population, according to the

2019 Census [5]. This was necessary because of the low-security conditions in other areas of the city where homeless persons reside.

Finally, it is imperative that governmental entities and policymakers implement epidemiological surveillance programs performing molecular techniques in non-invasive samples to improve the diagnosis of STIs in populations at risk, such as homeless persons. Additionally, future research should focus both on implementing molecular techniques in the detection of STIs and developing an ample sociodemographic profile, which allows the researcher to explore the risk factors more in depth. Also, future investigations should perform stratified analyses both in the general population and in high-risk groups, to have a broader view of the health situation, and consequently implement more focused social assistance programs that tackle these sexual health issues directly.

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Ethics statement

The consent, informed assent, and survey were previously approved by the Bioethics Committee of the Faculty of Medicine of the University of Antioquia – Colombia (Ethics approval number: 2017-022). This study was endorsed by the "Secretaría de Inclusión Social, Familia y Derechos Humanos" of the mayor's office of Medellín - Colombia.

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Contributorship statement

1. Mr. Diego Vélez: data collection, statistical data analysis, methodology design, database management, manuscript writing.

2. Dr. Natalia Torres-Vellojín: data collection, data analysis, manuscript writing.

3. Mr. Juan Camilo Grajales-Zapata: data collection, laboratory tests, methodology design, manuscript writing.

4. Dr. Juan Guillermo McEwen: Conceptualization, methodology design, laboratory tests, manuscript writing.

5. Dr. Alonso Martínez: Conceptualization, methodology design, project supervision, manuscript writing.

6. Ms. Verónica Ramírez-Lopera: data collection, data analysis, manuscript writing.

7. Prof. Aracelly Villegas-Castaño: Conceptualization, funds and resources management, methodology design, project administration and supervision, and manuscript writing.

Conflict of interest

None declared.

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Data sharing statement

Raw data, the database and the survey without any identifiers are available upon reasonable request, emailing diegovelezgomez@gmail.com (corresponding author).

Figure legend

Figure 1. Prevalence of Gonorrhea and Chlamydia infections by Gender.

Table 1. Characteristics of all participants

Variables	n (%)
Sex	
Male	352 (70.4)
Female	148 (29.6)
Age	
13-22	50 (10.0)
23-32	162 (32.4)
33-42	146 (29.2)
43-52	75 (15.0)
53-62	59 (11.8)
63-72	7 (1.4)
>73	1 (0.2)
Gender Identity	
Heterosexual	422 (84.4)
Lesbian	*16 (3.2)*
Gay	*9 (1.8)*
Bisexual	*43 (8.6)*
Transgender	*10 (2.0)*
Birthplace	
Medellín	279 (55.8)
Other	221 (44.2)
Marital Status	
Single	341 (68.2)
Civil union	94 (18.8)
Married	25 (5.0)
Other	40 (8.0)
Highest educational level (grades)	
No education	33 (6.6)
Basic primary (1-5)	177 (35.4)
Basic Secondary (6-9)	158 (31.6)
Secondary (10-11)	100 (20.0)
Technical/technological level	21 (4.2)
Bachelor's degree	10 (2.0)
Master's degree	1 (0.2)

Children, n	
None	197 (39.4)
<3	208 (41.6)
3-4	64 (12.8)
>4	31 (6.2)
Source of income*	
Street sales	217 (43.4)
Recycling	126 (25.2)
Panhandling	114 (22.8)
Running errands	78 (15.6)
Sex work	54 (10.8)
Selling drugs	54 (10.8)
Assistance from family or friends	46 (9.2)
Government assistance	11 (2.2)
Other	38 (7.6)
Daily psychoactive substance consumption*	
Tobacco	300 (60.0)
Marijuana	234 (46.8)
Cocaine / cocaine derivatives	312 (62.4)
Alcohol	122 (25.6)
Pills (unspecified)	57 (11.4)
Inhalant abuse	55 (11.0)
MDMA (ecstasy)	11 (2.2)
Other substances	42 (8.4)
No daily consumption	48 (9.6)
Sexual partners in lifetime	
No Answer	20 (4.0)
<50	381 (76.2)
50-100	45 (9.0)
>100	54 (10.8)
Sexual partners in the last 6 months	
No Answer	22 (4.4)
<11	426 (85.2)
11-50	35 (7.0)
>50	17 (3.4)
Age of first sexual activity	
No Answer	5 (1.0)
<10	58 (11.6)

10-14	253 (50.6)
>14	184 (36.8)
Use of contraception*	
Females	
Condoms	56 (37.8)
Tubal ligation	55 (37.2)
Implants	42 (28.4)
Injections	8 (5.4)
Pills	4 (2.7)
Others	2 (1.4)
None	28 (18.9)
Males	
Condoms	260 (73.9)
None	92 (26.1)
Condom use in the last 3 months*	
Yes	204 (40.8)
No	296 (59.2)
*Committed partner**	173 (58.4)
*Casual partner(s)**	203 (68.6)
Consent in past sexual encounters	
Females	
Non-consensual	64 (43.2)
Consensual	67 (45.3)
No answer	17 (11.5)
Males	
Non-consensual	41 (11.6)
Consensual	284 (80.7)
No answer	27 (7.7)
Frequency of intercourse	
No answer	44 (8.8)
Daily	37 (7.4)
2-3 times a week	115 (23.0)
2-3 times a month	187 (37.4)
At least once in the last 3 months	73 (14.6)
At least once in the last 6 months	44 (8.8)

*Survey respondents could choose more than one option

Table 2. Factors associated with *C. trachomatis* infection - Odds Ratio.

Variable	*Chlamydia trachomatis* qPCR test				Unadjusted Odds Ratio (95% CI)	*p* value Chi-Square
	Positive		Negative			
	n	%	n	%		
Sex						
Female	45	46.9	103	25.5	2.58 (1.63 - 4.08)	<0.001
Male	51	53.1	301	74.5		
Children						
Yes	71	74	232	57.4	2.11 (1.28 - 3.46)	0.003
No	25	26	172	42.6		
Has been taught how to use a condom						
No	20	20.8	44	10.9	2.15 (1.2 - 3.86)	0.009
Yes	76	79.2	360	89.1		
Consumption of glue/inhalant during intercourse						
Yes	13	13.5	25	6.2	2.37 (1.17 - 4.84)	0.015
No	83	86.5	379	93.8		
MDMA (ecstasy) consumption during intercourse						
Yes	10	10.4	18	4.5	2.49 (1.11 - 5.59)	0.022
No	86	89.6	386	95.5		
Consumption of cocaine during intercourse						
Yes	6	6.3	8	2	3.30 (1.12 - 9.75)	0.023
No	90	93.8	396	98		
Frequent irritation or discomfort symptoms						
Yes	9	9.4	16	4	2.51 (1.07 - 5.86)	0.029
No	87	90.6	388	96		
Condom use with casual partner						
No	41	62.1	128	47.9	1.18 (1.03 - 3.09)	0.039
Yes	25	37.9	139	52.1		
Domestic violence						
Yes	29	35.4	91	24.3	1.70 (1.02 - 2.84)	0.040
No	53	64.6	283	75.7		

Number of sexual partners in lifetime						
>100	16	17.2	38	9.8	1.91 (1.01 - 3.6)	0.043
<100	77	82.8	349	90.2		
Urethral discharge						
Yes	6	11.8	15	5	2.54 (0.94 - 6.89)	0.059
No	45	88.2	286	95		
Consent in past sexual encounters						
Non-consensual	25	30.5	80	21.4	1.61 (0.95 - 2.74)	0.076
Consensual	57	69.5	294	78.6		
Sleeping in a homeless care center						
Yes	84	87.5	322	79.7	1.78 (0.93 - 3.42)	0.079
No	12	12.5	82	20.3		
Heroin consumption						
Yes	9	9.4	19	4.7	2.10 (0.92 - 4.79)	0.074
No	87	90.6	385	95.3		
Sexual partners in the last 6 months						
>50	6	6.6	11	2.8	2.41 (0.87 - 6.71)	0.082
<50	85	93.4	376	97.2		
Condom use						
No	39	40.6	145	35.9	1.22 (0.78 - 1.93)	0.387
Yes	57	59.4	259	64.1		
Has had Syphilis in their lifetime						
Yes	24	25	83	20.5	1.29 (0.77 - 2.17)	0.339
No	72	75	321	79.5		
Sex work						
Yes	12	12.5	42	10.4	1.23 (0.62 - 2.44)	0.550
No	84	87.5	362	89.6		
Cannabis consumption						
Yes	60	62.5	294	72.8	0.62 (0.39 - 1.00)	0.047
No	36	37.5	110	27.2		

Table 3. Factors associated with *N. gonorrhoeae* infection - Odds Ratio.

Variable	*Neisseria gonorrhoeae* qPCR test				Unadjusted Odds Ratio (95% CI)	*p* value Chi-Square
	Positive		Negative			
	n	%	n	%		
Gender identity						
Transgender	6	5.3	4	1	5.37 (1.49 - 19.37)	0.00
Non-transgender people	107	94.7	383	99		
Last Pap Smear test						
>1 year ago	30	81.1	64	61.5	2.68 (1.08 - 6.67)	0.03
<1 year ago	7	18.9	40	38.5		
Place for personal hygiene						
Public place	107	94.7	341	88.1	2.41 (1.00 - 5.79)	0.04
House, apartment	6	5.3	46	11.9		
Had sexual contact while having an STI						
Yes	24	57.1	57	36.3	2.34 (1.17 - 4.67)	0.02
No	18	42.9	100	63.7		
Frequency of intercourse						
Daily	15	13.3	22	6.4	2.23 (1.12 - 4.47)	0.02
Once a week or less	98	86.7	321	93.6		
Sexual partners in the last 6 months						
≥11 partners	19	17.3	33	9	2.12 (1.15 - 3.90)	0.01
≤10 partners	91	82.7	335	91		
HIV						
Positive	6	5.3	10	2.6	2.11 (0.75 - 5.95)	0.09
Negative	107	94.7	377	97.4		
Type of sexual intercourse (last time)						
Oral and/or anal	17	15	31	8	2.03 (1.08 - 3.83)	0.03
Vaginal	96	85	356	92		
Sleeping in a homeless care center						
Yes	99	87.6	307	79.3	1.84 (1.00 - 3.40)	0.05
No	14	12.4	80	20.7		

Number of sexual partners in lifetime						
≥100	18	16.1	36	9.8	1.77 (0.96 - 3.25)	0.07
<100	94	83.9	332	90.2		
Sex work						
Yes	17	15	37	9.6	1.68 (0.90 - 3.11)	0.10
No	96	85	350	90.4		
Last sexual contact						
Commercial sex	27	23.9	66	17.1	1.53 (0.92 - 2.54)	0.10
Stable or casual	86	76.1	321	82.9		
Domestic violence						
Yes	35	31	85	24.8	1.36 (0.85 - 2.18)	0.20
No	78	69	258	75.2		
Sex						
Female	38	33.6	110	28.4	1.28 (0.82 - 2.00)	0.29
Male	75	66.4	277	71.6		

Table 4. Factors associated with *C. trachomatis* and *N. gonorrhoeae* infection - Adjusted Odds Ratio.

Bacteria	Risk factor	B	*P* value Wald	Adjusted Odds Ratio (95% CI)
Neisseria gonorrhoeae	Sexual intercourse while having an STI	1.16	0.00	3.19 (1.48 - 6.85)
	≥11 sexual partners in the last 6 months	1.07	0.04	2.91 (1.04 - 8.09)
	Daily sexual relations	1.15	0.05	3.15 (1.02 - 9.74)
Chlamydia trachomatis	Being a woman	0.88	0.00	2.42 (1.31 - 4.47)
	No condom use with casual partners	0.44	0.13	1.56 (0.87 - 2.77)
	Children	0.42	0.17	1.52 (0.83 - 2.78)
	>100 sexual partners in lifetime	0.42	0.26	1.52 (0.73 - 3.14)

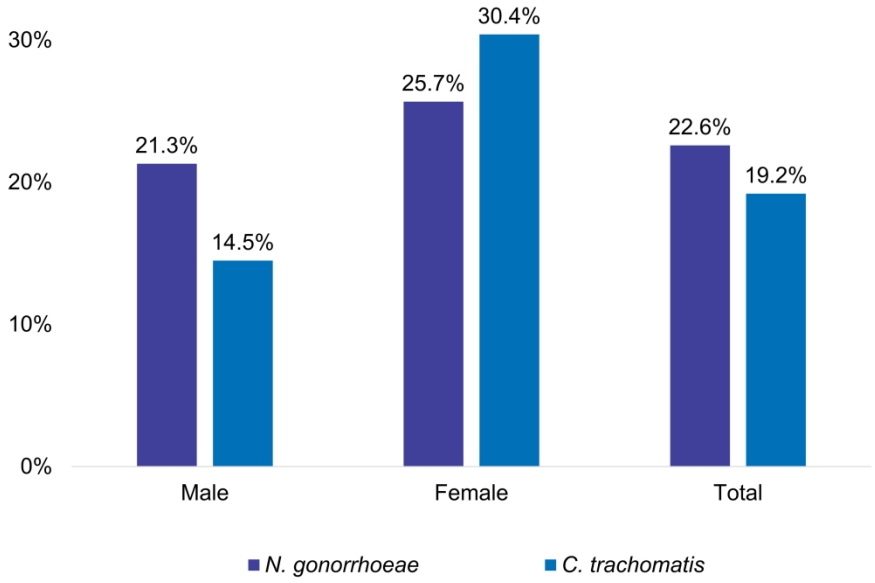

Figure 1. Prevalence of Gonorrhea and Chlamydia infections by Gender.

153x115mm (600 x 600 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1, 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	9
		(*e*) Describe any sensitivity analyses	9
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1, 2, 3
Outcome data	15*	Report numbers of outcome events or summary measures	Tables 2, 3, 4. Pages 11, 12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Tables 2, 3
		(*b*) Report category boundaries when continuous variables were categorized	Tables 2, 3. Pages 11, 12
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Tables 2, 3, 4. Pages 11, 12
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Tables 2, 3, 4. Pages 11, 12
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15, 16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13 - 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	13, 14, 15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Prevalence of Chlamydia trachomatis and Neisseria gonorrhoeae in the homeless population of Medellín, Colombia: a cross-sectional study.

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Prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in the homeless population of Medellín, Colombia: a cross-sectional study.

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Abstract

Objective: To determine the prevalence of *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) in the homeless population in Medellín, Colombia, using molecular diagnostic methods. It also intended to develop a demographic profile, exploring associated factors and the dynamics of the social and sexual interactions of this community.

Design: Cross-sectional study.

Setting: Two homeless care centers in Medellín, Colombia.

Participants: Homeless individuals that assisted to the main homeless care centers of Medellín, Colombia from 2017 to 2019.

Primary and secondary outcome measures: The prevalence of CT and NG in this population using qPCR detection, factors associated with CT and NG infection, and the sociodemographic profile of the community.

Results: The prevalence of CT infection was 19.2%, while that of NG was 22.6%. Furthermore, being a female was significantly correlated to CT infection p<0.05 (AOR 2.42, 95% CI 1.31 - 4.47). NG infection was significantly associated with factors such as: sexual intercourse while having an STI p<0.05 (AOR 3.19, 95% CI 1.48 - 6.85), having more than 11 sexual partners in the last 6 months p=0.04 (AOR 2.91, 95% CI 1.04 - 8.09) and having daily intercourse p=0.05 (AOR 3.15, 95% CI 1.02 - 9.74).

Conclusions: The prevalence of CT and NG was higher than that reported in the general population. Additionally, females had a higher percentage of infection compared to males.

Key words: Homeless Persons, Epidemiology, Molecular diagnostics, Public health, Infectious diseases, *Chlamydia trachomatis*, *Neisseria gonorrhoeae*.

Strengths and limitations of this study

- This research uses molecular techniques (qPCR) to evaluate urine samples to establish the prevalence of CT and NG in homeless populations of Medellín, Colombia.

- Risk factors associated with infection from CT and NG bacteria were established, and a demographic profile was developed with dynamics of social and sexual interaction.

- This is the first study that has used a sample of 500 homeless individuals in order to determine the prevalence of NG and CT in Colombia.

- Every piece of data regarding sociodemographic profiles and sexual behaviors was collected through a primary source.

- The main limitation was that the recruitment of the sample was carried out solely in homeless shelters of Medellín by the mayor's office, accommodations that cover roughly 70% of the target population.

Introduction

Sexually Transmitted Infections (STIs) have proven to be a global public health problem, as they are one of the most common acute conditions that affect populations around the world. Moreover, they are known to afflict people of any socio-economic level, age, and sex who have had contact with an infected person's fluids via unprotected intercourse, blood transfusions or vertical transmission [1].

In that matter, *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) are the second and third causes of STIs in the world, with an estimated prevalence of 4.2% in women and 2.7% in men for CT [1] and 0.9% in women and 0.7% in men for NG [2]. CT is asymptomatic in 70% of women and 50% of men, and it is responsible in many cases for pelvic inflammatory disease (PID), ectopic pregnancy, endometritis, and infertility. NG infection is highly symptomatic in men, causing dysuria and purulent discharge, epididymitis, prostatitis, and infertility [3].

Regarding Latin America, STIs caused by CT and NG have proven to be a serious public health problem, given the lack of resources in different clinical settings for diagnosis and treatment, and the scarce epidemiological research in this region. All of this combined with the high prevalence of both diseases (CT infection prevalence is 7.6% in women and 1.8% in men, and NG infection prevalence is 0.8% in women and 0.7% in men) [1].

Moreover, CT is a big concern in Colombia, since it is the most reported STI in the country, with a prevalence of 2% in asymptomatic people and 7% to 9.8% in the general population with lower genital tract symptoms. Meanwhile, even though NG prevalence is lower (1.5% to 3%), chlamydial coinfection with Neisseria gonorrhoeae has been reported in 10-40% of NG infection cases, and it has been showing increased antibiotic resistance [4]. However, since these infections are not notifiable diseases, there is little data on the prevalence of these infections stratified in high-risk populations in Latin America, such as homeless persons [5].

A homeless person is defined as someone whose life takes place mainly on the street, as a physical-social space, where they solve their vital needs, builds affective relationships and socio-cultural mediations, structuring a lifestyle [6]. The last census of homeless persons in Medellín, Colombia, was carried out in 2019 by the National Administrative Department of Statistics (DANE) where 3,214 people were reported to live in this situation of which 14.8% were women and 85.2% were men [7].

Additionally, the homeless population is especially vulnerable to STIs, as their prevalence reaches up to 52.5% [8]. This is due to various known high-risk behaviors that are common in this community (unprotected sexual intercourse, multiple sexual partners, sex work and the use of psychoactive substances while engaging in intercourse [8–11]. Currently, there is no in-depth research regarding CT and NG in the homeless population of Colombia. Therefore, this study aimed to determine the prevalence of CT and NG in this community in Medellín, Colombia, using molecular

diagnostic methods. It also intended to develop a demographic profile exploring associated factors and the dynamics of the social and sexual interactions of this community.

Materials and Methods

This is a cross-sectional quantitative study, which primarily utilized information from a survey of a homeless population between 15 and 88 years of age, who attended different institutions of the mayor's office in Medellín, Colombia. It also used laboratory testing in urine samples provided by the study subjects to detect CT and NG.

Sampling methods and recruitment

The sample size was calculated using the finite population method [12], and the Center of Diseases Control (CDC) software, Epi info™. This was performed using information from the census of homeless persons living Medellín in 2010 [13], considering a total homeless population of 3,381 persons. The sampling error was set at 5% and the confidence interval was set at 97%. The result of this calculation was n = 413, but it was rounded up to 500.

The information in this study was gathered from November 2017 to May 2019 in the Medellín homeless care centers, which are frequented by about 1,836 persons each day [7], from which participants were randomly selected. In order to ensure unbiased

randomization, we used the systematic sampling method, in which the sampling interval was 1 selected case every 7 persons, with weekly visits over the span of 18 months. The sample interval was calculated by dividing the total homeless population in Medellín (N= 3,381) [13], by the calculated sample size (n= 500).

The criteria for eligible participants were: 1) having ever engaged in sexual activity; 2) being a homeless individual. They signed an informed consent form; those under 18 years of age signed an assent form and were accompanied by the family defender from the institutions where they were being cared for. The subjects were excluded from the study if they had visible clinical signs of inebriation or an altered mental state.

Data collection

A structured electronic survey was administered to each participant by a member of the research team. It contained 89 questions pertaining to sociodemographics, sexual behaviors, previous STI infection and treatment, consumption of psychoactive substances, educational aspects, and general knowledge of sexual health and STIs. This survey aimed to identify different risk factors and to establish the population profile. The questions can be found in the supplementary material file.

Sample collection

Urine samples were obtained by self-collection. The first day that the patients were recruited, they received instructions and 30 ml sample bottles to collect the first urination of the next day or after 4-hour retention. The staff of the homeless care centers were aware of the patient's participation in the study and made sure that the patients did not forget the instructions and ensured a correct urine sample collection. The staff also refrigerated the samples, which were then shipped by the researchers early that same morning to the laboratory that is located less than 2 km away from the center (<5 minutes by car).

Laboratory testing

In the laboratory, each sample was tested for CT and NG infection. The urine was processed for DNA extraction, using the commercial QIAamp Viral RNA Mini Handbook (Qiagen, Germany). Nested PCR was performed to detect the cryptic plasmid and the MOMP gene from CT. This procedure was also used to detect the porin protein gene (por) and transferrin binding protein β subunit gene (tbp- β) from NG. Each PCR run was performed using positive and negative controls. PCR was considered positive when at least one of the amplicons was detected. In negative cases, qPCR was performed with the same primers, using the Luna Universal qPCR Mix kit (New England Biolabs, Ipswich, Massachusetts, USA).

The molecular sensitivity of both PCRs was established with logarithmic dilutions from 10 ng / µl to 1.0 fg / µl of the cloned CT and NG DNA fragment and was defined as the minimum DNA concentration detected by the nested PCR. Analytical specificity was defined as the ability of the different CT and NG primers to exclusively identify the gene from the microorganism of interest with 100% identity and was determined in silico using the National Center for Biotechnology Information database [14].

Statistical analyses

The data obtained in the questionnaire as well as the results of the qPCR for each participant were transferred to the statistical package SPSS version 24 (licensed by the University of Antioquia - Colombia).

Firstly, a general descriptive analysis was carried out, then the polytomous variables were recategorized, and a bivariate analysis was performed, in order to calculate the association between variables with chi-square tests (X^2), contemplating a p value <0.05 as a statistically significant association. The Odds Ratio (OR) was calculated with 95% confidence intervals for both CT and NG infections.

Finally, to calculate the adjusted OR (AOR), a binary logistic regression model was carried out, using the variables that previously had a p<0.05 in the bivariate analysis.

Patient and public involvement

Informative sessions were held in the homeless care centers of the mayor's office in Medellín, Colombia, to present the problem, raise awareness among the population, and explain the objectives of the study. Patients were not compensated monetarily for their participation in the study, but they were given their PCR results free of charge and were also directed to governmental healthcare programs that prescribed medicine and provided their infections at no cost. Additionally, symptomatic and clinical follow up after treatment was performed by a medical doctor of the institution for every subject in order to ensure the eradication of the infection.

Results

Study Population Characteristics

Between November 2017 and May 2019, 500 individuals that met the inclusion criteria completed the survey conducted by a professional and provided urine samples for the detection of CT and NG. The characteristics of all subjects are shown in table 1.

Additionally, 41.9% of the females and 38.9% of the males surveyed reported having an STI during their lifetime (p = 0.535). Of these past self-reported STIs, gonorrhea was the most common among men (23.3%), and syphilis among women (33.8%). Furthermore, 37.9% of heterosexuals, 55.8% of bisexuals, 33.3% of gay men, 37.5%

of lesbians, and 60% of transgender persons reported having a past STI in their lifetime. Among the latter group, 50% reported past syphilis infections.

Sex work was performed by 24.3% of women and 5.1% of men (p <0.001). A statistically significant difference was also observed between sexual orientation and sex work (p <0.001), finding that it was performed by 5.7% of the heterosexual population, 6.3% of lesbian, 44.4% of gay men, 34.9% of the bisexual population and 100% of transgender people. In addition, 25.9% of those who performed sex work reported an STI in their lifetime. It was found that 13.1% of men and 0.7% of women paid for sexual services (p <0.001).

Prevalence of CT and NG by qPCR

The diagnosis of CT and NG was done by qPCR (Figure 1). The results show a 22.6% prevalence of NG infection (n = 113), and a 19.2% prevalence of CT infection (n = 96) for the general population. Moreover, infection caused by a single agent was 14.6% (n = 73) for CT and 18.0% (n = 90) for NG. Coinfection occurred in 4.6% (n = 23).

In males, the prevalence of CT and NG was 14.5% and 21.3% respectively, while in females it was 30.4% for CT and 25.7% for NG. A statistically significant difference in CT prevalence was found between men and women (p = <0.001). On the contrary, for NG, this difference was not significant (p = 0.286).

Factors associated with CT and/or NG infection

Table 2 shows the results of different factors associated with CT infection. It is observed that the consumption of MDMA (ecstasy), toluene inhalants, and cocaine while having sex increases the chances of infection 2.37, 2.49, and 3.30 times respectively ($p < 0.05$), in contrast with the people who did not consume these substances during intercourse.

Table 3 shows the results of different factors associated with an NG infection. Among the most relevant, it is observed that transgender people are 5.37 times more likely to contract the infection than the rest of the population, with a statistically significant difference ($p = 0.004$).

A binary logistic regression model was performed to adjust the OR of CT infection with the potential associated factors. Table 4 shows that being a woman significantly increased the chances of infection (AOR = 2.42, 95% CI 1.31 - 4.47), ($p = 0.00$).

For NG, a binary logistic regression model was also performed (Table 4), finding that having intercourse while having an STI confers 3.19 times more chances of having an NG infection than those who avoid them. Another associated factor was having more than 11 sexual partners during the last 6 months (AOR 2.91, 95% CI 1.04 –

8.09), (p = 0.04) and having daily intercourse (AOR 3.15, 95% CI 1.02 – 9.74), (p = 0.05).

Discussion

In this cross-sectional study, we determined the prevalence of CT and NG in the homeless population of Medellín, Colombia using molecular diagnostic methods. We also developed a demographic profile exploring associated factors and the dynamics of the social and sexual interactions of the population. This study identified that approximately one in five homeless individuals residing in Medellín, Colombia was infected with CT or NG. It also found that females had approximately double the prevalence of infection by CT compared to males.

The prevalence found for NG and CT in the study population was 22.6% and 19.2% respectively; being higher than that reported in the general population (♀ CT: 4.2%, NG: 0.8%; ♂ CT: 2.7%, NG: 0.6%) [1]. Also, in the present research, the coinfection between CT and NG was 4.6%, which was higher compared to other papers, where the coinfection prevalence varied from 1.7% in juvenile detention centers in the USA [15] to 2.9% in sex workers [16]. All of this can be explained due to the fact that, unlike other studies, the researched sample was composed exclusively by homeless persons. This population presents multiple and simultaneous high-risk behaviors [8–11,17] such as sex work, the lack of condom use, intercourse while consuming

psychoactive substances, ignorance about STIs and multiple sexual partners. Also, another study performed in the USA, found a lower prevalence on both CT (6.4%-6.7%) and NG 0.3%-3.2% in homeless persons [8]. This is due to the difference both in the quality of education in STI prevention and the government's social assistance programs focusing on preventive healthcare between Colombia (a developing country) and other highly developed nations [18].

The prevalence of CT and NG infection was higher in women (CT: 30.4% in women and 14.5% in men; NG 25.7% in women and 21.3% in men). This is consistent with the results reported by the World Health Organization and other researchers [1,19,20]. Similar studies confirm that the CT prevalence between women and men presents significant differences, where it was reported in 31.7% of women and 9.2% of men [21]. The higher prevalence in women is likely due to the predominance of asymptomatic infections which leads to an alarming rate of subdiagnosis, subsequently leaving a lot of untreated and chronic cases amongst females compared to males [22]. On the other hand, infection by CT in males is more evident, as it is symptomatic to a greater extent (mainly dysuria, urethral discharge and testicular pain) [23]. Therefore, it is possible that a broader number of infected males had previously sought medical attention for genital irritative symptoms, which were then treated somewhat successfully. Regarding NG, there is a differential gene expression between men and women during the infection process, as well as differences in the pathogenic mechanisms used by this bacterium to infect the male

and female epithelium, which define the evolution of the infection and the host's presentation of symptoms [24,25].

Regarding the demographic profile, some variables such as substance use, income source and the distribution by age groups and sex, behaved similarly in the present study and in Colombia's census of homeless persons performed in 2019 [7]. The present study observed that the sample was predominantly composed of males (70.4%), and these results are comparable to those previously reported locally [26,27] and in other countries such as the United States (66.4% homeless males) [8] and Spain (90% homeless males) [28].

Furthermore, several studies determined risk factors associated with STIs, such as domestic violence, use of psychoactive substances, a history of incarceration, multiple sexual partners, non-use of condoms, lack of education about STIs, feelings of affection towards the partner, and not prioritizing the well-being of their own or others [8,10,11]. Correspondingly, in this study, we found that 59.2% of the individuals indicated that they did not use a condom in the three months prior to the survey, which was encountered more frequently when people had intercourse with a committed partner. This can be explained because according to the participants, there was trust or affection with their partner.

Another significant finding in this study was that MDMA and cocaine use was significantly associated with CT infection (p = 0.02). This can be attributed to the fact that being under the influence of psychoactive substances can lead homeless persons to engage in risky sexual behaviors [29]. Additionally, the most frequent STIs in the survey of the present study were syphilis (21.4%), gonorrhea (19.4%) and HIV (3.2%). Similar results were found both by national [11,27] and international [8,30,31] studies performed in homeless populations.

This research had limitations related to the recruitment of the sample. This was mainly because the application of surveys and collection of urine samples was carried out solely in homeless shelters of Medellín by the mayor's office, accommodations that cover roughly 70% of the target population, according to the 2019 Census [7]. This was necessary because of the low-security conditions in other areas of the city where homeless persons reside.

Finally, it is imperative that governmental entities and policymakers implement epidemiological surveillance programs performing molecular techniques in non-invasive samples to improve the diagnosis of STIs in populations at risk, such as homeless persons. Additionally, future research should focus both on implementing molecular techniques in the detection of STIs and developing an ample sociodemographic profile, which allows the researcher to explore the risk factors more in depth. Also, future investigations should perform stratified analyses both in the general population and in high-risk groups, to have a broader view of the health

situation, and consequently implement more focused social assistance programs that tackle these sexual health issues directly.

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Ethics statement

The consent, informed assent, and survey were previously approved by the Bioethics Committee of the Faculty of Medicine of the University of Antioquia – Colombia (Ethics approval number: 2017-022). This study was endorsed by the "Secretaría de Inclusión Social, Familia y Derechos Humanos" of the mayor's office of Medellín - Colombia.

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Contributorship statement

1. Mr. Diego Vélez: data collection, statistical data analysis, methodology design, database management, manuscript writing.

2. Dr. Natalia Torres-Vellojín: data collection, data analysis, manuscript writing.

3. Mr. Juan Camilo Grajales-Zapata: data collection, laboratory tests, methodology design, manuscript writing.

4. Dr. Juan Guillermo McEwen: Conceptualization, methodology design, laboratory tests, manuscript writing.

5. Dr. Alonso Martínez: Conceptualization, methodology design, project supervision, manuscript writing.

6. Ms. Verónica Ramírez-Lopera: data collection, data analysis, manuscript writing.

7. Prof. Aracelly Villegas-Castaño: Conceptualization, funds and resources management, methodology design, project administration and supervision, and manuscript writing.

Conflict of interest

None declared.

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Data sharing statement

Raw data, the database and the survey without any identifiers are available upon reasonable request, emailing diegovelezgomez@gmail.com (corresponding author).

Figure legend

Figure 1. Prevalence of Gonorrhea and Chlamydia infections by Gender.

Table 1. Characteristics of all participants

Variables	n (%)
Sex	
Male	352 (70.4)
Female	148 (29.6)
Age	
13-22	50 (10.0)
23-32	162 (32.4)
33-42	146 (29.2)
43-52	75 (15.0)
53-62	59 (11.8)
63-72	7 (1.4)
>73	1 (0.2)
Gender Identity	
Heterosexual	422 (84.4)
Lesbian	*16 (3.2)*
Gay	*9 (1.8)*
Bisexual	*43 (8.6)*
Transgender	*10 (2.0)*
Birthplace	
Medellín	279 (55.8)
Other	221 (44.2)
Marital Status	
Single	341 (68.2)
Civil union	94 (18.8)
Married	25 (5.0)
Other	40 (8.0)
Highest educational level (grades)	
No education	33 (6.6)
Basic primary (1-5)	177 (35.4)
Basic Secondary (6-9)	158 (31.6)
Secondary (10-11)	100 (20.0)
Technical/technological level	21 (4.2)
Bachelor's degree	10 (2.0)
Master's degree	1 (0.2)

Children, n	
None	197 (39.4)
<3	208 (41.6)
3-4	64 (12.8)
>4	31 (6.2)
Source of income*	
Street sales	217 (43.4)
Recycling	126 (25.2)
Panhandling	114 (22.8)
Running errands	78 (15.6)
Sex work	54 (10.8)
Selling drugs	54 (10.8)
Assistance from family or friends	46 (9.2)
Government assistance	11 (2.2)
Other	38 (7.6)
Daily psychoactive substance consumption*	
Tobacco	300 (60.0)
Marijuana	234 (46.8)
Cocaine / cocaine derivatives	312 (62.4)
Alcohol	122 (25.6)
Pills (unspecified)	57 (11.4)
Inhalant abuse	55 (11.0)
MDMA (ecstasy)	11 (2.2)
Other substances	42 (8.4)
No daily consumption	48 (9.6)
Sexual partners in lifetime	
No Answer	20 (4.0)
<50	381 (76.2)
50-100	45 (9.0)
>100	54 (10.8)
Sexual partners in the last 6 months	
No Answer	22 (4.4)
<11	426 (85.2)
11-50	35 (7.0)
>50	17 (3.4)
Age of first sexual activity	
No Answer	5 (1.0)
<10	58 (11.6)

10-14	253 (50.6)
>14	184 (36.8)
Use of contraception*	
Females	
Condoms	56 (37.8)
Tubal ligation	55 (37.2)
Implants	42 (28.4)
Injections	8 (5.4)
Pills	4 (2.7)
Others	2 (1.4)
None	28 (18.9)
Males	
Condoms	260 (73.9)
None	92 (26.1)
Condom use in the last 3 months*	
Yes	204 (40.8)
No	296 (59.2)
*Committed partner**	173 (58.4)
*Casual partner(s)**	203 (68.6)
Consent in past sexual encounters	
Females	
Non-consensual	64 (43.2)
Consensual	67 (45.3)
No answer	17 (11.5)
Males	
Non-consensual	41 (11.6)
Consensual	284 (80.7)
No answer	27 (7.7)
Frequency of intercourse	
No answer	44 (8.8)
Daily	37 (7.4)
2-3 times a week	115 (23.0)
2-3 times a month	187 (37.4)
At least once in the last 3 months	73 (14.6)
At least once in the last 6 months	44 (8.8)

*Survey respondents could choose more than one option

Table 2. Factors associated with *C. trachomatis* infection - Odds Ratio.

Variable	*Chlamydia trachomatis* qPCR test				Unadjusted Odds Ratio (95% CI)	*p* value Chi-Square
	Positive		Negative			
	n	%	n	%		
Sex						
Female	45	46.9	103	25.5	2.58 (1.63 - 4.08)	<0.001
Male	51	53.1	301	74.5		
Children						
Yes	71	74	232	57.4	2.11 (1.28 - 3.46)	0.003
No	25	26	172	42.6		
Has been taught how to use a condom						
No	20	20.8	44	10.9	2.15 (1.2 - 3.86)	0.009
Yes	76	79.2	360	89.1		
Consumption of glue/inhalant during intercourse						
Yes	13	13.5	25	6.2	2.37 (1.17 - 4.84)	0.015
No	83	86.5	379	93.8		
MDMA (ecstasy) consumption during intercourse						
Yes	10	10.4	18	4.5	2.49 (1.11 - 5.59)	0.022
No	86	89.6	386	95.5		
Consumption of cocaine during intercourse						
Yes	6	6.3	8	2	3.30 (1.12 - 9.75)	0.023
No	90	93.8	396	98		
Frequent irritation or discomfort symptoms						
Yes	9	9.4	16	4	2.51 (1.07 - 5.86)	0.029
No	87	90.6	388	96		
Condom use with casual partner						
No	41	62.1	128	47.9	1.18 (1.03 - 3.09)	0.039
Yes	25	37.9	139	52.1		
Domestic violence						
Yes	29	35.4	91	24.3	1.70 (1.02 - 2.84)	0.040
No	53	64.6	283	75.7		

Number of sexual partners in lifetime						
>100	16	17.2	38	9.8	1.91 (1.01 - 3.6)	0.043
<100	77	82.8	349	90.2		
Urethral discharge						
Yes	6	11.8	15	5	2.54 (0.94 - 6.89)	0.059
No	45	88.2	286	95		
Consent in past sexual encounters						
Non-consensual	25	30.5	80	21.4	1.61 (0.95 - 2.74)	0.076
Consensual	57	69.5	294	78.6		
Sleeping in a homeless care center						
Yes	84	87.5	322	79.7	1.78 (0.93 - 3.42)	0.079
No	12	12.5	82	20.3		
Heroin consumption						
Yes	9	9.4	19	4.7	2.10 (0.92 - 4.79)	0.074
No	87	90.6	385	95.3		
Sexual partners in the last 6 months						
>50	6	6.6	11	2.8	2.41 (0.87 - 6.71)	0.082
<50	85	93.4	376	97.2		
Condom use						
No	39	40.6	145	35.9	1.22 (0.78 - 1.93)	0.387
Yes	57	59.4	259	64.1		
Has had Syphilis in their lifetime						
Yes	24	25	83	20.5	1.29 (0.77 - 2.17)	0.339
No	72	75	321	79.5		
Sex work						
Yes	12	12.5	42	10.4	1.23 (0.62 - 2.44)	0.550
No	84	87.5	362	89.6		
Cannabis consumption						
Yes	60	62.5	294	72.8	0.62 (0.39 - 1.00)	0.047
No	36	37.5	110	27.2		

Table 3. Factors associated with *N. gonorrhoeae* infection - Odds Ratio.

Variable	*Neisseria gonorrhoeae* qPCR test				Unadjusted Odds Ratio (95% CI)	*p* value Chi-Square
	Positive		Negative			
	n	%	n	%		
Gender identity						
Transgender	6	5.3	4	1	5.37 (1.49 - 19.37)	0.00
Non-transgender people	107	94.7	383	99		
Last Pap Smear test						
>1 year ago	30	81.1	64	61.5	2.68 (1.08 - 6.67)	0.03
<1 year ago	7	18.9	40	38.5		
Place for personal hygiene						
Public place	107	94.7	341	88.1	2.41 (1.00 - 5.79)	0.04
House, apartment	6	5.3	46	11.9		
Had sexual contact while having an STI						
Yes	24	57.1	57	36.3	2.34 (1.17 - 4.67)	0.02
No	18	42.9	100	63.7		
Frequency of intercourse						
Daily	15	13.3	22	6.4	2.23 (1.12 - 4.47)	0.02
Once a week or less	98	86.7	321	93.6		
Sexual partners in the last 6 months						
≥11 partners	19	17.3	33	9	2.12 (1.15 - 3.90)	0.01
≤10 partners	91	82.7	335	91		
HIV						
Positive	6	5.3	10	2.6	2.11 (0.75 - 5.95)	0.09
Negative	107	94.7	377	97.4		
Type of sexual intercourse (last time)						
Oral and/or anal	17	15	31	8	2.03 (1.08 - 3.83)	0.03
Vaginal	96	85	356	92		
Sleeping in a homeless care center						
Yes	99	87.6	307	79.3	1.84 (1.00 - 3.40)	0.05
No	14	12.4	80	20.7		

Number of sexual partners in lifetime						
≥100	18	16.1	36	9.8	1.77 (0.96 - 3.25)	0.07
<100	94	83.9	332	90.2		
Sex work						
Yes	17	15	37	9.6	1.68 (0.90 - 3.11)	0.10
No	96	85	350	90.4		
Last sexual contact						
Commercial sex	27	23.9	66	17.1	1.53 (0.92 - 2.54)	0.10
Stable or casual	86	76.1	321	82.9		
Domestic violence						
Yes	35	31	85	24.8	1.36 (0.85 - 2.18)	0.20
No	78	69	258	75.2		
Sex						
Female	38	33.6	110	28.4	1.28 (0.82 - 2.00)	0.29
Male	75	66.4	277	71.6		

Table 4. Factors associated with *C. trachomatis* and *N. gonorrhoeae* infection - Adjusted Odds Ratio.

Bacteria	Risk factor	B	*P* value Wald	Adjusted Odds Ratio (95% CI)
Neisseria gonorrhoeae	Sexual intercourse while having an STI	1.16	0.00	3.19 (1.48 - 6.85)
	≥11 sexual partners in the last 6 months	1.07	0.04	2.91 (1.04 - 8.09)
	Daily sexual relations	1.15	0.05	3.15 (1.02 - 9.74)
Chlamydia trachomatis	Being a woman	0.88	0.00	2.42 (1.31 - 4.47)
	No condom use with casual partners	0.44	0.13	1.56 (0.87 - 2.77)
	Children	0.42	0.17	1.52 (0.83 - 2.78)
	>100 sexual partners in lifetime	0.42	0.26	1.52 (0.73 - 3.14)

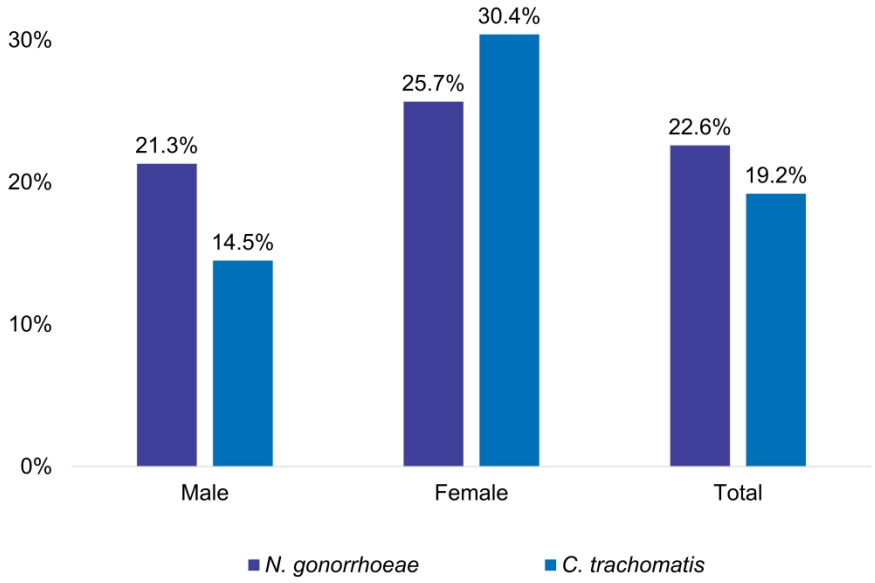

Figure 1. Prevalence of Gonorrhea and Chlamydia infections by Gender.

153x115mm (1155 x 1155 DPI)

Supplementary material

1. Translated questionnaire

1. Interview place
2. Bar code
3. Name of the interviewer
4. Interviewer code
5. Participant name
6. Identification
7. Biological sex
8. Department where they were born
9. Municipality where they were born
10. Time of residence in Medellín (Years)
11. How long ago did you leave your home?
12. How long have you been living on the street?
13. For what reasons did you become homeless?
14. Do you have contact with your family?
15. With whom did you become homeless?
16. Where do you currently live?
17. What neighborhood or area do you currently live in?
18. How old are you?
19. According to your culture, people or physical characteristics, what is your race.
20. What is your sexual orientation?
21. What is your marital status?
22. What is the highest level of study that you have graduated from?
23. Are you currently studying?
24. If so, what program are you currently attending?
25. Have you ever dropped out of school or college?
26. If you dropped out, what was the main reason for having done so?
27. In the last month, list all the places where you slept.
28. Where did you sleep last night?
29. In the last 3 months, indicate all the ways in which you earned or received money
30. What is your daily income?
31. What do you do with the money you get?
32. Have you been in jail?
33. Are you registered in the public health system?
34. How often do you shower?
35. In what places do you shower?
36. When was the last time you went to the doctor or a health center?
37. For what reasons have you visited the doctor or health center in the last 6 months?
38. How is your relationship with your family
39. What kind of support do you receive from your family?
40. Do you currently belong to a group or program for homeless people?

41. Which group do you belong to?
42. How often do you use substances?
43. During the past 6 months, have you had a sexually transmitted infection?
44. Which sexually transmitted infection (s) have you had?
45. Which sexually transmitted infection (s) have you had? [Other]
46. Did you receive medical treatment? (Ignore if the answer to the last two questions was negative)
47. If you had an STI, where did you go?
48. What did you or your partner (s) do to avoid infecting the other?
49. How often have you had the opportunity to participate in educational activities related to sexuality?
50. In the last 6 months, have you had sores or ulcers on your genitals?
51. When was the last time you had a Pap smear?
52. What was the result of the last Pap smear?
53. In the last 6 months, have you had burning with abnormal vaginal discharge?
54. In the last 6 months, have you had urethral discharge?
55. What planning and protection methods are you familiar with?
56. Do you use any contraceptive method?
57. What methods do you currently use?
58. How old were you when you had your first sexual encounter?
59. Who was the person with whom you had your first sexual encounter with?
60. Have you had sexual relations without consent?
61. Do you have biological children?
62. If yes, how many have you had?
63. How often do you have sex?
64. How many sexual partners have you had in your entire life?
65. How many sexual partners have you had in the last 6 months?
66. In your life, with how many men have you had sex?
67. In your life, with how many women have you had sex?
68. In your life, with how many transsexuals have you had sex?
69. Have you had sex without a condom in the last 3 months?
70. Have you ever requested a voluntary interruption of pregnancy in any health institution? [Women only]
71. Do you know of a place where you can get condoms?
72. Generally, how do you get condoms?
73. When you have sex, who generally suggests using a condom?
74. How easy would it be for you to get a condom if you need one?
75. Has a person or institution ever told you the correct way to use a condom?
76. How long would you be in a relationship to decide not to use a condom with this person?
77. Have you or did you have a stable sexual partner in the last 6 months?
78. Are you in a monogamous relationship?
79. How often did you and / or your monogamous partner use a condom when you had sex in the last 6 months?

80. What or what were the reasons why you did not use a condom with your monogamous partner?
81. Have you had casual or casual sexual partners in the last 6 months?
82. Your casual partners are generally:
83. How often did you and / or your casual partners use a condom when you had sexual intercourse in the last 6 months
84. What or what were the reasons for not using a condom with your casual partner ?
85. Status of the couple
86. Sector / neighborhood where the couple lives
87. Place where they met
88. What is the location of this place?
89. Did you or your partner used contraceptives before or during the relationship?

2. Original questionnaire (Spanish version)

1. Lugar de la entrevista
2. Código de barras
3. Nombre del participante
4. Identificación
5. Sexo biológico
6. Entrevistador
7. Persona
8. Departamento donde nació
9. Municipio donde nació
10. Tiempo de residencia en Medellín (Años)
11. ¿Hace cuanto tiempo abandonó su hogar?
12. ¿Cuánto tiempo lleva viviendo en la calle?
13. ¿Por qué razones llegó a la calle? [Desplazamiento forzado por actores armados]
14. ¿Tiene contacto con la familia?
15. ¿Con quién llegó a la calle?
16. ¿Dónde vive actualmente?
17. ¿En qué barrio o zona vive actualmente?
18. ¿Qué edad tiene usted?
19. De acuerdo con su cultura, pueblo o rasgos físicos, usted es o se reconoce como:
20. ¿Cuál es su orientación sexual?
21. ¿Cuál es su estado civil?
22. ¿Cuál es el nivel de estudio más alto que usted tiene aprobado?
23. ¿Usted estudia actualmente?
24. Actualmente está asistiendo a:
25. ¿Alguna vez abandonó la escuela o el colegio?
26. ¿En caso de haber abandonado los estudios, ¿cuál fue la principal razón haberlo hecho?
27. En el último mes, indique todos los lugares donde ha dormido

28. ¿Dónde durmió anoche?
29. En los últimos 3 meses, indique todas las maneras a través de las cuales ganó o recibió dinero
30. ¿Cuánto dinero consigue en un día por la actividad que desempeña?
31. ¿Qué hace con el dinero que obtiene?
32. ¿Usted ha estado en la cárcel?
33. ¿Cuál es el tipo de vinculación que usted tiene al sistema de salud?
34. ¿Con qué frecuencia se asea o baña usted?
35. ¿En qué lugares se asea o se baña usted?
36. ¿Cuándo fue la última vez que fue al médico o centro de salud?
37. ¿Por qué razones ha acudido los últimos 6 meses al médico o centro de salud?
38. Relación con su familia
39. ¿Qué tipo de apoyo recibe usted de su familia?
40. ¿Actualmente pertenece a algún grupo o programa de personas en situación de calle?
41. ¿A cuál grupo pertenece?
42. ¿Con qué frecuencia consume las siguientes sustancias?
43. Durante los últimos 6 meses, ¿ha tenido alguna infección de transmisión sexual?
44. ¿Cuál o cuáles infecciones de trasmisión sexual tiene o ha tenido?
45. ¿Cuál o cuáles infecciones de trasmisión sexual tiene o ha tenido?
46. Para esa o ésas infecciones que tuvo, ¿usted recibió tratamiento médico?
47. En caso de haber tenido una ITS, ¿a dónde acudió?
48. ¿Qué hizo usted o su(s) pareja(s) para evitar infectar al otro?
49. ¿Con qué frecuencia usted ha tenido la oportunidad de participar en actividades de educación relacionadas con la sexualidad?
50. ¿En los últimos 6 meses usted ha tenido llagas o úlceras en los genitales?
51. ¿Cuándo fue la última vez que le hicieron la citología vaginal?
52. ¿Cuál fue el resultado de la última citología vaginal?
53. ¿En los últimos 6 meses usted ha tenido ardor con flujo vaginal anormal?
54. ¿En los últimos 6 meses usted ha tenido secreción uretral?
55. ¿Qué métodos de planificación y protección conoce?
56. ¿Utiliza algún método?
57. ¿Qué métodos utiliza actualmente?
58. ¿Cuántos años tenía usted cuando tuvo su primera relación sexual?
59. La persona con la que tuvo su primera relación sexual era:
60. ¿Usted ha tenido relaciones sexuales sin su consentimiento?
61. ¿Ha tenido algún hijo o hija?
62. De ser afirmativo, ¿cuántos ha tenido?
63. ¿Con qué frecuencia tiene relaciones sexuales?
64. ¿Cuántas parejas sexuales ha tenido durante toda su vida?
65. ¿Cuántas parejas sexuales ha tenido durante los últimos 6 meses?
66. En su vida, ¿con cuántos hombres ha tenido relaciones sexuales?
67. En su vida, ¿con cuántas mujeres ha tenido relaciones sexuales?
68. En su vida, ¿con cuántos transexuales ha tenido relaciones sexuales?
69. ¿Ha tenido relaciones sexuales sin condón los últimos 3 meses?

70. ¿Solicitó usted alguna vez una interrupción voluntaria del embarazo en alguna institución de salud? [Sólo mujeres]
71. ¿Sabe de un lugar donde se puedan conseguir condones?
72. Generalmente, ¿cómo obtienes los condones?
73. Cuando usted tiene relaciones sexuales, ¿quién sugiere el uso del condón generalmente?
74. ¿Qué tan fácil le resultaría conseguir un condón en caso de necesitarlo?
75. ¿Alguna vez una persona o institución le indicó la forma correcta de usar el condón?
76. ¿Cuánto tiempo estarías en una relación de pareja para decidir no utilizar condón con esta persona?
77. ¿Usted tiene o tuvo una pareja sexual estable los últimos 6 meses?
78. Su pareja estable es:
79. ¿Con qué frecuencia usted y/o su pareja estable usaron condón cuando tuvieron relaciones sexuales en los últimos 6 meses?
80. ¿Cuál o cuáles fueron los motivos por los cuales no utiliza condón con su pareja estable?
81. ¿Usted ha tenido parejas sexuales ocasionales o casuales durante los últimos 6 meses?
82. Sus parejas ocasionales generalmente son:
83. Con que frecuencia usted y/o sus parejas ocasionales usaron condón cuando tuvieron relaciones sexuales en los últimos 6 meses
84. ¿Cuál o cuáles fueron los motivos por los cuales no utiliza condón con su pareja ocasional?
85. Tipo de pareja
86. Sector/barrio donde vive la pareja
87. Lugar donde tuvieron el encuentro
88. ¿Cuál es la ubicación de este lugar?
89. Usted o su pareja consumieron antes o durante la relación

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1 - 3
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1 - 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10, 11
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10, 11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10, 11
		(*b*) Describe any methods used to examine subgroups and interactions	10, 11
		(*c*) Explain how missing data were addressed	10, 11
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	10, 11
		(*e*) Describe any sensitivity analyses	10, 11
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA

Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1, 2, 3
Outcome data	15*	Report numbers of outcome events or summary measures	Tables 2, 3, 4. Pages 11 - 14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Tables 2, 3
		(*b*) Report category boundaries when continuous variables were categorized	Tables 2, 3. Pages 11 - 14
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Tables 2, 3, 4. Pages 11 - 14
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Tables 2, 3, 4. Pages 11 - 14
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14 - 18
Generalisability	21	Discuss the generalisability (external validity) of the study results	14 - 18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	23

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.